1242, 1250, 1260, 1270 Gordon Street and 9 Valley Road, Guelph, ON – Environmental Impact Study Addendum

Report

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Abbreviations

AMSL	Above Mean Sea Level
ANSI	Significant Areas of Natural and Scientific Interest
CC	Coefficient of Conservatism
cm	Centimeter
DBH	Diameter at Breast Height
ECCC	Environment and Climate Change Canada
EIR	Environmental Implementation Report
EIS	Environmental Impact Study
ELC	Ecological Land Classification
ESA	Endangered Species Act
FSR	Functional Servicing Report
GRCA	Grand River Conservation Authority
ha	Hectare
LID	Low Impact Development
LIO	Land Information Ontario
m	Meter
MBCA	Migratory Bird Convention Act
MECP	Ministry of Environment Conservation and Parks
mm	Millimeter
MNRF	Ministry of Natural Resources and Forestry
NHIC	Natural Heritage Information Centre

NHS	Natural Heritage System
NRSI	Natural Resource Solutions Inc.
OP	Official Plan
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetland
SAR	Species at Risk
SARO	Species at Risk in Ontario
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
TPP	Tree Preservation Plan

1.0 INTRODUCTION

The Subject Property is approximately 3.3 hectares (ha) in size and is comprised of five properties located at 1242,1250, 1260, and 1270 Gordon Street and 9 Valley Road in the City of Guelph, Ontario (**Figure 1**, **Appendix A**). At the time this report was written 1270 Gordon (formerly Montes Place) is currently an occupied residence and the remaining residential properties (1242, 1250, and 1260 Gordon Street, 9 Valley Road) have been demolished in accordance with a demolition permit.

Surrounding the Subject Property is a 120-metre (m) Study Area boundary, as shown on **Figure 1** (**Appendix A**), which is comprised of single-family residential lots to the northeast and newly constructed apartments to the east and west. Forest and wetland features associated with the Torrance Creek Swamp Provincially Significant Wetland (PSW) borders the Subject Property at the northeast with the Hanlon Creek PSW located west of Gordon Street.

Stantec Consulting Ltd. was retained by Tricar Developments Inc. (Tricar) to complete an Environmental Impact Study (EIS) in support of a Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment to accommodate the proposed development of two 10-storey apartment buildings with surface and below grade parking. Following approval, the development will proceed to detailed design and subdivision registration.

An EIS, dated May 4, 2020, was submitted to the City of Guelph and presented results of the 2018 and 2019 field program with an analysis of concordance of the proposed development with existing provincial and municipal policy. The purpose of the EIS was to characterize the significance and sensitivity of existing natural features in the Study Area, identify potential impacts of the project on these natural features, and recommend appropriate measures to avoid or minimize potential negative impacts and demonstrate no negative impact.

The purpose of this EIS Addendum is to address City of Guelph comments received on the first EIS submission, provided in **Appendix B1**, and update the previously submitted site plan. Since the first submission, the building heights have been reduced from 12-storeys to 10-storeys and an additional property to the south (1270 Gordon Street, formerly Montes Place) has been added to the Subject Property, as shown on **Figure 1** (**Appendix A**).

This EIS Addendum is based on responses to City comments through the completion of a Comment Matrix (**Appendix C**) and where topics require additional information or clarification are included in sections found in the body of this report. This Addendum does not reiterate information presented in the previously submitted EIS that was not comment on in the City’s review. Minor corrections and clarifications are addressed and explained in the Comment Matrix. This approach was developed through consultation with City of Guelph during a July 6, 2021 meeting and follow-up email correspondence (**Appendix B2**).

To address required updates, the following updated supporting documentation is appended and includes:

- Tree Preservation Plan (Appendix D)
- Hydrogeological Investigation (Appendix E)
- Butternut Health Assessment and Tree Permit Application (Appendix G)
- Functional Servicing Report (Appendix H)
- Grading Plan (Appendix I)
- Erosion and Sediment Control Plan (Appendix I)
- Landscape Plan (Appendix J)

2.0 POLICY CONSIDERATIONS

An assessment of the natural heritage features and functions within the study area was undertaken to comply with the requirements of the following policy and guidance documents in the original EIS and included a review of:

- Provincial Policy Statement
- City of Guelph Official Plan (OP), Zoning By-law, Tree By-law, Subwatershed studies
- Grand River Conservation Authority Policies and Regulations
- Migratory Bird Convention Act
- Endangered Species Act

The original EIS described these policies and addressed concordance of the previous development site plan. The City of Guelph OP has been updated since the first submission and therefore the June 2021 consolidation was consulted during the preparation of this EIS Addendum where required. Both the PPS and City of Guelph OP require the test of no negative impact, which is addressed in **Section 8.0**, below.

3.0 ADDITIONAL FIELD INVESTIGATIONS

To supplement field investigations conducted in 2018 and 2019, address City of Guelph comments (specifically Comment 120; Appendix B) and accommodate the addition of the parcel of land to the south (formerly Montes place) additional field studies were conducted in 2021. Survey details are provided in Table 3.1, below.

Table 3.1: 2021 Survey Dates, Time and Weather Conditions

SURVEY Type	DATE/TIME	WEATHER				SURVEYORS
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
Tree Inventory (1270 Gordon)	May 21, 2021	N/A	N/A	N/A	N/A	Natural Resources Solutions Inc. (NRSI)
Breeding Bird (Early)	June 2, 2021 05:30-08:00	7°C	0	0	None	Melissa Straus
Ecological Land Classification and Botanical Inventory (1270 Gordon)	June 2, 2021 07:15-08:00	7°C	0	0	None	Melissa Straus
Infiltration Trench Testing	June 10, 2021 June 11, 2021	N/A	N/A	N/A	N/A	D&J Lockhart Excavators Ltd.
Bat Exit Survey #1 (1270 Gordon)	June 10, 2021 21:01-22:31	21°C	3	0	None	Melissa Straus
Bat Exit Survey #2 (1270 Gordon)	June 28, 2021 21:05-22:35	26°C	2	20	None	Melissa Straus

3.1 VEGETATION

A site visit was completed in 2021 to confirm ELC and complete a botanical inventory of the property to the south (1270 Gordon) which had been surveyed previously from the property boundary (Lee et al. 1998).

Plant species status were considered and evaluated using the Rare Vascular Plants of Ontario, Fourth Edition (Oldham and Brinker 2009) for provincial significance; provincial and federal status is based on Species at Risk in Ontario. Identification of potentially sensitive native plant species will be determined based on their assigned coefficient of conservatism (CC) value, as determined by Oldham et al. (1995). CC values range from 0 (low) to 10 (high) considering a species' tolerance of disturbance and fidelity to a specific natural habitat. Species with a high CC value of 9 or 10 generally exhibit a high degree of fidelity to a narrow range of habitat parameters. Locally significant species were based on *Locally Significant Species List – City of Guelph 2012.*

3.2 TREE INVENTORY

A Tree Preservation Plan (TPP) was completed by NRSI at the property to the south (1270 Gordon Street) on May 21, 2021.

The following information was recorded for each tree:

- species,
- DBH,
- crown radius (metres),
- general health (excellent, good, fair, poor, very poor, dead),
- potential for structural failure (improbable, possible, probable, imminent),
- tree location (on-site/boundary/off-site), and,
- general comments (i.e., disease, aesthetic quality, development constraints, sensitivity to development).

Full details on methods can be found in the TPP in **Appendix D**.

3.3 BAT EXIT SURVEYS

The property to the south (1270 Gordon) has an existing building on the property that will require removal to facilitate the proposed development. To determine if bats (including bat Species at Risk; SAR) are using this building, bat exit surveys were conducted in accordance with *Surveying for the presence of Little Brown Myotis and Northern Myotis* (MNR 2013). This consisted of observers watching the identified building looking for signs of bats exiting or entering the buildings using binoculars and flashlights, as well as use of an acoustic monitoring device to record bat calls for species identification. Surveys started 30 minutes before sunset and finished 60 minutes after sunset.

3.4 BREEDING BIRD SURVEYS

One breeding bird survey was conducted on the Subject Property in June 2021 in accordance with the Breeding Bird Atlas (Cadman et al., 2007) to compliment surveys completed in previous years. Fieldwork commenced approximately 15 minutes prior to sunrise and concluded at 08:00 under favorable weather conditions.

The survey consisted of recording all species of birds that were seen or heard within each habitat while traversing the Subject Property. A conservative approach to determining breeding status was taken, birds seen or heard in appropriate habitat during the breeding season were assumed to be breeding.

4.0 HYDROGEOLOGY

Existing hydrogeological conditions on the Subject Property were provided in the first EIS submission and can be found in **Appendix E**.

4.1 TERRESTRIAL RESOURCES

Results of the terrestrial field investigations are summarized in the sections below, with available field notes provided in **Appendix F.**

4.1.1 Vegetation Communities

The vegetation communities identified in the Study Area are shown on **Figures 2-4, Appendix A**. All communities identified are considered common in southern Ontario.

During the botanical inventory conducted in June 2021 at 1270 Gordon, staff concluded that no changes were required to ELC community boundaries. An update to the cultural meadow community description to include a more detailed description of 1270 Gordon is provided below in **Table 4.1.**

Table 4.1: Ecological Land Classification (ELC) Vegetation Types

ELC Type	Community Description
Cultural (CU)	
CUM1 Mineral Cultural Meadow	Centralized disturbed meadow, dominated by orchard grass, common Timothy and goldenrod in the ground layer, with common buckthorn and Tartarian honeysuckle in the understory and scattered white elm in the canopy. A small cultural meadow pocket located behind 1242 Gordon consists of predominantly maintained lawn and a few fruit trees. The eastern portion of the cultural meadow, located behind 1270 Gordon, is open with regenerating black walnut and poplars (<10 % canopy coverage) and dominated by grasses (e.g., awnless brome [*Bromus inermus*]) with goldenrods present.

4.1.2 Vascular Plant Species

A few vegetation species not previously observed were identified on the Subject Property during the botanical inventory in 2021, none of which are at risk or rare. New observations included large-tooth aspen (*Populus Grandidentata),* common hawkweed (*Hieracium vulgatum),* and highbush cranberry (*Viburnum opulus americanum)*.

SAR and rare plants as reported in the original EIS can be found on **Figure 4 (Appendix A).**

4.1.3 Tree Preservation Plan

A total of 714 trees of 25 species were inventoried by NRSI during the preparation of the Tree Preservation Plan. Of the trees assessed, 482 (67.5%) are native species and 232 (32.5%) are non-native.

The Tree Preservation Plan can be found in **Appendix D.**

4.1.4 Bat Exit Surveys

Two bat exit surveys were conducted in June 2021 at the existing residence located at 1270 Gordon. No bats, including SAR, were observed entering or exiting the building. Foraging bats were documented during the survey, identified using software to analyzed calls recorded on hand-held bat detectors to be Big Brown Bats, Red Bats, and Hoary Bats. In some cases, the calls cannot be distinguished due to the quality of the call and as such both species are reported. In two cases, two faint calls were recorded on June 28, 2021 from the northwest corner of the building that appeared to be Little Brown Myotis (Endangered provincially).

The number of bat calls does not provide an indication as to the number of individuals present, as a single bat can result in multiple recorded calls by making several passes over a detector. However, the number of calls can generally be used as an index of bat activity. The bat station locations and number of bat calls recorded are presented in Error! Reference source not found.**4.1**.

Table 4.1 Bat Survey Results by Station at 1270 Gordon (formerly Montes Place)

Date	Detector ID	Detector Location	Species / Guild	Number of Bat Calls Identified
June 10, 2021	SM4-I	Southeast side of building	None	-
	SM4-N	Northernmost corner of building	Big Brown Bat	2
	SM4-O	North side of building	Big Brown Bat/ Silver-haired Bat	36
			Big Brown Bat	82
	SM4-S	Southernmost corner of building	Big Brown Bat/ Silver-haired Bat	1

			Big Brown Bat	2
June 28, 2021	ETK	Northwest corner of building	Big Brown Bat/ Silver-haired Bat	52
			Big Brown Bat	26
			Little Brown Bat	2
	ETL	Southeast corner of building	Big Brown Bat/ Silver-haired Bat	1
			Hoary Bat	5

4.1.5 Breeding Bird Surveys

During breeding bird surveys conducted in June 2021, Stantec observed eight species not recorded during field investigations in 2018. These were Canada Goose, Mourning Dove, Eastern Kingbird, American Crow, Cedar Waxwing, Brown-headed Cowbird, Baltimore Oriole and Northern Waterthrush. Of these eight species, all but the American Crow and Canada Goose were observed displaying breeding evidence.

Three species Northern Flicker, Eastern Kingbird and Baltimore Oriole are locally significant in the City of Guelph. Eastern Kingbird and Baltimore Oriole were observed within the meadow section of the Subject Property and the Northern Flicker was observed in the deciduous woodlot to the northeast. These species, in addition to SAR and locally significant bird species identified previously in the Study Area are shown on **Figure 4** (**Appendix A**).

4.1.6 Snake Habitat Assessment

Snake habitat and presence was recorded during all surveys conducted on the Subject Property. Hibernacula features such as house foundations, cracks and crevices and stone piles were assessed for access to below ground. Suitable habitat to support snake hibernacula was not identified on the Subject Property.

Snakes were recorded incidentally during surveys conducted on the Subject Property, including one DeKay's Brown Snake, several Eastern Gartersnakes and one Red-bellied Snake during an onsite visit with the City of Guelph during favorable weather conditions on May 16, 2019.

5.0 SIGNIFICANT NATURAL HERITAGE FEATURES

5.1 HABITAT OF ENDANGERED AND THREATENED SPECIES

Four (4) species protected under the ESA were identified on the Subject Property and/or in the Study Area and include:

- Butternut

- Barn Swallow
- Bat SAR (Little Brown Myotis and Northern Myotis)

Barn Swallow was observed flying over the Subject Property and as such not expected to be breeding. No evidence of Barn Swallow nesting was observed on site. Butternut and bat SAR are described below, with species occurrences are provided in **Figure 4** (**Appendix A**).

5.1.1 Butternut

Six butternut trees were originally identified on the Subject Property by NRSI during the tree inventory, as shown on **Figure 4** (**Appendix A**). Butternut is provincially ranked S3? (possibly-vulnerable); and is considered endangered provincially and federally. Butternut is afforded habitat protection under the ESA (2007), which includes a 25 m buffer to protect the tree from root damage.

A Notice of Activity was submitted to MECP to facilitate the removal of one Butternut, one Butternut hybrid, and the harm of another Butternut. A tree permit was obtained from the City of Guelph to remove the two Butternuts, which occurred in December 2020. The necessary compensation plantings for these Butternuts as required under the *Endangered Species Act* were installed in the Fall of 2020, consisting of 40 butternuts and 40 companion trees of sugar maple, black cherry, and red oak. The butternut tree removal permit application and butternut health assessment completed by NRSI is provided in **Appendix G**.

5.1.2 Bat SAR

Bat SAR were documented in 2018 within the significant woodland during field studies, and at a distance from the building at 1270 Gordon in 2021, however; bat exit surveys were completed of the residences and snag trees in the development footprint revealed no evidence of SAR bat roosts in the surveyed locations. Although impacts to SAR bats are not anticipated, an Information Gathering Form will be submitted to the Ministry of Environment, Conservation and Parks (MECP) to confirm the required approach for these species.

5.2 PROVINCIAL-LEVEL ANALYSIS OF SIGNIFICANCE

An analysis of feature significance was included in the original EIS submission. For clarity, this section has been divided into jurisdiction (provincial vs. City of Guelph) with additional details provided on Significant Wildlife Habitat (SWH) and the OP, as requested in City of Guelph comments #124-127.

The analysis of significance based on the Natural Heritage Policy (Section 2.1) of the PPS (OMAH 2014) was completed in the original EIS, identifying significant wetlands (Torrance Creek and Hanlon Creek PSW Complexes), significant woodland, in the Study Area and various types of Significant Wildlife Habitat (SWH) based on criteria set out in *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E* (MNRF 2015). Tables 5.1-5.4 detail this SWH analysis with candidate or confirmed SWH mapped by table category (e.g., seasonal concentration areas, rare or specialized habitat, etc.) where identified on **Figures 2 and 3** (**Appendix A**).

Table 5.1: Summary of Seasonal Concentrations Areas within the Subject Property and Study Area

Habitat Type	Habitat Features	Presence / Absence within the Subject Property and Study Area
Waterfowl stopover and staging areas	Field with evidence of annual spring flooding from meltwater or runoff; aquatic habitats such as ponds, marshes, lakes, bays, and watercourses used during migration, including large marshy wetlands	Absent
Shorebird migratory stopover area	Beaches and un-vegetated shorelines of lakes, rivers, and wetlands	Absent
Raptor wintering areas	Combination of fields and woodland (>20 ha)	Absent
Bat hibernacula	Abandoned mine shafts, underground foundations, caves, and crevices	Absent
Bat maternity colonies	Mixed and deciduous forests and swamps with large diameter dead or dying trees with cavities	Candidate SWH present in Study Area.
Turtle wintering area	Permanent waterbodies and large wetlands with sufficient dissolved oxygen	Candidate SWH present in Study Area.
Reptile hibernacula	Rock piles or slopes, stone fences, crumbling foundations	Absent
Colonially – nesting bird breeding habitat (bank and cliff)	Eroding banks, sandy hills, steep slopes, rock faces or piles	Absent
Colonially – nesting bird breeding habitat (trees/shrubs)	Dead trees in large marshes and lakes, flooded timber, and shrubs, with nests of Great Blue Heron, Great Egret, Green Heron, or Black-crowned Night-Heron	Absent
Colonially – nesting bird breeding habitat (ground)	Rock islands and peninsulas in a lake or large river	Absent
Migratory butterfly stopover area	Fields and forests that are a minimum of 10 ha and are located within 5 km of Lake Erie or Lake Ontario	Absent
Landbird migratory stopover area	Woodlands of a minimum size located within 5 km of Lake Erie or Lake Ontario	Absent
Deer wintering congregation areas	Deer yards are mapped by MNRF	Confirmed SWH present in Study Area.

Table 5.2: Summary of Rare or Specialized Habitat within the Subject Property and Study Area

Habitat Type	Habitat Features	Presence / Absence within the Subject Property and Study Area
Rare Vegetation Communities		
Sand barren, alvar, cliffs and talus slopes	Sand barren, Alvar, Cliff and Talus ELC Community Classes, and other areas of exposed bed rock and patchy soil development, near vertical exposed bedrock and slopes of rock rubble	Absent
Prairie and savannah	Open canopy habitats (tree cover < 60%) dominated by prairie species	Absent
Old growth forest	Relatively undisturbed, structurally complex; dominant trees > 100 years' old	Absent
Other rare vegetation communities	Vegetation communities ranked S1-S3 by the NHIC	Absent
Specialized Habitats		
Waterfowl nesting areas	Upland habitats adjacent to wetlands (within 120 m)	Absent
Bald Eagle and Osprey nesting, foraging and perching habitat	Treed communities adjacent to rivers, lakes, ponds, and other wetlands with stick nests of Bald Eagle or Osprey	Absent
Woodland raptor nesting habitat	Forested ELC communities >30ha with 10 ha of interior habitat	Candidate SWH present in the Study Area
Turtle nesting areas	Exposed soil, including sand and gravel in open sunny areas in proximity to wetlands	Absent
Seeps and springs	Any forested area with groundwater at surface within the headwaters of a stream or river system	Candidate SWH present in the Study Area
Amphibian breeding habitat (woodland and wetland)	Treed uplands with vernal pools, and wetland ecosites	Absent
Woodland area sensitive breeding bird habitat	Large mature forest stands, woodlots >30 ha	Candidate SWH present in the Study Area

Table 5.3: Summary of Habitat for Species of Conservation Concern within the Subject Property

Habitat Type	Habitat Features	Presence / Absence of Rare or Specialized Habitat within the Subject Property and Study Area
Open country bird breeding habitat	Large grasslands and fields (>30 ha)	Absent
Shrub/early successional bird breeding habitat	Large shrub and thicket habitats (>10 ha)	Absent
Marsh bird breeding habitat	Wetlands with shallow water with emergent aquatic vegetation	Absent
Terrestrial Crayfish	Wet meadows and edges of shallow marshes	Candidate SWH present in the Study Area
Special Concern and provincially rare wildlife (as identified in Table 3-1)	Habitat for Special Concern species:	Confirmed SWH.
	1. Common Nighthawk: Open habitats with gravel substrate	Absent
	2. Eastern Wood-Pewee: Deciduous and mixed forests	Confirmed SWH present in Study Area.
	3. Red-headed Woodpecker: Deciduous and riparian forests, orchards, parks, grasslands	Absent
	4. Snapping Turtle: Ponds, sloughs, streams, rivers, and shallow bays	Candidate SWH present within Study Area.
	5. Wood Thrush: Deciduous and mixed forests	Absent
	6. Monarch: Milkweed and wildflowers	Absent

Table 5.4: Summary of Wildlife Movement Corridors

Habitat Type	Habitat Feature	Presence / Absence of Wildlife Movement Corridors within the Subject Property
Deer movement corridors	Associated with confirmed deer wintering habitat/area	Absent

Habitat Type	Habitat Feature	Presence / Absence of Wildlife Movement Corridors within the Subject Property
Amphibian movement corridors	Associated with confirmed amphibian breeding habitat	Absent

5.3 CITY OF GUELPH ANALYSIS OF SIGNIFICANCE

The City of Guelph's Natural Heritage System (NHS) as defined in Section 4.1.1 of the OP is comprised of:

- Significant Natural Areas
    - Significant Areas of Natural and Scientific Interest (ANSI)
    - Significant Habitat for Provincially Endangered and Threatened Species
    - Significant Wetlands
    - Surface Water Features and Fish Habitat
    - Significant Woodlands
    - Significant Valleylands
    - Significant Landform
    - Significant Wildlife Habitat (SWH; including Ecological Linkages)
    - Restoration Areas
    - Minimum or Established buffers (where applicable)
- Natural Areas
    - Other Wetlands
    - Cultural Woodlands
    - Habitat of Significant Species
    - Established buffers (where applicable)

The City of Guelph OP identifies components of the Natural Heritage System within the Study Area on Schedule 4, including:

- locally and provincially significant wetlands (Schedule 4A)
- significant woodlands (Schedule 4C)
- significant wildlife habitat (Schedule 4E)
- deer crossing and ecological linkage (Schedule 4).

Wetlands (PSWs) and SWH were previously discussed in Section 5.1 above while the recommendation to update the locally significant wetland boundary that overlaps with FOC2-2 was previously provided in the original EIS and are not further discussed.

Significant woodlands, deer crossing and ecological linkage, as well as locally significant species (not identified in the OP) are discussed in more detail in the sections below.

5.3.1 Significant Woodlands

Significant Woodlands in the City of Guelph are identified on Schedule 4C of the OP and are defined in Section 4.1.3.6 of the Official Plan:

- woodlands ≥1ha not identified as cultural woodlands or plantations
- woodlands ≥0.5ha consisting of Dry-Fresh Sugar Maple Deciduous Forest
- any woodlands ranked S1-S3 by the NHIC.
- Include a 10 m buffer

The forested portion associated with the Torrance Creek PSW (i.e., FOC2-2 and SWM3-2; **Figure 3**, **Appendix A**), adjacent deciduous forest (FOD5-6), two contiguous plantations (CUP3 and CUP3-3) are designed as Significant Woodland on Schedule 4C of the City's Official Plan. The significant woodland boundary was delineated in the field by NRSI with the City of Guelph in 2014 and 2017, which appears to follow the OP designation, as shown on **Figure 4**, **Appendix A**.

No other woodlands in the Study Area are designated significant by the City in their OP.

5.3.2 Cultural Woodlands

One deciduous woodland (WODM4-4), comprised of regenerating black walnut, is present on the Subject Property and was excluded from the Significant Woodland as delineated by the City of Guelph and NRSI.

Cultural Woodlands are defined in the OP as:

i) equal to or greater than 1 hectare in size, and

ii) not dominated by non-indigenous, invasive species.

WODM4-4 does not meet the minimum size criteria to be classified as a cultural woodland, which is supported by the lack of cultural woodlands identified on the Subject Property or in the Study Area on Schedule 4C of the OP.

5.3.3 Deer Crossing and Ecological Linkage

Section 7.1.4 of the original EIS provides a detailed analysis of the two deer crossing locations identified in the Study Area on the City of Guelph OP. The results of the analysis concluded that the southern crossing, Crossing A; **Figure 5**, **Appendix A** is the primary crossing and favoured post-development. In addition to being noted as a deer crossing location, this area was also designated as an ecological linkage by the City of Guelph in their OP. The field survey data and analysis identify crossing A as the NHS linkage as depicted on **Figure 5** (**Appendix A**).

5.3.4 Habitat of Significant Species

Eight locally significant wildlife species were identified within the Study Area during field studies undertaken on the Subject Property in 2018 and 2021:

- Eight bird species: Barn Swallow, Baltimore Oriole, Eastern Wood-Pewee, Eastern Kingbird, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Yellow-billed Cuckoo
- One reptile: Red-bellied Snake.

The locations of these species, and the two locally significant plant species, are shown on **Figure 4** (**Appendix A**).

5.4 SIGNIFICANT NATURAL HERITAGE FEATURES SUMMARY

Significant natural heritage features identified on the Subject Property and/or Study Area are shown on **Figures 2, 3, and 4** (**Appendix A**), and include:

- Hanlon Creek and Torrance Creek PSW (MAS2-1, SWM3-2)
- Significant Woodlands (SWM3-2, FODM6-5, CUP3, CUP3-3)
- habitat of Endangered and Threatened Species (butternut, bat SAR)
- Significant Wildlife Habitat
    - Confirmed SWH
        - Seasonal Concentration Areas of Animals (deer wintering area; SWM3-2, FOC2-2)
        - Habitat for Species of Conservation Concern (Eastern Wood-Pewee; SWM3-2, FOC2-2)
    - Candidate SWH
        - Seasonal Concentration Areas of Animals
            - bat maternity colonies (SWM3-2, FOD5-6, FOC2-2)
            - turtle wintering area (SWM3-2)
            - woodland raptor nesting habitat (SWM3-2)
        - Habitat for Species of Conservation Concern
            - terrestrial crayfish
            - Snapping Turtle
        - Specialized Habitat for Wildlife
            - seeps and springs (SWM3-2)
            - woodland area sensitive breeding bird habitat (SWM3-2)
- provincially rare plants (honey locust; planted)
- Locally Significant Features
    - locally significant wetland (City of Guelph OP)
    - deer crossing and ecological corridor Crossing A; (City of Guelph OP and Stantec EIS analysis of corridor potential and use)

  - habitat for locally significant wildlife (Barn Swallow, Baltimore Oriole, Eastern Kingbird, Eastern Wood-Pewee, Northern Flicker, Hairy Woodpecker, Pileated Woodpecker, Yellow-billed Cuckoo, Red-bellied Snake) and plants (butternut, black maple).

6.0 PROPOSED DEVELOPMENT

Tricar is proposing to construct two 10-storey residential buildings, one fronting on Gordon Street and one adjacent to the southwest boundary of the Subject Property, as shown on **Figure 5** (**Appendix A**). Surface and underground parking, stormwater management infiltration galleries, and internal roadways are proposed to service the development. A park block is also included in the proposed development.

6.1 STORMWATER MANAGEMENT

The Functional Servicing Report (FSR; Appendix H) outlines the stormwater management strategy for the proposed development and includes:

- Sanitary service is provided by the proposed upgrade to the municipal system located on Gordon Street just west of the site access
- Water service is provided from the existing 400 mm watermain on Gordon Street
- Enhanced (Level 1) water quality control will be provided for the Subject Property by a combination of an Oil Grit Separate (OGS) unit and infiltration gallery.
- Adequate water quality volumes will be provided to meet the Ministry of Environment Conservation and Parks water quality requirements associated with infiltration facilities.
- The proposed rooftop storage and infiltration facility storage will control the 2- to 100-year peak flows to predevelopment levels prior to discharge to Gordon Street.

6.1.1 Water Quantity and Treatment

Water quantity control of stormwater will be achieved by a combination of rooftop controls (both buildings) and a Permavoid storage and infiltration system located in the south landscaped area. Rooftops will allow for up to 16.0 cm of ponding and control outflow through the use of flow control features on the roof drains.

The rooftop runoff on the East Building will connect into an on-site infiltration trench with overflow out-letting east to the Torrance Creek PSW. The roof runoff of the West Building will connect to the Permavoid infiltration system with overflow directed into the additional Permavoid storage. This storage will also collect runoff from the on-site parking area, including total flows from the south parking area and minor flows from the north parking area. A 75 mm orifice control will be provided on the downstream end, prior to discharge to the Gordon Street storm sewer.

The Permavoid storage has been sized such that the post-development runoff flow rates to Gordon Street are attenuated to pre-development flow rates. During the 100-year event a total of 310 m^3 of active storage will be utilized in the Permavoid storage tank, 136 m^3 of active storage will be provided on the West Building rooftop and 138 m^3 of active storage will be provided on the East Building rooftop

Pre-development targets are met for the two site outlets in the post-development condition.

6.1.2 Infiltration Trenches

The east on-site infiltration (rock) trench was sized to capture and infiltrate the 25 mm event over the east building roof area. The total controlled area is 2300 m^2 of rooftop and 110 m^2 of landscaped area. This infiltration trench will be located along the east portion of the development, and trench was sized to draw-down within 48 hours.

The south Permavoid infiltration trench was sized to capture and infiltrate the 25 mm event over parking Areas, the west building and the Permavoid area. The total controlled area is 2400 m^2 of rooftop, 6900 m2 of parking and 1400 m^2 of landscaped area. This Permavoid infiltration trench will be located along the south portion of the development and was sized to draw-down within 48 hours after roof-top ponding.

6.1.3 Infiltration Testing and Mounding Assessment

As requested by the City, an assessment of the magnitude of groundwater mounding that could potentially occur beneath the infiltration trenches described above (east and south trenches) was undertaken to determine the ability to support stormwater infiltration strategies proposed for the Subject Property under the post-development conditions.

Based on the input parameters utilized, the maximum groundwater mounding predicted to occur beneath the center of the East Infiltration Trench after a 25 mm event is 0.6 m, equating to an elevation of 339.8 m AMSL based on the seasonally high groundwater elevation. The rise in the groundwater table does not exceed 0.1 m beyond 18 m from the trench center point after a 25 mm storm event.

Maximum groundwater mounding predicted to occur beneath the center of the South Infiltration Trench after a 25 mm event is 1.1 m, equating to an elevation of 340.1 m AMSL based on the seasonally high groundwater elevation. This rise in the groundwater table does not exceed 0.1 m beyond 30 m from the trench center point after a 25 mm storm event.

The Design Infiltration Rate for each infiltration facility as per the approach outlined by the CVC/TRCA (2010). The calculated infiltration rate used in the design of the East and South Infiltration Trenches is 32 mm/hour and 23 mm/hour, respectively, indicating that both trenches will maintain or enhance pre-development infiltration volumes to the subwatershed under the post-development condition.

> Further details on the infiltration testing and mounding assessment can be found in the hydrogeological investigations provided in **Appendix E**.

6.1.4 Water Balance and Infiltration

Pre- and post-development water balance calculations for the Subject Property were revised utilizing the same methodology as presented in the previously submitted hydrogeological assessment report, with minor changes being made to the pre- and post-development catchments areas, annual precipitation values, and sub-area topographic categories as requested by the City.

6.1.4.1 Upper Hanlon Creek Subwatershed

Under existing conditions, the average annual volume of infiltration occurring within Catchment 101 (see **Appendix E**) is estimated to be 2,387 m^3, equating to a rate of 212 mm/year. Under the post-development condition, the annual infiltration occurring across the remaining pervious areas is estimated to be 300 m^3, equating to a rate of 21 mm/year. Consequently, the resulting pre- to post-development infiltration deficit is estimated to be 2,086 m^3/year. Annual volumes of surface water runoff from these lands will concurrently increase from 1,711 m^3 to 11,696 m^3 for a runoff increase of 9,985 m^3/year.

The south infiltration trench is designed return infiltration volumes lost from the pre- to post-development condition within the portion of the Subject Property located within the Upper Hanlon Creek Subwatershed. This trench is sized to infiltrate stormwater captured by 9,300 m^2 of impervious surfaces associated with the western building and parking areas during a 25 mm storm event, resulting in an infiltration volume of 232.5 m^3 for each such storm event. On average there are approximately five days a year where storm events total 25 mm, equating to a total volume of 1,185 m^3 that will be directed to the south infiltration trench and will mitigate roughly 57% of the projected annual infiltration deficit. Given that there are on average a total of 29 days where precipitation totals will range from 10 to 25 mm and 55 days where precipitation totals will range from five to 10 mm, it is reasonable to conclude that the proposed south infiltration trench will be capable at mitigating the remaining annual infiltration deficit for this portion of the Subject Property.

6.1.4.2 Torrance Creek Subwatershed

Under existing conditions, the average annual volume of infiltration occurring within Catchment 102 (see **Appendix E**) is estimated to be 3,869 m^3, equating to a rate of 224 mm/year. Under the post-development condition, the annual infiltration occurring across the remaining pervious areas is estimated to be 2,148 m^3, equating to a rate of 149 mm/year. Consequently, the resulting pre- to post-development infiltration deficit is estimated to be 712 m^3/year. Annual volumes of surface water runoff from these lands will concurrently decrease from 2,308 m^3 to 2,148 m^3 for a runoff decrease of 160 m^3/year.

The east infiltration trench is designed return infiltration volumes lost from the pre- to post-development condition within the portion of the Subject Property located within the Torrance Creek Subwatershed. This trench is sized to infiltrate a 25 mm storm event captured by the 2,300 m^2 of the eastern building rooftop, resulting in an infiltration volume of 57.5 m^3 for each such storm event. On average there are approximately five days a year where storm events total 25 mm, equating to a total volume of 287 m^3 that will be directed to the infiltration gallery and, subsequently, mitigate roughly 40% of the projected annual infiltration deficit. Given that there are on average a total of 29 days where precipitation totals will range from 10 to 25 mm and 55 days where precipitation totals will range from five to 10 mm, it is reasonable to conclude that the proposed east infiltration trench will more than mitigate the remaining annual infiltration deficit for this portion of the Subject Property.

Overall, the proposed development will reduce infiltration volumes to the Torrance Creek and Upper Hanlon Subwatersheds by 712 m^3/year and 2,086 m^3/year respectively. However, with both the south and east infiltration trenches, pre-development infiltration rates will be maintained or enhanced post-development to the two subwatershed. Furthermore, the predicted groundwater mounds for the east and south infiltration trenches are not expected to intercept the residential buildings located on surrounding properties.

7.0 POTENTIAL IMPACTS OF DEVELOPMENT AND MITIGATION RECOMMENDATIONS

To address City comments #139 and #141, potential impacts and mitigation measures associated with grading, lighting, bird strike, and water balance impacts to the wetland are described below.

7.1 GRADING

To facilitate the proposed development, the grading plan provided in **Appendix I** will require the removal of onsite vegetation including trees as detailed in the TPP (**Appendix D**). The identified NHS components (significant woodland, wetland, etc.) as shown on Figure 5 (Appendix A), including associated buffers, are outside of the proposed areas of grading.

To protect the NHS during grading, tree protection fencing (**Appendix D**) and erosion and sediment control measures (**Appendix I**) will be implemented. With the implementation of these mitigation measures, in addition to those previously discussed in the original EIS, potential impacts are not anticipated to the NHS resulting from grading.

7.2 LIGHTING AND BIRD STRIKES

Impacts of the proposed development on wildlife may occur through bird-building collisions and disturbance due to light intrusion can be mitigated through the implementation of specific design details for both the building and associated lighting.

The City of Toronto's Bird-friendly Best Practices Glass (2016) and 2017 Best Practices Effective Lighting (2017) provide guidance on these items and include:

- design to eliminate fly-through conditions
- visual markers (e.g., frosted, film, opaque)
- awning and overhangs

- directing external lights downward
- use motion sensors on safety and security lighting.

Bird-building collisions are further mitigated by the reduction of building heights from 12- to 10-storeys as well as the location of the Subject Property away from the confluence of migration pathways and the Great Lakes, two factors that make the City of Toronto a high-risk area for these types of collisions (City of Toronto 2016). Despite these mitigating factors, it is generally accepted that the lower stories of buildings are the most dangerous because they are at the same level as trees and other landscape features that attract birds (City of Toronto 2016) and therefore decreasing the reflectivity of the materials in these lower levels adjacent to landscaping proposed in the Landscape Plan (**Appendix J**) will be critical.

Effects of artificial lighting on wildlife may result in changes to:

- movement patterns through attraction or repulsion
- orientation
- interspecies interactions
- communication
- reproduction
- and mortality rates (Longcore and Rich; 2004)

Properly planned lighting can mitigation these potential impacts which, according to Gaston et al., (2012) includes the following considerations:

i) *prevent areas from being artificially lit*

ii) *limit the duration of lighting*

iii) *reduce the ‘trespass’ of lighting into areas that are not intended to be lit (including the night sky)*

iv) *change the intensity of lighting*

v) *change the spectral composition of lighting.*

7.3 HYDROLOGIC IMPACTS TO THE WETLANDS

Typical hydrologic impacts include an increase in overland flow for any given storm event and a reduction in infiltration rates results post-development due to the introduction of impervious ground surfaces. The proposed stormwater management strategy detailed in **Section 6.1** includes LID infiltration trenches designed to match or exceed pre-development infiltration volumes for the Torrance Creek and Upper

Hanlon subwatershed. No impacts hydrologic impacts to the Torrance Creek PSW are anticipated post-development.

8.0 POLICY COMPLIANCE

This addendum report addresses the natural heritage features defined in the PPS, City of Guelph OP, GRCA Regulation 150/06 and the *ESA*, and demonstrates that the recommendations and intent of the relevant provincial and municipal policies have been incorporated in the proposed development.

8.1 PROVINCIAL POLICY STATEMENT

Development is sited outside of the Torrance and Hanlon Creek PSW, consistent with the PPS which does not allow development within significant wetlands. Development is also cited outside of SWH features, with the PPS allowing development in or adjacent to SWH if no negative impacts are anticipated. Although we anticipate redirecting of deer movement around the Subject Property post-development, significant negative impacts to deer and the other identified SWH in the Study Area are not anticipated with the implementation of the avoidance and mitigation recommendations.

Development and site alteration is not permitted within habitat of threatened or endangered species, except in accordance with provincial and federal requirements. Considerations for bat SAR and butternut are discussed under **Section 8.4**

8.2 CITY OF GUELPH OFFICIAL PLAN

The City's OP permits development on lands adjacent to Significant Natural Areas or within Natural Areas if an EIS can demonstrate no negative impacts on the features or on their associated ecological functions. Grading is not proposed within the 10 m buffer adjacent to the significant woodland boundary and at the time of this report, tree plantings have been undertaken in the buffer in accordance with requirements of Section 23.7 of Ontario Regulation 242/08 of the ESA (**Appendix G**). Eighty seedlings (40 butternut and 40 companion trees) have been planted which will be supplemented with additional plantings to be detailed in an updated Landscape Plan submitted as part of the EIR. The concept plan is developed to maintain the ecological function of the buffer, attenuation of noise, air, and visual influences on the feature and is consistent with the buffer guideline of the OP. No negative impacts are anticipated from the development with the implementation of the avoidance and mitigation recommendations include in the original EIS and this addendum (e.g., dripline and root zone avoidance, fencing, monitoring). Therefore, the proposed development is in compliance with the polices of the OP. The buffers inclusion in the apartment block zoning will have no negative impacts to the natural heritage features given the aforementioned concept plan, established land use and plantings, and additional initiatives that will be implemented and subject to conditions of Site Plan Approval.

Minimum setbacks required in the OP have been respected by the proposed development (i.e., 30 to PSW, 10 to significant woodland).

8.3 GRAND RIVER CONSERVATION AUTHORITY

The proposed development is located within the GRCA's regulated area within the area of interference (i.e., 120 m) of the Torrance Creek PSW.

The development is consistent with GRCA policy as the Hydrogeological Assessment Report provided in **Appendix E** indicated that the hydrogeological function of the Torrance Creek PSW to the northeast of the Subject Property will not be impacted by the proposed development. The planned post-development LID infiltration strategy is designed to maintain existing/pre-development groundwater flow volumes towards this PSW.

8.4 ENDANGERED SPECIES ACT

Bat SAR and butternut may be impacted by the proposed development.

A notice of assessment to impact (i.e., remove, construct within 25 m) butternut trees was made under Ontario Regulation 242/08 Section 23.7. A replanting plan has been implemented in accordance with the Regulation.

Although bat exit surveys did not confirm use at any of the identified candidate roost trees located within the hedgerows and residential areas, bat SAR were documented during surveys conducted in 2018 and 2021. An Information Gathering Form will be submitted to MECP to determine requirements under the ESA.

9.0 REPORT SUMMARY

This EIS Addendum documented the following:

- Results of the background records review identified the following features on the Subject Property and/or in the Study Area
  - Hanlon Creek and Torrance Creek PSW
  - deer wintering habitat
  - locally and provincially significant wetlands (City of Guelph OP Schedule 4A)
  - significant woodlands (OP, Schedule 4C)
  - significant wildlife habitat (OP, Schedule 4E)
  - deer crossing and ecological linkage (OP, Schedule 4).
- Results of the field programs conducted in 2018 and 2021 identified the following features, as shown on **Figures 3** and **4** (**Appendix A**):
  - habitat of Endangered and Threatened Species (butternut, bat SAR)
  - Significant Wildlife Habitat
    - Confirmed SWH
      - Seasonal Concentration Areas of Animals (deer wintering area; SWM3-2, FOC2-2)
      - Habitat for Species of Conservation Concern (Eastern Wood-Pewee; SWM3-2, FOC2-2)
    - Candidate SWH
      - Seasonal Concentration Areas of Animals
        - bat maternity colonies (SWM3-2, FOD5-6)
        - turtle wintering area (SWM3-2)
        - woodland raptor nesting habitat (SWM3-2)
      - Habitat for Species of Conservation Concern
        - terrestrial crayfish
        - Snapping Turtle
      - Specialized Habitat for Wildlife
        - seeps and springs (SWM3-2)
        - woodland area sensitive breeding bird habitat (SWM3-2)
- One provincially rare plant (honey locust) was documented on the Subject Property but is proposed to be retained. It is possible this tree was planted based on the location along property boundaries.
- The two (2) deer crossings identified in the City of Guelph OP were assessed as part of movement studies and analysis of significance. Crossing A, as shown on Figure 5 (Appendix A) is included as part of the NHS for deer crossing and ecological corridor as addressed in the EIS.
- Locally significant species (Barn Swallow, Baltimore Oriole, Eastern Kingbird, Eastern Wood-Pewee, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Yellow-billed Cuckoo, Red-bellied Snake) and plants (butternut, black maple) were identified, predominantly outside of the proposed project footprint.

- The proposed development consists of two 10-storey residential buildings, one fronting on Gordon Street and one adjacent to the southwest boundary of the Subject Property. Surface and underground parking, stormwater management infiltration galleries, and internal roadways are proposed to service the proposed development. A park block is also included in the proposed development however the details of which are to be designed by the City in the future.
- Stormwater quantity control by a combination of rooftop controls over both the west and east building and subsurface storage. Two on-site infiltration systems are proposed to promote infiltration of the rooftop and parking lot runoff to the groundwater system, with overflows out-letting to the Gordon Street storm sewer, controlled to the pre-development flow rate. The infiltration galleries are designed to at least maintain pre-development infiltration volumes occurring in the catchment that provides groundwater flow to the Torrance Creek PSW and in the catchment that provides groundwater flow to Hanlon Creek under the post-development condition. Infiltration testing and groundwater mounding calculations were completed to assess the feasibility of the proposed stormwater management infiltration trenches.
- Potential impacts of the proposed development and associated mitigation measures were detailed in the previously submitted EIS. This Addendum detailed grading, lighting, and hydrologic impacts to the wetland and mitigation measures such that no negative impacts on the NHS are anticipated as a result of the proposed development. This is in accordance with the PPS, City of Guelph OP, and GRCA policies.

10.0 RECOMMENDATIONS FOR THE ENVIRONMENTAL IMPLEMENTATION REPORT

It is our understanding that an Environmental Implementation Report (EIR) will be required to provide guidance on how to address recommendations contained within the original EIS and this EIS Addendum. The following topics are recommended for inclusion in the EIR:

- Demonstrate how policies and the conditions of approval have been met
- Demonstrate how municipal infrastructure servicing will be undertaken in a manner that will protect significant natural heritage features and their ecological functions
- Additional details on the landscape plans for the buffer areas and stormwater management facility will be prepared. These plans will be completed by an accredited Landscape Architect and include:
    - compensation plantings of native species for trees being removed
    - tree protection fencing
    - demarcation

  - signage
  - educational/interpretive and stewardship materials
- A detailed Erosion and Sediment Control Plan
- Detailed guidance on bird-friendly building design to be incorporated as part of detailed design.
- Provide additional details on the proposed post-construction monitoring plan provided in the EIS
- Include a Groundwater Dewatering Assessment and recommendations for monitoring and best practice.
- Invasive species management, monitoring, and removal plan
- Hazard tree management
- Recommendations contained within the TPP for inclusion in the EIR:
  - Polygon A should be inventoried individually to properly quantify the number of trees to be removed and retained
  - Tree retention within the park block should be reassessed based on City needs and trail design
  - Compensation requirements should be updated to reflect the above items
  - The compensation plan should be developed by, or reviewed and approved by a Certified Arborist
  - Include hardy, native tree species where feasible that are known to thrive in more urban conditions (i.e. compacted soil, drought, high salt tolerance)
  - Include a diversity of trees from several genus to increase disease and pest tolerance and discourage monocultures (no more than 30% from a single genus, 10% from a single species)
  - Include a watering and monitoring plan for 2 years following planting
  - Be replaced if they are documented to have died within the 2-year monitoring plan
  - Be spaced so as to allow material to reach its ultimate size and form
  - Be provided with appropriate soil types and soil volumes
  - Avoid ash species due to the risk of the emerald ash borer (*Agrilus planipennis*)

  - Avoid ‘messy trees’, such as fruiting trees or poplars (Populus spp.) where plantings occur in close proximity to driveways and roadways
  - Spacing of plant material should account for the ultimate size and form of the selected species and also the purpose of the planting, whether it be for screening, shade, naturalizing, rehabilitation, etc.
  - Special attention to location and height of trees in proximity to utilities.

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APPENDIX A
FIGURES

Stantec

Legend

⬚ Study Area (120 m)

🟥 Subject Property

— Watercourse (Permanent)

▨ Property to the South (Formerly Monty's Place)

0 25 50 Metres

1:3,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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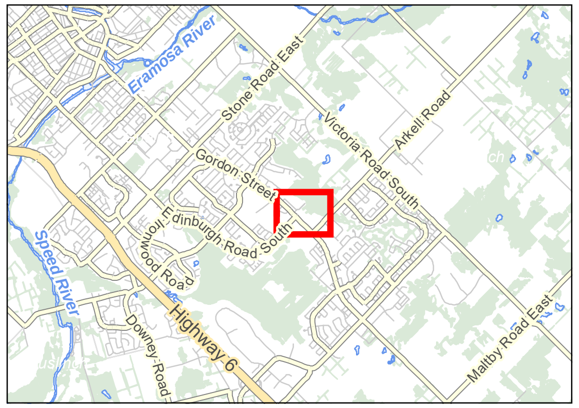
3. Orthoimagery © First Base Solutions, 2018. Imagery flown in 2019.



Project Location
City of Guelph

161413684
Prepared by DH on 2021-08-11

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
EIS ADDENDUM

Figure No.
1

DRAFT

Title
Study Area

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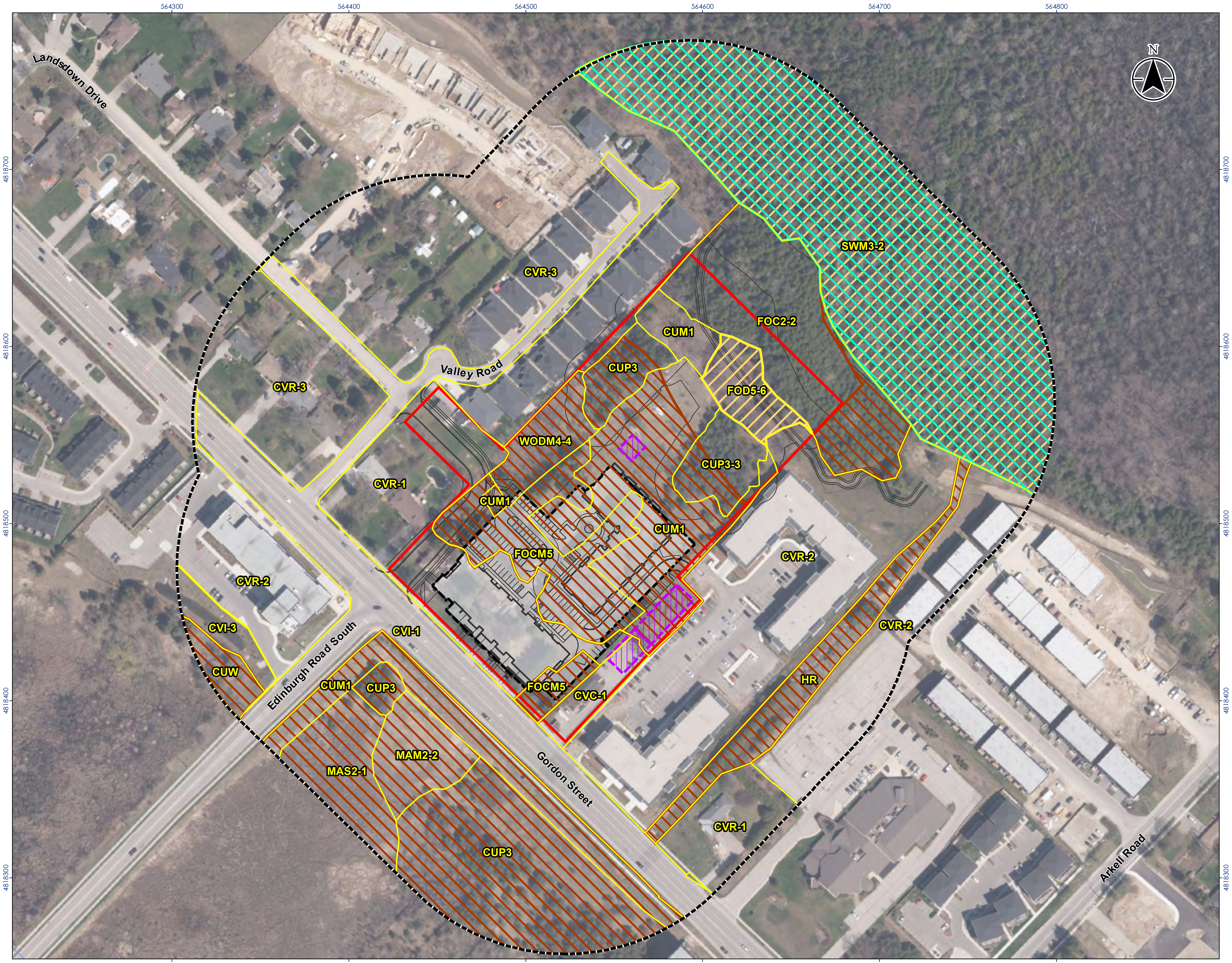

Stantec

Legend
- Study Area (120 m)
- Subject Property
- Watercourse (Permanent)
- ELC Boundary

Development Plan
- Proposed Building
- Proposed Building (Underground)
- Proposed Development Plan
- Proposed Extent of Underground Parking
- Proposed Stormwater Management

Candidate Significant Wildlife Habitat
- Habitat for Species of Conservation Concern
- Seasonal Concentration Areas of Animals
- Specialized Habitat for Wildlife

0 25 50 Metres

1:2,200 (At original document size of 11x17)

Notes
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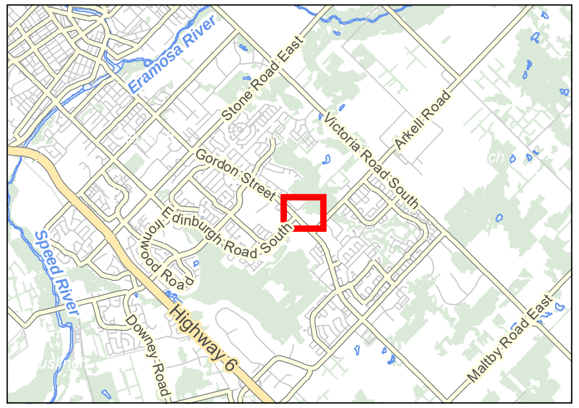

Project Location
City of Guelph

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1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
EIS ADDENDUM

Figure No.
2

DRAFT

Title
Candidate Significant Wildlife Habitat

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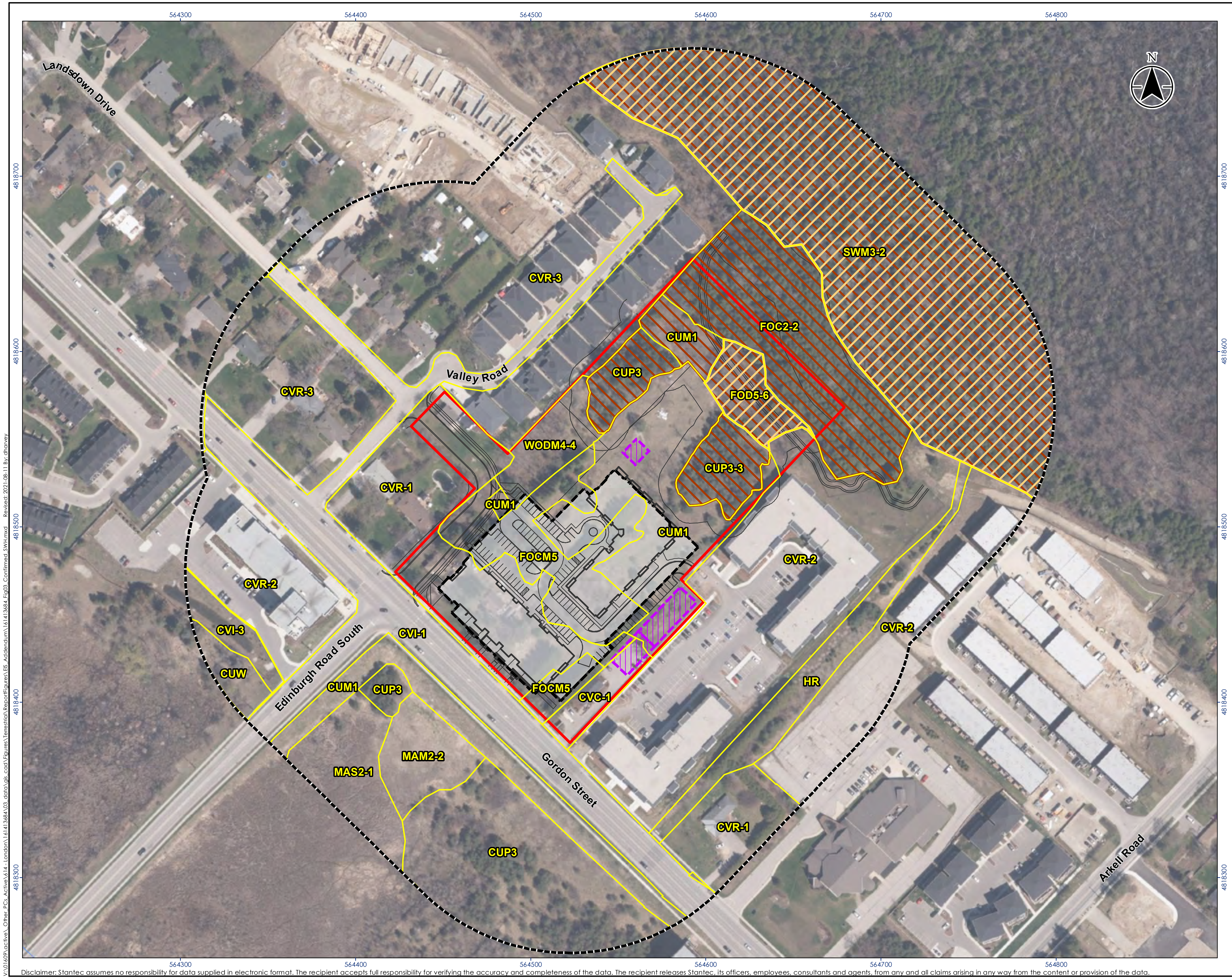

Stantec

Legend

- ⬚ Study Area (120 m)
- 🟥 Subject Property
- Watercourse (Permanent)
- 🟨 ELC Boundary

Development Plan

- Proposed Building
- Proposed Building (Underground)
- Proposed Development Plan
- Proposed Extent of Underground Parking
- ▨ Proposed Stormwater Management

Confirmed Significant Wildlife Habitat

- ▨ Habitat for Species of Conservation Concern
- ▨ Seasonal Concentration Areas of Animals

0 25 50 Metres

1:2,200 (At original document size of 11x17)

Notes

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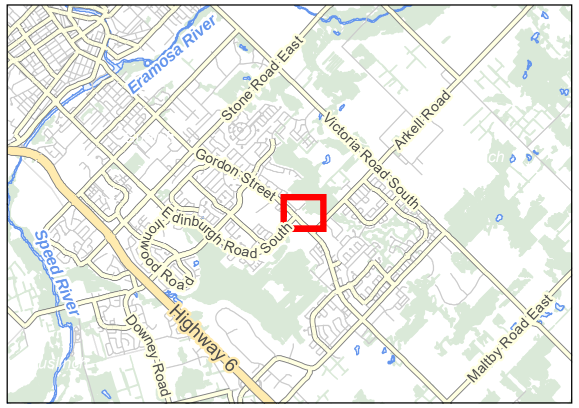

Project Location City of Guelph	161413684 Prepared by DH on 2021-08-11

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
EIS ADDENDUM

Figure No.
3 **DRAFT**

Title
Confirmed Significant Wildlife Habitat

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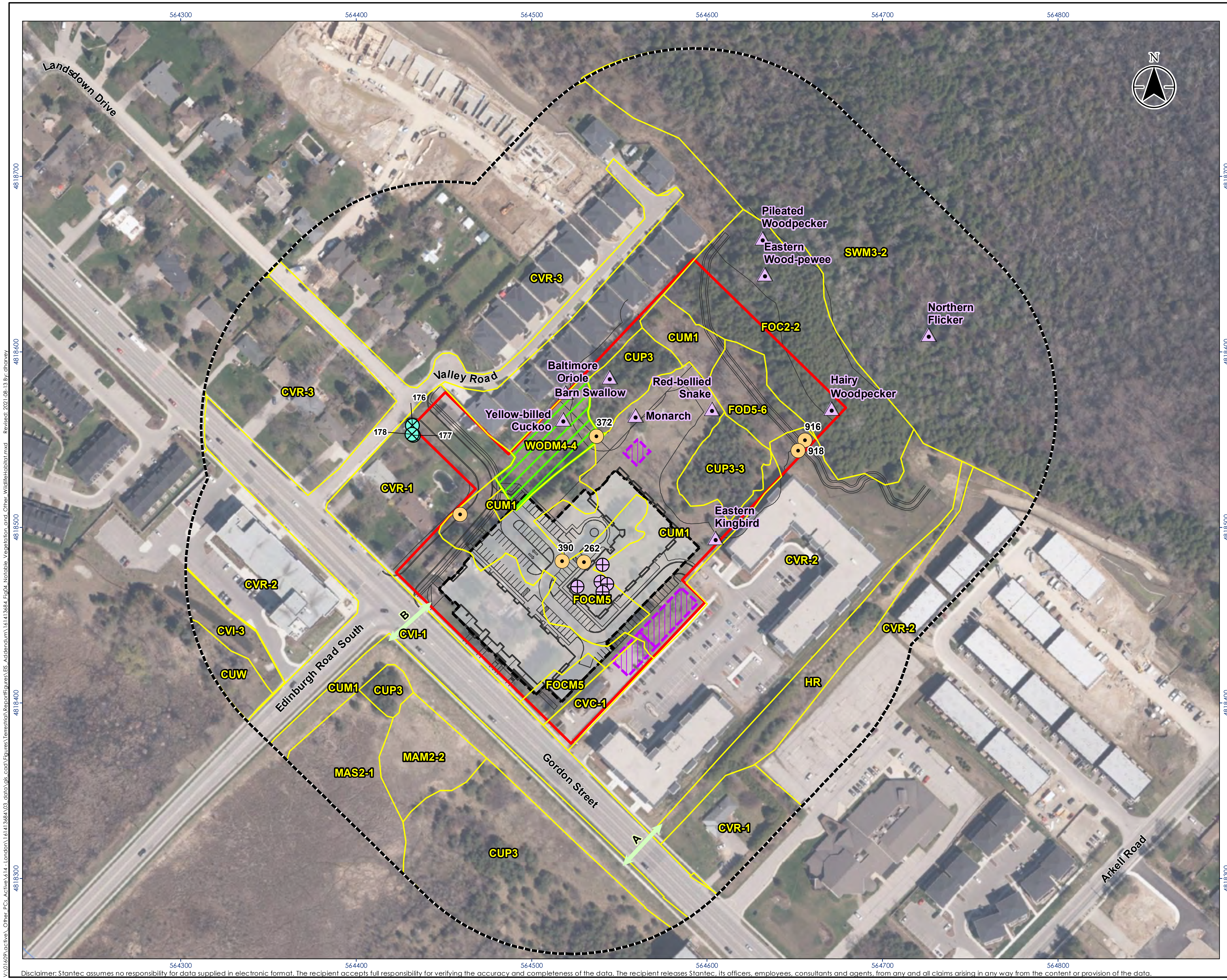

Stantec

Legend

- Study Area (120 m)
- Subject Property
- Watercourse (Permanent)
- ELC Boundary

Development Plan

- Proposed Building
- Proposed Building (Underground)
- Proposed Development Plan
- Proposed Extent of Underground Parking
- Proposed Stormwater Management

Notable Vegetation

- Species at Risk Plant Species - Butternut
- Provincally Rare Plant Species - Honey Locust
- Locally Significant Plant Species - Black Maple
- Cultural Woodland (WODM4-4)

Other Wildlife Habitat

- Locally Significant Species Observation
- Deer Crossing (City of Guelph OP Schedule 4)

0 25 50 Metres

1:2,200 (At original document size of 11x17)

Notes

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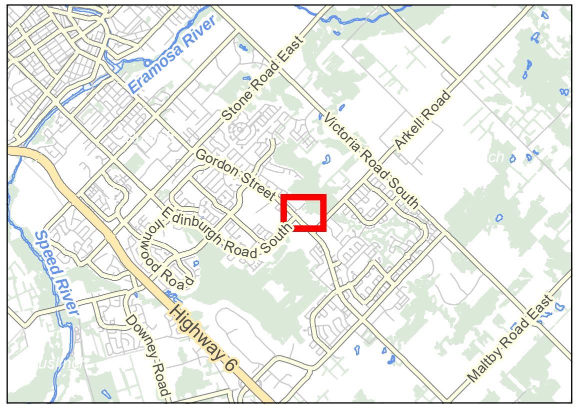

Project Location
City of Guelph

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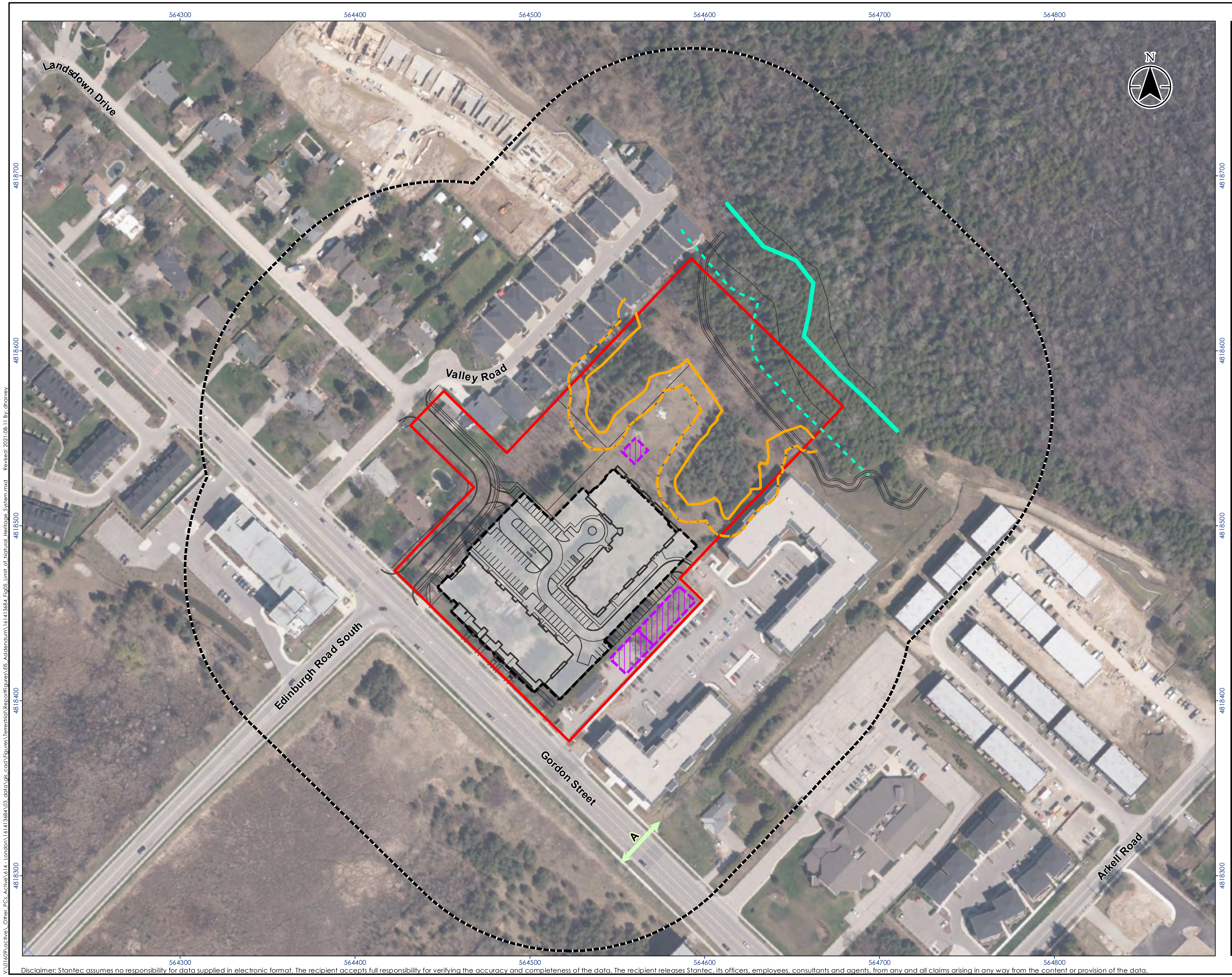
EIS ADDENDUM

Figure No.
4

DRAFT

Title
Notable Vegetation and Other Wildlife Habitat

V:\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Terrestrial\ReportFigures\EIS_Addendum\161413684_Fig05_Limit_of_Natural_Heritage_System.mxd Revised: 2021-08-11 By: dharvey



Stantec

Legend

⬚	Study Area (120 m)	↔	Deer Crossing (City of Guelph OP Schedule 4)
🟥	Subject Property	—	Woodland Boundary (NRSI)
—	Watercourse (Permanent)	- -	Woodland Setback

Development Plan

—	Proposed Building
- -	Proposed Building (Underground)
—	Proposed Development Plan
▭	Proposed Extent of Underground Parking
▨	Proposed Stormwater Management

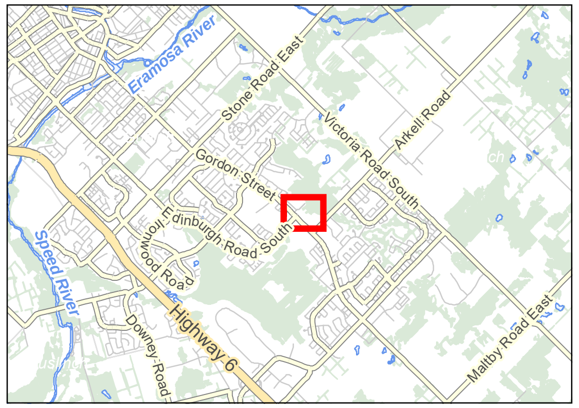
Limit of Natural Heritage System

—	Approximate Wetland Boundary (Stantec 2019)
- -	Wetland Setback (30 m)

0 25 50 Metres

1:2,200 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2020.
3. Orthoimagery © First Base Solutions, 2018. Imagery flown in 2019.



Project Location
City of Guelph

161413684
Prepared by DH on 2021-08-11

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
EIS ADDENDUM

Figure No.
5

DRAFT

Title
Limit of Natural Heritage System

APPENDIX B
CITY CONSULTATION

APPENDIX B.1
CITY OF GUELPH COMMENTS

Internal Memo

Date	December 8, 2020
To	**Lindsay Sulatycki, Senior Development Planner**
From	Leah Lefler, Environmental Planner
Service Area	Infrastructure, Development and Enterprise Services
Department	Planning and Building Services
Subject	**1242-1260 Gordon Street and 9 Valley Road** **Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment** **Environmental Planning Comments on First Submission**

Environmental Planning reviewed the following documents that pertain to the proposed Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment at 1242-1260 Gordon Street and 9 Valley Road:

Environmental Impact Study, Stantec, May 2020
Functional Servicing Report, Stantec, April 2020
Geotechnical Report, CMT Engineering Inc., April 2018
Hydrogeological Assessment, Stantec, May 2020
Landscape Concept, Stantec, March 2020
Planning Justification Report – May 2020
Tree Inventory and Preservation Plan – March 2020

Based on the review of the materials listed above, Environmental Planning staff offer the following comments at this time:

Environmental Impact Study

1. In the Introduction, please note that the planning approval sought by the applicant is a Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment. Following approval, the development will proceed to detailed design and subdivision registration. Text in the third paragraph should be updated accordingly.
2. Under 1.1 Agency Consultation, reference is made to a Hydrology Report. Please revise this to Hydrogeological Assessment.
3. Under 2.2.1 Official Plan, it is stated that "Natural Areas where development may be permitted provided an EIS can demonstrate that there will be no negative impacts to the natural heritage features or their ecological function". This statement is incorrect. General Permitted uses and feature specific policies apply to Significant Natural Areas and Natural Areas alike. Permitted uses may be more permissive in Natural Areas in comparison to Significant Natural Areas,

but not necessarily. If a feature does not meet criteria for protection, development may be permitted. Conversely, if a feature meets criteria for protection, the general permitted use policies and feature-specific policies apply. Please clarify this.

4. The last sentence on page 2.2 states that “The Natural Heritage System also incorporates hazard lands including steep slopes, erosion hazard lands and unstable soils that are under the jurisdiction of the GRCA”. This statement is incorrect. Criteria for designating Significant Valleylands (a Significant Natural Area included in the NHS) includes undeveloped portions of the regulatory floodplain. Hazard lands are not outright included in the NHS. Please correct this.
5. Under 2.2.3 Tree By-law, it is stated that the “Tree By-law was created to prevent damage or destruction to trees”. This statement is incorrect. The Tree By-law ‘regulates’ the destruction or injuring of trees and enables the City of Guelph to require a tree permit prior to the injury/destruction of a regulated tree, and compensation. The Tree By-law helps protect and enhance the tree canopy cover in the City. Please revise accordingly.
6. Under 3.2 Field Investigations on page 3.8, please include bat acoustic surveys as well as bat exit surveys in the list of targeted field surveys.
7. Under 3.2.8.2 Bat Exit Surveys on page 3.14, please include the type of device used for acoustic monitoring. For example, was a hand-held unit used, a song meter or both?
8. Under 3.2.9.1 Diurnal Surveys on page 3.15, it is stated that “fieldwork was conducted at, or within, half an hour of sunrise”. This statement does not match dates and times listed in Table 3.7. Best results are achieved within half an hour of sunrise, especially in noisy urban environments, and especially in forested ecosystems. The first breeding bird survey was completed on June 12, 2018, which is very late for a first visit. Based on timing of field surveys, data should be interpreted accordingly (i.e. lack of record does not indicate absence). Please update the text, as appropriate.
9. Under 3.2.9.2 Crepuscular Surveys on page 3.16, mention of moon phase is not made. Were conditions appropriate for surveying crepuscular birds during site visits completed for bats? Refer to MNRF’s ‘Eastern Whip-poor-will and Common Nighthawk Survey Protocol’ for guidance.
10. Under 4.4.6 Amphibian Survey and Habitat Assessment on page 4.6, it is stated that suitable habitat for amphibian breeding was not present. This seems odd, given that the Torrance Creek PSW is located within the Study Area, which is known to provide woodland amphibian breeding habitat. Snow melt and a high groundwater table result in seasonal ponding within this wetland complex. Please clarify.
11. Under 4.4.14 Incidental Wildlife Observations, the DeKay’s Brownsnake observation from May 16, 2019 should be added to the list of incidental wildlife. This species was observed, along with several Eastern Gartersnake and a Red-bellied Snake during the feature staking exercise, with City staff. Further, please assess the significance of the snake records recorded with respect to

significant wildlife habitat and the potential for snake hibernacula to occur in the vicinity of the subject property.

12. Section 5.0 Significant Natural Heritage Features should be based on the natural heritage and water resources policies of the City of Guelph Official Plan (March 2018 Consolidation), in addition to the policies of the Provincial Policy Statement. Please update this section to address Official Plan policy.
13. Section 5.2 Significant Woodlands includes the following statement: "notwithstanding the criteria denoted in the OP excluding plantations". This statement is incorrect. *Plantations* is a defined term in the Official Plan. Cultural Plantation, per ELC, is not the same thing as *plantation* in the Official Plan. A cultural plantation unit must meet the Official Plan's definition of *plantation* to be excluded from the assessment of significant woodland. Please clarify this.
14. Section 5.2.1 Other Woodlands refers to a deciduous woodland and claims that it was excluded from Significant Woodland due to composition, origin and size. Please provide the analysis to support this. Do the Cultural Woodlands criteria of the Official Plan to this deciduous woodland? This assessment should also be included in a revised EIS.
15. What does the bolded text indicate in Table 5.1? For clarity, please uses bolded text consistently within each Table, and among Tables 5.1 through 5.4. Also, please update Tables 5.1 through 5.4 to accurately assess field data collected against MNRF's Ecoregion 6E Criteria to determine whether or not Candidate or Confirmed SWH is present within the Study Area and/or Subject Property.
16. Section 5.3.5 Locally Significant Species should be updated to include the names of the two locally significant plant species. Also, the list of locally significant bird species should be updated to include Northern Flicker. A total of six locally significant bird species were documented, based on field records.
17. Section 5.4.1 Butternut should be updated to indicate that an 'authorization' under the *Endangered Species Act* is sought. The EIS should be updated with information from the MECP and Natural Resource Solutions Inc. to reflect the current status of Butternut, ESA requirements and compensation plantings. Correspondence and supporting documentation should be included as an Appendix.
18. Section 5.4.3 Bat SAR, please provide a map showing the extent of bat species at risk habitat (roosting habitat, foraging habitat). Please also provide correspondence with MECP confirming support of the proposed approach.
19. Section 5.5 Significant Natural Heritage Features Summary, on page 5.8, please update the bullet list to include bat species at risk, and to note that honey locust is a planted specimen. Also, the statement "unable to confirm presence/absence" is incorrect. The field surveys were designed to enable an assessment of SWH. For example, breeding bird survey results in fact confirm the woodland as Woodland Area Sensitive Breeding Bird Habitat. Based on results of field surveys, it may or may not be possible to confirm SWH. Unconfirmed SWH would remain Candidate SWH in areas meeting the criteria of the schedules for 6E. Please clarify this in the text.
20. Section 5.5 Significant Natural Heritage Features Summary, on page 5.9, includes other woodlands (WODM4-4). Based on the ELC figure, the WODM4-4

vegetation community appears to be contiguous with an FOCM5 vegetation community. As per comment 14 above, please assess this woodland against the Official Plan's criteria for Cultural Woodland and update the text on page 5.9 accordingly.

21. Section 6.1 Stormwater Management should reference stormwater targets prescribed in the Torrance Creek Subwatershed Study for infiltration rates. A portion of the site is located in Catchment 102, where the following targets apply:

    - infiltrate to enhance baseflow in Torrance Creek: 150mm/yr to 200mm/year or match pre- to post-
    - pre- to post- peak flow control for all design events (2 to 100-year events)
    - 24-hour extended detention for 25mm rainfall event
    - minimum 80% TSS removal

    Similarly, the Stormwater targets prescribed in the Hanlon Creek Subwatershed Study should be referenced in this section, as a portion of the site is located within the Hanlon Creek Subwatershed. The proposed stormwater outlet drains to Tributary D, where the following targets apply:

    - match pre- to post- peak flows for all storm events
    - implement infiltration best practice to the great extent feasible

22. The Functional Servicing Report (FSR)and Engineering Plans indicate that parking lot water as well as rooftop water will be directed to the infiltration trench. Further, stormwater management does not appear to be provided for a portion of the site, including drainage from the extension of Edinburgh Road. Lastly, sufficient capacity to accommodate flows from the proposed development is not available in the receiving stormwater management pond. Section 6.1 should be updated to provide an accurate and detailed description of the proposed stormwater management system so that all potential impacts can be identified in Section 7.0.

23. The first paragraph on page 6.2 states that "the total flow to Gordon Street (inclusive of rooftop-controlled flow) meets the predevelopment target rates". Please provide supporting documentation or provide reference to specific values and/or sections of the FSR.

24. On page 6.2, a description of the infiltration trench is provided. Based on this description, it is unclear how groundwater levels factored into the design of the facility. For example, has 1m separation distance from the high-water level mark been factored in?

25. Section 6.1.2 Trail, references the Guelph Trail Master Plan and a proposed connection through the subject property. A recommendation is provided that the trail be completed as part of a broader trail design approach, to be completed by the City at a future date. This recommendation conflicts with the requirements set out in the Terms of Reference, which included an assessment of the trail route, recommendation for trail alignment consistent with Official Plan policy (i.e., consistent with permitted uses within the natural heritage system, demonstration of no negative impact, etc.) and identification of best management practices to provide the basis for basic trail design, which is to be

completed as part of the Environmental Implementation Report (refer to pages 18 and 20 of the approved TOR). The Active Transportation Network Study maps the portion of trail through the subject property as a desired Active Transportation route (i.e. for cycling). The feasibility of accommodating an Active Transportation route through the subject project is to be assessed based on Official Plan policy in the EIS. Lastly, a trail connection from the Park Block to the trail network is desired and should be assessed and evaluated through the EIS to inform the design.

26. Section 7.0 Potential Impacts of Development and Mitigation Recommendations, reference is made to “net environmental impact assessment”. This is not appropriate as the policy test is “no negative impact”. Please revise this statement and confirm that the analysis provided is based on the “no negative impact” test.
27. Section 7.1 Impacts on Significant Natural Features, given that two 12 storey buildings are proposed, the EIS should evaluate the potential for bird strike impacts, and inform the design, as appropriate. Lighting impacts may also result from the proposal; the EIS should make recommendations for lighting adjacent to the natural heritage system based on best management practices. Lastly, grading impacts should be assessed in the EIS. An analysis of the grading plan should be provided in the context of permitted uses within the natural heritage system. Please update section 7.1 accordingly.
28. In Section 7.1.1 Significant Wetlands, it is stated that “incidental runoff impacts associated with sediments, dust, as well as nutrient loads will be reduced by the natural polishing function of the vegetative zone between the feature ad development”. It is unclear what this statement means. The Stormwater system is designed to infiltrate the 25mm storm event via an infiltration trench. Surplus runoff will fill a storage tank and then outlet to the storm sewer on Gordon Street, which outlets to a stormwater pond, which discharges to the Hanlon Creek PSW. Further, the last sentence of the first paragraph in this section states that “all surface runoff from the proposed development is directed to the existing storm sewer on Gordon Street”. This statement is not consistent with section 6.1 of the EIS or the FSR. Please clarify.
29. Also in Section 7.1.1 Significant Wetlands, please demonstrate that infiltration rates and volumes have been matched, pre- to post- in the Torrance Creek and Hanlon Creek Subwatersheds. This section notes that infiltration will “match and likely notably exceed pre-development infiltration volumes” in the catchment that directs flows to Torrance Creek. Torrance PSW has both a recharge and discharge function, depending on the time of year. During periods of an elevated water table and an upward hydraulic gradient, are impacts associated with the infiltration trench anticipated? For example, if infiltration cannot occur due to a high-water table, surplus will fill the storage tank and discharge to Hanlon PSW, likely resulting in a negative impact to both PSWs. Please include an in-depth analysis of stormwater impacts on the natural heritage system’s features and functions.
30. On page 7.2, discussion is provided on the predicted impacts associated with reduced infiltration to the Hanlon Creek Subwatershed, with a conclusion of no negative impact drawn. Please provide the supporting analysis to support this

claim. For example, what is the difference in pre- to post- infiltration volumes and rates? If infiltration is reduced, is the potential for baseflow impacts in Hanlon Creek? If infiltration is reduced, will more runoff be directed to Hanlon PSW? In addition, the FSR indicates that this runoff would be directed to the storm sewer on Gordon. The EIS fails to address Stormwater impacts associated with unattenuated/untreated runoff from the catchment containing the extension of Valley Road/Edinburgh.

31. The Torrance Creek PSW has a recharge and discharge function. What impact does the proposed stormwater management system have on the recharge/discharge function of the wetland? Please update the EIS to include a comparison of pre- to post- monthly differences in vertical hydraulic gradients, infiltration, runoff, etc. Note that this is required to demonstrate no negative impact the PSW.

32. Section 7.1.5 Significant Habitat of Endangered and Threatened Species, please provide documentation of correspondence with MECP confirming the proposed mitigation measures for bat species at risk are acceptable. Please also update the Butternut paragraph to include details from NRSI, as requested above.

33. Section 7.1.6 Locally Significant Species, please clarify where the Yellow-billed Cuckoo was heard. The text appears to indicate that the Yellow-billed Cuckoo was heard singing from the development area of the site. Please provide an assessment based on the Official Plan’s policy on Habitat for Significant Species to establish whether or not this Natura Area designation applies.

34. In section 7.3.1.3 Wildlife Friendly Building Design, please note that the EIR should include more detailed guidance on bird-friendly building design to inform detailed design.

35. Environmental planning staff are supportive of the timing recommendations made for the removal of debris and woodchip piles to protect snakes. Consider including a recommendation to incorporate snake hibernacula and/or gestation site habitat structures in the buffer portion of the natural heritage system. The Environmental Implementation Report would then provide further information on location, design, etc. to assist with detailed design and implementation.

36. In section 7.3.4 on page 7.8, please update the paragraph on Butternut to reflect the outcome of the Butternut Health Assessment and authorization. NRSI should be contacted for this information.

37. The details included in the post-construction monitoring program are acceptable for the EIS; however, please note that a requirement of the forthcoming EIR will be to provide a detailed post-construction monitoring plan. Similarly, additional detail on vegetation plantings will also need to be provided in the EIR. Please update the EIS to include a summary section on EIR requirements and a proposed outline for the future report. Please note that this was included within the approved Terms of Reference.

38. The following major topics were omitted from the EIS and should be assessed in detail in a revised EIS as part of the next submission:

    - assessment of bat species at risk habitat and supporting documentation from MECP;
    - Butternut assessment details and supporting documentation from MECP;

  - assessment of Habitat for Significant Species;
  - assessment of Cultural Woodland;
  - assessment of the need for Established Buffers;
  - assessment of grading impacts;
  - assessment of wetland water balance, based on assessment of monthly differences, pre- to post-development, for lands draining to the Torrance PSW and Hanlon PSW, to determine whether or not ecological and/or hydrologic impacts resulting from the proposed development are anticipated; and
  - recommended scope for EIR.

39. Section 9.0 Policy Compliance should focus on the consistency of the proposal with the "no negative impact test". As written, the focus appears to be on establishing feature-based constraints to development. This is not consistent with the PPS, and the natural heritage system's approach to protecting, enhancing and restoring natural heritage in Ontario.

40. Section 10.1 Report Summary, please update the bullet on SWH to indicate Candidate vs Confirmed. Further, the bullet on the proposed stormwater management plan indicates that parking lot runoff will be infiltrated. This detail was not included in the description of the stormwater management system presented earlier in the EIS. Please ensure that all statements are consistent and coordinated with the engineering plans prepared for the proposed development. Please note that infiltration of parking lot water is not supported by the City. Lastly, the report summary should include changes to wetland hydrology and ecology, and removal of accessory habitat to list of potential impacts associated with the proposed development.

41. Please update section 10.2 Recommendations to include the erection of Tree Protection Fencing prior to the commencement of site alteration/construction.

42. Please update mapping provided in Appendix A to include the following:

  - established wetland buffer;
  - Ecological Land Classification vegetation community information for polygon adjacent to FOD5-6;
  - extent and type of Significant Wildlife Habitat features;
  - limit of the Natural Heritage System; and
  - Cultural Woodland and/or Habitat for Significant Species, as appropriate, based on the criteria-based assessment requested above.

Hydrogeological Assessment

43. In section 4.2.4.1, pre-treatment for TSS is suggested to eliminate a number of sediment-bound metals in the discharge effluent. City staff agree that the proposed pre-treatment approach would likely reduce these concentrations; however, please note that samples would still be required to be collected to confirm this assumption, prior to the discharge being authorized to City sewers.

44. Please update section 4.2.4.1 to clarify whether or not VOCs were sampled to confirm presence/absence. The City's Sewer Use By-law prohibits discharge of VOC-impacted. Please note that VOC sampling may be required under a future discharge agreement with the City's Wastewater Division.

45. The post-development water balance provided in section 5.3 does not appear to account for the lands fronting on Valley Road (0.27ha catchment shown on Figure 15). Please explain why this area was excluded from water balance calculations, or update the water balance to include this catchment. Further, the size of the catchment draining to Torrance provided in the water balance assessment is 1.73ha, which does not match the catchment area of 1.44 ha in the hydrologic model. Please update the calculations ensuring that consistent catchment areas are applied.

46. The EIS should refer to Section 6.0 Groundwater Dewatering Assessment and include recommendations for monitoring and best practice. This could be included as an item for the future EIR.

47. Section 6.1 – It appears that a safety factor was not considered in the calculations of dewatering volume estimation, nor was any basal seepage considered. Although the site typically has observed downward gradients, the hydrological assessment indicates that upward gradients are present. Please add a factor of safety to the calculations and account for basal seepage, or provide text to explain why these elements were not considered in the calculations.

48. An infiltration (rock) trench is proposed to address the infiltration deficit. The infiltration (rock) trench is located within the Torrance Creek Subwatershed. Please include an analysis of the post-development water balance per watershed. For example, with LID measures in place, the water balance should demonstrate that the infiltration rate/volume should roughly match pre- to post-rates/volumes within each Subwatershed (i.e. Torrance and Hanlon). A stormwater management design and supporting analysis demonstrate no negative impact to the receiving natural heritage system is required. This is typically achieved by demonstrating that the proposed development and stormwater management system matches pre- to post- monthly infiltration rates/volumes and monthly runoff rates/volumes. Hydrographs depicting monthly differences in runoff volumes and infiltration volumes are helpful in demonstrating consistency with the natural heritage system “no negative impact” policy test.

49. In Section 7.2 construction proximity to the nearby municipal well is accounted for; however, there is no discussion provided as to private residential wells in the area. During the filing of an application for PTTW or registration under the EASR, it is recommended that the proponent assess potential impacts to private residential wells.

Tree Preservation Plan

50. Please update the Tree Preservation Plan to include recommendations for the EIR and detailed design.

51. Environmental planning is generally supportive of using a polygon approach in certain situations; however, based on data provided in Appendix 1 Tree Inventory Data, it is unclear how the stem count column relates to the Polygon. For example, 1 stem is reported from each of Polygons A, B, C, E and F. Given the brief description provided on page 4 of the plan: “If trees were present in monoculture hedgerow features, a polygon method was used”. Based on this description, >1 stem per polygon would be expected. Please clarify.

52. Please update Map 2 of the Tree Inventory and Preservation Plan to show Tree Protection Fencing around the perimeter of the natural heritage system.

Functional Servicing Report

53. Please update section 5.1.2 Torrance Creek Subwatershed Study to accurately reflect recommended infiltration rates, which in the case of the proposed development is between 150mm/yr to 200 mm/yr.
54. The FSR indicates that the area outletting to Gordon Street (Hanlon Creek Subwatershed) will increase, post-development. The infiltration trench is proposed in the Torrance Creek Subwatershed, which means the majority of stormwater originating from the Hanlon Creek catching will be generated as runoff. Please clarify that the receiving stormwater pond has capacity to control the runoff volumes generated by the proposed development. Please note that surcharge of this facility is directed to the Hanlon PSW. Runoff volumes should match pre- to post- per the Hanlon Creek Subwatershed recommendations.
55. The description of Catchment 202 provided at the bottom of 5.6 indicates that roof-top water will be directed the storm sewer on Gordon Street, with the 25mm event being directed to the infiltration trench. Please clarify that up to and including the 25mm is intended to be directed to the infiltration trench. Events in excess of 25mm or when back to back events occur prior to draw-down would be directed to the storage tank, eventually draining to the storm sewer when capacity is reached. Environmental planning strongly encourages infiltration of ‘clean’ water to maintain infiltration and baseflow in Hanlon Creek to the greatest extent feasible. Please consider this comment when updating the FSR.
56. The EIS should include an analysis of the findings presented on page 5.8 which relate to pre- to post- differences in runoff and infiltration being directed to the Torrance and Hanlon Subwatersheds under the post-development scenario. Based on the analysis provided in the FSR, the EIS should provide an assessment as to whether or not impacts to the ecology or hydrology of the wetlands are anticipated.
57. How would the infiltration trench function in the event of back-to-back storms? Please clarify whether or not a safety factor was incorporated into the sizing and design of the infiltration trench.
58. In section 5.6 On-site Infiltration, on page 5.9, it is stated that “The infiltration gallery should only be intercepted by groundwater in spring-time”. How was this detail factored into the water balance? The EIS should provide an analysis of potential impacts arising from the proposed stormwater design. For example, if groundwater intercepts the infiltration trench during the spring, infiltration will not occur which would result in more runoff being directed to Hanlon Subwatershed. This is unacceptable and should be addressed in the next submission.
59. Please note that in situ permeameter testing is required to demonstrate that the proposed infiltration trench will function as anticipated. Please provide this information in the next submission.

60. Drawing SSP-2 Storm Drainage Area Plan – It is unclear how the Area IDs relate to the Catchments described in the FSR and Hydrological Investigation report's water balance calculations. Please ensure that this is clarified and coordinated among studies and drawings in the next submission.
61. Drawing GP-1 Grading Plan indicates that extensive grading is required adjacent to the natural heritage system. Please provide additional detail on grading requirements (e.g. spot elevations) to enable a proper assessment of consistency with Official Plan policy. Please note that a cross-section can be helpful in demonstrating how the required grading relates to the protection of the natural heritage system. At a minimum, please update GP-1 to show differences in grade adjacent to the natural heritage system, and slope, particularly at the southeast end of the site.
62. It is unclear how the proposed erosion and sediment control plan has been coordinated with the proposed grading plan. For example, tree protection fencing and silt fencing is proposed in an area identified for extensive grading on GP-1. Please clarify.

Landscape Concept

63. The Landscape Concept proposes the planting of coniferous and deciduous trees on top of the infiltration facility. Guelph's Engineering Development Manual specifies a minimum 1m offset of plant material from infiltration galleries. Please relocate the proposed trees outside of the infiltration gallery area.

Summary

A revised EIS is required to address the comments provided above. Revisions to the supporting studies, including the Tree Preservation Plan, Hydrological Assessment, Functional Servicing Report and Landscape Plan are required. Environmental planning encourages the applicant to meet with City staff to discuss the comments provided, prior to providing a second submission. Substantial work remains outstanding to adequately demonstrate no negative impact to the natural heritage system's ecological and hydrologic features and functions.

Please note that comments provided by Scott Cousins, City of Guelph Hydrologist, are incorporated into the comments provided under the Hydrogeological Assessment heading above.

Leah Lefler, Environmental Planner
Planning and Building Services, **Infrastructure, Development and Enterprise**
Location: City Hall
519-822-1260 extension 2362
leah.lefler@guelph.ca

Copy: Mohsin Talpur, Jyoti Pathak, Scott Cousins

INTERNAL MEMO

DATE December 18, 2020

TO **Lindsay Sulatycki**

FROM Jyoti Pathak
DIVISION Parks and Recreation
DEPARTMENT Public Services

SUBJECT **1242-1260 Gordon Street and 9 Valley Road- proposed Draft Plan of Subdivision, Official Plan Amendment and a Zoning By-law Amendment (OZS20-004)**

Parks have reviewed the following documents submitted in support of the above noted proposed Draft Plan of Subdivision, Official Plan Amendment and a Zoning By-law Amendment, circulated on July 9, 2020

- **Notice of Complete Applications – July 2020**
- **Notice of Public Meeting – September 2020**
- **Draft Plan of Subdivision – February 2020**
- **Angular Plane Diagrams – April 2020**
- **Boundary Survey – January 2015**
- **Conceptual Site Plan – May 2020**
- **Draft Official Plan Amendment – May 2020**
- **Draft Plan – Parking Level 2 – February 2020**
- **Draft Plan – Parking Plan Level 1 – February 2020**
- **Draft Plan of Subdivision with Concept – February 2020**
- **Draft Zoning By-law – May 2020**
- **Engineering Plans – April 2020**
- **Environmental Impact Study – May 2020**
- **Functional Servicing Report – April 2020**
- **Geotechnical Report – April 2018**
- **Landscape Concept – March 2020**
- **Planning Justification Report – May 2020**
- **Renderings – March 2020**
- **Tree Inventory and Preservation Plan – March 2020**
- **Urban Design Brief – April 2020**

Parks offer the following comments:

Proposed Draft Plan of Subdivision:
A residential subdivision is proposed on the subject lands which are approximately 3.12 hectares in size and include developable area and natural heritage system. The applicant is proposing a residential block with two, 12-storey apartment buildings with a total of 377 apartment units, a municipal park block and an open space block.

Planning Justification Report:
Revise the parkland dedication information on page 4 of the Planning Justification report to reflect current alternative rate (1 ha per 300 dwelling units for parkland conveyance and 1 ha per 500 dwelling units for payment in lieu of conveyance) for parkland dedication requirement under s.51.1 of the Planning Act and City’s Official Plan Policy 7.3.5.1.

Parkland Dedication:
Parkland dedication is required for the proposed subdivision according to the Official Plan (OP) Policy 7.3.5.1. The OP policy states the following:

> 1. The City will require parkland dedication as a condition of *development, consent* or subdivision proposals in an amount up to:
>   ii) 5% of the land or one hectare for each 300 *dwelling units* for residential purposes

The current draft plan of proposed subdivision includes an area of 3.12 hectares and the proposal includes development of 377 apartment units. In accordance with the Official Plan policy 7.3.5.1 at an alternative rate a park block of 1.25 ha is required. However due to the size of the development parcel Parkland dedication will be required as a combination of parkland and payment in lieu of conveyance for the proposed draft plan.

Park Block Location:
Generally, the park location is satisfactory however City requires parkland to be conveyed free and clear of all encumbrances. The proposed park block is encumbered due to its proposed location on top of an underground parking structure. The park block currently includes a tree protection zone and this impacts usability, functionality and accessibility of this very small park. Park would encourage achieving 0.2 ha park size outside of the tree protection zone.

We intend to provide pedestrian access to the park along the Edinburgh Road extension from Gordon Street and along Landsdown Drive/ boulevard trail/ sidewalk from north and trees would have to be cleared if blocking this access.

Generally, City requires park blocks to meet City's Zoning Bylaw, plans, policies, and guidelines and the following criteria:

- The site provides a critical public trail connection to the proposed Citywide trail/ ATN route west of Torrance Creek PSW from Gordon Street along Edinburgh Road extension through the proposed park block. **GTMP and OP Policy 7.3.5.5 (ii) (Parkland Dedication)**

- The site satisfies the development criteria for a neighbourhood park; **OP Policy 7.3.5.5 (Parkland Dedication)**

- The park should contain both active and passive recreational activities (i.e. children's play equipment, shade structure, seating, site furniture and planting etc.). **OP Policy 7.3.2 (Park Hierarchy)**

- The park should be connected to public sidewalks and should be designed as an accessible and barrier free space. **Facility Accessibility Design Manual – 2015**

- The park should be mostly flat (i.e. 80% table land with 2-3% slopes). **OP Policy 7.3.2.4 (Park Hierarchy)**

- The park should contain adequate public street frontage for high visibility and surveillance and for adequate public and operational access as identified in **Zoning Bylaw Table 9.2 (Row 3)** as follows: A minimum of 50 metres or 1 metre of street frontage for every 100 square metres of park area whichever is greater as identified in Section 9.2 of the City of Guelph's Zoning Bylaw.

- The park should be completely outside of natural heritage features. Natural heritage features and natural hazard lands as outlined in the City of Guelph's Official Plan will not be accepted as parkland dedication. **OP Policy 7.3.5.3 (Parkland Dedication)**

- parkland shall be conveyed free and clear of all encumbrances. **Development Charges background study Appendix E- Local Service Policy (basic park development - PAGES E-2 and E-3)**

- The park site should be well drained and have access to water, sanitary and storm water drainage servicing. **OP Policy 7.3.2.4 (Park Hierarchy), Development Charges background study Appendix E- Local Service Policy (basic park development - PAGES E-2 and E-3)**

Park Block Lot Frontage and park access

Park Operations require vehicular access to the park block and to the proposed trail to the east for maintenance and operational purpose. Provide options for review for achieving vehicular access.

Basic Park Development:

The developer is directly responsible for the basic park development according to the Development Charges background study - Appendix E- Local Service Policy (basic park development - PAGES E-2 and E-3):

The basic park development will include clearing, grubbing, site grading, storm water drainage, site servicing, topsoil and sodding of the Park block. The costs of the following items shall be direct developer responsibilities as a local service:
Base parkland development of lands conveyed to the City in connection with development including, but not limited to, the following:

- clearing and grubbing;
- topsoil or any fill or soils shall not be stockpiled on parkland;
- parkland shall be free of any contaminated soil or subsoil;
- servicing – water, hydro, stormwater, sanitary, electrical, catch basins as per City's requirements. rough grading (pre-grading) and the supply of topsoil to the required depth as per City's requirements;
- Seek City approval of the structural fill material if park requires filling.
- parkland shall not be mined for engineering fill and replaced with fill or topsoil;
- parkland shall be conveyed free and clear of all encumbrances; all parks are to be developed to the locally accepted "basic park development" standard which includes all aspects up to fine grade, topsoil and sod; which is to be maintained up to park acceptance.

- The park block shall be graded to meet approved parkland grade, including any associated infrastructure requirements (retaining walls, drainage, etc.) and sodded to minimize erosion and dust.
- Temporary fencing may also be required where there is no permanent fence to prevent illegal dumping; temporary park sign advising future residents that the site is a future park. Perimeter fencing of parkland to the City's standard located on the public property side of the property line adjacent land uses (residential or non-residential) as required by the City, or other approval authority.

The developer will be responsible for the Basic park development and City would require a cost estimate and security in the form of cash or a letter of credit based on the City approved estimated costs prior to the registration of the subdivision.

Trail Network:

The Official Plan – Schedule 8 'Trail Network' includes a proposed off-road secondary trail route along western edge of the Torrance Creek provincially significant wetlands through the subject property that connects to the approved proposed trail west of Valley Road condominium to the north and west of 1280 Gordon Street to the south.

Please note that the trail alignments north and south of the subject site have been designed and approved through the development review process and the developer is responsible to identify the trail alignment and preliminary trail design on the subject site as included in the terms of reference for the EIS.

Local trail connection:

Provide a local accessible trail connection, 2.5 m wide, to connect the proposed park to the proposed Citywide trail at the back of the property. This trail connection is to be designed and developed as part of the Landscaping works on the subject site.

Provide conceptual trail alignment for City's review of the following connections:

- North-south Citywide trail connection
- East-west local trail connection

Provide preliminary grading and Drainage plans and other plans as applicable to demonstrate that the trail can be built to the current City standards as follows:

1. The design and construction of the trail shall meet the accessibility criteria outlined in the City's Facility Accessibility Design Manual (FADM). The criteria include maximum running slope on trails to be 5% and the maximum cross slope on trails to be 2%, provision of rest areas at regular intervals, information and directional signage etc. Section 4.5.2 OUTDOOR RECREATIONAL FACILITIES of the FADM outlines the accessibility guidelines for trails. This document can be viewed at the following link:

   http://guelph.ca/wpcontent/uploads/Guelph_FADM_2015-06-30-FINAL.pdf

2. Provide minimum 0.6 metre wide mowed grass strips longitudinally along both sides of the trail surface at a cross slope of 2% away from the trail.

3. Provide sodded drainage swales and culverts at appropriate locations if the adjacent ground is higher to the trail surfacing levels.

Environmental Implementation Report:

An environmental implementation report (EIR) will be required to address the recommendations provided through the final approved Environmental Impact Study including Open Space Works and restoration, detailed landscape plans (by an accredited landscape architect); detailed design and mitigation plans to support the trail.

The EIR will address the recommendations related to trail system and natural open space system, including detail design of the trail system; preparation of Landscape Plans and details to address demarcation, removal of invasive species, hazard trees along the trail system and residential properties; clean-up of debris and waste; restoration; compensation and enhancement planting for buffers; invasive species management; design of educational/ interpretive and stewardship materials/ signage.

Detailed trail layout, grading and drainage plans showing trail design details such as signage, structures, etc. will be provided in the Environmental Implementation Report consistent with City of Guelph's current trail standards and other City Guidelines i.e. Facility Accessibility Design Manual and Engineering Development Manual where applicable. The trail plan, design and construction will comply with all relevant regulations applicable to trail management made under the Accessibility for Ontarians with Disabilities Act.

Open Space Works and Restoration:

Provide planting to enhance ecological buffers and wildlife corridors and compensation for removed trees, etc. and detailed planting plans will be provided with the Environmental Implementation Report. Provide seeding to restore graded areas within the open space

Tree Preservation and removal of invasive species and hazard trees:
Schedule removal of the common buckthorn within the trail corridor prior to trail construction.

A review of hazard trees (e. g. dead, partially dead or dying trees) along the trail route will be conducted at the time of vegetation removal by a qualified arborist. Identify all hazardous trees along the trail route in consultation with Parks staff for removal prior to start of trail construction.

Hazard trees only would be removed within striking distance of the trail.

Environmental Education:
The environmental education/ interpretive signage is proposed to be provided along the trail in the subdivision to provide resident education on the area’s environmental features and address the common resident impact items including dumping of yard waste, encroachments, pet waste, etc. The signage will be designed to meet City’s accessibility guidelines and the details of the signage will be provided in the EIR- trail and landscape plans.

Open Space Dedication:
Parks recommends conveyance of natural open space block to City for the purpose of the protection of natural heritage system and trail construction.

Demarcation:
The property demarcation will consist of 1.5 m black vinyl Chain Link fence and/or property markers in accordance with the City’s Property Demarcation Policy and specification and City approved demarcation plan will be included in EIR.

Summary:
Parks does not support the proposed development based on the current information provided. Parks needs revised documents which reflect the comments provided above for our further review and comments. Draft conditions would be provided upon receiving satisfactory proposal.

Regards,

Jyoti Pathak, Parks Planner
Parks
Public Services
T 519-822-1260 x 2431
E Jyoti.pathak@guelph.ca

From: Leah Lefler
To: Straus, Melissa
Subject: RE: Resources
Date: Tuesday, July 6, 2021 4:42:40 PM

Thanks Melissa. Thank you for taking notes during our meeting. They look great.

I'll be in touch about the bats/MECP ASAP.

Leah

Leah Lefler (she/her), Environmental Planner
Planning and Building Services, **Infrastructure, Development and Enterprise**
City of Guelph
519-822-1260 extension 2362
leah.lefler@guelph.ca

From: Straus, Melissa <Melissa.Straus@stantec.com>
Sent: Tuesday, July 06, 2021 4:16 PM
To: Leah Lefler <Leah.Lefler@guelph.ca>
Subject: RE: Resources

Thanks Leah,

See attached meeting minutes, if you require any updates just let me know.

Thanks for the links to the resources you provided, much appreciated.

Melissa Straus M.Sc.
Terrestrial Ecologist

Direct: 519 780-8103
Mobile: 226 971-2704
Fax: 519 836-2493
Melissa.Straus@stantec.com

Stantec
1-70 Southgate Drive
Guelph ON N1G 4P5

From: Leah Lefler <Leah.Lefler@guelph.ca>
Sent: Tuesday, July 6, 2021 3:07 PM
To: Straus, Melissa <Melissa.Straus@stantec.com>
Subject: Resources

Stantec

Meeting Agenda

Meeting Minutes

EIS Comments, 3 files: **1250 Gordon**

Virtual: Melissa Straus (Stantec) and Leah Lefler (City of Guelph)
July 6, 2021

Other Development Files Discussed Removed from Meeting Minutes

Project Name: 1242-1250 Gordon Street and 9 Valley Road **Stantec file #:** 161413684 **Comments:** EIS comments		
Species at Risk • Section 5.4.3 Bat SAR, please provide a map showing the extent of bat species at risk habitat (roosting habitat, foraging habitat). Please also provide correspondence with MECP confirming support of the proposed approach.	• Roosting habitat unconfirmed • Foraging habitat?	• City to look into recent MECP consultation approach with respect to bats.
Species of Conservation Concern • Under 3.2.9.2 Crepuscular Surveys on page 3.16, mention of moon phase is not made. Were conditions appropriate for surveying crepuscular birds during site visits completed for bats? Refer to MNRF's 'Eastern Whip-poor-will and Common Nighthawk Survey Protocol' for guidance.	• Conducted incidentally.	• Conducted incidentally as species could occur but unlikely therefore specific surveys not conducted.

Wetland Impacts • The EIS should include an analysis of the findings presented on page 5.8 which relate to pre- to post- differences in runoff and infiltration being directed to the Torrance and Hanlon Subwatersheds under the post-development scenario. Based on the analysis provided in the FSR, the EIS should provide an assessment as to whether or not impacts to the ecology or hydrology of the wetlands are anticipated.	• Does the City provide guidelines, reference studies, or have input on what type of impact details they are looking for? • Applies generally to all 3 projects.	• Consider percent increase/decrease, will receiving vegetation be required to change? • Hydrographs, does it match hydroperiod as per under pre-development conditions? • Look at topography and contours, what depth or area will water cover. Is the receiving vegetation be impacted? • Stacking of events, tied to SWM. • City to provide TRCA/GRCA sensitivity tool to assist.
Deer crossings	•	• City to provide Gordon Street EA to reference recommendations.

Hi Melissa,

As promised, here are links to the following documents:

- Guelph Trail Master Plan → refer to Table 3. Trail Classification. Secondary Trail type is the one that would typically be implemented in the buffer of the NHS, like at Bluewater. Design guidelines are flexible to limit impacts to the NHS.
- Gordon Street EA Project File Report and Appendix B – EIS and Tree Inventory.
- Wetland Water Balance Risk Evaluation, Appendix 2 lists wetland community types and hydrological sensitivity (High, Medium, Low).
- I learned a lot from reading TRCA's Water Balance for Protection of Natural Features too.

I will follow up with additional information on bats and MECP.

Leah

Leah Lefler, Environmental Planner
Planning and Building Services, **Infrastructure, Development and Enterprise**
City of Guelph
519-822-1260 extension 2362
leah.lefler@guelph.ca

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APPENDIX B.2
CITY OF GUELPH CONSULTATION

From: Leah Lefler
To: Straus, Melissa
Subject: RE: EIS resubmissions confirmation
Date: Monday, July 26, 2021 11:39:45 AM

Hi Melissa,

Thanks for confirming your approach. Please submit an EIS Addendum for 220 Arkell, 1250 Gordon and MacAlister/Victoria. The approach outlined in your email below is appropriate.

Regards,
Leah

Leah Lefler (she/her), Environmental Planner
Planning and Building Services, **Infrastructure, Development and Enterprise**
City of Guelph
519-822-1260 extension 2362
leah.lefler@guelph.ca

From: Straus, Melissa <Melissa.Straus@stantec.com>
Sent: Monday, July 19, 2021 3:25 PM
To: Leah Lefler <Leah.Lefler@guelph.ca>
Subject: EIS resubmissions confirmation

Hi Leah,

I know we discussed this but just wanted to make sure I was completely clear on the expectations.

For resubmission of 220 Arkell, Victoria Road at MacAlistar and 1250 Gordon you had indicated that an addendum was appropriate. To me, an addendum contains a comment matrix and only discusses bigger issues brought up in comments. It’s not an update of previous version of the reports. So for example, there wouldn’t be a repetition of the policy section if comments on that section were minor (grammatical, clarification points only). But if the analysis on say SWH was questioned, that section would be included in the addendum and updated.

Feel free to give me a call on my cell if you’d like to discuss.

Melissa Straus M.Sc.
Terrestrial Ecologist

Direct: 519 780-8103
Mobile: 226 971-2704
Fax: 519 836-2493
Melissa.Straus@stantec.com

Stantec
1-70 Southgate Drive
Guelph ON N1G 4P5

From: Leah Lefler
To: Straus, Melissa
Subject: Info on Bats
Date: Tuesday, July 27, 2021 1:40:11 PM

Hi Melissa,

Please see below for a summary on approach for dealing with bats, bat-related surveys and the MECP. This was provided to me by a consultant and colleague:

I connected with Michelle Karam, who is the bat management biologist with MECP, about what the expected approach is with SAR bats and bat habitat moving forward. Here are the takeaways and what we should now be considering.

- Communication is already required but may vary depending on the project. In general, Southern Ontario will require more discussions and likely an IGF. Northern Ontario may be more along the lines of a 'self-assessment' with the communication of the results.
- Biologists should understand bat behaviour and habitat requirements to make justifiable rational (or all bat questions go to those who do).
- Snag surveys are no longer considered required. If you understand what vegetation communities are habitat, there is no requirement for these surveys.
  - EXEMPTION some cases in Southern Ontario will require snag surveys as habitat is much more restricted, and it really could come down to one tree.
- To document species presence/absence, we are to use the best methods. This means that recorders may not be the best method. MECP strongly supports the use of mist netting for the presence/absence of bat species.
  - Mist netting provides more detail regarding species and individuals. No survey protocol exists (i.e., one night might be suitable).
  - Acoustic recording might be cost-effective or prohibitive depending on the project, hence why there is now another option. If using acoustic recording, place detectors in the best areas, not within woodlands (unless that is the best area), for the best quality recording. There is a template for submitting recording results.
    - I am thrilled there is no more of this 'place in a wooded area' nonsense. Note that there is no guidance on the density of detectors to ensure coverage.
    - In Southern Ontario, it may still be required to place detectors near ideal trees.
    - Detectors should still be deployed in June for ten ideal weather days.

Typically, you can assume the presence of bats, and for areas where habitat is not limited (i.e., northern Ontario) generally, removal of trees will not contravene section 9. As there is plenty of other habitat the removal of a small area of trees outside roosting times is considered avoidance and therefore compliant. The rationale for these cases can be provided to MECP, and they will respond with either next steps or an email detailing agreement.

You can also assume the presence of SAR bats in Southern Ontario and that removal of trees will contravention the ESA (no other habitat for bats to go to). In these cases, an IGF should be provided to MECP as soon as possible for the next steps/guidance.

Note in both cases, surveys to determine species may be requested, but I would consider these the go-to first steps (caveat, IF there is time) since we should have an understanding of potential SAR on sites/ completing a SAR screening. MECP will not helpful until you have done a good SAR screening and can put together an IGF. I would recommend always deploying detectors during summer surveys for appropriate and accessible Southern Ontario sites if we do not have a response from MECP yet.

Based on the above, MECP should be consulted where there is a potential for SAR bats. MECP's preferred approach is the use of the IGF, ideally based on current fieldwork.

Regarding the development files we discussed a few weeks ago, I would recommend submitting an IGF to MECP as soon as possible so that correspondence and confirmation of approach from MECP can be provided in the EIS addendums.

Leah

Leah Lefler (she/her), Environmental Planner
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leah.lefler@guelph.ca

APPENDIX C
COMMENT MATRIX

1242 – 1260 Gordon Street and 9 Valley Road, Guelph
Comment Matrix for First Submission
Draft Plan of Subdivision, Official Plan and Zoning By-law Amendment
Last updated January 14, 2021
Leah Lefler, Environmental Planner 519-822-1260 extension 2362
leah.lefler@guelph.ca December 8, 2020

113	**Environmental Impact Study** 1. In the Introduction, please note that the planning approval sought by the applicant is a Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment. Following approval, the development will proceed to detailed design and subdivision registration. Text in the third paragraph should be updated accordingly.	Acknowledged, updated in Addendum.
114	2. Under 1.1 Agency Consultation, reference is made to a Hydrology Report. Please revise this to Hydrogeological Assessment.	Acknowledged, additional details not required in Addendum.
115	3. Under 2.2.1 Official Plan, it is stated that "Natural Areas where development may be permitted provided an EIS can demonstrate that there will be no negative impacts to the natural heritage features or their ecological function". This statement is incorrect. General Permitted uses and feature specific policies apply to Significant Natural Areas and Natural Areas alike. Permitted uses may be more permissive in Natural Areas in comparison to Significant Natural Areas, but not necessarily. If a feature does not meet criteria for protection, development may be permitted. Conversely, if a feature meets criteria for protection, the general permitted use policies and feature-specific policies apply. Please clarify this.	Acknowledged, additional details not required in Addendum.
116	4. The last sentence on page 2.2 states that "The Natural Heritage System also incorporates hazard lands including steep slopes, erosion hazard lands and unstable soils that are under the jurisdiction of the GRCA". This statement is incorrect. Criteria for designating Significant Valleylands (a Significant Natural Area included in the NHS) includes undeveloped portions of the regulatory floodplain. Hazard lands are not outright included in the NHS. Please correct this.	Acknowledged, additional details not required in Addendum.
117	5. Under 2.2.3 Tree By-law, it is stated that the "Tree By-law was created to prevent damage or destruction to trees". This statement is incorrect. The Tree By-law 'regulates' the destruction or injuring of trees and enables the City of Guelph to require a tree permit prior to the injury/destruction of a regulated tree, and compensation. The Tree By-law helps protect and enhance the tree canopy cover in the City. Please revise accordingly.	Acknowledged, additional details not required in Addendum.

118	6. Under 3.2 Field Investigations on page 3.8, please include bat acoustic surveys as well as bat exit surveys in the list of targeted field surveys.	Additional studies conducted in 2021 and detailed in addendum.
119	7. Under 3.2.8.2 Bat Exit Surveys on page 3.14, please include the type of device used for acoustic monitoring. For example, was a hand-held unit used, a song meter or both?	Additional studies conducted in 2021 and detailed in addendum.
120	8. Under 3.2.9.1 Diurnal Surveys on page 3.15, it is stated that "fieldwork was conducted at, or within, half an hour of sunrise". This statement does not match dates and times listed in Table 3.7. Best results are achieved within half an hour of sunrise, especially in noisy urban environments, and especially in forested ecosystems. The first breeding bird survey was completed on June 12, 2018, which is very late for a first visit. Based on timing of field surveys, data should be interpreted accordingly (i.e. lack of record does not indicate absence). Please update the text, as appropriate.	While June 12 is within the acceptable timing window of breeding bird surveys, we have conducted an additional survey on June 2, 2021 and have included the results in the addendum accordingly.
121	9. Under 3.2.9.2 Crepuscular Surveys on page 3.16, mention of moon phase is not made. Were conditions appropriate for surveying crepuscular birds during site visits completed for bats? Refer to MNRF's 'Eastern Whip-poor-will and Common Nighthawk Survey Protocol' for guidance.	Crepuscular surveys were conducted as per the approved ToR, incidentally in conjunction with bat exit surveys in June during clear evenings. However, surveys were completed between June 12 and June 26, 2018. Full moon dates were on May 29 and June 27, 2018 and therefore at least 3 surveys were conducted 1 week prior to the full moon with two having clear conditions, in accordance with MNRF's protocol. No additional details provided in the Addendum.
122	10. Under 4.4.6 Amphibian Survey and Habitat Assessment on page 4.6, it is stated that suitable habitat for amphibian breeding was not present. This seems odd, given that the Torrance Creek PSW is located within the Study Area, which is known to provide woodland amphibian breeding habitat. Snow melt and a high groundwater table result in seasonal ponding within this wetland complex. Please clarify.	Based on conducted amphibian surveys, suitable habitat for amphibian breeding is not present within the study area. This includes a May 28, 2018 search for vernal pools (as shown on Figure 2) that did not find any pooling areas and

		therefore breeding amphibian habitat is absent. No additional details provided in the Addendum.
123	11. Under 4.4.14 Incidental Wildlife Observations, the DeKay's Brown123) observation from May 16, 2019 should be added to the list of incidental wildlife. This species was observed, along with several Eastern Gartersnake and a Red-bellied Snake during the feature staking exercise, with City staff. Further, please assess the significance of the snake records recorded with respect to significant wildlife habitat and the potential for snake hibernacula to occur in the vicinity of the subject property.	Updated wildlife list and additional discussion on snake hibernacula provided in the Addendum.
124	12. Section 5.0 Significant Natural Heritage Features should be based on the natural heritage and water resources policies of the City of Guelph Official Plan (March 2018 Consolidation), in addition to the policies of the Provincial Policy Statement. Please update this section to address Official Plan policy.	Analysis included in Addendum.
125	13.Section 5.2 Significant Woodlands includes the following statement: "notwithstanding the criteria denoted in the OP excluding plantations". This statement is incorrect. *Plantations* is a defined term in the Official Plan. Cultural Plantation, per ELC, is not the same thing as *plantation* in the Official Plan. A cultural plantation unit must meet the Official Plan's definition of *plantation* to be excluded from the assessment of significant woodland. Please clarify this.	Acknowledged, additional details not required in Addendum.
126	14.Section 5.2.1 Other Woodlands refers to a deciduous woodland and claims that it was excluded from Significant Woodland due to composition, origin and size. Please provide the analysis to support this. Do the Cultural Woodlands criteria of the Official Plan to this deciduous woodland? This assessment should also be included in a revised EIS.	Analysis included in Addendum.
127	15.What does the bolded text indicate in Table 5.1? For clarity, please uses bolded text consistently within each Table, and among Tables 5.1 through 5.4. Also, please update Tables 5.1 through 5.4 to accurately assess field data collected against MNRF's Ecoregion 6E Criteria to determine whether or not Candidate or Confirmed SWH is present within the Study Area and/or Subject Property.	Bolded text is removed and Tables 5.1-5.4 are reiterated and updated in the Addendum.
128	16.Section 5.3.5 Locally Significant Species should be updated to include the names of the two locally significant plant species. Also, the list of locally	Acknowledged, reiterated in the Addendum.

	significant bird species should be updated to include Northern Flicker. A total of six locally significant bird species were documented, based on field records.	
129	17.Section 5.4.1 Butternut should be updated to indicate that an 'authorization' under the *Endangered Species Act* is sought. The EIS should be updated with information from the MECP and Natural Resource Solutions Inc. to reflect the current status of Butternut, ESA requirements and compensation plantings. Correspondence and supporting documentation should be included as an Appendix.	NRSI supporting documentation for Butternut provided in Addendum Appendix G.
130	18.Section 5.4.3 Bat SAR, please provide a map showing the extent of bat species at risk habitat (roosting habitat, foraging habitat). Please also provide correspondence with MECP confirming support of the proposed approach.	As per City of Guelph consultation with MECP, project-specific consultation is required. An Information Gathering Form (IGF) will be submitted to MECP. Habitat mapping is not provided and additional details are not required in Addendum.
131	19.Section 5.5 Significant Natural Heritage Features Summary, on page 5.8, please update the bullet list to include bat species at risk, and to note that honey locust is a planted specimen. Also, the statement "unable to confirm presence/absence" is incorrect. The field surveys were designed to enable an assessment of SWH. For example, breeding bird survey results in fact confirm the woodland as Woodland Area Sensitive Breeding Bird Habitat. Based on results of field surveys, it may or may not be possible to confirm SWH. Unconfirmed SWH would remain Candidate SWH in areas meeting the criteria of the schedules for 6E. Please clarify this in the text.	Summary of natural heritage features will be reiterated in the Addendum.
132	20.Section 5.5 Significant Natural Heritage Features Summary, on page 5.9, includes other woodlands (WODM4-4). Based on the ELC figure, the WODM4-4 vegetation community appears to be contiguous with an FOCM5 vegetation community. As per comment 14 above, please assess this woodland against the Official Plan's criteria for Cultural Woodland and update the text on page 5.9 accordingly.	Analysis included in Addendum.
133	21.Section 6.1 Stormwater Management should reference stormwater targets prescribed in the Torrance Creek Subwatershed Study for infiltration rates. A portion of the site is located in Catchment 102, where the following targets apply: − infiltrate to enhance baseflow in Torrance Creek: 150mm/yr to 200mm/year or match pre- to post-	The Stormwater Management (SWM) strategy has been revised to have an LID/rain garden feature at the east portion of property to provide recharge to Torrance Creek subwatershed and a new

	− pre- to post- peak flow control for all design events (2 to 100-year events) − 24-hour extended detention for 25mm rainfall event − minimum 80% TSS removal Similarly, the Stormwater targets prescribed in the Hanlon Creek Subwatershed Study should be referenced in this section, as a portion of the site is located within the Hanlon Creek Subwatershed. The proposed stormwater outlet drains to Tributary D, where the following targets apply: − match pre- to post- peak flows for all storm events − implement infiltration best practice to the great extent feasible	gallery in the newly acquired south piece of the site to provide recharge to Hanlon Creek subwatershed. Additional details provided on Stormwater Management in Addendum.
137	25.Section 6.1.2 Trail, references the Guelph Trail Master Plan and a proposed connection through the subject property. A recommendation is provided that the trail be completed as part of a broader trail design approach, to be completed by the City at a future date. This recommendation conflicts with the requirements set out in the Terms of Reference, which included an assessment of the trail route, recommendation for trail alignment consistent with Official Plan policy (i.e., consistent with permitted uses within the natural heritage system, demonstration of no negative impact, etc.) and identification of best management practices to provide the basis for basic trail design, which is to be completed as part of the Environmental Implementation Report (refer to pages 18 and 20 of the approved TOR). The Active Transportation Network Study maps the portion of trail through the subject property as a desired Active Transportation route (i.e. for cycling). The feasibility of accommodating an Active Transportation route through the subject project is to be assessed based on Official Plan policy in the EIS. Lastly, a trail connection from the Park Block to the trail network is desired and should be assessed and evaluated through the EIS to inform the design.	Tricar is deferring trail design and analysis, including potential impacts and compatibility with the Official Plan, to the City of Guelph. This approach allows the City flexibility to complete the trails to their specifications and concordance as determined by City staff. Additional details not included in Addendum.
138	26.Section 7.0 Potential Impacts of Development and Mitigation Recommendations, reference is made to “net environmental impact assessment”. This is not appropriate as the policy test is “no negative impact”. Please revise this statement and confirm that the analysis provided is based on the “no negative impact” test.	Acknowledged, additional details not required in Addendum.

139	27.Section 7.1 Impacts on Significant Natural Features, given that two 12 storey buildings are proposed, the EIS should evaluate the potential for bird strike impacts, and inform the design, as appropriate. Lighting impacts may also result from the proposal; the EIS should make recommendations for lighting adjacent to the natural heritage system based on best management practices. Lastly, grading impacts should be assessed in the EIS. An analysis of the grading plan should be provided in the context of permitted uses within the natural heritage system. Please update section 7.1 accordingly.	The updated site plan has changed both buildings to 10 storeys. Bird strikes mitigation and lighting is included in Section 7.3.1.3. Based on updated grading, as shown on Figure 1, Appendix A, grading is located outside of the buffer and as such an analysis is not required.
140	28.In Section 7.1.1 Significant Wetlands, it is stated that “incidental runoff impacts associated with sediments, dust, as well as nutrient loads will be reduced by the natural polishing function of the vegetative zone between the feature ad development”. It is unclear what this statement means. The Stormwater system is designed to infiltrate the 25mm storm event via an infiltration trench. Surplus runoff will fill a storage tank and then outlet to the storm sewer on Gordon Street, which outlets to a stormwater pond, which discharges to the Hanlon Creek PSW. Further, the last sentence of the first paragraph in this section states that “all surface runoff from the proposed development is directed to the existing storm sewer on Gordon Street”. This statement is not consistent with section 6.1 of the EIS or the FSR. Please clarify.	Understood, strike quoted sentences and defer to updated FSR. Additional details not required in Addendum
141	29.Also in Section 7.1.1 Significant Wetlands, please demonstrate that infiltration rates and volumes have been matched, pre- to post- in the Torrance Creek and Hanlon Creek Subwatersheds. This section notes that infiltration will “match and likely notably exceed pre-development infiltration volumes” in the catchment that directs flows to Torrance Creek. Torrance PSW has both a recharge and discharge function, depending on the time of year. During periods of an elevated water table and an upward hydraulic gradient, are impacts associated with the infiltration trench anticipated? For example, if infiltration cannot occur due to a high-water table, surplus will fill the storage tank and discharge to Hanlon PSW, likely resulting in a negative impact to both PSWs. Please include an in-depth analysis of stormwater impacts on the natural heritage system’s features and functions.	Engineering strategy for the site has been updated and is described in supporting documents (FSR, Appendix H; Hydrogeological report, Appendix E). There is no conflict with the high ground water table for the east infiltration gallery as the design of the gallery has been revised and the depth reduced. Also note the storage tank in the underground parking garage has been removed as the stormwater management strategy has been revised such that surplus water will be directed overland to the Torrence Creek Watershed.

		Pre- and post-development water balances are matched as described in the Hydrogeological Report. Addendum updated.
142	30.On page 7.2, discussion is provided on the predicted impacts associated with reduced infiltration to the Hanlon Creek Subwatershed, with a conclusion of no negative impact drawn. Please provide the supporting analysis to support this claim. For example, what is the difference in pre- to post-infiltration volumes and rates? If infiltration is reduced, is the potential for baseflow impacts in Hanlon Creek? If infiltration is reduced, will more runoff be directed to Hanlon PSW? In addition, the FSR indicates that this runoff would be directed to the storm sewer on Gordon. The EIS fails to address Stormwater impacts associated with unattenuated/untreated runoff from the catchment containing the extension of Valley Road/Edinburgh.	See above. In regard to stormwater at Valley Road and Edinburgh, these are municipal streets and should be treated by existing downstream facilities. Infrastructure within the right of way is to be provided in accordance with municipal standards.
143	31.The Torrance Creek PSW has a recharge and discharge function. What impact does the proposed stormwater management system have on the recharge/discharge function of the wetland? Please update the EIS to include a comparison of pre- to post- monthly differences in vertical hydraulic gradients, infiltration, runoff, etc. Note that this is required to demonstrate no negative impact the PSW.	Pre- and post-development water balances are matched as described in the Hydrogeological Report and included in the Addendum.
144	32.Section 7.1.5 Significant Habitat of Endangered and Threatened Species, please provide documentation of correspondence with MECP confirming the proposed mitigation measures for bat species at risk are acceptable. Please also update the Butternut paragraph to include details from NRSI, as requested above.	Information Gathering Form to be prepared for bat species at risk. Butternut information provided as Appendix G.
145	33.Section 7.1.6 Locally Significant Species, please clarify where the Yellow-billed Cuckoo was heard. The text appears to indicate that the Yellow-billed Cuckoo was heard singing from the development area of the site. Please provide an assessment based on the Official Plan’s policy on Habitat for Significant Species to establish whether or not this Natura Area designation applies.	Location of Yellow-billed Cuckoo shown on Figure 4. Upon further inspection, it appears that the observation was within the buffer area of the significant woodland (outside development area). However, the single observation of a Yellow-billed Cuckoo (not observed in 2021) does not constitute habitat for significant species.

		Included in Addendum.
146	34.In section 7.3.1.3 Wildlife Friendly Building Design, please note that the EIR should include more detailed guidance on bird-friendly building design to inform detailed design.	Acknowledged. Additional details not required in Addendum.
147	35.Environmental planning staff are supportive of the timing recommendations made for the removal of debris and woodchip piles to protect snakes. Consider including a recommendation to incorporate snake hibernacula and/or gestation site habitat structures in the buffer portion of the natural heritage system. The Environmental Implementation Report would then provide further information on location, design, etc. to assist with detailed design and implementation.	Acknowledged. Additional details not required in Addendum.
148	36.In section 7.3.4 on page 7.8, please update the paragraph on Butternut to reflect the outcome of the Butternut Health Assessment and authorization. NRSI should be contacted for this information.	Butternut information provided in Appendix G of the Addendum.
149	37.The details included in the post-construction monitoring program are acceptable for the EIS; however, please note that a requirement of the forthcoming EIR will be to provide a detailed post-construction monitoring plan. Similarly, additional detail on vegetation plantings will also need to be provided in the EIR. Please update the EIS to include a summary section on EIR requirements and a proposed outline for the future report. Please note that this was included within the approved Terms of Reference.	EIR requirements included in Addendum.
150	38.The following major topics were omitted from the EIS and should be assessed in detail in a revised EIS as part of the next submission: − assessment of bat species at risk habitat and supporting documentation from MECP; − Butternut assessment details and supporting documentation from MECP; - assessment of Habitat for Significant Species; − assessment of Cultural Woodland; − assessment of the need for Established Buffers; − assessment of grading impacts; − assessment of wetland water balance, based on assessment of monthly differences, pre- to post-development, for lands draining to the Torrance PSW and Hanlon PSW, to determine whether or not ecological and/or hydrologic impacts resulting from the proposed development are anticipated; and − recommended scope for EIR.	Established buffers are set out in the Official Plan and therefore the analysis required and determined need for those buffers has already been completed during Official Plan Amendment 42 and is therefore not re-examined. An assessment of bat species at risk habitat is not required based on follow up consultation between the City and MECP. However, an Information Gathering Form will be submitted concurrently with this EIS Addendum and follow up documentation will

		be provided to the City when received. The remaining bulleted items will be addressed in the Addendum.
151	39.Section 9.0 Policy Compliance should focus on the consistency of the proposal with the “no negative impact test”. As written, the focus appears to be on establishing feature-based constraints to development. This is not consistent with the PPS, and the natural heritage system’s approach to protecting, enhancing and restoring natural heritage in Ontario.	Acknowledged, policy compliance updated in Addendum.
152	40.Section 10.1 Report Summary, please update the bullet on SWH to indicate Candidate vs Confirmed. Further, the bullet on the proposed stormwater management plan indicates that parking lot runoff will be infiltrated. This detail was not included in the description of the stormwater management system presented earlier in the EIS. Please ensure that all statements are consistent and coordinated with the engineering plans prepared for the proposed development. Please note that infiltration of parking lot water is not supported by the City. Lastly, the report summary should include changes to wetland hydrology and ecology, and removal of accessory habitat to list of potential impacts associated with the proposed development.	Stormwater management section of the EIS addendum has been updated to reflect the revised SWM design and are consistent. Parking lot water will be infiltrated. To comply with the City of Guelph ‘treatment train’ recommendation, an Oil-Grit Separator Unit (Stormceptor EF4) was sized also upstream of the Permavoid storage tank, to treat runoff produced over the parking area (Catchment 204 and 208). In addition, catchbasin shields will be provided on-site. As the Stormceptor EF 4 will provide approximately 90% TSS removal to contributing runoff, this approach will incorporate redundancy into the water quality system and it can be expected that the entire site will have approximately 80% TSS removal. Updated summary of candidate vs. confirmed SWH to be included in Addendum.
153	41.Please update section 10.2 Recommendations to include the erection of Tree Protection Fencing prior to the commencement of site alteration/construction.	Acknowledged, additional details not required in Addendum.
154	42.Please update mapping provided in Appendix A to include the following: − established wetland buffer;	Updated mapping provided in Appendix A.

	− Ecological Land Classification vegetation community information for polygon adjacent to FOD5-6; − extent and type of Significant Wildlife Habitat features; − limit of the Natural Heritage System; and − Cultural Woodland and/or Habitat for Significant Species, as appropriate, based on the criteria-based assessment requested above.	
155	**Hydrogeological Assessment** 43.In section 4.2.4.1, pre-treatment for TSS is suggested to eliminate a number of sediment-bound metals in the discharge effluent. City staff agree that the proposed pre-treatment approach would likely reduce these concentrations; however, please note that samples would still be required to be collected to confirm this assumption, prior to the discharge being authorized to City sewers.	Acknowledged.
156	44.Please update section 4.2.4.1 to clarify whether or not VOCs were sampled to confirm presence/absence. The City's Sewer Use By-law prohibits discharge of VOC-impacted. Please note that VOC sampling may be required under a future discharge agreement with the City's Wastewater Division.	The testing for volatile organic compounds (VOCs) was not completed for the groundwater samples collected from selected on-Site monitoring wells in September 2018. Tricar acknowledges that the testing for VOCs may be required under a future discharge agreement with the City's Wastewater Division.
157	45.The post-development water balance provided in section 5.3 does not appear to account for the lands fronting on Valley Road (0.27ha catchment shown on Figure 15). Please explain why this area was excluded from water balance calculations, or update the water balance to include this catchment. Further, the size of the catchment draining to Torrance provided in the water balance assessment is 1.73ha, which does not match the catchment area of 1.44 ha in the hydrologic model. Please update the calculations ensuring that consistent catchment areas are applied.	As stated under Section 5.0 (Page 5.3) of the Stantec (2020) Hydrogeological Assessment report, "…the lands fronting Valley Road within the northeastern portion of the Site are not included in the pre- and post-development water balance calculations, given that these lands are to come under the ownership of the City and, subsequently, will no longer be the responsibility of Tricar." Note that under the initial water balance analysis, this 0.27 ha catchment remains unchanged from the pre- to post-development condition, making the inclusion of this

		land parcel in the analysis unnecessary. As requested, the pre- to post-development water balance calculations have been updated to account for the specified area discrepancy (1.73 ha vs. 1.44 ha). Please refer to the attached Infiltration and Groundwater Mounding Assessment Technical Memorandum (Stantec, 2021) for further details.
158	46.The EIS should refer to Section 6.0 Groundwater Dewatering Assessment and include recommendations for monitoring and best practice. This could be included as an item for the future EIR.	Acknowledged, will be included in EIR recommendations in Addendum.
159	47.Section 6.1 – It appears that a safety factor was not considered in the calculations of dewatering volume estimation, nor was any basal seepage considered. Although the site typically has observed downward gradients, the hydrological assessment indicates that upward gradients are present. Please add a factor of safety to the calculations and account for basal seepage, or provide text to explain why these elements were not considered in the calculations.	Factor of safety will be added to calculations in the Hydrogeology Report.
160	48.An infiltration (rock) trench is proposed to address the infiltration deficit. The infiltration (rock) trench is located within the Torrance Creek Subwatershed. Please include an analysis of the post-development water balance per watershed. For example, with LID measures in place, the water balance should demonstrate that the infiltration rate/volume should roughly match pre- to post- rates/volumes within each Subwatershed (i.e. Torrance and Hanlon). A stormwater management design and supporting analysis demonstrate no negative impact to the receiving natural heritage system is required. This is typically achieved by demonstrating that the proposed development and stormwater management system matches pre- to post- monthly infiltration rates/volumes and monthly runoff rates/volumes. Hydrographs depicting monthly differences in runoff volumes and infiltration volumes are helpful in demonstrating consistency with the natural heritage system “no negative impact” policy test.	Updated water balance calculations based on the revised SWM approach included in Addendum. Pre- and post-development infiltration and runoff rates are matched.

161	49.In Section 7.2 construction proximity to the nearby municipal well is accounted for; however, there is no discussion provided as to private residential wells in the area. During the filing of an application for PTTW or registration under the EASR, it is recommended that the proponent assess potential impacts to private residential wells.	Acknowledged.
162	**Tree Preservation Plan** 50.Please update the Tree Preservation Plan to include recommendations for the EIR and detailed design.	Recommendations for the EIR and detailed design stage have been included in the TPP in Section 6.4.
163	51.Environmental planning is generally supportive of using a polygon approach in certain situations; however, based on data provided in Appendix 1 Tree Inventory Data, it is unclear how the stem count column relates to the Polygon. For example, 1 stem is reported from each of Polygons A, B, C, E and F. Given the brief description provided on page 4 of the plan: “If trees were present in monoculture hedgerow features, a polygon method was used”. Based on this description, >1 stem per polygon would be expected. Please clarify.	The tree tables in Appendix I have been updated to include the accurate number of trees for each tree polygon.
164	52.Please update Map 2 of the Tree Inventory and Preservation Plan to show Tree Protection Fencing around the perimeter of the natural heritage system.	Updated Tree Preservation Plan provided. Map 2 in the TPP has been updated to show the Tree Protection Fencing around the perimeter of the Natural Heritage System, at the 10m Significant Woodland buffer.
165	**Functional Servicing Report** 53.Please update section 5.1.2 Torrance Creek Subwatershed Study to accurately reflect recommended infiltration rates, which in the case of the proposed development is between 150mm/yr to 200 mm/yr.	Updated in revised FSR.
166	54.The FSR indicates that the area outletting to Gordon Street (Hanlon Creek Subwatershed) will increase, post-development. The infiltration trench is proposed in the Torrance Creek Subwatershed, which means the majority of stormwater originating from the Hanlon Creek catching will be generated as runoff. Please clarify that the receiving stormwater pond has capacity to control the runoff volumes generated by the proposed development. Please note that surcharge of this facility is directed to the Hanlon PSW. Runoff volumes should match pre- to post- per the Hanlon Creek Subwatershed recommendations.	Revised SWM strategy to match the pre and post Torrence Creek and Hanlon Creek subwatershed water balance.

167	55.The description of Catchment 202 provided at the bottom of 5.6 indicates that roof-top water will be directed the storm sewer on Gordon Street, with the 25mm event being directed to the infiltration trench. Please clarify that up to and including the 25mm is intended to be directed to the infiltration trench. Events in excess of 25mm or when back to back events occur prior to draw-down would be directed to the storage tank, eventually draining to the storm sewer when capacity is reached. Environmental planning strongly encourages infiltration of 'clean' water to maintain infiltration and baseflow in Hanlon Creek to the greatest extent feasible. Please consider this comment when updating the FSR.	SWM strategy has been revised.
168	56.The EIS should include an analysis of the findings presented on page 5.8 which relate to pre- to post-differences in runoff and infiltration being directed to the Torrance and Hanlon Subwatersheds under the post-development scenario. Based on the analysis provided in the FSR, the EIS should provide an assessment as to whether or not impacts to the ecology or hydrology of the wetlands are anticipated.	Updated water balance calculations based on the revised SWM approach included in Addendum. Pre- and post-development infiltration and runoff rates are matched.
169	57.How would the infiltration trench function in the event of back-to-back storms? Please clarify whether or not a safety factor was incorporated into the sizing and design of the infiltration trench.	A safety factor has been incorporated (2.5 for the South trench, and 3.5 for the East trench). The system is equipped with an overflow and the site designed with an overland flow route to direct major event flow toward the Gordon Street right-of-way.
170	58.In section 5.6 On-site Infiltration, on page 5.9, it is stated that "The infiltration gallery should only be intercepted by groundwater in spring-time". How was this detail factored into the water balance? The EIS should provide an analysis of potential impacts arising from the proposed stormwater design. For example, if groundwater intercepts the infiltration trench during the spring, infiltration will not occur which would result in more runoff being directed to Hanlon Subwatershed. This is unacceptable and should be addressed in the next submission.	The SWM strategy has been revised to incorporate an infiltration gallery (south) while changing the previous eastern infiltration gallery to a rain garden LID feature. The LID feature maintains a separation of 1 m from the high ground water table recorded as 340.3m. Added monitoring wells within the footprint of the LID feature will confirm the high groundwater table and confirm separation.
171	59.Please note that in situ permeameter testing is required to demonstrate that the proposed infiltration trench will function as anticipated. Please provide this information in the next submission.	Onsite testing to be completed in June and is incorporated into the Hydrogeological Report.

172	60.Drawing SSP-2 Storm Drainage Area Plan – It is unclear how the Area IDs relate to the Catchments described in the FSR and Hydrological Investigation report's water balance calculations. Please ensure that this is clarified and coordinated among studies and drawings in the next submission.	Inconsistencies remedied in revised FSR.
173	61.Drawing GP-1 Grading Plan indicates that extensive grading is required adjacent to the natural heritage system. Please provide additional detail on grading requirements (e.g. spot elevations) to enable a proper assessment of consistency with Official Plan policy. Please note that a cross-section can be helpful in demonstrating how the required grading relates to the protection of the natural heritage system. At a minimum, please update GP-1 to show differences in grade adjacent to the natural heritage system, and slope, particularly at the southeast end of the site.	Grading is no longer proposed within established buffers.
174	62.It is unclear how the proposed erosion and sediment control plan has been coordinated with the proposed grading plan. For example, tree protection fencing and silt fencing is proposed in an area identified for extensive grading on GP-1. Please clarify.	Inconsistencies have been rectified in updated plans included in the Addendum.
175	**Landscape Concept** 63.The Landscape Concept proposes the planting of coniferous and deciduous trees on top of the infiltration facility. Guelph's Engineering Development Manual specifies a minimum 1m offset of plant material from infiltration galleries. Please relocate the proposed trees outside of the infiltration gallery area.	Landscape concept have been revised to not include tree plantings on the infiltration galleries.
176	**Summary** A revised EIS is required to address the comments provided above. Revisions to the supporting studies, including the Tree Preservation Plan, Hydrological Assessment, Functional Servicing Report and Landscape Plan are required. Environmental planning encourages the applicant to meet with City staff to discuss the comments provided, prior to providing a second submission. Substantial work remains outstanding to adequately demonstrate no negative impact to the natural heritage system's ecological and hydrologic features and functions.	Acknowledged, supporting documentation provided.

<table>
<tr><th colspan="3">Jyoti Pathak, Parks and Recreation 519-822-1260 x 2431 Jyoti.pathak@guelph.ca
December 18, 2020</th></tr>
<tr><td>184</td><td>Trail Network:


The Official Plan – Schedule 8 ‘Trail Network’ includes a proposed off-road secondary trail route along western edge of the Torrance Creek provincially significant wetlands through the subject property that connects to the approved proposed trail west of Valley Road condominium to the north and west of 1280 Gordon Street to the south.</td><td>See response to #137</td></tr>
<tr><td>185</td><td>Please note that the trail alignments north and south of the subject site have been designed and approved through the development review process and the developer is responsible to identify the trail alignment and preliminary trail design on the subject site as included in the terms of reference for the EIS.</td><td>See response to #137</td></tr>
<tr><td>186</td><td>Local trail connection:
Provide a local accessible trail connection, 2.5 m wide, to connect the proposed park to the proposed Citywide trail at the back of the property. This trail connection is to be designed and developed as part of the Landscaping works on the subject site.</td><td>See response to #137</td></tr>
<tr><td>187</td><td>Provide conceptual trail alignment for City’s review of the following connections:
• North-south Citywide trail connection
• East-west local trail connection</td><td>See response to #137</td></tr>
<tr><td>189</td><td>Environmental Implementation Report:
An environmental implementation report (EIR) will be required to address the recommendations provided through the final approved Environmental Impact Study including Open Space Works and restoration, detailed landscape plans (by an accredited landscape</td><td>Acknowledged. Recommendations for the EIR are included in the Addendum.</td></tr>
</table>

	architect); detailed design and mitigation plans to support the trail. The EIR will address the recommendations related to trail system and natural open space system, including detail design of the trail system; preparation of Landscape Plans and details to address demarcation, removal of invasive species, hazard trees along the trail system and residential properties; clean-up of debris and waste; restoration; compensation and enhancement planting for buffers; invasive species management; design of educational/ interpretive and stewardship materials/ signage. Detailed trail layout, grading and drainage plans showing trail design details such as signage, structures, etc. will be provided in the Environmental Implementation Report consistent with City of Guelph's current trail standards and other City Guidelines i.e. Facility Accessibility Design Manual and Engineering Development Manual where applicable. The trail plan, design and construction will comply with all relevant regulations applicable to trail management made under the Accessibility for Ontarians with Disabilities Act.	
190	**Open Space Works and Restoration:** Provide planting to enhance ecological buffers and wildlife corridors and compensation for removed trees, etc. and detailed planting plans will be provided with the Environmental Implementation Report. Provide seeding to restore graded areas within the open space	Acknowledged. No additional detail required in Addendum.
191	**Tree Preservation and removal of invasive species and hazard trees:** Schedule removal of the common buckthorn within the trail corridor prior to trail construction. A review of hazard trees (e. g. dead, partially dead or dying trees) along the trail route will be conducted at the time of vegetation removal by a qualified arborist. Identify all hazardous trees along the trail route in consultation with Parks staff for removal prior to start of trail construction. Hazard trees only would be removed within striking distance of the trail.	Acknowledged. No additional detail required in Addendum.
195	**Summary:** Parks does not support the proposed development based on the current information provided. Parks needs revised documents which reflect the comments provided above for our further review and comments. Draft conditions would be provided upon receiving satisfactory proposal.	Acknowledged. No additional detail required in Addendum.

APPENDIX D
TREE PRESERVATION PLAN

Map 2

1250 Gordon Street

Tree Inventory and Preservation Plan

Legend

- ▬ Subject Property
- — Proposed Grading
- — Proposed Development
- — Existing Development
- ▨ Significant Woodland (To be Retained)
- – – Significant Woodland Boundary - City of Guelph (October 2014 and July 2017)
- - - - Significant Woodland 10m Setback
- ✕— Tree Protection Fencing
- ⊙ Inventoried Tree to be Retained (Crown to Scale)
- ⊗ Inventoried Tree to be Removed (Crown to Scale)
- ▨ Hedgerow to be Retained Where Feasible
- ▨ Hedgerow to be Removed

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

Map Produced by Natural Resource Solutions Inc. This map is proprietary and confidential and must not be duplicated or distributed by any means without express written permission of NRSI. Data provided by MNRF© Copyright: Queen's Printer Ontario.

Project: 2347 Date: August 6, 2021	NAD83 - UTM Zone 17 Size: 24x36" **1:350**

0 5 10 15 20 Meters

APPENDIX E
HYDROGEOLOGICAL ASSESSMENT

Hydrogeological Assessment

1242, 1250 and 1260 Gordon Street
and 9 Valley Road
City of Guelph, ON

FINAL REPORT
Version 2

August 13, 2021

Prepared for:

Tricar Developments Inc.
3800 Colonel Talbot Road
London, ON N6P 1H5

Prepared by:

Stantec Consulting Ltd.
100-300 Hagey Blvd.
Waterloo, ON N2L 0A4

First Submission: May 2020
Second Submission: August 2021

File: 161413684

Sign-off Sheet

This document entitled Hydrogeological Assessment, 1242, 1250 and 1260 Gordon Street and 9 Valley Road, City of Guelph, ON was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Tricar Developments Inc. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

G. Whitehead

Digitally signed by Grant Whitehead
Date: 2021.08.13
12:18:56 -04'00'

Prepared by ______________________________
(signature)

Grant Whitehead, MES, P.Geo. (Limited)
Senior Hydrogeologist

R. F.

Digitally signed by Roger Freymond
Date: 2021.08.13
12:24:56 -04'00'

Reviewed by ______________________________
(signature)

Roger Freymond, P.Eng.
Senior Hydrogeologist

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LIST OF APPENDICES

APPENDIX A: FIGURES

APPENDIX B: TABLES

Abbreviations

AMSL	above mean sea level
ASTM	American Society for Testing and Materials
BGS	below ground surface
City	City of Guelph
EASR	Environmental Activity Sector Registry
GRCA	Grand River Conservation Area
GRIN	Grand River Information Network
GUDI	Groundwater Under the Direct Influence of Surface Water
DNAPL	dense non-aqueous phase liquid
GUDI	Groundwater Under the Direct Influence
HDPE	high-density polyethylene
HVA	Highly Vulnerable Aquifer
ID	inside diameter
IPZ	Intake Protection Zone
LID	Low Impact Development
Maxxam	Maxxam Analytics Inc.
MECP	Ontario Ministry of the Environment, Conservation and Parks
ODWQS	Ontario Drinking Water Quality Standards
ORP	oxidation reduction potential
PTTW	Permit to Take Water
PVC	polyvinyl chloride

Site	1242, 1250 & 1260 Gordon Street, within the City of Guelph, Ontario
SGRA	Significant Groundwater Recharge Area
Stantec	Stantec Consulting Ltd.
Tricar	Tricar Developments Inc.
WHPA	Well Head Protection Area

1.0 INTRODUCTION

Tricar Developments Inc. (Tricar) retained Stantec Consulting Limited (Stantec) to complete a hydrogeological investigation of the property located at 1242, 1250 & 1260 Gordon Street, within the City of Guelph, Ontario (Site) (Figure 1). The Site is approximately 3.1 hectares (ha) in size and is bounded to the northwest by existing residential subdivision, to the northeast by protected woodlot affiliated with the Torrance Creek Swamp, to the southeast by existing high-density development (i.e., Liberty Square apartment complex), and to the southwest by Gordon Street.

The purpose of the hydrogeological investigation is to support Zoning By-law and Official Plan Amendments and the Site Plan Application to permit the construction of the proposed residential development, which will consist of two 12 story apartment buildings having nine townhouse units and 368 apartment units. The development will have a combination of surface parking and two levels of underground parking. The proposed underground parking footprint will cover an area of approximately 11,450 m^2, with the anticipated base of the underground parking garage being located at an elevation of 335.7 m AMSL.

As per input initially provided by the City of Guelph (City) (2018) (Appendix J) and comments provided by the City (2020) following the first submission of this report (Appendix J), this hydrogeological assessment consists of meeting the following objectives:

- Characterize current geological and hydrogeological conditions at the Site, including a discussion of overburden and bedrock stratigraphy, hydrostratigraphic units, seasonal fluctuations in groundwater levels and hydraulic gradients, flow direction across the Site, soil infiltration potential, and groundwater quality conditions.
- Evaluate the hydraulic relationship between the groundwater system present beneath the Site and the adjacent Torrance Creek Swamp and assess whether the future development of the Site could potentially disrupt the hydrogeological form and/or function of this wetland.
- Evaluate pre-development infiltration volumes at the Site and assess the impact that proposed land use changes could potentially have on these volumes under the post-development condition, including an evaluation of potential measures that could be employed throughout the Site under the post-development condition to mitigate these impacts.
- Perform infiltration testing and groundwater mounding analysis to support stormwater infiltration strategies proposed for the Site under the post-development condition.
- Assess whether proposed buildings, site servicing and associated construction activities will intercept the groundwater table and if construction dewatering may be required and assess whether any measures are required to mitigate these potential disturbances to pre-development groundwater levels, flow patterns, and groundwater-surface water interactions.

- Evaluate whether proposed land use activities conform to Source Water Protection requirements as stipulated in the Clean Water Act, S.O. 2006, Chapter 22.

This report is arranged into ten sections, including this introduction (Section 1). Section 2 presents the physical setting of the Site at a regional scale. Section 3 outlines the methods utilized to evaluate the Site hydrogeological conditions. Section 4 presents the results of the Site investigation, with Section 5 presenting the water balance assessment. Section 6 presents the groundwater mounding assessment in support of the post-development stormwater infiltration strategy. Section 7 presents the groundwater dewatering assessment and Section 8 discusses the potential hydrogeological impacts of the project and recommended mitigation measures. Report conclusions and references are listed in Sections 9 and 10, respectively. All figures and tables referenced in this report are presented in Appendices A and B, respectively. Appendices C to J include Regional Groundwater Flow Mapping, Regional Groundwater Recharge Mapping, Borehole Logs, Laboratory Certificates of Analysis, Hydraulic Conductivity Analytical Solutions, Dewatering Calculations, Source Protection Plan - Threat Policy Applicability Mapping, and City of Guelph Correspondence, respectively.

2.0 PHYSICAL SETTING

2.1 PHYSIOGRAPHY AND TOPOGRAPHY

The Site is situated within the physiographic region referred to by Chapman and Putnam (1984) as the Guelph Drumlin Field. The Guelph Drumlin Field consists of a series of broad oval type hills with axes trending in a northwest to southeast direction (i.e., drumlins). As shown in Figure 2, most of the Site is situated upon a drumlin, which is further supported by the regional topographic setting (Figure 3). The drumlins and associated till plain of the physiographic region consist of stony, calcareous till derived from dolostone of the Goat Island and Gasport Formations (formerly referred to as the Amabel Formation) and consists of sand (50%; average content based on grain-size analysis completed on till samples), silt (35%) and clay (15%) (Chapman and Putnam, 1984). The drumlin groupings occur in swampy valleys that are flanked by terraced spillway channels of sand and gravel, which contain tributaries of the Grand River (e.g., Torrance Creek Swamp located northeast of the Site; Figure 2). Gravel ridges or eskers are also known to cut through the till plain in the same general direction as the drumlins.

Most of the Site lies within the Torrance Creek Subwatershed (Totten Sims Hubicki Associates *et al.*, 1998), with the southwestern portions of the property being located within the Upper Hanlon Creek Subwatershed (Golder, 2011; Gamsby & Mannerow, 1993). Both subwatersheds occur within the Grand River Watershed and are under the jurisdiction of the Grand River Conservation Authority (GRCA). The Torrance Creek Subwatershed is characterized by hummocky terrain associated with the drumlins and by the network of broad, relatively flat spillway channels that cut through the drumlin fields. As shown on Figure 3, topographic high points occur along the northwestern and southeastern boundaries within the central portion of the Site, with the topography generally sloping to the northeast towards Torrance Creek Swamp and the southwest towards Gordon Street. As shown on Figure 1, topographic contours throughout the Site range from highs of 344.5 m AMSL near Valley Road (northwest boundary) and 342.5 m AMSL near Borehole 4 (southeast boundary), to lows of 337 m AMSL near Gordon Street and 335 m AMSL along the northeast boundary of the Site near Torrance Creek Swamp.

As shown on Figure 15 and discussed in the Stantec (2021) *Functional Servicing Report*, the direction of surface water runoff occurring within the Site under existing conditions is split between two catchments. Catchment 101 directs surface water runoff westward to an existing storm sewer on Gordon Street, whereas surface water runoff occurring within Catchment 102 flows overland to the east and eventually discharges to Torrance Creek Swamp.

2.2 REGIONAL GEOLOGY AND HYDROSTRATIGRAPHY

Geological conditions within the region have been mapped and described by Matrix Solutions Inc. (2017), the Lake Erie Region Source Protection Committee (LERSPC, 2015a), Golder Associates Limited (2011), Totten Sims Hubicki Associates *et al.* (1998), Gamsby & Mannerow (1993), and Jagger Hims Limited (1998). Based on these previous studies, overburden and bedrock geology near the Site is summarized as follows, listed from ground surface downward:

Organic Deposits: Accumulations of peat and/or muck associated with wetland areas (Figure 4, Unit 20).

Glaciofluvial Deposits: Glaciofluvial outwash and glaciolacustrine deposits of sand and gravel with minor silt and clay associated with the spillway channels (Figure 4, Units 7a and 7b).

Ice-Contact Deposits: Predominantly sand and gravel containing lenses of silt and clay left behind by the melting of enclosed ice blocks (i.e., eskers, kames) (Figure 4, Unit 6).

Port Stanley Till: An occasionally stony, silty sand to sandy silt till, forming the till plain and drumlins that characterize the region (Figure 4, Unit 5b). Some of the drumlins, however, can consist of an older clayey silt till core that is subsequently covered by a veneer of Port Stanley Till (Karrow, 1968). In the areas south of the Speed River, the till plain is often covered by a layer of glaciofluvial and glaciolacustrine sediments (i.e., fine to silty sand, sandy silt, sand and gravel) deposited from melting glacier ice, with the till extending to the bedrock surface.

Bedrock: The Eramosa Formation (Reformatory Quarry Member), representing the uppermost bedrock unit beneath the Site is described as a light brown to cream coloured, pseudonodular, thickly bedded and coarsely crystalline dolostone, which may act as an aquitard (Brunton, 2008). As per Golder (2011), the bedrock surface near the Site appears to be located at an elevation of 320 m AMSL and will not be encountered with the proposed development.

2.3 REGIONAL HYDROGEOLOGY

Based on previous groundwater modeling work completed by Matrix Solutions Inc. (2017), the following aquifer and aquitard systems are identified as occurring throughout the region in which the Site resides:

Upper Sand and Gravel Aquifer: an unconfined aquifer system consisting predominantly of outwash sand and gravel deposits. This unit is reported to have a horizontal hydraulic conductivity ranging from 7.0 x 10^{-4} m/s to 6.0 x 10^{-6} m/s, with the vertical hydraulic conductivity being one tenth (0.1) to an order (1.0) of magnitude lower than the horizontal hydraulic conductivity (Golder, 2011). Soil permeability testing using a Guelph Permeameter indicates that the sandy soils of this unit have vertical hydraulic conductivities in the range of 10^{-5} m/s (Totten Sims Hubicki Associates *et al.*, 1998).

Lower Till Aquitard: dense sandy to silty glacial till (i.e., Port Stanley Till) that is occasionally interbedded with discontinuous lenses of coarse sand and gravel. This unit is reported to have a horizontal hydraulic conductivity ranging from 1.0 x 10^{-4} m/s to 2.0 x 10^{-9} m/s, with the vertical hydraulic conductivity being one half (0.5) to an order (1.0) of magnitude lower than the horizontal hydraulic conductivity (Golder, 2011).

Contact Zone Aquifer: coarse, unconsolidated granular deposits directly overlying, and hydraulically connected to, upper weathered/fractured bedrock. This unit typically forms a thin aquifer having an assumed thickness of four meters (two meters above and below bedrock surface) (Golder, 2011). This aquifer is reported to have a horizontal hydraulic conductivity ranging from 1.0 x 10^{-4} m/s to 1.0 x 10^{-5} m/s, with the vertical hydraulic conductivity being one half (0.5) to an order (1.0) of magnitude lower than the horizontal hydraulic conductivity (Golder, 2011).

Bedrock Aquifer: consisting of medium to thick bedded fossiliferous dolostone of the Guelph Formation. This unit is reported to have a horizontal hydraulic conductivity ranging from 8.0 x 10^{-3} m/s to 7.0 x 10^{-9} m/s, with the vertical hydraulic conductivity being one tenth (0.1) to an order (1.0) of magnitude lower than the horizontal hydraulic conductivity (Golder, 2011).

As presented in Figure 4.3 of Matrix Solutions Inc. (2017) (Appendix C), simulated groundwater table surface elevations produced via a calibrated steady-state groundwater flow model suggests that regional groundwater movement is to the northwest through the overburden aquifer located beneath the Site, eventually discharging to the Speed River. However, groundwater flow interpretations presented in Totten Sims Hubicki Associates *et al.* (1998) (Figure 4.4.7, Appendix C) suggest that at a local scale, groundwater movement through the shallow overburden near the Site is to the northeast and east, with these flows potentially being influenced by pumping from the Burke and/or Carter Municipal Production Wells.

Regionally, the lands containing the Site are characterized by groundwater recharge conditions. Mapping created using the Grand River Information Network (GRIN) (GRCA, 2019) indicates that downward vertical hydraulic gradients are present beneath the Site, with annual recharge rates across the property ranging from 100 to 200 mm/year (Appendix D).

2.4 SOURCE WATER PROTECTION

As established under the Ontario Clean Water Act, 2006, S.O., 2006, c. 22, source protection areas and associated land use restrictions exist for all municipal drinking water sources located throughout the Grand River Source Protection Area (i.e., defined by the boundaries of the Grand River Watershed). Within the Source Protection Area (SPA), the Ministry of the Environment, Conservation and Parks (MECP) has designated four types of vulnerable areas that apply to drinking water sources:

Wellhead Protection Areas (WHPA): an area delineated on the ground surface that represents the capture zone for the underlying aquifer in which a given municipal well draws its water. The zone represents the total amount of time it would take for groundwater to flow through the aquifer system and reach the intake of a given municipal well. The zones are defined as follows:

- WHPA-A: 100 m radius around the municipal well.
- WHPA-B: Horizontal time of travel to the municipal well is two years or less.

- WHPA-C: Horizontal time of travel to the municipal well is equal to or less than five years and greater than two years.
- WHPA-D: Horizontal time of travel to the municipal well is equal to or less than 25 years and greater than five years.
- WHPA-E: Area where groundwater is under the direct influence of surface water (GUDI), where horizontal time of travel to the municipal well is two hours or less from the surface water body to the well.

As shown on Figure 5, the Site is located within the WHPA for the Burke Municipal Production Well (Burke Well), with this production well located approximately 165 m to the southwest of the Site. Specifically, the Site is intercepted by Burke Well WHPA-B and -C, noting that the footprint for the proposed development is confined to the WHPA-C (i.e., representing an area where it takes greater than two years but less than five years for precipitation that has recharged the aquifer to flow through this aquifer to the production well intake). The WHPA-C has an assigned vulnerability score ranging from four (4) to six (6) (Figure 6). Development on municipal services in areas where vulnerability scores are in the 4 to 6 range represent a low threat to drinking water supplies.

The northeastern portion of the Site also lies within the WHPA-E (vulnerability score of 7.2, MECP, 2020; Figure 7) of the Burke Well, with this well being classified as Groundwater Under the Direct Influence (GUDI) of surface water (i.e., a surface water source has a direct connection to the groundwater system and is drawn into the production well during pumping). The extents of the WHPA-E are equivalent to the area of an Intake Protection Zone (IPZ); that is, a capture zone delineated for those drinking-water systems that obtain their potable water from surface water bodies. The WHPA-E is equivalent to an IPZ-3, which represents surface water bodies and adjacent lands (i.e., GRCA Regulation Limit or 120 m, whichever is greater) that may be impacted by extreme events such as storms (e.g., 100-year rainfall event) and subsequently, potentially contribute surface water to the municipal well. For the Burke Well, the IPZ-3 encompasses the nearby Torrance Creek Swamp.

Significant Groundwater Recharge Areas (SGRA): This is an area where it is desirable to regulate drinking water threats that may affect recharge of an aquifer. Recharge areas are classified as “significant” when they supply more water to an aquifer used as a drinking water source than the surrounding area. As shown in Figure 8, the SGRA represents an area where the rate of annual recharge to the underlying aquifer system is greater than the average annual rate of recharge within the Grand River SPA by a factor of 1.15 or more (i.e., at least 15% greater than the average recharge rate). Based on the modeling results presented in AquaResource (2009), the average annual rate of recharge within the Grand River SPA is calculated to be 176 mm/year; consequently, a SGRA threshold is defined as an area within the watershed where the annual recharge rate equals or is greater than 202 mm/year. A similar SGRA threshold of 200 mm/year was calculated for those lands located within the City of Guelph and Township of Guelph/Eramosa as described in Matrix Solutions Inc. (2017). For the Site, the SGRA is assigned a vulnerability score of four (4), indicating that activities occurring in this area of the property that limit recharge to the underlying aquifer pose a moderate threat to groundwater quantities in the aquifer, which is or may be used as a source of drinking water.

Highly Vulnerable Aquifers (HVA): Defined as subsurface, geologic formations that are sources of drinking water, which could be easily affected by the release of pollutants on the ground surface. The HVA is identified using variables that include depth to the aquifer, physical properties of the overlying soil and/or rock, and the aquifer composition. In general, an HVA will consist of granular aquifer materials (i.e., sands and gravels) that are exposed near the ground surface and where a relatively shallow groundwater table is present. As per the mapping provided by the MECP (2020), the Site does not occur in an area defined as HVA.

Intake Protection Zones (IPZ): A zone established around a drinking / surface water intake within which a spill or leak may get to the intake too quickly for the operators of the municipal water treatment plant to shut the intake down until the pollutant passes by. These zones also include land adjacent to streams and storm sewers where surface water runoff can quickly reach the intake. As discussed above, the northeastern portion of the Site is intercepted by an IPZ-3.

3.0 METHODOLOGY

The hydrogeological site investigation included the:

- drilling of boreholes
- installation of monitoring wells
- installation of drive-point piezometers
- monitoring of groundwater levels
- collection of groundwater samples for quality testing
- performing hydraulic response (hydraulic conductivity) testing
- completion of infiltration (soil permeability) testing.

The methodology for these tasks is described in Section 3.1 to 3.6 below.

3.1 BOREHOLE DRILLING AND MONITORING WELL INSTALLATIONS

Between July 9 and 30, 2018 boreholes were advanced at seven locations across the Site (Figure 1). Five of the locations involved the drilling of a borehole, which was then equipped with a single monitoring well (i.e., MW1-18 to MW3-18, MW6-18, MW7-18). The remaining two locations involved the installation of a multi-level monitoring well (i.e., MW4-18(S/D) and MW5-18(S/D)) where two boreholes (one shallow and one deep) were drilled within meters of each other, with each of these boreholes then being equipped with a single monitoring well. Overall, the boreholes were strategically positioned throughout the Site to obtain a spatially representative understanding of soil conditions, groundwater depths and fluctuations, and to evaluate local patterns of groundwater flow.

Stantec on behalf of Tricar retained Aardvark Drilling Inc. to complete the borehole drilling and monitoring well installations. The boreholes were drilled using a CME track-mounted drilling rig equipped with a hollow stem auger drilling system (i.e., to permit the installation of monitoring wells). Soil samples were collected using split-spoon sampling techniques. Soil sampling occurred using a 0.6 m long stainless-steel split spoon sampler at 0.75 m (2.5 feet) intervals for the first 6.0 m (20 feet) of drilling depth, followed by sample collection occurring at approximately every 1.5 m (5 feet) to the termination depth of the borehole. The completed depths of the boreholes ranged from 12.8 m to 15.8 m below ground surface (BGS). Stantec personnel directed the drilling and soil sampling operations and logged the borehole stratigraphy using the American Society for Testing and Materials (ASTM) guideline for the description and identification of soils (ASTM, 2009). The borehole logs contain descriptions (where relevant and possible) of soil type, texture, colour, structure, consistency, plasticity, moisture content, and other visual and olfactory observations. Copies of the borehole logs are provided in Appendix E.

The drilling contractor installed the monitoring wells adhering to the construction requirements as outlined under Ontario Regulation 903 (O.Reg. 903) (MOE, 1990). Installation details for each of the monitoring wells are summarized in Table 1. Each monitoring well is constructed of 50 mm inside diameter, Schedule 40 polyvinyl chloride (PVC) pipe, having a No. 10 slot screen (0.01-inch slot) measuring 3.0 m in length. Backfilling of the screened interval consisted of silica sand to a height of approximately 0.3 m above the top of screen, followed by granular bentonite to ground surface prevent a hydraulic connection from occurring between the screened formation and overlying soils. The completion of each monitoring well involved encasing the pipe stick-up within a lockable steel casing. Stantec Geomatics surveyed the ground surface and top-of-pipe elevations at each monitoring well location to a geodetic benchmark using the Can-Net GPS Survey system, having a spatial accuracy of +/- 0.03 m and +/- 0.02 m in the vertical and horizontal plane, respectively.

Following installation, Stantec personnel purged each monitoring well using dedicated 16 mm (2/3 inch) inside diameter high density polyethylene (HDPE) tubing connected to a D-25 Waterra™ foot valve. Using the dedicated tubing, Stantec personnel purged 10 standing column volumes from each well (where possible) to clear out any fine-grained sediments and, subsequently, establish a proper hydraulic connection with the native aquifer material.

3.2 DRIVE-POINT PIEZOMETER INSTALLATIONS

On April 10, 2019 Stantec personnel installed one multi-level drive-point piezometer, consisting of a shallow and a deep piezometer (i.e., DP1-19(S) and DP1-19(D)), within a section of the Torrance Creek Swamp located approximately 75 m to the northeast of the Site (Figure 1). The multi-level piezometer was installed to evaluate whether this wetland functions as a groundwater recharge feature (i.e., contributes water to subsurface), discharge feature (receives water from the subsurface), or a combination of both.

Each drive-point piezometer is constructed of a 0.42 m long steel screen (19 mm diameter) that is connected to 25 mm diameter steel riser pipes. Stantec personnel drove the drive-point piezometers into the substrate using a fence post driver, with shallow and deep pipes being constructed within one meter of each other and their screens being separated by a vertical distance of approximately 1.7 m. Construction details for the drive-point piezometers are summarized in Table 1.

3.3 GROUNDWATER LEVEL MONITORING

Groundwater levels were recorded at the monitoring well and piezometer locations from July 2018 to June 2020 using a combination of automated and manual measurement methods. Solinst® Edge Leveloggers® (Leveloggers) were installed at all monitoring well and piezometer locations to allow automatic measurement of water levels. The Leveloggers were suspended into the water column at each monitoring well and drive-point piezometer and set to record water levels at 60-minute intervals. Leveloggers are not vented to the atmosphere and therefore record total pressure (where total pressure is the sum of the atmospheric pressure and the height of water column). To obtain an accurate measurement of the groundwater level at each well, the water level data obtained from the Leveloggers were corrected for atmospheric pressure using data obtained from a Solinst® Edge Barologger® (Barologger), which was suspended in the air column at monitoring well MW5-18(S).

Groundwater levels were manually measured several times from the onsite monitoring wells (nine events) and the multi-level drive-point piezometer (six events) between July 2018 and June 2020. The groundwater level measurements were recorded in metres to the nearest 0.01 m using a battery-operated water level indicator. Manual groundwater level measurements were used to verify data recorded by the Leveloggers. Manual water levels collected from the monitoring wells and drive-point piezometer are presented in Tables 2 and 3, respectively. Hydrographs presenting both the automatic and manually measured groundwater level data are provided in Figures 9 and 10.

3.4 GROUNDWATER SAMPLING AND TESTING

Groundwater quality samples were collected from MW2-18, MW4-18(S), MW6-18, and MW7-18 on September 11, 2018. The samples were collected to help evaluate pre-development groundwater quality conditions at the Site. Specifically, all samples were analyzed for general inorganic parameters and dissolved metals and compared against their corresponding Ontario Drinking Water Quality Standard (ODWQS) (MOE, 2006) concentrations, with MW2-18 results being compared against those parameters listed under the City of Guelph Sanitary and Storm Sewer By-law (1996)-15202.

Stantec personnel collected groundwater samples from the onsite monitoring wells using dedicated HDPE tubing connected to a foot valve. Prior to collecting the samples, wells were purged and field parameters including pH, temperature, electrical conductivity, oxidation reduction potential (ORP), and dissolved oxygen (DO) were monitored periodically during the purging process using a multi-parameter water quality meter and flow through cell. The meter was calibrated prior to use according to the manufacturer’s specifications with the appropriate calibration standards. Groundwater sampling occurred after these field parameter concentrations had stabilized, indicating that water being pumped from the monitoring wells was representative of groundwater flowing into the well from surrounding geological formations.

The groundwater sample collected from each monitoring well consisted of pouring water directly from the HDPE tubing into lab supplied sample bottles. Groundwater samples collected for metals analysis were field-filtered using disposable in-line 0.45 µm (micron) filters attached to the HDPE tubing. The groundwater samples were carefully packed into coolers with ice, which was added to maintain sample temperatures below 10ºC during transport to the analytical laboratory. Samples were delivered to Maxxam Analytics Inc. (Maxxam) for analysis. Chain of custody forms were completed and included with the samples.

The results of the groundwater quality testing are summarized in Tables 4 (Sewer By-law) and 5 (ODWQS) and illustrated in a piper diagram on Figure 11. A copy of the Laboratory Certificate of Analysis is presented in Appendix F.

3.5 HYDRAULIC RESPONSE TESTING

Stantec performed in-situ hydraulic response testing at each monitoring well between July 26 and 27, 2018 to estimate the horizontal hydraulic conductivity of the deposits beneath the Site. The testing consisted of creating an instantaneous change in the well water level by removing a known volume of water followed by recording the time taken for the water level to return to static conditions (i.e., a rising head or bail test). Data were analyzed using the Bouwer and Rice (1976) solution for a bail test in an unconfined aquifer as provided in the software package AQTESOLV™ Pro Version 4.5 (Duffield, 2014). Testing provided an estimate of the horizontal hydraulic conductivity of the sediments within the screened interval for each monitoring well. Table 1 provides a summary of the calculated horizontal hydraulic conductivities, with the analytical solutions for the data being presented in Appendix G.

Since hydraulic conductivity in the horizontal direction is generally an order (potentially two orders for clay-based deposits) of magnitude higher than hydraulic conductivity in the vertical direction (Todd 1980; Freeze and Cherry 1979), the vertical hydraulic conductivities for overburden deposits surrounding the well screens were assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities calculated at MW2-18 to MW7-18. Infiltration rates were calculated based on an established relationship between vertical hydraulic conductivity and infiltration rate presented in the Credit Valley Conservation and Toronto and Region Conservation Authority (CVC-TRCA, 2010) Low Impact Stormwater Management Planning and Design Guideline - Version 1.0. Table 6 provides a summary of estimated infiltration rates based on the results of the horizontal hydraulic conductivity testing.

3.6 INFILTRATION TESTING

As discussed in the Stantec (2021) *Functional Servicing Report*, the revised stormwater management strategy for the Site will include the construction of the East Infiltration Trench (i.e., rock trench) immediately to the northeast of Building 2 (Figure 12). The South Infiltration Trench (i.e., Permavoid) will be constructed along the southwestern limits of the Site immediately to the south of Building 2 (Figure 12).

On June 10 and 11, 2021 D&J Lockhart Excavators Ltd. (Lockhart) excavated a series of test pits within locations of the Site where the previously mentioned post-development stormwater infiltration facilities are planned. The excavation of three test pits (TP1 to TP3) occurred near the southeastern limits of the Site where the South Infiltration Trench is proposed for construction, and two test pits (TP4 and TP5) within the central portion of the property at the future location of the East Infiltration Trench (Figure 12). Stantec notes that the locations of TP4 and TP5 occurred in the original footprint of the East Infiltration Trench (as presented in the Stantec (2020) *Hydrogeological Assessment* report); however, the extents of this facility have since been revised resulting in the test pits now being located from five to 22 m outside of the new footprint. However, given that the subsurface deposits characterizing the Site are relatively ubiquitous (i.e., silty to sandy glacial till), the testing results obtained from these test pits are still considered to be representative of infiltration conditions within the new East Infiltration Trench footprint.

Under the supervision of Stantec personnel, the test pit excavations extended to the projected base elevation of each infiltration trench for the performing of soil infiltration testing. Once completing the soil infiltration testing at the proposed base elevation of each trench, the test pits were then excavated further to depths of at least 1.5 m below these base elevations, with the soils at these depths also being subjected to infiltration testing as per the protocols outlined in the Credit Valley Conservation (CVC) and Toronto and Region Conservation (TRCA) (2010) *Low Impact Stormwater Management Planning and Design Guideline*. Stantec personnel classified the soils targeted for infiltration testing using the ASTM guideline for visual-manual description and identification of soils (ASTM D2488-00) and once the test pit was no longer required, Lockhart backfilled the excavations to the existing grade.

Assessment of the infiltration potential for the on-Site soils involved the use of a Guelph Permeameter (a constant head permeameter designed to measure in-situ vertical hydraulic conductivities of a given substrate). At the various excavated depths of the test pits, Stantec personnel used a hand auger to drill an approximately 0.5 m deep, 50 mm diameter cylindrical hole into the native soil to be tested. The Guelph Permeameter was then filled with water, inserted into the hole while making a concerted effort to avoid knocking debris into the excavation, and then stabilized against the substrate. Stantec personnel then proceeded to record the eventual steady-state rate of water recharge into the soil. The infiltration rate for each soil tested was converted from the measured vertical hydraulic conductivity using the established relationship between vertical hydraulic conductivity and infiltration rate presented by the CVC/TRCA (2010). Table 7 presents the results of this soil infiltration testing.

Using the infiltration testing results, Stantec proceeded to calculate the Design Infiltration Rate for each infiltration facility as per the approach outlined by the CVC/TRCA (2010). The calculated infiltration rate used in the design of the East and South Infiltration Trenches is 32 mm/hour and 23 mm/hour, respectively (Table 8).

4.0 LOCAL GEOLOGY AND HYDROGEOLOGY

4.1 GEOLOGY

Figure 4 presents the surficial geology throughout the Site as mapped by the OGS (2010), with this mapping indicating that the entire Site is covered by stone-poor, silty to sandy glacial till (i.e., the Port Stanley Till). Figure 1 shows the locations of Cross-Section A-A’ (Figure 13) and B-B’ (Figure 14), which were constructed using geological information obtained from the onsite drilling completed at the Site by CMT Engineering (2018) and Stantec (Appendix E). Although onsite drilling results confirm that silty sand to sandy silt till (Port Stanley Till) predominantly forms a horizontally and vertically contiguous unit beneath the Site, this unit is overlain by a 2.3 to 4.8 m thick diamicton deposit consisting of very loose to dense sand and silt, with some gravel and trace clay (CMT, 2018). A 2.4 m thick, discontinuous layer of sand was encountered in the Port Stanley Till at a depth of 11.3 m BGS (331.7 m AMSL) at MW2-18. The Port Stanley Till occurs at elevations ranging from 341.6 to 334.7 m AMSL beneath the Site, with this unit extending to the termination depth of the onsite boreholes (333.4 to 324.6 m AMSL). Locally, the bedrock surface is reported to occur at an elevation of approximately 320 m AMSL (Golder, 2011).

4.2 HYDROGEOLOGY

4.2.1 Groundwater Levels and Flow

Figures 9 and 10 and Table 2 present the continuous and manual water levels recorded within the monitoring wells between July 2018 and June 2020. Groundwater elevations across the Site ranged from 0.9 m BGS (at MW5-18) to 9.2 m BGS (at MW1-18) over the monitoring period, equating to elevations ranging from 332.6 m to 340.7 m AMSL.

As shown in the hydrographs (Figures 9 and 10), the groundwater table demonstrated a similar pattern in fluctuations across the Site, with high groundwater conditions predominantly occurring in the spring (i.e., early March to early June) due to lower evapotranspiration losses and a melting snowpack, which in turn provided a greater volume of water available to infiltrate and recharge the groundwater system. Starting in mid-June, the groundwater table across the entire Site begins to experience a steady decline, reaching its lowest elevation in late October to early November as a response to more water being drawn from the subsurface over this period to meet evapotranspiration demands. Overall, the groundwater table decline that occurred from the early summer to late fall at the monitoring well locations ranged from 1.4 m (MW7-18) to 5.6 m (MW2-18).

Throughout the Site, groundwater levels showed no marked response to notable precipitation events (i.e., immediate spike/rise in the groundwater table), suggesting that there is no direct hydraulic connection between the ground surface and the groundwater system (i.e., via vertical fissures/fractures in the overburden). The subdued response to precipitation events is not surprising, given that dense to very densely packed native deposits of silty sand to sandy silt till are present beneath the Site, with these deposits being characterized by horizontal hydraulic conductivities in the range of 10^{-7} to 10^{-9} m/s

(Table 1; Appendix G). However, Stantec notes that infiltration testing completed in the shallower native deposits of silty sand to sandy silt till (i.e., 0.5 to 3.5 m BGS) suggest that horizontal hydraulic conductivities are higher within certain areas of the Site (e.g., near proposed locations of the proposed infiltration trenches) where estimated values range from 10^{-5} to 10^{-7} m/s (Table 7).

Figure 12 presents groundwater elevation contours and the interpreted direction of horizontal flow through the groundwater system beneath the Site using level measurements collected from the on-site monitoring wells in May 2019. In general, groundwater contours mimic the prevailing topography of the Site, with a localized groundwater divide running along the northeast-southwest axis of the drumlin upon which the property is situated (Figure 3). From the divide, groundwater is shown to flow to the northeast across the Site towards Torrance Creek Swamp at a calculated horizontal hydraulic gradient of 0.04 m/m, which is in general agreement with regional flow patterns presented in Totten Sims Hubicki Associates *et al.* (1998) (Figure 4.4.7, Appendix C). However, groundwater is also shown to flow to the southwest from the divide towards Gordon Street at a calculated horizontal hydraulic gradient of 0.09 m/m and onward towards Hanlon Creek Swamp. These groundwater flow patterns also mimic existing surface water runoff / drainage patterns occurring at the Site as discussed in Stantec (2021).

Horizontal hydraulic conductivity estimates calculated from onsite hydraulic response testing completed at the onsite monitoring wells, which are all screened within sandy silt till, ranged from 5.4×10^{-7} m/s to 1.6×10^{-9} m/s (Table 1; Appendix G). These calculated values are consistent with the literature values of hydraulic conductivity provided for these deposits (Fetter, 1994) and with values provided for the Lower Till Aquitard (Port Stanley Till) as reported in Golder (2011). Overall, the estimated bulk (i.e., geometric mean) horizontal hydraulic conductivity calculated for the overburden deposits is 3.7×10^{-8} m/s (Table 1).

The velocity at which groundwater horizontally flows through the subsurface is calculated through the application of Darcy’s law, where:

$$v = \frac{K \nabla}{\theta}$$

where: v = velocity (m/yr)
K = hydraulic conductivity
∇ = hydraulic gradient
θ = effective porosity

Assuming a soil porosity of 0.2 for glacial till (Fetter, 1994), an average horizontal hydraulic gradient of 0.04 m/m for groundwater moving towards the northeast, and geometric mean hydraulic conductivity of 3.7×10^{-8} m/s, the estimated velocity of groundwater flowing through the overburden beneath the Site towards Torrance Creek Swamp is calculated to be approximately 0.23 m/year (i.e., one meter every 4.3 years). Using the same input parameters as above, except for an average horizontal hydraulic gradient of 0.09 m/m, the estimated velocity of groundwater flowing through the overburden beneath the Site towards Gordon Street is calculated to be approximately 0.52 m/year (i.e., one meter every 1.9 years).

The Site is also characterized by downward vertical hydraulic gradients as recorded at MW4-18(S/D) (Figure 9) and MW5-18(S/D) (Figure 10). Vertical hydraulic gradients ranged from -0.5 to -1.0 over the monitoring period, confirming that the Site is a groundwater recharge area.

4.2.2 Groundwater-Surface Water Interaction

Data available on the Grand River Information Network (GRIN) (GRCA, 2019) indicates that downward vertical hydraulic gradients are present beneath the Site and in the surrounding area, with annual recharge rates within the boundaries of the Site ranging from 100 to 200 mm/year (Appendix D). As shown in Figure 10, over the monitoring period (i.e., April 2019 to June 2020) groundwater levels recorded in the multi-level drive-point piezometer (i.e., DP1-19(S/D)) installed within Torrance Creek Swamp approximately 75 m to the northeast of the Site show that the groundwater table occurred at or above ground surface during the spring, declining to depths up to 1.1 m BGS by the late summer to early fall (Table 3; Figure 10). Neutral to upward vertical hydraulic gradients consistently occur beneath this area of the Torrance Creek Swamp, although the vertical gradient did switch to downward over the monitoring period. Overall, vertical hydraulic gradients at DP1-19(S/D) have ranged from -0.06 to 0.17, indicating that this area of the wetland functions as both a groundwater recharge and discharge feature. However, the potential volume of groundwater discharging to the Torrance Creek Swamp during those periods where discharge conditions are present is expected to be minimal, given that groundwater moves at a very slow rate through the overburden deposits (i.e., one meter every 4.3 years).

4.2.3 Infiltration Potential

Estimated infiltration rates for the overburden deposits are provided in Tables 6 and 7. Infiltration rates were calculated based on an established relationship between vertical hydraulic conductivity and infiltration rate presented in CVC-TRCA (2010), with vertical hydraulic conductivities being estimated based on both the results of in-situ hydraulic response testing completed at each monitoring well (Section 3.5) and Guelph Permeameter testing completed within the footprints of the proposed infiltration trenches (Section 3.6). Vertical hydraulic conductivities for the deeper deposits of sandy silt till (i.e., 5.0 m to 15.1 m BGS) are assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities, resulting in values ranging from 5.6 x 10^{-8} to 1.6 x 10^{-10} m/s for these till deposits (Table 6). However, results of infiltration testing completed in the areas of the Site where the East and South Infiltration Trenches will be constructed had vertical hydraulic conductivities ranging from 3.9 x 10^{-5} m/s to 1.8 x 10^{-7} m/s (i.e., from depths of 0.5 to 3.6 m BGS) (Table 7). Based on these values, the calculated infiltration rates for the previously mentioned deposits can range from as low as 5 mm/hour to an upper value of 123 mm/hour (Tables 6 and 7).

4.2.4 Groundwater Quality

Groundwater quality results from the sample collected from MW2-18 on September 11, 2018 was assessed against City of Guelph Sanitary and Storm Sewer By-law (1996)-15202 guidelines (i.e., for quality of water potentially discharged to storm or sanitary sewage works during dewatering) (Table 4). Groundwater samples collected from MW4-18(S), MW6-18, and MW7-18, together with the previously mentioned sample results, were also compared against the ODWQS (Table 5). A summary of the results is discussed in the sections below.

4.2.4.1 City of Guelph Sanitary and Sewer By-Law

Results of groundwater quality analysis for the sample collected from MW2-18 (Table 4), which was not field-filtered (i.e., representing the quality of groundwater that would be pumped from an open excavation and discharged to the sewer system without treatment), indicate that this groundwater does not meet the City of Guelph Storm Sewer By-law guidelines due to the following parameter concentrations being exceeded:

- Fecal Coliform (200 MPN/100mL): exceeded the storm sewer limit with a count of 350 MPN/100mL.
- Total Cadmium (0.001 mg/L): exceeded the storm sewer limit with a concentration of 0.0019 mg/L.
- Total Copper (0.01 mg/L): exceeded the storm sewer limit with a concentration of 0.03 mg/L.
- Total Lead (0.05 mg/L): exceeded the storm sewer limit with a concentration of 0.13 mg/L.
- Total Suspended Solids (15 mg/L): exceeded the storm sewer limit with a count of 2,500 mg/L.
- Total Zinc (0.05 mg/L): exceeded the storm sewer limit with a concentration of 0.64 mg/L.

The groundwater also does not meet the City of Guelph Sanitary Sewer By-law guidelines due to the following parameter concentrations being exceeded:

- Total Suspended Solids (350 mg/L): exceeded the sanitary sewer limit with a count of 2,500 mg/L.

Stantec notes that results for the set of groundwater samples that were field-filtered and collected from MW4-18(S), MW6-18, and MW7-18 indicate that if groundwater pumped as part of construction dewatering (if required) is treated for TSS prior to leaving the Site that the removal of the associated sediment-bound metals from the groundwater would result in the remaining dissolved concentrations of cadmium (<0.0001 mg/L), copper (<0.001 mg/L), lead (<0.00056 mg/L), and zinc (<0.005 mg/L) (Table 5) not exceeding the corresponding City of Guelph Storm Sewer By-law concentrations for these parameters.

4.2.4.2 Ontario Drinking Water Quality Standards

Results of the quality testing indicates that the groundwater beneath the Site is classified as calcium-bicarbonate type groundwater (Figure 11), which is typical of shallow fresh groundwater systems in Ontario. The parameters tested in the groundwater samples (i.e., MW4-18(S), MW6-18, and MW7-18) did not exceed any corresponding ODWQS health-related criteria; however, the following tested parameters did exceed their corresponding ODWQS Aesthetic Objectives (non-health related):

- Hardness (100 mg/L): exceeded with concentrations ranging from 320 mg/L to 520 mg/L.
- Total Dissolved Solids (500 mg/L): exceeded at MW4-18(S) (540 mg/L) and MW7-18 (530 mg/L).

In addition, the Medical Officer of Health Reporting Limit (Ontario) of 20 mg/L for sodium was exceeded at MW7-18 (34 mg/L).

5.0 WATER BALANCE

Water balance calculations were completed to quantify infiltration volumes at the Site and confirm the recharge function. A comparison of water balance data under existing (i.e., pre-development) and proposed (i.e., post-development) conditions was completed to determine the potential impacts of development on the Site's recharge function. The methodology for the water balance calculations is provided in Section 5.1. Results of the pre- and post-development water balance analysis are presented in Sections 5.2 and 5.3, respectively.

5.1 METHODOLOGY

Within the hydrologic cycle, the flow of water into and out of system can be described through a simplified water balance equation as follows:

$$P = ET + S + R + I$$ **Equation 1**

Where:

P = precipitation
ET = evapotranspiration
S = change in groundwater storage
R = runoff
I = infiltration (groundwater recharge)

Equation 1 may be further simplified by ignoring the change in groundwater storage (S), which trends over time to zero. The various components of the hydrologic cycle may be estimated through calculations or based on measurements made in the field. Precipitation (P) is typically a measured value. Evapo-transpiration (ET) is calculated based on measured air temperatures. Infiltration (I) and Runoff (R) are calculated based on P and ET, where the difference between P and ET is the water surplus (WS) available for Infiltration (I) and Recharge (R) as follows:

$$WS = P - ET$$ **Equation 2**

Where WS is used to calculate I after applying an infiltration factor (IF),

$$I = WS \times IF$$ **Equation 3**

And R is estimated by subtracting I from WS,

$$R = WS - I$$ **Equation 4**

For this assessment, ET was calculated using the soil moisture balance model by Thornthwaite and Mather (1955). In the Thornthwaite and Mather model monthly potential evapotranspiration (PET) is calculated based on the measured average monthly daily temperature (T_a) and a heat index (H_i) value assuming 12 hours of daylight in a day and 30 days in a month, as follows:

$$PET = 16 \times \left(\frac{10T_a}{H_i}\right)^{\alpha}$$ **Equation 5**

Where T_a is taken as 0 degrees Celsius for months with negative temperatures, and H_i, the heat index is estimated as,

$$H_i = \sum_{i=1}^{12}\left(\frac{10T_a}{5}\right)^{1.514}$$ **Equation 6**

For α

$$\alpha = 0.49 + (0.0179 \times H_i) - \left(0.0000771 \times H_i^{2}\right) + \left(0.000000675 \times H_i^{3}\right)$$ **Equation 7**

PET values are then multiplied by an adjustment factor, after Thornthwaite and Mather (1957), which represents the average number of daylight hours per month at the latitude of the subject property to give the Adjusted Potential Evapotranspiration (PET_{adj}).

Actual Evapotranspiration (AET) is derived as,

$$AET = PET_{adj} - \Delta S$$ **Equation 8**

Where ΔS is the change in storage for the month, calculated as,

$$\Delta S = S_{mc} \times e^{\left(\frac{APWL}{S_{mc}}\right)}$$ **Equation 9**

Where:

S_{mc} = soil moisture capacity

APWL = accumulated potential water loss, calculated for ΔP < 0 as $APWL = -\sum_{i=0}^{12} PET_i$, and for ΔP > 0 by rearranging equation 8; with ΔP= net precipitation = P - PET_{adj}

WS is derived by subtracting AET from the monthly precipitation,

$$WS = P - AET$$ **Equation 10**

And the infiltration and runoff calculated per Equations 3 and 4 above.

The infiltration factor shown in Equation 3 is estimated based on the topography, soil type and land cover after MOE (2003) and the Ministry of the Environment and Energy (MOEE) (1995). To define appropriate infiltration factors, the Site is divided into four Sub-Areas based on similarities in soil type, topography and vegetation cover as follows:

Sub-Area A	Fine sandy to silt loam, rolling topography, woodland cover
Sub-Area B	Fine sandy to silt loam, rolling topography, pasture and shrubs land cover
Sub-Area C	Fine sandy to silt loam, rolling topography, urban lawn
Sub-Area D	Fine sandy to silt loam, rolling topography, urban lawn, 95% impervious cover

The delineated Sub-Areas are shown on Figure 15 and the infiltration factors assigned for each Sub-Area under existing conditions (i.e., pre-development) within Catchment 101 (i.e., drainage directed westward towards Upper Hanlon Creek Watershed) and Catchment 102 (i.e., drainage directed eastward towards Torrance Creek subwatershed) is presented in Tables 9 and 10, respectively. As shown in Figure 15, the lands fronting Valley Road within the northeastern portion of the Site are not included in the pre- and post-development water balance calculations, given that these lands are to come under the ownership of the City and, subsequently, will no longer be the responsibility of Tricar.

Soil moisture capacity was set between 75 mm to 300 mm among the Sub-Areas depending on the soil type and land cover as specified under MOE (2003). In Sub-Area A, where the fine sandy to silt loam and woodland cover is present, soil moisture was set at 75 mm. For Sub-Area B, soil moisture content was set at 150 mm corresponding to a fine sandy to silt loam covered with pasture and shrub vegetation. For Sub-Areas C and D, soil moisture content was set at 300 mm corresponding to fine sandy to silt loam having urban lawn type cover associated with the existing onsite residential and commercial properties.

For this water balance assessment, climate normals (1981 to 2010) as recorded at the Waterloo Wellington A Climate Station were used to obtain monthly values of precipitation and temperature. The climate data were obtained from Environment Canada (2020) and are summarized in Table 11. The Waterloo Wellington A Climate Station is located approximately 15 km to the southwest of the Site. Although the Guelph Arboretum Climate Station is located approximately 1.5 km to the northwest of the Site, climate normals from 1971 to 2000 are only available from this station.

5.2 PRE-DEVELOPMENT WATER BALANCE

5.2.1 Catchments Contributing to Upper Hanlon Creek Subwatershed

The average annual precipitation at the Site is estimated at 916 mm based on data obtained from the Waterloo Wellington A Climate Station (Environment Canada, 2020). In comparison, Matrix Solutions Inc. (2017) reported average annual precipitation in the Upper Speed Assessment Area is 923 mm/year as measured at the Guelph Arboretum Climate Station. In Sub-Areas A, B, and C/D, annual actual evapotranspiration from pervious areas is estimated as 563 mm, 554 mm, and 541 mm, respectively. This means that 353 mm of surplus water is available for runoff and infiltration across Sub-Area A on an annual basis, with annual surpluses of 362 mm and 375 mm being available across Sub-Areas B and C/D, respectively. Applying the estimated infiltration factors of 0.65 for Sub-Area A, 0.60 for Sub-Area B and 0.50 for Sub-Area C/D, the calculated annual infiltration for these sub-areas is 230 mm, 217 mm, and 188 mm, respectively.

Based on the previously mentioned water balance components, the average annual volume of infiltration occurring within Catchment 101 (Figure 15) under the pre-development condition is estimated at 2,553 m^3, equating to a rate of 192 mm/year (Table 9). This infiltration rate falls within the 100 mm/year to 200 mm/year groundwater recharge rate range modeled for the Site as per GRIN mapping (Appendix D).

The average annual volume of surface water runoff occurring within Catchment 101 (Figure 15) under the pre-development condition is 2,952 m^3 (222 mm/year) (Table 9).

5.2.2 Catchments Contributing to Torrance Creek Subwatershed

The average annual precipitation at the Site is estimated at 916 mm based on data obtained from the Waterloo Wellington A Climate Station (Environment Canada, 2020). In Sub-Areas A, B, and C, annual actual evapotranspiration from pervious areas is estimated as 563 mm, 554 mm, and 541 mm, respectively. This means that 353 mm of surplus water is available for runoff and infiltration across Sub-Area A on an annual basis, with annual surpluses of 362 mm and 375 mm being available across Sub-Areas B and C/D, respectively. Applying the estimated infiltration factors of 0.65 for Sub-Area A, 0.60 for Sub-Area B and 0.50 for Sub-Area C, the calculated annual infiltration for these sub-areas is 230 mm, 217 mm, and 188 mm, respectively.

Based on the previously mentioned water balance components, the average annual volume of infiltration occurring within Catchment 102 (Figure 15) under the pre-development condition is estimated at 3,828 m^3, equating to a rate of 222 mm/year (Table 10). This infiltration rate slightly exceeds the 200 mm/year groundwater recharge rate range modeled for the Site as per GRIN mapping (Appendix D).

The average annual volume of surface water runoff occurring within Catchment 101 (Figure 15) under the pre-development condition is 2,443 m^3 (222 mm/year) (Table 10).

5.3 POST-DEVELOPMENT WATER BALANCE

5.3.1 Catchments Contributing to Upper Hanlon Creek Subwatershed

Under the post-development condition in the former area of Catchment 101, Stantec has assumed for the water balance calculations that the topography and physical characteristics of the surficial soil deposits (i.e., fine sandy to silt loam) in each of the Sub-Areas will remain relatively unchanged; however, land cover was adjusted to reflect the projected imperviousness cover percentages of the new catchment areas that will occur under proposed conditions (i.e., Catchments 201 to 204 and 207 to 209) (Figure 16). Stantec also assumes that the remaining pervious areas within the new catchment areas will consist of urban lawns and other vegetation associated with urban landscaping. Overall, approximately 80% (1.16 ha) of the Site area covered by the previously mentioned catchments will be converted to impervious surfaces. Under this scenario, the annual volume of infiltration occurring across these lands will decline from 2,553 m^3 to 553 m^3, resulting in an annual infiltration deficit of 2,000 m^3 (Table 12). Annual volumes of surface water runoff from these lands will concurrently increase from 2,952 m^3 to 11,177 m^3, for a runoff increase of 8,225 m^3 (Table 10).

5.3.2 Catchments Contributing to Torrance Creek Subwatershed

In the former Catchment 102, which will be replaced largely by Catchments 205 and 206, the topography, soil deposits (i.e., fine sandy to silt loam), and vegetation cover of these lands will remain mostly unchanged between pre- and post-development conditions. Overall, approximately 1% (0.02 ha) of the Site area covered by the previously mentioned catchments will be converted to impervious surfaces. Under this scenario, the annual volume of infiltration occurring across these lands will decline from 3,828 m^3 to 3,550 m^3, resulting in an annual infiltration deficit of 279 m^3 (Table 13). Annual volumes of surface water runoff from these lands will concurrently decrease from 2,443 m^3 to 2,245 m^3, for a runoff decrease of 198 m^3 (Table 13).

6.0 GROUNDWATER MOUNDING ASSESSMENT

As requested by the City, Stantec completed an assessment of the magnitude of groundwater mounding that could potentially occur directly beneath the East Infiltration Trench and South Infiltration Trench following a 25 mm storm event. Stantec calculated the projected height of groundwater mounding up to 36 m away from each infiltration gallery using a spreadsheet developed by the United States Geological Survey (USGS) applying the Hantush equation (Carelton, 2010). The equation consists of the following input parameters:

R = recharge (Infiltration) rate (feet/day)
Sy = specific yield (unitless)
K = horizontal hydraulic conductivity (feet/day)
x = 1/2 length of infiltration gallery
y = 1/2 width of infiltration gallery
t = duration of infiltration (drawdown) period (days)
hi(0) = initial thickness of saturated zone receiving recharge (feet)

The specific values entered in the equation and the subsequent results for each infiltration gallery assessment are discussed below.

The projected high groundwater condition occurring in both areas where the East and South Infiltration Trenches will be constructed is based on groundwater elevation monitoring completed at the Site and the groundwater elevation contours constructed from these data as documented in this report. The groundwater elevation contour mapping presented on Figure 12 (based on data collected in May 2019) represents the period of the monitoring program where groundwater elevations recorded across the Site were at their highest elevation. As shown in Figure 12, groundwater elevations underlying the East Infiltration Trench slope to the northeast from an elevation of 339.2 m AMSL to 338.6 m AMSL and, as such, Stantec used a groundwater elevation of 339.2 m AMSL for the mounding assessment beneath this facility. For the South Infiltration Trench, groundwater elevations underlying this facility are estimated to range from 339.0 m AMSL to 338 m AMSL, with the elevation of 339.0 m AMSL being used in the mounding analysis for this trench. Stantec notes that monitoring wells are proposed for installation within and near the footprints of both infiltration trenches (i.e., MW101-21 to MW104-21), with these wells being equipped with continuous data logging equipment to confirm the high groundwater elevation assumptions utilized in each mounding assessment.

The specific values entered in the USGS spreadsheet and the subsequent results for each infiltration trench groundwater mounding assessment are discussed below.

6.1 EAST INFILTRATION TRENCH

The proposed construction location for the East Infiltration Trench will be in the central portion of the Site (Catchment 206) immediately to the northeast of Building 2 (Figure 16), with this facility being situated within the Torrance Creek Subwatershed. The East Infiltration Trench will receive stormwater runoff from the rooftop of Building 2 (Catchment 203). The invert (base) of this rock trench will be constructed at an elevation of 340.0 m AMSL, placing the base elevation of the gallery approximately 0.8 m above the projected seasonally high groundwater table in this area of the Site (i.e., 339.2 m AMSL) (Figure 12).

The projected elevation and extents of the groundwater mound are based on the following equation inputs:

- **R** - Design Infiltration Rate of 32 mm/hour (Table 8).
- **Sy** - A specific yield of 0.23 based on the average of specific yields for silt, fine sand, medium sand, coarse sand, and gravelly sand as reported by Johnson (1967).
- **K** - A geometric vertical hydraulic conductivity of 2.0 x10^{-6} m/s is calculated for the subsurface deposits situated from five to 22 m from the trench footprint based on in-situ Guelph Permeameter testing completed on various soil horizons located at elevations ranging from 340.4 m AMSL to 337.4 m AMSL (Table 7). Since hydraulic conductivity in the horizontal direction is generally an order of magnitude higher than hydraulic conductivity in the vertical direction (Todd 1980; Freeze and Cherry 1979), the horizontal hydraulic conductivity of the shallow groundwater system is assumed to be 2.0 x 10^{-5} m/s (5.62 feet/day). This estimated horizontal hydraulic conductivity falls within the range of conductivities reported for the silty sand and gravel to sandy gravelly silt deposits that characterize the subsurface of the Upper Hanlon Creek Watershed (i.e., 10^{-3} m/s to 10^{-6} m/s; Gamsby and Mannerow Ltd. 1993).
- **x, y** - The dimensions of the infiltration trench are 11 m (36.1 feet) long by 10 m (32.8 feet) wide.
- **t** - The time taken for the infiltration gallery to drain following a 25 mm storm event is 18 hours (0.75 days).
- **hi(0)** – A saturated zone thickness of 19.2 m (62.9 feet) (i.e., high groundwater elevation of 339.2 m AMSL minus bedrock surface elevation of 320.0 m AMSL that underlies the Site).

Table 14 presents the results of the groundwater mounding analysis for the East Infiltration Trench. Based on the above input parameters, the maximum groundwater mounding predicted to occur beneath the center of the East Infiltration Trench after a 25 mm event is 0.6 m, equating to an elevation of 339.8 m AMSL based on the seasonally high groundwater elevation (i.e., 339.2 m AMSL + 0.6 m = 339.8 m AMSL). As shown on Table 14 and Figure 17, the rise in the groundwater table does not exceed 0.1 m beyond 18 m from the trench center point after a 25 mm storm event.

Although storm event induced mounding will temporarily raise groundwater elevations beneath the foundation of Building 2, the magnitude of this mounding not expected to exceed more than 0.1 m (Figure 17). Stantec notes that this building foundation (as with all onsite building foundations) will be constructed as a watertight structure (sealed with a water impermeable membrane), with the floor slab designed to structurally resist the hydrostatic pressure exerted by the groundwater. Consequently, no permanent drainage system / dewatering will be required for Building 2. The groundwater mound is also not expected to extend below the residential homes fronting Valley Road to the northwest of the Site.

Stantec notes that East Infiltration Trench overflows potentially occurring following a greater than 25 mm storm event will be directed overland to the northeast where this runoff will eventually discharge to the Torrance Creek Swamp (refer to Stantec (2021) *Stormwater Management Brief* for additional details).

6.2 SOUTH INFILTRATION TRENCH

The proposed construction location for the South Infiltration Trench is near the southwest limits of the Site, with this facility being situated within the Upper Hanlon Creek Subwatershed (Figure 16). The South Infiltration Trench will receive stormwater runoff from the rooftop of Building 1 (Catchment 202) and associated parking areas (Catchments 204 and 208). The invert (base) of this Permavoid infiltration trench will be constructed at an elevation of 340.4 m AMSL, placing the base elevation of the gallery approximately 1.4 m above the projected seasonally high groundwater table in this area of the Site (i.e., 339.0 m AMSL) (Figure 12).

The projected elevation and extents of the groundwater mound are based on the following equation inputs:

- **R** - Design Infiltration Rate of 23 mm/hour (Table 8).
- **Sy** - A specific yield of 0.23 based on the average of specific yields for silt, fine sand, medium sand, coarse sand, and gravelly sand as reported by Johnson (1967).
- **K** - A geometric vertical hydraulic conductivity of 1.8 $\times 10^{-6}$ m/s is calculated for the subsurface deposits situated within the trench footprint based on in-situ Guelph Permeameter testing completed on various soil horizons located at elevations ranging from 341.6 m AMSL to 339.1 m AMSL (Table 7). Since hydraulic conductivity in the horizontal direction is generally an order of magnitude higher than hydraulic conductivity in the vertical direction (Todd 1980; Freeze and Cherry 1979), the horizontal hydraulic conductivity of the shallow groundwater system is assumed to be 1.8 $\times 10^{-5}$ m/s (5.02 feet/day). This estimated horizontal hydraulic conductivity falls within the range of conductivities reported for the silty sand and gravel to sandy gravelly silt deposits that characterize the subsurface of the Upper Hanlon Creek Watershed (i.e., 10^{-3} m/s to 10^{-6} m/s; Gamsby and Mannerow Ltd. 1993).
- **x, y** - The dimensions of the infiltration trench are 33.3 m (109.2 feet) long by 12.7 m (41.8 feet) wide.
- **t** - The time taken for the infiltration gallery to drain following a 25 mm storm event is 24 hours (one day).
- **hi(0)** – A saturated zone thickness of 19.0 m (62.3 feet) (i.e., high groundwater elevation of 339.0 m AMSL minus bedrock surface elevation of 320.0 m AMSL that underlies the Site).

Table 14 presents the results of the groundwater mounding analysis for the South Infiltration Trench. Based on the above input parameters, the maximum groundwater mounding predicted to occur beneath the center of the South Infiltration Trench after a 25 mm event is 1.1 m, equating to an elevation of 340.1 m AMSL based on the seasonally high groundwater elevation (i.e., 339.0 m AMSL + 1.1 m = 340.1 m AMSL). As shown on Table 14 and Figure 17, the rise in the groundwater table does not exceed 0.1 m beyond 30 m from the trench center point after a 25 mm storm event.

As shown in Figure 17, storm event induced mounding will temporarily raise groundwater elevations beneath the underground parking area of the development by 0.7 m along southern limits of this structure, with the mound disappearing once reaching the underside of Building 2. As previously mentioned, the building and underground parking foundations will be constructed as watertight structures (sealed with a water impermeable membrane) to resist the hydrostatic pressure exerted by the groundwater. As such, no permanent drainage system / dewatering will be required for these structures. The predicted groundwater mound is also not expected to intercept the residential buildings located on the adjacent property immediately to the southeast of the Site.

Stantec notes that any overflows from the South Infiltration Trench following a greater than 25 mm storm event will be directed to an underground Permavoid storage tank and ultimately outlet to the Gordon Street storm sewer (refer to Stantec (2021) *Stormwater Management Brief* for additional details).

6.3 IMPACT TO NATURAL HERITAGE FEATURES

As shown in Figure 17, groundwater mounding predicted to occur beneath the East Infiltration Trench under the previously mentioned storm event scenario will not intercept the Torrance Creek Swamp, which is located approximately 75 m to the northeast from where the groundwater mounding effects cease. As such, there is no opportunity for the groundwater mounding to potentially reverse vertical hydraulic gradients observed to occur beneath this wetland (i.e., reversing from a groundwater discharge to recharge function).

Eventually, when storm water exiting the East Infiltration Trench and infiltrating to the groundwater table equals the rate at which the receiving groundwater system can transport this water away, the mounding will subside. This recharge water will flow through the groundwater system to the northeast and discharge to the Torrance Creek Swamp. Stantec's opinion is that this increased recharge will not only help to maintain, but likely enhance, groundwater inputs to the wetland.

7.0 GROUNDWATER DEWATERING ASSESSMENT

The following section evaluates the potential onsite needs for construction dewatering and/or the installation of a permanent drainage system, and what mitigation measures could be employed at the Site to minimize any potential disturbances these activities may cause to the form and function of the groundwater system. If dewatering is anticipated, the section will also provide an indication of the quantity and quality of groundwater that will be discharged to the City sewer system. The evaluation is based on information collected from the Site as part of the field investigation together with a review of available background hydrogeological information.

7.1 GROUNDWATER DEWATERING – QUANTITY

7.1.1 Construction Dewatering Volumes

The proposed residential development is to consist of two 12 story apartment buildings having nine townhouse units and 368 apartment units. The development will have a combination of surface parking and two levels of underground parking. The proposed footprint of the underground parking area will cover approximately 11,450 m^2, with the anticipated base of the second level of underground parking being located at an elevation of 335.7 m AMSL. Since seasonally high groundwater depths measured within the proposed underground parking area range from 1.0 m to 4.8 m BGS (334.0 m to 340.3 m AMSL), Stantec anticipates that the excavation for this sturcture will intercept the groundwater table.

Stantec utilized the Dupuit-Forchheimer equation (Powers et al., 2007) to calculate what volume of dewatering could be required to lower the groundwater elevation in the excavation of the underground parking area:

$$Q = \frac{\pi K(H^2 - {h_w}^2)}{\ln R_o/r_w}$$

where Q = steady state pumping rate (m^3/s)
K = representative hydraulic conductivity (m/s)
H = height of static water level above assigned datum (m)
h_w = depth of dewatering relative to assigned datum (m)
r_w = equivalent radius of dewatering area (m)
R_o = dewatering radius of influence (m)

The input parameters required for this equation were taken from the findings of this hydrogeological investigation, regional geological studies (Golder, 2011), and the layout for the proposed underground parking area (Figure 1), such as information pertaining to the projected area of the excavation, horizontal hydraulic conductivity of the subsurface material, the base elevation of the aquifer being pumped, and the targeted groundwater dewatering elevation.

For the excavation, the groundwater dewatering volume potentially required during construction is calculated based on the following assumptions:

- The groundwater table resides within the native diamicton deposits of sand and silt to silty sand / sandy silt till (Port Stanley Till) that underly the Site, which is characterized by horizontal conductivities ranging from 5.4 x 10^{-7} m/s to 1.6 x 10^{-9} m/s. The calculated bulk horizontal hydraulic conductivity for the overburden is 3.7 x 10^{-8} m/s, representing the geometric mean of the above field-tested hydraulic conductivities. For the purposes of the dewatering calculations, Stantec used the bulk horizontal hydraulic conductivity of 3.7 x 10^{-8} m/s (Table 1).

- The highest groundwater levels measured in the overburden monitoring wells constructed within the proposed footprint of the underground parking area over the monitoring period (i.e., July 2018 to June 2020) ranged from 1.0 m to 4.8 m BGS, corresponding to elevations of 334.0 m to 340.3 m AMSL. A high groundwater elevation of 340.3 m AMSL was assumed to occur over the full area of the proposed underground parking, with this assumption contributing to the overall conservative nature of the analysis.

- The depth of dewatering is set to 1.0 m below the elevation of the second parking level, which will be constructed at an elevation of 335.7 m AMSL (i.e., 335.7 m – 1.0 m = 334.7 m AMSL).

- The base of the groundwater flow system is set to the elevation of the bedrock surface, which is estimated to occur at an elevation of 320 m AMSL.

- The area of the proposed underground parking structure is estimated to be 11,450 m^2.

Based on the above assumptions, the predicted maximum daily volume of groundwater that will be pumped from the subsurface within the footprint of the underground parking area is approximately 37,700 L (Table H1, Appendix H). Stantec notes that this predicted groundwater volume will likely only be realized during the initial stages of dewatering, with the bulk of this volume representing groundwater that is stored in the overburden deposits. Once this overburden storage is drained and removed from the subsurface, Stantec anticipates that the pumping volumes will lower to reflect a reduced rate of groundwater flowing into the excavation (i.e., normalize to a steady state discharge rate). To account for the initial removal of overburden storage volumes and potential basal groundwater seepage into the excavation, a 3.0 factor of safety is applied to the previously mentioned calculated steady state inflow rate, resulting in a projected dewatering volume of **113,100 L/day**. Stantec notes that these dewatering calculations are estimates and will be subject to adjustments if any changes are made to the input parameters discussed above.

Stantec notes that the predicted dewatering volume does not account for any runoff that may enter the open excavation during construction following a rainfall and/or snowmelt event. Assumming that the excavation required to construct the underground parking garage area is fully open (i.e., 11,450 m^2) during a 25 mm precipitation event, the resulting volume of stormwater accumulating in the excavation together with groundwater inflow volumes could be in the range of **399,350 L.**

Under O. Reg. 64/16 and O. Reg. 63/16, a MECP Permit to Take Water (PTTW) is required when construction dewatering rates are anticipated to exceed 400,000 L/day, whereas an Environmental Activity and Sector Registry (EASR) is required when dewatering volumes are expected to range between 50,000 L/day and 400,000 L/day. Consequently, Stantec's opinion is that Site will require an EASR to complete construction dewatering for the proposed underground parking garage.

The MECP has made recent amendments to EASR requirements for construction dewatering that came into effect July 1, 2021. The following provides a brief summary of the changes:

- The ability to register multiple dewatering pits for a single project under the same EASR.
- Allowing construction dewatering of up to 400,000 L/day for each dewatering pit as long as the dewatering area of influence do not overlap.
- Stormwater will no longer be counted in the 400,000 L/day water taking limit, however, registrants will at a minimum be required to keep a record of precipitation events, or if determined by a Qualified Person, detailed monitoring/documentation.
- EASRs will apply to linear projects including transit and pipelines.
- Registrants will be required to notify the local municipalities and conservation authorities if the water taking is intended to continue for more than 365 days.

Based on the predicted volumes to be pumped from the native diamicton deposits of sand and silt to silty sand / sandy silt till (Port Stanley Till), groundwater dewatering is expected to be handled using conventional pumping methods (i.e., standard sump pumps).

7.1.2 Dewatering Radius of Influence

One of the key issues of concern with the performing of dewatering activities for construction purposes is the potential impact that pumping water from the groundwater system could have on the hydrogeological form and function of nearby natural heritage features, such as the Torrance Creek Swamp.

Based on the above calculations, temporary construction dewatering will likely be required for the short-term cut and cover works associated with the building construction. The effects of local dewatering in general cannot be mitigated, since dewatering deliberately seeks to create an effect (i.e., temporary lowering of groundwater levels); however, the amount of drawdown to occur due to construction activities is expected to remain within a relatively small distance around the excavations due to the low permeability of the surrounding deposits. The lateral extent of groundwater level drawdown from the excavation areas is calculated using the Sichart and Kryieleis method (Powers et al., 2007):

$$R_o = r_w + 3000(H - h_w)\sqrt{K}$$

where R_o = dewatering radius of influence (m)
K = representative hydraulic conductivity (m/s)
H = height of static water level above assigned datum (m)
h_w = depth of dewatering relative to assigned datum (m)
r_w = equivalent radius of dewatering area from center of the excavation (m)

According to the calculation, the predicted dewatering radius of influence from the proposed development is approximately 64 m from the edge of the excavation area (Table H1, Appendix H). Overall, the radius of influence from short-term construction dewatering is not expected to extend into nearby natural heritage features (Figure 18).

7.1.3 Long-term Drainage

The proposed foundation of the underground parking area will be constructed with a waterproof base and, as such, no permanent drainage system / dewatering is planned for this structure.

7.2 GROUNDWATER DEWATERING – QUALITY

7.2.1 Discharging to Storm Sewer

As discussed in Section 4.2.4, groundwater quality results for the sample collected from MW2-18 (Table 4) indicate that any potential dewatering volumes cannot be discharged to the City storm sewer system as the following parameters exceed the City of Guelph Sanitary and Storm Sewer By-law (1996)-15202 limits due to concentrations exceeding the following parameters:

- Fecal Coliform (200 MPN/100mL): exceeded the storm sewer limit with a count of 350 MPN/100mL.
- Total Cadmium (0.001 mg/L): exceeded the storm sewer limit with a concentration of 0.0019 mg/L.
- Total Copper (0.01 mg/L): exceeded the storm sewer limit with a concentration of 0.03 mg/L.
- Total Lead (0.05 mg/L): exceeded the storm sewer limit with a concentration of 0.13 mg/L.
- Total Suspended Solids (15 mg/L): exceeded the storm sewer limit with a count of 2,500 mg/L.
- Total Zinc (0.05 mg/L): exceeded the storm sewer limit with a concentration of 0.64 mg/L.

7.2.2 Discharging to Sanitary Sewer

Groundwater at the Site does largely satisfy the bylaw limits to permit discharging to the City sanitary sewer system, except for TSS:

- Total Suspended Solids (350 mg/L): exceeded the sanitary sewer limit with a count of 2,500 mg/L.

However, if groundwater is treated for TSS (e.g., filtration or sedimentation measures) prior to leaving the Site, the concentration for this parameter can be reduced to levels that would allow for this groundwater to be discharged to the sanitary sewer system.

Prior to discharging groundwater pumped from the excavation (during construction dewatering) to the sanitary sewer, the Contractor retained to complete the dewatering will be expected to implement measures to reduce TSS in the discharge water to below the corresponding concentrations mentioned above.

The Contractor should consult with the City to confirm whether there are preferred methods and/or policies for reducing TSS concentrations in discharge water (including monitoring requirements). In Stantec's experience, common mitigation measures utilized to reduce TSS concentrations in discharge water can include:

- wrapping of the inlet pump head (i.e., sump/trash pumps) with filter fabric and surrounding the inlet with clear stone, or equivalent
- passing discharge water through geotextile filter bags or straw bale/filter fabric device
- directing discharge through a tank, allowing time for the suspended solids to settle out prior to being released to the sewer.

In addition, the Contractor's responsibilities will often include:

- obtaining a sewer use permit prior to discharging to the sanitary sewer
- ensuring that the quality of the pumped groundwater meets required By-law limits
- complete any additional groundwater quality testing as required by the City of Guelph.

8.0 IMPACT ASSESSMENT AND MITIGATION MEASURES

8.1 GROUNDWATER RECHARGE

As per the proposed Site Plan (Figure 1), development is to include the construction of two 12 story apartment buildings having nine townhouse units, internal roadways, surface parking, and two levels of underground parking. In the areas of the Site where this development is to occur, there will also be the introduction of impervious surfaces (e.g., rooftops, concrete/asphalt roadways, and walkways) and, subsequently, a corresponding reduction in the volume of water infiltrating to the subsurface. The potential impacts associated with the introduction of impervious surfaces on the recharge function of the Site are discussed below.

Under the post-development condition, impervious surfaces in the former Catchment 101 (lands draining to the Upper Hanlon Creek Subwatershed) are expected to cover approximately 80% of the post-development catchment areas (1.16 ha of 1.46 ha), resulting in a projected infiltration volume deficit of 2,000 m^3/year (i.e., from 2,553 m^3/year to 553 m^3/year) (Tables 9 and 12). For the former Catchment 102 (lands draining to the Torrance Creek Subwatershed), impervious surfaces will cover approximately 1% of the post-development catchment areas (0.02 ha of 1.60 ha), resulting in a projected infiltration volume deficit of 279 m^3/year (i.e., from 3,828 m^3/year to 3,550 m^3/year) (Tables 10 and 13). Overall, the total volume of infiltration at the Site will be reduced from 6,381 m^3/year to 4,103 m^3/year (infiltration deficit of 2,278 m^3/year) from the pre- to post-development condition.

Low impact development (LID) is a stormwater management strategy that seeks to mitigate the impacts of increased stormwater runoff by managing this runoff as close to source as possible, with the implementation of such strategies also providing the residual benefit of offsetting potential infiltration losses associated with the increase in impervious surfaces associated with a given development. Infiltration augmentation options (as described in CVC-TRCA *Low Impact Development Stormwater Management Planning and Design Guide*, 2010) that could potentially be available for use across the Site to assist in maximizing infiltration under the post-development condition include:

- roof downspout disconnection
- soakaways / infiltration trenches
- bioretention cells
- vegetated filter strips
- grass swales or enhanced grassed swales

As discussed in the Stormwater Management Brief, which is provided in the *Functional Servicing Report* (Stantec, 2021), the post-development LID infiltration strategy proposed for the Site will involve the construction of two infiltration facilities referred to as the East Infiltration Trench and South Infiltration Trench (Figure 12).

The East Infiltration Trench is designed return infiltration volumes lost from the pre- to post-development condition within the portion of the Site located within the Torrance Creek Subwatershed. This trench is sized to infiltrate a 25 mm storm event captured by the 2,300 m^2 of building rooftop in Catchment 203, resulting in an infiltration volume of 57.5 m^3 for each such storm event. As per historical climate records (Table 11), on average there are approximately five days a year where storm events total 25 mm, equating to a total volume of 287 m^3 that will be directed to the infiltration gallery and, subsequently, mitigate roughly 40% of the projected annual infiltration deficit. Given that there are on average a total of 29 days where precipitation totals will range from 10 to 25 mm (assume each daily event is 10 mm: $0.01 \text{ m} * 2{,}300 \text{ m}^2 * 29 \text{ days} = 667 \text{ m}^3$) and 55 days where precipitation totals will range from five to 10 mm, it is reasonable to conclude that the proposed East Infiltration Trench will more than mitigate the remaining annual infiltration deficit for this portion of the Site.

The South Infiltration Trench is designed return infiltration volumes lost from the pre- to post-development condition within the portion of the Site located within the Upper Hanlon Creek Subwatershed. This trench is sized to infiltrate stormwater captured by 9,300 m^2 of impervious surfaces associated with the Building 1 rooftop (Catchment 202) and parking areas within Catchments 204 and 208 during a 25 mm storm event, resulting in an infiltration volume of 232.5 m^3 for each such storm event. As per historical climate records (Table 11), on average there are approximately five days a year where storm events total 25 mm, equating to a total volume of 1,185 m^3 that will be directed to the South Infiltration Trench and will mitigate roughly 57% of the projected annual infiltration deficit. Given that there are on average a total of 29 days where precipitation totals will range from 10 to 25 mm (assume each daily event is 10 mm: $0.01 \text{ m} * 9{,}300 \text{ m}^2 * 29 \text{ days} = 2{,}967 \text{ m}^3$) and 55 days where precipitation totals will range from five to 10 mm, it is reasonable to conclude that the proposed South Infiltration Trench will be capable at mitigating the remaining annual infiltration deficit for this portion of the Site.

8.2 GROUNDWATER DEWATERING

One of the key issues of concern with the performing of dewatering activities for construction purposes is the potential impact that pumping water from the groundwater system could have on nearby natural heritage features.

The effects of local dewatering in general cannot be mitigated, since dewatering deliberately seeks to create an effect (i.e., temporary lowering of groundwater levels); however, the amount of drawdown expected to occur due to construction activities is expected to remain within a small distance around the development excavation. According to the dewatering calculations, the predicted maximum horizontal distance that the pumping zone of influence will extend outward from the active zone of dewatering is estimated at 64 m. As shown in Figure 17, this predicted dewatering radius of influence will not intercept the Torrance Creek Swamp to the northeast or Hanlon Creek Swamp to the southwest of the Site.

Stantec notes that the residual effects of short-term construction dewatering are reversible seeing that once pumping ceases, groundwater levels will recover and re-equilibrate to the local groundwater table.

Since the proposed underground parking area will be constructed with a waterproof base, no permanent drainage system / dewatering is planned for this structure. As such, there will be no long-term effects of permanent dewatering associated with this development.

8.3 SOURCE WATER PROTECTION

A drinking-water threat is an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water. The following activities are prescribed by the province of Ontario under O. Reg. 287/07 to be drinking water threats (i.e., Significant Drinking Water Threat Policy Categories):

1. The establishment, operation, or maintenance of a waste disposal site within the meaning of Part V of the *Environmental Protection Act*.
2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.
3. The application of agricultural source material to land.
4. The storage of agricultural source material.
5. The management of agricultural source material.
6. The application of non-agricultural source material to land.
7. The handling and storage of non-agricultural source material.
8. The application of commercial fertilizer to land.
9. The handling and storage of commercial fertilizer.
10. The application of pesticide to land.
11. The handling and storage of pesticide.
12. The application of road salt.
13. The handling and storage of road salt.
14. The storage of snow.
15. The handling and storage of fuel.
16. The handling and storage of a dense non-aqueous phase liquid (DNAPL).

17. The handling and storage of an organic solvent.
18. The management of runoff that contains chemicals used in the de-icing of aircraft.
19. An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body.
20. An activity that reduces the recharge of an aquifer.
21. The use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard. O. Reg. 385/08, s. 3.

The Site is intercepted by the Burke Well WHPA-B and -C, noting that the footprint for the proposed development is confined to the WHPA-C. The WHPA-C has an assigned vulnerability score ranging from four (4) to six (6) (Figure 6), indicating that the threat of an activity or condition occurring at ground surface within this area, and subsequently adversely affecting the quality and/or quantity of the aquifer system in which the Burke Well draws its groundwater supply, is low to medium, respectively.

As per the Source Protection Plan (SPP) (LERSPC, 2015b), the Site is only subject to the protection policies specified under Significant Drinking Water Threat Policy Category 16 (DNAPLs). Since the planned use for the Site does not involve the onsite handling and storage of a DNAPL, the policies under Category 16 does not apply.

No protection policies are specified in the SPP (LERSPC, 2015b) that apply to the Site’s designation as a SGRA or WHPA-E (intercepts the northeast portion of the property).

8.4 SPILL CONTAINMENT AND RESPONSE

The potential exists for spills during any construction activity, with the most probable type of spill occurring being attributable to the refuelling of construction equipment that cannot readily leave the Site (e.g., earth movers). The potential impacts of a spill could be the contamination of soils, groundwater and/or surface water. By implementing proper protocols for the handling of fuels and lubricants during construction, the risk of a spill occurring will be greatly reduced. The procedures to be implemented to prevent onsite spills are as follows:

- all trucks or other road vehicles would be refuelled and maintained offsite, where practicable
- refuelling and lubrication of other construction equipment would not be allowed within 30 m of a drainage system or dewatering excavation
- regular inspections of hydraulic and fuel systems on machinery, with leaks being repaired immediately upon detection or the equipment being removed from Site
- spill kits containing absorbent materials would be kept on hand
- implement best management practices and develop an emergency spill response plan

Given that anticipated construction activities at the Site are not expected to involve the storage or use of bulk chemicals or fuels, any potential spill that does occur would be localized and involve a small volume of material. Standard containment facilities and emergency response materials are to be maintained onsite as required, with refuelling, equipment maintenance, and other potentially contaminating activities being confined to designated areas. As appropriate, spills are to be reported immediately to the MECP Spills Action Centre.

9.0 CONCLUSIONS

Based on the hydrogeological assessment, using the existing data collected at the Site and information obtained from a background review of regional data, the following conclusions are provided:

1. Subsurface conditions across the Site consist of silty sand to sandy silt till (Port Stanley Till), which predominantly forms a horizontally and vertically contiguous unit beneath the Site, with this unit being overlain by a 2.3 to 4.8 m thick diamicton deposit consisting of very loose to dense sand and silt, with some gravel and trace clay. The Port Stanley Till occurs at elevations ranging from 341.6 to 334.7 m AMSL beneath the Site, with this unit extending to the termination depth of the onsite boreholes (333.4 to 324.6 m AMSL). Locally, the bedrock surface is reported to occur at an elevation of approximately 320 m AMSL and does not factor into the construction of the proposed development.

2. Groundwater depths across the Site range from 1.0 m to 9.2 m BGS over the monitoring period (July 2018 to June 2020), fluctuating between elevations of 332.6 m to 340.7 m AMSL. Overall, the highest groundwater table occurred in the spring, declining by up to 5.6 m to its lowest elevation by late fall.

3. Groundwater contours mimic the prevailing topography of the Site, with a localized groundwater divide running along the northeast-southwest axis of the drumlin upon which the property is situated (Figure 12). Groundwater flows from the divide to the northeast and southwest towards Torrance Creek Swamp and Gordon Street, respectively.

4. The estimated velocity of groundwater flowing through the overburden beneath the Site towards Torrance Creek Swamp is calculated to be approximately 0.23 m/year (i.e., one meter every 4.3 years). Groundwater flow towards Gordon Street is estimated to move at a velocity of approximately 0.52 m/year (i.e., one meter every 1.9 years).

5. Neutral to upward vertical hydraulic gradients consistently occur beneath the area of the Torrance Creek Swamp that is located approximately 75 m to the northeast of the Site, although noting that the vertical hydraulic gradient is observed to switch downward over the year. Overall, vertical hydraulic gradients beneath this wetland ranged from -0.06 to 0.17, indicating that the wetland functions as both a groundwater recharge and discharge feature. However, the potential volume of groundwater discharging to the Torrance Creek Swamp during those periods where discharge conditions are present is expected to be minimal, given that groundwater moves at a very slow rate through the overburden deposits (i.e., one meter every 4.3 years).

6. Vertical hydraulic conductivities for the sandy silt till range from 5.6×10^{-8} to 1.6×10^{-10} m/s at depths ranging from 5.0 m to 15.1 m BGS throughout the Site. However, results of infiltration testing completed in the areas of the Site where the East and South Infiltration Trenches will be constructed had vertical hydraulic conductivities ranging from 3.9×10^{-5} m/s to 1.8×10^{-7} m/s (i.e., from depths of 0.5 to 3.6 m BGS). Based on these values, the calculated infiltration rates for the previously mentioned deposits can range from as low as 5 mm/hour to an upper value of 123 mm/hour at the Site.

7. Groundwater beneath the Site is classified as calcium-bicarbonate type water. No tested parameters having health-related ODWQS were detected above their applicable standards. The ODWQS for hardness was exceeded in samples collected at all wells. The presence of elevated hardness concentrations is typical of groundwater in southern Ontario.

8. The proposed development footprint for the Site is located within the WHPA-C for the Burke Municipal Well. Subsequently, as per the Source Protection Plan, the Site is only subject to the protection policies specified under Significant Drinking Water Threat Policy Category 16 (DNAPLs). Since the planned use for the Site does not involve the onsite handling and storage of a DNAPL, the policies under Category 16 do not apply to the development.

9. Tricar is proposing to construct an infiltration facility (i.e., East Infiltration Trench) within the portion of the Site that lies within the Torrance Creek Subwatershed. Water balance calculations indicate that the proposed development of the Site will reduce infiltration volumes to the Torrance Creek Subwatershed by 279 m^3/year. However, calculations indicate that the East Infiltration Trench as currently designed will maintain to enhance pre-development infiltration volumes to this subwatershed under the post-development condition.

10. The maximum groundwater mounding predicted to occur beneath the center of the East Infiltration Trench after a 25 mm event is 0.6 m, equating to an elevation of 339.8 m AMSL based on the seasonally high groundwater elevation. Although storm event induced mounding will temporarily raise groundwater elevations beneath the foundation of Building 2, the magnitude of this mounding is not expected to exceed more than 0.1 m. Stantec notes that this building foundation (as with all onsite building foundations) will be constructed as a watertight structure (sealed with a water impermeable membrane), with the floor slab designed to structurally resist the hydrostatic pressure exerted by the groundwater.

11. Tricar is proposing to construct an infiltration facility (i.e., South Infiltration Trench) within the portion of the Site that lies within the Upper Hanlon Creek Subwatershed. Water balance calculations indicate that the proposed development of the Site will reduce infiltration volumes to the Upper Hanlon Creek Subwatershed by 2,000 m^3/year. However, calculations indicate that the South Infiltration Trench as currently designed will maintain to enhance pre-development infiltration volumes to the subwatershed under the post-development condition.

12. The maximum groundwater mounding predicted to occur beneath the center of the South Infiltration Trench after a 25 mm event is 1.1 m, equating to an elevation of 340.1 m AMSL based on the seasonally high groundwater elevation. The rise in the groundwater table does not exceed 0.1 m beyond 30 m from the trench center point after a 25 mm storm event. This groundwater storm event induced mounding will temporarily raise groundwater elevations beneath the underground parking area of the development by 0.7 m along southern limits of this structure, with the mound disappearing once reaching the underside of Building 2.

13. The predicted groundwater mounds for the East and South Infiltration Trenches are not expected to intercept the residential buildings located on surrounding properties.

14. Groundwater mounding predicted to occur beneath the East Infiltration Trench will not intercept the Torrance Creek Swamp, which is located approximately 75 m to the northeast from where the groundwater mounding effects cease. As such, there is no opportunity for the groundwater mounding to potentially reverse vertical hydraulic gradients beneath this wetland (i.e., reversing from a groundwater discharge to recharge function).

15. The steady-state groundwater pumping rate for construction dewatering activities is predicted to be 37,700 L/day. Higher dewatering rates could be realized at the start of construction and during storm / snowmelt events. A design dewatering rate of 399,350 L/day reflects a factor of safety to provide an adequate dewatering volume to account for wet weather events and potential basal groundwater seepage into the excavation. Consequently, an MECP EASR will be required to complete construction dewatering activities, given that pumped volumes will exceed 50,000 L/day and remain below 400,000 L/day. Based on the volumes predicted and the type of material (dense till), groundwater dewatering is expected to be handled using conventional pumping methods (i.e., standard sump pumps).

16. The proposed underground parking area associated with the development will be constructed with a waterproof base and, as such, no permanent drainage system / dewatering is planned for this structure.

17. According to the dewatering calculations, the predicted maximum horizontal distance that the pumping zone of influence will extend is 64 m outward from the active zone of dewatering (Figure 18). This predicted dewatering radius of influence will not intercept the Torrance Creek Swamp to the northeast or Hanlon Creek Swamp to the southwest of the Site and, consequently, not interfere with the hydrogeological function of these wetlands.

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APPENDIX A:
FIGURES

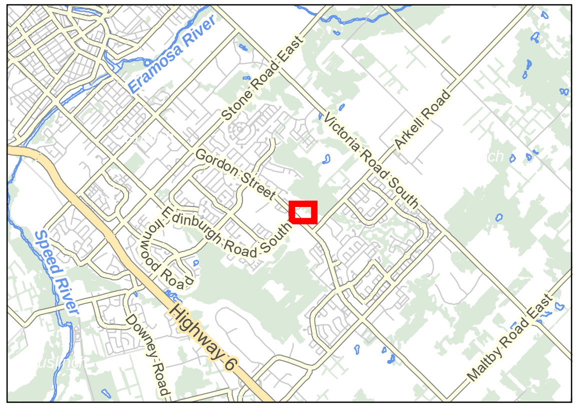
Stantec

Legend
- ⬚ Site Boundary
- ⌖ Monitoring Well (Stantec, 2018)
- ⊗ Drive-Point Piezometer (Stantec, 2019)
- ◐ Borehole (CMT Engineering, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⌖ Proposed Monitoring Well (Stantec, 2021)
- ⊙ MECP Water Well
- — Cross-Section Location
- — Proposed Development Plan
- — Topographic Contour (m AMSL)
- ▭ Proposed Extent of Underground Parking
- ▨ Wetland - Evaluated (Provincial)

0 25 50 Metres

1:1,250 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2020.
3. Orthoimagery © First Base Solutions, 2018. Imagery flown in 2019.
4. MECP water wells have been positioned based on published UTM coordinates and should be considered approximate.



Project Location
City of Guelph

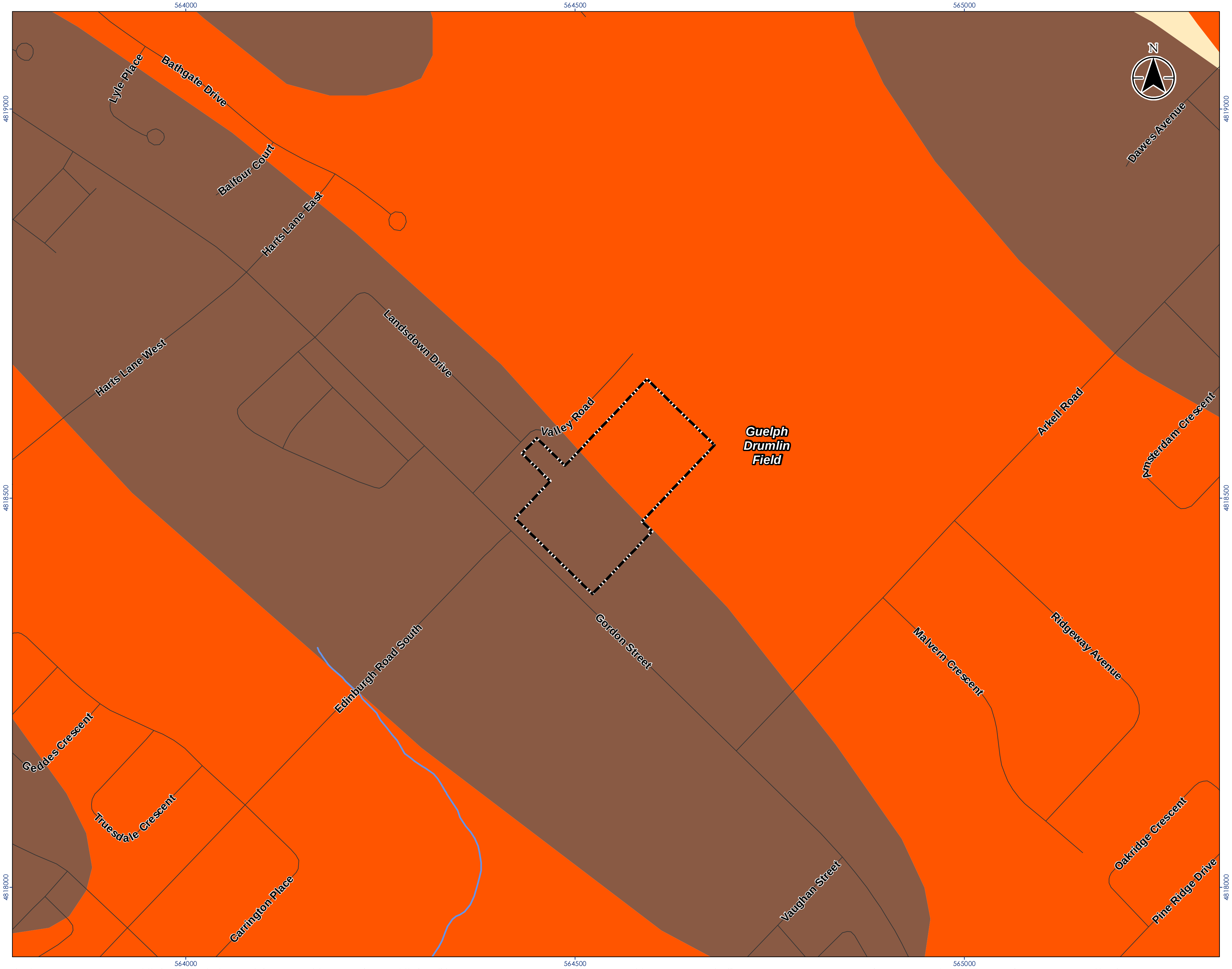
161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
1

Title
Site Location

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig01_SitePlan.mxd Revised: 2021-08-12 By: CCoghlan



Stantec

Legend

▭ Site Boundary
— Watercourse (Permanent)
▭ Physiographic Region Boundary

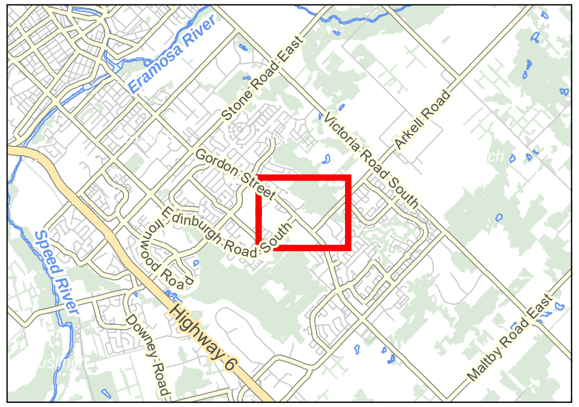
Physiography

🟫 7: Drumlins
🟨 6: Till Plains (Drumlinized)
🟧 3: Spillways

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.



Project Location
City of Guelph

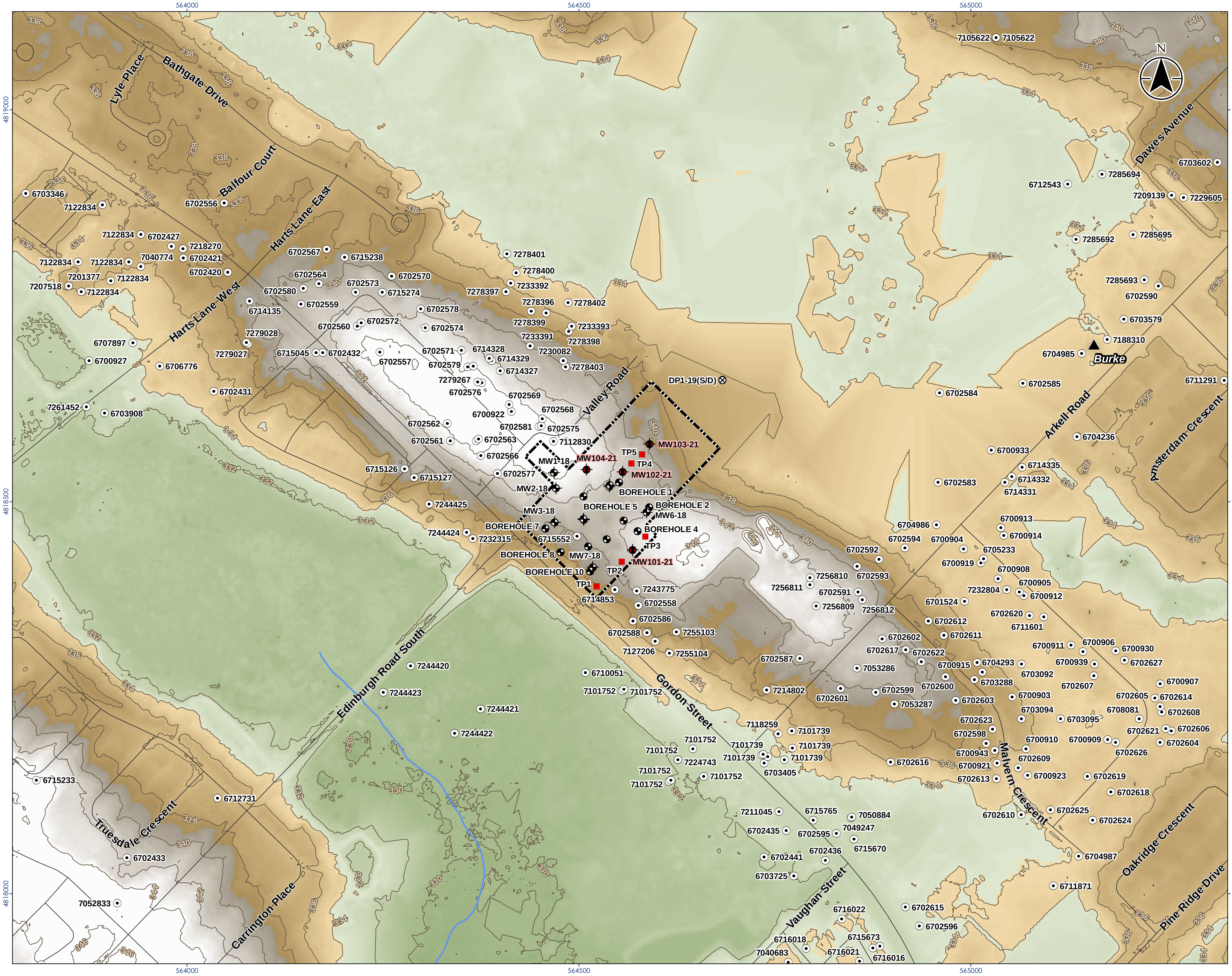
161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
2

Title
Physiography

\\ca0220-ppfs01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig02_Physiography.mxd Revised: 2021-08-12 By: CCoghlan



![Stantec]

Legend

- ⬚ Site Boundary
- ⊕ Monitoring Well (Stantec, 2018)
- ⊗ Drive-Point Piezometer (Stantec, 2019)
- ● Borehole (CMT Engineering, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⊕ Proposed Monitoring Well (Stantec, 2021)
- ▲ Production Well
- ⊙ MECP Water Well
- — Watercourse (Permanent)
- — Topographic Contour (m AMSL)

Ground Surface Elevation (m AMSL)

High : 348.52

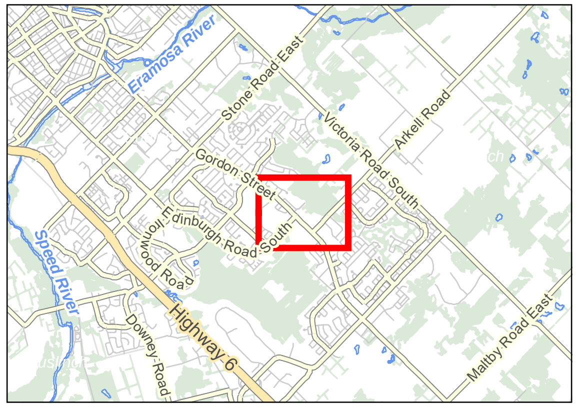
Low : 328.91

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2019.
3. Topography derived from the Southwestern Ontario Orthophotography Project (2015) © Queen's Printer for Ontario, 2019.



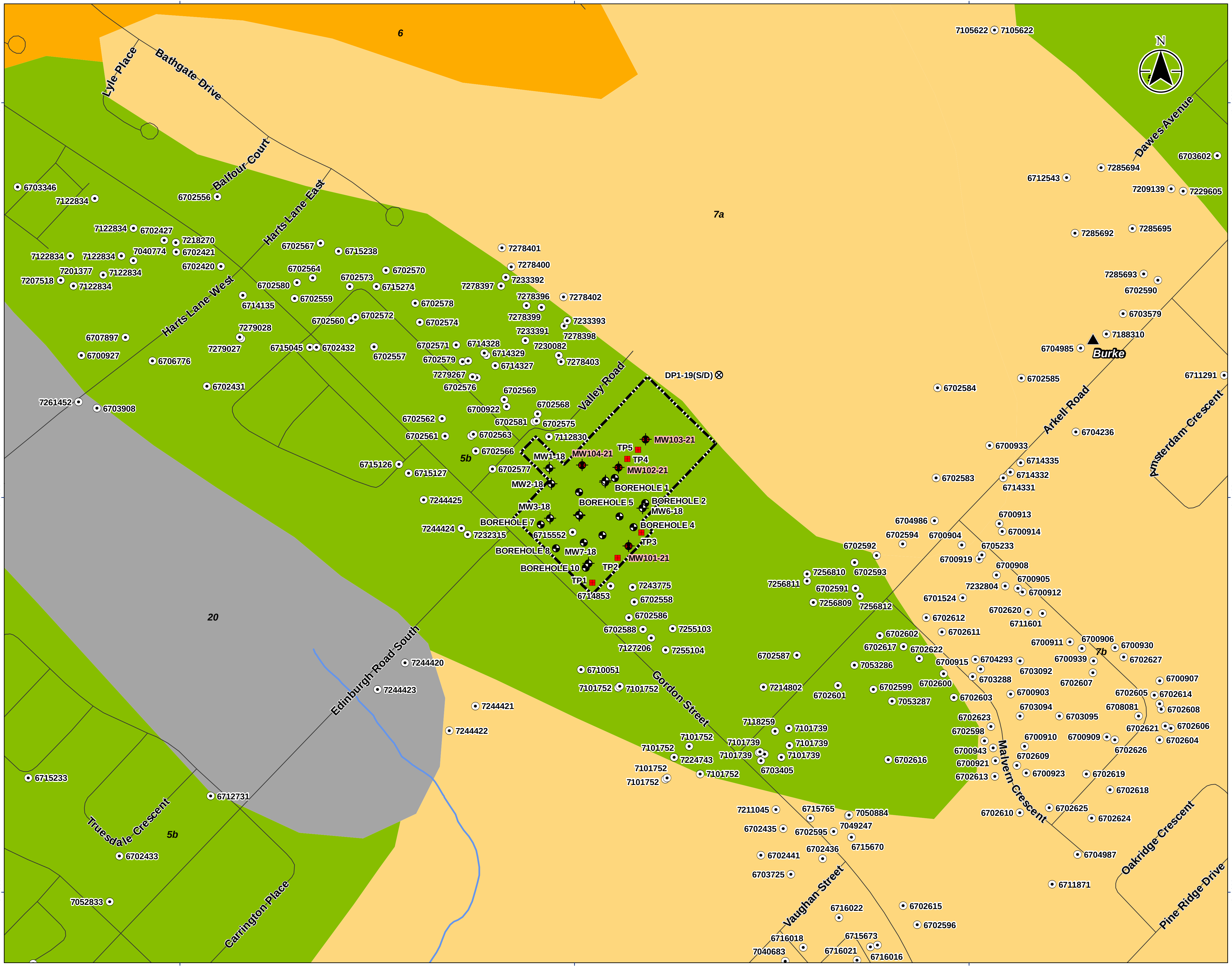
Project Location
City of Guelph

161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
3

Title
Topography



Stantec

Legend

⬚ Site Boundary

⊕ Monitoring Well (Stantec, 2018)

⊗ Drive-Point Piezometer (Stantec, 2019)

● Borehole (CMT Engineering, 2018)

🟥 Test Pit (Stantec, 2021)

⊕ Proposed Monitoring Well (Stantec, 2021)

▲ Production Well

⊙ MECP Water Well

— Watercourse (Permanent)

Surficial Geology

▨ 20: Organic deposits

🟨 7a: Glaciofluvial deposits (Sandy deposits)

🟨 7b: Glaciofluvial deposits (Gravelly deposits)

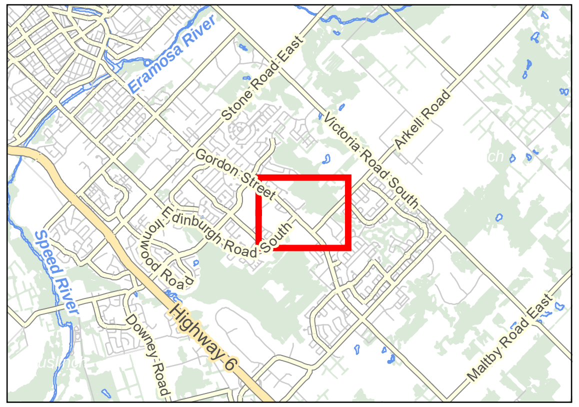
🟧 6: Ice-contact stratified deposits

🟩 5b: Stone-poor, carbonate-derived silty to sandy till

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV ISBN 978-1-4435-2483-4



Project Location
City of Guelph

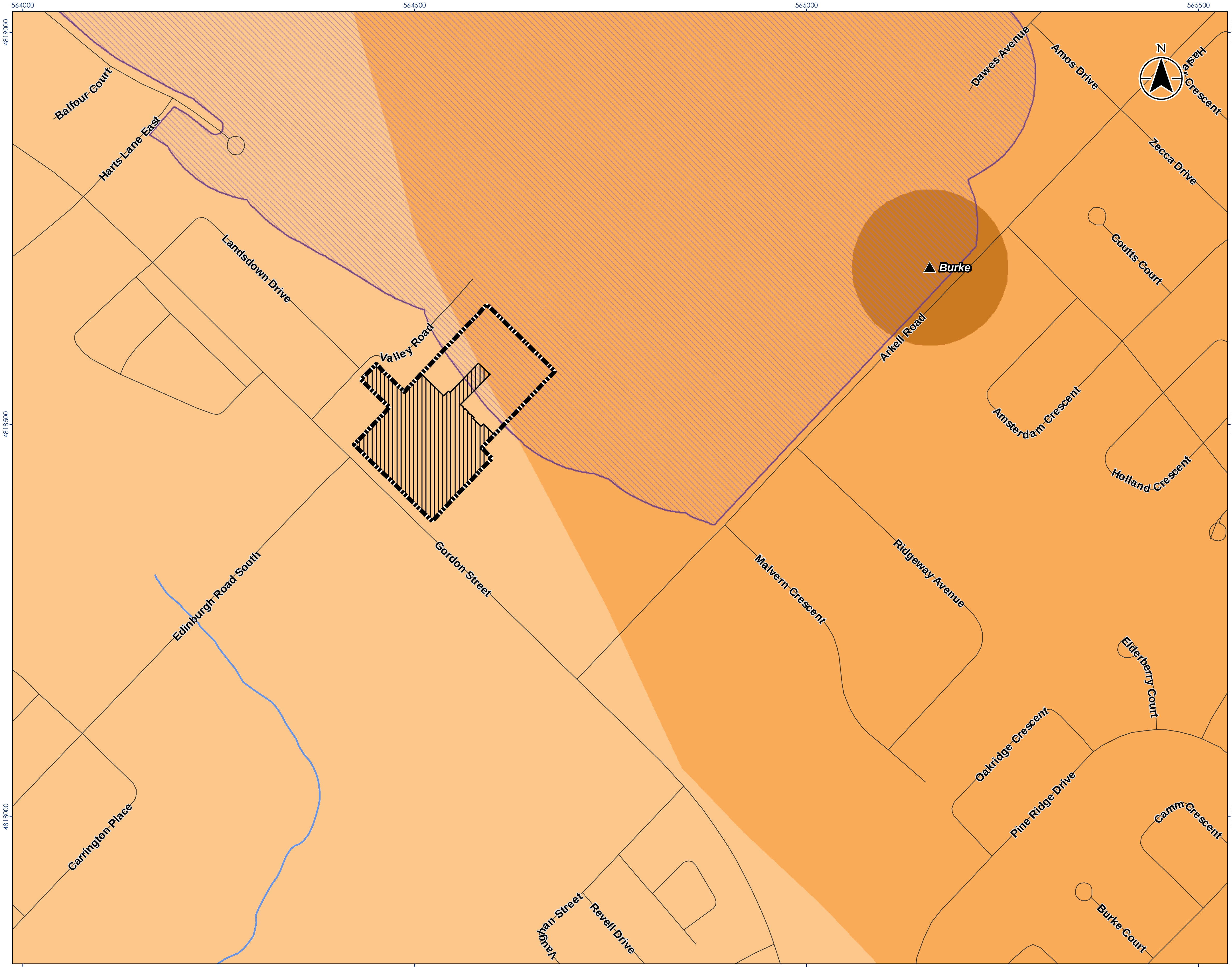
161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
4

Title
Surficial Geology

Revised: 2021-08-12 By: CCoghlan



Stantec

Legend

- ⬚ Site Boundary
- ▥ Proposed Development Footprint
- — Watercourse (Permanent)

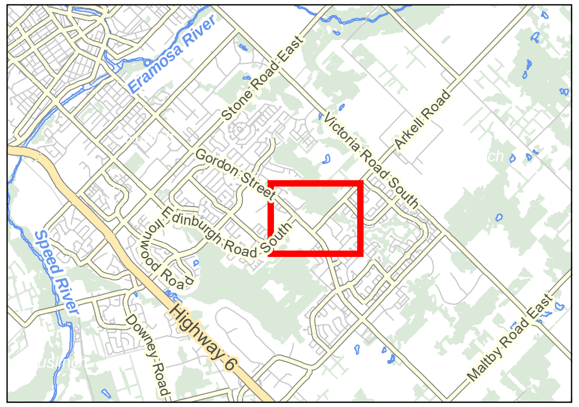
Wellhead Protection Areas

- 🟫 WHPA-A
- 🟧 WHPA-B
- 🟨 WHPA-C
- ▨ WHPA-E

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Wellhead protection areas © Grand River Conservation, 2018.



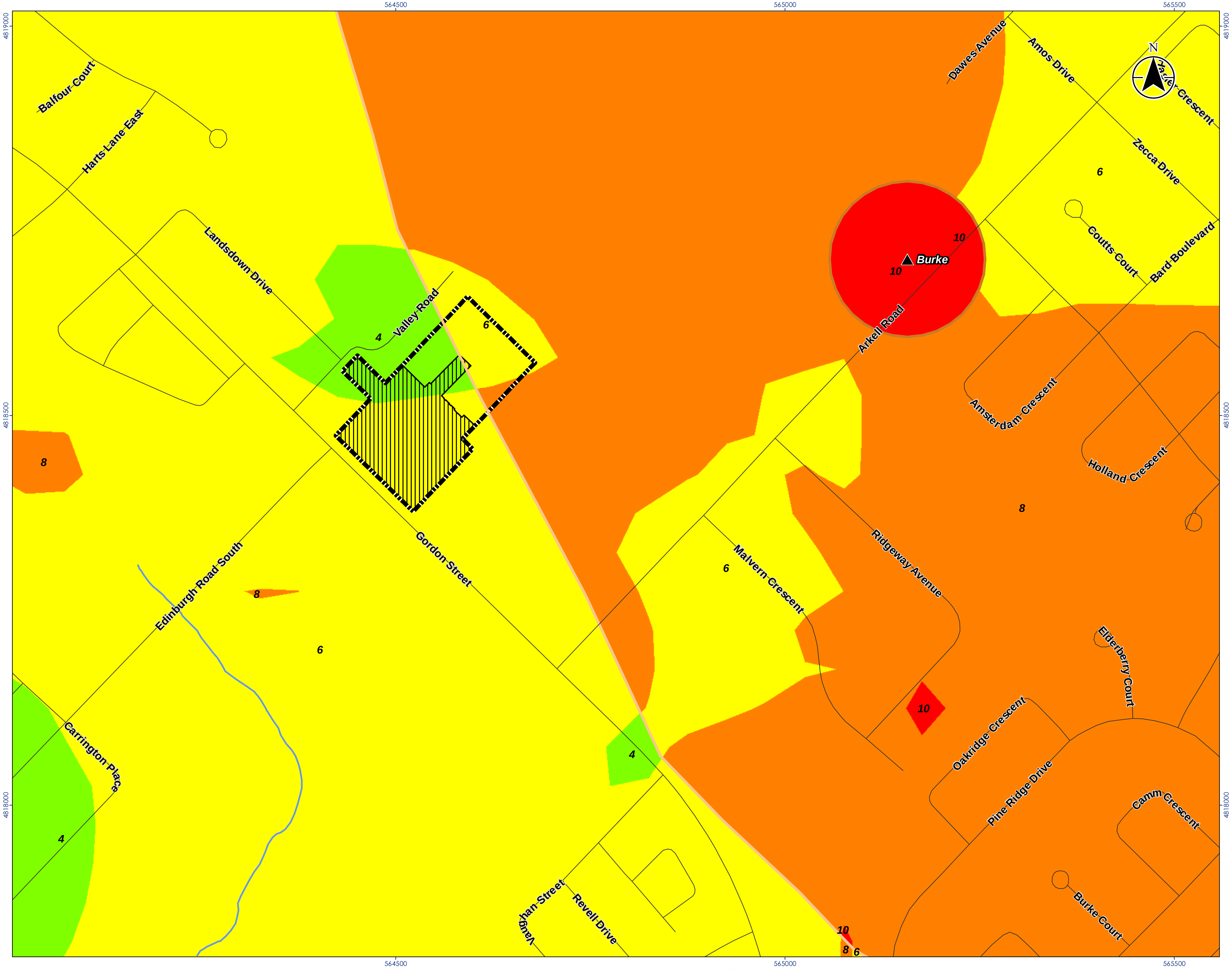
Project Location 161413684
City of Guelph Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
5

Title
Wellhead Protection Areas

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig05_WHPAs.mxd Revised: 2021-08-12 By: CCoghlan



Stantec

Legend

▨ Site Boundary

▥ Proposed Development Footprint

— Watercourse (Permanent)

Wellhead Protection Areas

☐ WHPA-A

☐ WHPA-B

☐ WHPA-C

Vulnerability Scoring

🟩 4

🟨 6

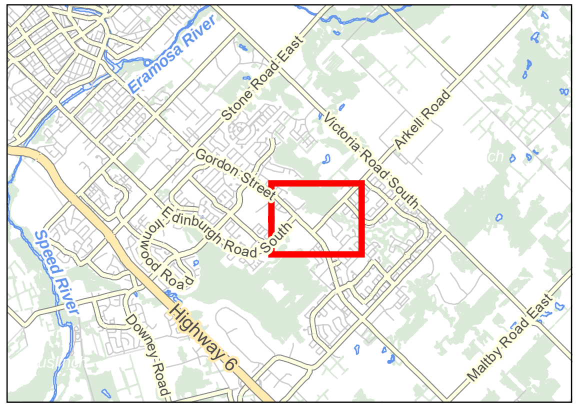
🟧 8

🟥 10

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Wellhead protection areas © Grand River Conservation, 2018.



Project Location
City of Guelph

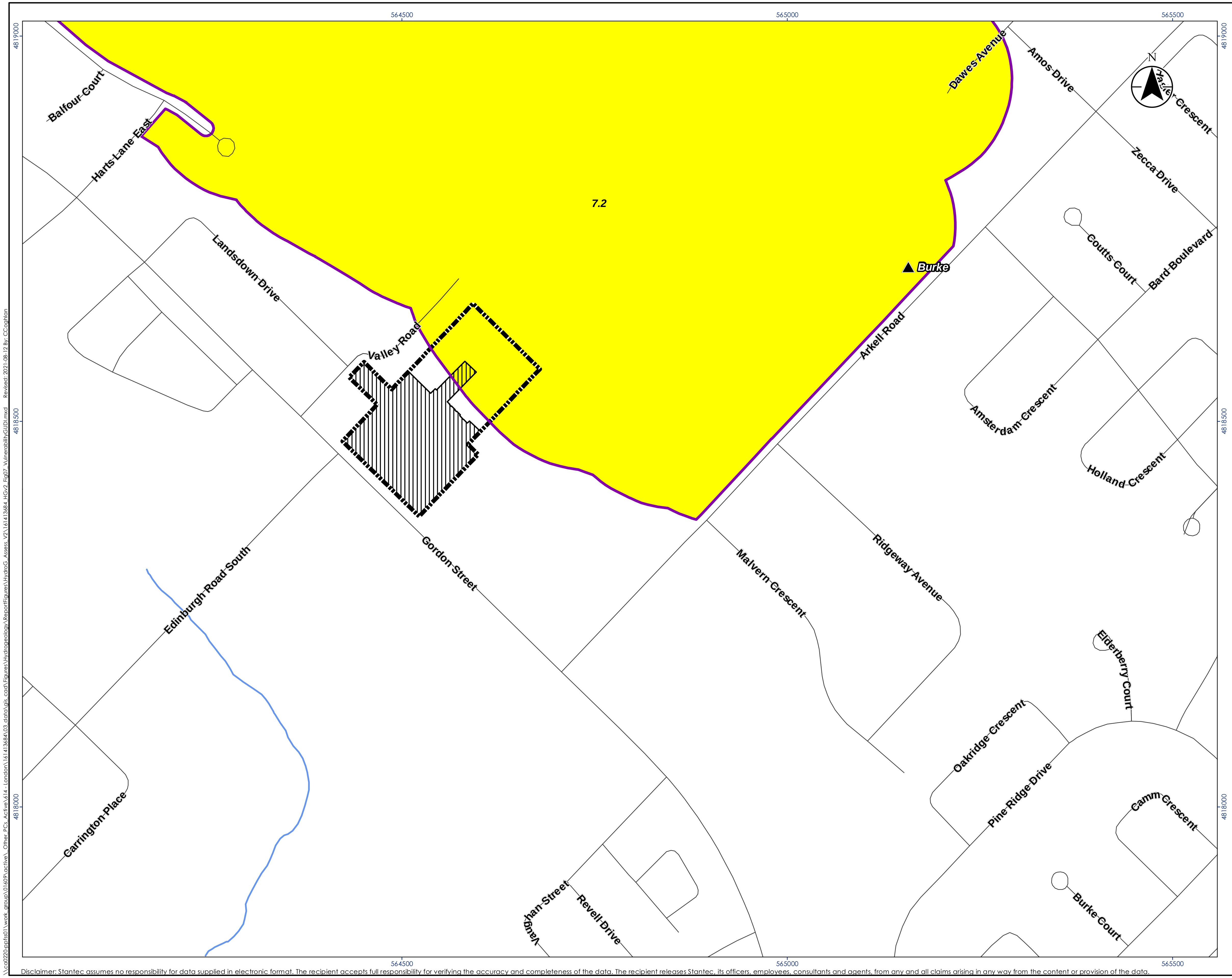
161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
6

Title
WHPA Vulnerability Scores

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig06_Vulnerability.mxd Revised: 2021-08-12 By: CCoghlan



Stantec

Legend

▨ Site Boundary

▥ Proposed Development Footprint

— Watercourse (Permanent)

Wellhead Protection Areas

☐ WHPA-E (GUDI)

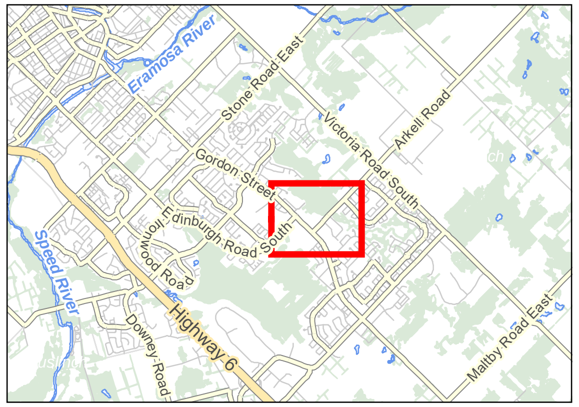
Vulnerability Scoring

🟨 7.2

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Wellhead protection areas © Grand River Conservation, 2018.



Project Location
City of Guelph

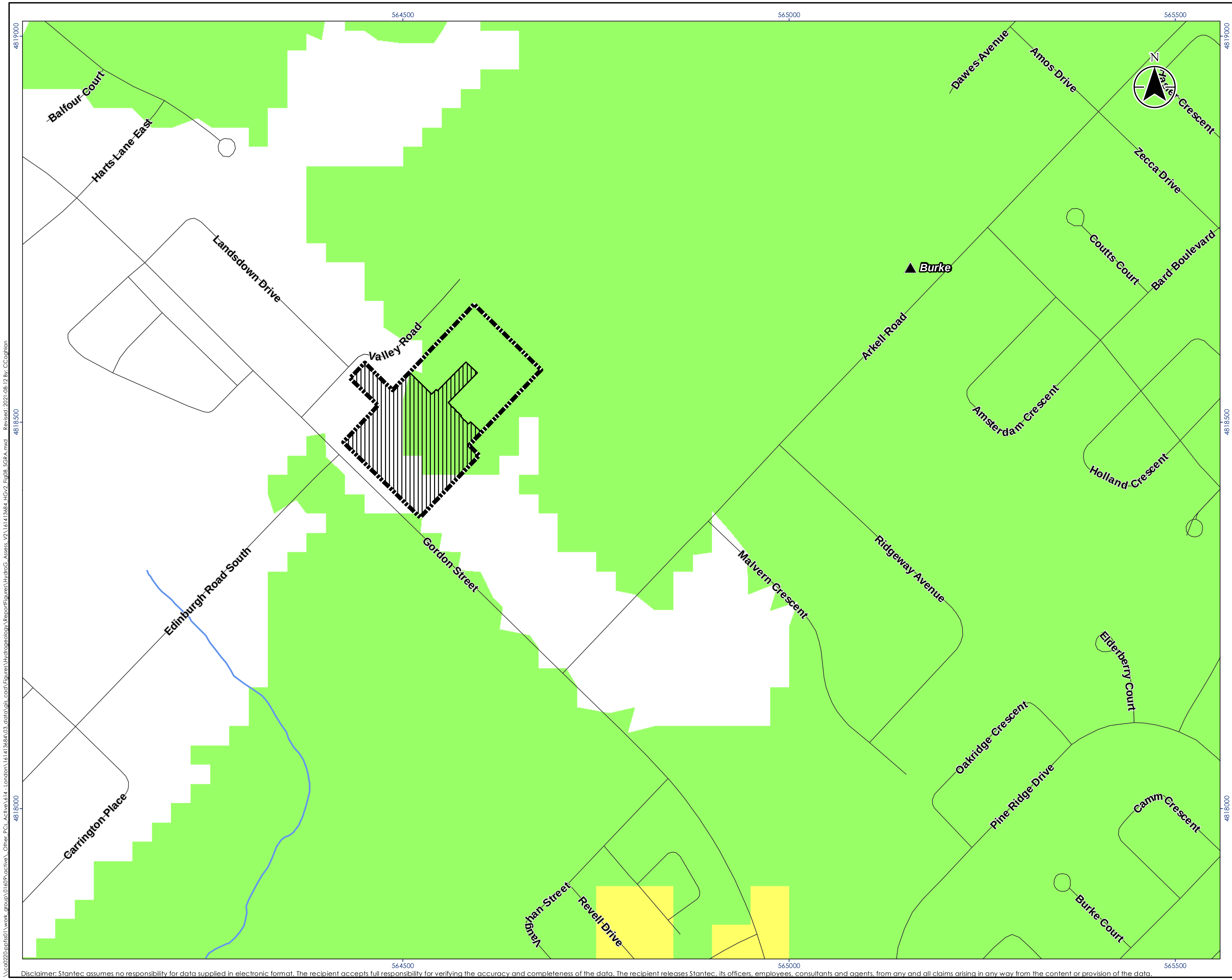
161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
7

Title
WHPA-E Vulnerability Scores

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig07_VulnerabilityGUDI.mxd Revised: 2021-08-12 By: CCoghlan



Stantec

Legend

- ▨ Site Boundary
- ▥ Proposed Development Footprint
- — Watercourse (Permanent)

Significant Groundwater Recharge Area

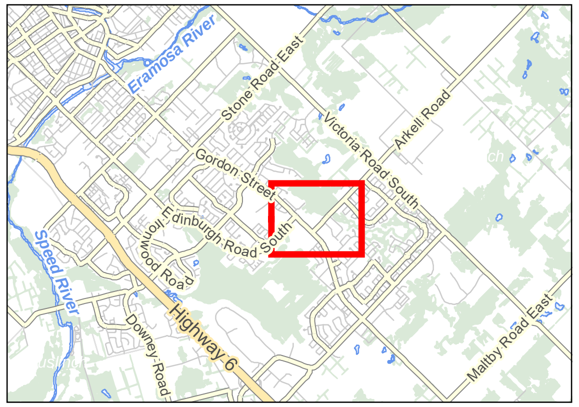
- 🟨 Vulnerability 6
- 🟩 Vulnerability 4

0 125 250 Metres

1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Wellhead protection areas © Grand River Conservation, 2018.



Project Location
City of Guelph

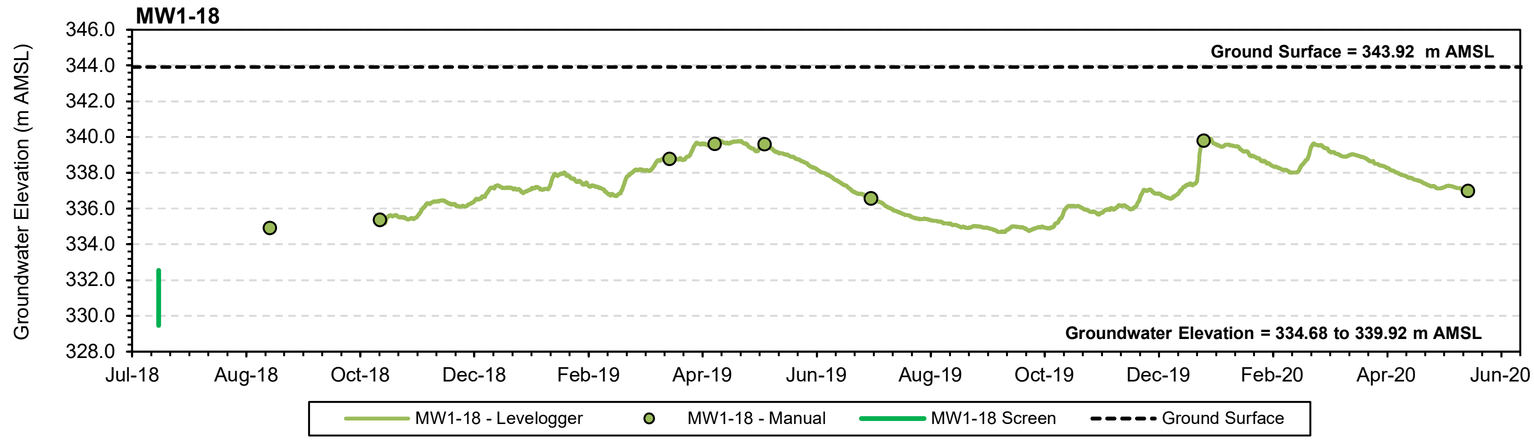
161413684
Prepared by CMC on 2021-08-12

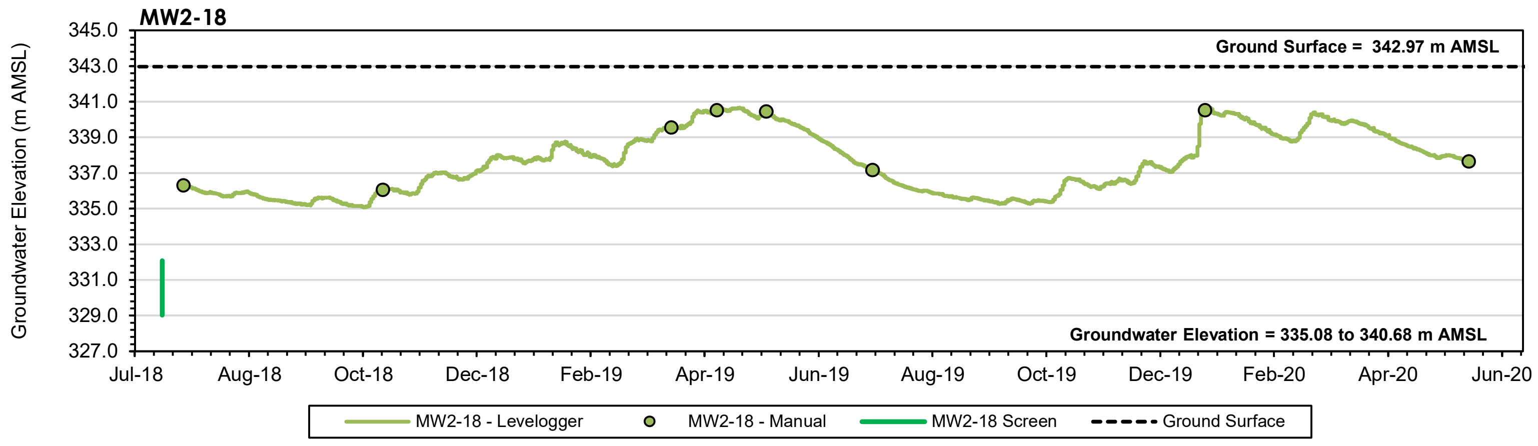
Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

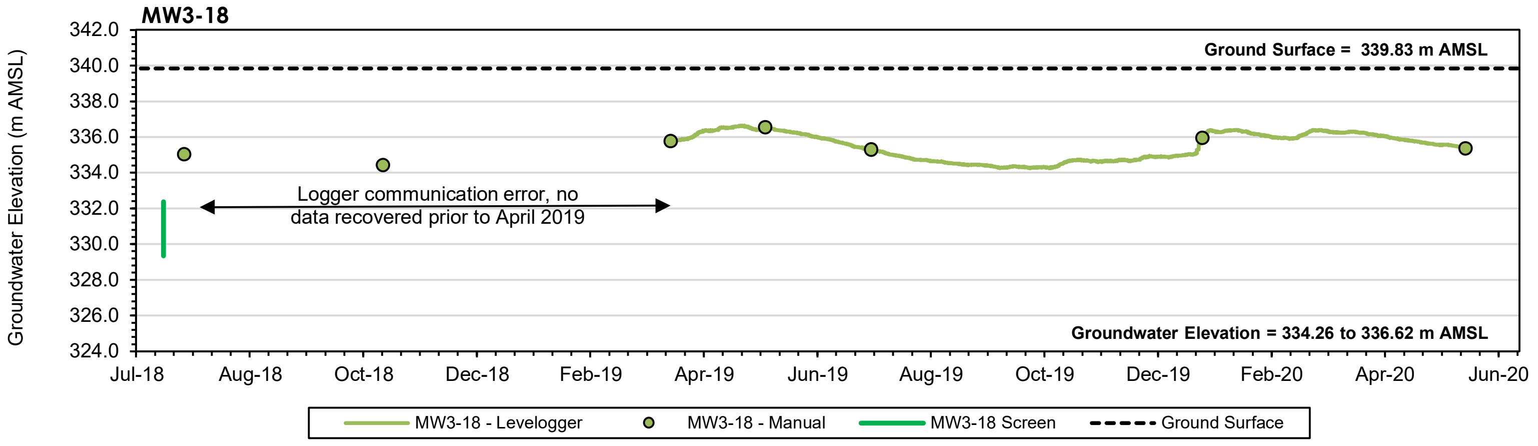
Figure No.
8

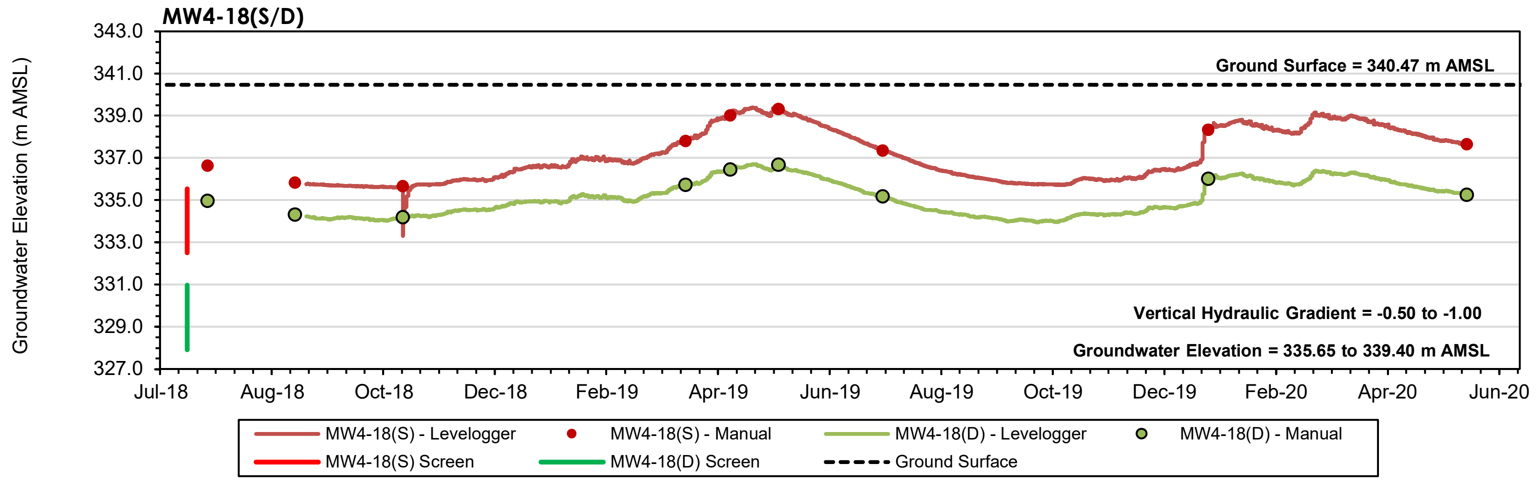
Title
Significant Groundwater Recharge Area

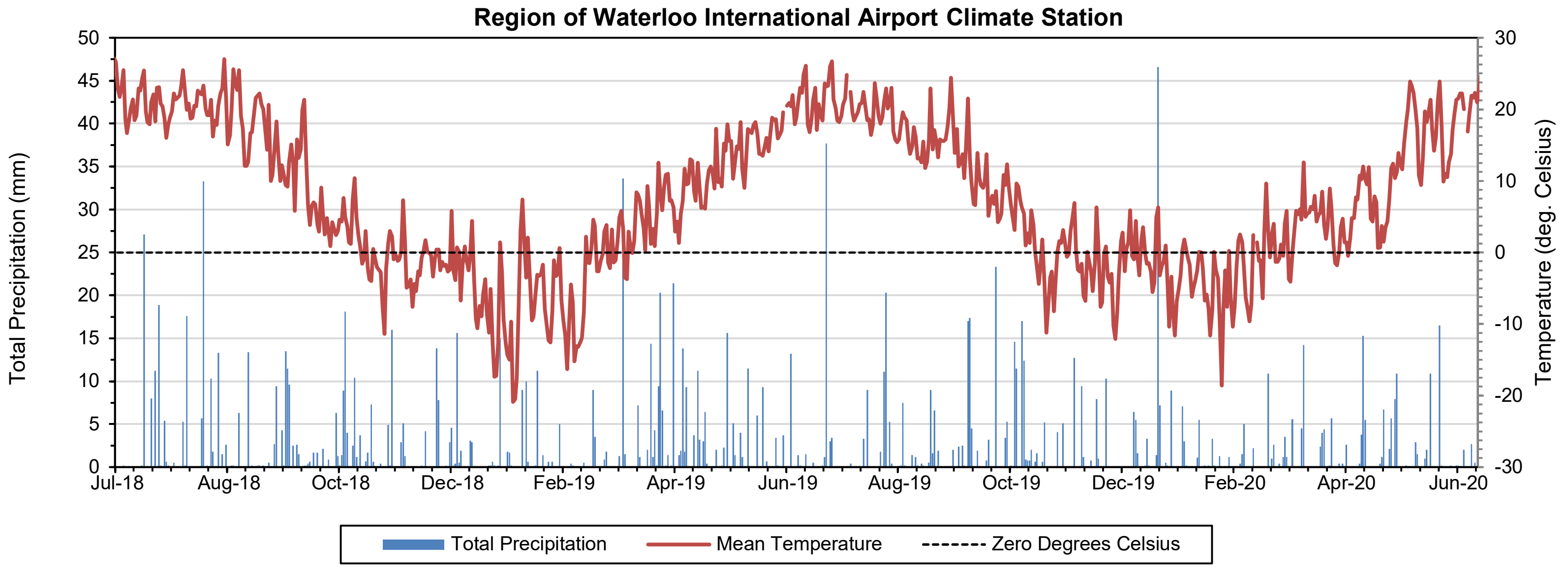
\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\Report\Figures\HydroG_Assess_V2\161413684_HGv2_Fig08_SGRA.mxd Revised: 2021-08-12 By: CCoghlan









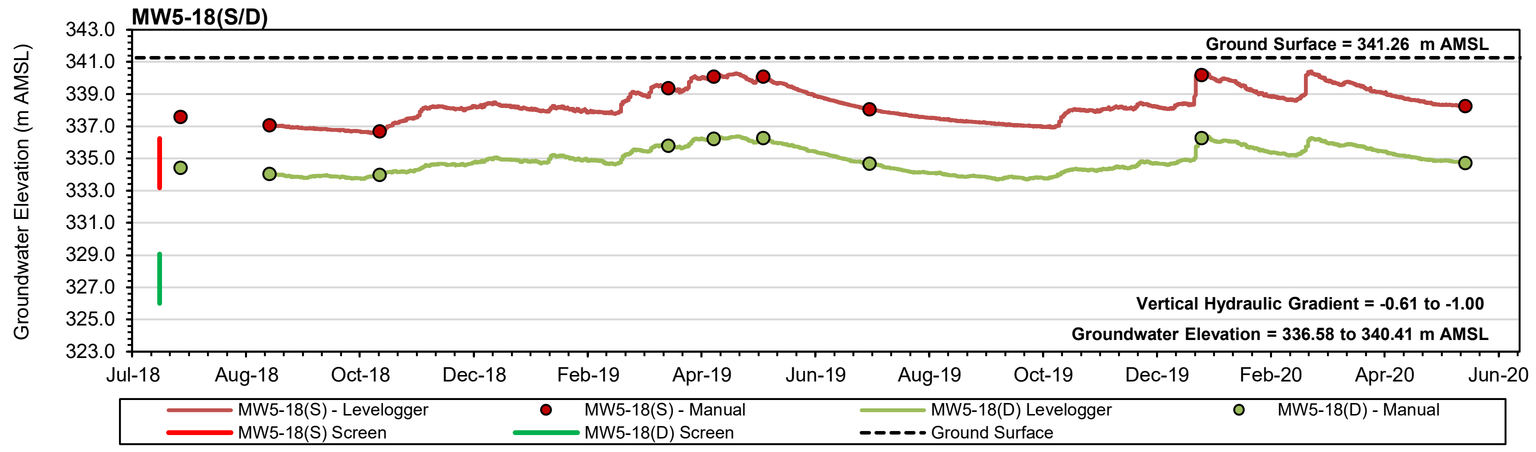


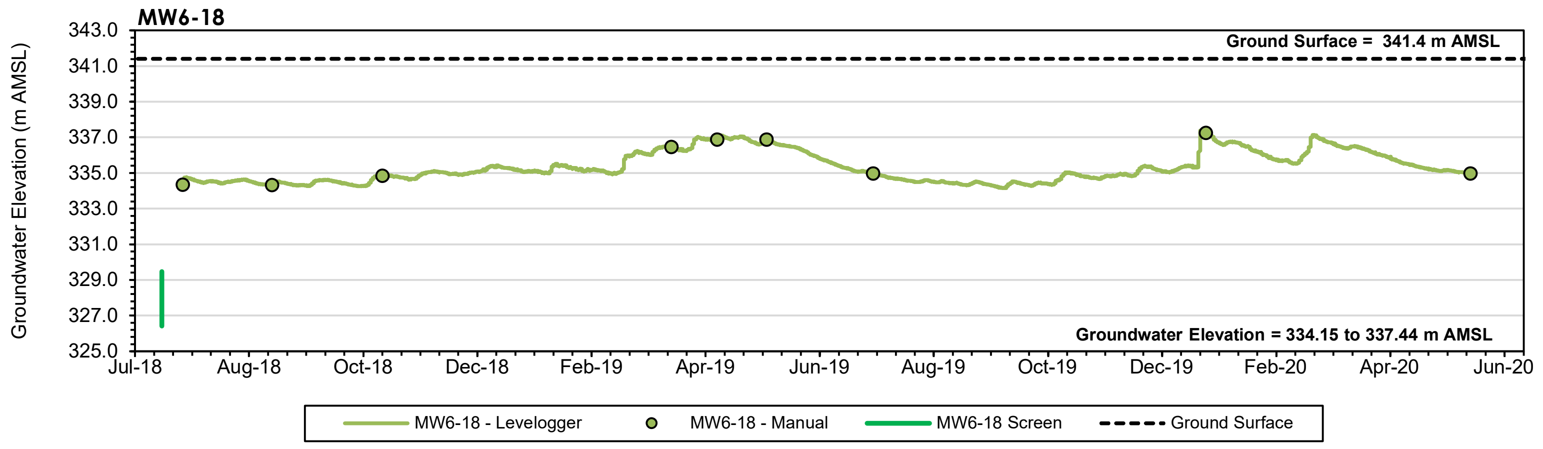
Precipitation and temperature data obtained from Environment Canada for the Region of Waterloo International Airport Climate Station (ID 6144239), accessed June 2020.

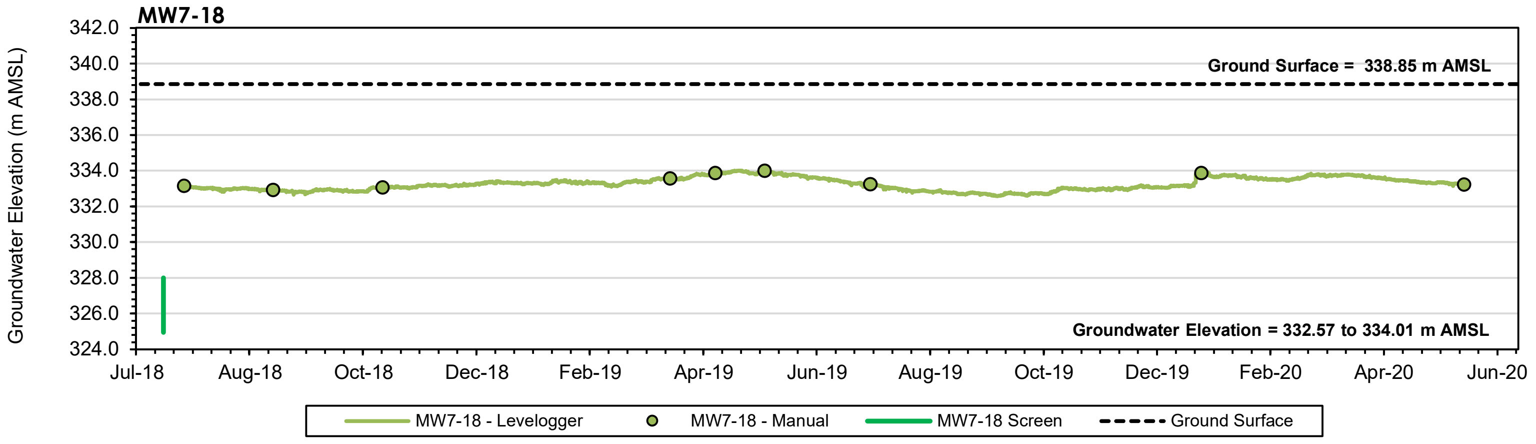
Client/Project
Tricar Developments Inc.
1242, 1250, 1260 Gordon Street and 9 Valley Road, Guelph
Hydrogeological Assessment

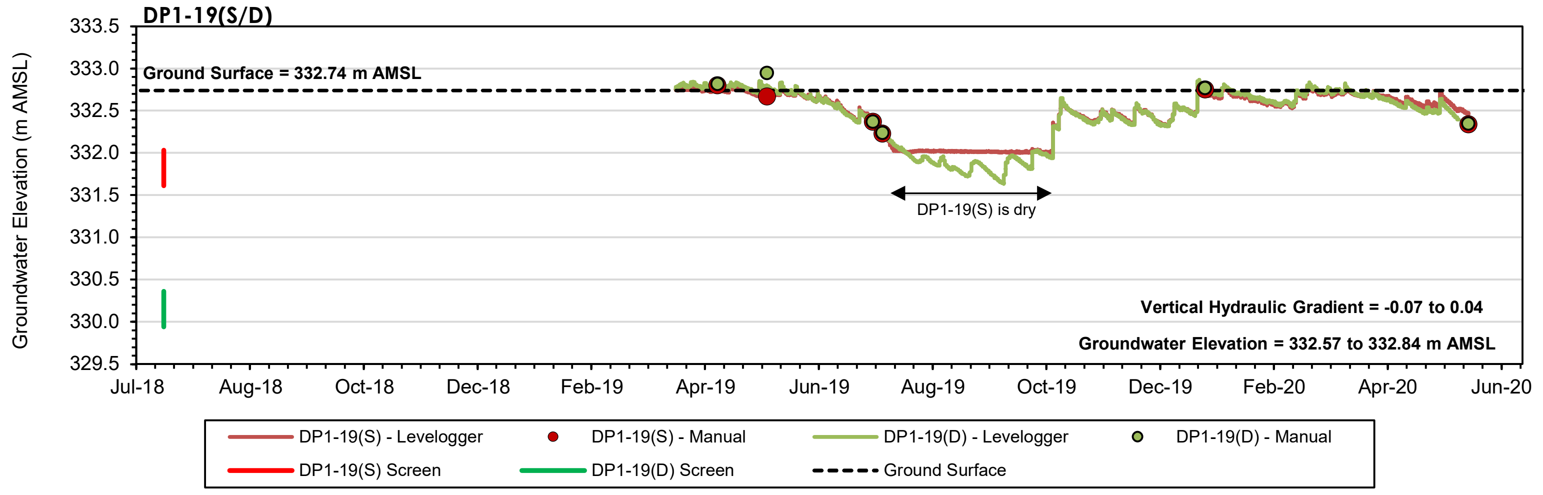
Figure No.
9

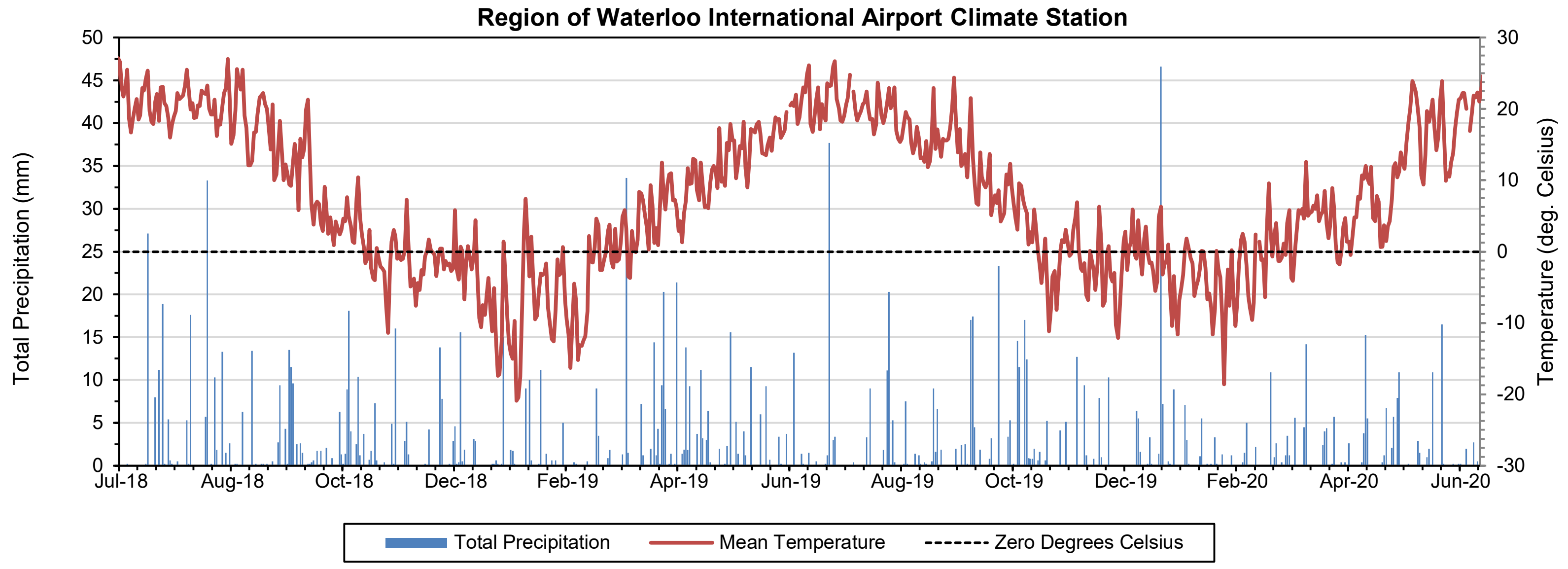
Title
HYDROGRAPHS
MW1-18 to MW4-18











Precipitation and temperature data obtained from Environment Canada for the Region of Waterloo International Airport Climate Station (ID 6144239), accessed June 2020.

Client/Project

Tricar Developments Inc.
1242, 1250, 1260 Gordon Street and 9 Valley Road, Guelph
Hydrogeological Assessment

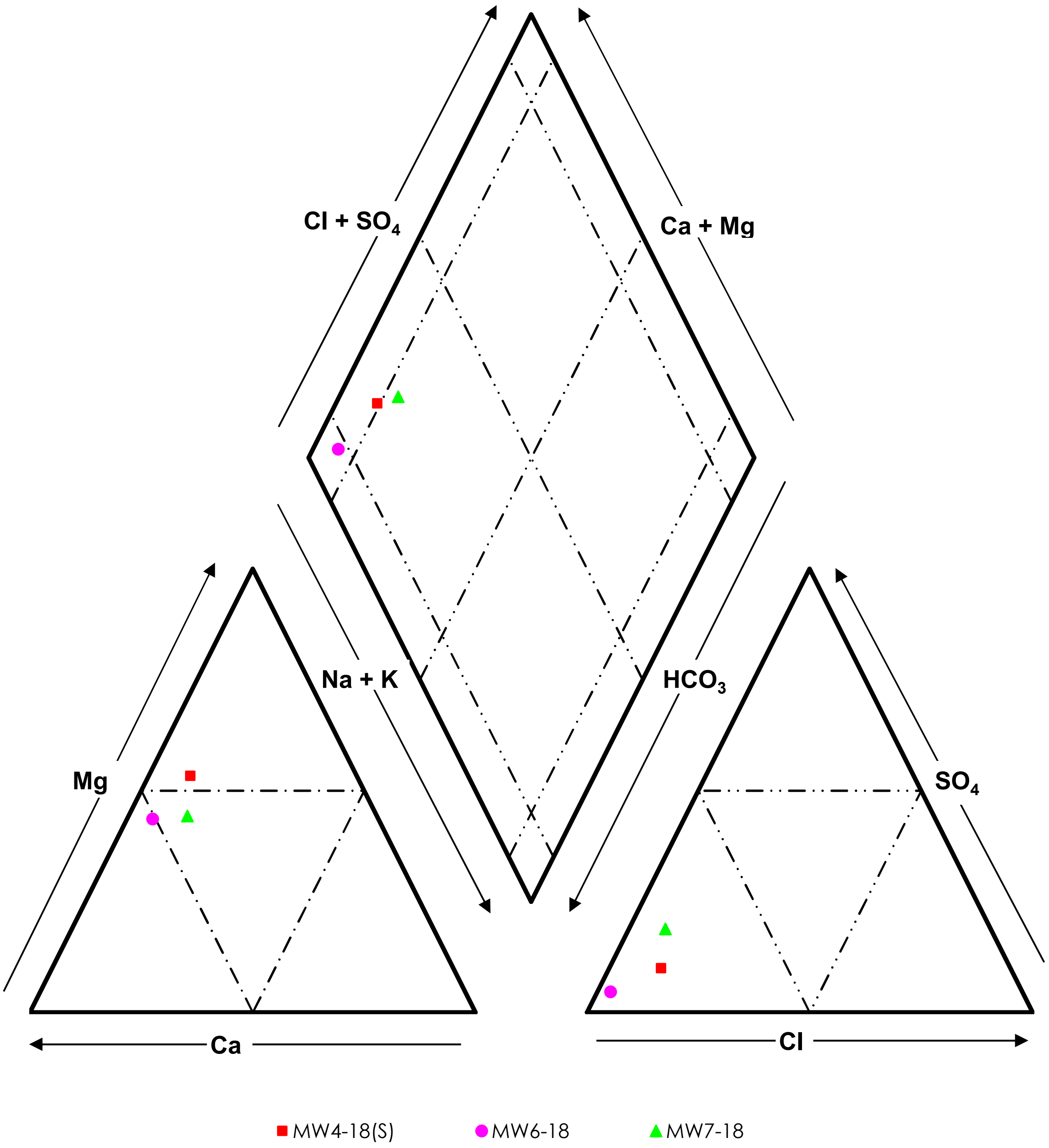
Figure No.

10

Title

HYDROGRAPHS
MW5-18 to MW7-18 and DP1-19(S/D)

Stantec

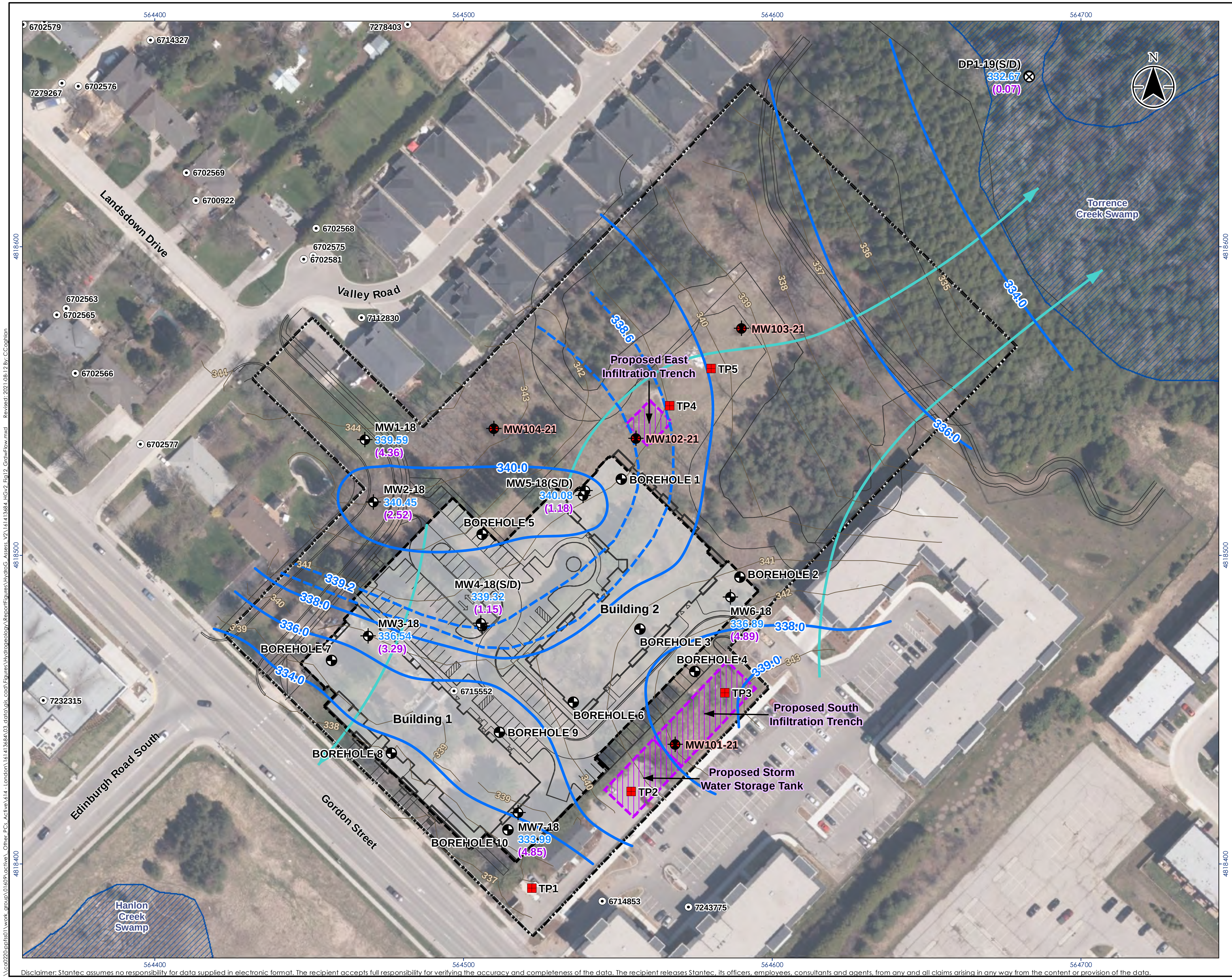


Stantec

**1242, 1250, 1260 GORDON ST. AND 9 VALLEY DR.
HYDROGEOLOGICAL ASSESSMENT**

PIPER DIAGRAM

DATE:	SCALE:	PROJECT No.	FIGURE No.
August 2021		161413684	**11**



Stantec

Legend

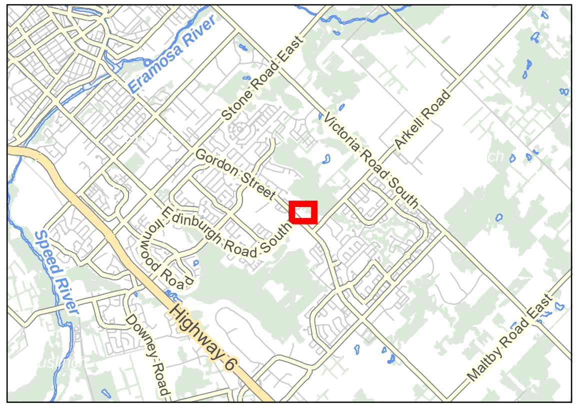
- ⬚ Site Boundary
- ⊕ Monitoring Well (Stantec, 2018)
- ⊗ Drive-Point Piezometer (Stantec, 2019)
- ◕ Borehole (CMT Engineering, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⊕ Proposed Monitoring Well (Stantec, 2021)
- ⊙ MECP Water Well
- 337.54 Groundwater Elevation (m AMSL) - May 2019
- (4.35) Groundwater Depth (m BGS)
- — Groundwater Contour (m AMSL)
- → Interpreted Direction of Groundwater Flow
- — Proposed Building
- - - Proposed Building (Underground)
- — Proposed Development Plan
- — Topographic Contour (m AMSL)
- ▭ Proposed Extent of Underground Parking
- ▨ Proposed Stormwater Management Facility
- ▨ Wetland - Evaluated (Provincial)

0 25 50 Metres

1:1,250 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery flown in 2017.
4. MECP water wells have been positioned based on published UTM coordinates and should be considered approximate.



Project Location
City of Guelph

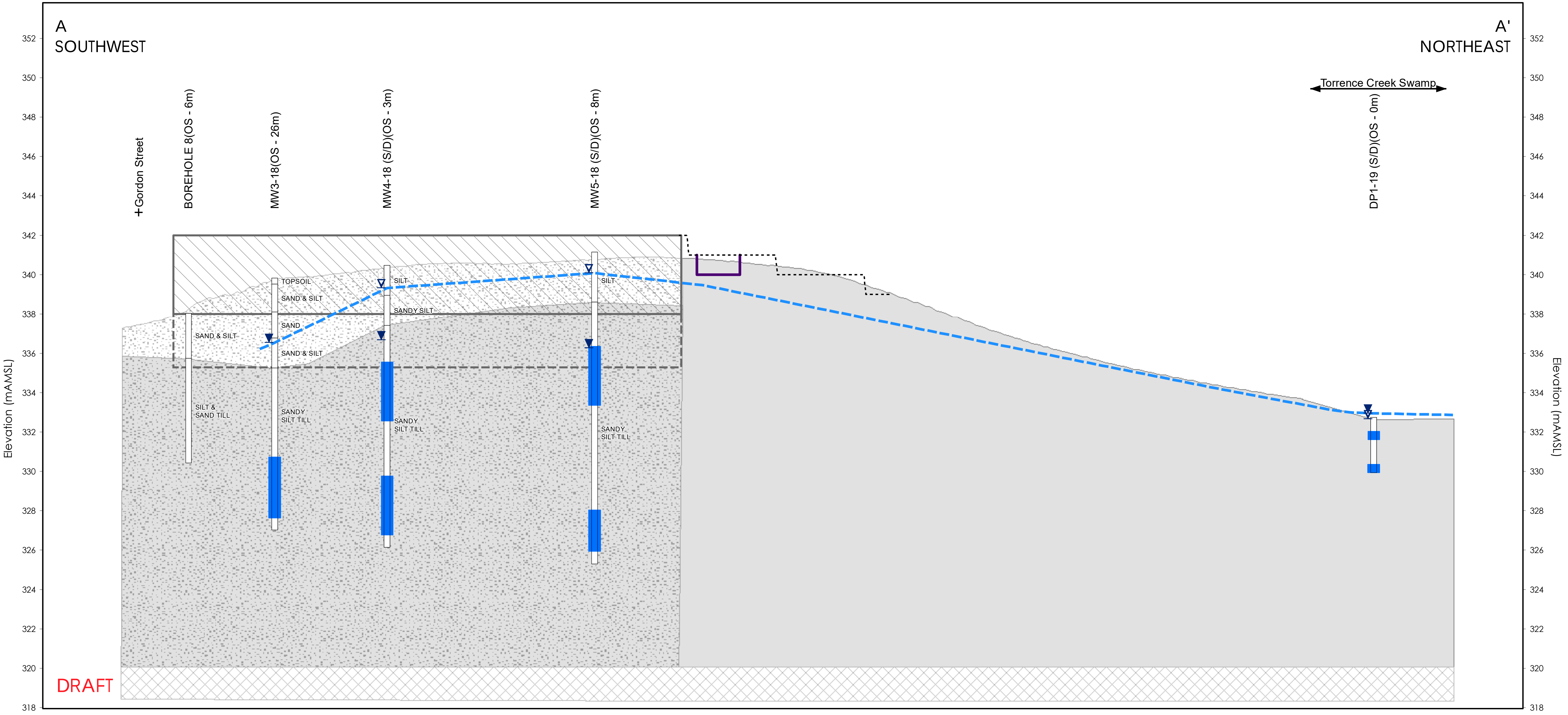
161413684
Prepared by CMC on 2021-08-12

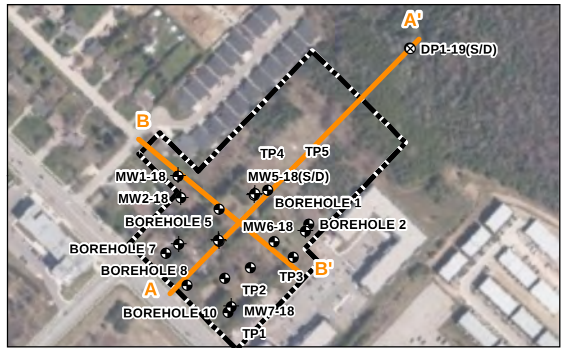
Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
12

Title
Groundwater Flow

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig12_GrdwFlow.mxd Revised: 2021-08-12 By: CCoghlan





Notes

1. Groundwater levels measured on May 29, 2019.
2. Orthoimagery © First Base Solutions, 2018. Imagery flown in 2019.

MW1-15 (OS m)

Well ID (Offset)

Sand Stratigraphy

▽ Water Level (Shallow Pipe)

▼ Water Level (Deep Pipe)

■ Well Screen

- - - Interpreted Water Table (May 29, 2019)

······ Proposed Post Development Grade

— Proposed East Infiltration Trench (Base Elevation of 340 m AMSL)

▨ Proposed Condo Building/Parking Level 1

⬚ Proposed Underground Parking Level 2 (Approximate)

▒ Overburden (No Borehole Data Available)

░ Diamicton (Silt, Sand, Gravel)

▒ Port Stanley Till (Silty Sand to Sandy Silt Till)

▨ Bedrock

5x Vertical Exaggeration

0 20 40 metres

1:1,000 (At original document size of 11x17)

Stantec

Project Location
City of Guelph

161413684 REVA
Prepared by CCoghlan on 2021-08-12
Technical Review by xxx on xxxx-xx-xx

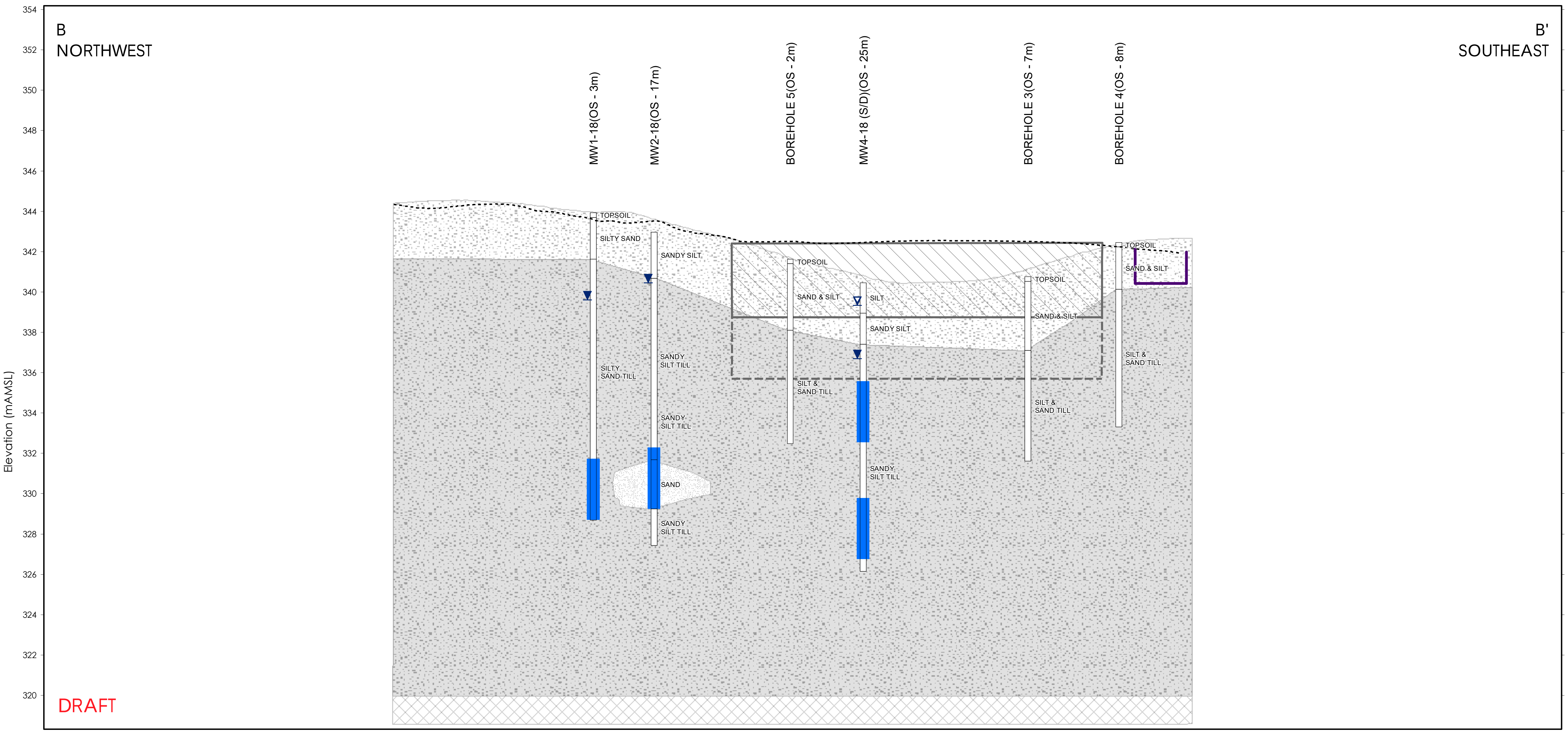
Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

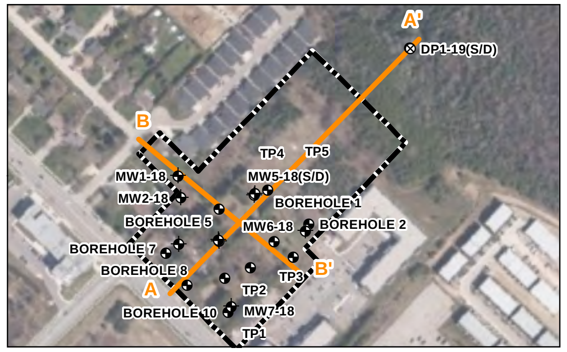
Figure No.
13

DRAFT

Title
Cross-Section A-A'

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig13_xsecAA.mxd Revised: 2021-08-12 By: CCoghlan





Notes
1. Groundwater levels measured on May 29, 2019.
2. Orthoimagery © First Base Solutions, 2018. Imagery flown in 2017.

MW1-15 (OS m) **Well ID (Offset)**
Sand Stratigraphy
▽ Water Level (Shallow Pipe)
▼ Water Level (Deep Pipe)
■ Well Screen

— Proposed South Infiltration Trench (Base Elevation of 340.43 m AMSL)
----- Proposed Post Development Grade
▨ Proposed Condo Building/Parking Level 1
⬚ Proposed Underground Parking Level 2
▢ Overburden (No Borehole Data Available)
▢ Diamicton (Silt, Sand, Gravel)
▢ Sand
▢ Port Stanley Till (Silty Sand to Sandy Silt Till)
▢ Bedrock

5x Vertical Exaggeration
0 20 40 metres
1:1,000 (At original document size of 11x17)

Project Location
City of Guelph

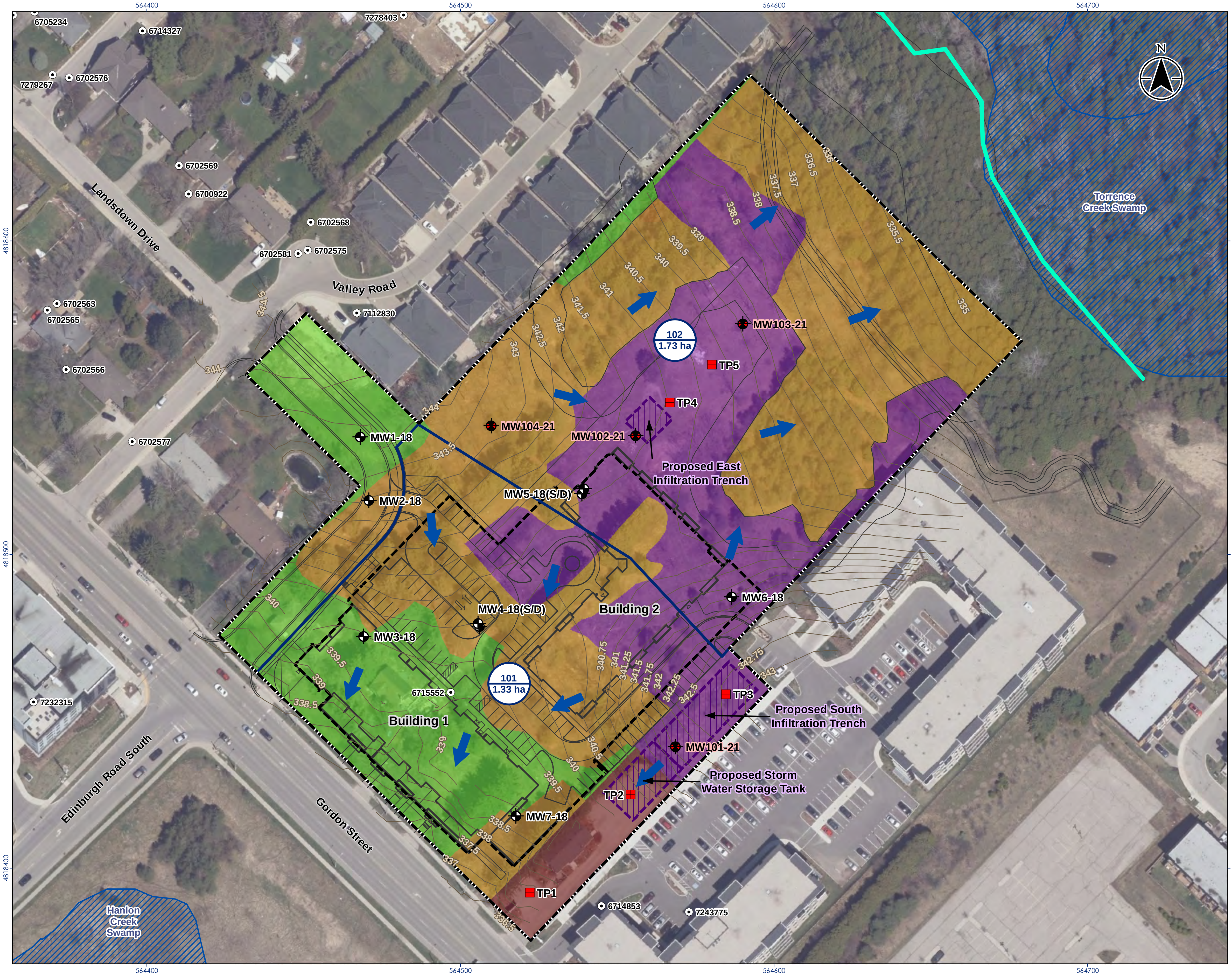
161413684 REVA
Prepared by CCoghlan on 2021-08-12
Technical Review by xxx on xxxx-xx-xx

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
14
DRAFT

Title
Cross-Section B-B'

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig14_xsecBB.mxd Revised: 2021-08-12 By: CCoghlan



Stantec

Legend
- ⬚ Site Boundary
- ⊕ Monitoring Well (Stantec, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⊕ Proposed Monitoring Well (Stantec, 2021)
- ⊙ MECP Water Well
- — Proposed Building
- - - Proposed Building (Underground)
- — Proposed Development Plan
- — Approximate GRCA Wetland Boundary (2014)
- ➡ Major Overland Flood Route
- — Topographic Contour (m AMSL)
- ▥ Proposed Stormwater Management Facility
- ☐ Stormwater Catchment (Existing Conditions)
- ▨ Wetland - Evaluated (Provincial)

Water Balance Sub Areas
- 🟨 Sub-Area A - Rolling, Fine Sandy Loam, Mature Forest
- 🟪 Sub-Area B - Rolling, Fine Sandy Loam, Pasture and Shrubs
- 🟩 Sub-Area C - Rolling, Fine Sandy Loam, Urban Lawn
- 🟫 Sub-Area D - Rolling, Fine Sandy Loam, Urban Lawn, 95% Impervious Cover

0 25 50 Metres

1:1,250 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
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3. Orthoimagery © First Base Solutions, 2021. Imagery flown in 2020.
4. MECP water wells have been positioned based on published UTM coordinates and should be considered approximate.

Project Location
City of Guelph

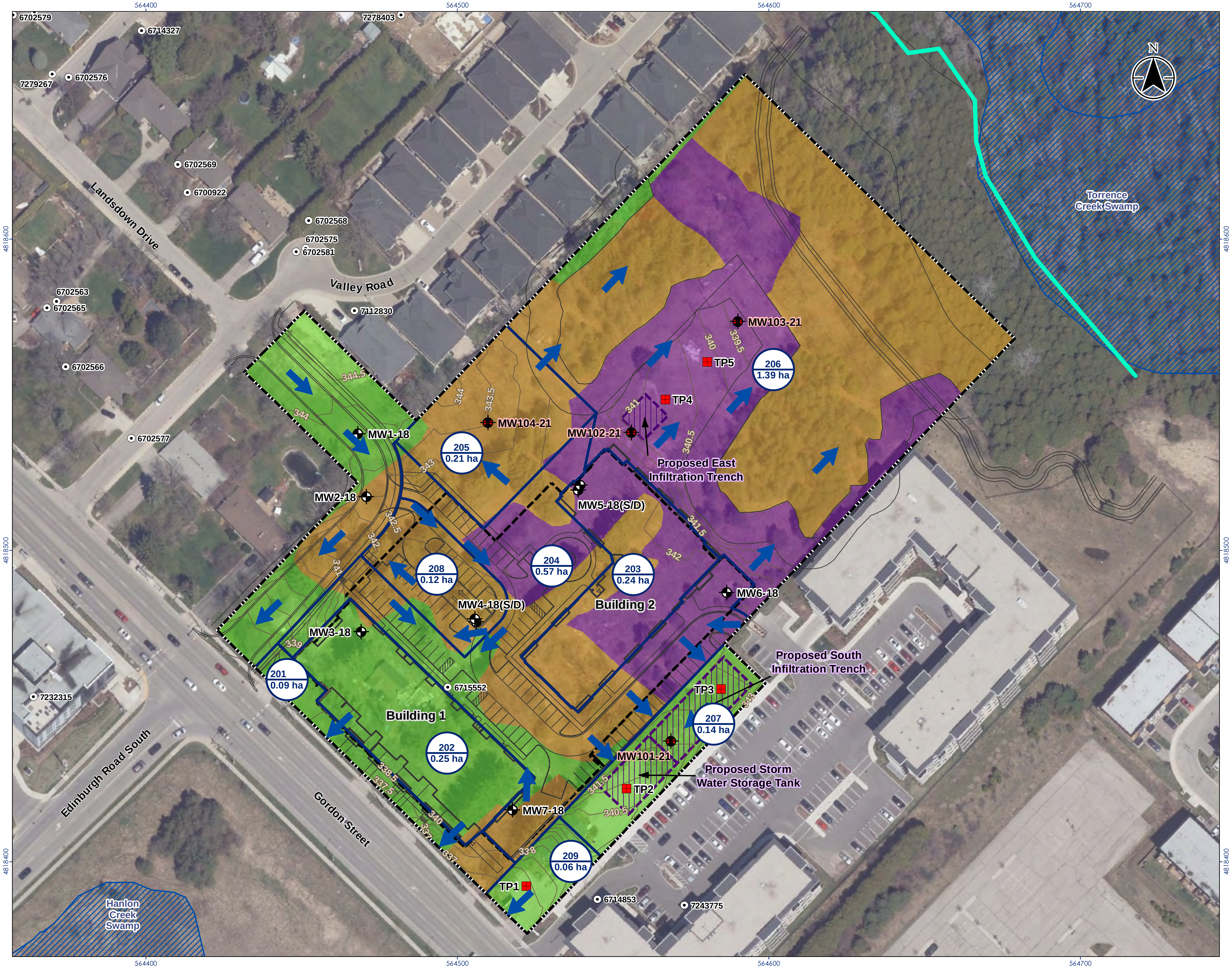
161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
15

Title
Water Balance - Pre-Development Condition

\\ca0220-ppfss01\work_group\01609\active_Other_PCs_Active\614 - London\161413684\03_data\gis_cad\Figures\Hydrogeology\ReportFigures\HydroG_Assess_V2\161413684_HGv2_Fig15_WaterBalancePreDev.mxd Revised: 2021-08-12 By: CCoghlan



Stantec

Legend

- ⬚ Site Boundary
- ⊕ Monitoring Well (Stantec, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⊕ Proposed Monitoring Well (Stantec, 2021)
- ⊙ MECP Water Well
- — Proposed Building
- - - Proposed Building (Underground)
- — Proposed Development Plan
- — Approximate GRCA Wetland Boundary (2014)
- ➡ Major Overland Flood Route
- — Proposed Topographic Contour (m AMSL)
- ▥ Proposed Stormwater Management Facility
- ☐ Stormwater Catchment (Proposed Conditions)
- ▨ Wetland - Evaluated (Provincial)

Water Balance Sub Areas

- 🟨 Sub-Area A - Rolling, Fine Sandy Loam, Mature Forest
- 🟪 Sub-Area B - Rolling, Fine Sandy Loam, Pasture and Shrubs
- 🟩 Sub-Area C - Rolling, Fine Sandy Loam, Urban Lawn

0 25 50 Metres

1:1,250 (At original document size of 11x17)

Notes

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Project Location
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161413684
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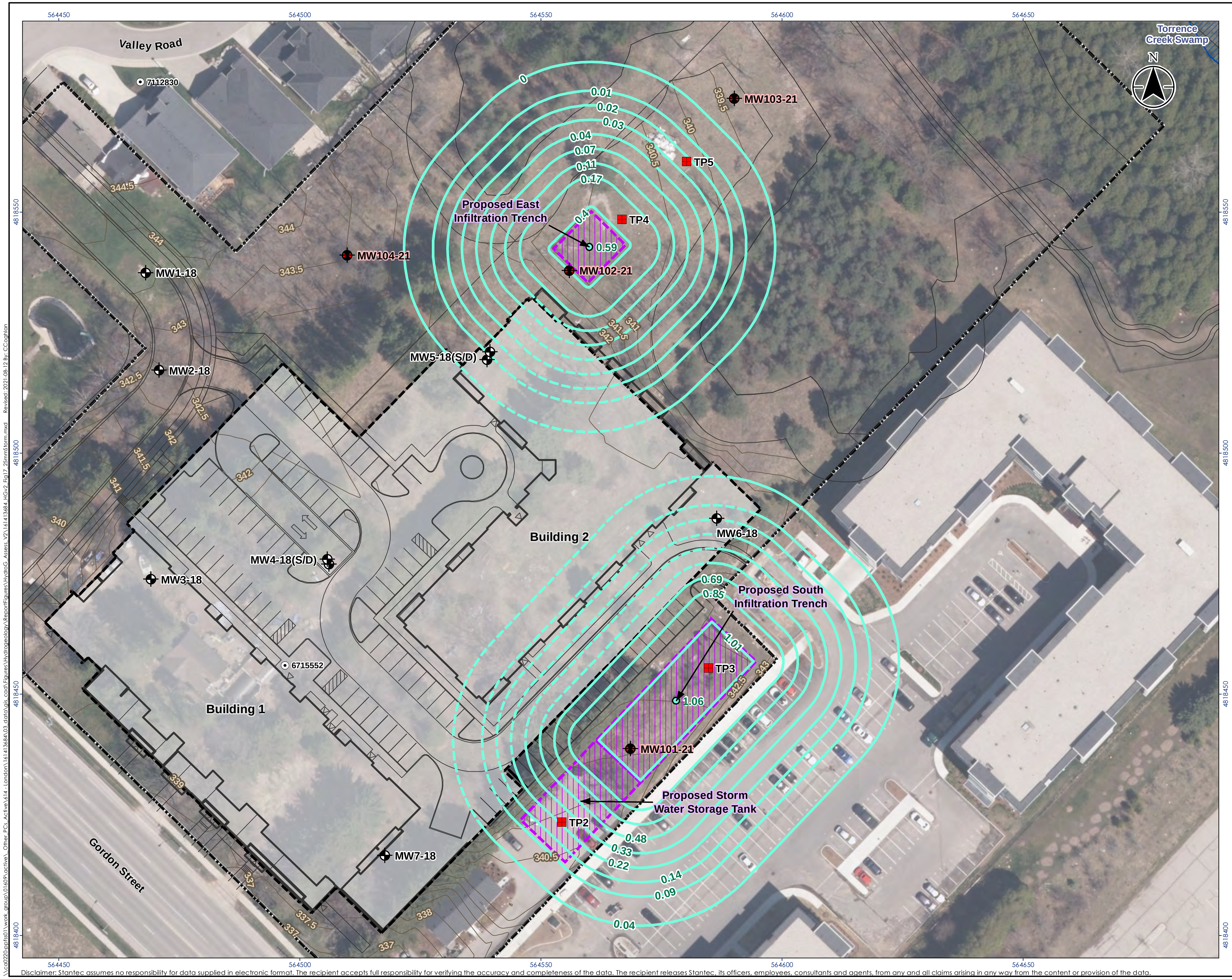
Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
16

Title
Water Balance - Post-Development Conditions



Stantec

Legend

- ⬚ Site Boundary
- ⊕ Monitoring Well (Stantec, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⊕ Proposed Monitoring Well (Stantec, 2021)
- ⊙ MECP Water Well
- — Proposed Building
- - - Proposed Building (Underground)
- — Proposed Development Plan
- — Proposed Topographic Contour (m
- 337.54 Predicted Groundwater Mounding Height (m)
- — Predicted Groundwater Mounding Contour (mAMSL)
- ▭ Proposed Extent of Underground Parking
- ▥ Proposed Stormwater Management Facility
- ▨ Wetland - Evaluated (Provincial)

0 12.5 25 Metres

1:800 (At original document size of 11x17)

Notes
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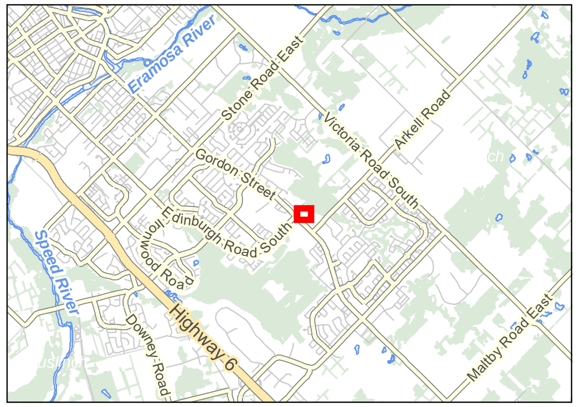
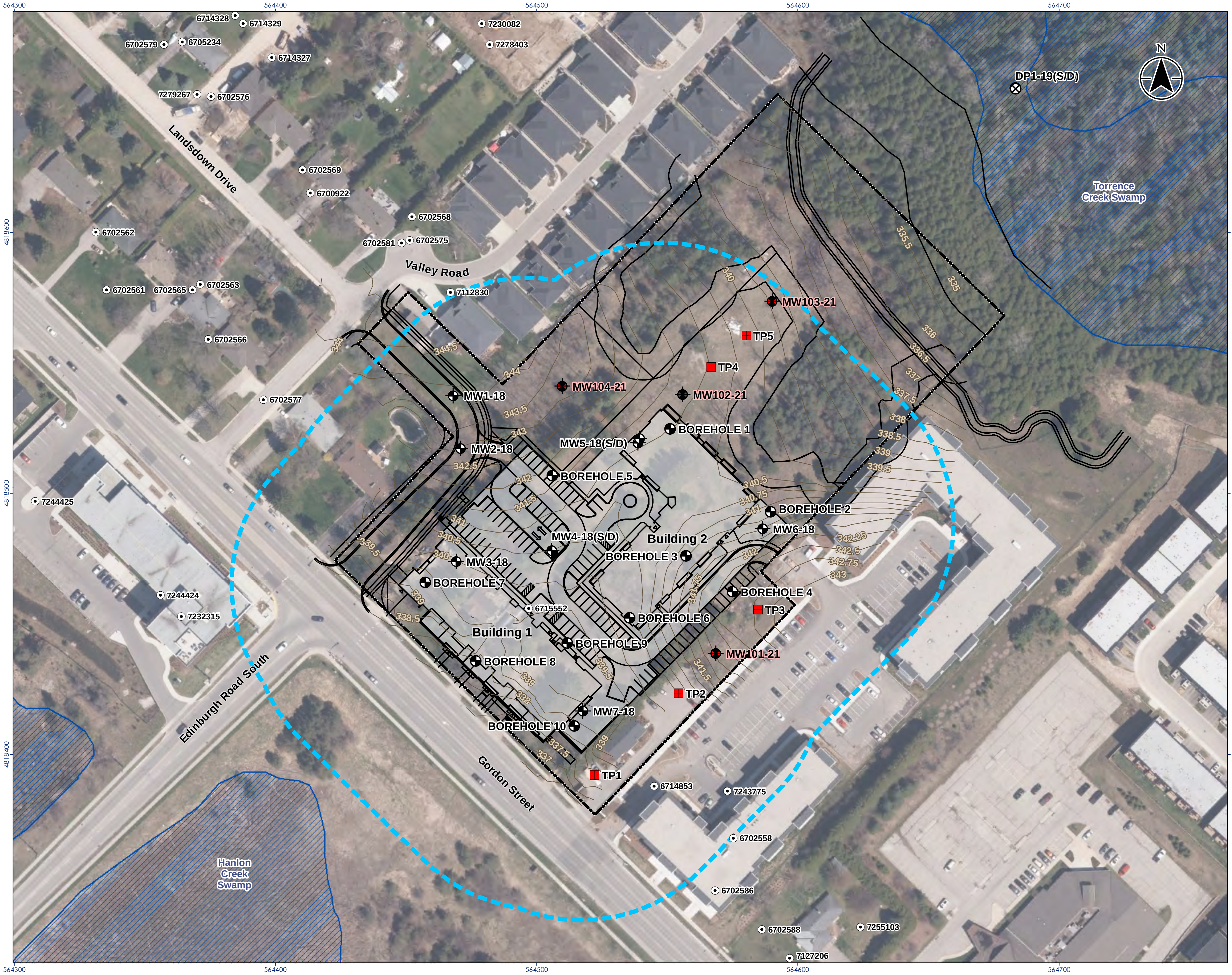


Project Location City of Guelph	161413684 Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
17

Title
Groundwater Mounding -
25mm Storm Event



Stantec

Legend
- ⬚ Site Boundary
- ⊕ Monitoring Well (Stantec, 2018)
- ⊗ Drive-Point Piezometer (Stantec, 2019)
- ◐ Borehole (CMT Engineering, 2018)
- 🟥 Test Pit (Stantec, 2021)
- ⊕ Proposed Monitoring Well (Stantec, 2021)
- ⊙ MECP Water Well
- — Proposed Development Plan
- — Topographic Contour (m AMSL)
- ⬚ Dewatering Radius of Influence
- ▭ Proposed Extent of Underground Parking
- ▨ Wetland - Evaluated (Provincial)

0 25 50 Metres

1:1,500 (At original document size of 11x17)

Notes
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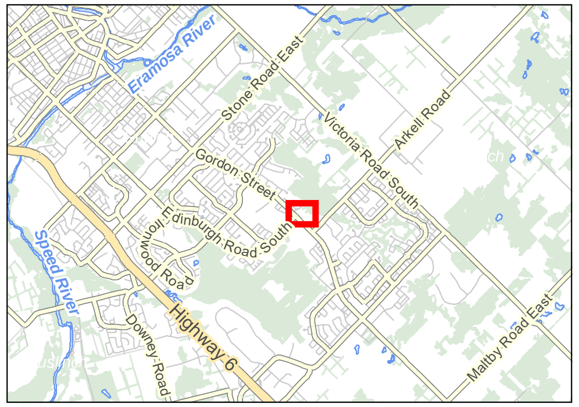
4. MECP water wells have been positioned based on published UTM coordinates and should be considered approximate.



Project Location
City of Guelph

161413684
Prepared by CMC on 2021-08-12

Client/Project
TRICAR DEVELOPMENTS INC.
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD
HYDROGEOLOGICAL ASSESSMENT

Figure No.
18

Title
Dewatering Radius of Influence

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APPENDIX B:
TABLES

TABLE 1
WELL CONSTRUCTION DETAILS

Well ID	UTM Coordinates		Elevations				Well	Well	Screened Interval				Screened	Hydraulic
	Northing	Easting	Top of Casing (m AMSL)	Ground Surface (m AMSL)	Well Stick-up (m)	Well Depth (m BTOC)	Depth (m BGS)	Base Elevation (m AMSL)	Top Elevation (m BGS)	(m AMSL)	Bottom Elevation (m BGS)	(m AMSL)	Material Description $^{(a)}$	Conductivity $^{(b)}$ (m/s)
Stantec Monitoring Wells														
MW1-18	4818537	564468	344.72	343.92	0.77	15.99	15.22	328.70	12.17	331.75	15.22	328.70	Sandy SILT TILL	-
MW2-18	4818517	564471	343.77	342.97	0.80	14.74	13.94	329.03	10.89	332.08	13.94	329.03	Sandy SILT TILL (19%) / SAND (81%)	4.7E-07
MW3-18	4818474	564469	340.91	339.83	1.08	13.30	12.22	327.61	9.17	330.66	12.22	327.61	Sandy SILT TILL	1.6E-09
MW4-18(S)	4818478	564506	341.32	340.47	0.85	8.82	7.97	332.50	4.92	335.55	7.97	332.50	Sandy SILT TILL	1.8E-07
MW4-18(D)	4818478	564506	341.28	340.47	0.81	14.51	13.70	326.77	10.65	329.82	13.70	326.77	Sandy SILT TILL	3.4E-09
MW5-18(S)	4818521	564540	342.02	341.26	0.76	8.84	8.08	333.18	5.03	336.23	8.08	333.18	Sandy SILT TILL	1.2E-08
MW5-18(D)	4818519	564539	342.02	341.14	0.88	16.01	15.13	326.01	13.61	327.53	15.13	326.01	Sandy SILT TILL	2.0E-08
MW6-18	4818487	564586	342.55	341.40	1.15	16.14	14.99	326.41	13.47	327.93	14.99	326.41	Sandy SILT TILL	5.4E-07
MW7-18	4818416	564518	339.64	338.85	0.79	14.69	13.90	324.95	12.38	326.47	13.90	324.95	Sandy SILT TILL	5.8E-08
													GEOMEAN =	**3.7E-08**
Stantec Drive-Point Piezometers														
DP1-19(S)	4818655	564683	333.74	332.74	1.00	2.13	1.13	331.61	0.71	332.03	1.13	331.61	-	-
DP1-19(D)	4818655	564683	333.89	332.74	1.15	3.95	2.80	329.94	2.38	330.36	2.80	329.94	-	-

Notes:

(a) Refer to **Appendix E** for borehole and well construction logs

(b) Refer to **Appendix G** hydraulic conductivity analytical solutions

m AMSL = meters above mean sea level

m BGS = meters below ground surface

m BTOC = meters below top of well casing

\- = data not available

TABLE 2
GROUNDWATER LEVEL DATA - MONITORING WELLS

Well ID	UTM Coordinates		Date	Time	Well Depth			Screen Length	Screen Separation (1)	Top of Casing Elevation (m AMSL)	Ground Surface Elevation (m AMSL)	Pipe Stick-up (m)	Groundwater Level			Vertical Hydraulic Gradient (3)
	Northing	Easting			(m BTOC)	(m BGS)	(m AMSL)	(m)	(m)				(m BGS) (2)	(m BTOC)	(m AMSL)	(+) = Upward (-) = Downward
MW1-18	4818537	564468	26-Jul-18	10:15 AM	15.99	15.22	329.50	3.05		344.72	343.92	0.77	-	-	-	
			11-Sep-18	9:17 AM									9.03	9.80	334.89	
			8-Nov-18	9:10 AM									8.57	9.34	335.35	
			9-Apr-19	2:14 PM									5.16	5.93	338.76	
			3-May-19	8:41 AM									4.34	5.11	339.58	
			29-May-19	11:07 AM									4.36	5.13	339.56	
			24-Jul-19	11:30 AM									7.38	8.15	336.54	
			15-Jan-20	10:55 AM									4.15	4.92	339.77	
			2-Jun-20	12:06 PM									6.97	7.74	336.95	
MW2-18	4818517	564471	26-Jul-18	3:58 PM	14.74	13.94	329.83	3.05		343.77	342.97	0.80	6.65	7.45	336.32	
			11-Sep-18	-									-	-	-	
			8-Nov-18	9:33 AM									6.90	7.70	336.07	
			9-Apr-19	2:14 PM									3.42	4.22	339.55	
			3-May-19	8:52 AM									2.44	3.24	340.53	
			29-May-19	11:15 AM									2.52	3.32	340.45	
			24-Jul-19	11:41 AM									5.80	6.60	337.17	
			15-Jan-20	11:04 AM									2.45	3.25	340.52	
			2-Jun-20	11:56 AM									5.31	6.11	337.66	
MW3-18	4818474	564469	26-Jul-18	2:56 PM	13.30	12.22	328.69	3.05		340.91	339.83	1.08	4.81	5.89	335.02	
			11-Sep-18	-									-	-	-	
			8-Nov-18	9:45 AM									5.41	6.49	334.42	
			9-Apr-19	3:29 PM									4.07	5.15	335.76	
			3-May-19	10:55 AM									-	-	-	
			29-May-19	11:22 AM									3.29	4.37	336.54	
			24-Jul-19	11:41 AM									4.54	5.62	335.29	
			15-Jan-20	11:11 AM									3.89	4.97	335.94	
			2-Jun-20	11:52 AM									4.47	5.55	335.36	
MW4-18(S)	4818478	564506	26-Jul-18	10:15 AM	8.82	7.97	333.35	3.05		341.32	340.47	0.85	3.83	4.68	336.64	
			11-Sep-18	1:18 PM									4.63	5.48	335.84	
			8-Nov-18	10:54 AM									4.81	5.66	335.66	
			9-Apr-19	3:26 PM									2.66	3.51	337.81	
			3-May-19	10:34 AM									1.45	2.30	339.02	
			29-May-19	12:20 PM									1.15	2.00	339.32	
			24-Jul-19	11:56 AM									3.11	3.96	337.36	
			15-Jan-20	12:06 PM									2.12	2.97	338.35	
			2-Jun-20	11:22 AM									2.82	3.67	337.65	
MW4-18(D)	4818478	564506	26-Jul-18	10:16 AM	14.51	13.70	327.58	3.05	2.68	341.28	340.47	0.81	5.49	6.30	334.98	-0.62
			11-Sep-18	1:20 PM									6.15	6.96	334.32	-0.57
			8-Nov-18	10:54 AM									6.27	7.08	334.20	-0.54
			9-Apr-19	3:23 PM									4.73	5.54	335.74	-0.77
			3-May-19	10:35 AM									4.01	4.82	336.46	-0.96
			29-May-19	12:18 PM									3.79	4.60	336.68	-0.99
			24-Jul-19	11:59 AM									5.28	6.09	335.19	-0.81
			15-Jan-20	12:08 PM									4.46	5.27	336.01	-0.87
			2-Jun-20	11:20 AM									5.21	6.02	335.26	-0.89

TABLE 2
GROUNDWATER LEVEL DATA - MONITORING WELLS

Well ID	UTM Coordinates		Date	Time	Well Depth			Screen Length	Screen Separation [1]	Top of Casing Elevation (m AMSL)	Ground Surface Elevation (m AMSL)	Pipe Stick-up (m)	Groundwater Level			Vertical Hydraulic Gradient [3]
	Northing	Easting			(m BTOC)	(m BGS)	(m AMSL)	(m)	(m)				(m BGS) [2]	(m BTOC)	(m AMSL)	(+) = Upward (-) = Downward
MW5-18(S)	4818521	564540	26-Jul-18	11:27 AM	8.84	8.08	333.94	3.05		342.02	341.26	0.76	3.67	4.43	337.59	
			11-Sep-18	10:17 AM									4.20	4.96	337.06	
			8-Nov-18	10:28 AM									4.57	5.33	336.69	
			9-Apr-19	3:11 PM									1.89	2.65	339.37	
			3-May-19	10:13 AM									1.17	1.93	340.09	
			29-May-19	11:57 AM									1.18	1.94	340.08	
			24-Jul-19	12:29 PM									3.21	3.97	338.05	
			15-Jan-20	11:20 AM									1.06	1.82	340.20	
			2-Jun-20	11:30 AM									3.01	3.77	338.25	
MW5-18(D)	4818519	564539	26-Jul-18	11:24 AM	14.69	13.81	328.21	1.52	4.21	342.02	341.14	0.88	6.72	7.60	334.42	-0.75
			11-Sep-18	10:18 AM									7.11	7.99	334.03	-0.72
			8-Nov-18	10:23 AM									7.15	8.03	333.99	-0.64
			9-Apr-19	3:09 PM									5.35	6.23	335.79	-0.85
			3-May-19	10:14 AM									4.92	5.80	336.22	-0.92
			29-May-19	11:51 AM									4.87	5.75	336.27	-0.90
			24-Jul-19	12:31 PM									6.46	7.34	334.68	-0.80
			15-Jan-20	11:22 AM									4.87	5.75	336.27	-0.93
			2-Jun-20	11:29 AM									6.41	7.29	334.73	-0.84
MW6-18	4818487	564586	26-Jul-18	1:05 PM	16.14	14.99	329.73	3.05		342.55	341.40	1.15	7.43	8.20	334.35	
			11-Sep-18	11:20 AM									7.45	8.22	334.33	
			8-Nov-18	10:14 AM									6.93	7.70	334.85	
			9-Apr-19	2:52 PM									5.31	6.08	336.47	
			3-May-19	10:03 AM									4.89	5.66	336.89	
			29-May-19	11:43 AM									4.89	5.66	336.89	
			24-Jul-19	12:18 PM									6.80	7.57	334.98	
			15-Jan-20	11:45 AM									4.53	5.30	337.25	
			2-Jun-20	11:44 AM									6.79	7.56	334.99	
MW7-18	4818416	564518	26-Jul-18	2:04 PM	14.69	13.90	329.87	1.52		339.64	338.85	0.79	5.70	6.50	333.14	
			11-Sep-18	12:00 PM									5.92	6.72	332.92	
			8-Nov-18	10:03 AM									5.79	6.59	333.05	
			9-Apr-19	2:42 PM									5.28	6.08	333.56	
			3-May-19	9:51 AM									4.99	5.79	333.85	
			29-May-19	11:34 AM									4.85	5.65	333.99	
			24-Jul-19	12:07 PM									5.60	6.40	333.24	
			15-Jan-20	11:55 AM									4.98	5.78	333.86	
			2-Jun-20	11:48 AM									5.61	6.41	333.23	

Notes:

(1) Distance between the top of the screen in the deep well and the bottom of screen in the shallow well.
(2) A negative value indicates that the water level measured within the pipe is located above ground surface
(3) Negative and positive values indicate downward and upward gradients, respectively.

m BGS = meters below ground surface
m BTOC = meters below top of casing
DRY = no groundwater or surface water was observed in the piezometer or watercourse, respectively

TABLE 3
GROUNDWATER LEVEL DATA - DRIVE-POINT PIEZOMETERS

Piezometer ID	UTM Coordinates		Total Depth		Screen Length	Screen Separation (1)	Pipe Stick-up	Ground Surface Elevation	Top of Casing Elevation	Date	Time	Groundwater Level			Surface Water Level		Vertical Hydraulic Gradient(4)
	Northing	Easting	(m BTOC)	(m BGS)	(m)	(m)	(m)	(m AMSL)	(m AMSL)			(m BGS) (2)	(m BTOC)	(m AMSL)	(m BTOC) (3)	(m AMSL)	(+) = Upward (-) = Downward
DP1-19(S)	4818655	564683	2.13	1.13	0.30		1.00	332.74	333.74	3-May-19	9:10 AM	-0.06	0.94	332.80	0.90	332.84	
										29-May-19	10:48 AM	0.07	1.07	332.67	DRY	-	
										24-Jul-19	11:02 AM	0.37	1.37	332.37	DRY	-	
										29-Jul-19	3:08 PM	0.51	1.51	332.23	DRY	-	
										15-Jan-20	10:34 AM	-0.01	0.99	332.75	DRY	-	
										2-Jun-20	11:35 AM	0.40	1.40	332.34	DRY	-	
DP1-19(D)	4818655	564683	3.95	2.80	0.30	1.67	1.15	332.74	333.89	3-May-19	9:15 AM	-0.08	1.07	332.82	1.03	332.86	0.01
										29-May-19	10:48 AM	-0.21	0.94	332.95	DRY	-	0.17
										24-Jul-19	11:02 AM	0.37	1.52	332.37	DRY	-	0.00
										29-Jul-19	3:08 PM	0.50	1.65	332.24	DRY	-	0.01
										15-Jan-20	10:37 AM	-0.03	1.12	332.77	DRY	-	0.01
										2-Jun-20	11:34 AM	0.39	1.54	332.35	DRY	-	0.01

Notes:

(1) Distance between the mid-point of the screened intervals of the shallow and deep piezometer.
(2) A negative value indicates that the water level measured within the pipe is located above ground surface.
(3) A negative value indicates that the surface water level is above the top of the piezometer.
(4) Vertical hydraulic gradient between the surface water feature substrate and the piezometer screened interval.

m BGS = meters below ground surface
m BTOC = meters below top of casing
DRY = no groundwater or surface water was observed in the piezometer or surface water feature, respectively
n/a = measurement not available

TABLE 4 - GROUNDWATER QUALITY RESULTS
CITY OF GUELPH SANITARY AND SEWER BY-LAW (1996)-15202

Sample Location			**MW2-18**	
Sample Date			**11-Sep-18**	**11-Sep-18**
Sample ID			**WG-161413684-20180911-DS-04**	**WG-161413684-20180911-DS-04 Lab-Dup**
Sampling Company			**STANTEC**	**STANTEC**
Laboratory			**MAXX**	**MAXX**
Laboratory Work Order			**B8N6455**	**B8N6455**
Laboratory Sample ID			**HSJ715**	**HSJ715**
Sample Type	**Units**	**City of Guelph**		**Lab Replicate**
General Chemistry				
Chloride	mg/L	1,500^{A}	46	-
Cyanide	mg/L	2^{A}	<0.0050	-
Fluoride	mg/L	10^{A}	0.13	-
pH, lab	S.U.	5.5-9.5^{A} 6.0-9.0^{B}	7.90	-
Phenols-4AAP	mg/L	n/v	<0.0010	-
Sulfate	mg/L	1,500^{A}	40	-
Total Suspended Solids	mg/L	350^{A} 15^{B}	**2,500^{AB}**	-
Carbonaceous BOD - 5 Day	mg/L	n/v	<2	<2
Total Kjeldahl Nitrogen	mg/L	100^{A}	1.7	-
Petroleum Hydrocarbons				
Animal/Veg Oil & Grease	mg/L	100^{A}	<0.50	-
Mineral Oil and Grease	mg/L	n/v	<0.50	-
Oil and Grease, Total	mg/L	n/v	<0.50	-
Metals, Total				
Aluminum	mg/L	50^{A}	15	-
Antimony	mg/L	5^{A}	<0.00050	-
Arsenic	mg/L	1^{A}	0.0062	-
Bismuth	mg/L	5^{A}	<0.0010	-
Cadmium	mg/L	1^{A} 0.001^{B}	**0.0019^{B}**	-
Chromium	mg/L	5^{A} 0.2^{B}	0.040	-
Cobalt	mg/L	5^{A}	0.0096	-
Copper	mg/L	3^{A} 0.01^{B}	**0.030^{B}**	-
Iron	mg/L	50^{A}	23	-
Lead	mg/L	5^{A} 0.05^{B}	**0.13^{B}**	-
Manganese	mg/L	5^{A}	1.3	-
Mercury	mg/L	0.1^{A} 0.001^{B}	<0.0001	-
Molybdenum	mg/L	5^{A}	0.0032	-
Nickel	mg/L	3^{A} 0.05^{B}	0.021	-
Phosphorus	mg/L	10^{A}	1.1	-
Selenium	mg/L	5^{A}	<0.0020	-
Silver	mg/L	5^{A}	<0.00010	-
Tin	mg/L	5^{A}	0.0011	-
Titanium	mg/L	5^{A}	0.49	-
Vanadium	mg/L	5^{A}	0.031	-
Zinc	mg/L	3^{A} 0.05^{B}	**0.64^{B}**	-
Microbiological				
Fecal Coliform	5TMPN/100ML	200 (MPN/100mL)^{B}	**350^{B}**	-

Notes:

Guelph	City of Guelph
^{A}	City of Guelph Sanitary Sewer-Use By-Law No. (1996)-15202
^{B}	City of Guelph Storm Sewer-Use By-Law
6.5^{A}	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.

TABLE 5 - GROUNDWATER QUALITY RESULTS
ONTARIO DRINKING WATER QUALITY STANDARDS

Sample Location			**MW2-18**	**MW4-18(S)**	**MW6-18**	**MW7-18**
Sample Date			**11-Sep-18**	**11-Sep-18**	**11-Sep-18**	**11-Sep-18**
Sample ID			**WG-161413684-20180911-DS-04**	**WG-161413684-20180911-DS-03**	**WG-161413684-20180911-DS-01**	**WG-161413684-20180911-DS-02**
Sampling Company			**STANTEC**	**STANTEC**	**STANTEC**	**STANTEC**
Laboratory			**MAXX**	**MAXX**	**MAXX**	**MAXX**
Laboratory Work Order			**B8N6455**	**B8N6455**	**B8N6455**	**B8N6455**
Laboratory Sample ID	**Units**	**ODWS**	**HSJ715**	**HSJ714**	**HSJ712**	**HSJ713**
General Chemistry						
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	-	5.3	3.7	4.7
Alkalinity, Total (as CaCO3)	mg/L	$30\text{-}500^{E}$	-	410	310	340
Ammonia (as N)	mg/L	n/v	-	0.071	<0.050	<0.050
Anion Sum	me/L	n/v	-	10.7	6.67	9.3
Bicarbonate(as CaCO3, Calculated)	mg/L	n/v	-	410	300	330
Cation Sum	me/L	n/v	-	10.9	6.66	11.8
Chloride	mg/L	250^{C}	46	43	7	27
Dissolved Organic Carbon (DOC)	mg/L	5^{C}	-	1.4	0.83	1
Electrical Conductivity, Lab	µmhos/cm	n/v	-	950	580	830
Hardness (as CaCO3)	mg/L	$80\text{-}100^{E}$	-	**490^{E}**	**320^{E}**	**520^{E}**
Ion Balance	%	n/v	-	1.08	0.05	12.1
Langelier Index (at 20 C)	none	n/v	-	1.2	1.01	1.25
Langelier Index (at 4 C)	none	n/v	-	0.947	0.762	0.997
Nitrate (as N)	mg/L	10.0_{d}^{B}	-	1.93	0.25	0.12
Nitrate + Nitrite (as N)	mg/L	10.0_{d}^{B}	-	1.96	0.25	0.12
Nitrite (as N)	mg/L	1.0_{d}^{B}	-	0.026	<0.010	<0.010
Orthophosphate(as P)	mg/L	n/v	-	0.012	<0.010	<0.010
pH, lab	S.U.	$6.5\text{-}8.5^{E}$	7.90	8.14	8.11	8.18
Saturation pH (at 20 C)	none	n/v	-	6.95	7.1	6.93
Saturation pH (at 4 C)	none	n/v	-	7.2	7.35	7.18
Sulfate	mg/L	500_{h}^{C}	40	50	15	84
Total Dissolved Solids (Calculated)	mg/L	500^{C}	-	**540^{C}**	330	**530^{C}**
Total Suspended Solids	mg/L	n/v	-	100	1,800	1,200
Metals, Dissolved						
Aluminum	mg/L	0.1^{E}	-	0.0064	<0.0050	0.063
Antimony	mg/L	0.006^{B}	-	<0.00050	<0.00050	<0.00050
Arsenic	mg/L	0.01^{B}	-	<0.0010	<0.0010	0.0015
Barium	mg/L	1^{B}	-	0.13	0.032	0.076
Beryllium	mg/L	n/v	-	<0.00050	<0.00050	<0.00050
Boron	mg/L	5^{B}	-	0.11	0.014	0.013
Cadmium	mg/L	0.005^{B}	-	<0.00010	<0.00010	<0.00010
Calcium	mg/L	n/v	-	82	69	100
Chromium	mg/L	0.05^{B}	-	<0.0050	<0.0050	<0.0050
Cobalt	mg/L	n/v	-	<0.00050	<0.00050	<0.00050
Copper	mg/L	1^{C}	-	<0.0010	<0.0010	<0.0010
Iron	mg/L	0.3^{C}	-	<0.10	<0.10	0.19
Lead	mg/L	0.01^{B}	-	<0.00050	<0.00050	0.00056
Magnesium	mg/L	n/v	-	71	36	63
Manganese	mg/L	0.05^{C}	-	0.02	0.011	0.046
Molybdenum	mg/L	n/v	-	0.0042	0.00079	0.003
Nickel	mg/L	n/v	-	<0.0010	<0.0010	<0.0010
Phosphorus	mg/L	n/v	-	0.11	<0.10	<0.10
Potassium	mg/L	n/v	-	5.9	1.1	2.6
Selenium	mg/L	0.05^{B}	-	0.0022	<0.0020	<0.0020
Silicon	mg/L	n/v	-	5.2	6.3	7.9
Silver	mg/L	n/v	-	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200_{g}^{C} 20_{g}^{D}	-	20	5.4	**34^{D}**
Strontium	mg/L	n/v	-	0.23	0.13	0.2
Thallium	mg/L	n/v	-	<0.000050	<0.000050	<0.000050
Titanium	mg/L	n/v	-	<0.0050	<0.0050	0.0051
Uranium	mg/L	0.02^{B}	-	0.003	0.00063	0.0022
Vanadium	mg/L	n/v	-	0.0012	<0.00050	0.0014
Zinc	mg/L	5^{C}	-	<0.0050	<0.0050	<0.0050

Notes:

ODWS	O.Reg 169/03 - Ontario Drinking Water Quality Standards (January 1, 2018); Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (MOE, 2006), in support of O.Reg 169/03 (January 1, 2018)
A	Schedule 1 - Microbiological Standards (expressed as a maximum)
B	Schedule 2 - Chemical Standards (expressed as a maximum acceptable concentration)
C	ODWS Table 4 - Chemical/Physical Objectives and Guidelines, Aesthetic Objectives
D	ODWS Table 4 - Medical Officer of Health Reporting Limit
E	ODWS Table 4 - Chemical/Physical Objectives and Guidelines, Operational Guidelines
6.5^{A}	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
d	Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).
g	The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.
h	When sulfate levels exceed 500 mg/L, water may have a laxative effect on some people.

TABLE 6 - INFILTRATION RATES ESTIMATED FROM HORIZONTAL HYDRAULIC CONDUCTIVITY TESTING RESULTS

Testing Location ID	Horizontal Hydraulic Conductivity	Vertical Hydraulic Conductivity		Infiltration Rate	Pit Depth	Screened Interval	Soil Substrate Tested	Surficial Deposit or Hydrostratigraphic Unit
	(m/s)	(cm/s)	(m/s)	(mm/hr)	(m BGS)	(m BGS)		
In-situ Hydraulic Response Testing (Monitoring Wells)								
MW2-18	4.7E-07	-	4.7E-08	20	-	10.9 - 13.9	Sandy SILT TILL (19%) / SAND (81%)	Lower Till Aquitard (Sand Layer)
MW3-18	1.6E-09	-	1.6E-10	5	-	7.5 - 10.5	Sandy SILT TILL	Lower Till Aquitard
MW4-18(S)	1.8E-07	-	1.8E-08	15	-	5.0 - 8.0	Sandy SILT TILL	Lower Till Aquitard
MW4-18(D)	3.4E-09	-	3.4E-10	5	-	9.5 - 12.5	Sandy SILT TILL	Lower Till Aquitard
MW5-18(S)	1.2E-08	-	1.2E-09	8	-	5.0 - 8.0	Sandy SILT TILL	Lower Till Aquitard
MW5-18(D)	2.0E-08	-	2.0E-09	9	-	12.1 - 15.1	Sandy SILT TILL	Lower Till Aquitard
MW6-18	5.4E-07	-	5.4E-08	21	-	12.0 - 15.0	Sandy SILT TILL	Lower Till Aquitard
MW7-18	5.8E-08	-	5.8E-09	12	-	10.9 - 13.9	Sandy SILT TILL	Lower Till Aquitard

Notes:

(1) Infiltration rate calculated based on established relationship between vertical hydraulic conductivity and infiltration rate presented in *Credit Valley Conservation and Toronto and Region Conservation (2010) Low Impact Stormwater Management Planning and Design Guideline - Version 1.0.*

(2) Vertical hydraulic conductivities for deeper overburden deposits assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities

TABLE 7 - INFILTRATION RATE TESTING RESULTS (2021)

Testing Location ID	Ground Surface Elevation	Vertical Hydraulic Conductivity		Infiltration Rate (1)	Horizontal Hydraulic Conductivity (2)	Testing Depth		Soil Substrate Tested
	(m AMSL)	(cm/s)	(m/s)	(mm/hr)	(m/s)	(m BGS)	(m AMSL)	
East Infiltration Trench - designed base elevation: 340.00 m AMSL								
TP4-21	340.9	3.9E-03	3.9E-05	123	3.9E-04	0.6	340.4	Clayey SAND TILL, fine to medium grained sand
TP5-21	340.3	1.8E-03	1.8E-05	100	1.8E-04	0.6	339.7	Clayey SAND TILL, fine to medium grained sand
TP4-21	340.9	1.1E-04	1.1E-06	48	1.1E-05	2.0	339.0	Clayey SAND TILL, fine to medium grained sand
TP5-21	340.3	2.0E-06	2.0E-08	16	2.0E-07	2.9	337.4	Clayey SAND TILL, fine to medium grained sand
MW5-18(S)	341.3	-	-	8	1.2E-08	5.0 - 8.0	336.2 - 333.2	Sandy SILT TILL
MW5-18(D)	341.1	-	-	9	2.0E-08	13.6 - 15.1	327.5 - 326.0	Sandy SILT TILL
South Infiltration Trench - designed base elevation: 340.43 m AMSL								
TP1-21 (Test 1)	337.9	8.7E-06	8.7E-08	24	8.7E-07	0.5	337.4	Silty Clay FILL, trace fine grained sand and cobbles
TP1-21 (Test 2)	337.9	2.9E-05	2.9E-07	33	2.9E-06	0.5	337.4	Silty Clay FILL, trace fine grained sand and cobbles
TP1-21	337.9	3.5E-03	3.5E-05	120	3.5E-04	1.4	336.5	Silty Clay FILL, trace fine grained sand and cobbles
TP2-21	340.5	1.2E-03	1.2E-05	89	1.2E-04	0.6	340.0	Sandy SILT TILL, fine to medium grained sand
TP2-21	340.5	1.8E-05	1.8E-07	29	1.8E-06	1.5	339.1	Sandy SILT TILL, fine to medium grained sand
TP3-21 (Test 1)	342.8	2.7E-04	2.7E-06	60	2.7E-05	1.2	341.6	Sandy SILT TILL, fine to medium grained sand
TP3-21 (Test 2)	342.8	2.2E-04	2.2E-06	57	2.2E-05	1.2	341.6	Sandy SILT TILL, fine to medium grained sand
TP3-21 (Test 1)	342.8	1.4E-04	1.4E-06	51	1.4E-05	2.6	340.2	Sandy SILT TILL, fine to medium grained sand
TP3-21 (Test 2)	342.8	5.1E-04	5.1E-06	71	5.1E-05	2.6	340.2	Sandy SILT TILL, fine to medium grained sand
TP3-21 (Test 1)	342.8	4.6E-04	4.6E-06	70	4.6E-05	3.5	339.3	Sandy SILT TILL, fine to medium grained sand
TP3-21 (Test 2)	342.8	2.3E-05	2.3E-07	31	2.3E-06	3.6	339.3	Sandy SILT TILL, fine to medium grained sand
MW6-18	342.5	-	-	21	5.4E-07	13.5 - 15.0	327.9 - 326.4	Sandy SILT TILL
MW7-18	339.6	-	-	12	5.8E-08	12.4 - 13.9	326.5 - 324.9	Sandy SILT TILL

Notes:

(1) Infiltration rate calculated based on established relationship between vertical hydraulic conductivity and infiltration rate presented in *Credit Valley Conservation and Toronto and Region Conservation (2010) Low Impact Stormwater Management Planning and Design Guideline - Version 1.0.*

(2) Horizontal hydraulic conductivity assumed to be one order of magnitude greater than Guelph Permeameter tested / calculated vertical hydraulic conductivity as per Freeze and Cherry (1979) and Todd (1980). Note that horizontal hydraulic conductivities for provided MW5-18(S/D), MW6-18 and MW7-18 calculated from in-situ hydraulic response testing completed on each monitoring well.

TABLE 8 - DESIGN INFILTRATION RATE CALCULATIONS

East Infiltration Trench					
	Calculated Vertical Hydraulic Conductivities (m/s)			Geomean	Infiltration Rate (mm/hr)
Base (340.00 m AMSL)	3.9E-05	1.8E-05		2.6E-05	111
~1.5 m below Base (338.5 m AMSL)	1.1E-06			1.1E-06	48
Ratio (Base / 1.5 m)					*2.3*
Safety Factor					3.5
Design Infiltration Rate					***32***

South Infiltration Trench					
	Calculated Vertical Hydraulic Conductivities (m/s)			Geomean	Infiltration Rate (mm/hr)
Base (340.43 m AMSL)	2.7E-06	2.2E-06		2.4E-06	58
~1.5 m below Base (338.93 m AMSL)	1.4E-06	5.1E-06	1.2E-05	4.4E-06	69
Ratio (Base / 1.5 m)					*0.8*
Safety Factor					2.5
Design Infiltration Rate					***23***

TABLE 9 - PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENT 101 (LANDS DRAINING TO THE UPPER HANLON CREEK SUBWATERSHED)

Pre-Development
Model Type: Thornthwaite and Mather (1955)
Client: Tricar Developments Inc.
Location Catchment 101 (Lands Draining to Upper Hanlon Creek Subwatershed)
Total Site Area (ha) 1.33

Land Description Factors (Sub-area descriptions provided below)	**Sub-Area A**	**Sub-Area B**	**Sub-Area C**	**Sub-Area D**									**Total**
Topography	0.20	0.20	0.20	0.20									
Soils	0.25	0.25	0.25	0.25									
Cover	0.20	0.15	0.05	0.05									
Sum (Infiltration Factor)[†]	0.65	0.60	0.50	0.50									
Soil Moisture Capacity (mm)	300	150	75	75									
Site area (ha)	0.52	0.26	0.43	0.12									1.33
Imperviousness Coefficient	0.00	0.00	0.00	1.00									
Impervious Area (ha)	0.00	0.00	0.00	0.12									0.12
Percentage of Total Site Area	0.0%	0.0%	0.0%	9.3%									9%
Remaining Pervious Area (ha)	0.52	0.26	0.43	0.00									1.20
Total Pervious Site Area (ha)	0.52	0.26	0.43	0.00									1.20
Percentage of Total Site Area	38.8%	19.4%	32.4%	0.0%									91%

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Climate Data (Waterloo Wellington A Climate Normals, 1981 - 2010)[‡]													
Average Daily Temperature (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	**7.0**
Precipitation (mm)	65.2	54.9	61	74.5	82.3	82.4	98.6	83.9	87.8	67.4	87.1	71.2	**916**

Potential Evapotranspiration Analysis for Site	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Heat Index	0.0	0.0	0.0	1.4	4.0	6.7	8.2	7.5	5.0	2.1	0.4	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.0	60.8	87.2	99.8	94.0	71.1	39.0	11.1	0.0	**492**
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	32	75	112	126	110	74	36	9	0	**573**
Precipitation - PET (mm)	65	55	61	42	8	-30	-27	-26	14	32	78	71	**343**

Evapotranspiration Analysis													
Sub-Area A	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-65	-28	0	0	
Storage (S)	300	300	300	300	300	272	248	228	242	273	300	300	
Change in Storage	0	0	0	0	0	-28	-23	-20	14	32	27	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	111	122	104	74	36	9	0	**563**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	51	71	**353**
Potential Infiltration (I)	42	36	40	27	5	0	0	0	0	0	33	46	230
Potential Direct Surface Water Runoff (R)	23	19	21	15	3	0	0	0	0	0	18	25	124
Potential Infiltration (mm)	0	0	0	191	5	0	0	0	0	0	33	0	230
Pervious Evapotranspiration (m^3)	0	0	0	167	385	571	629	537	382	185	46	0	2,902
Pervious Runoff (m^3)	118	99	110	76	14	0	0	0	0	0	93	128	**637**
Pervious Infiltration (m^3)	0	0	0	986	25	0	0	0	0	0	172	0	**1,184**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

TABLE 9 - PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENT 101 (LANDS DRAINING TO THE UPPER HANLON CREEK SUBWATERSHED)

Evapotranspiration Analysis													
Sub-Area B	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-60	-19	0	0	
Storage (S)	150	150	150	150	150	123	103	87	100	132	150	150	
Change in Storage	0	0	0	0	0	-27	-20	-16	14	32	18	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	109	119	100	74	36	9	0	**554**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	60	71	**362**
Potential Infiltration (I)	39	33	37	25	5	0	0	0	0	0	36	43	217
Potential Direct Surface Water Runoff (R)	26	22	24	17	3	0	0	0	0	0	24	28	145
Potential Infiltration (mm)	0	0	0	177	5	0	0	0	0	0	36	0	217
Pervious Evapotranspiration (m^3)	0	0	0	84	193	282	307	258	191	92	23	0	1,431
Pervious Runoff (m^3)	67	57	63	43	8	0	0	0	0	0	62	74	**374**
Pervious Infiltration (m^3)	0	0	0	456	12	0	0	0	0	0	93	0	**560**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Evapotranspiration Analysis													
Sub-Area C	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-50	-5	0	0	
Storage (S)	75	75	75	75	75	50	35	25	39	70	75	75	
Change in Storage	0	0	0	0	0	-25	-15	-10	14	32	5	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	107	114	94	74	36	9	0	**541**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	73	71	**375**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	37	0	188
Pervious Evapotranspiration (m^3)	0	0	0	140	322	461	491	406	320	154	39	0	2,333
Pervious Runoff (m^3)	141	118	132	91	16	0	0	0	0	0	158	154	**809**
Pervious Infiltration (m^3)	0	0	0	635	16	0	0	0	0	0	158	0	**809**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Evapotranspiration Analysis													
Sub-Area D	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-50	-5	0	0	
Storage (S)	75	75	75	75	75	50	35	25	39	70	75	75	
Change in Storage	0	0	0	0	0	-25	-15	-10	14	32	5	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	107	114	94	74	36	9	0	**541**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	73	71	**375**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	37	0	188
Pervious Evapotranspiration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	81	68	75	92	102	102	122	104	108	83	108	88	**1,132**

TABLE 9 - PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENT 101 (LANDS DRAINING TO THE UPPER HANLON CREEK SUBWATERSHED)

Pre-Development Infiltration (INF)	2,553	m^3/yr	192	mm/yr	0.1	L/s
Pre-Development Runoff (R)	2,952	m^3/yr	222	mm/yr	0.1	L/s
Pre-Development Evapotranspiration (ET)	6,666	m^3/yr	501	mm/yr	0.2	L/s
Total = INF + R + ET	12,171	m^3/yr	915	mm/yr	0.4	L/s
Precipitation	12,171	m^3/yr	916	mm/yr	0.4	L/s

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area A	Rolling, Fine Sandy to Silt Loam, Mature Forest
Sub-Area B	Rolling, Fine Sandy to Silt Loam, Pasture and Shrubs
Sub-Area C	Rolling, Fine Sandy to Silt Loam, Urban Lawn
Sub-Area D	Rolling, Fine Sandy to Silt Loam, Urban Lawn, 95% Impervious Cover

Notes:

† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.

‡ Climate Data after Environment Canada, 2020. Canadian Climate Normals 1981-2010, Waterloo Wellington A Station, Climate ID 6149387. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html Accessed June 30, 2020.

Assumptions:
[1] The monthly average precipitation collected at the Waterloo Wellington A climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

TABLE 10 - PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENT 102 (LANDS DRAINING TO TORRANCE CREEK SUBWATERSHED)

Pre-Development
Model Type: Thornthwaite and Mather (1955)
Client: Tricar Developments Inc.
Location Catchment 102 (Lands Draining to Torrance Creek Subwatershed)
Total Site Area (ha) 1.73

Land Description Factors (Sub-area descriptions provided below)	**Sub-Area A**	**Sub-Area B**	**Sub-Area C**										**Total**
Topography	0.20	0.20	0.20										
Soils	0.25	0.25	0.25										
Cover	0.20	0.15	0.05										
Sum (Infiltration Factor)†	0.65	0.60	0.50										
Soil Moisture Capacity (mm)	300	150	75										
Site area (ha)	0.98	0.72	0.03										1.73
Imperviousness Coefficient	0.01	0.01	0.01										
Impervious Area (ha)	0.01	0.01	0.00										0.02
Percentage of Total Site Area	0.6%	0.4%	0.0%										1%
Remaining Pervious Area (ha)	0.97	0.71	0.03										1.71
Total Pervious Site Area (ha)	0.97	0.71	0.03										1.71
Percentage of Total Site Area	56.1%	41.2%	1.6%										99%

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Climate Data (Waterloo Wellington A Climate Normals, 1981 - 2010)‡													
Average Daily Temperature (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	**7.0**
Precipitation (mm)	65.2	54.9	61	74.5	82.3	82.4	98.6	83.9	87.8	67.4	87.1	71.2	**916**
Potential Evapotranspiration Analysis for Site	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Heat Index	0.0	0.0	0.0	1.4	4.0	6.7	8.2	7.5	5.0	2.1	0.4	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.0	60.8	87.2	99.8	94.0	71.1	39.0	11.1	0.0	**492**
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	32	75	112	126	110	74	36	9	0	**573**
Precipitation - PET (mm)	65.2	54.9	61.0	42.0	7.6	-29.7	-27.0	-25.6	13.7	31.6	78.1	71.2	**343**
	0	0	0	100	100	100	100	100	100	100	100	0	
Evapotranspiration Analysis													
Sub-Area A	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)	639	538	598	730	807	807	966	822	860	660	854	698	**8,979**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-65	-28	0	0	
Storage (S)	300	300	300	300	300	272	248	228	242	273	300	300	
Change in Storage	0	0	0	0	0	-28	-23	-20	14	32	27	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	111	122	104	74	36	9	0	**563**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	51	71	**353**
Potential Infiltration (I)	42	36	40	27	5	0	0	0	0	0	33	46	230
Potential Direct Surface Water Runoff (R)	23	19	21	15	3	0	0	0	0	0	18	25	124
Potential Infiltration (mm)	0	0	0	191	5	0	0	0	0	0	33	0	230
Pervious Evapotranspiration (m^3)	0	0	0	315	725	1074	1184	1011	719	347	87	0	5,462
Pervious Runoff (m^3)	221	186	207	143	26	0	0	0	0	0	174	242	**1,200**
Pervious Infiltration (m^3)	0	0	0	1856	48	0	0	0	0	0	324	0	**2,228**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	6	5	6	7	8	8	10	8	9	7	9	7	**90**

TABLE 10 - PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENT 102 (LANDS DRAINING TO TORRANCE CREEK SUBWATERSHED)

Evapotranspiration Analysis													
Sub-Area B	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)	469	395	439	536	593	593	710	604	632	485	627	513	**6,598**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-60	-19	0	0	
Storage (S)	150	150	150	150	150	123	103	87	100	132	150	150	
Change in Storage	0	0	0	0	0	-27	-20	-16	14	32	18	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	109	119	100	74	36	9	0	**554**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	60	71	**362**
Potential Infiltration (I)	39	33	37	25	5	0	0	0	0	0	36	43	217
Potential Direct Surface Water Runoff (R)	26	22	24	17	3	0	0	0	0	0	24	28	145
Potential Infiltration (mm)	0	0	0	177	5	0	0	0	0	0	36	0	217
Pervious Evapotranspiration (m^3)	0	0	0	232	533	780	847	713	528	255	64	0	3,952
Pervious Runoff (m^3)	186	157	174	120	22	0	0	0	0	0	171	203	**1,032**
Pervious Infiltration (m^3)	0	0	0	1259	32	0	0	0	0	0	257	0	**1,548**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	5	4	4	5	6	6	7	6	6	5	6	5	**66**

Evapotranspiration Analysis													
Sub-Area C	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)	18	16	17	21	23	23	28	24	25	19	25	20	**260**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-50	-5	0	0	
Storage (S)	75	75	75	75	75	50	35	25	39	70	75	75	
Change in Storage	0	0	0	0	0	-25	-15	-10	14	32	5	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	107	114	94	74	36	9	0	**541**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	73	71	**375**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	37	0	188
Pervious Evapotranspiration (m^3)	0	0	0	9	21	30	32	26	21	10	3	0	152
Pervious Runoff (m^3)	9	8	9	6	1	0	0	0	0	0	10	10	**53**
Pervious Infiltration (m^3)	0	0	0	41	1	0	0	0	0	0	10	0	**53**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**3**

Catchment 102						
Pre-Development Infiltration (INF)	3,828	m^3/yr	222	mm/yr	0.1	L/s
Pre-Development Runoff (R)	2,443	m^3/yr	141	mm/yr	0.1	L/s
Pre-Development Evapotranspiration (ET)	9,566	m^3/yr	553	mm/yr	0.3	L/s
Total = INF + R + ET	15,837	m^3/yr	916	mm/yr	0.5	L/s
Precipitation	15,837	m^3/yr	916	mm/yr	0.5	L/s
Error	0.000	m^3/yr	0.000	mm/yr	0.000	L/s

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area A	Rolling, Fine Sandy to Silt Loam, Mature Forest
Sub-Area B	Rolling, Fine Sandy to Silt Loam, Pasture and Shrubs
Sub-Area C	Rolling, Fine Sandy to Silt Loam, Urban Lawn

Notes:

† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.

‡ Climate Data after Environment Canada, 2020. Canadian Climate Normals 1981-2010, Waterloo Wellington A Station, Climate ID 6149387. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html Accessed June 30, 2020.

Assumptions:
[1] The monthly average precipitation collected at the Waterloo Wellington A climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

TABLE 11
1981 TO 2010 CANADIAN CLIMATE NORMALS (WATERLOO WELLINGTON A)

Climate Normals 1981-2010 Station Data
Metadata including Station Name, Province, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_NAME	PROVINCE	LATITUDE	LONGITUDE	ELEVATION	CLIMATE_ID	WMO_ID	TC_ID
WATERLOO WELLINGTON A	ON	43°27'00.000" N	80°23'00.000" W	317.0 m	6149387		

Legend
A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)
B = At least 25 years
C = At least 20 years
D = At least 15 years

1981 to 2010 Canadian Climate Normals Station Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Temperature														
Daily Average (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	7	C
Standard Deviation	2.9	2.5	2	1.4	2.1	1.3	1.3	1.3	1.2	1.4	1.5	2.9	0.9	C
Daily Maximum (°C)	-2.6	-1.2	3.6	11.5	18.5	23.6	26	24.8	20.4	13.5	6.3	0.2	12	C
Daily Minimum (°C)	-10.3	-9.7	-5.6	0.8	6.4	11.5	14	12.9	8.6	2.9	-1.4	-6.8	2	C
Extreme Maximum (°C)	14.2	13.7	24.4	29.2	32	36.1	36	36.5	33.3	29.4	21.7	18.7		
Date (yyyy/dd)	1995/14	2000/26	2000/08	1990/25	1987/28	1988/25	1988/07	2001/08	1973/03	1971/02	1974/01	1982/03		
Extreme Minimum (°C)	-31.9	-29.2	-25.4	-16.1	-3.9	-0.6	5	1.1	-3.7	-8.3	-15.4	-27.2		
Date (yyyy/dd)	1984/16	1979/18	1980/02	1972/08	1970/07	1972/11	1971/03	1982/29	1989/27	1976/27	2000/23	1980/25		
Precipitation														
Rainfall (mm)	28.7	29.7	36.8	68	81.8	82.4	98.6	83.9	87.8	66.1	75	38	776.8	C
Snowfall (cm)	43.7	30.3	26.5	7.3	0.4	0	0	0	0	1.4	13	37.2	159.7	C
Precipitation (mm)	65.2	54.9	61	74.5	82.3	82.4	98.6	83.9	87.8	67.4	87.1	71.2	916.5	C
Average Snow Depth (cm)	11	11	6	0	0	0	0	0	0	0	1	5	3	C
Median Snow Depth (cm)	11	11	4	0	0	0	0	0	0	0	0	3	3	C
Snow Depth at Month-end (cm)	12	9	1	0	0	0	0	0	0	0	1	9	3	C
Extreme Daily Rainfall (mm)	43	47	36.8	53.4	51.8	54.2	89.8	73.7	74.4	39.2	56	36.8		
Date (yyyy/dd)	1995/15	2001/09	1991/27	1992/16	1996/20	1984/17	1985/15	1975/24	1986/10	1977/08	1992/12	1990/29		
Extreme Daily Snowfall (cm)	16.8	17.8	21.2	22.9	6	0	0	0	0	6	16.6	22.4		
Date (yyyy/dd)	1992/14	1985/12	1980/08	2002/02	1984/13	1970/01	1970/01	1970/01	1970/01	1997/26	1986/20	1971/30		
Extreme Daily Precipitation (mm)	43	47	53.8	53.4	51.8	54.2	89.8	73.7	74.4	39.2	56	36.8		
Date (yyyy/dd)	1995/15	2001/09	1976/02	1992/16	1996/20	1984/17	1985/15	1975/24	1986/10	1977/08	1992/12	1990/29		
Extreme Snow Depth (cm)	58	74	77	18	0	0	0	0	0	2	19	50		
Date (yyyy/dd)	1976/24	1982/14	1982/10	1975/04	1970/01	1970/01	1970/01	1970/01	1970/01	1989/21	1986/21	2000/31		
Days with Maximum Temperature														
<= 0 °C	20.7	15.7	9.2	0.64	0	0	0	0	0	0	3.2	14	63.5	C
> 0 °C	10.3	12.5	21.8	29.4	31	30	31	31	30	31	26.8	17	301.7	C
> 10 °C	0.45	0.5	4.9	17.3	29.3	29.9	31	31	29.6	22.5	7.4	1.6	205.4	C
> 20 °C	0	0	0.29	2.9	11.6	23.5	29.7	28.1	15.9	3.6	0.15	0	115.7	C
> 30 °C	0	0	0	0	0.32	2.1	3.6	1.9	0.45	0	0	0	8.4	C
> 35 °C	0	0	0	0	0	0.05	0.23	0.05	0	0	0	0	0.33	C
Days with Minimum Temperature														
> 0 °C	1.5	1.9	4	15.5	28.9	30	31	31	29.2	21.7	10.4	2.5	207.6	C
<= 2 °C	30.5	27.9	29.2	19.6	6.1	0.23	0	0.09	2.6	14.6	24.2	29.8	184.7	C
<= 0 °C	29.5	26.4	27	14.5	2.1	0	0	0	0.77	9.3	19.7	28.5	157.6	C
< -2 °C	27.2	23.6	21.9	8.3	0.18	0	0	0	0.18	3.8	13.1	23.1	121.3	C
< -10 °C	15.1	13.4	6.7	0.18	0	0	0	0	0	0	0.85	9.1	45.4	C
< -20 °C	2.9	2	0.41	0	0	0	0	0	0	0	0	0.67	6	C
< - 30 °C	0.05	0	0	0	0	0	0	0	0	0	0	0	0.05	C
Days with Rainfall														
>= 0.2 mm	5.6	5	6.9	11.5	12.4	12	10.6	10.7	12.2	13.7	11.6	6.9	118.7	C
>= 5 mm	1.8	1.8	2.5	4.1	5.1	5.2	5.1	4.4	5	4.4	4.7	2.8	46.9	C
>= 10 mm	0.95	1	1.4	2.1	2.9	3.1	3.4	2.8	2.8	2.4	2.4	1.2	26.4	C
>= 25 mm	0.09	0.14	0.09	0.32	0.45	0.36	0.95	0.77	0.68	0.14	0.48	0.14	4.6	C
Days With Snowfall														
>= 0.2 cm	16.1	11.9	9	3.3	0.18	0	0	0	0	0.91	6.5	14.4	62.2	C
>= 5 cm	2.5	1.8	1.9	0.36	0.05	0	0	0	0	0.05	0.67	2.3	9.6	C
>= 10 cm	0.64	0.5	0.64	0.09	0	0	0	0	0	0	0.05	0.57	2.5	C
>= 25 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	C
Days with Precipitation														
>= 0.2 mm	18.2	14.2	13.8	13.7	12.4	12	10.6	10.7	12.2	13.9	16.4	18.1	166	C
>= 5 mm	4.3	3.2	4	4.5	5.2	5.2	5.1	4.4	5	4.5	5.3	4.5	55.1	C
>= 10 mm	1.5	1.6	1.8	2.3	2.9	3.1	3.4	2.8	2.8	2.4	2.5	2.1	29.2	C
>= 25 mm	0.09	0.18	0.27	0.32	0.45	0.36	0.95	0.77	0.68	0.14	0.48	0.38	5.1	C
Days with Snow Depth														
>= 1 cm	26.9	24.3	17.2	1.7	0	0	0	0	0	0.18	5.6	19.4	95.3	C
>= 5 cm	20.6	17.5	9.7	0.41	0	0	0	0	0	0	1.1	10.5	59.8	C
>= 10 cm	13.7	11.2	6.5	0.05	0	0	0	0	0	0	0.33	4.5	36.2	C
>= 20 cm	6.8	5.1	1.5	0	0	0	0	0	0	0	0	1.4	14.7	C
Wind														
Speed (km/h)	15.2	14.3	14.9	14.6	12.3	10.4	9.6	8.5	9.8	11.7	14.5	14.8	12.6	C
Most Frequent Direction	W	W	W	NW	NW	NW	NW	NW	NW	W	W	SW	W	C
Maximum Hourly Speed (km/h)	70	67	74	72	71	52	52	45	53	63	66	61	74	
Date (yyyy/dd)	1982/04	2002/01	2002/09	1984/30	1976/05	1998/02	2001/01	1966/09	1967/26	2001/26	1975/10	1972/13	2002/09	
Direction of Maximum Hourly Speed	SW	W	W	S	SW	W	NW	W	S	SW	SW	SW	W	
Maximum Gust Speed (km/h)	113	113	120	98	106	89	111	98	89	96	100	96	120	
Date (yyyy/dd)	1978/26	2002/01	1981/30	1984/30	1976/05	1998/02	1997/14	1990/27	1997/29	2001/25	1998/11	1982/28	1981/30	

TABLE 11
1981 TO 2010 CANADIAN CLIMATE NORMALS (WATERLOO WELLINGTON A)

Direction of Maximum Gust	S	W	SW	SW	SW	W	W	N	W	SW	SW	SW	SW	
Days with Winds >= 52 km/h														
Days with Winds >= 63 km/h														
Degree Days														
Above 24 °C	0	0	0	0	0.1	1.6	5.2	2.5	0.3	0	0	0	9.8	C
Above 18 °C	0	0	0	1	10.2	40.9	77.2	54.7	16.6	0.7	0	0	201.4	C
Above 15 °C	0	0	0.1	3.7	30.2	94.1	157.3	125	46.3	4.5	0	0	461.2	C
Above 10 °C	0	0	2.3	20.3	103.6	227.6	310.8	275.6	145.8	33	3.8	0.6	1123.2	C
Above 5 °C	1.2	0.9	13.4	75.1	234.7	376.8	465.8	430.5	286.4	115.6	28.1	5	2033.3	C
Above 0 °C	11	13.9	55.4	190.6	388.6	526.8	620.8	585.5	436.2	255.6	100.1	26.1	3210.6	C
Below 0 °C	211.7	168	89.7	6.1	0	0	0	0	0	0.2	23.6	129.4	628.8	C
Below 5 °C	356.8	296.1	202.7	40.7	1.1	0	0	0	0.1	15.2	101.7	263.3	1277.6	C
Below 10 °C	510.7	436.4	346.7	135.8	25	0.8	0	0.2	9.6	87.5	227.3	413.8	2193.7	C
Below 15 °C	665.7	577.5	499.4	269.3	106.6	17.2	1.5	4.6	60.1	214.1	373.6	568.3	3357.8	C
Below 18 °C	758.7	662.2	592.4	356.6	179.7	54	14.4	27.2	120.4	303.3	463.6	661.3	4193.6	C
Humidex														
Extreme Humidex	13.4	13	28	33.7	39.6	43.2	47.7	48.3	41.2	34.5	24.4	22.1		
Date (yyyy/dd)	1995/14	1997/21	1998/30	2002/16	1987/30	1988/25	1995/14	1988/02	1983/10	1971/02	1987/03	1982/03		
Wind Chill														
Extreme Wind Chill	-40.5	-37.1	-30.2	-20.6	-8.1	0	0	0	-4.1	-11.9	-22.2	-31.2		
Date (yyyy/dd)	1982/17	1979/17	1989/07	1982/04	1978/01	1966/13	1966/01	1966/01	1989/27	1969/23	1976/29	1983/26		
Humidity														
Average Relative Humidity - 0600LST (%)	86.4	83.4	84.8	84.4	84.7	87	90.1	93.6	94.3	90.6	87.6	87.1	87.8	D
Average Relative Humidity - 1500LST (%)	78.2	75.4							66.5	69.7		81.7		

1981 to 2010 Canadian Climate Normals station data (Frost-Free)							
	Frost-Free:	Code					
Average Date of Last Spring Frost	7-May	D					
Average Date of First Fall Frost	2-Oct	D					
Average Length of Frost-Free Period	147 Days	D					
Probability of last temperature in spring of 0 °C or lower or	10%	25%	33%	50%	66%	75%	90%
Date	18-May	15-May	13-May	8-May	4-May	30-Apr	28-Apr
Probability of first temperature in fall of 0 °C or lower on or	10%	25%	33%	50%	66%	75%	90%
Date	19-Sep	24-Sep	25-Sep	30-Sep	3-Oct	8-Oct	16-Oct
Probability of frost-free period equal to or less than indicate	10%	25%	33%	50%	66%	75%	90%
Days	128	135	136	144	152	157	169

Source: Environment Canada, 2020. Canadian Climate Normals 1981-2010. Online [http://climate.weather.gc.ca/climate_normals/index_e.html] Last Accessed February 2018

TABLE 12 - POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 201 TO 204 AND 207 TO 209 (LANDS DRAINING TO THE UPPER HANLON CREEK SUBWATERSHED)

Post-Development
Model Type: Thornthwaite and Mather (1955)
Client: Tricar Developments Inc.
Location **Former Catchment 101 (Lands Draining to Upper Hanlon Creek Subwatershed)**
Post-Development Catchments 201 to 204 and 207 to 209
Total Site Area (ha) 1.46

Land Description Factors (Sub-area descriptions provided below)	**Sub-Area A**	**Sub-Area B**	**Sub-Area C**										**Total**
Topography	0.20	0.20	0.20										
Soils	0.25	0.25	0.25										
Cover	0.05	0.05	0.05										
Sum (Infiltration Factor)[†]	0.50	0.50	0.50										
Soil Moisture Capacity (mm)	300	150	75										
Site area (ha)	0.51	0.32	0.63										1.46
Imperviousness Coefficient	0.91	0.94	0.63										
Impervious Area (ha)	0.46	0.30	0.40										1.16
Percentage of Total Site Area	31.6%	20.7%	27.2%										79.5%
Remaining Pervious Area (ha)	0.05	0.02	0.23										0.30
Total Pervious Site Area (ha)	0.05	0.02	0.23										0.30
Percentage of Total Site Area	3.2%	1.4%	15.9%										20.5%

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Climate Data (Waterloo Wellington A Climate Normals, 1981 - 2010)[‡]													
Average Daily Temperature (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	**7.0**
Precipitation (mm)	65.2	54.9	61	74.5	82.3	82.4	98.6	83.9	87.8	67.4	87.1	71.2	**916**

Potential Evapotranspiration Analysis for Site	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Heat Index	0.0	0.0	0.0	1.4	4.0	6.7	8.2	7.5	5.0	2.1	0.4	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.0	60.8	87.2	99.8	94.0	71.1	39.0	11.1	0.0	**492**
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	32	75	112	126	110	74	36	9	0	**573**
Precipitation - PET (mm)	65	55	61	42	8	-30	-27	-26	14	32	78	71	**343**

Evapotranspiration Analysis **Sub-Area A**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)													**4,647**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-65	-28	0	0	
Storage (S)	300	300	300	300	300	272	248	228	242	273	300	300	
Change in Storage	0	0	0	0	0	-28	-23	-20	14	32	27	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	111	122	104	74	36	9	0	563
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	51	71	**353**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	26	36	177
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	26	36	177
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	26	0	177
Pervious Evapotranspiration (m^3)	0	0	0	15	34	51	56	48	34	16	4	0	259
Pervious Runoff (m^3)	15	13	14	10	2	0	0	0	0	0	12	16	**81**
Pervious Infiltration (m^3)	0	0	0	68	2	0	0	0	0	0	12	0	**81**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	301	253	281	344	380	380	455	387	405	311	402	328	**4,225**

TABLE 12 - POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 201 TO 204 AND 207 TO 209 (LANDS DRAINING TO THE UPPER HANLON CREEK SUBWATERSHED)

Evapotranspiration Analysis													
Sub-Area B	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)													**2,944**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-60	-19	0	0	
Storage (S)	150	150	150	150	150	123	103	87	100	132	150	150	
Change in Storage	0	0	0	0	0	-27	-20	-16	14	32	18	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	109	119	100	74	36	9	0	**554**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	60	71	**362**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	30	36	181
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	30	36	181
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	30	0	181
Pervious Evapotranspiration (m^3)	0	0	0	6	15	22	24	20	15	7	2	0	110
Pervious Runoff (m^3)	6	5	6	4	1	0	0	0	0	0	6	7	**36**
Pervious Infiltration (m^3)	0	0	0	29	1	0	0	0	0	0	6	0	**36**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	197	165	184	225	248	248	297	253	265	203	263	215	**2,762**

Evapotranspiration Analysis													
Sub-Area C	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)													**5,766**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-50	-5	0	0	
Storage (S)	75	75	75	75	75	50	35	25	39	70	75	75	
Change in Storage	0	0	0	0	0	-25	-15	-10	14	32	5	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	107	114	94	74	36	9	0	**541**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	73	71	**375**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	37	0	188
Pervious Evapotranspiration (m^3)	0	0	0	75	174	248	265	219	172	83	21	0	1,257
Pervious Runoff (m^3)	76	64	71	49	9	0	0	0	0	0	85	83	**436**
Pervious Infiltration (m^3)	0	0	0	342	9	0	0	0	0	0	85	0	**436**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	259	218	242	296	327	327	391	333	348	268	346	283	**3,637**

Post-Development Catchments 201 to 204 and 207 to 209

Post-Development Infiltration (INF)	553	m^3/yr	38	mm/yr	0.0	L/s
Post-Development Runoff (R)	11,177	m^3/yr	767	mm/yr	0.4	L/s
Post-Development Evapotranspiration (ET)	1,626	m^3/yr	112	mm/yr	0.1	L/s
Total = INF + R + ET	13,356	m^3/yr	916	mm/yr	0.4	L/s
Precipitation	13,356	m^3/yr	916	mm/yr	0.4	L/s

Pre-Development Infiltration	2,553	m^3/yr
Infiltration Deficit	**-2,000**	**m^3/yr**

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area A	Rolling, Fine Sandy to Silt Loam, Mature Forest
Sub-Area B	Rolling, Fine Sandy to Silt Loam, Pasture and Shrubs
Sub-Area C	Rolling, Fine Sandy to Silt Loam, Urban Lawn

Notes:

† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.

‡ Climate Data after Environment Canada, 2020. Canadian Climate Normals 1981-2010, Waterloo Wellington A Station, Climate ID 6149387. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html Accessed June 30, 2020.

Assumptions:
[1] The monthly average precipitation collected at the Waterloo Wellington A climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

TABLE 13 - POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 205 AND 206 (LANDS DRAINING TO TORRANCE CREEK SUBWATERSHED)

	Post-Development
Model Type:	Thornthwaite and Mather (1955)
Client:	Tricar Developments Inc.
Location	**Former Catchment 102 (Lands Draining to Torrance Creek Subwatershed)**
	Post-Development Catchments 205 and 206
Total Site Area (ha)	1.60

Land Description Factors (Sub-area descriptions provided below)	**Sub-Area A**	**Sub-Area B**	**Sub-Area C**										**Total**
Topography	0.20	0.20	0.20										
Soils	0.25	0.25	0.25										
Cover	0.20	0.15	0.05										
Sum (Infiltration Factor)†	0.65	0.60	0.50										
Soil Moisture Capacity (mm)	300	150	75										
Site area (ha)	0.99	0.58	0.03										1.60
Imperviousness Coefficient	0.01	0.01	0.01										
Impervious Area (ha)	0.01	0.01	0.00										0.02
Percentage of Total Site Area	0.6%	0.4%	0.0%										1.0%
Remaining Pervious Area (ha)	0.98	0.57	0.03										1.58
Total Pervious Site Area (ha)	0.98	0.57	0.03										1.58
Percentage of Total Site Area	61.2%	35.8%	2.1%										99.0%

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Climate Data (Waterloo Wellington A Climate Normals, 1981 - 2010)‡													
Average Daily Temperature (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	**7.0**
Precipitation (mm)	65.2	54.9	61	74.5	82.3	82.4	98.6	83.9	87.8	67.4	87.1	71.2	**916**

Potential Evapotranspiration Analysis for Site	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Heat Index	0.0	0.0	0.0	1.4	4.0	6.7	8.2	7.5	5.0	2.1	0.4	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.0	60.8	87.2	99.8	94.0	71.1	39.0	11.1	0.0	**492**
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	32	75	112	126	110	74	36	9	0	**573**
Precipitation - PET (mm)	65	55	61	42	8	-30	-27	-26	14	32	78	71	**343**

Evapotranspiration Analysis													
Sub-Area A	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)													**9,053**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-65	-28	0	0	
Storage (S)	300	300	300	300	300	272	248	228	242	273	300	300	
Change in Storage	0	0	0	0	0	-28	-23	-20	14	32	27	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	111	122	104	74	36	9	0	563
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	51	71	**353**
Potential Infiltration (I)	42	36	40	27	5	0	0	0	0	0	33	46	230
Potential Direct Surface Water Runoff (R)	23	19	21	15	3	0	0	0	0	0	18	25	124
Potential Infiltration (mm)	0	0	0	191	5	0	0	0	0	0	33	0	230
Pervious Evapotranspiration (m^3)	0	0	0	318	731	1083	1193	1019	725	350	88	0	5,507
Pervious Runoff (m^3)	223	188	209	144	26	0	0	0	0	0	176	244	**1,209**
Pervious Infiltration (m^3)	0	0	0	1871	48	0	0	0	0	0	327	0	**2,246**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	6	5	6	7	8	8	10	8	9	7	9	7	**91**

TABLE 13 - POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 205 AND 206 (LANDS DRAINING TO TORRANCE CREEK SUBWATERSHED)

Evapotranspiration Analysis													
Sub-Area B	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)													**5,294**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-60	-19	0	0	
Storage (S)	150	150	150	150	150	123	103	87	100	132	150	150	
Change in Storage	0	0	0	0	0	-27	-20	-16	14	32	18	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	109	119	100	74	36	9	0	**554**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	60	71	**362**
Potential Infiltration (I)	39	33	37	25	5	0	0	0	0	0	36	43	217
Potential Direct Surface Water Runoff (R)	26	22	24	17	3	0	0	0	0	0	24	28	145
Potential Infiltration (mm)	0	0	0	177	5	0	0	0	0	0	36	0	217
Pervious Evapotranspiration (m^3)	0	0	0	186	427	626	680	572	424	205	51	0	3,171
Pervious Runoff (m^3)	149	126	140	96	17	0	0	0	0	0	137	163	**828**
Pervious Infiltration (m^3)	0	0	0	1010	26	0	0	0	0	0	206	0	**1,242**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	4	3	4	4	5	5	6	5	5	4	5	4	**53**

Evapotranspiration Analysis													
Sub-Area C	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation (m^3)													**303**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-50	-5	0	0	
Storage (S)	75	75	75	75	75	50	35	25	39	70	75	75	
Change in Storage	0	0	0	0	0	-25	-15	-10	14	32	5	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	107	114	94	74	36	9	0	**541**
Recharge/Runoff Analysis													
Water Surplus (mm)	65	55	61	42	8	0	0	0	0	0	73	71	**375**
Potential Infiltration (I)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Direct Surface Water Runoff (R)	33	27	31	21	4	0	0	0	0	0	37	36	188
Potential Infiltration (mm)	0	0	0	147	4	0	0	0	0	0	37	0	188
Pervious Evapotranspiration (m^3)	0	0	0	11	24	35	37	31	24	12	3	0	177
Pervious Runoff (m^3)	11	9	10	7	1	0	0	0	0	0	12	12	**62**
Pervious Infiltration (m^3)	0	0	0	48	1	0	0	0	0	0	12	0	**62**
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	65	55	61	75	82	82	99	84	88	67	87	71	916
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**3**

Catchments 205 and 206

Post-Development Infiltration (INF)	3,550	m^3/yr	222	mm/yr	0.1	L/s
Post-Development Runoff (R)	2,245	m^3/yr	140	mm/yr	0.1	L/s
Post-Development Evapotranspiration (ET)	8,855	m^3/yr	554	mm/yr	0.3	L/s
Total = INF + R + ET	14,650	m^3/yr	916	mm/yr	0.5	L/s
Precipitation	14,650	m^3/yr	916	mm/yr	0.5	L/s

Pre-Development Infiltration	3,828	m^3/yr
Infiltration Deficit	**-279**	**m^3/yr**

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area A	Rolling, Fine Sandy to Silt Loam, Mature Forest
Sub-Area B	Rolling, Fine Sandy to Silt Loam, Pasture and Shrubs
Sub-Area C	Rolling, Fine Sandy to Silt Loam, Urban Lawn

Notes:

† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.

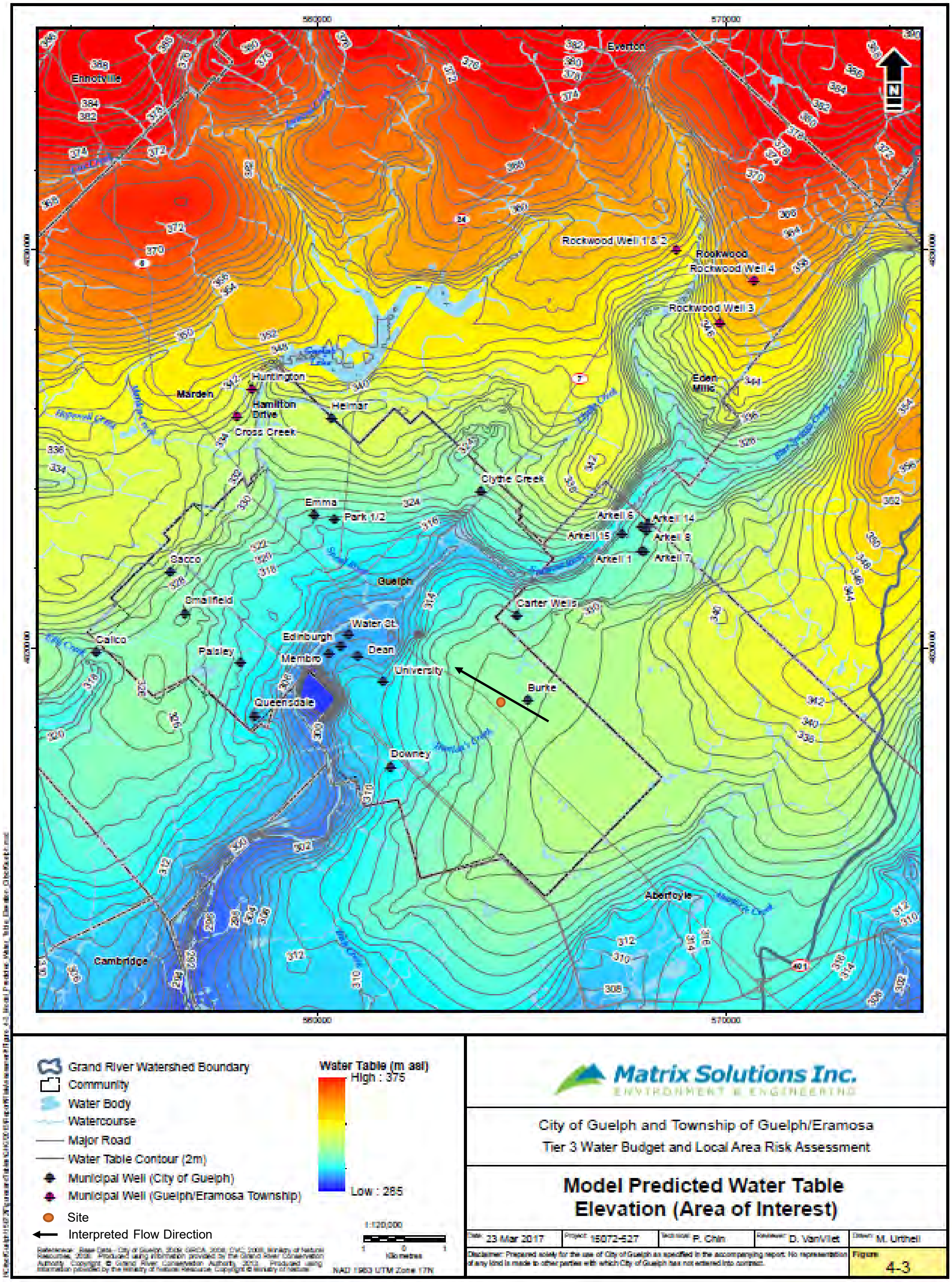
‡ Climate Data after Environment Canada, 2020. Canadian Climate Normals 1981-2010, Waterloo Wellington A Station, Climate ID 6149387. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html Accessed June 30, 2020.

Assumptions:
[1] The monthly average precipitation collected at the Waterloo Wellington A climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

TABLE 14 - GROUNDWATER MOUNDING ANALYSIS

Storm Event	Duration of Infiltration Period (1) (days)	Groundwater Mounding Height Above Seasonal High Water Table at Distance (d) from Center of Infiltration Gallery																			
		d = 0 m		d = 6 m		d = 12 m		d = 15 m		d = 18 m		d = 21 m		d =24 m		d = 27 m		d = 30 m		d = 36 m	
		(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)	(m)	(m AMSL)
East Infiltration Trench																					
Obvert (Top) Elevation =		340.40	m AMSL																		
Invert (Base) Elevation =		340.00	m AMSL																		
High Groundwater =		339.20	m AMSL	as estimated from Figure 1																	
25 mm		*0.59*	339.79	*0.40*	339.60	*0.17*	339.37	*0.11*	339.31	*0.07*	339.27	*0.04*	339.24	*0.03*	339.23	*0.02*	339.22	*0.01*	339.21	*0.00*	339.20
South Infiltration Trench																					
Obvert (Top) Elevation =		340.86	m AMSL																		
Invert (Base) Elevation =		340.43	m AMSL																		
High Groundwater =		339.00	m AMSL	as estimated from Figure 1																	
25 mm	1.00	*1.06*	340.06	*1.01*	340.01	*0.85*	339.85	*0.69*	339.69	*0.48*	339.48	*0.33*	339.33	*0.22*	339.22	*0.14*	339.14	*0.09*	339.09	*0.04*	339.04

APPENDIX C:
REGIONAL GROUNDWATER FLOW MAPPING



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

City of Guelph and Township of Guelph/Eramosa
Tier 3 Water Budget and Local Area Risk Assessment

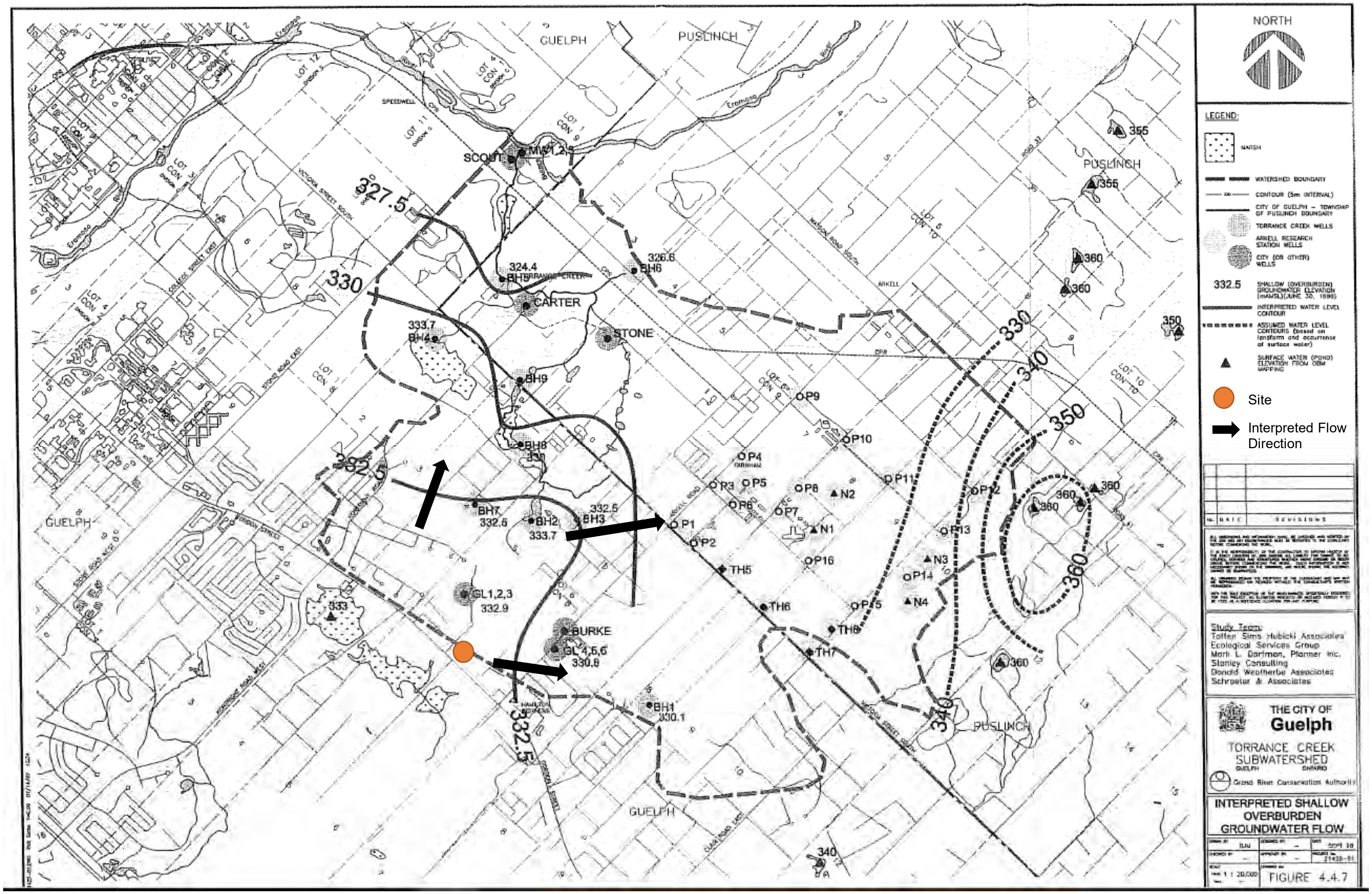
Model Predicted Water Table Elevation (Area of Interest)

Date	Project	Technical	Reviewer	Drawn
23 Mar 2017	15072-527	P. Chin	D. VanVliet	M. Urtheil

Disclaimer: Prepared solely for the use of City of Guelph as specified in the accompanying report. No representation of any kind is made to other parties with which City of Guelph has not entered into contract.

Figure 4-3

Source: Matrix Solutions Inc. 2017. City of Guelph and Township of Guelph/Eramosa Tier Three Water Budget and Local Area Risk Assessment.



Source: Totten Sims Hubicki Associates, Ecological Services Group, Ray Blackport, Mark L. Dorfman Planner Inc., Shroeter & Associates, and Donald G. Weatherbe Associates. 1998. Torrance Creek Subwatershed Study - Management Study. Prepared for City of Guelph and Grand River Conservation Authority, September 1998, September 1998, Revised November 1998.

APPENDIX D:
REGIONAL GROUNDWATER RECHARGE MAPPING

Map Centre (UTM NAD83 z17): 564,582.48 4,818,656.58

This map is not to be used for navigation

Grand River
Conservation Authority
Date: Jul 22, 2019

Hydraulic Gradient

Legend

- ☐ Municipal Boundary (GRCA)
- — Watercourse - Local (GRCA)
- — Contour 5m (ON)
- ☐ Park - Local (GRCA)
- ■ Waterbody - Local (GRCA)

Hydraulic Gradient (GRCA)

- ■ Upward
- ■ Downward

☐ **Site Boundary (Approximate)**

The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: https://maps.grandriver.ca/Sources-and-Citations.pdf

0 45 90 180 270 Metres

N

NAD 1983 UTM Zone 17N

Scale: 7,762

Grand River
Conservation Authority
Date: Jul 22, 2019

Average Annual Recharge

Map Centre (UTM NAD83 z17): 564,582.48 4,818,656.58

This map is not to be used for navigation

Legend

- Municipal Boundary (GRCA)
- Watercourse - Local (GRCA)
- Contour 5m (ON)
- Park - Local (GRCA)
- Waterbody - Local (GRCA)

Average Annual Recharge (GRCA)

- less than 50 mm/yr
- 50 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- \> 400

🟥 **Site Boundary (Approximate)**

The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: https://maps.grandriver.ca/Sources-and-Citations.pdf

0 45 90 180 270 Metres

NAD 1983 UTM Zone 17N

Scale: 7,762

N

APPENDIX E:
BOREHOLE LOGS

kell Rd. Well #2'

6. № ~~1~~933 f

PW2/66(COG)

Burke Well

12 inch E

5 R N

5 R 1 1 0 0

The Ontario Water Resources Commission Act

WATER WELL RECORD

12 3 ~~of District~~ ~~Wellington~~ ..... Township, Village, Town or City ~~Corp.~~ City of Guelph

number 8 ..... Lot ..... number 6 ..... Date completed ..... 16th June 1966 - well ~~20th~~ Aug 1966 - testing

Corporation of the City of Guelph (print in block letters) ..... Address ..... Guelph Ont.

Casing and Screen Record

side diameter of casing ..... 12 inch

length of casing 64 ft 10 in.

ype of screen nil

ength of screen nil

to top of screen nil

Diameter of finished hole 12 inch

Pumping Test

Static level 10 ft. 332

Test-pumping rate 1000 G.P.M.

Pumping level 20 ft 11 inches

Duration of test pumping 24 hours

Water clear or cloudy at end of test clear

Recommended pumping rate 800 G.P.M.

with pump setting of 100 feet below ground surface

Well Log

Overburden and Bedrock Record	From	To	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
	0 ft.	4 ft.		
black muck and gravel	4	24	136 ft	fresh
rough gravel	24	34		
sandy blue clay	34	55		
blue clay	55	64		
blue clay & gravel	64	95		
light brown rock	95	104		
dark brown rock	104	140		
dark brown & black rock	140	245		
dark grey rock	245	253		
dark blue rock	253	259		
blue shale				

r what purpose(s) is the water to be used? Corporation of the City of Guelph

well on upland, in valley, or on hillside?

rilling or Boring Firm Graham Well Drilling

ddress 119 Renfield St. Guelph Ont.

icence Number 2076

ame of Driller or Borer Arthur Titus

ddress Eramosa Rd. Guelph Ont.

ate Aug 31st 1966

J L Graham - per MCG

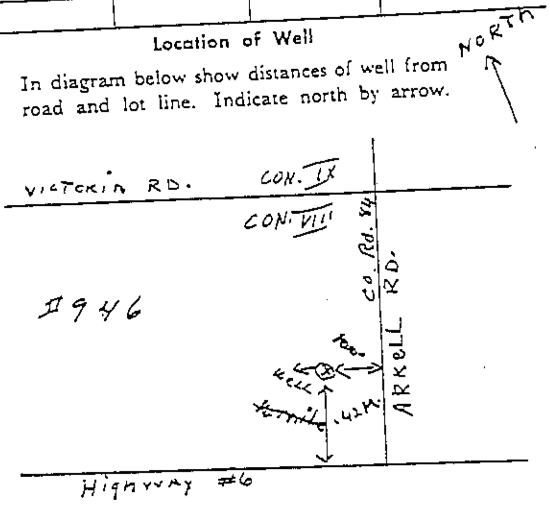
(Signature of Licensed Drilling or Boring Contractor)

orm 7 15M-60-4138

OWRC COPY

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



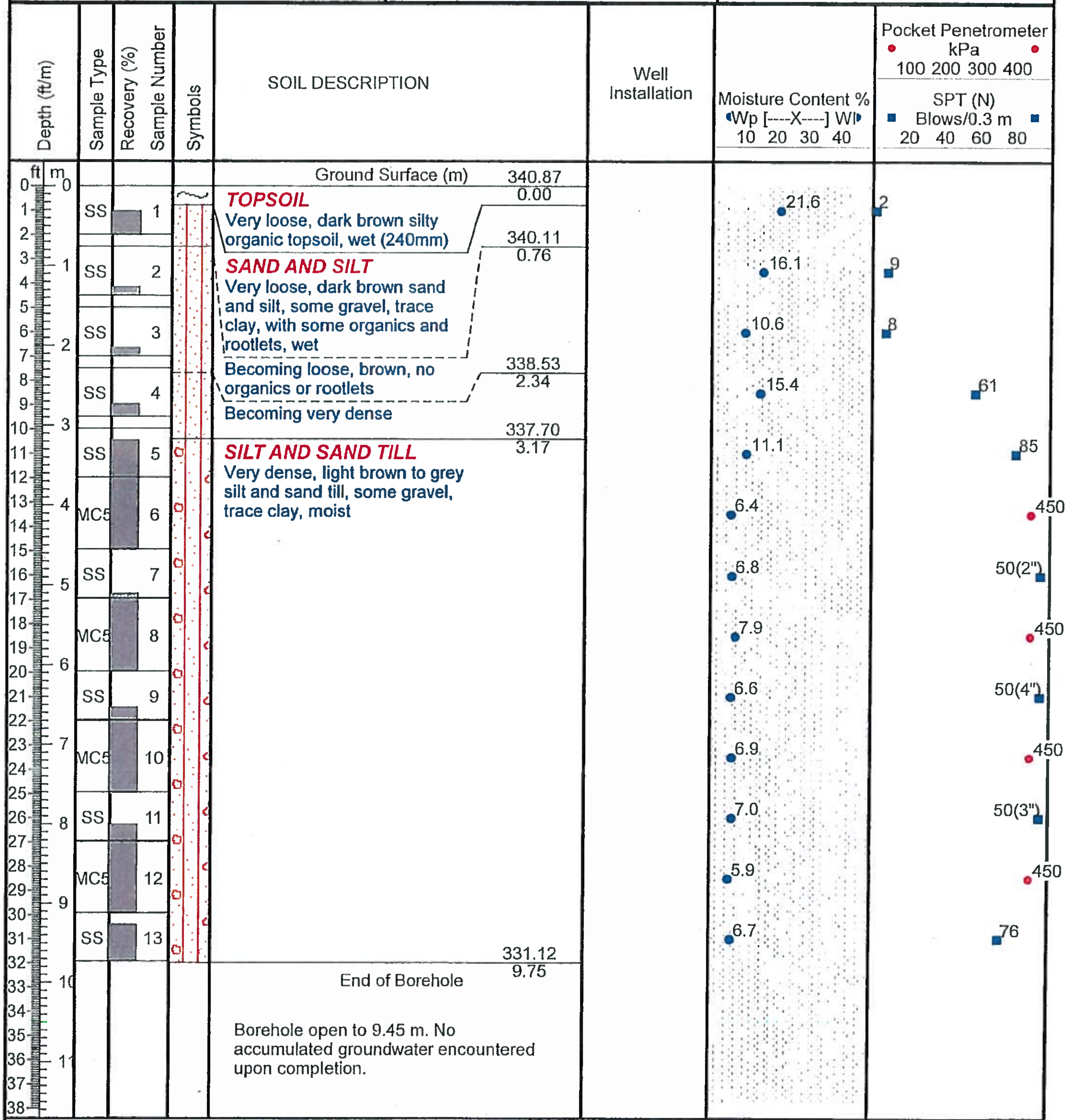
BOREHOLE 1

Page 1 of 1

Date Drilled: April 18, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 340.87 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



Sample Type	Sample Number	Moisture Content %	SPT (N) / Pocket Penetrometer
SS	1	21.6	2
SS	2	16.1	9
SS	3	10.6	8
SS	4	15.4	61
SS	5	11.1	85
MC5	6	6.4	450
SS	7	6.8	50(2")
MC5	8	7.9	450
SS	9	6.6	50(4")
MC5	10	6.9	450
SS	11	7.0	50(3")
MC5	12	5.9	450
SS	13	6.7	76

SOIL DESCRIPTION

Ground Surface (m) 340.87 / 0.00

TOPSOIL
Very loose, dark brown silty organic topsoil, wet (240mm)

340.11 / 0.76

SAND AND SILT
Very loose, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet

338.53 / 2.34

Becoming loose, brown, no organics or rootlets

Becoming very dense

337.70 / 3.17

SILT AND SAND TILL
Very dense, light brown to grey silt and sand till, some gravel, trace clay, moist

331.12 / 9.75

End of Borehole

Borehole open to 9.45 m. No accumulated groundwater encountered upon completion.

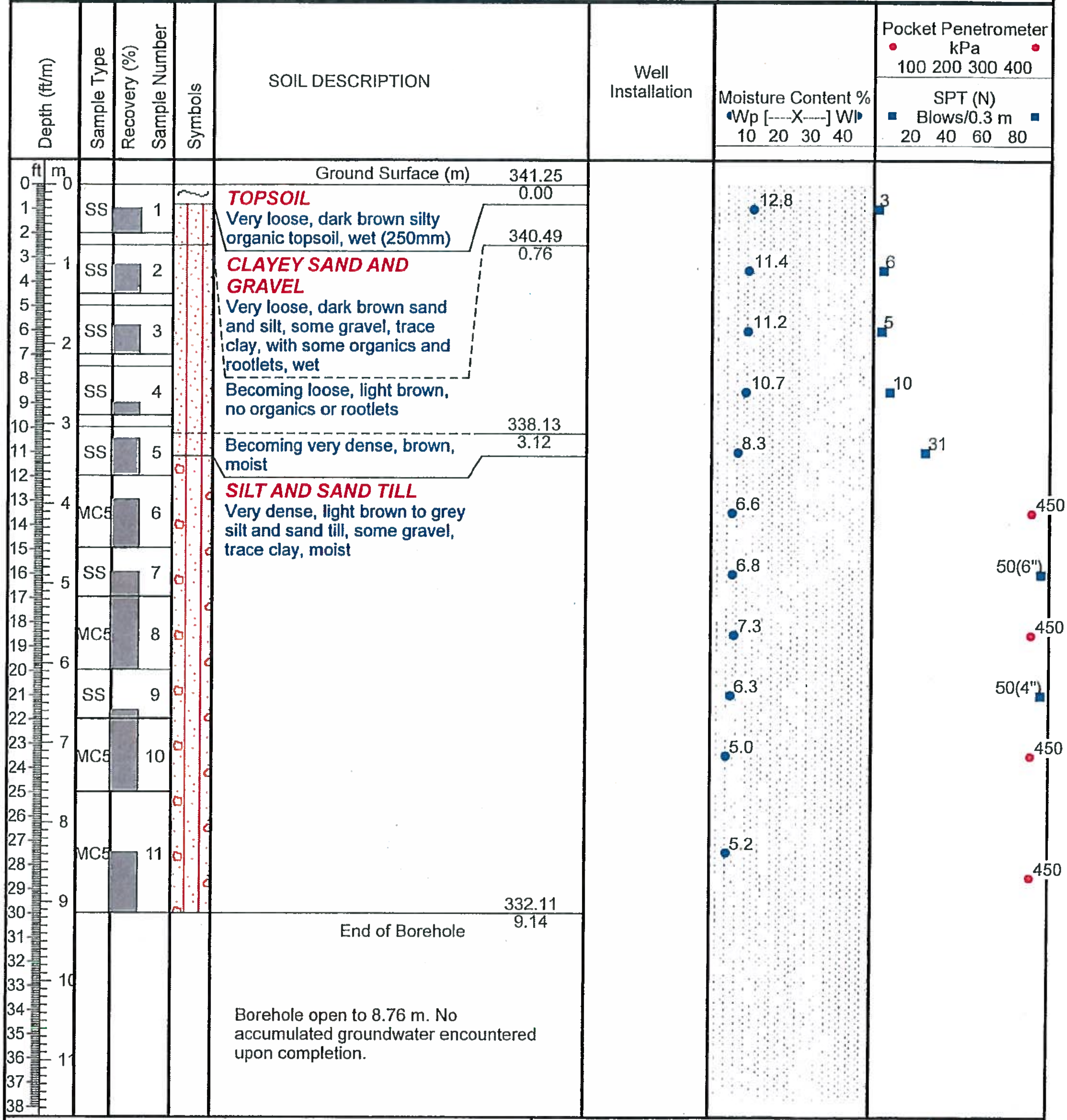
BOREHOLE 2

Page 1 of 1

Date Drilled: April 18, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 341.25 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



Ground Surface (m) 341.25

0.00

TOPSOIL
Very loose, dark brown silty organic topsoil, wet (250mm)

340.49
0.76

CLAYEY SAND AND GRAVEL
Very loose, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet

Becoming loose, light brown, no organics or rootlets

338.13
3.12

Becoming very dense, brown, moist

SILT AND SAND TILL
Very dense, light brown to grey silt and sand till, some gravel, trace clay, moist

332.11
9.14

End of Borehole

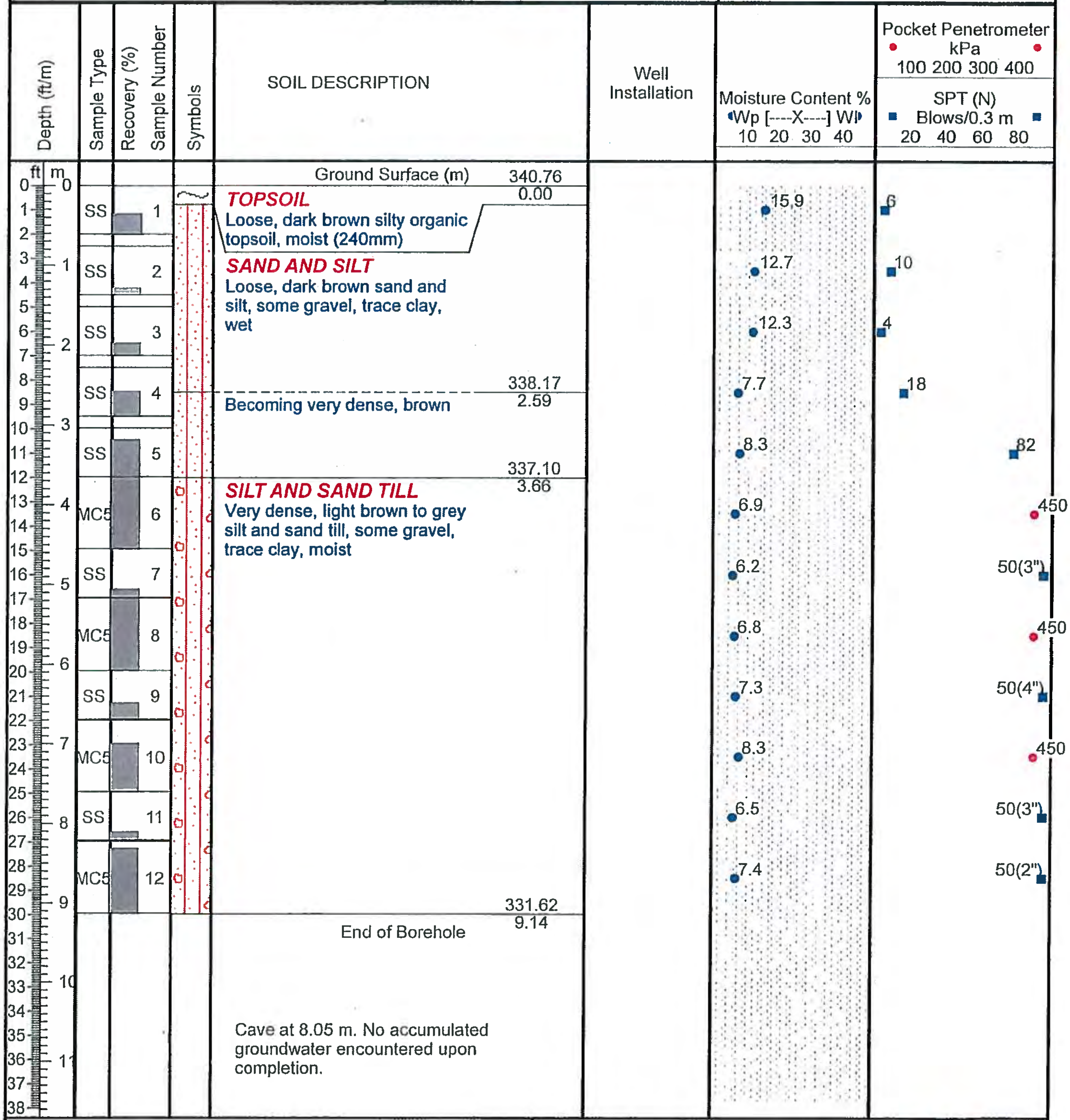
Borehole open to 8.76 m. No accumulated groundwater encountered upon completion.

BOREHOLE 3

Date Drilled: April 17, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 340.76 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



Ground Surface (m) 340.76 / 0.00

TOPSOIL
Loose, dark brown silty organic topsoil, moist (240mm)

SAND AND SILT
Loose, dark brown sand and silt, some gravel, trace clay, wet

338.17 / 2.59
Becoming very dense, brown

337.10 / 3.66

SILT AND SAND TILL
Very dense, light brown to grey silt and sand till, some gravel, trace clay, moist

331.62 / 9.14
End of Borehole

Cave at 8.05 m. No accumulated groundwater encountered upon completion.

Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m	Pocket Penetrometer kPa
SS	1	15.9	6	
SS	2	12.7	10	
SS	3	12.3	4	
SS	4	7.7	18	
SS	5	8.3	82	
MC5	6	6.9		450
SS	7	6.2	50(3")	
MC5	8	6.8		450
SS	9	7.3	50(4")	
MC5	10	8.3		450
SS	11	6.5	50(3")	
MC5	12	7.4	50(2")	

BOREHOLE 4

Page 1 of 1

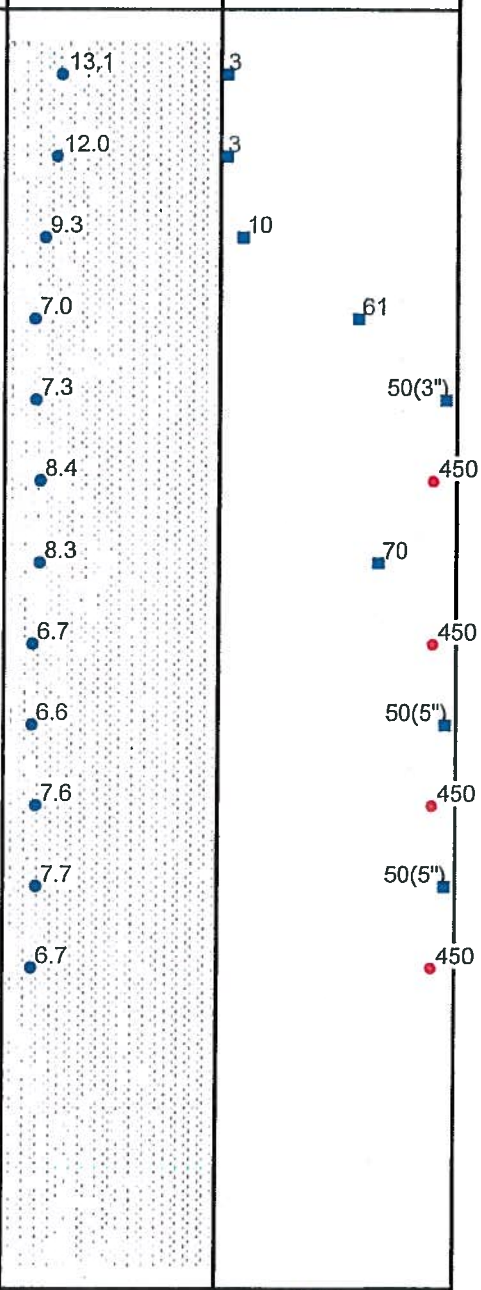
Date Drilled: April 18, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 342.45 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON

Elevation (m) / Depth (m)	SOIL DESCRIPTION
342.45	Ground Surface (m)
342.45 0.00	**TOPSOIL** Very loose, dark brown silty organic topsoil, wet (210mm)
341.69 0.76	**SAND AND SILT** Very loose dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet
340.93 1.52	No organics or rootlets
340.14 2.31	Becoming compact, brown
	SILT AND SAND TILL Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist
333.31 9.14	End of Borehole

Borehole open to 8.89 m. No accumulated groundwater encountered upon completion.



Sample Type	Sample Number	Moisture Content %	SPT (N)	Pocket Penetrometer (kPa)
SS	1	13.1	3	
SS	2	12.0	3	
SS	3	9.3	10	
SS	4	7.0	61	
SS	5	7.3	50(3")	
MC5	6	8.4		450
SS	7	8.3	70	
MC5	8	6.7		450
SS	9	6.6	50(5")	
MC5	10	7.6		450
SS	11	7.7	50(5")	
MC5	12	6.7		450

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

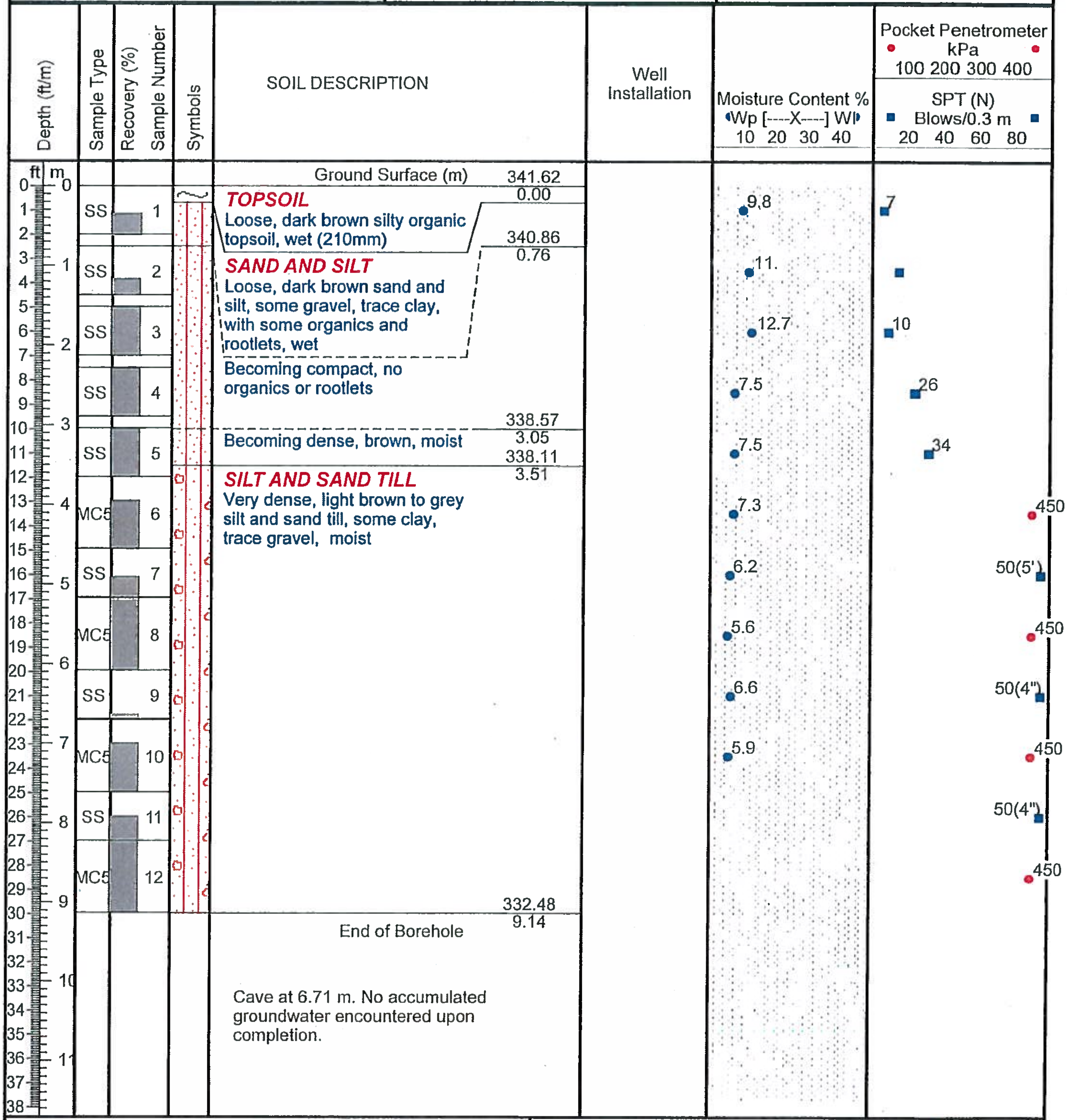
BOREHOLE 5

Page 1 of 1

Date Drilled: April 19, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 341.62 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m	Pocket Penetrometer kPa
SS	1	9.8	7	
SS	2	11.		
SS	3	12.7	10	
SS	4	7.5	26	
SS	5	7.5	34	
MC5	6	7.3		450
SS	7	6.2	50(5')	
MC5	8	5.6		450
SS	9	6.6	50(4")	
MC5	10	5.9		450
SS	11		50(4")	
MC5	12			450

Ground Surface (m) 341.62

0.00

TOPSOIL
Loose, dark brown silty organic topsoil, wet (210mm)

340.86
0.76

SAND AND SILT
Loose, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet

Becoming compact, no organics or rootlets

338.57
3.05

Becoming dense, brown, moist

338.11
3.51

SILT AND SAND TILL
Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist

332.48
9.14

End of Borehole

Cave at 6.71 m. No accumulated groundwater encountered upon completion.

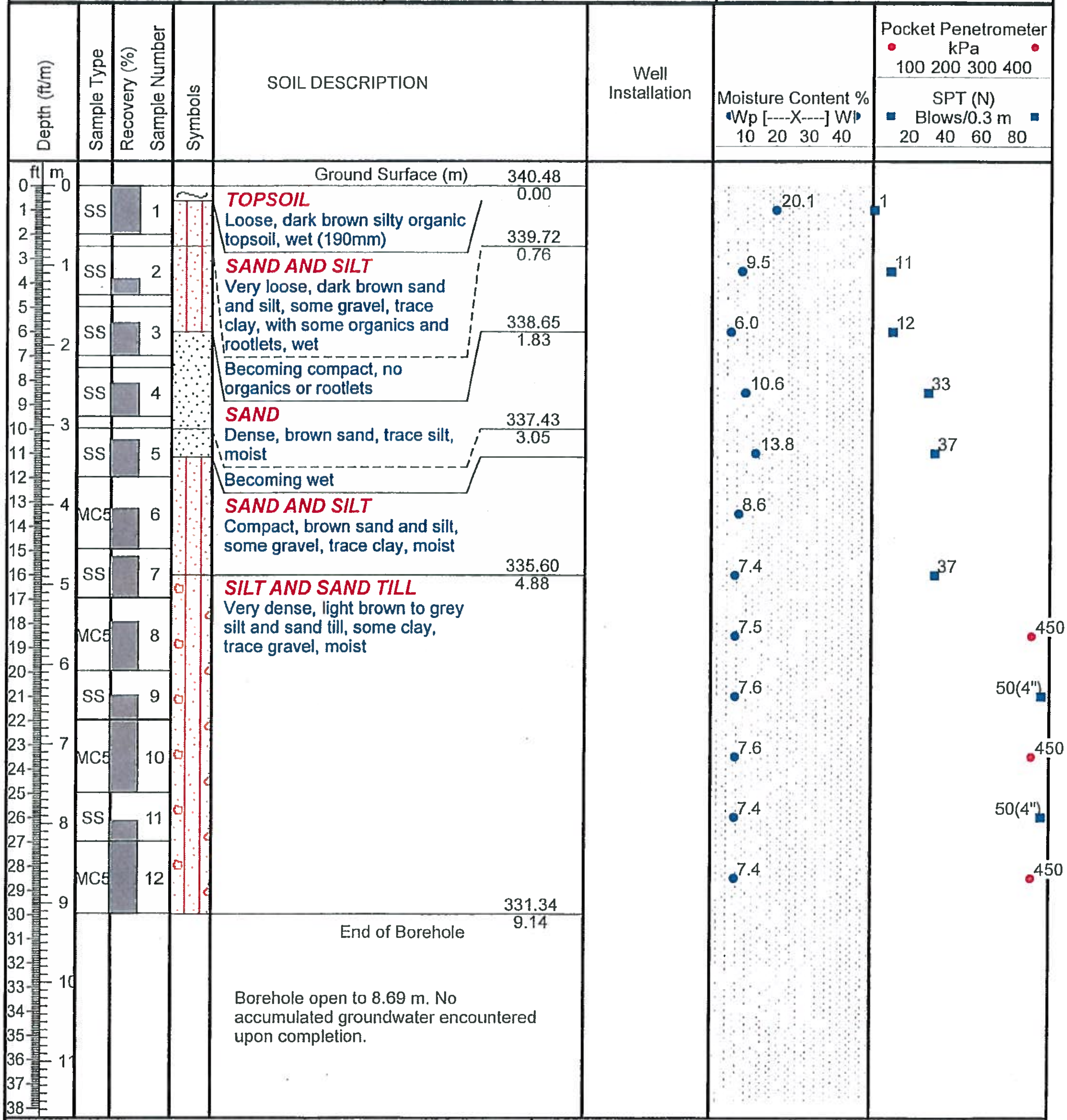
BOREHOLE 6

Page 1 of 1

Date Drilled: April 19, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 340.48 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



SOIL DESCRIPTION	Elevation (m)	Depth (m)
Ground Surface (m)	340.48	0.00
TOPSOIL Loose, dark brown silty organic topsoil, wet (190mm)	339.72	0.76
SAND AND SILT Very loose, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet Becoming compact, no organics or rootlets	338.65	1.83
SAND Dense, brown sand, trace silt, moist Becoming wet	337.43	3.05
SAND AND SILT Compact, brown sand and silt, some gravel, trace clay, moist	335.60	4.88
SILT AND SAND TILL Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist	331.34	9.14
End of Borehole		

Sample Type	Sample Number	Moisture Content %	SPT (N)	Pocket Penetrometer kPa
SS	1	20.1	1	
SS	2	9.5	11	
SS	3	6.0	12	
SS	4	10.6	33	
SS	5	13.8	37	
MC5	6	8.6		
SS	7	7.4	37	
MC5	8	7.5		450
SS	9	7.6	50(4")	
MC5	10	7.6		450
SS	11	7.4	50(4")	
MC5	12	7.4		450

Borehole open to 8.69 m. No accumulated groundwater encountered upon completion.

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BOREHOLE 7

Page 1 of 1

Date Drilled: April 19, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 339.88 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON

Elevation (m)	Depth (m)	SOIL DESCRIPTION
339.88		Ground Surface (m)
	0.00	**TOPSOIL** Loose, dark brown silty organic topsoil, wet (210mm)
339.12	0.76	**SAND AND SILT** Very loose, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet
338.15	1.73	Becoming compact, no organics or rootlets
337.59	2.29	**SAND** Dense, brown sand, trace gravel, moist
336.83	3.05	Becoming trace silt and clay, wet
		SAND AND SILT Compact, brown, sand and silt, some gravel, trace clay, moist
335.31	4.57	**SILT AND SAND TILL** Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist
332.26	7.62	End of Borehole

Borehole open to 6.91 m. No accumulated groundwater encountered upon completion.

Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m	Pocket Penetrometer kPa
SS	1	11,2	2	
SS	2	9.8	14	
SS	3	12.3	14	
SS	4	18.4	45	
SS	5	14.0	41	
SS	6	6.9	82	
MC5	7	6.5		450
SS	8	8.5	50(3")	
MC5	9	6.2		450

Well Installation

Moisture Content % Wp [----X----] Wl 10 20 30 40

Pocket Penetrometer kPa 100 200 300 400

SPT (N) Blows/0.3 m 20 40 60 80

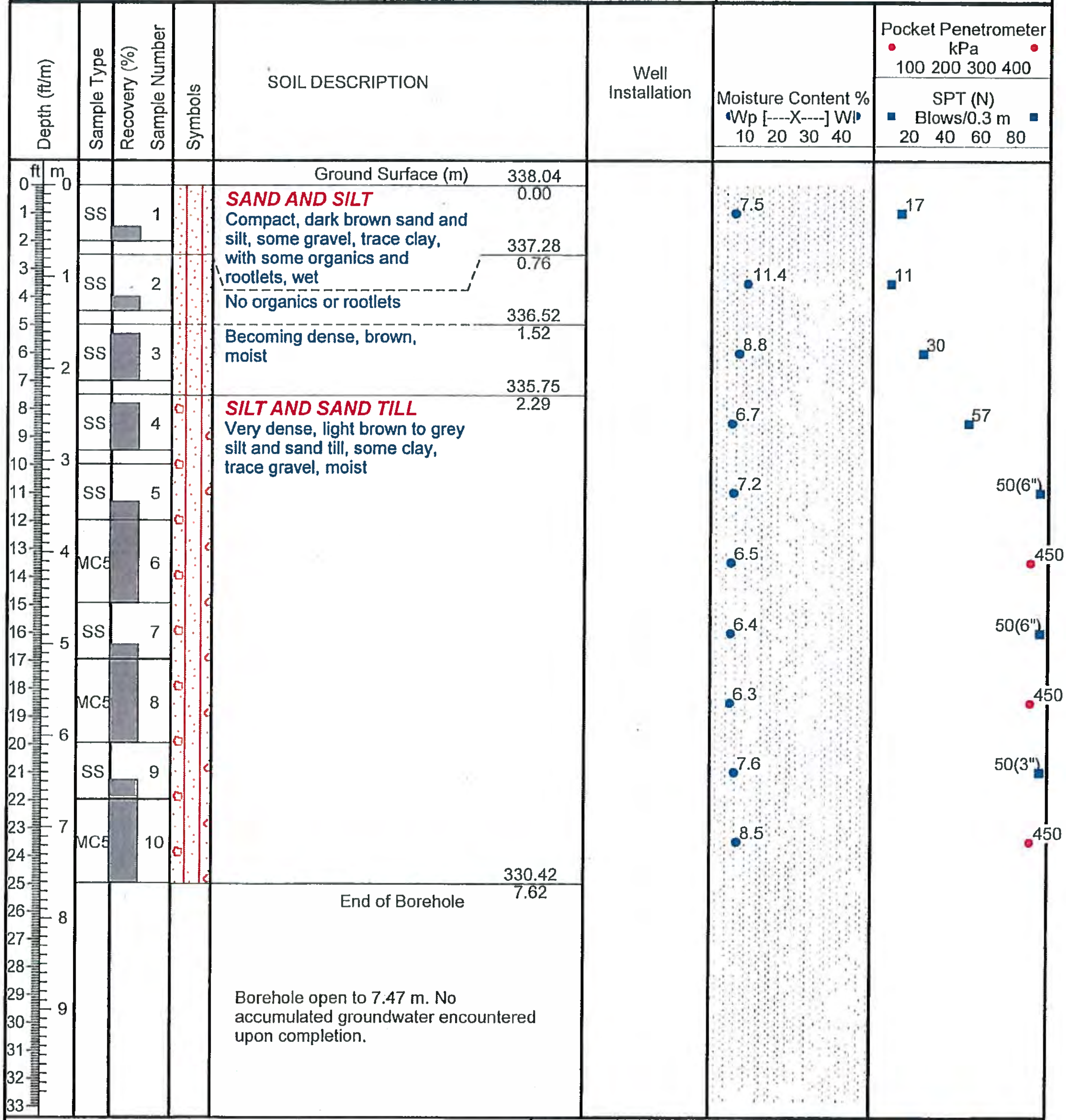
BOREHOLE 8

Page 1 of 1

Date Drilled: April 19, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 338.04 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



Ground Surface (m) 338.04 / 0.00

SAND AND SILT
Compact, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet

337.28 / 0.76

No organics or rootlets

336.52 / 1.52

Becoming dense, brown, moist

335.75 / 2.29

SILT AND SAND TILL
Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist

330.42 / 7.62

End of Borehole

Borehole open to 7.47 m. No accumulated groundwater encountered upon completion.

Sample Type	Sample Number	Moisture Content %	SPT (N) / Pocket Penetrometer (kPa)
SS	1	7.5	17
SS	2	11.4	11
SS	3	8.8	30
SS	4	6.7	57
SS	5	7.2	50(6")
MC5	6	6.5	450
SS	7	6.4	50(6")
MC5	8	6.3	450
SS	9	7.6	50(3")
MC5	10	8.5	450

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BOREHOLE 9

Page 1 of 1

Date Drilled: April 19, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 339.15 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON

Elevation (m) / Depth (m)	SOIL DESCRIPTION
339.15	Ground Surface (m)
0.00	**TOPSOIL** Very loose, dark brown silty organic topsoil, wet (210mm)
338.39 / 0.76	**SAND AND SILT** Very loose dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet Becoming loose, no organics or rootlets
337.63 / 1.52	**SAND** Compact, brown sand, trace silt and gravel, wet
334.58 / 4.57	**SILT AND SAND TILL** Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist
330.92 / 8.23	End of Borehole

Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m	Pocket Penetrometer kPa
SS	1	22.4	2	
SS	2	9.1	7	
SS	3	11.3	10	
SS	4	13.7	14	
SS	5	16.6	24	
SS	6	6.1	62	
MC5	7	7.0		450
SS	8	6.8	50(6")	
MC5	9	8.0		450
SS	10		50(5)	

Borehole open to 4.70 m. Groundwater accumulated to 3.17 m upon completion.

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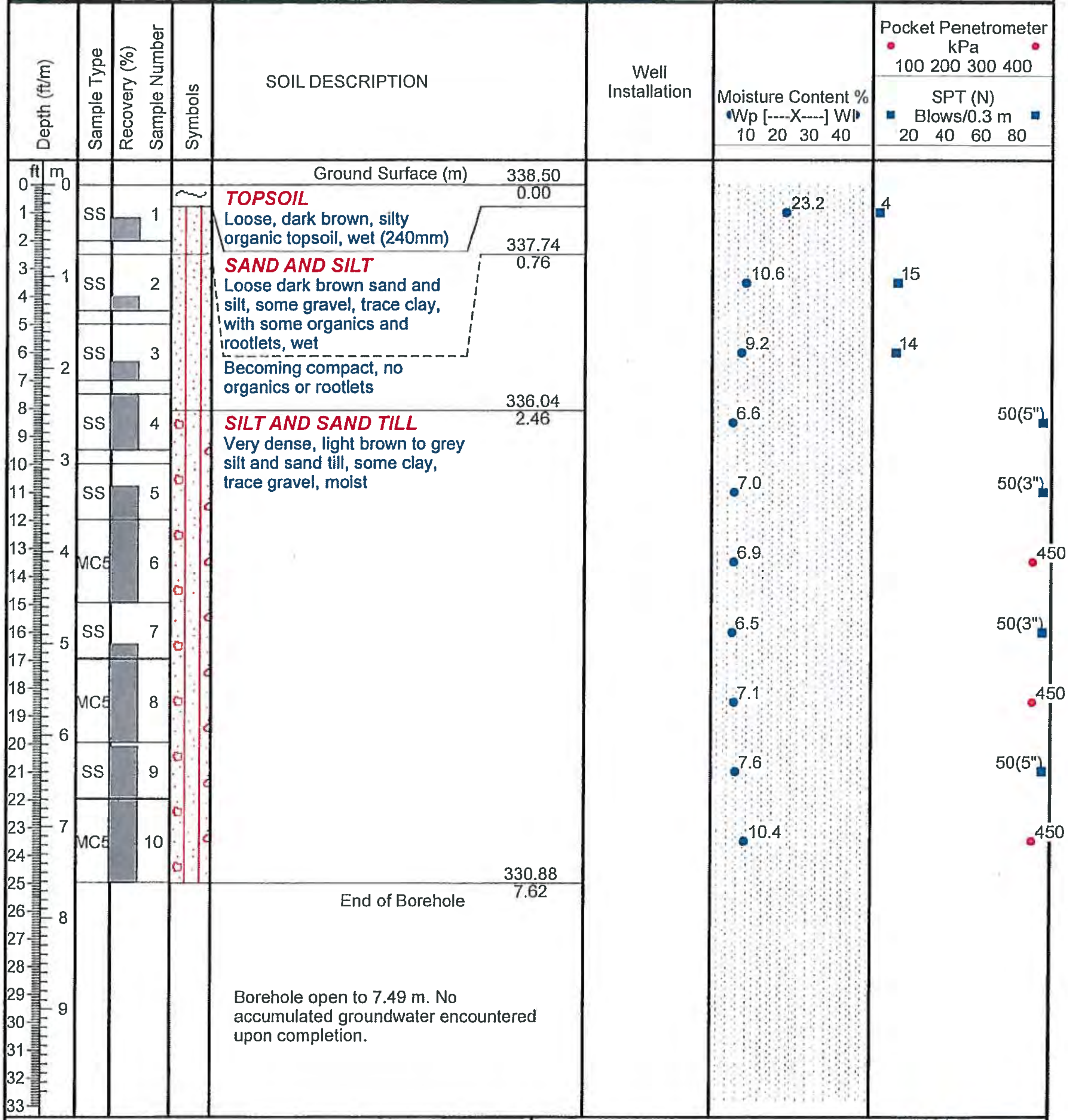
BOREHOLE 10

Page 1 of 1

Date Drilled: April 17, 2018
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 338.50 m
Logged by: SW

Project No.: 18-099
Project: Two 12 Storey Appt. Buildings
Location: 1242, 1250, 1260 Gordon St
Guelph, ON



Ground Surface (m) 338.50

TOPSOIL 0.00
Loose, dark brown, silty organic topsoil, wet (240mm)

337.74
SAND AND SILT 0.76
Loose dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet

Becoming compact, no organics or rootlets

336.04
SILT AND SAND TILL 2.46
Very dense, light brown to grey silt and sand till, some clay, trace gravel, moist

330.88
End of Borehole 7.62

Borehole open to 7.49 m. No accumulated groundwater encountered upon completion.

Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m	Pocket Penetrometer kPa
SS	1	23.2	4	
SS	2	10.6	15	
SS	3	9.2	14	
SS	4	6.6	50(5")	
SS	5	7.0	50(3")	
MC5	6	6.9		450
SS	7	6.5	50(3")	
MC5	8	7.1		450
SS	9	7.6	50(5")	
MC5	10	10.4		450

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

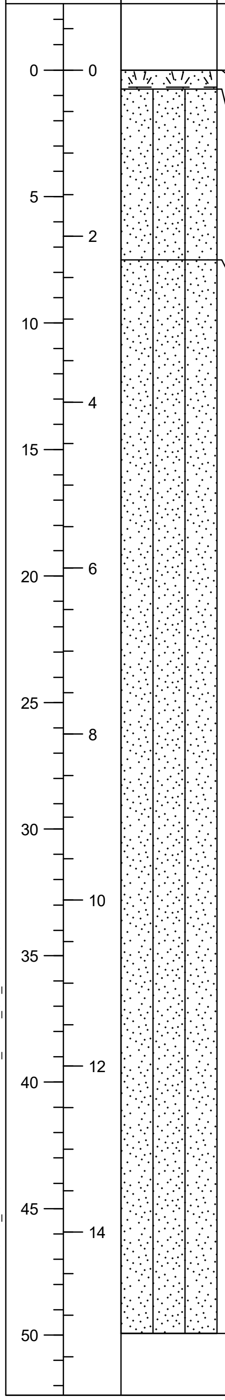
Monitoring Well: MW1-18

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: C. Davis
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 30-Jul-2018

Ground surface elevation: 343.92 m AMSL
Top of casing elevation: 344.72 m AMSL
Easting: 564468
Northing: 4818537

SUBSURFACE PROFILE

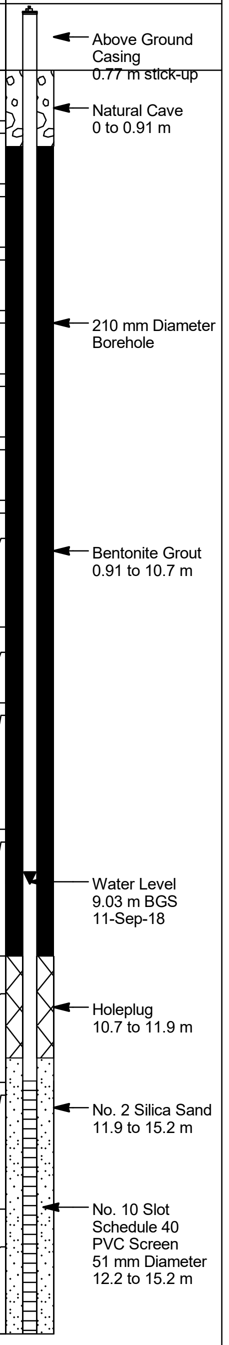


Lithologic Description	Elevation (m AMSL) Depth (m BGS)
	344.72
Ground Surface	343.92 0.00
TOPSOIL Loose, very dark brown (7.5 YR 2/3), silty sand, fine to medium grained sand, fine gravel, dry to moist	343.69 0.23
SILTY SAND Compact, yellowish brown (10 YR 5/4), fine to coarse grained sand, trace fine gravel, trace to some clay in dry clumps, dry to moist Becoming moist at 1.1 m BGS Clay and gravel content increases at 1.5 m BGS Colour change to brown (10 YR 5/3) at 1.6 m BGS Becomes moist to wet at 1.9 m BGS Limestone cobble at 2.1 m BGS	341.63 2.29
SILTY SAND TILL Compact, pale brown (10 YR 6/3), fine to coarse grained sand, limestone fragments, trace to some clay in clumps, fine gravel and cobbles (angular), dry to moist Becoming dense at 3.0 m BGS Metamorphic rock fragments at 3.6 m BGS Very dense, increased clay content starting at 3.8 m BGS Cobble/boulders from 5.5 to 6.7 m BGS At 6.8 m BGS, becomes very dense, grey, fine silty sand, trace medium and coarse grained sand, trace gravel, dry Some rounded fine gravel at 7.6 m BGS Becoming less compact, trace limestone fragments, moist at 10.7 m BGS Cobble at 11.2 m BGS Becoming moist at 14.0 m BGS	328.70 15.22
End of Borehole	

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	6" 25%	2-5-6-4 (11)
2	SS	18" 75%	5-8-8-11 (16)
3	SS	21" 88%	4-6-7-10 (13)
4	SS	24" 100%	5-8-10-12 (18)
5	SS	24" 100%	9-20-15-40 (35)
6	SS	24" 100%	29-37-50 (87)
7	SS	24" 100%	29-31-49-50 (80)
8	SS	10.5" 88%	13-50 (50)
9	SS	11" 92%	40-50 (50)
10	SS	n/a	50 (0)
11	SS	5" 83%	50 (0)
12	SS	22" 122%	28-40-50 (90)
13	SS	6" 100%	50 (0)
14	SS	19" 106%	47-35-50 (85)
15	SS	0" 0%	50 (0)

WELL DETAILS



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Stantec

Drawn By/Checked By: AH / SR / GW

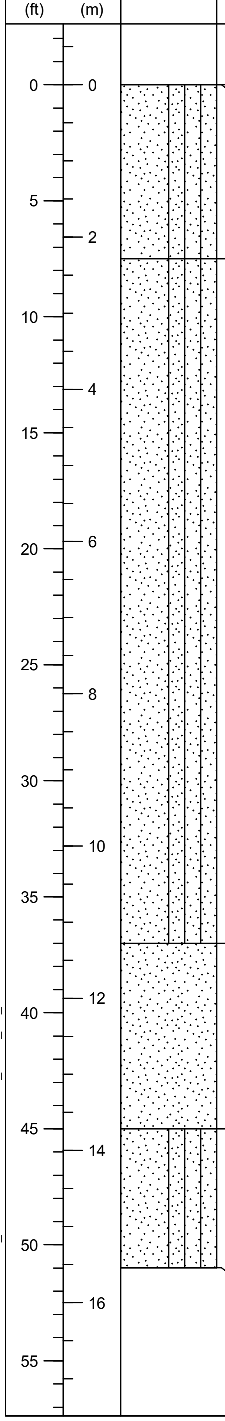
Monitoring Well: MW2-18

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: A. Healey
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 09-Jul-2018 / 10-Jul-2018

Ground surface elevation: 342.97 m AMSL
Top of casing elevation: 343.77 m AMSL
Easting: 564471
Northing: 4818517

SUBSURFACE PROFILE

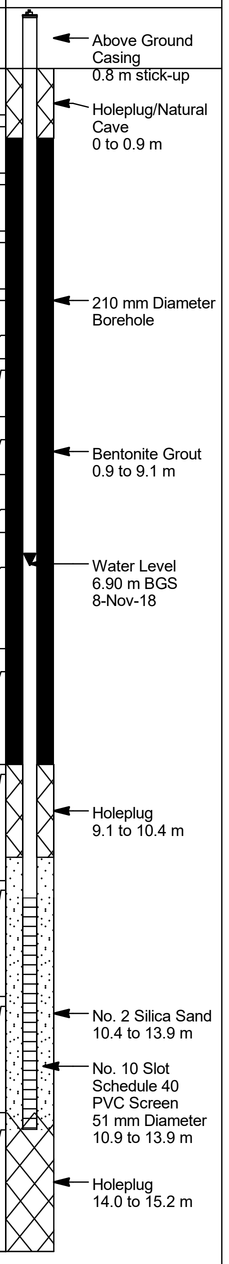


Lithologic Description	Elevation (m AMSL) Depth (m BGS)
	343.77
Ground Surface	342.97
SANDY SILT Loose, 10 YR 4/3 brown, with organics (roots) and some subangular coarse gravel, dry Compact, organics no longer visible, increased subangular fine and coarse gravel, change in colour to 10 YR 6/3 pale brown at 0.76 m BGS, crumbles easily becoming more silt with some sand, some subangular fine and coarse gravel, moist to dry	0.00 340.68
SANDY SILT TILL Compact, 10 YR 5/3 brown, fine sand with some clay and angular fine and coarse gravel, trace coarse sand, moist Very dense, trace 10 YR 6/1 gray coarse gravel/cobble 10 YR 6/1 gray cobble at 5.0 m BGS becoming slightly more moist than above change in colour to 10 YR 6/2 light brownish gray	2.29 331.69
SAND Very dense, medium to coarse sand, some subangular fine gravel, trace coarse gravel, wet	11.28 329.25
SANDY SILT TILL Very dense, 10 YR 6/2 light brownish gray, some medium sand and fine to coarse gravel, trace clay, moist crushed cobble at 13.8 m BGS increased clay content at 13.9 m BGS crushed cobble at 15.3 m BGS	13.72 327.43
End of Borehole	15.54

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	17" 71%	3-3-3-10 (6)
2	SS	19" 79%	8-11-14-17 (25)
3	SS	20" 83%	10-11-11-12 (22)
4	SS	24" 100%	4-7-9-18 (16)
5	SS	19" 106%	13-30-50 (80)
6	SS	2" 33%	50 (0)
7	SS	14" 117%	30-50 (50)
8	SS	20" 111%	26-39-50 (89)
9	SS	23" 128%	30-42-50 (92)
10	SS	13" 108%	31-50 (50)
11	SS	6" 119%	50/5.0" (50/5.0")
12	SS	8" 159%	50/5.0" (50/5.0")
13	SS	4" 79%	50/5.0" (50/5.0")
14	SS	15" 167%	47-50/3.0" (50/3.0")
15	SS	18" 150%	41-50 (50)

WELL DETAILS



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Stantec

Drawn By/Checked By: AH / SR / GW

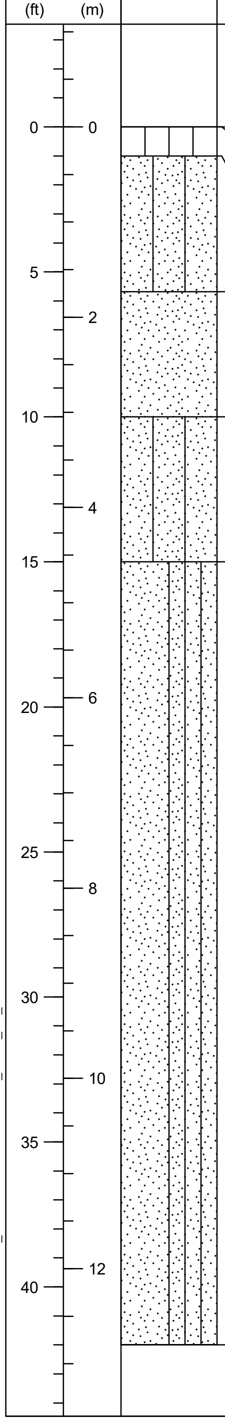
Monitoring Well: MW3-18

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: A. Healey
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 12-Jul-2018 / 13-Jul-2018

Ground surface elevation: 339.83 m AMSL
Top of casing elevation: 340.91 m AMSL
Easting: 564469
Northing: 4818474

SUBSURFACE PROFILE

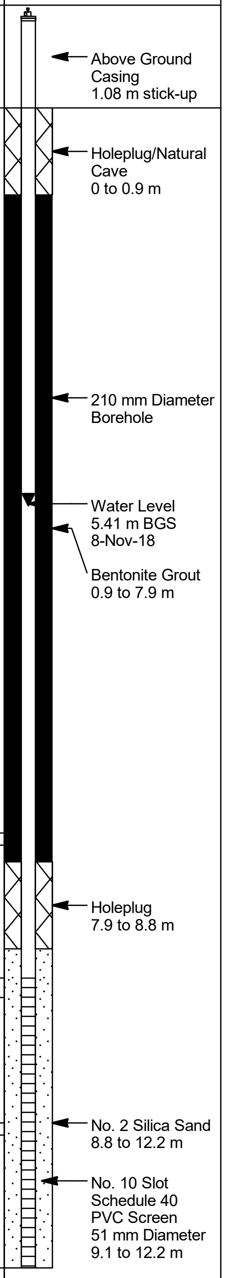


Lithologic Description	Elevation (m AMSL) Depth (m BGS)
	340.91
Ground Surface	339.83
TOPSOIL Loose, dark brown silty organic topsoil, wet	0.00
SAND AND SILT Very loose, dark brown sand and silt, some gravel, trace clay, with some organics and rootlets, wet becoming compact, no organics or rootlets	339.53 0.30
SAND Dense, brown sand, trace gravel, moist becoming trace silt and clay, wet	338.10 1.73
SAND AND SILT Compact, brown, sand and silt, some gravel, trace clay, moist	336.78 3.05
SANDY SILT TILL Very dense, 10 YR 6/1 gray, fine sand with trace coarse sand and fine gravel, trace clay, moist wet at 9.4 m BGS trace coarse gravel at 10.8 m BGS	335.26 4.57
End of Borehole	327.03 12.80

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	5" 99%	50/5.0" (50/5.0")
2	SS	12" 149%	43-50/2.0" (50/2.0")
3	SS	6" 119%	50/5.0" (50/5.0")
4	SS	12" 109%	49-50/5.0" (50/5.0")

WELL DETAILS



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Well was straight drilled to 7.6 m due to proximity of well in comparison to recently drilled borehole (BH7, drilled April 19, 2018 by CMT Drilling Inc.). Stratigraphy from 0-7.6 m is inferred from this borehole log.

Stantec

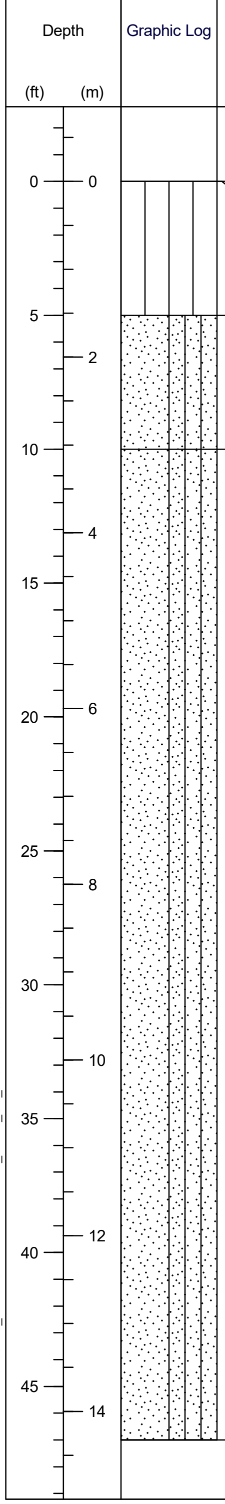
Drawn By/Checked By: AH / SR / GW

Monitoring Well: MW4-18 (S/D)

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: A. Healey
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 11-Jul-2018 / 12-Jul-2018

SUBSURFACE PROFILE



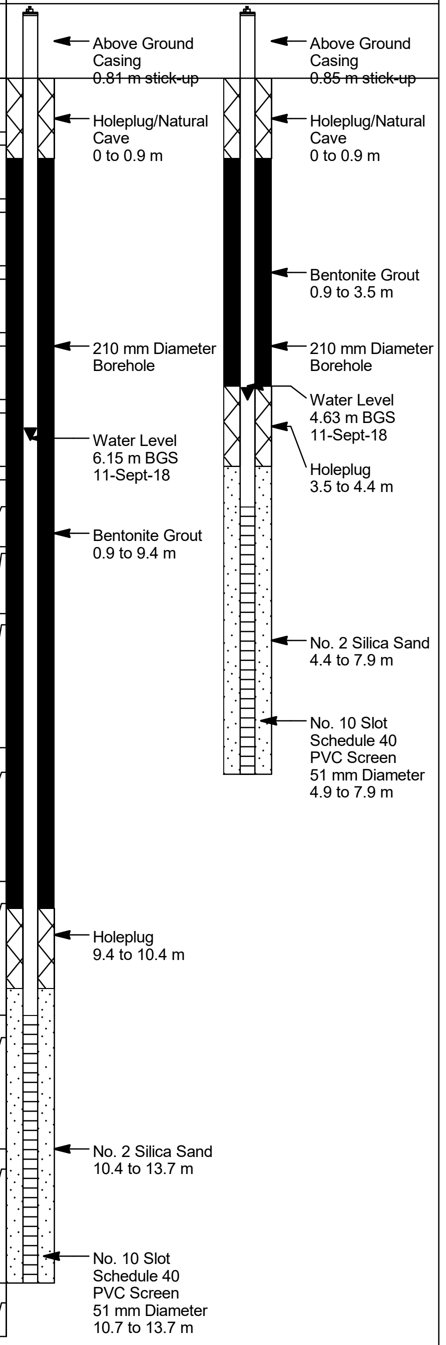
Lithologic Description	Elevation (m AMSL) Depth (m BGS)
	341.32
Ground Surface	340.47 0.00
SILT (TOPSOIL) Loose, 10 YR 5/3 brown to 10 YR 5/4 yellowish brown, trace to some fine sand, some organics and fine and coarse gravel (subangular) in top 2 cm, moist compact, increased sand and fine gravel content starting at 1.0 m BGS crushed coarse gravel/cobble at 1.3 m BGS	338.95
SANDY SILT Loose, 10 YR 5/4 yellowish brown, fine sand with some medium to coarse sand and fine to coarse subangular gravel, trace clay, moist compact, crushed coarse gravel/cobble at 2.5 m BGS	1.52 337.42
SANDY SILT TILL Compact, 10 YR 5/3 brown, fine sand and some medium to coarse sand, some fine to coarse gravel, trace clay, moist minor reddish brown mottling at 3.4 m BGS dense, increased sand and gravel content from 3.8 to 4.4 m BGS crushed coarse gravel/cobble at 4.6 and 4.8 m BGS crushed coarse gravel/cobble at 5.3 and 6.2 m BGS change in colour to 10 YR 5/1 gray at 6.1 m BGS, wet coarse gravel at 12.3 m BGS becoming slightly softer at 12.5 m BGS	3.05 326.14
End of Borehole	14.33

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	20" 83%	3-3-2-2 (5)
2	SS	14" 58%	3-8-18-23 (26)
3	SS	16" 67%	3-4-5-7 (9)
4	SS	20" 83%	11-10-9-7 (19)
5	SS	24" 100%	4-4-12-15 (16)
6	SS	25" 104%	11-21-20-20 (41)
7	SS	12" 100%	46-50 (50)
8	SS	4" 133%	50/3.0" (50/3.0")
9	SS	9" 179%	50/5.0" (50/5.0")
10	SS	18" 163%	44-50/5.0" (50/5.0")
11	SS	17" 171%	49-50/4.0" (50/4.0")
12	SS	13" 131%	49-50/4.0" (50/4.0")
13	SS	14" 156%	39-50/3.0" (50/3.0")
14	SS	12" 133%	48-50/3.0" (50/3.0")

WELL DETAILS

Name:	MW4-18D	Name:	MW4-18S
GS Elev:	340.47 m AMSL	GS Elev:	340.47 m AMSL
TOC Elev:	341.28 m AMSL	TOC Elev:	341.32 m AMSL
Easting:	564506	Easting:	564506
Northing:	4818478	Northing:	4818478
Stick-up:	0.81 m	Stick-up:	0.85 m



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Stantec

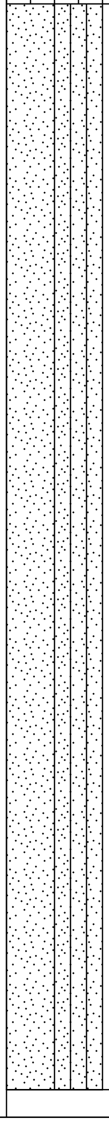
Drawn By/Checked By: AH / SR / GW

Monitoring Well: MW5-18 (S/D)

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: A. Healey
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 10-Jul-2018 / 11-Jul-2018

SUBSURFACE PROFILE



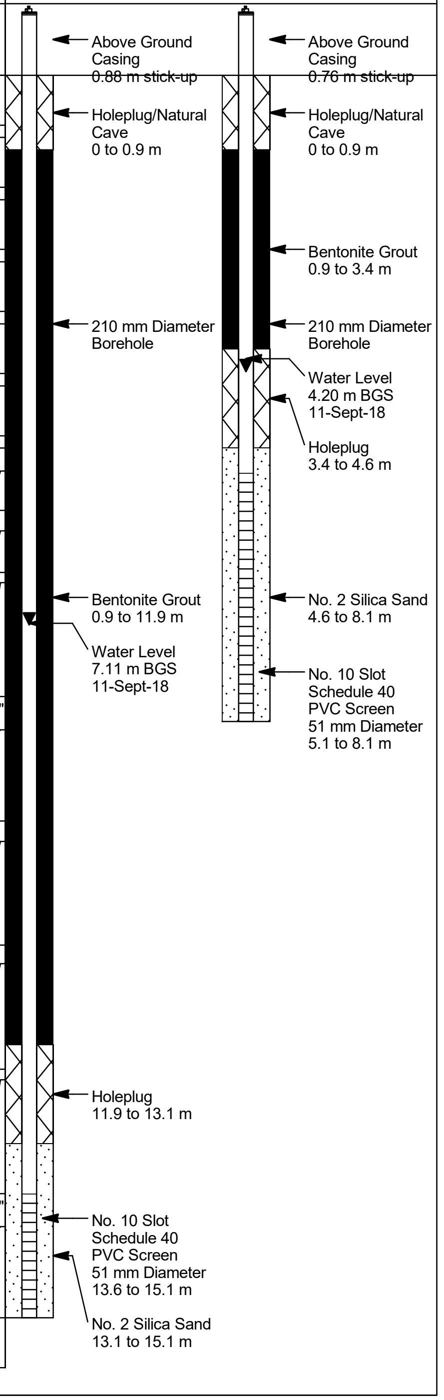
Depth (ft) (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)
		342.02
0	Ground Surface	341.14
	SILT Loose, 10 YR 4/2 dark grayish brown with organics, trace clay and fine to coarse sand, moist	0.00
	SILT Compact, 10 YR 4/3 brown, trace clay and fine to coarse sand, moist increased coarse sand content, trace subangular fine gravel crushed 10 YR 6/1 gray coarse gravel, cobbles further increase of coarse sand and fine gravel content, increased moisture content some coarse gravel starting at 2.0 m BGS	340.78 0.36
	SANDY SILT TILL Compact, 10 YR 6/3 pale brown, fine sand, some medium to coarse sand and fine to coarse subangular gravel, moist 10 YR 6/1 gray coarse gravel/cobble at 2.8 m BGS becoming less compact from 3.0 to 3.6 m BGS very dense, some coarse gravel starting at 3.7 m BGS minor reddish brown mottling from 4.3 to 7.6 m BGS coarse gravel/cobble at 4.9 m BGS change in colour to 10 YR 6/2 light brownish gray at 6.1 m BGS coarse gravel/cobble at 6.2 m BGS coarse gravel/cobble at 8.1 m BGS medium to coarse sand content increasing starting at 10.8 m BGS becomes less dense and moisture content increases at 13.8 m BGS, reduced sand content	338.60 2.54
16	End of Borehole	325.29 15.85

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	19" 79%	3-3-3-4 (6)
2	SS	18" 75%	3-4-12-9 (16)
3	SS	15" 63%	2-7-13-12 (20)
4	SS	14" 58%	4-8-9-11 (17)
5	SS	14" 58%	3-4-6-12 (10)
6	SS	30" 125%	15-31-36-32 (67)
7	SS	23" 208%	21-50/5.0" (50/5.0")
8	SS	7" 70%	50 (0)
9	SS	6" 119%	50/5.0" (50/5.0")
10	SS	18" 113%	16-27-50/4.0" (50/4.0")
11	SS	12" 120%	48-50/4.0" (50/4.0")
12	SS	16" 178%	45-50/3.0" (50/3.0")
13	SS	5" 99%	50/5.0" (50/5.0")
14	SS	27" 169%	13-27-50/4.0" (50/4.0")
15	SS	23" 96%	30-40-47-47 (87)

WELL DETAILS

Name: MW5-18D	Name: MW5-18S
GS Elev: 341.14 m AMSL	GS Elev: 341.26 m AMSL
TOC Elev: 342.02 m AMSL	TOC Elev: 342.02 m AMSL
Easting: 564540	Easting: 564540
Northing: 4818521	Northing: 4818521
Stick-up: 0.88 m	Stick-up: 0.76 m



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Drawn By/Checked By: AH / SR / GW

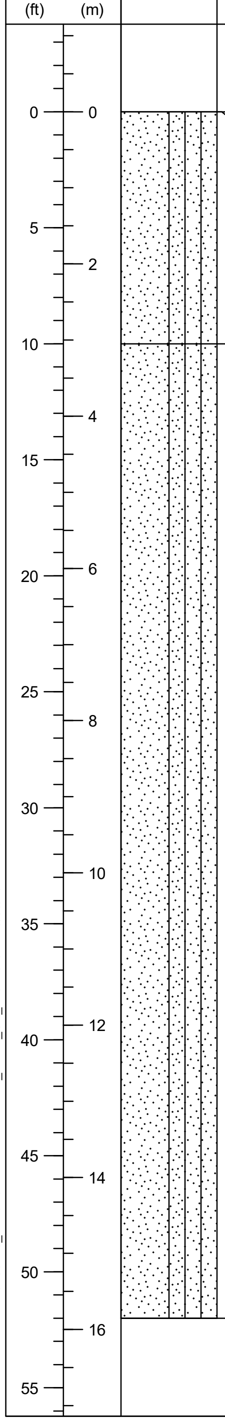
Monitoring Well: MW6-18

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: A. Healey
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 13-Jul-2018 / 16-Jul-2018

Ground surface elevation: 341.40 m AMSL
Top of casing elevation: 342.55 m AMSL
Easting: 564586
Northing: 4818487

SUBSURFACE PROFILE

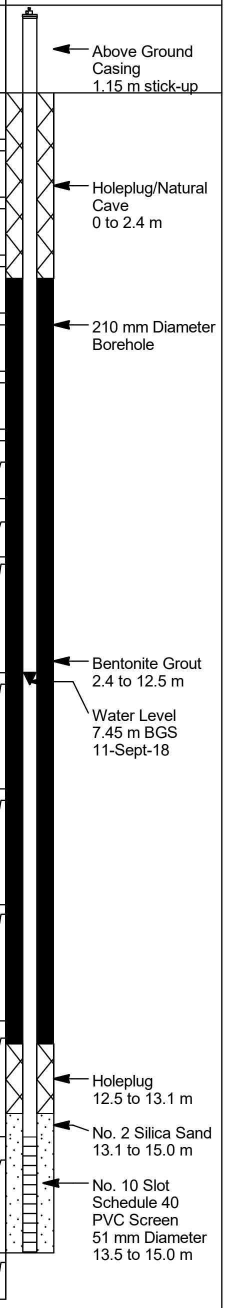


Elevation (m AMSL) Depth (m BGS)	Lithologic Description
342.55	
341.40 0.00	Ground Surface SANDY SILT Loose, 10 YR 4/3 brown, fine sand, some organics, trace fine gravel, moist to dry becoming trace organics starting at 0.3 m BGS becoming moist at 0.43 m BGS some coarse sand and fine gravel starting at 0.89 m BGS minor reddish brown mottling from 1.8 to 2.0 m BGS
338.35 3.05	SANDY SILT TILL Very dense, 10 YR 6/3 pale brown, fine sand, some medium to coarse sand and fine to coarse gravel, trace clay, moist, crushed coarse gravel/cobbles throughout change in colour to 7.5 YR 5/1 gray wet at 12.2 m BGS increase in clay content and decrease in sand content
325.55 15.85	End of Borehole

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	18" 75%	3-4-5-12 (9)
2	SS	20" 83%	10-9-8-7 (17)
3	SS	13" 54%	5-5-4-7 (9)
4	SS	21" 88%	3-5-13-20 (18)
5	SS	27" 113%	8-21-26-37 (47)
6	SS	25" 104%	44-39-43-37 (82)
7	SS	12" 109%	44-50/5.0" (50/5.0")
8	SS	12" 100%	44-50 (50)
9	SS	6" 152%	50/4.0" (50/4.0")
10	SS	8" 133%	50 (0)
11	SS	6" 100%	50 (0)
12	SS	6" 119%	50/5.0" (50/5.0")
13	SS	11" 122%	40-50/3.0" (50/3.0")
14	SS	14" 117%	45-50 (50)
15	SS	8" 159%	50/5.0" (50/5.0")

WELL DETAILS



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Stantec

Drawn By/Checked By: AH / SR / GW

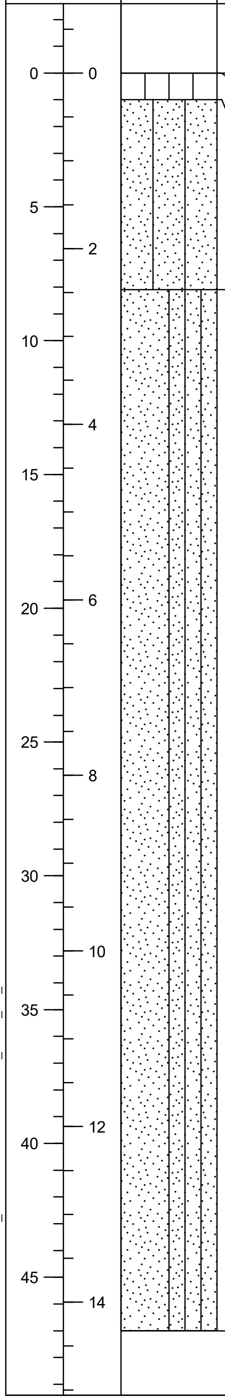
Monitoring Well: MW7-18

Project: 1242, 1250 and 1260 Gordon Street and 9 Valley Road
Client: Tricar Developments Inc.
Location: Guelph, Ontario
Number: 161413684

Field Investigator: A. Healey
Contractor: Aardvark Drilling, Inc
Drilling method: Hollow Stem Auger
Date started/completed: 16-Jul-2018

Ground surface elevation: 338.85 m AMSL
Top of casing elevation: 339.64 m AMSL
Easting: 564518
Northing: 4818416

SUBSURFACE PROFILE

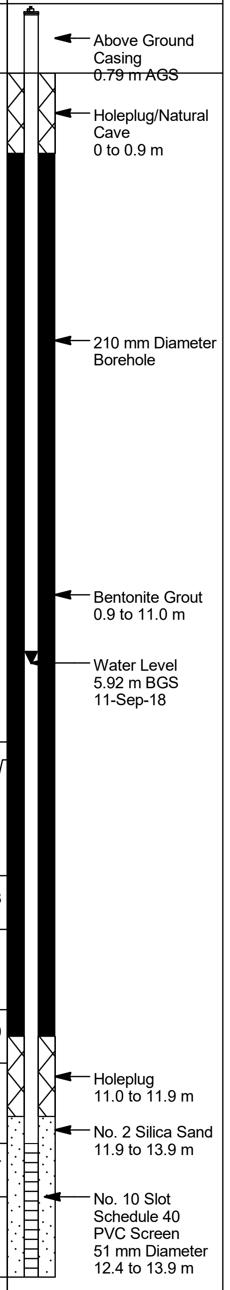


Lithologic Description	Elevation (m AMSL) Depth (m BGS)
	339.64
Ground Surface	338.85 0.00
TOPSOIL Loose, dark brown, silty organic topsoil	338.55 0.30
SAND AND SILT loose, dark brown, sand and silt, some gravel, trace clay, with some organics and rootlets, wet becoming compact, no organics or rootlets	336.38 2.47
SANDY SILT TILL Compact, 7.5 YR 5/2 brown, fine sand, trace medium to coarse sand, some fine subangular gravel, trace crushed gravel/cobble throughout, moist change in colour to 10 YR 5/1 gray at 9.1 m BGS becoming wet at 9.6 m BGS	324.52
End of Borehole	14.33

SAMPLE DETAILS

Sample Number	Sample Type	Recovery	N Value
1	SS	13" 162%	44-50/2.0" (50/2.0")
2	SS	26" 108%	37-31-32-38 (63)
3	SS	26" 108%	13-20-22-30 (42)
4	SS	24" 100%	24-28-34-47 (62)
5	SS	25" 104%	14-13-24-27 (37)

WELL DETAILS



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available/applicable

Well was straight drilled to 7.6 m due to proximity of well in comparison to recently drilled borehole (BH10, drilled April 19, 2018 by CMT Drilling Inc.). Stratigraphy from 0-7.6 m is inferred from this borehole log.

Stantec

Drawn By/Checked By: AH / SR / GW

APPENDIX F:
LABORATORY CERTIFICATES OF ANALYSIS

Your Project #: 161413684
Site Location: GUELPH, ON
Your C.O.C. #: 111362

Attention: Grant Whitehead

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2018/09/19
Report #: R5406235
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8N6455
Received: 2018/09/11, 16:40

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	2	N/A	2018/09/14	CAM SOP-00448	SM 23 2320 B m
Alkalinity	1	N/A	2018/09/19	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	3	N/A	2018/09/14	CAM SOP-00102	APHA 4500-CO2 D
Carbonaceous BOD	1	2018/09/12	2018/09/17	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	1	N/A	2018/09/13	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry	2	N/A	2018/09/14	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry	1	N/A	2018/09/19	CAM SOP-00463	EPA 325.2 m
Conductivity	3	N/A	2018/09/14	CAM SOP-00414	SM 23 2510 m
Total Cyanide	1	2018/09/13	2018/09/13	CAM SOP-00457	OMOE E3015 5 m
Dissolved Organic Carbon (DOC) (1)	3	N/A	2018/09/14	CAM SOP-00446	SM 23 5310 B m
Fluoride	1	2018/09/12	2018/09/13	CAM SOP-00449	SM 23 4500-F C m
Hardness (calculated as CaCO3)	3	N/A	2018/09/17	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	1	2018/09/14	2018/09/14	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	1	N/A	2018/09/14	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2018/09/17	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2018/09/19	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2018/09/13	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	3	N/A	2018/09/17		
Anion and Cation Sum	3	N/A	2018/09/17		
Fecal coliform, (5TMPN/100mL)	1	N/A	2018/09/11	BBY4 SOP-000127	MFHPB-19
Total Ammonia-N	3	N/A	2018/09/18	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	3	N/A	2018/09/13	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Animal and Vegetable Oil and Grease	1	N/A	2018/09/14	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2018/09/14	2018/09/14	CAM SOP-00326	EPA1664B m,SM5520A m
pH	1	N/A	2018/09/13	CAM SOP-00413	SM 4500H+ B m
pH	3	N/A	2018/09/14	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2018/09/14	CAM SOP-00444	OMOE E3179 m
Orthophosphate	3	N/A	2018/09/14	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	3	N/A	2018/09/17		

Your Project #: 161413684
Site Location: GUELPH, ON
Your C.O.C. #: 111362

Attention: Grant Whitehead

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2018/09/19
Report #: R5406235
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8N6455
Received: 2018/09/11, 16:40

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sat. pH and Langelier Index (@ 4C)	3	N/A	2018/09/17		
Sulphate by Automated Colourimetry	1	N/A	2018/09/13	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	3	N/A	2018/09/14	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	3	N/A	2018/09/17		
Total Kjeldahl Nitrogen in Water	1	2018/09/17	2018/09/17	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (3)	1	2018/09/14	2018/09/14	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	4	2018/09/12	2018/09/13	CAM SOP-00428	SM 23 2540D m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Your Project #: 161413684
Site Location: GUELPH, ON
Your C.O.C. #: 111362

Attention: Grant Whitehead

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2018/09/19
Report #: R5406235
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8N6455
Received: 2018/09/11, 16:40

Encryption Key

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Colby Coutu
Project Manager Assistant
19 Sep 2018 17:12:27
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Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Augustyna Dobosz, Project Manager
Email: ADobosz@maxxam.ca
Phone# (905)817-5700 Ext:5798
==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

THE CITY OF GUELPH SANITARY SEWER BYLAW (WATER)

Maxxam ID		HSJ715			HSJ715		
Sampling Date		2018/09/11 15:05			2018/09/11 15:05		
COC Number		111362			111362		
	UNITS	**WG-161413684-20180911-DS-04**	**RDL**	**QC Batch**	**WG-161413684-20180911-DS-04 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	0.50	5724443			
Inorganics							
Total Carbonaceous BOD	mg/L	<2	2	5726645	<2	2	5726645
Fluoride (F-)	mg/L	0.13	0.10	5727841			
Total Kjeldahl Nitrogen (TKN)	mg/L	1.7	0.10	5734882			
pH	pH	7.90		5727848			
Phenols-4AAP	mg/L	<0.0010	0.0010	5729249			
Total Suspended Solids	mg/L	2500	33	5727677			
Dissolved Sulphate (SO4)	mg/L	40	1.0	5727421			
Total Cyanide (CN)	mg/L	<0.0050	0.0050	5729123			
Dissolved Chloride (Cl-)	mg/L	46	1.0	5727413			
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L	<0.50	0.50	5731988			
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	5732048			
Metals							
Mercury (Hg)	mg/L	<0.0001	0.0001	5731153			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Stantec Consulting Ltd
Client Project #: 161413684
Site Location: GUELPH, ON
Sampler Initials: DS

THE CITY OF GUELPH STORM SEWER BYLAW (WATER)

Maxxam ID		HSJ715		
Sampling Date		2018/09/11 15:05		
COC Number		111362		
	UNITS	**WG-161413684-20180911-DS-04**	**RDL**	**QC Batch**
Metals				
Total Aluminum (Al)	mg/L	15	0.025	5728921
Total Antimony (Sb)	mg/L	<0.00050	0.00050	5728921
Total Arsenic (As)	mg/L	0.0062	0.0010	5728921
Total Bismuth (Bi)	mg/L	<0.0010	0.0010	5728921
Total Cadmium (Cd)	mg/L	0.0019	0.00010	5728921
Total Chromium (Cr)	mg/L	0.040	0.0050	5728921
Total Cobalt (Co)	mg/L	0.0096	0.00050	5728921
Total Copper (Cu)	mg/L	0.030	0.0010	5729988
Total Iron (Fe)	mg/L	23	0.10	5728921
Total Lead (Pb)	mg/L	0.13	0.00050	5728921
Total Manganese (Mn)	mg/L	1.3	0.0020	5728921
Total Molybdenum (Mo)	mg/L	0.0032	0.00050	5728921
Total Nickel (Ni)	mg/L	0.021	0.0010	5728921
Total Phosphorus (P)	mg/L	1.1	0.10	5728921
Total Selenium (Se)	mg/L	<0.0020	0.0020	5728921
Total Silver (Ag)	mg/L	<0.00010	0.00010	5728921
Total Tin (Sn)	mg/L	0.0011	0.0010	5728921
Total Titanium (Ti)	mg/L	0.49	0.0050	5728921
Total Vanadium (V)	mg/L	0.031	0.00050	5728921
Total Zinc (Zn)	mg/L	0.64	0.0050	5728921
Microbiological				
Fecal coliform	5TMPN/100mL	350	1.8	5726125

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		HSJ712		HSJ713		
Sampling Date		2018/09/11 12:40		2018/09/11 13:10		
COC Number		111362		111362		
	UNITS	**WG-161413684-20180911-DS-01**	**QC Batch**	**WG-161413684-20180911-DS-02**	**RDL**	**QC Batch**
Calculated Parameters						
Anion Sum	me/L	6.67	5724250	9.30	N/A	5724250
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	300	5724251	330	1.0	5724251
Calculated TDS	mg/L	330	5724255	530	1.0	5724255
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.7	5724251	4.7	1.0	5724251
Cation Sum	me/L	6.66	5724250	11.8	N/A	5724250
Hardness (CaCO3)	mg/L	320	5724254	520	1.0	5724254
Ion Balance (% Difference)	%	0.0500	5724249	12.1	N/A	5724249
Langelier Index (@ 20C)	N/A	1.01	5724252	1.25		5724252
Langelier Index (@ 4C)	N/A	0.762	5724253	0.997		5724253
Saturation pH (@ 20C)	N/A	7.10	5724252	6.93		5724252
Saturation pH (@ 4C)	N/A	7.35	5724253	7.18		5724253
Inorganics						
Total Ammonia-N	mg/L	<0.050	5732437	<0.050	0.050	5732437
Conductivity	umho/cm	580	5727479	830	1.0	5727479
Dissolved Organic Carbon	mg/L	0.83	5727802	1.0	0.50	5727802
Orthophosphate (P)	mg/L	<0.010	5727668	<0.010	0.010	5727668
pH	pH	8.11	5727480	8.18		5727480
Dissolved Sulphate (SO4)	mg/L	15	5727661	84	1.0	5727661
Alkalinity (Total as CaCO3)	mg/L	310	5727466	340	1.0	5738172
Dissolved Chloride (Cl-)	mg/L	7.4	5727647	27	1.0	5738161
Nitrite (N)	mg/L	<0.010	5727425	<0.010	0.010	5727425
Nitrate (N)	mg/L	0.25	5727425	0.12	0.10	5727425
Nitrate + Nitrite (N)	mg/L	0.25	5727425	0.12	0.10	5727425
Metals						
Dissolved Aluminum (Al)	mg/L	<0.0050	5728244	0.063	0.0050	5738013
Dissolved Antimony (Sb)	mg/L	<0.00050	5728244	<0.00050	0.00050	5738013
Dissolved Arsenic (As)	mg/L	<0.0010	5728244	0.0015	0.0010	5738013
Dissolved Barium (Ba)	mg/L	0.032	5728244	0.076	0.0020	5738013
Dissolved Beryllium (Be)	mg/L	<0.00050	5728244	<0.00050	0.00050	5738013
Dissolved Boron (B)	mg/L	0.014	5728244	0.013	0.010	5738013

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		HSJ712		HSJ713		
Sampling Date		2018/09/11 12:40		2018/09/11 13:10		
COC Number		111362		111362		
	UNITS	**WG-161413684-20180911-DS-01**	**QC Batch**	**WG-161413684-20180911-DS-02**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	<0.00010	5728244	<0.00010	0.00010	5738013
Dissolved Calcium (Ca)	mg/L	69	5728244	100	0.20	5738013
Dissolved Chromium (Cr)	mg/L	<0.0050	5728244	<0.0050	0.0050	5738013
Dissolved Cobalt (Co)	mg/L	<0.00050	5728244	<0.00050	0.00050	5738013
Dissolved Copper (Cu)	mg/L	<0.0010	5728244	<0.0010	0.0010	5738013
Dissolved Iron (Fe)	mg/L	<0.10	5728244	0.19	0.10	5738013
Dissolved Lead (Pb)	mg/L	<0.00050	5728244	0.00056	0.00050	5738013
Dissolved Magnesium (Mg)	mg/L	36	5728244	63	0.050	5738013
Dissolved Manganese (Mn)	mg/L	0.011	5728244	0.046	0.0020	5738013
Dissolved Molybdenum (Mo)	mg/L	0.00079	5728244	0.0030	0.00050	5738013
Dissolved Nickel (Ni)	mg/L	<0.0010	5728244	<0.0010	0.0010	5738013
Dissolved Phosphorus (P)	mg/L	<0.10	5728244	<0.10	0.10	5738013
Dissolved Potassium (K)	mg/L	1.1	5728244	2.6	0.20	5738013
Dissolved Selenium (Se)	mg/L	<0.0020	5728244	<0.0020	0.0020	5738013
Dissolved Silicon (Si)	mg/L	6.3	5728244	7.9	0.050	5738013
Dissolved Silver (Ag)	mg/L	<0.00010	5728244	<0.00010	0.00010	5738013
Dissolved Sodium (Na)	mg/L	5.4	5728244	34	0.10	5738013
Dissolved Strontium (Sr)	mg/L	0.13	5728244	0.20	0.0010	5738013
Dissolved Thallium (Tl)	mg/L	<0.000050	5728244	<0.000050	0.000050	5738013
Dissolved Titanium (Ti)	mg/L	<0.0050	5728244	0.0051	0.0050	5738013
Dissolved Uranium (U)	mg/L	0.00063	5728244	0.0022	0.00010	5738013
Dissolved Vanadium (V)	mg/L	<0.00050	5728244	0.0014	0.00050	5738013
Dissolved Zinc (Zn)	mg/L	<0.0050	5728244	<0.0050	0.0050	5738013

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B8N6455
Report Date: 2018/09/19

Stantec Consulting Ltd
Client Project #: 161413684
Site Location: GUELPH, ON
Sampler Initials: DS

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		HSJ714		
Sampling Date		2018/09/11 13:55		
COC Number		111362		
	UNITS	**WG-161413684-20180911-DS-03**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	10.7	N/A	5724250
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	410	1.0	5724251
Calculated TDS	mg/L	540	1.0	5724255
Carb. Alkalinity (calc. as CaCO3)	mg/L	5.3	1.0	5724251
Cation Sum	me/L	10.9	N/A	5724250
Hardness (CaCO3)	mg/L	490	1.0	5724254
Ion Balance (% Difference)	%	1.08	N/A	5724249
Langelier Index (@ 20C)	N/A	1.20		5724252
Langelier Index (@ 4C)	N/A	0.947		5724253
Saturation pH (@ 20C)	N/A	6.95		5724252
Saturation pH (@ 4C)	N/A	7.20		5724253
Inorganics				
Total Ammonia-N	mg/L	0.071	0.050	5732437
Conductivity	umho/cm	950	1.0	5727479
Dissolved Organic Carbon	mg/L	1.4	0.50	5727802
Orthophosphate (P)	mg/L	0.012	0.010	5727668
pH	pH	8.14		5727480
Dissolved Sulphate (SO4)	mg/L	50	1.0	5727661
Alkalinity (Total as CaCO3)	mg/L	410	1.0	5727466
Dissolved Chloride (Cl-)	mg/L	43	1.0	5727647
Nitrite (N)	mg/L	0.026	0.010	5727425
Nitrate (N)	mg/L	1.93	0.10	5727425
Nitrate + Nitrite (N)	mg/L	1.96	0.10	5727425
Metals				
Dissolved Aluminum (Al)	mg/L	0.0064	0.0050	5728244
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00050	5728244
Dissolved Arsenic (As)	mg/L	<0.0010	0.0010	5728244
Dissolved Barium (Ba)	mg/L	0.13	0.0020	5728244
Dissolved Beryllium (Be)	mg/L	<0.00050	0.00050	5728244
Dissolved Boron (B)	mg/L	0.11	0.010	5728244

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		HSJ714		
Sampling Date		2018/09/11 13:55		
COC Number		111362		
	UNITS	**WG-161413684-20180911-DS-03**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	<0.00010	0.00010	5728244
Dissolved Calcium (Ca)	mg/L	82	0.20	5728244
Dissolved Chromium (Cr)	mg/L	<0.0050	0.0050	5728244
Dissolved Cobalt (Co)	mg/L	<0.00050	0.00050	5728244
Dissolved Copper (Cu)	mg/L	<0.0010	0.0010	5728244
Dissolved Iron (Fe)	mg/L	<0.10	0.10	5728244
Dissolved Lead (Pb)	mg/L	<0.00050	0.00050	5728244
Dissolved Magnesium (Mg)	mg/L	71	0.050	5728244
Dissolved Manganese (Mn)	mg/L	0.020	0.0020	5728244
Dissolved Molybdenum (Mo)	mg/L	0.0042	0.00050	5728244
Dissolved Nickel (Ni)	mg/L	<0.0010	0.0010	5728244
Dissolved Phosphorus (P)	mg/L	0.11	0.10	5728244
Dissolved Potassium (K)	mg/L	5.9	0.20	5728244
Dissolved Selenium (Se)	mg/L	0.0022	0.0020	5728244
Dissolved Silicon (Si)	mg/L	5.2	0.050	5728244
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	5728244
Dissolved Sodium (Na)	mg/L	20	0.10	5728244
Dissolved Strontium (Sr)	mg/L	0.23	0.0010	5728244
Dissolved Thallium (Tl)	mg/L	<0.000050	0.000050	5728244
Dissolved Titanium (Ti)	mg/L	<0.0050	0.0050	5728244
Dissolved Uranium (U)	mg/L	0.0030	0.00010	5728244
Dissolved Vanadium (V)	mg/L	0.0012	0.00050	5728244
Dissolved Zinc (Zn)	mg/L	<0.0050	0.0050	5728244

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

RESULTS OF ANALYSES OF WATER

Maxxam ID		HSJ712	HSJ713		HSJ714		
Sampling Date		2018/09/11 12:40	2018/09/11 13:10		2018/09/11 13:55		
COC Number		111362	111362		111362		
	UNITS	**WG-161413684-20180911-DS-01**	**WG-161413684-20180911-DS-02**	**RDL**	**WG-161413684-20180911-DS-03**	**RDL**	**QC Batch**
Inorganics							
Total Suspended Solids	mg/L	1800	1200	25	100	1.3	5727677

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TEST SUMMARY

Maxxam ID: HSJ712
Sample ID: WG-161413684-20180911-DS-01
Matrix: Water

Collected: 2018/09/11
Shipped:
Received: 2018/09/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5727466	N/A	2018/09/14	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5724251	N/A	2018/09/14	Automated Statchk
Chloride by Automated Colourimetry	KONE	5727647	N/A	2018/09/14	Deonarine Ramnarine
Conductivity	AT	5727479	N/A	2018/09/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5727802	N/A	2018/09/14	Shivani Shivani
Hardness (calculated as CaCO3)		5724254	N/A	2018/09/17	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5728244	N/A	2018/09/17	Arefa Dabhad
Ion Balance (% Difference)	CALC	5724249	N/A	2018/09/17	Automated Statchk
Anion and Cation Sum	CALC	5724250	N/A	2018/09/17	Automated Statchk
Total Ammonia-N	LACH/NH4	5732437	N/A	2018/09/18	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5727425	N/A	2018/09/13	Chandra Nandlal
pH	AT	5727480	N/A	2018/09/14	Surinder Rai
Orthophosphate	KONE	5727668	N/A	2018/09/14	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5724252	N/A	2018/09/17	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5724253	N/A	2018/09/17	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5727661	N/A	2018/09/14	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5724255	N/A	2018/09/17	Automated Statchk
Total Suspended Solids	BAL	5727677	2018/09/12	2018/09/13	Jingwei (Alvin) Shi

Maxxam ID: HSJ713
Sample ID: WG-161413684-20180911-DS-02
Matrix: Water

Collected: 2018/09/11
Shipped:
Received: 2018/09/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5738172	N/A	2018/09/19	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5724251	N/A	2018/09/14	Automated Statchk
Chloride by Automated Colourimetry	KONE	5738161	N/A	2018/09/19	Deonarine Ramnarine
Conductivity	AT	5727479	N/A	2018/09/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5727802	N/A	2018/09/14	Shivani Shivani
Hardness (calculated as CaCO3)		5724254	N/A	2018/09/17	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5738013	N/A	2018/09/19	Thao Nguyen
Ion Balance (% Difference)	CALC	5724249	N/A	2018/09/17	Automated Statchk
Anion and Cation Sum	CALC	5724250	N/A	2018/09/17	Automated Statchk
Total Ammonia-N	LACH/NH4	5732437	N/A	2018/09/18	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5727425	N/A	2018/09/13	Chandra Nandlal
pH	AT	5727480	N/A	2018/09/14	Surinder Rai
Orthophosphate	KONE	5727668	N/A	2018/09/14	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5724252	N/A	2018/09/17	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5724253	N/A	2018/09/17	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5727661	N/A	2018/09/14	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5724255	N/A	2018/09/17	Automated Statchk
Total Suspended Solids	BAL	5727677	2018/09/12	2018/09/13	Jingwei (Alvin) Shi

TEST SUMMARY

Maxxam ID: HSJ714
Sample ID: WG-161413684-20180911-DS-03
Matrix: Water

Collected: 2018/09/11
Shipped:
Received: 2018/09/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5727466	N/A	2018/09/14	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5724251	N/A	2018/09/14	Automated Statchk
Chloride by Automated Colourimetry	KONE	5727647	N/A	2018/09/14	Deonarine Ramnarine
Conductivity	AT	5727479	N/A	2018/09/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5727802	N/A	2018/09/14	Shivani Shivani
Hardness (calculated as CaCO3)		5724254	N/A	2018/09/17	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5728244	N/A	2018/09/14	Arefa Dabhad
Ion Balance (% Difference)	CALC	5724249	N/A	2018/09/17	Automated Statchk
Anion and Cation Sum	CALC	5724250	N/A	2018/09/17	Automated Statchk
Total Ammonia-N	LACH/NH4	5732437	N/A	2018/09/18	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5727425	N/A	2018/09/13	Chandra Nandlal
pH	AT	5727480	N/A	2018/09/14	Surinder Rai
Orthophosphate	KONE	5727668	N/A	2018/09/14	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5724252	N/A	2018/09/17	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5724253	N/A	2018/09/17	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5727661	N/A	2018/09/14	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5724255	N/A	2018/09/17	Automated Statchk
Total Suspended Solids	BAL	5727677	2018/09/12	2018/09/13	Jingwei (Alvin) Shi

Maxxam ID: HSJ715
Sample ID: WG-161413684-20180911-DS-04
Matrix: Water

Collected: 2018/09/11
Shipped:
Received: 2018/09/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	5726645	2018/09/12	2018/09/17	Frank Zhang
Chloride by Automated Colourimetry	KONE	5727413	N/A	2018/09/13	Alina Dobreanu
Total Cyanide	SKAL/CN	5729123	2018/09/13	2018/09/13	Xuanhong Qiu
Fluoride	ISE	5727841	2018/09/12	2018/09/13	Surinder Rai
Mercury in Water by CVAA	CV/AA	5731153	2018/09/14	2018/09/14	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5728921	N/A	2018/09/13	Arefa Dabhad
Fecal coliform, (5TMPN/100mL)	INC	5726125	N/A	2018/09/11	Sirimathie Aluthwala
Animal and Vegetable Oil and Grease	BAL	5724443	N/A	2018/09/14	Automated Statchk
Total Oil and Grease	BAL	5731988	2018/09/14	2018/09/14	Amjad Mir
pH	AT	5727848	N/A	2018/09/13	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5729249	N/A	2018/09/14	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5727421	N/A	2018/09/13	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	5734882	2018/09/17	2018/09/17	Rajni Tyagi
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	5732048	2018/09/14	2018/09/14	Amjad Mir
Total Suspended Solids	BAL	5727677	2018/09/12	2018/09/13	Jingwei (Alvin) Shi

TEST SUMMARY

Maxxam ID: HSJ715 Dup
Sample ID: WG-161413684-20180911-DS-04
Matrix: Water

Collected: 2018/09/11
Shipped:
Received: 2018/09/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	5726645	2018/09/12	2018/09/17	Frank Zhang

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.7°C

Sample HSJ713 [WG-161413684-20180911-DS-02] : Elevated ion balance result was confirmed by re-analysis.

Sample HSJ715, Total Metals Analysis by ICPMS: Test repeated.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5726645	Total Carbonaceous BOD	2018/09/17					<2	mg/L	NC	30	98	85 - 115
5727413	Dissolved Chloride (Cl-)	2018/09/13	NC	80 - 120	104	80 - 120	<1.0	mg/L	0.80	20		
5727421	Dissolved Sulphate (SO4)	2018/09/13	NC	75 - 125	97	80 - 120	<1.0	mg/L	0.58	20		
5727425	Nitrate (N)	2018/09/13	89	80 - 120	102	80 - 120	<0.10	mg/L	NC	20		
5727425	Nitrite (N)	2018/09/13	104	80 - 120	104	80 - 120	<0.010	mg/L	NC	20		
5727466	Alkalinity (Total as CaCO3)	2018/09/14			97	85 - 115	<1.0	mg/L	0.90	20		
5727479	Conductivity	2018/09/14			101	85 - 115	<1.0	umho/cm	0.36	25		
5727480	pH	2018/09/14			101	98 - 103			0.24	N/A		
5727647	Dissolved Chloride (Cl-)	2018/09/14	114	80 - 120	101	80 - 120	<1.0	mg/L	13	20		
5727661	Dissolved Sulphate (SO4)	2018/09/14	104	75 - 125	103	80 - 120	<1.0	mg/L	0.21	20		
5727668	Orthophosphate (P)	2018/09/14	109	75 - 125	99	80 - 120	<0.010	mg/L	NC	25		
5727677	Total Suspended Solids	2018/09/13					<10	mg/L	NC	25	95	85 - 115
5727802	Dissolved Organic Carbon	2018/09/14	95	80 - 120	98	80 - 120	<0.50	mg/L	5.0	20		
5727841	Fluoride (F-)	2018/09/13	97	80 - 120	99	80 - 120	<0.10	mg/L	6.7	20		
5727848	pH	2018/09/13			102	98 - 103			0.24	N/A		
5728244	Dissolved Aluminum (Al)	2018/09/14	102	80 - 120	100	80 - 120	<0.0050	mg/L				
5728244	Dissolved Antimony (Sb)	2018/09/14	105	80 - 120	101	80 - 120	<0.00050	mg/L	NC	20		
5728244	Dissolved Arsenic (As)	2018/09/14	101	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
5728244	Dissolved Barium (Ba)	2018/09/14	102	80 - 120	100	80 - 120	<0.0020	mg/L	1.7	20		
5728244	Dissolved Beryllium (Be)	2018/09/14	112	80 - 120	105	80 - 120	<0.00050	mg/L	NC	20		
5728244	Dissolved Boron (B)	2018/09/14	112	80 - 120	104	80 - 120	<0.010	mg/L	NC	20		
5728244	Dissolved Cadmium (Cd)	2018/09/14	103	80 - 120	101	80 - 120	<0.00010	mg/L	NC	20		
5728244	Dissolved Calcium (Ca)	2018/09/14	NC	80 - 120	94	80 - 120	<0.20	mg/L				
5728244	Dissolved Chromium (Cr)	2018/09/14	99	80 - 120	94	80 - 120	<0.0050	mg/L	NC	20		
5728244	Dissolved Cobalt (Co)	2018/09/14	95	80 - 120	96	80 - 120	<0.00050	mg/L	NC	20		
5728244	Dissolved Copper (Cu)	2018/09/14	101	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5728244	Dissolved Iron (Fe)	2018/09/14	103	80 - 120	101	80 - 120	<0.10	mg/L				
5728244	Dissolved Lead (Pb)	2018/09/14	99	80 - 120	100	80 - 120	<0.00050	mg/L	NC	20		
5728244	Dissolved Magnesium (Mg)	2018/09/14	106	80 - 120	102	80 - 120	<0.050	mg/L				
5728244	Dissolved Manganese (Mn)	2018/09/14	100	80 - 120	98	80 - 120	<0.0020	mg/L				

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5728244	Dissolved Molybdenum (Mo)	2018/09/14	105	80 - 120	103	80 - 120	<0.00050	mg/L	8.3	20		
5728244	Dissolved Nickel (Ni)	2018/09/14	96	80 - 120	95	80 - 120	<0.0010	mg/L	3.1	20		
5728244	Dissolved Phosphorus (P)	2018/09/14	115	80 - 120	116	80 - 120	<0.10	mg/L				
5728244	Dissolved Potassium (K)	2018/09/14	106	80 - 120	104	80 - 120	<0.20	mg/L				
5728244	Dissolved Selenium (Se)	2018/09/14	99	80 - 120	99	80 - 120	<0.0020	mg/L	NC	20		
5728244	Dissolved Silicon (Si)	2018/09/14	100	80 - 120	102	80 - 120	<0.050	mg/L				
5728244	Dissolved Silver (Ag)	2018/09/14	98	80 - 120	98	80 - 120	<0.00010	mg/L	NC	20		
5728244	Dissolved Sodium (Na)	2018/09/14	NC	80 - 120	101	80 - 120	<0.10	mg/L	3.9	20		
5728244	Dissolved Strontium (Sr)	2018/09/14	101	80 - 120	98	80 - 120	<0.0010	mg/L				
5728244	Dissolved Thallium (Tl)	2018/09/14	100	80 - 120	97	80 - 120	<0.000050	mg/L	NC	20		
5728244	Dissolved Titanium (Ti)	2018/09/14	105	80 - 120	103	80 - 120	<0.0050	mg/L				
5728244	Dissolved Uranium (U)	2018/09/14	102	80 - 120	101	80 - 120	<0.00010	mg/L	4.9	20		
5728244	Dissolved Vanadium (V)	2018/09/14	97	80 - 120	93	80 - 120	<0.00050	mg/L	NC	20		
5728244	Dissolved Zinc (Zn)	2018/09/14	98	80 - 120	97	80 - 120	<0.0050	mg/L	4.0	20		
5728921	Total Aluminum (Al)	2018/09/13	112	80 - 120	101	80 - 120	0.0062, RDL=0.0050	mg/L	0.18	20		
5728921	Total Antimony (Sb)	2018/09/13	101	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20		
5728921	Total Arsenic (As)	2018/09/13	99	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
5728921	Total Bismuth (Bi)	2018/09/13	89	80 - 120	91	80 - 120	<0.0010	mg/L	NC	20		
5728921	Total Cadmium (Cd)	2018/09/13	100	80 - 120	99	80 - 120	<0.00010	mg/L	NC	20		
5728921	Total Chromium (Cr)	2018/09/13	98	80 - 120	95	80 - 120	<0.0050	mg/L	NC	20		
5728921	Total Cobalt (Co)	2018/09/13	99	80 - 120	97	80 - 120	<0.00050	mg/L	NC	20		
5728921	Total Iron (Fe)	2018/09/13	99	80 - 120	98	80 - 120	<0.10	mg/L	1.5	20		
5728921	Total Lead (Pb)	2018/09/13	92	80 - 120	92	80 - 120	<0.00050	mg/L	1.7	20		
5728921	Total Manganese (Mn)	2018/09/13	95	80 - 120	96	80 - 120	<0.0020	mg/L	2.3	20		
5728921	Total Molybdenum (Mo)	2018/09/13	97	80 - 120	100	80 - 120	<0.00050	mg/L	3.9	20		
5728921	Total Nickel (Ni)	2018/09/13	91	80 - 120	92	80 - 120	<0.0010	mg/L	NC	20		
5728921	Total Phosphorus (P)	2018/09/13	NC	80 - 120	111	80 - 120	<0.10	mg/L				
5728921	Total Selenium (Se)	2018/09/13	105	80 - 120	105	80 - 120	<0.0020	mg/L	NC	20		
5728921	Total Silver (Ag)	2018/09/13	95	80 - 120	95	80 - 120	<0.00010	mg/L	NC	20		
5728921	Total Tin (Sn)	2018/09/13	98	80 - 120	97	80 - 120	<0.0010	mg/L	NC	20		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5728921	Total Titanium (Ti)	2018/09/13	96	80 - 120	98	80 - 120	<0.0050	mg/L	6.5	20		
5728921	Total Vanadium (V)	2018/09/13	94	80 - 120	94	80 - 120	<0.00050	mg/L	7.8	20		
5728921	Total Zinc (Zn)	2018/09/13	99	80 - 120	100	80 - 120	<0.0050	mg/L	1.6	20		
5729123	Total Cyanide (CN)	2018/09/13	85	80 - 120	97	80 - 120	<0.0050	mg/L	1.6	20		
5729249	Phenols-4AAP	2018/09/13	93	80 - 120	94	80 - 120	<0.0010	mg/L	NC	20		
5729988	Total Copper (Cu)	2018/09/14	102	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20		
5731153	Mercury (Hg)	2018/09/14	95	75 - 125	92	80 - 120	<0.0001	mg/L	NC	20		
5731988	Total Oil & Grease	2018/09/14	91	75 - 125	96	85 - 115	<0.50	mg/L	1.6	25		
5732048	Total Oil & Grease Mineral/Synthetic	2018/09/14	93	75 - 125	92	85 - 115	<0.50	mg/L	2.7	25		
5732437	Total Ammonia-N	2018/09/18	101	75 - 125	102	80 - 120	<0.050	mg/L	NC	20		
5734882	Total Kjeldahl Nitrogen (TKN)	2018/09/17	98	80 - 120	100	80 - 120	<0.10	mg/L	1.7	20	99	80 - 120
5738013	Dissolved Aluminum (Al)	2018/09/19	105	80 - 120	99	80 - 120	<0.0050	mg/L				
5738013	Dissolved Antimony (Sb)	2018/09/19	110	80 - 120	100	80 - 120	<0.00050	mg/L	NC	20		
5738013	Dissolved Arsenic (As)	2018/09/19	103	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
5738013	Dissolved Barium (Ba)	2018/09/19	107	80 - 120	99	80 - 120	<0.0020	mg/L	1.1	20		
5738013	Dissolved Beryllium (Be)	2018/09/19	99	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20		
5738013	Dissolved Boron (B)	2018/09/19	104	80 - 120	100	80 - 120	<0.010	mg/L	0.083	20		
5738013	Dissolved Cadmium (Cd)	2018/09/19	98	80 - 120	98	80 - 120	<0.00010	mg/L	NC	20		
5738013	Dissolved Calcium (Ca)	2018/09/19	NC	80 - 120	99	80 - 120	<0.20	mg/L				
5738013	Dissolved Chromium (Cr)	2018/09/19	100	80 - 120	97	80 - 120	<0.0050	mg/L	NC	20		
5738013	Dissolved Cobalt (Co)	2018/09/19	99	80 - 120	97	80 - 120	<0.00050	mg/L	3.6	20		
5738013	Dissolved Copper (Cu)	2018/09/19	104	80 - 120	98	80 - 120	<0.0010	mg/L	NC	20		
5738013	Dissolved Iron (Fe)	2018/09/19	104	80 - 120	100	80 - 120	<0.10	mg/L				
5738013	Dissolved Lead (Pb)	2018/09/19	90	80 - 120	97	80 - 120	<0.00050	mg/L	NC	20		
5738013	Dissolved Magnesium (Mg)	2018/09/19	NC	80 - 120	99	80 - 120	<0.050	mg/L				
5738013	Dissolved Manganese (Mn)	2018/09/19	101	80 - 120	98	80 - 120	<0.0020	mg/L				
5738013	Dissolved Molybdenum (Mo)	2018/09/19	113	80 - 120	101	80 - 120	<0.00050	mg/L	1.9	20		
5738013	Dissolved Nickel (Ni)	2018/09/19	95	80 - 120	96	80 - 120	<0.0010	mg/L	7.9	20		
5738013	Dissolved Phosphorus (P)	2018/09/19	116	80 - 120	118	80 - 120	<0.10	mg/L				
5738013	Dissolved Potassium (K)	2018/09/19	108	80 - 120	99	80 - 120	<0.20	mg/L				
5738013	Dissolved Selenium (Se)	2018/09/19	99	80 - 120	100	80 - 120	<0.0020	mg/L	NC	20		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5738013	Dissolved Silicon (Si)	2018/09/19	107	80 - 120	101	80 - 120	<0.050	mg/L				
5738013	Dissolved Silver (Ag)	2018/09/19	96	80 - 120	97	80 - 120	<0.00010	mg/L	NC	20		
5738013	Dissolved Sodium (Na)	2018/09/19	NC	80 - 120	97	80 - 120	<0.10	mg/L	1.4	20		
5738013	Dissolved Strontium (Sr)	2018/09/19	NC	80 - 120	97	80 - 120	<0.0010	mg/L				
5738013	Dissolved Thallium (Tl)	2018/09/19	90	80 - 120	96	80 - 120	<0.000050	mg/L	NC	20		
5738013	Dissolved Titanium (Ti)	2018/09/19	110	80 - 120	101	80 - 120	<0.0050	mg/L				
5738013	Dissolved Uranium (U)	2018/09/19	96	80 - 120	100	80 - 120	<0.00010	mg/L	1.8	20		
5738013	Dissolved Vanadium (V)	2018/09/19	106	80 - 120	97	80 - 120	<0.00050	mg/L	NC	20		
5738013	Dissolved Zinc (Zn)	2018/09/19	90	80 - 120	96	80 - 120	<0.0050	mg/L	NC	20		
5738161	Dissolved Chloride (Cl-)	2018/09/19	115	80 - 120	102	80 - 120	<1.0	mg/L	5.6	20		
5738172	Alkalinity (Total as CaCO3)	2018/09/19			96	85 - 115	<1.0	mg/L	1.2	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Sirimathie Aluthwala, Campobello Micro

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam MICRO
A Bureau Veritas Group Company

CHAIN OF CUSTODY RECORD 111362

Page 1 of 1

Invoice Information
Company Name: Stantec
Contact Name: Grant Whitehead
Address:
Phone: Fax:
Email: Grant.whitehead@stantec.com

Report Information (if differs from invoice)
Company Name:
Contact Name:
Address:
Phone: Fax:
Email:

Project Information (where applicable)
Quotation #: Stantec 2015-2018
P.O. # AFE#:
Project #: 161413684
Site Location: Guelph, ON
Site #:
Sampled By: Drew Smith

Turnaround Time (TAT) Required
☒ Regular TAT (5-7 days) Most analyses
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Rush TAT (Surcharges will be applied)
☐ 1 Day ☐ 2 Days ☐ 3-4 Days
Date Required:
Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153
☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other
☐ For RSC
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations
☐ CCME ☐ Sanitary Sewer Bylaw
☐ MISA ☐ Storm Sewer Bylaw
☒ PWQO Region
☒ Other (Specify) ODWS
☐ REG 558 (MIN 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	Sample Identification	Date Sampled	Time Sampled (HH:MM)	Matrix	# of Containers Submitted	Field Filtered (circle) [✓ Metals] / Hg / Cr VI	BCAA comprehensive	Guelph Sewer	TSS	Hold - Do Not Analyze
1	WG-161413684-20180911-DS-01	2018/09/11	12:40	GW		X	X		X	
2	WG-161413684-20180911-DS-02	2018/09/11	13:10	GW		X	X		X	
3	WG-161413684-20180911-DS-03	2018/09/11	13:55	GW		X	X		X	
4	WG-161413684-20180911-DS-04	2018/09/11	15:15	GW				X		
5										
6										
7										
8										
9										
10										

LABORATORY USE ONLY
Custody Seal Y / N: Present / Intact
Cooler Temperatures
Cooling Media Present Y / N
Comments

REC'D IN WATERLOO

Relinquished By (Signature/Print)	Date (YYYY/MM/DD)	Time (HH:MM)	Received By (Signature/Print)	Date (YYYY/MM/DD)	Time (HH:MM)
/ Drew Smith	2018/09/11	16:42			
			1442 9/11 arrived/ wcd	2018/09/11	18:[illegible]

11-Sep-18 16:40
Augustyna Dobosz
B8N6455
VMK ENV-1263

Maxxam
A Bureau Veritas Group Company

Your Project #: 161413684
Your C.O.C. #: 686036-01-01

Attention: Grant Whitehead

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA . N2L 0A4

Report Date: 2018/11/14
Report #: R5484375
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T9171
Received: 2018/11/08, 14:50

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	4	N/A	2018/11/10	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	4	N/A	2018/11/12	CAM SOP-00102	APHA 4500-CO2 D
Carbonaceous BOD	1	2018/11/09	2018/11/14	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	5	N/A	2018/11/12	CAM SOP-00463	EPA 325.2 m
Conductivity	4	N/A	2018/11/10	CAM SOP-00414	SM 23 2510 m
Total Cyanide	1	2018/11/12	2018/11/13	CAM SOP-00457	OMOE E3015 5 m
Dissolved Organic Carbon (DOC) (1)	4	N/A	2018/11/12	CAM SOP-00446	SM 23 5310 B m
Fluoride	1	2018/11/10	2018/11/13	CAM SOP-00449	SM 23 4500-F C m
Hardness (calculated as CaCO3)	4	N/A	2018/11/13	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	1	2018/11/14	2018/11/14	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	5	N/A	2018/11/12	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2018/11/12	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	4	N/A	2018/11/13		
Anion and Cation Sum	4	N/A	2018/11/13		
Fecal coliform, (5TMPN/100mL)	1	N/A	2018/11/08	BBY4 SOP-000127	MFHPB-19
Total Ammonia-N	3	N/A	2018/11/12	CAM SOP-00441	EPA GS I-2522-90 m
Total Ammonia-N	1	N/A	2018/11/13	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	4	N/A	2018/11/13	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Animal and Vegetable Oil and Grease	1	N/A	2018/11/13	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2018/11/13	2018/11/13	CAM SOP-00326	EPA1664B m,SM5520A m
pH	4	N/A	2018/11/10	CAM SOP-00413	SM 4500H+ B m
pH	1	N/A	2018/11/12	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2018/11/13	CAM SOP-00444	OMOE E3179 m
Orthophosphate	4	N/A	2018/11/12	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	4	N/A	2018/11/13		
Sat. pH and Langelier Index (@ 4C)	4	N/A	2018/11/13		
Sulphate by Automated Colourimetry	5	N/A	2018/11/12	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	4	N/A	2018/11/13		
Total Kjeldahl Nitrogen in Water	1	2018/11/10	2018/11/12	CAM SOP-00938	OMOE E3516 m

Your Project #: 161413684
Your C.O.C. #: 686036-01-01

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CANADA N2L 0A4

Report Date: 2018/11/14
Report #: R5484375
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T9171
Received: 2018/11/08, 14:50

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Mineral/Synthetic O & G (TPH Heavy Oil) (3)	1	2018/11/13	2018/11/13	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	5	2018/11/09	2018/11/12	CAM SOP-00428	SM 23 2540D m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Your Project #: 161413684
Your C.O.C. #: 686036-01-01

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Report Date: 2018/11/14
Report #: R5484375
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T9171
Received: 2018/11/08, 14:50

Encryption Key

Colby Coutu
Project Manager Assistant
14 Nov 2018 17:01:42

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Augustyna Dobosz, Project Manager
Email: ADobosz@maxxam.ca
Phone# (905)817-5700 Ext:5798

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

THE CITY OF GUELPH SANITARY SEWER BYLAW (WATER)

Maxxam ID		IGE068		
Sampling Date		2018/11/08 11:30		
COC Number		686036-01-01		
	UNITS	**WG-161413684-20181108-DS01**	**RDL**	**QC Batch**
Calculated Parameters				
Total Animal/Vegetable Oil and Grease	mg/L	3.3	0.50	5827390
Inorganics				
Total Carbonaceous BOD	mg/L	<2	2	5829310
Fluoride (F-)	mg/L	0.12	0.10	5831501
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5831642
pH	pH	7.69		5831504
Phenols-4AAP	mg/L	<0.0010	0.0010	5832393
Total Suspended Solids	mg/L	4800	17	5830227
Dissolved Sulphate (SO4)	mg/L	44	1.0	5831429
Total Cyanide (CN)	mg/L	<0.0050	0.0050	5832812
Dissolved Chloride (Cl-)	mg/L	38	1.0	5831425
Petroleum Hydrocarbons				
Total Oil & Grease	mg/L	3.3	0.50	5833748
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	5833755
Metals				
Mercury (Hg)	mg/L	<0.0001	0.0001	5836000

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

THE CITY OF GUELPH STORM SEWER BYLAW (WATER)

Maxxam ID		IGE068		
Sampling Date		2018/11/08 11:30		
COC Number		686036-01-01		
	UNITS	**WG-161413684-20181108-DS01**	**RDL**	**QC Batch**
Metals				
Total Aluminum (Al)	mg/L	7.4	0.0050	5831797
Total Antimony (Sb)	mg/L	<0.00050	0.00050	5831797
Total Arsenic (As)	mg/L	0.0038	0.0010	5831797
Total Bismuth (Bi)	mg/L	<0.0010	0.0010	5831797
Total Cadmium (Cd)	mg/L	0.00024	0.00010	5831797
Total Chromium (Cr)	mg/L	0.019	0.0050	5831797
Total Cobalt (Co)	mg/L	0.0040	0.00050	5831797
Total Copper (Cu)	mg/L	0.011	0.0010	5831797
Total Iron (Fe)	mg/L	10	0.10	5831797
Total Lead (Pb)	mg/L	0.030	0.00050	5831797
Total Manganese (Mn)	mg/L	0.40	0.0020	5831797
Total Molybdenum (Mo)	mg/L	0.0040	0.00050	5831797
Total Nickel (Ni)	mg/L	0.0089	0.0010	5831797
Total Phosphorus (P)	mg/L	0.41	0.10	5831797
Total Selenium (Se)	mg/L	<0.0020	0.0020	5831797
Total Silver (Ag)	mg/L	<0.00010	0.00010	5831797
Total Tin (Sn)	mg/L	0.0015	0.0010	5831797
Total Titanium (Ti)	mg/L	0.22	0.0050	5831797
Total Vanadium (V)	mg/L	0.016	0.00050	5831797
Total Zinc (Zn)	mg/L	0.098	0.0050	5831797
Microbiological				
Fecal coliform	5TMPN/100mL	<1.8	1.8	5828861
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		IGE069	IGE070	IGE071		
Sampling Date		2018/11/08 12:40	2018/11/08 13:15	2018/11/08 13:20		
COC Number		686036-01-01	686036-01-01	686036-01-01		
	UNITS	WG-161413684-20181108-DS02	WG-161413684-20181108-DS03	WG-161413684-20181108-DS04	RDL	QC Batch
Calculated Parameters						
Anion Sum	me/L	8.98	7.31	6.51	N/A	5827281
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	230	310	240	1.0	5827280
Calculated TDS	mg/L	460	350	330	1.0	5827284
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.2	3.2	4.1	1.0	5827280
Cation Sum	me/L	9.29	7.10	5.93	N/A	5827281
Hardness (CaCO3)	mg/L	380	330	190	1.0	5827179
Ion Balance (% Difference)	%	1.72	1.43	4.65	N/A	5827180
Langelier Index (@ 20C)	N/A	0.601	0.775	0.477		5827282
Langelier Index (@ 4C)	N/A	0.352	0.526	0.228		5827283
Saturation pH (@ 20C)	N/A	7.57	7.27	7.78		5827282
Saturation pH (@ 4C)	N/A	7.82	7.52	8.03		5827283
Inorganics						
Total Ammonia-N	mg/L	0.23	<0.050	<0.050	0.050	5831662
Conductivity	umho/cm	840	630	590	1.0	5830552
Dissolved Organic Carbon	mg/L	1.4	0.98	0.68	0.50	5830640
Orthophosphate (P)	mg/L	<0.010	0.012	0.027	0.010	5830606
pH	pH	8.17	8.04	8.26		5830556
Dissolved Sulphate (SO4)	mg/L	20	20	54	1.0	5830605
Alkalinity (Total as CaCO3)	mg/L	240	310	250	1.0	5830538
Dissolved Chloride (Cl-)	mg/L	140	18	17	1.0	5830597
Nitrite (N)	mg/L	<0.010	0.074	<0.010	0.010	5830573
Nitrate (N)	mg/L	<0.10	1.01	<0.10	0.10	5830573
Nitrate + Nitrite (N)	mg/L	<0.10	1.08	<0.10	0.10	5830573
Metals						
Dissolved Aluminum (Al)	mg/L	0.25	0.0071	0.0071	0.0050	5828185
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00051	<0.00050	0.00050	5828185
Dissolved Arsenic (As)	mg/L	<0.0010	<0.0010	0.0044	0.0010	5828185
Dissolved Barium (Ba)	mg/L	0.046	0.088	0.024	0.0020	5828185
Dissolved Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	0.00050	5828185
Dissolved Boron (B)	mg/L	0.071	0.047	0.036	0.010	5828185
Dissolved Cadmium (Cd)	mg/L	<0.00010	<0.00010	<0.00010	0.00010	5828185

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		IGE069	IGE070	IGE071		
Sampling Date		2018/11/08 12:40	2018/11/08 13:15	2018/11/08 13:20		
COC Number		686036-01-01	686036-01-01	686036-01-01		
	UNITS	**WG-161413684-20181108-DS02**	**WG-161413684-20181108-DS03**	**WG-161413684-20181108-DS04**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	33	47	18	0.20	5828185
Dissolved Chromium (Cr)	mg/L	<0.0050	<0.0050	<0.0050	0.0050	5828185
Dissolved Cobalt (Co)	mg/L	<0.00050	<0.00050	<0.00050	0.00050	5828185
Dissolved Copper (Cu)	mg/L	<0.0010	0.0015	<0.0010	0.0010	5828185
Dissolved Iron (Fe)	mg/L	0.33	<0.10	<0.10	0.10	5828185
Dissolved Lead (Pb)	mg/L	0.0020	<0.00050	<0.00050	0.00050	5828185
Dissolved Magnesium (Mg)	mg/L	73	51	35	0.050	5828185
Dissolved Manganese (Mn)	mg/L	0.030	0.012	<0.0020	0.0020	5828185
Dissolved Molybdenum (Mo)	mg/L	0.027	0.010	0.019	0.00050	5828185
Dissolved Nickel (Ni)	mg/L	0.0021	<0.0010	0.0011	0.0010	5828185
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	0.10	5828185
Dissolved Potassium (K)	mg/L	5.1	7.5	3.0	0.20	5828185
Dissolved Selenium (Se)	mg/L	<0.0020	<0.0020	<0.0020	0.0020	5828185
Dissolved Silicon (Si)	mg/L	5.9	3.9	4.3	0.050	5828185
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	0.00010	5828185
Dissolved Sodium (Na)	mg/L	33	7.7	47	0.10	5828185
Dissolved Strontium (Sr)	mg/L	0.21	0.15	0.27	0.0010	5828185
Dissolved Thallium (Tl)	mg/L	<0.000050	<0.000050	<0.000050	0.000050	5828185
Dissolved Titanium (Ti)	mg/L	0.012	<0.0050	<0.0050	0.0050	5828185
Dissolved Uranium (U)	mg/L	0.00050	0.0017	0.0010	0.00010	5828185
Dissolved Vanadium (V)	mg/L	0.00084	0.0012	0.0014	0.00050	5828185
Dissolved Zinc (Zn)	mg/L	0.0062	<0.0050	<0.0050	0.0050	5828185

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		IGE072		
Sampling Date		2018/11/08 13:45		
COC Number		686036-01-01		
	UNITS	**WG-161413684-20181108-DS05**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	13.3	N/A	5827281
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	290	1.0	5827280
Calculated TDS	mg/L	700	1.0	5827284
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.4	1.0	5827280
Cation Sum	me/L	13.2	N/A	5827281
Hardness (CaCO3)	mg/L	470	1.0	5827179
Ion Balance (% Difference)	%	0.280	N/A	5827180
Langelier Index (@ 20C)	N/A	0.753		5827282
Langelier Index (@ 4C)	N/A	0.506		5827283
Saturation pH (@ 20C)	N/A	7.18		5827282
Saturation pH (@ 4C)	N/A	7.43		5827283
Inorganics				
Total Ammonia-N	mg/L	0.13	0.050	5831661
Conductivity	umho/cm	1300	1.0	5830552
Dissolved Organic Carbon	mg/L	1.0	0.50	5830640
Orthophosphate (P)	mg/L	0.012	0.010	5830606
pH	pH	7.94		5830556
Dissolved Sulphate (SO4)	mg/L	84	1.0	5830605
Alkalinity (Total as CaCO3)	mg/L	300	1.0	5830538
Dissolved Chloride (Cl-)	mg/L	200	2.0	5830597
Nitrite (N)	mg/L	<0.010	0.010	5830573
Nitrate (N)	mg/L	<0.10	0.10	5830573
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5830573
Metals				
Dissolved Aluminum (Al)	mg/L	<0.0050	0.0050	5828185
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00050	5828185
Dissolved Arsenic (As)	mg/L	0.0011	0.0010	5828185
Dissolved Barium (Ba)	mg/L	0.089	0.0020	5828185
Dissolved Beryllium (Be)	mg/L	<0.00050	0.00050	5828185
Dissolved Boron (B)	mg/L	0.069	0.010	5828185
Dissolved Cadmium (Cd)	mg/L	<0.00010	0.00010	5828185

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RCAP - COMPREHENSIVE (WATER)

Maxxam ID		IGE072		
Sampling Date		2018/11/08 13:45		
COC Number		686036-01-01		
	UNITS	**WG-161413684-20181108-DS05**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	71	0.20	5828185
Dissolved Chromium (Cr)	mg/L	<0.0050	0.0050	5828185
Dissolved Cobalt (Co)	mg/L	<0.00050	0.00050	5828185
Dissolved Copper (Cu)	mg/L	0.0016	0.0010	5828185
Dissolved Iron (Fe)	mg/L	<0.10	0.10	5828185
Dissolved Lead (Pb)	mg/L	<0.00050	0.00050	5828185
Dissolved Magnesium (Mg)	mg/L	71	0.050	5828185
Dissolved Manganese (Mn)	mg/L	0.021	0.0020	5828185
Dissolved Molybdenum (Mo)	mg/L	0.012	0.00050	5828185
Dissolved Nickel (Ni)	mg/L	0.0015	0.0010	5828185
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	5828185
Dissolved Potassium (K)	mg/L	5.6	0.20	5828185
Dissolved Selenium (Se)	mg/L	<0.0020	0.0020	5828185
Dissolved Silicon (Si)	mg/L	5.0	0.050	5828185
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	5828185
Dissolved Sodium (Na)	mg/L	84	0.10	5828185
Dissolved Strontium (Sr)	mg/L	0.26	0.0010	5828185
Dissolved Thallium (Tl)	mg/L	<0.000050	0.000050	5828185
Dissolved Titanium (Ti)	mg/L	<0.0050	0.0050	5828185
Dissolved Uranium (U)	mg/L	0.0027	0.00010	5828185
Dissolved Vanadium (V)	mg/L	0.0012	0.00050	5828185
Dissolved Zinc (Zn)	mg/L	<0.0050	0.0050	5828185

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

RESULTS OF ANALYSES OF WATER

Maxxam ID		IGE069		IGE070		IGE071		
Sampling Date		2018/11/08 12:40		2018/11/08 13:15		2018/11/08 13:20		
COC Number		686036-01-01		686036-01-01		686036-01-01		
	UNITS	**WG-161413684-20181108-DS02**	**RDL**	**WG-161413684-20181108-DS03**	**RDL**	**WG-161413684-20181108-DS04**	**RDL**	**QC Batch**
Inorganics								
Total Suspended Solids	mg/L	3000	20	630	10	2400	20	5830227

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		IGE072		
Sampling Date		2018/11/08 13:45		
COC Number		686036-01-01		
	UNITS	**WG-161413684-20181108-DS05**	**RDL**	**QC Batch**
Inorganics				
Total Suspended Solids	mg/L	1400	10	5830227

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		IGE068		
Sampling Date		2018/11/08 11:30		
COC Number		686036-01-01		
	UNITS	**WG-161413684-20181108-DS01**	**RDL**	**QC Batch**
Metals				
Dissolved Aluminum (Al)	mg/L	<0.0050	0.0050	5828185
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00050	5828185
Dissolved Arsenic (As)	mg/L	<0.0010	0.0010	5828185
Dissolved Bismuth (Bi)	mg/L	<0.0010	0.0010	5828185
Dissolved Cadmium (Cd)	mg/L	<0.00010	0.00010	5828185
Dissolved Chromium (Cr)	mg/L	<0.0050	0.0050	5828185
Dissolved Cobalt (Co)	mg/L	<0.00050	0.00050	5828185
Dissolved Copper (Cu)	mg/L	0.0012	0.0010	5828185
Dissolved Iron (Fe)	mg/L	<0.10	0.10	5828185
Dissolved Lead (Pb)	mg/L	<0.00050	0.00050	5828185
Dissolved Manganese (Mn)	mg/L	0.019	0.0020	5828185
Dissolved Molybdenum (Mo)	mg/L	0.0027	0.00050	5828185
Dissolved Nickel (Ni)	mg/L	<0.0010	0.0010	5828185
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	5828185
Dissolved Selenium (Se)	mg/L	<0.0020	0.0020	5828185
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	5828185
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	5828185
Dissolved Titanium (Ti)	mg/L	<0.0050	0.0050	5828185
Dissolved Vanadium (V)	mg/L	0.0015	0.00050	5828185
Dissolved Zinc (Zn)	mg/L	<0.0050	0.0050	5828185

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TEST SUMMARY

Maxxam ID: IGE068
Sample ID: WG-161413684-20181108-DS01
Matrix: Water

Collected: 2018/11/08
Shipped:
Received: 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	5829310	2018/11/09	2018/11/14	Althea Gonzalez
Chloride by Automated Colourimetry	KONE	5831425	N/A	2018/11/12	Deonarine Ramnarine
Total Cyanide	SKAL/CN	5832812	2018/11/12	2018/11/13	Xuanhong Qiu
Fluoride	ISE	5831501	2018/11/10	2018/11/13	Surinder Rai
Mercury in Water by CVAA	CV/AA	5836000	2018/11/14	2018/11/14	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5828185	N/A	2018/11/12	Thao Nguyen
Total Metals Analysis by ICPMS	ICP/MS	5831797	N/A	2018/11/12	Arefa Dabhad
Fecal coliform, (5TMPN/100mL)	INC	5828861	N/A	2018/11/08	Sirimathie Aluthwala
Animal and Vegetable Oil and Grease	BAL	5827390	N/A	2018/11/13	Automated Statchk
Total Oil and Grease	BAL	5833748	2018/11/13	2018/11/13	Francis Afonso
pH	AT	5831504	N/A	2018/11/12	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5832393	N/A	2018/11/13	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5831429	N/A	2018/11/12	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	5831642	2018/11/10	2018/11/12	Rajni Tyagi
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	5833755	2018/11/13	2018/11/13	Francis Afonso
Total Suspended Solids	BAL	5830227	2018/11/09	2018/11/12	Nilam Borole

Maxxam ID: IGE069
Sample ID: WG-161413684-20181108-DS02
Matrix: Water

Collected: 2018/11/08
Shipped:
Received: 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5830538	N/A	2018/11/10	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5827280	N/A	2018/11/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	5830597	N/A	2018/11/12	Deonarine Ramnarine
Conductivity	AT	5830552	N/A	2018/11/10	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5830640	N/A	2018/11/12	Nimarta Singh
Hardness (calculated as CaCO3)		5827179	N/A	2018/11/13	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5828185	N/A	2018/11/12	Thao Nguyen
Ion Balance (% Difference)	CALC	5827180	N/A	2018/11/13	Automated Statchk
Anion and Cation Sum	CALC	5827281	N/A	2018/11/13	Automated Statchk
Total Ammonia-N	LACH/NH4	5831662	N/A	2018/11/12	Chandra Nandlal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5830573	N/A	2018/11/13	Chandra Nandlal
pH	AT	5830556	N/A	2018/11/10	Neil Dassanayake
Orthophosphate	KONE	5830606	N/A	2018/11/12	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5827282	N/A	2018/11/13	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5827283	N/A	2018/11/13	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5830605	N/A	2018/11/12	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5827284	N/A	2018/11/13	Automated Statchk
Total Suspended Solids	BAL	5830227	2018/11/09	2018/11/12	Nilam Borole

TEST SUMMARY

Maxxam ID: IGE070
Sample ID: WG-161413684-20181108-DS03
Matrix: Water

Collected: 2018/11/08
Shipped:
Received: 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5830538	N/A	2018/11/10	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5827280	N/A	2018/11/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	5830597	N/A	2018/11/12	Deonarine Ramnarine
Conductivity	AT	5830552	N/A	2018/11/10	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5830640	N/A	2018/11/12	Nimarta Singh
Hardness (calculated as CaCO3)		5827179	N/A	2018/11/13	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5828185	N/A	2018/11/12	Thao Nguyen
Ion Balance (% Difference)	CALC	5827180	N/A	2018/11/13	Automated Statchk
Anion and Cation Sum	CALC	5827281	N/A	2018/11/13	Automated Statchk
Total Ammonia-N	LACH/NH4	5831662	N/A	2018/11/12	Chandra Nandlal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5830573	N/A	2018/11/13	Chandra Nandlal
pH	AT	5830556	N/A	2018/11/10	Neil Dassanayake
Orthophosphate	KONE	5830606	N/A	2018/11/12	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5827282	N/A	2018/11/13	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5827283	N/A	2018/11/13	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5830605	N/A	2018/11/12	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5827284	N/A	2018/11/13	Automated Statchk
Total Suspended Solids	BAL	5830227	2018/11/09	2018/11/12	Nilam Borole

Maxxam ID: IGE071
Sample ID: WG-161413684-20181108-DS04
Matrix: Water

Collected: 2018/11/08
Shipped:
Received: 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5830538	N/A	2018/11/10	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5827280	N/A	2018/11/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	5830597	N/A	2018/11/12	Deonarine Ramnarine
Conductivity	AT	5830552	N/A	2018/11/10	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5830640	N/A	2018/11/12	Nimarta Singh
Hardness (calculated as CaCO3)		5827179	N/A	2018/11/13	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5828185	N/A	2018/11/12	Thao Nguyen
Ion Balance (% Difference)	CALC	5827180	N/A	2018/11/13	Automated Statchk
Anion and Cation Sum	CALC	5827281	N/A	2018/11/13	Automated Statchk
Total Ammonia-N	LACH/NH4	5831662	N/A	2018/11/12	Chandra Nandlal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5830573	N/A	2018/11/13	Chandra Nandlal
pH	AT	5830556	N/A	2018/11/10	Neil Dassanayake
Orthophosphate	KONE	5830606	N/A	2018/11/12	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5827282	N/A	2018/11/13	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5827283	N/A	2018/11/13	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5830605	N/A	2018/11/12	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5827284	N/A	2018/11/13	Automated Statchk
Total Suspended Solids	BAL	5830227	2018/11/09	2018/11/12	Nilam Borole

TEST SUMMARY

Maxxam ID: IGE072
Sample ID: WG-161413684-20181108-DS05
Matrix: Water

Collected: 2018/11/08
Shipped:
Received: 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5830538	N/A	2018/11/10	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5827280	N/A	2018/11/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	5830597	N/A	2018/11/12	Deonarine Ramnarine
Conductivity	AT	5830552	N/A	2018/11/10	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5830640	N/A	2018/11/12	Nimarta Singh
Hardness (calculated as CaCO3)		5827179	N/A	2018/11/13	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	5828185	N/A	2018/11/12	Thao Nguyen
Ion Balance (% Difference)	CALC	5827180	N/A	2018/11/13	Automated Statchk
Anion and Cation Sum	CALC	5827281	N/A	2018/11/13	Automated Statchk
Total Ammonia-N	LACH/NH4	5831661	N/A	2018/11/13	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5830573	N/A	2018/11/13	Chandra Nandlal
pH	AT	5830556	N/A	2018/11/10	Neil Dassanayake
Orthophosphate	KONE	5830606	N/A	2018/11/12	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5827282	N/A	2018/11/13	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5827283	N/A	2018/11/13	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5830605	N/A	2018/11/12	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5827284	N/A	2018/11/13	Automated Statchk
Total Suspended Solids	BAL	5830227	2018/11/09	2018/11/12	Nilam Borole

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.0°C

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5828185	Dissolved Aluminum (Al)	2018/11/12	97	80 - 120	98	80 - 120	<0.0050	mg/L				
5828185	Dissolved Antimony (Sb)	2018/11/12	110	80 - 120	101	80 - 120	<0.00050	mg/L	2.4	20		
5828185	Dissolved Arsenic (As)	2018/11/12	103	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
5828185	Dissolved Barium (Ba)	2018/11/12	100	80 - 120	99	80 - 120	<0.0020	mg/L	1.3	20		
5828185	Dissolved Beryllium (Be)	2018/11/12	103	80 - 120	100	80 - 120	<0.00050	mg/L	NC	20		
5828185	Dissolved Bismuth (Bi)	2018/11/12	92	80 - 120	92	80 - 120	<0.0010	mg/L				
5828185	Dissolved Boron (B)	2018/11/12	99	80 - 120	100	80 - 120	<0.010	mg/L	2.5	20		
5828185	Dissolved Cadmium (Cd)	2018/11/12	103	80 - 120	99	80 - 120	<0.00010	mg/L	NC	20		
5828185	Dissolved Calcium (Ca)	2018/11/12	NC	80 - 120	98	80 - 120	<0.20	mg/L				
5828185	Dissolved Chromium (Cr)	2018/11/12	100	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20		
5828185	Dissolved Cobalt (Co)	2018/11/12	100	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20		
5828185	Dissolved Copper (Cu)	2018/11/12	103	80 - 120	99	80 - 120	<0.0010	mg/L	NC	20		
5828185	Dissolved Iron (Fe)	2018/11/12	103	80 - 120	101	80 - 120	<0.10	mg/L				
5828185	Dissolved Lead (Pb)	2018/11/12	94	80 - 120	94	80 - 120	<0.00050	mg/L	NC	20		
5828185	Dissolved Magnesium (Mg)	2018/11/12	NC	80 - 120	98	80 - 120	<0.050	mg/L				
5828185	Dissolved Manganese (Mn)	2018/11/12	101	80 - 120	98	80 - 120	<0.0020	mg/L				
5828185	Dissolved Molybdenum (Mo)	2018/11/12	106	80 - 120	101	80 - 120	<0.00050	mg/L	4.7	20		
5828185	Dissolved Nickel (Ni)	2018/11/12	101	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
5828185	Dissolved Phosphorus (P)	2018/11/12	109	80 - 120	109	80 - 120	<0.10	mg/L				
5828185	Dissolved Potassium (K)	2018/11/12	102	80 - 120	99	80 - 120	<0.20	mg/L				
5828185	Dissolved Selenium (Se)	2018/11/12	103	80 - 120	105	80 - 120	<0.0020	mg/L	NC	20		
5828185	Dissolved Silicon (Si)	2018/11/12	96	80 - 120	97	80 - 120	<0.050	mg/L				
5828185	Dissolved Silver (Ag)	2018/11/12	98	80 - 120	99	80 - 120	<0.00010	mg/L	NC	20		
5828185	Dissolved Sodium (Na)	2018/11/12	NC	80 - 120	97	80 - 120	<0.10	mg/L	0.78	20		
5828185	Dissolved Strontium (Sr)	2018/11/12	NC	80 - 120	99	80 - 120	<0.0010	mg/L				
5828185	Dissolved Thallium (Tl)	2018/11/12	93	80 - 120	93	80 - 120	<0.000050	mg/L	NC	20		
5828185	Dissolved Tin (Sn)	2018/11/12	103	80 - 120	99	80 - 120	<0.0010	mg/L				
5828185	Dissolved Titanium (Ti)	2018/11/12	98	80 - 120	101	80 - 120	<0.0050	mg/L				
5828185	Dissolved Uranium (U)	2018/11/12	105	80 - 120	102	80 - 120	<0.00010	mg/L	1.2	20		
5828185	Dissolved Vanadium (V)	2018/11/12	102	80 - 120	98	80 - 120	<0.00050	mg/L	9.2	20		
5828185	Dissolved Zinc (Zn)	2018/11/12	99	80 - 120	99	80 - 120	<0.0050	mg/L	NC	20		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5829310	Total Carbonaceous BOD	2018/11/14					<2	mg/L	9.6	30	96	85 - 115
5830227	Total Suspended Solids	2018/11/12					<10	mg/L	NC	25	96	85 - 115
5830538	Alkalinity (Total as CaCO3)	2018/11/09			94	85 - 115	<1.0	mg/L	1.2	20		
5830552	Conductivity	2018/11/09			100	85 - 115	<1.0	umho/cm	0.43	25		
5830556	pH	2018/11/09			101	98 - 103			1.5	N/A		
5830573	Nitrate (N)	2018/11/13	90	80 - 120	98	80 - 120	<0.10	mg/L	0.38	20		
5830573	Nitrite (N)	2018/11/13	103	80 - 120	103	80 - 120	<0.010	mg/L	NC	20		
5830597	Dissolved Chloride (Cl-)	2018/11/12	115	80 - 120	104	80 - 120	<1.0	mg/L	1.3	20		
5830605	Dissolved Sulphate (SO4)	2018/11/12	NC	75 - 125	105	80 - 120	<1.0	mg/L	0.99	20		
5830606	Orthophosphate (P)	2018/11/12	113	75 - 125	100	80 - 120	<0.010	mg/L	NC	25		
5830640	Dissolved Organic Carbon	2018/11/12	95	80 - 120	98	80 - 120	<0.50	mg/L	0.55	20		
5831425	Dissolved Chloride (Cl-)	2018/11/12	110	80 - 120	103	80 - 120	<1.0	mg/L	0.67	20		
5831429	Dissolved Sulphate (SO4)	2018/11/12	NC	75 - 125	106	80 - 120	<1.0	mg/L	0.10	20		
5831501	Fluoride (F-)	2018/11/12	95	80 - 120	107	80 - 120	<0.10	mg/L	0	20		
5831504	pH	2018/11/12			102	98 - 103			2.1	N/A		
5831642	Total Kjeldahl Nitrogen (TKN)	2018/11/12	NC	80 - 120	102	80 - 120	<0.10	mg/L	0.78	20	99	N/A
5831661	Total Ammonia-N	2018/11/13	103	75 - 125	101	80 - 120	<0.050	mg/L	3.8	20		
5831662	Total Ammonia-N	2018/11/12	97	75 - 125	100	80 - 120	<0.050	mg/L	NC	20		
5831797	Total Aluminum (Al)	2018/11/12	101	80 - 120	101	80 - 120	<0.0050	mg/L	1.1	20		
5831797	Total Antimony (Sb)	2018/11/12	104	80 - 120	101	80 - 120	<0.00050	mg/L				
5831797	Total Arsenic (As)	2018/11/12	102	80 - 120	101	80 - 120	<0.0010	mg/L				
5831797	Total Bismuth (Bi)	2018/11/12	102	80 - 120	101	80 - 120	<0.0010	mg/L				
5831797	Total Cadmium (Cd)	2018/11/12	104	80 - 120	101	80 - 120	<0.00010	mg/L	NC	20		
5831797	Total Chromium (Cr)	2018/11/12	95	80 - 120	94	80 - 120	<0.0050	mg/L	NC	20		
5831797	Total Cobalt (Co)	2018/11/12	102	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20		
5831797	Total Copper (Cu)	2018/11/12	103	80 - 120	102	80 - 120	<0.0010	mg/L	10	20		
5831797	Total Iron (Fe)	2018/11/12	99	80 - 120	99	80 - 120	<0.10	mg/L	0.34	20		
5831797	Total Lead (Pb)	2018/11/12	101	80 - 120	100	80 - 120	<0.00050	mg/L	NC	20		
5831797	Total Manganese (Mn)	2018/11/12	96	80 - 120	97	80 - 120	<0.0020	mg/L	2.3	20		
5831797	Total Molybdenum (Mo)	2018/11/12	103	80 - 120	97	80 - 120	<0.00050	mg/L	1.3	20		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5831797	Total Nickel (Ni)	2018/11/12	99	80 - 120	99	80 - 120	<0.0010	mg/L	0.39	20		
5831797	Total Phosphorus (P)	2018/11/12	102	80 - 120	106	80 - 120	<0.10	mg/L				
5831797	Total Selenium (Se)	2018/11/12	109	80 - 120	109	80 - 120	<0.0020	mg/L				
5831797	Total Silver (Ag)	2018/11/12	100	80 - 120	97	80 - 120	<0.00010	mg/L	NC	20		
5831797	Total Tin (Sn)	2018/11/12	104	80 - 120	101	80 - 120	<0.0010	mg/L	NC	20		
5831797	Total Titanium (Ti)	2018/11/12	99	80 - 120	101	80 - 120	<0.0050	mg/L	NC	20		
5831797	Total Vanadium (V)	2018/11/12	97	80 - 120	96	80 - 120	<0.00050	mg/L	13	20		
5831797	Total Zinc (Zn)	2018/11/12	100	80 - 120	101	80 - 120	<0.0050	mg/L	3.2	20		
5832393	Phenols-4AAP	2018/11/13	101	80 - 120	102	80 - 120	<0.0010	mg/L	NC	20		
5832812	Total Cyanide (CN)	2018/11/13	103	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20		
5833748	Total Oil & Grease	2018/11/13			99	85 - 115	<0.50	mg/L	3.9	25		
5833755	Total Oil & Grease Mineral/Synthetic	2018/11/13			96	85 - 115	<0.50	mg/L	2.7	25		
5836000	Mercury (Hg)	2018/11/14	99	75 - 125	105	80 - 120	<0.0001	mg/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

Sirimathie Aluthwala, Campobello Micro

MICRO

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CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:

Company Name: #9197 Stantec Consulting Ltd
Attention: Accounts Payable
Address: 300 Hagey Blvd Suite 100
Waterloo ON N2L 0A4
Tel: (519) 579-4410 Fax: (519) 579-6733
Email: SAPinvoices@Stantec.com

REPORT TO:

Company Name:
Attention: Grant Whitehead
Address:
Tel: (519) 585-7400 Fax: (519) 579-4239
Email: grant.whitehead@stantec.com

PROJECT INFORMATION:

Quotation #: B77373
P.O. #: 400
Project: 161413684
Project Name:
Site #:
Sampled By: Drew Smith

Laboratory Use Only:

Maxxam Job #:
Bottle Order #: 586036
COC #: C#586036-01-01
Project Manager: Augustyna Dobosz

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011):
☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ For RSC
☐ Table ___

Other Regulations:
☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality ______
☒ PWQO
☒ Other ODWS

Special Instructions:

Include Criteria on Certificate of Analysis (Y/N)? ______

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required ______ Time Required ______ ☐
Rush Confirmation Number ______ (call lab for #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle) [✓ Metals] / Hg / Cr VI	RCAp - Comprehensive	Total Suspended Solids	The City of Guelph Sanitary and Storm Sewer Bylaw	Total metals (not filtered)							# of Bottles	Comments
1		WG-161413684-20181108-DP01	2018/11/08	11:30	GW	X			X	X							11	Total metals and dissolved metals
2		WG-161413684-20181108-DS07	2018/11/08	12:40	GW	X	X	X									5	
3		WG-161413684-20181108-DS03		13:15	GW	X	X	X									5	
4		WG-161413684-20181108-DS04		13:20	GW	X	X	X									5	
5		WG-161413684-20181108-DS05		13:45	GW	X	X	X									5	
6																		
7																		
8																		
9																		
10																		

08-Nov-18 14:50
Augustyna Dobosz
B8T9171
CA2 ENV-961

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
/ Drew Smith	18/11/08	15:00		2018/11/08	16:50	
				2018/11/08	17:59	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	0 0 0	Present		✓
		Intact		

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF

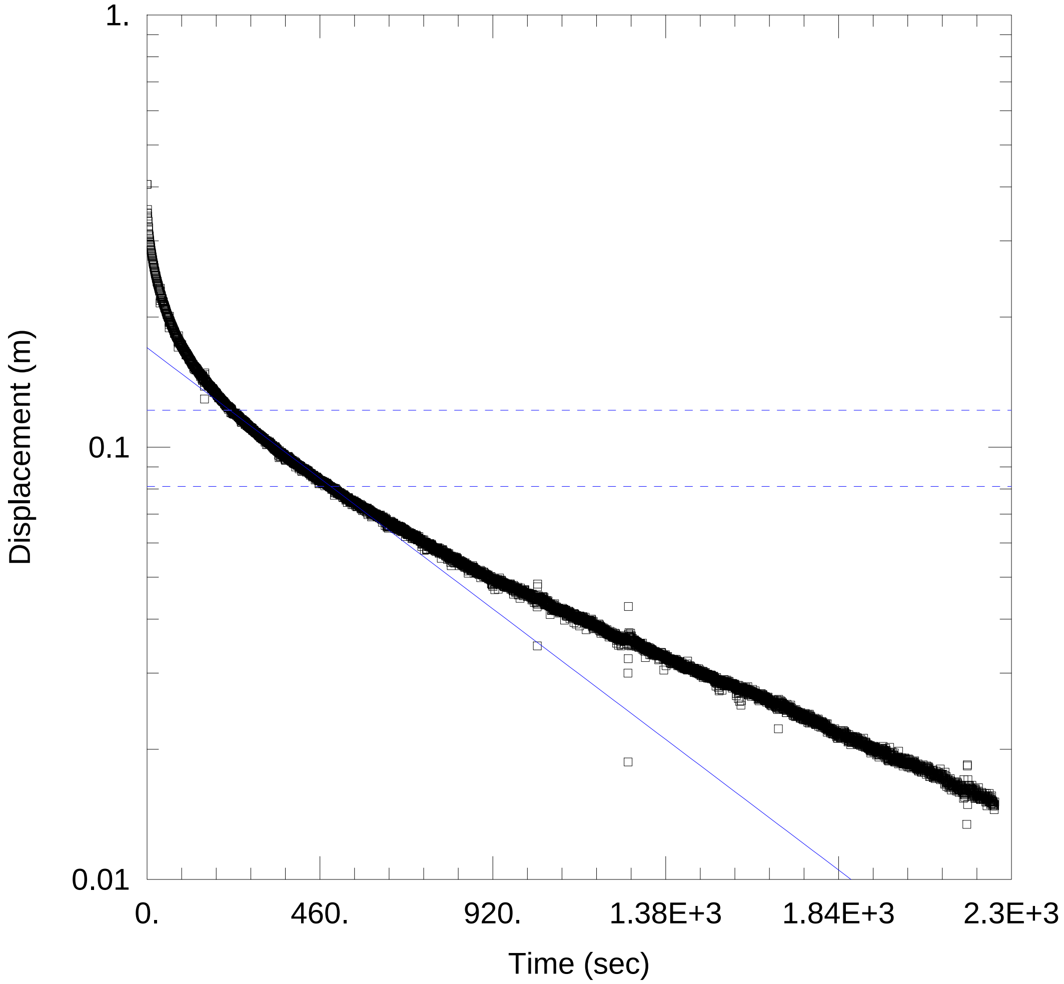
SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxam Yellow: Client

37021 6/3/4 ice 1 cs

Maxxam Analytics International Corporation o/a Maxxam Analytics

APPENDIX G:
HYDRAULIC CONDUCTIVITY ANALYTICAL SOLUTIONS



MW2-18

Data Set: \...\161413684_MW2-18_20180803_DS_JK.aqt
Date: 11/21/18 Time: 15:25:14

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Guelph, Ontario
Test Well: MW2-18
Test Date: 2018/07/27

AQUIFER DATA

Saturated Thickness: 2.44 m
Anisotropy Ratio (Kz/Kr): 0.5

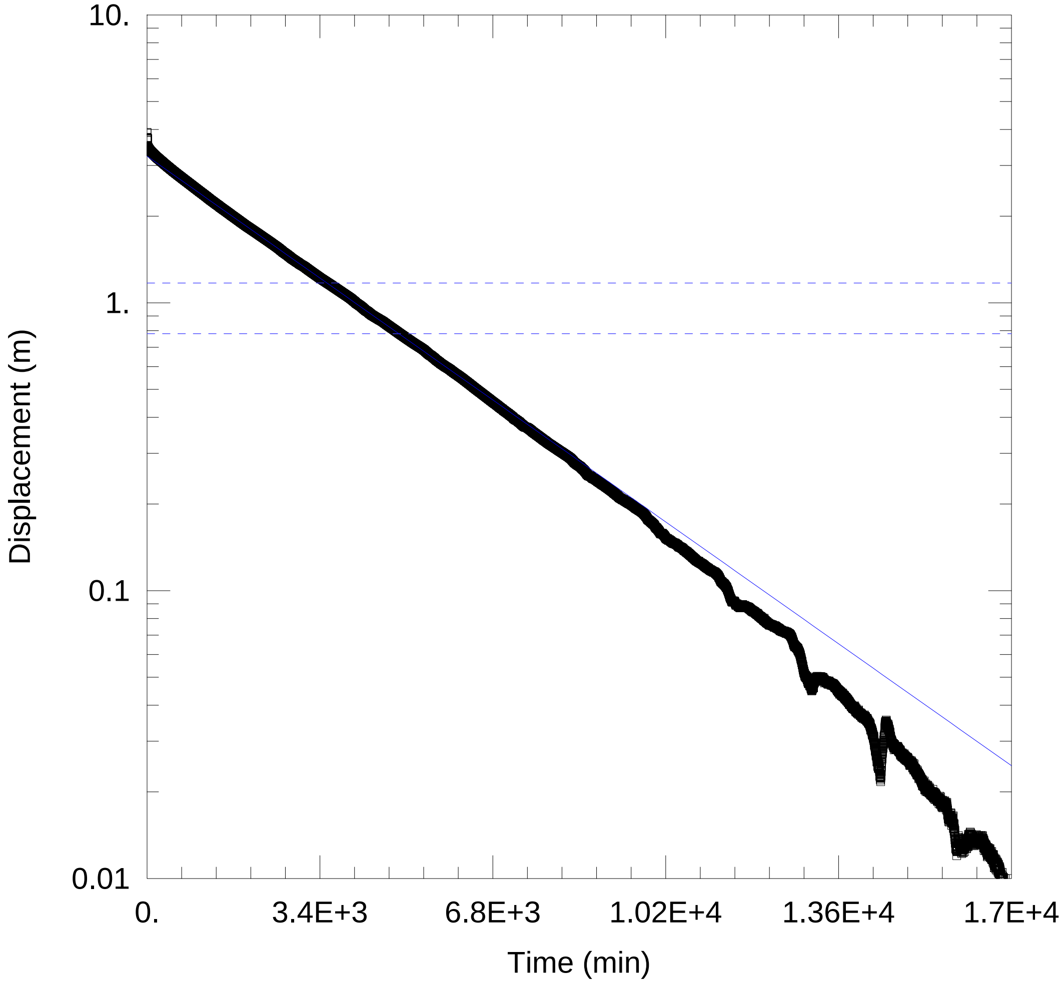
WELL DATA (MW2-18)

Initial Displacement: 0.4056 m
Static Water Column Height: 7.29 m
Total Well Penetration Depth: 2.44 m
Screen Length: 2.44 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 4.7E-7 m/sec
y0 = 0.1699 m



MW3-18

Data Set: \...\161413684_MW3-18_DS_JK.aqt
Date: 11/21/18 Time: 16:06:39

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Kitchener, ON
Test Well: MW3-18
Test Date: 2018/07/27

AQUIFER DATA

Saturated Thickness: 6.91 m
Anisotropy Ratio (Kz/Kr): 0.3

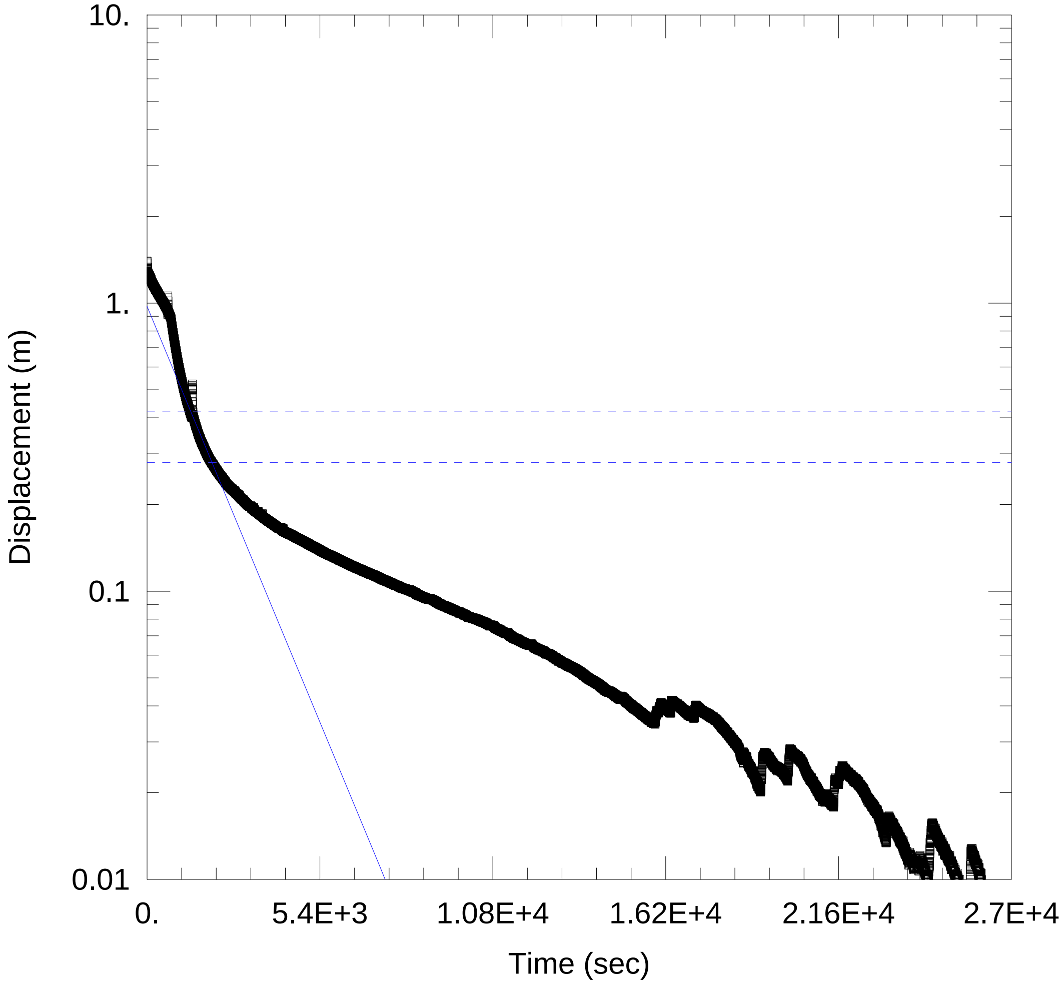
WELL DATA (MW3-18)

Initial Displacement: 3.902 m
Static Water Column Height: 6.375 m
Total Well Penetration Depth: 6.325 m
Screen Length: 3.05 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.6E-9 m/sec
y0 = 3.231 m



MW4-18S

Data Set: \...\161413684_MW4-18S_DS_JK.aqt
Date: 11/22/18 Time: 10:00:42

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Kitchener, ON
Test Well: MW4-18S
Test Date: 2018/07/27

AQUIFER DATA

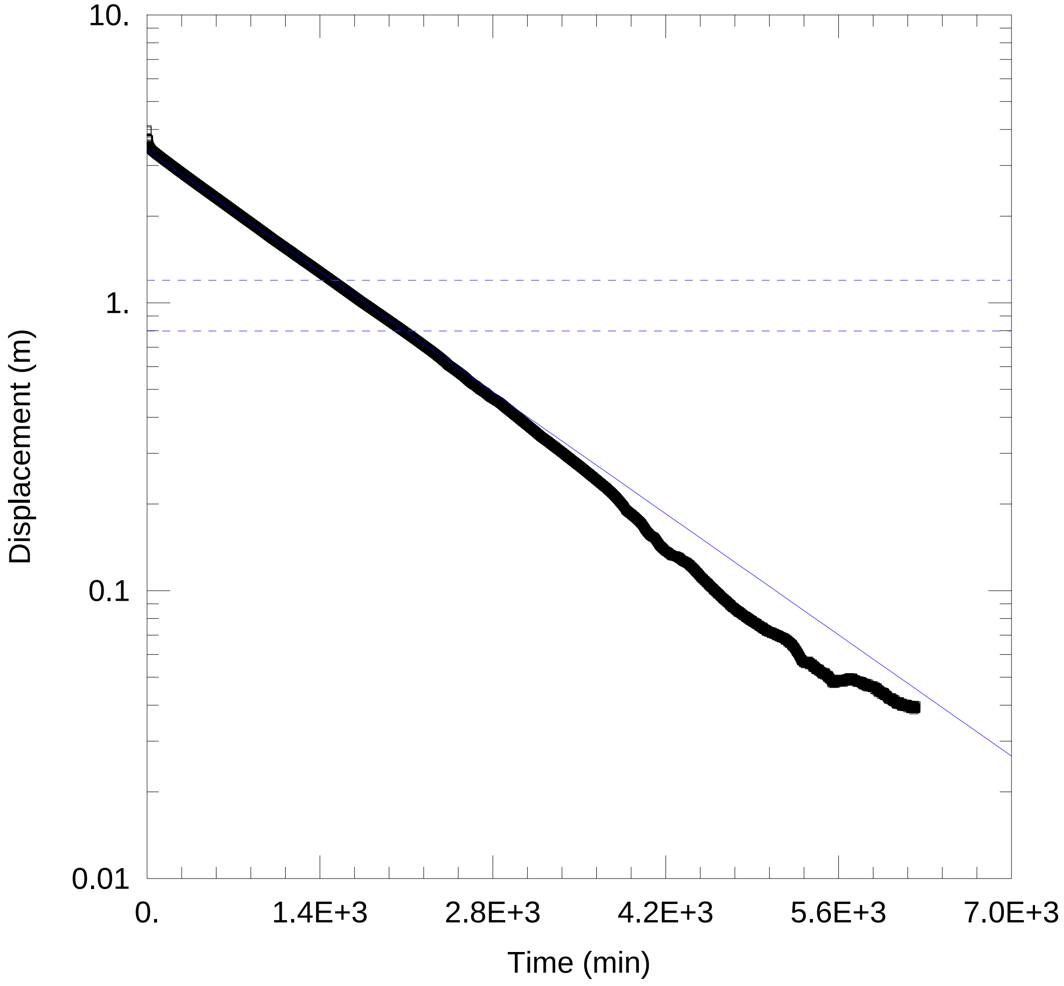
Saturated Thickness: 10.41 m
Anisotropy Ratio (Kz/Kr): 0.3

WELL DATA (MW4-18S)

Initial Displacement: 1.398 m
Static Water Column Height: 4.105 m
Total Well Penetration Depth: 4.155 m
Screen Length: 3.05 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.8E-7 m/sec
y0 = 0.9741 m



MW4-18D

Data Set: \...\161413684_MW4-18D_confined_DS_JK.aqt
Date: 11/22/18 Time: 09:54:50

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Kitchener, ON
Test Well: MW4-18D
Test Date: 2018/07/27

AQUIFER DATA

Saturated Thickness: 3.63 m
Anisotropy Ratio (Kz/Kr): 0.3

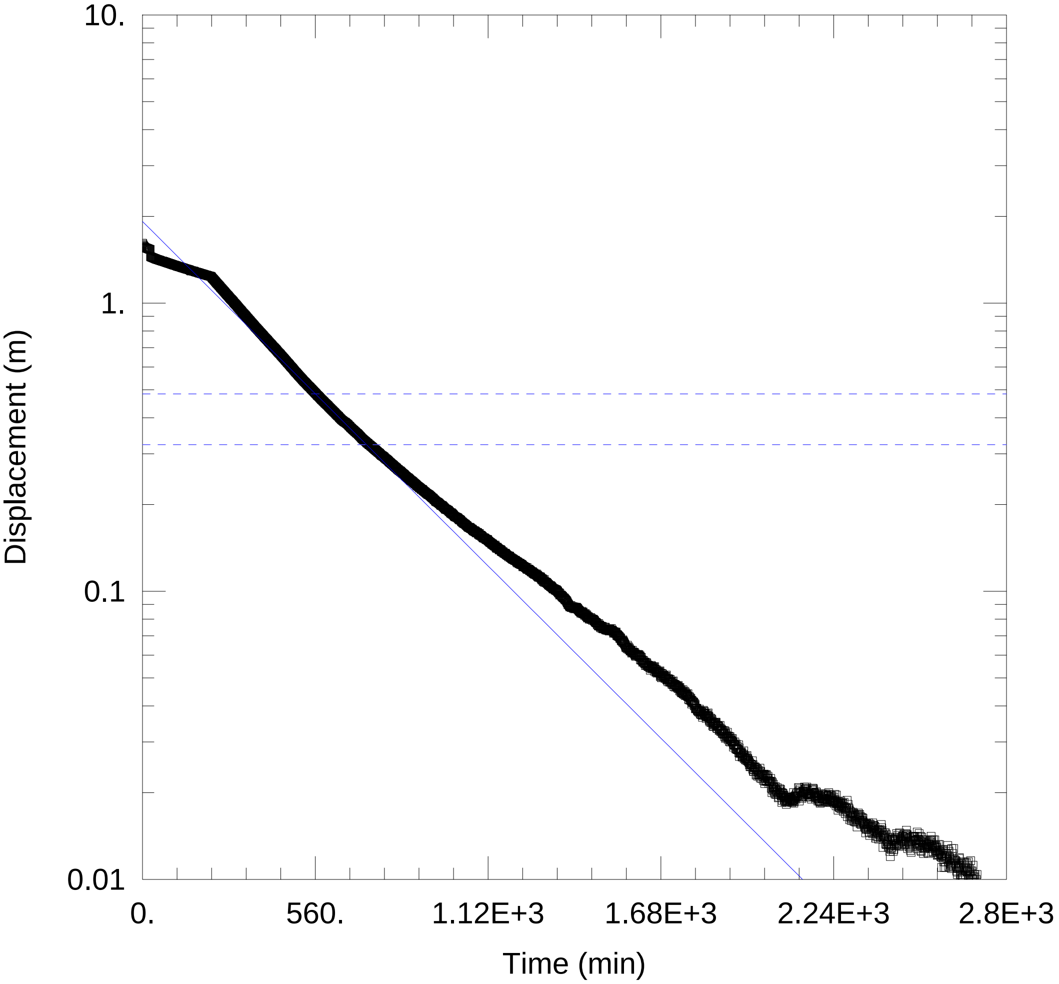
WELL DATA (MW4-18D)

Initial Displacement: 3.99 m
Static Water Column Height: 8.185 m
Total Well Penetration Depth: 3.05 m
Screen Length: 3.05 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 3.4E-9 m/sec
y0 = 3.387 m



MW5-18S

Data Set: \...\161413684_MW5-18S_DS_JK.aqt
Date: 11/21/18 Time: 16:35:11

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Guelph, ON
Test Well: MW5-18S
Test Date: 2018/07/27

AQUIFER DATA

Saturated Thickness: 12.16 m Anisotropy Ratio (Kz/Kr): 0.3

WELL DATA (MW5-18S)

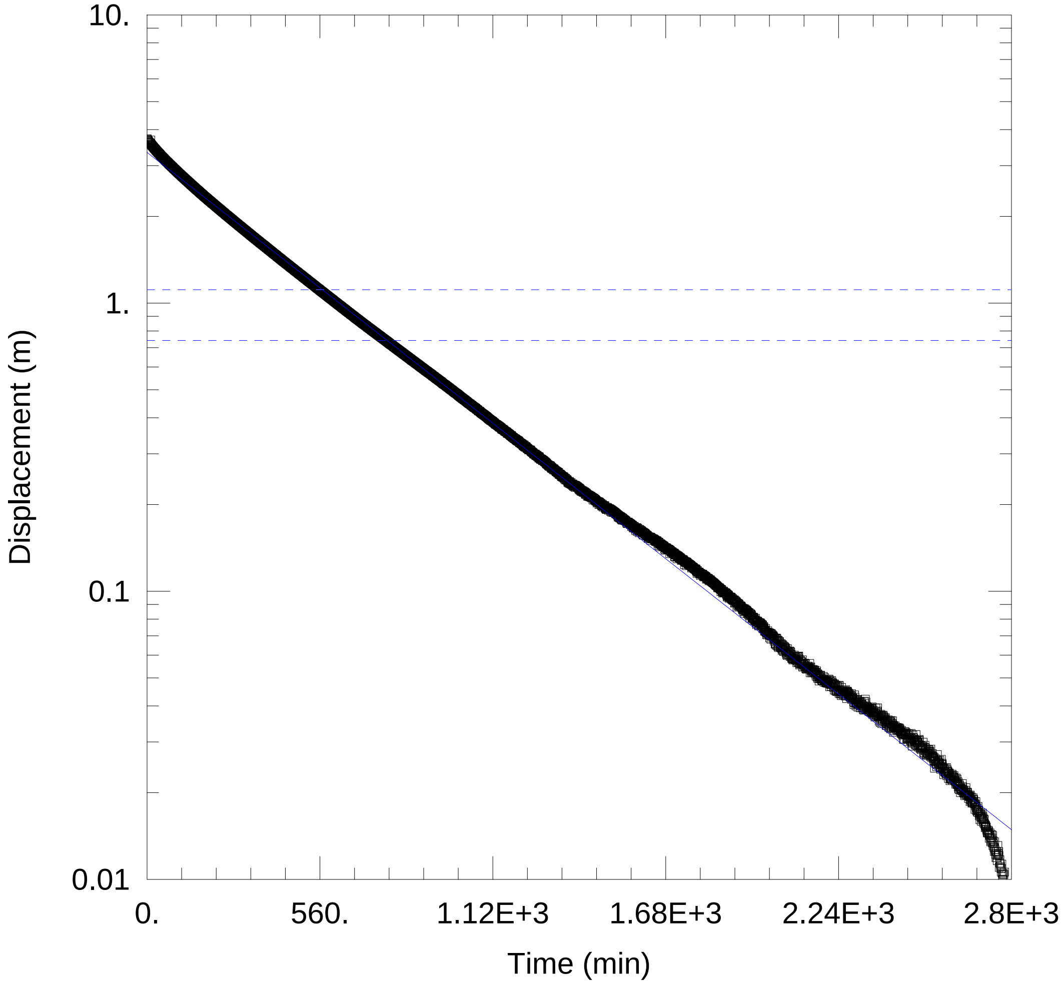
Initial Displacement: 1.613 m
Total Well Penetration Depth: 4.35 m
Casing Radius: 0.0254 m

Static Water Column Height: 4.35 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.2E-8 m/sec y0 = 1.92 m



MW5-18D

Data Set: \...\161413684_MW5-18D_DS_JK.aqt
Date: 11/21/18 Time: 16:34:37

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Kitchener, ON
Test Well: MW5-18D
Test Date: 2018/07/27

AQUIFER DATA

Saturated Thickness: 9.015 m
Anisotropy Ratio (Kz/Kr): 0.3

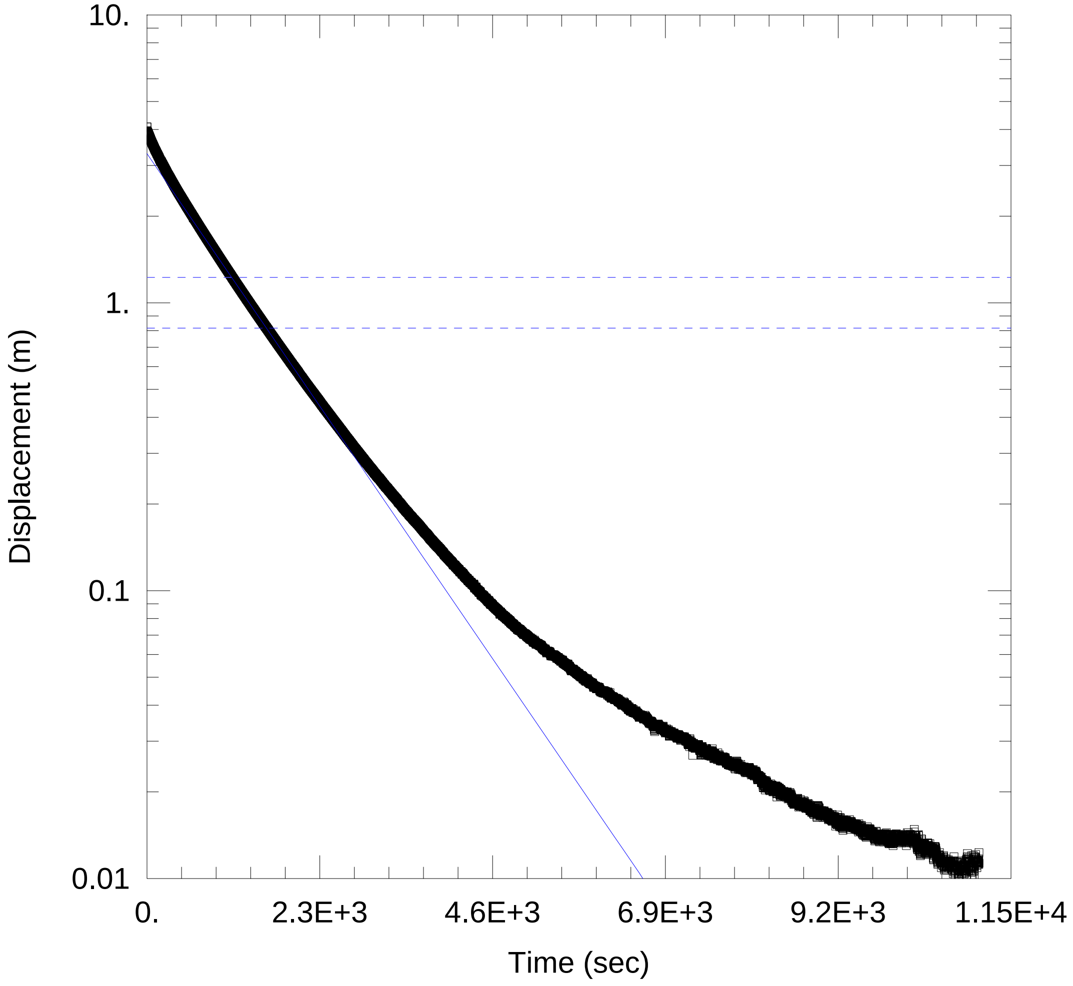
WELL DATA (MW5-18D)

Initial Displacement: 3.711 m
Static Water Column Height: 8.455 m
Total Well Penetration Depth: 8.459 m
Screen Length: 1.524 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.0E-8 m/sec
y0 = 3.333 m



MW6-18

Data Set: \...\161413684_MW6-18_20180807_DS_JK.aqt
Date: 11/21/18 Time: 16:37:22

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Guelph, Ontario
Test Well: MW6-18
Test Date: 2018/07/26

AQUIFER DATA

Saturated Thickness: 8.545 m
Anisotropy Ratio (Kz/Kr): 0.3

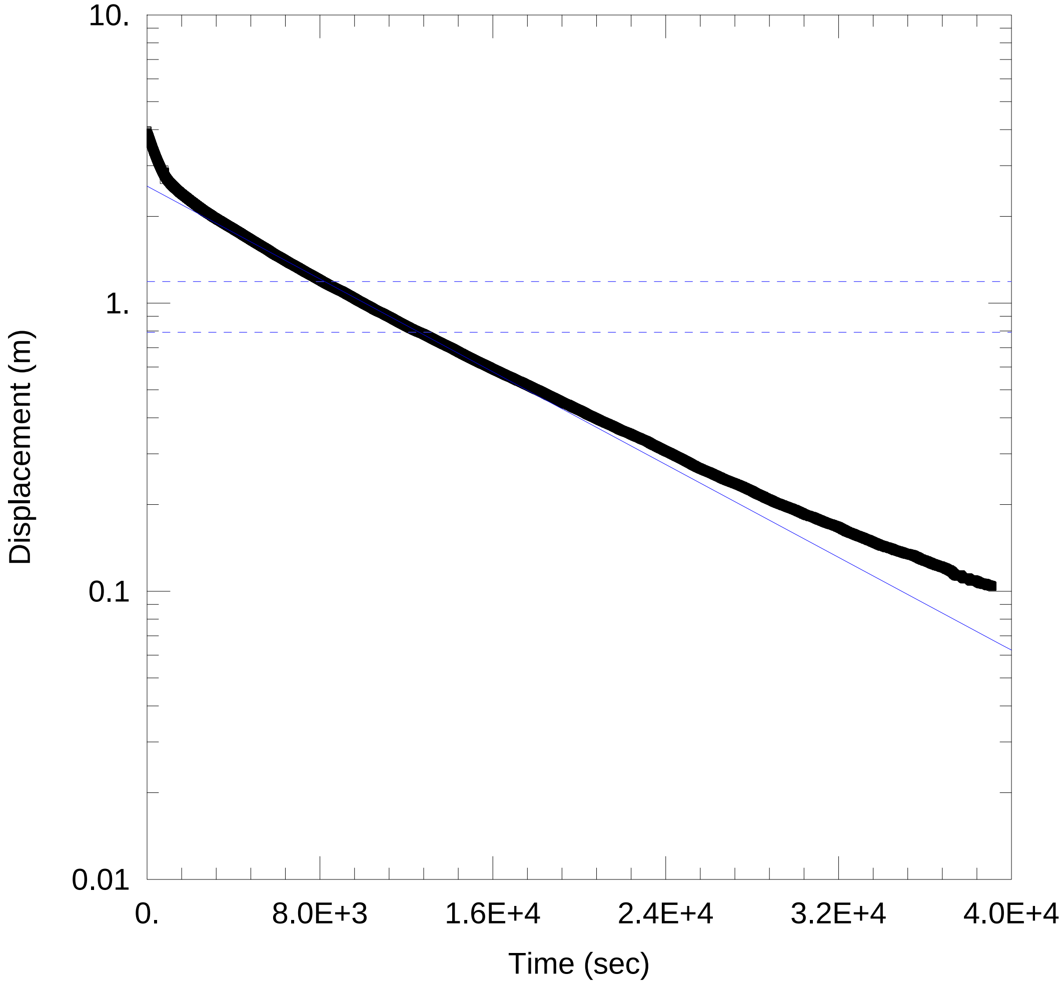
WELL DATA (MW6-18)

Initial Displacement: 4.08 m
Static Water Column Height: 7.94 m
Total Well Penetration Depth: 7.964 m
Screen Length: 1.524 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.4E-7 m/sec
y0 = 3.297 m



MW7-18

Data Set: \...\161413684_MW7-18_20180803_DS_JK.aqt
Date: 11/21/18 Time: 16:42:06

PROJECT INFORMATION

Company: Stantec
Project: 161413684
Location: Guelph, Ontario
Test Well: MW7-18
Test Date: 2018/07/26

AQUIFER DATA

Saturated Thickness: 8.64 m
Anisotropy Ratio (Kz/Kr): 0.3

WELL DATA (MW7-18)

Initial Displacement: 3.961 m
Static Water Column Height: 8.195 m
Total Well Penetration Depth: 8.219 m
Screen Length: 1.524 m
Casing Radius: 0.0254 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.8E-8 m/sec
y0 = 2.545 m

APPENDIX H:
DEWATERING CALCULATIONS

Table H1 - Groundwater Dewatering Calculations

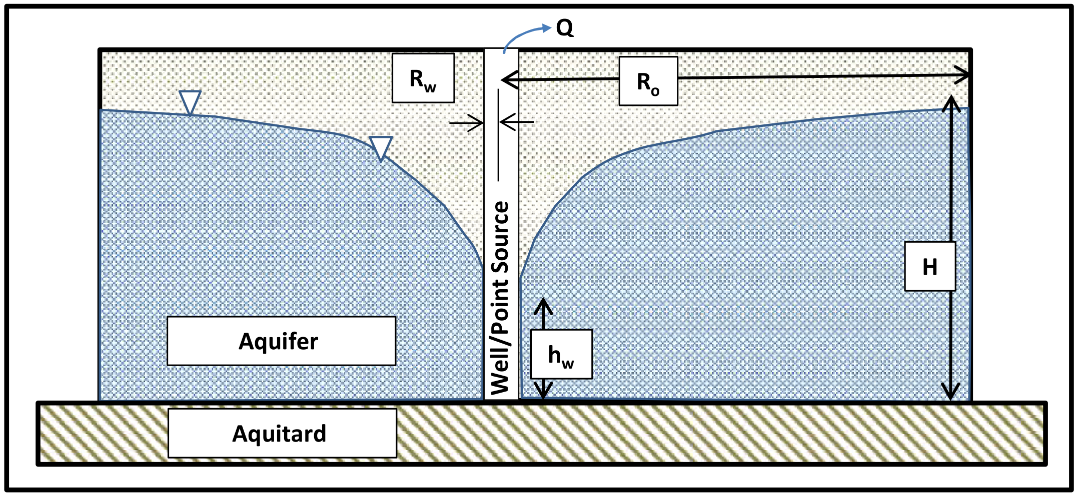
Dupuit Forcheimer Equation for Radial Flow to a Well or Point Source Excavation in an Unconfined Aquifer:

$$Q = \frac{\pi K\left(H^2 - {h_w}^2\right)}{ln\frac{R_o}{r_w}}$$

Where:

Q = pumping rate (m^3/s)
K = hydraulic conductivity (m/s)
H = hydraulic head of the original water table (m)
h_w = hydraulic head at maximum dewatering (m)
R_o = radius of influence from centre of the excavation caused by pumping (m)
r_w = equivalent radius of dewatering area / theoretical radius of pumping well (m)

Conceptual Drawdown



The equivalent radius of influence (R_o) is approximated using the Sichart and Kryieleis method:

$$R_o = r_w + 3000(H - h_w)\sqrt{K}$$

The term r_w is calculated as follows:

$$r_w = \sqrt{\frac{area}{\pi}}$$

Where: area = area of excavation (m^2)

Calculations:

K = 3.7E-08 m/s
H = 20.3 m
h_w = 14.7 m
R_o = 63.6 m
r_w = 60.4 m

Q= 0.00043649 m^3/s
37,713 L/day

Saftey Factor = 3.0

Safety Factor Adjusted Volume
113,138 L/day

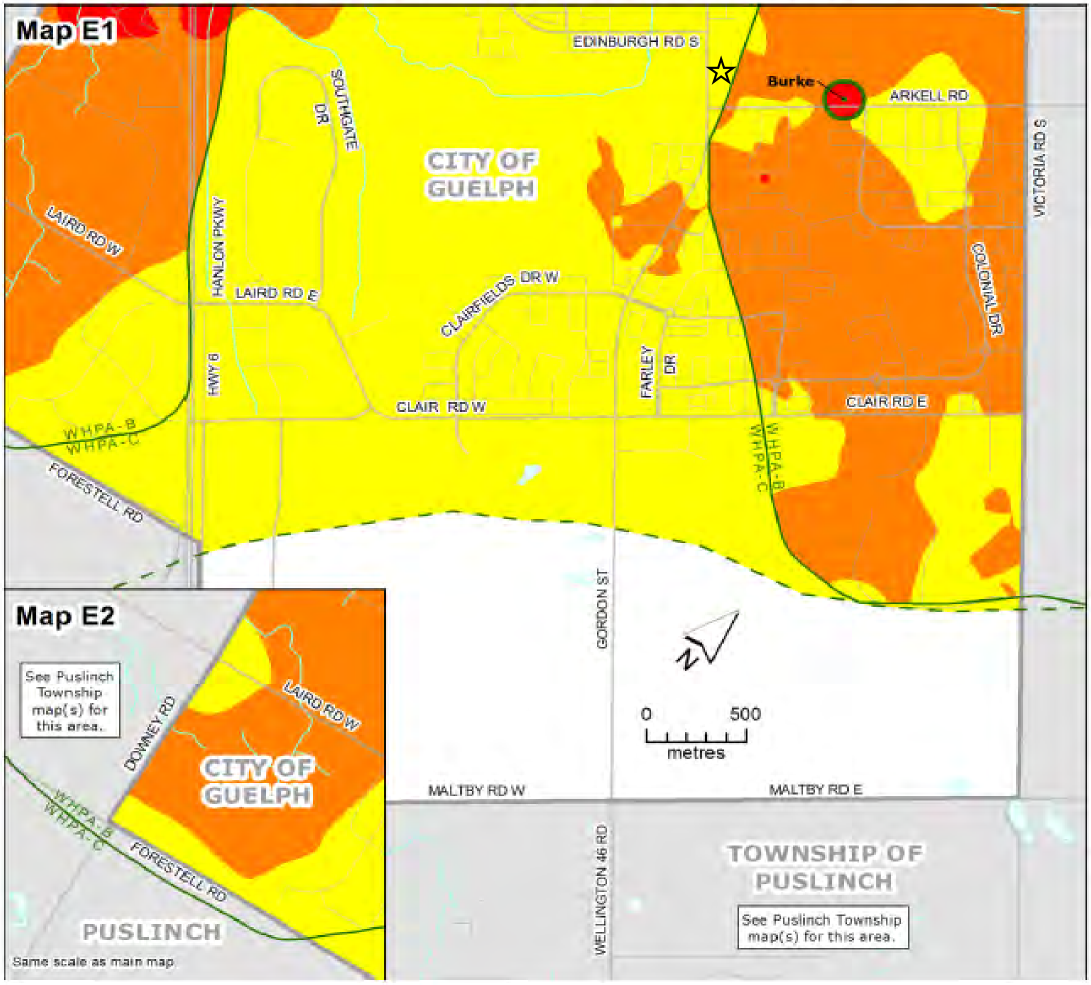
Dewatering radius of influence beyond edge of dewatering area = 3.2 m

Base of Aquifer	320	m AMSL		approximate elevation at which bedrock is encountered beneath the Site
Static Water Level	340.3	m AMSL		highest groundwater elevation measured in onsite monitoring wells
Elevation requiring dewatering	334.7	m AMSL	5.6	meters of groundwater height to be lowered (base elevation of Parking Level 2)

Equations obtained from Powers, J.P., A.B. Corwin, P.C. Schmall, and W.E. Kaeck, 2007. Construction Dewatering and Groundwater Control, New Methods and Applications. John Wiley & Sons, Inc., 3rd Edition.

APPENDIX I:
SOURCE PROTECTION PLAN - THREAT POLICY APPLICABILITY MAPPING

8.12 Schedule F: City of Guelph: Guelph Waterworks Well Supply, Map E



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

Significant Drinking Water Threat Policy Applicability

Significant Drinking Water Threat Policy Categories		Vulnerability Scores on Map		
		10	8	2,4,6
1.	Waste Disposal	🟥	🟧	
2.	Sewage Systems	🟥	🟧	
3, 4.	Agricultural Source Material	🟥		
6, 7.	Non-Agricultural Source Material*	🟥		
8, 9.	Commercial Fertilizer*	🟥		
10, 11.	Pesticide	🟥		
12, 13.	Road Salt*	🟥		
14.	Storage of Snow	🟥		
15.	Fuel	🟥		
16.	DNAPLs	🟥	🟧	🟨
17.	Organic Solvents	🟥		
18.	Aircraft De-icing	🟥		
21.	Livestock Area	🟥		
Local Threat	Oil Pipelines	🟥		

Note: This table provides a summary of the activities listed in the Clean Water Act (2006) that apply as Prescribed Drinking Water Threats (PDWT) within the Non-GUDI Wellhead Protection Zones shown on this map. For details refer to the text of the Source Protection Plan and the Ministry of the Environment Drinking Water Threats Tables.

*Application of Commercial Fertilizer, Non-Agricultural Source Material, and Road Salt may not be a significant drinking water threat in some areas due to the % managed land, livestock density, and/or % impervious surface calculations for these areas. See the text of the plan for further details.

Ontario Grand River Conservation Authority

1. Updated November 18, 2014
2. Larger scale mapping of some map layers, including roads and vulnerability scores, is available at www.sourcewater.ca.
3. This map is for illustrative purposes only. Information contained hereon is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.

Source: Lake Erie Region Source Protection Committee. 2015b. Grand River Source Protection Area, Approved Source Protection Plan – Volume II. November 26, 2015.

APPENDIX J:
CORRESPONDENCE WITH CITY OF GUELPH

17 October 2018

Sent via email

Melissa Straus, MSc.
Terrestrial Ecologist
Stantec
1-70 Southgate Drive
Guelph ON
N1G 4P5

Dear Melissa,

RE: 1242, 1250 and 1260 Gordon Street and 9 Valley Road EIS TOR

City of Guelph Environmental Planning and Park Planning staff reviewed the proposed Environmental Impact Study (EIS) Terms of Reference (TOR) prepared by Stantec, dated July 19, 2018. Park Planning staff provided comments to Environmental Planning Staff on September 7, 2018. The Grand River Conservation Authority (GRCA) also provided comments on the EIS TOR on October 17, 2018 via email. All comments received to date are integrated below and appended to this letter.

On September 12, 2018 the EIS TOR was brought forward to the Environmental Advisory Committee (EAC) and the TOR was accepted with conditions.

Subwatershed Context:

1. The EIS TOR should indicate that the lands fall partially within the Hanlon Creek Subwatershed and partially within the Torrance Creek Subwatershed. As part of the background review, the Torrance Creek Subwatershed Study and Hanlon Creek Subwatershed Study should be referred to. These subwatershed studies include targets and recommendations that should also be considered in the EIS.
2. The hydrology of the adjacent Provincially Significant Wetland (PSW) should be characterized and an associated water balance for the natural feature should be prepared as part of a Hydrogeological Report to support the EIS, in addition to the water budget that forms part of the Stormwater Management Report. This should include consideration for any groundwater impacts from underground parking, where proposed. Incorporation of Low Impact Development (LID) as part of the stormwater management (SWM) approach is also encouraged to assist with achieving a water balance for the site, and maintaining infiltration and recharge functions.

Hydrological / Hydrogeological Study to support EIS

3. It is not clear where or what type of instrumentation will be used to characterize existing conditions and assess the wetland water balance. In terms of data collection, staff would like to see continuous data loggers installed in piezometers. Also, ensure wetland catchments are delineated and depicted to set the context and that the analysis is provided on a

monthly as well as annual basis. Please interpret the data in terms of the pre-to-post wetland water balance.

4. The Hydrogeological Study should identify groundwater levels to inform the required separation distance for the development from the groundwater table.
5. Consideration should also be given to the protection of groundwater functions, including recharge. Also review and consider any other recommendations or requirements from the Torrance Creek Subwatershed Study within the EIS.
6. Results from the Hydrological Study should be integrated into the EIS to assess the potential for hydrologic impacts to the adjacent wetland.

Preliminary Screening Assessment for Significant Wildlife Habitat:

7. April 2017 guidance from the Ministry of Natural Resources and Forestry (MNRF) Guelph District on survey protocols for identifying suitable maternity roost trees indicate that surveys should be completed during leaf-on condition for Tri-colored Bat (*Perimyotis subflavus*) which roost in dead/dying leaves along a dead branch, and during leaf-off condition for Little Brown Myotis/Northern Myotis (*Myotis lucifugus*/*M. septentrionalis*) which roost in tree hollows and cracks. Field surveys are proposed in May to assess Bat Roost Habitat, and should also be proposed during leaf-off condition. Note that surveys in May should be completed in late May to ensure that leaves have in fact developed.
8. Note that where surveys for SWH are not proposed, staff expect a conservative approach to be taken in the EIS which acknowledges candidate SWH and identifies constraints based on the precautionary principle.
9. The EIS TOR indicates that candidate SWH is present for Reptile Hibernaculum. Clarification is needed as to what field surveys for wildlife habitat assessment entail. It is unclear whether or not snake exit surveys and/or snake surveys are proposed.
10. Candidate SWH is also identified for Woodland Raptor Nesting Habitat. Clarification is needed as to whether or woodland raptor nesting surveys are proposed as part of surveys for wildlife habitat.
11. Note that deer movement occurs along the edge of the PSW (as observed through other EISs) as well as across Gordon Street (as indicated in the Natural Heritage Strategy). Table 1 should be updated to reflect this information.

EIS Field Surveys:

12. Location of field surveys, such as breeding bird point count locations and amphibian monitoring stations should be provided on a study area map.
13. MNRF has identified the Torrance Creek PSW as a deer winter congregation area. The habitat should be characterized and impacts assessed through the EIS. In addition, staff request that movement of deer be studied on the subject lands using wildlife cameras to assess movement in the east-west and north-south direction.
14. Clarification on the timing (e.g. spring emergence, first/second breeding bird window), conditions and search effort proposed for wildlife surveys, species of special concern and rare species searches is necessary.
15. Vegetation community mapping should also indicate woodland staking with City staff as a requirement.

16. Spring botanical inventories should ideally be completed in early May. Waiting until June will miss early spring ephemerals, which will have senesced by June.
17. Vegetation community descriptions should include description of soils, per the Ecological Land Classification (ELC) protocol.
18. Table 1 indicates that incidental observations of terrestrial crayfish will be recorded. Clarify where searches for terrestrial crayfish will be performed (i.e. target habitats).
19. Regarding Species of Conservation Concern/Locally Rare Species, it should be noted that City records show that American Bullfrog (*Lithobates catesbeianus*) and Meadow Horsetail (*Equisetum pretense*) have been recently documented in the Torrance Creek Subwatershed.
20. Section 4.2.1.2 Vascular Plants should be revised to indicate that a three-season botanical inventory will be completed.
21. Note that formal wetland boundary and woodland boundary delineation with agencies is required.
22. With respect to area sensitive breeding bird habitat, based on results from multiple EISs completed in this area of the City, it has been confirmed that the Torrance Creek PSW is SWH for area-sensitive breeding bird habitat. The proposed studies should assess the use of habitat edges and areas in relation to the site in order to assess potential impacts.

Tree Inventory and Preservation Plan:

23. The subject lands are regulated under the City's Private Tree By-law and any tree removals will require authorization from the City. The EIS should inform the development application and should look for opportunities to retain trees and integrate them into the development proposal, where feasible. A Tree Inventory and Preservation Plan (TIPP), undertaken by a qualified arborist, is required and should be integrated into the EIS. The TIPP should include the following:
    - Tree inventory information for all trees 10cm Diameter at Breast Height (DBH) or greater proposed to be removed/retained including: Tree # corresponding to plan/drawing, species name, DBH, crown diameter, condition (vigour), remarks, recommended action and rationale.
    - Identify shared, public and private trees with crowns that are within 6m of property lines.
    - Identify opportunities for protection, enhancement and restoration of trees within the Urban Forest.
    - Tree Protection Fencing locations and/or other tree protection/mitigation measures.
24. The TIPP should also note that where preservation is not possible, as agreed to by the City, compensation is required. Note that the City seeks compensation at a 3:1 replacement ratio. Where replacement plantings are not achievable cash-in-lieu may be accepted at a rate of $500 for each damaged or destroyed tree.

EIS Data Analysis

25. The EIS TOR should indicate that where candidate or confirmed SWH exists, staff would like to see it mapped in the EIS.

26. The City of Guelph Local Species List should be consulted when doing the impact analysis and the species lists should include a column to indicate any locally significant species.
27. Deer movement patterns that occur on the subject lands should be mapped in the EIS, and all data collected from wildlife cameras and field studies should be provided.

Impact Analysis:

28. A buffer analysis should be included within the impacts assessment/avoidance discussion. While the City's OP does include policies for minimum buffers, the establishment of larger buffers warrants consideration in the EIS and is also reflected in the City's OP policies.
29. The proposed development concept needs to consider the trail connection across the site. The EIS should explore alternatives for a trail alignment and assess impacts associated with each alignment. Staff should be consulted for further direction on this item.
30. The setbacks and buffers assigned to the development should factor in the community trail that will be built, even though the trail will ultimately be completed by the City.
31. Opportunities for protection, enhancement and restoration of trees within the Urban Forest should also be identified.
32. The impact analysis should mention potential impacts and/or mitigation measures to address salt application.
33. It is acknowledged that the EIS will include a more defined concept of the proposed development plan in order to assess potential impacts resulting from grading, roads, SWM, etc.

Recommended Mitigation Measures:

34. The EIS should also recommend mitigation measures including environmental education and outreach opportunities, demarcation and any recommendations for monitoring plans.
35. The monitoring plan should include post-construction monitoring of SWM design, LID measures and mitigation.
36. An Environmental Implementation Report (EIR) will be required for this development. Environmental Planning staff have found it helpful to document considerations for the EIR in the EIS.

Park Planning Comments (see attached Memo):

37. Provide a revised development concept plan indicating all the proposed elements including public park, east-west and north-south public trail, Active Transportation Network (ATN) and open space in consultation with City staff.
38. Park planning staff would like to walk the site along with the environmental consultant and environmental planning staff to identify and approve a preliminary trail alignment. The approved trail alignment will be flagged on site. Identify the final trail alignment west of Torrance Creek PSW, through EIS and flag the trail route on site for City's review.
39. Trail design including surfacing, clear width and height, grading and drainage, trail signage, etc. should be provided in consultation with Park Planning staff. The design and development of the trail system should be completed in accordance with the city's Facility Accessibility Design

Manual, the city's current trail design and development practice and standards, and ATN standards.

40. Assess the environmental impact of the proposed trail development in the EIS.
41. Recommend measures to mitigate the environmental impact due to the proposed trail development in the EIS.
42. Recommend management of the woodland along the trail route including removal of invasive species and hazard trees in the EIS.
43. Recommend preparation of an EIR, Trail and Landscape Drawings through EIS to detail design an appropriate trail system and associated mitigation measures in accordance with the city's design and development standards.
44. Provide preliminary grading and drainage plans to demonstrate that the design of the park block, trail connection and open space meets city standards.
45. The owner will be responsible for implementation of city approved landscape plans in accordance with the EIR including, but not limited to restoration, compensation and enhancement planting within the open space.
46. Describe the recommended approach to demarcate existing and proposed public park and open spaces, if any, within and adjacent to the subject property.
47. Recommend provision of public education through educational/interpretive signage at the entry points to the trail and open space system. Public education should address the environmental sensitivity of natural heritage features and procedures residents can follow to protect and/or enhance these areas.
48. City will review and approve the design and locations of interpretive and educational signage, to be included on landscape plans.

Environmental Advisory Committee:
On September 12, 2018 the EIS TOR was brought forward to EAC and resulted in the following draft motion. Note that motions remain draft until such time that EAC formally adopts the minutes.

Staff recommends that the Environmental Advisory Committee accept the Terms of Reference for an Environmental Impact Study prepared by Stantec (July 19, 2018) with the following condition:
THAT a revised EIS TOR is provided which addresses staff comments and at a minimum includes:

- A study area map showing survey locations;
- A Tree Inventory and Preservation Plan;
- Clarification on surveys proposed for assessing significant wildlife habitat;
- Deer movement surveys using wildlife cameras;
- Commitment to utilize continuous data loggers to collect data to support a wetland water balance and a monthly analysis;
- Recommended mitigation measures for salt management; and
- Considerations for a future Environmental Implementation Report.
- A hydrogeological report that includes the following:
    - Infiltration testing using a Guelph Permeameter (or equivalent method) to support SWM planning;

- Hydrographs that include high water table data including the spring freshet and other storm and melt events. Groundwater data should be collected for a minimum of 1 year, with comparison to local precipitation data;
- It is also recommended that groundwater data be collected from the wetland area (pending access).

Do not hesitate to contact me further should you have any questions.

Regards,

Leah Lefler

Leah Lefler, MES
Environmental Planner

Planning, Urban Design and Building Services
Infrastructure, Development and Enterprise
City of Guelph: 1 Carden Street, Guelph

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cc Chris DeVriendt – Manager, Development Planning
Melissa Aldundate – Manager, Planning Policy and Urban Design
Mary Angelo – Supervisor, Development Engineering
Jyoti Pathak – Park Planner

INTERNAL MEMO

CITY OF Guelph
Making a Difference

DATE September 7, 2018

TO **Leah Lefler**

FROM Jyoti Pathak
DIVISION Parks and Recreation
DEPARTMENT Public Services

SUBJECT **1242, 1250 and 1260 Gordon Street and 9 Valley Road – Proposed Terms of Reference for Environmental Impact Study –(File # TBD)**

Parks Planning and Development has reviewed the draft Terms of Reference (TOR) prepared by Stantec dated July 19, 2018 for an Environmental Impact Study (EIS) to be compiled in support of a draft plan of subdivision and Zoning By-Law and Official Plan Amendments for the proposed high density residential subdivision development on the subject property.

Location: The subject property is located on the east side of Gordon Street immediately south of Valley Road.

Development Proposal: The future development proposal will include a public street, public park, public trail/ ATN route, natural open space, residential apartments and townhouses. A pre-consultation meeting between the applicant and City staff was scheduled on Wednesday June 13, 2018 and a concept plan has been developed by the applicant. The site area is 3.67 hectares inclusive of natural heritage features and a developable area.

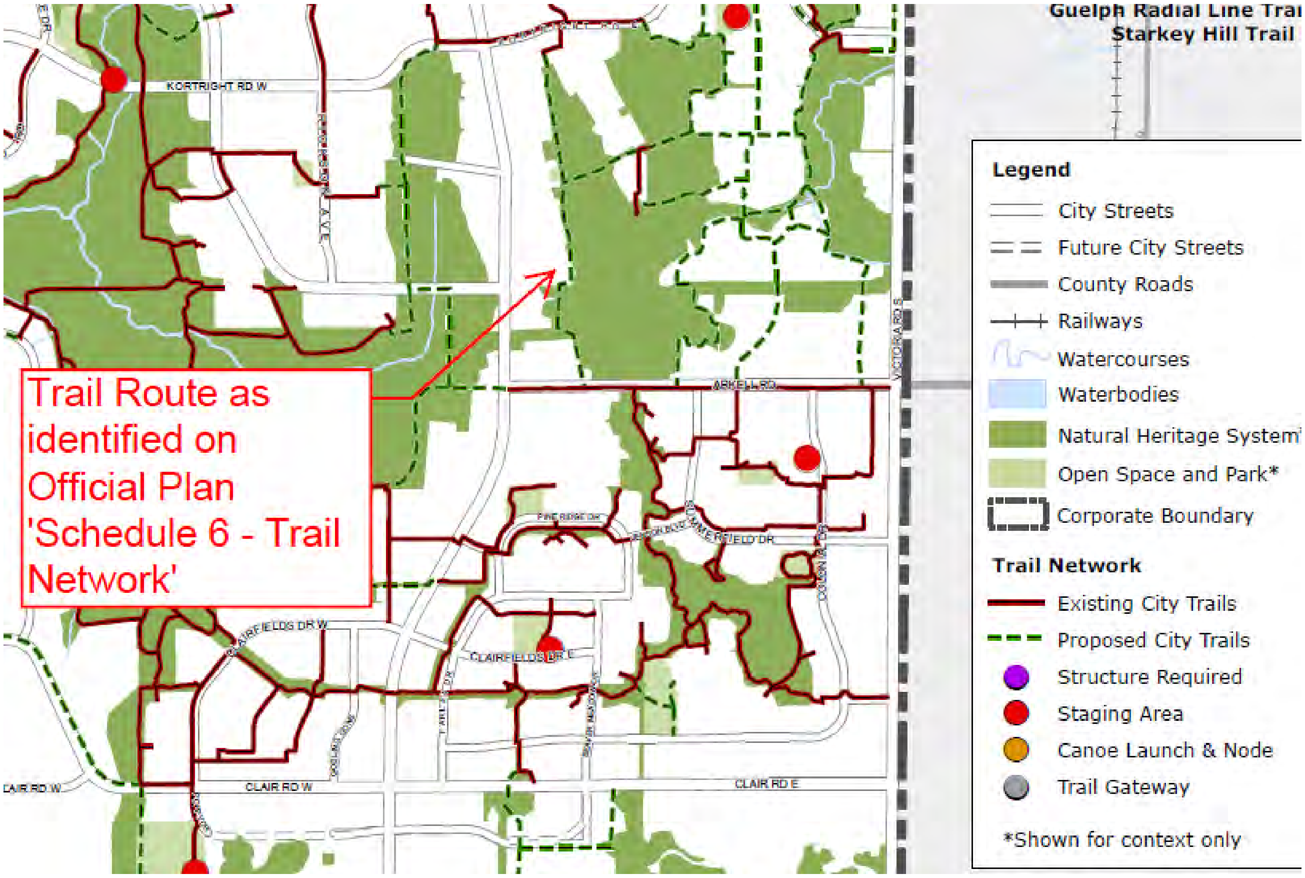
Background:

Parkland Dedication:
In accordance with the City's Official Plan Policy 7.3.5.1 (ii) parkland dedication is required for the proposed residential subdivision development. Park block frontage, size and configuration of the park will be determined in accordance with the neighbourhood park design criteria outlined in City's official Plan and Zoning By-Law. Park block would be located within developable area of the site and outside of the existing natural heritage system.

Guelph Trail Network:
Official Plan 'Schedule 6 - Trail Network' identifies a proposed north-south multi-use trail route from Brady Lane (south of Kortright Road East) to Arkell Road along the west side of Torrance Creek PSW Complex. The proposed multi-use trail would be used for walking, cycling, personal mobility devices etc.

Multi-Use Trail System / Active Transportation Route (AT Route) (north-south) from Arkell Road to Brady Lane west of the Torrance Creek provincially significant wetlands (PSW):
The trail system from Arkell Road to Brady Lane aligns with the active transportation route and serves both recreational and transportation purposes. This route is being detailed designed in segments through review of the past and current development applications. The trail route immediately north of the subject property was identified through site plan approval process of the existing Valley Road extension condominium and the trail property immediately south of the subject property has been secured through development approval process on 1280 and 1284 Gordon Street.

Multi-Use Trail / AT Route (east-west) from Gordon Street to the proposed Trail west of Torrance Creek PSW: Provide a direct, accessible, multi-use active transportation route from the Gordon Street to the proposed Multi Use Trail system.


Trail Route as identified on Official Plan 'Schedule 6 - Trail Network'

Active Transportation Route in yellow highlight

Parks Planning and Development offer the following comments:

1. **Development concept plan:**
    - Provide a revised development concept plan indicating all the proposed elements including public park, east-west and north-south public trail/ ATN route from Gordon Street to the and open space in consultation with City staff.

2. **Trail route alignment:**
    - Park planning staff would like to walk the site along with the environmental consultant and environmental planning staff to identify and approve preliminary trail alignment. The approved trail alignment will be flagged on site. Identify the final trail alignment west of Torrance Creek PSW, through EIS and flag the trail route on site for City's review.

3. **Trail design and development standards:**
    - Trail design including surfacing, clear width and height, grading and drainage, trail signage etc. would be finalized in consultation with Park Planning staff. The design and development of the trail system would be completed in accordance with City's Facility Accessibility Design Manual, City's current trail design and development practice and standards and Active Transpiration standards.

4. **Environmental impacts and mitigation:**
   - Assess the environmental impact of the proposed trail development through EIS.

   - Recommend measures to mitigate the environmental impact due to the proposed trail development through the EIS.

   - Recommend management of the woodlot along the trail route including removal of invasive species and hazard trees through the EIS.

   - Recommend preparation of an Environmental Implementation Report (EIR), Trail and Landscape Drawings through EIS to detail design an appropriate trail system and associated mitigation measures in accordance with the City's design and development standards.

5. **Grading and drainage:**
   - Provide preliminary grading and drainage plans to demonstrate that the design of the park block, trail connection and open space meets City's standards.

6. **Open space restoration and enhancement:**
   - The owner will be responsible for implementation of City approved landscape plans in accordance with the EIR including, but not limited to, restoration, compensation and enhancement planting within the open space.

7. **Demarcation of public open space:**
   - Describe the recommended approach to demarcate existing and proposed public park and open spaces, if any, within and adjacent to the subject property.

8. **Public education:**
   - Recommend provision of public education through educational/ interpretive signage at the entry points to the trail and open space system. Public education should address the environmental sensitivity of natural Heritage features and procedures residents can follow to protect and/or enhance these areas.

   - City will review and approve the design and locations of interpretive and educational signage, to be included on landscape plans.

Summary:
Revise the Terms of Reference for scoped EIS, to address Parks comments above, for our further review.

Please contact me if you have any questions.

Sincerely,

Jyoti Pathak,
Parks Planner

Parks and Recreation
Public Services
Location: City Hall
T 519-822-1260 x 2431
E Jyoti.pathak@guelph.ca

From:	Fred Natolochny <fnatolochny@grandriver.ca>
Sent:	Wednesday, October 17, 2018 10:11 AM
To:	Leah Lefler
Subject:	FW: 1242, 1250, 1260 Gordon St. 9 Valley Rd. Guelph

From our ecologist. Can you also send me the original message again – I appear to have mis-filed it. Sorry

---

From: Robert Messier
Sent: October 16, 2018 9:06 AM
To: Fred Natolochny
Subject: 1242, 1250, 1260 Gordon St. 9 Valley Rd. Guelph

I have reviewed the ToR EIS for the redevelopment of 1242, 1250, 1260 Gordon St. and 9 Valley Rd. in Guelph. As part of the background review they should also look at the Torrence Creek Subwatershed study and the Hanlon Creek subwatershed study. For the monitoring plan they should include a post construction monitoring of SWM design and mitigation. The setbacks and buffers assigned to the development should factor in the community trail that will be built even though the trail will ultimately be completed by the City. If you have any questions please let me know

Robert Messier
Ecologist
Grand River Conservation Authority
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Cambridge, Ontario N1R 5W6
(519) 621-2763 x2310
www.grandriver.ca

INTERNAL MEMO

DATE October 2, 2020 File No. 16.152.369

TO **Lindsay Sulatycki**

FROM Mohsin Talpur
DIVISION Engineering Services
DEPARTMENT Infrastructure, Development and Enterprise Services

SUBJECT **1242-1260 Gordon Street and 9 Valley Road – Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment.**

We have reviewed the following plans and reports that were submitted in support of the 1242-1260 Gordon Street and 9 Valley Road Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment:

a) *Report, Re, Functional Servicing Report for Gordon Street, Guelph ON; dated April 13, 2020; prepared by Stantec;*
b) *b) Report, Re, Geotechnical Investigation, Two 12-story Apartment Buildings 1242, 1250, 1260 Gordon Street, Guelph Ontario; dated April 25, 2018; prepared by CMT Engineering Inc.;*
c) *Report, Re, Hydrogeological Assessment, 1242, 1250, 1260 Gordon Street, City of Guelph ON; dated May 4, 2020; prepared by Stantec;*
d) *Report, Re, Noise Impact Study, 1250 Gordon Street, Guelph ON; dated February 20, 2020; prepared by J.E. Coulter Associates Limited;*
e) *Engineering Plans; dated April 15, 2020; prepared by Stantec;*
f) *Report, Re, 1242, 1250, 1260 Gordon Street and 9 Valley Road, Traffic Impact Study; dated May 21, 2020; prepared by Stantec.; and*
g) *Report, Re, 1242, 1250, 1260 Gordon Street and 9 Valley Road, Guelph, ON-Environmental Impact Sturdy; dated May 22, 2020; prepared by Stantec.*

And offer the following comments:

Functional Servicing Report

1. The disclaimer statement does not include City of Guelph to rely on the report. Please include City in the disclaimer statement or remove it.

2. Please provide a copy of Phase One ESA and/or Phase Two ESA reports for our review prior to zone change.

3. Sufficient and adequate capacity is available of the City’s existing water supply and distribution system to accommodate the proposed development

and there are no water capacity constraints expected for most demand scenarios. However, there is potential for marginal water supply pressures in proposed development under certain conditions such as peak hour demand scenario at locations with elevation greater than 346 m height above mean sea level (AMSL) and average day demand scenario at locations with elevation greater than 339 m height AMSL in the existing water system.

4. In Section 3, email correspondence from City regarding sanitary servicing capacity was discussed, but there are no email attachments found in the report as mentioned. Please include the correspondence is the FSR.

5. No capacity is available in the City's Gordon St. existing downstream sanitary sewer to accommodate discharge of sanitary flows from the proposed development. However, City is in process of studying the upgradation of the sanitary service capacity within Gordon Street. Therefore, a 'H' (holding) symbol will be placed on the property until such time a new sewer is installed.

6. The gradient of Street A, an extension of Landsdown Drive and Edinburgh appears to be over 6% that is not desirable in the approach of an intersection. Please refer TAC section 9.7.3 and lower the gradient.

7. The typical cross-section and label for centreline radius (minimum 18m) are missing. Please provide the details for review.

8. The pavement width should be 8.4 m as per Development Engineering manual. Provide sidewalks on both sides of proposed Street A.

9. Provide traffic geometrics plan showing large moving trucks to/from the site.

10. The proposed Street A ROW appears to be excluded from the pre-development and post-development stormwater management plan. The drainage area (i.e. 0.29 ha) of the Street A is discharging stormwater to Gordon Street uncontrolled without any quality control measures. Please include the area of Street A and demonstrate the quality and quantity control requirements are met and provide details for review.

11. Based on the topographic plan, there are external areas draining to the proposed development site from adjacent lots on Valley Road and the backyards of Gordon Street lots. Please delineate the external drainage areas discharging to the proposed development and update the drainage plans by accounting for external drainage under pre- and post-development stormwater management plan.

12. In section 5, the stormwater management strategy is discussed. The first document referred is Hanlon Creek Watershed Plan (HCWSP) that states all

stormwater generated from the area including 100-year storm must either infiltrate into the ground or evaporate (i.e. zero runoff). Another document referred is Torrance Creek Subwatershed Study (TCSS) that states that for the zone 2, detain the post-development flow to pre-development rates for the 2-year to 100-year storm events and to infiltrate minimum 150 mm/year. The Report indicates that the TCSS criteria is decided to be applicable for the site. However, it appears that, except for the woodlot area (draining uncontrolled east to the TCSS), the proposed stormwater is diverted to the Gordon street (Hanlon Creek Subwatershed area), which is contradicting the selection criteria. Please demonstrate the equitable share of surface water contribution to TCSS is maintained under post development conditions.

13. Based on information provided in figure 1, the existing stormwater is divided between two Subwatershed areas, major portion of the area (1.73 ha) discharges to TCSS and remaining area (1.13 ha) discharge to Gordon Street (HCWSP). The groundwater flow follows a similar divide to the surface water flow, with a portion flowing east as part of the Torrance Creek Subwatershed another portion flowing west as part of the Hanlon Creek Subwatershed. However, under proposed conditions, the infiltration gallery is proposed at TCSS portion and we have concerns that that may reduce recharge targets for Hanlon Creek Subwatershed area. Please demonstrate equitable share of recharge is maintained for each Subwatershed under post development adopting distributed infiltration approach.

14. It is mentioned that the development will also increase the impervious area and will produce increase in stormwater flows to the downstream Gordon Street storm sewer. The Gordon storm sewer (525 mm diameter storm sewer) is discharging to the existing downstream SWM facility (at 1291 Gordon Street), which is already at capacity. The additional flow from the development including uncontrolled flow from Street A could cause surcharging in the existing storm sewers and negative impacts downstream such as, erosion etc. Therefore, it is suggested to explore the option of discharging additional stormwater to the TCSS area.

15. Rooftop controls (i.e. 16 cm of ponding) are proposed for both buildings for the attenuation of stormwater discharging to the infiltration trench through downspout system with 75mm diameter orifice. The overflow arrangements of infiltration trench are directing water to the underground storage tank for out-letting to Gordon Street. The rooftop water is considered as clean; therefore, it is recommended to direct the overflow towards Provincially Significant Wetland (PSW) part of Torrance Creek Subwatershed.

16. It appears that an underground storage tank (located in the underground parking structure) is proposed to attenuate runoff generated form parking area and laneway; in addition, the underground storage is proposed for

attenuation of active storage required for rooftop runoff at 100-year event. The underground storage tank is not a desirable option for the City. Please explore surface water storage for the water quantity control.

17. The proposed infiltration gallery invert is set at 339.00 m and the invert of perforated pipe at inlet appears to be at 339.96 m. Based on the nearest monitoring well (MW5-18 (S)) data provided in the hydrological assessment report shows that the seasonal high groundwater level is approximately 340.7 m. Thus, all rooftop runoff could bypass the gallery and discharge to proposed underground storage via proposed overflow arrangements. Please revise the infiltration gallery design and ensure bottom of infiltration gallery is set minimum 1m higher than the seasonal high groundwater elevation and size appropriately to meet recharge targets.

18. It appears that the propose cover for the infiltration gallery is less than 0.5 m that does not meet frost protection requirement of minimum 1.2 m. Please ensure the minimum 1.2 m cover for the frost protection. Please refer Section 5.7.8 of DEM for further details

19. There is no discussion of on-site permeameter testing conducted at the location of proposed infiltration gallery. Please conduct in-situ permeameter testing using Guelph Permeameter or double ring infiltration testing method as per our Development Engineering Manual and CVC LID manual− Appendix C and size the infiltration gallery accordingly.

20. For water quality control an Oil-grit Separator (i.e. Stormceptor EF 4) is proposed and claimed 90% TSS removal. Based on Environmental Testing Verification (ETV) Canada, Oil-grit separators are 60% efficient when used as stand alone. Therefore, please justify enhanced quality control through the proposed OGS unit.

21. The IDF values used for hydrologic modeling are based on our Development Engineering Manual (DEM); however, the runoff coefficient (C) values do not match DEM. Please be consistent in using hydrologic parameters for the analysis based on DEM.

Hydrogeological Report

22. It seems that the proposed foundation of the underground parking area will be constructed with a water proof base and, as such, no permanent drainage system/dewatering is expected for these structures. However, a large footprint of infiltration is proposed in the close proximity of proposed building. Assuming it functions as designed, the concentrated flow from infiltration gallery and presence of dense glacial till encountered in the lower zone may have the potential to create perched water condition. There are chances of groundwater mounding impacts on the building’s underground

parking lot and adjacent properties. Please conduct a groundwater mounding analysis including influence zone and submit for review.

23. Approach to analysis of slug testing results. Most of Stantec’s graphs display a double straight-line effect that may be exaggerating the geometric mean conductivity values in the formation itself. They have matched most of the curves to the early drawdown, which typically is assumed to be the response of the gravel pack and not the formation itself.

24. The in-situ hydraulic response testing conducted at each monitoring well to estimate horizontal hydraulic conductivity of the deposit. All MW screens are located within sandy silt till layer that are deeper than the bottom of proposed infiltration gallery. Thus, the hydraulic conductivity estimated using slug tests would not be representative (k) values for designing infiltration galleries. The field saturated hydraulic conductivity should be determine using Constant heads Guelph Permeameter method or Constant head double-ring infiltrometer method. As stated in City’s Development Engineering Manual (DEM), a minimum of one on-site infiltration test shall be conducted at the proposed bottom elevation of infiltration gallery; in addition, one on-site infiltration test shall be conducted at every other soil horizon encountered with 1.5 meters below the proposed bottom elevation. Please arrange onsite testing at the proposed locations and design infiltration gallery as per details provided in Section 5.7.7 & 5.7.8 of DEM.

Water Balance Analysis

25. Evapotranspiration estimations for pre-development conditions is based on annual precipitation (i.e. 916 mm) from Waterloo Wellington A. However, under post-development water balance evapotranspiration estimations are based on annual precipitation (i.e. 921 mm) seems from another climate station. Despite climatic data taken from two different stations, the adjusting factor for latitude remains unchanged. Please justify.

26. The climate data of 1981 to 2010 (22 years) selected from Waterloo Wellington Station A for water balance calculations. However, the climate data is available for more than 36 years period. Please provide the rationale for using only 22 years data.

27. It appears that the topographic factor (0.1) used for the sub-area A to Sub-area C considering the areas as hilly. However, these sub-areas can be categorized as rolling lands with factor 0.2. Please update the factors in water balance calculations.

Source Water Protection:

28. The property is located in a WHPA B and C with a vulnerability score of 4-8. As such, all construction related activities are subject to the City of Guelph’s

SOP for construction projects within 500 m of a municipal well (attached). The property is not located in an Issue Contributing Area.

29. In accordance with Grand River Source Protection Policy CG-CW-29, please provide 5 digital copies of a Salt Management Plan.

30. Ensure that any private water supply or monitoring wells that are no longer in use are abandoned in accordance with O. Reg. 903.

31. In accordance with Grand River Source Protection Policy CG-CW-37, the applicant will need to indicate what DNAPL (if any) or other potentially significant drinking water threats will be stored and/or handled on the property. A Risk Management Plan may need to be developed.

Noise Impact Study

32. The title of the report is Noise Impact Study. The report appears to be a combination of both feasibility study and detailed study features as per the Guelph Noise Control Guidelines (GNCG) study requirements. Please clarify and change the tile appropriately to avoid any confusion.

33. The Noise Impact Study (NIS) submitted in support of "Zone change and Draft Plan amendment for the property 1242 – 1260 Gordon Street. However, the address mentioned as 1250 Gordon Street that is not consistent with the submission. Please correct the address.

34. In Section 2 of the NIS report, it is mentioned that the west facades of the Buildings A and B are setback approximately 24 m and 77m, respectively from the centerline of Gordon Street. However, other drawings included in the submission show that parts of the building facade with amenity areas are approximately 12.4m from the centreline of Gordon Street, and approximately 8.3m from the centreline of Street A (an extension of Edinburgh Road South). Please clarify, updating the report as necessary.

35. Table 1 includes "Outside bedroom window" and "Outside living room window" as part of the listed "Sound Level Limits…". The other values in this table correspond to MECP NPC-300 stated criteria sound level limits, whereas these two categories correspond to values used to determine ventilation and building component requirements; distinction between these should be made (we suggest separating them into two separate tables, for clarity).

36. The statement in the footnote of Table 1 is incorrect and should be removed or reworded. Excess above the stated criteria for OLAs may be permitted, with engineering judgment and justification, at the discretion of the Municipality, and are not automatically allowed.

37. In Section 3.2, not sure why the word “excesses” is used; the unit ventilation requirements are stated, and no “excess” to these are permitted. In addition, there are no discussions about building component design requirements.

38. In Section 3.3, technically, the stationary noise criteria is based on the worst-case scenario for the affected site; while is this often at the point of time of lowest ambient roadway traffic, that isn't always the case, and is not the way NPC-300 defines it. Please correct.

39. In Section 3.3, it is mentioned that the proposed development is located in a Class 1 Urban Area. However, this is Class 2 Area. Please update the report and analysis accordingly.

40. Table 2, there are several datasets included in the appendix. How was AADT values mentioned determined? If additional calculations were done, please include them in the report. In addition, future heavy truck percentage on Edinburgh Road is assumed as zero. Even if existing heavy truck % is zero, why is projected heavy truck % zero? It would only be valid if the road has a heavy truck prohibition (if it does, verify it is planned to remain in place to the horizon year). Please also update the roadway descriptions to include the class of road (arterial, collector, etc.) and whether or not it is a divided roadway

41. The note for the Table 2 mentioned that the traffic growth on all roads has been assumed to be 1.5% per annum. There is no rationale provided for the assumption of only 1.5% per year. The standard is 2.5% traffic growth rate. Please justify or correct it accordingly.

42. The first paragraph in Section 5 refers to Appendix A, Figure 2 for calculation locations. However, Appendix A Figure 2 does not appear to specify or otherwise indicate the calculation locations. Please update the figure accordingly.

43. The building identifications mentioned in Table 3 is not consistent with other submitted plans/reports. Please standardize building identifications.

44. The outdoor amenity is mentioned in the Table 3, without referring to amenity location. The concept plan submitted with the complete application (revision 3 dated 2020.05.21) shows two separate outdoor common amenity areas, plus a proposed park, and an “Amenity Roof”. Please verify that all appropriate OLAs are being analyzed. In addition, the outdoor amenity daytime sound level at exterior façade mentioned as << 55 dB L_{eq}. Please clarify if this value is calculated/predicted or assumed: only calculated/predicted values should be indicated in the table.

45. The Table 3 note 2 does not match the definition of an OLA as per the Guelph Noise Control Guidelines. Please correct it. In addition, the second sentence of note 2 should be separated as note 3. Again, actual calculated/predicted values should always be reported in the table, even if upon analysis they are determined to be "insignificant". That said, it may be relevant to not include noise from Edinburgh Road South for some of the calculated receiver locations: this should be outlined in the report complete with justification.

46. In Section 6, air conditioning and warning clauses are listed as noise control measures. These are not noise control measures and should not be listed as such. In addition, it appears that the building component calculations are missing in the report. Please include in the report and reference in the section.

47. There are patio/balconies identified on the submitted plans that are more than 4m deep. However, there are also ground-based OLAs and indoor amenity spaces that have not been identified or analyzed. Please clarify, updating the report as necessary.

48. When including stationary noise calculations in a noise report, many more details are required. Please see the Guelph Noise Control Guidelines for information on what level of detail is required.

49. The point of reception for stationary off-site noise sources are identified in Section 7, but it is not clear how were these locations selected? Are there other locations (including other floors) that would experience a larger impact from these sources? Please provide details.

50. Section 7 does not include analysis of proposed outdoor points of reception. Please include these in the analysis.

51. In Section 8, the surrounding buildings (1280 Gordon Street & 1284 Gordon Street) are identified as 5 story buildings but that is not consistent with earlier in the report where they are identified as 6 story apartment buildings. Please clarify.

52. Please include, in an appendix of this report, the HVAC design drawings for each building. Verify that there are no planned sources of noise at any location on/at/around these proposed buildings other than the roof-top (above the 12th storey): other elements that may be missing from this analysis include (but not limited to) blowers/exhaust from the underground parking, emergency generators, HVAC equipment on lower roof levels, etc. If the HVAC has not yet been designed, this needs to be documented in this report, along with sources for equipment/noise levels used in the analysis, assumptions on location, assumptions on other equipment, etc.

53. The analysis of the impact of proposed development on the surrounding areas appears to be based on a "best-case scenario" for HAVC design for buildings of this type, and provides little assistance to identify possible noise impacts to external sensitive receivers. Please provide justification within the report concerning the type, number, placement and selection of HVAC equipment for these proposed buildings.

54. Please clarify what methodology was used for the evaluation in Section 10. Additional details are required, as are the calculations completed (can be included in an appendix). Based on most methods, review of actual architectural drawings would be required: was this done? If this is a Feasibility Noise Study, the level of detail expected is much lower, but detailed evaluation would be required as part of the subsequent Detailed Noise Study (typically at Site Plan or similar stage of the land development). It should be noted in this section that a review of the building components is a requirement under NPC-300 due to the sound levels predicted.

55. The summary of on-site noise impacts on adjacent noise sensitive land uses is missing. Please include it.

56. In Section 12 recommendation 2 identifies reference to recommended warning clauses. Please note that, if this is a Detailed Noise Study, the warning clauses need to be specified in detail within the report, as per the GNCG Appendix A, and not simply referenced by clause "letter". If this is a Feasibility Noise Study, warning clauses need not be recommended (see the GNCG for details of report requirements).

57. In Section 12, it is mentioned in recommendation 4 that the analysis will be conducted prior to building permit. This analysis will be required prior to Site Plan Approval, as per the Guelph Noise Control Guidelines.

58. The Figure 1 does not include standard required map orientation items. Please include standard-required map orientation items, such as a north arrow, etc. This figure should also outline the extents of the site under investigation.

59. Please include the locations of the on-site points of reception used in the evaluation of transportation noise in Figure 2.

60. Please include standard required map orientation items, such as a north arrow in Figure 3 & Figure 4.

61. Please clarify that the building description is based on magnetic north or project/site north in the STAMPSON output, and/or coordinate and standardize the location descriptions to cardinal points based on included drawings.

62. The location of the points of reception mentioned in the model are unknown, beyond the general description (as they are not shown on an included drawing/figure). Once they are known, we will review the STAMSON predictions in more detail. Until that time, please see some general comments below.

63. It appears that absorptive ground surface is used in the model. Based on the included drawings, the intervening ground surface to all receptors on site would not be considered absorptive. Therefore, reflective ground should be used for all predictions.

64. The receiver height mentioned in STAMPSON is 36.00 m. However, based on the submitted elevation drawings, this value does not appear correct. Please clarify how the receiver height was determined?

65. It appears that a barrier is included in some predictions. Why was a barrier introduced? If a barrier exists, complete the three elevation values. Note that barriers should not be included in the analysis for receivers in the bright zone of the barrier.

Water Servicing, including Metering

66. The plans are missing a property line valve. For new servicing we are looking for a tapping valve (or valve on the 'T') and a property line valve in all cases.

67. All water, including that to supply fire suppression and hydrants, must be bulk metered.

68. The water meter shall be located within a meter chamber at property line. The chamber position would be at the PL of building 1 or be bulk metered inside Building 1 for the entire property

Traffic Impact Study

69. "Section 7.1 Zoning By-law Requirements" noted that a review was completed to determine the reduced drive aisle width of 6.7m meters. Please provide the details of the review.

70. The proponent will be responsible for design and construction of Street A, and reconstruction of the intersection at Gordon Street and Edinburgh Road including any modifications to geometry and traffic signalization.

TDM

71. Per section 8.2 of the TIS, please strengthen active transportation connections between Buildings #1, #2 and Gordon Street, on the south side of the site. A 3.0 m wide shared pathway for pedestrians and cyclists

eliminates the need for these users to travel out of their way via the proposed municipal ROW, when travelling southbound on Gordon Street.

72. Per section 8.1 of the TIS, staff recommend provision of high quality, secure, indoor bicycle storage. This means at least half of the bike racks provided should be horizontal and lift-assist, rather than all racks being vertical wall mounted. Providing high quality amenities ensures a range of users can access these spaces, and promotes active transportation as an appealing alternative to single-occupancy vehicle use.

73. Several ground mounted racks for oversized bicycles such as cargo bikes, recumbent hand cycles and bicycles with trailers attached should be provided.

74. Section 2.0, on page 2.1 indicates there will be 442 bicycle parking spaces underground, while table 13 indicates 415 spaces. Please clarify.

75. Note, per the Site Plan procedures and guidelines the long term bike parking should be provided at a rate of one space per unit, while the 2 spaces per 20 units are for visitor bike parking. These visitor bike parking spaces should be situated above ground, directly next to the main building entrances.

76. Please consider unbundled parking provisions so residents can opt-out of parking spaces they may not need.

77. Staff recommend the implementation of EV-charging stations for residents in the underground parking.

Please do not hesitate to contact me if you have any questions regarding my comments.
Thanks,

Mohsin Ali Talpur, M.Eng., P.Eng.
Development - Environmental Engineer

Internal Memo

Date	December 8, 2020
To	**Lindsay Sulatycki, Senior Development Planner**
From	Leah Lefler, Environmental Planner
Service Area	Infrastructure, Development and Enterprise Services
Department	Planning and Building Services
Subject	**1242-1260 Gordon Street and 9 Valley Road** **Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment** **Environmental Planning Comments on First Submission**

Environmental Planning reviewed the following documents that pertain to the proposed Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment at 1242-1260 Gordon Street and 9 Valley Road:

Environmental Impact Study, Stantec, May 2020
Functional Servicing Report, Stantec, April 2020
Geotechnical Report, CMT Engineering Inc., April 2018
Hydrogeological Assessment, Stantec, May 2020
Landscape Concept, Stantec, March 2020
Planning Justification Report – May 2020
Tree Inventory and Preservation Plan – March 2020

Based on the review of the materials listed above, Environmental Planning staff offer the following comments at this time:

Environmental Impact Study

1. In the Introduction, please note that the planning approval sought by the applicant is a Draft Plan of Subdivision, Official Plan Amendment and Zoning By-law Amendment. Following approval, the development will proceed to detailed design and subdivision registration. Text in the third paragraph should be updated accordingly.
2. Under 1.1 Agency Consultation, reference is made to a Hydrology Report. Please revise this to Hydrogeological Assessment.
3. Under 2.2.1 Official Plan, it is stated that "Natural Areas where development may be permitted provided an EIS can demonstrate that there will be no negative impacts to the natural heritage features or their ecological function". This statement is incorrect. General Permitted uses and feature specific policies apply to Significant Natural Areas and Natural Areas alike. Permitted uses may be more permissive in Natural Areas in comparison to Significant Natural Areas,

but not necessarily. If a feature does not meet criteria for protection, development may be permitted. Conversely, if a feature meets criteria for protection, the general permitted use policies and feature-specific policies apply. Please clarify this.

4. The last sentence on page 2.2 states that “The Natural Heritage System also incorporates hazard lands including steep slopes, erosion hazard lands and unstable soils that are under the jurisdiction of the GRCA”. This statement is incorrect. Criteria for designating Significant Valleylands (a Significant Natural Area included in the NHS) includes undeveloped portions of the regulatory floodplain. Hazard lands are not outright included in the NHS. Please correct this.
5. Under 2.2.3 Tree By-law, it is stated that the “Tree By-law was created to prevent damage or destruction to trees”. This statement is incorrect. The Tree By-law ‘regulates’ the destruction or injuring of trees and enables the City of Guelph to require a tree permit prior to the injury/destruction of a regulated tree, and compensation. The Tree By-law helps protect and enhance the tree canopy cover in the City. Please revise accordingly.
6. Under 3.2 Field Investigations on page 3.8, please include bat acoustic surveys as well as bat exit surveys in the list of targeted field surveys.
7. Under 3.2.8.2 Bat Exit Surveys on page 3.14, please include the type of device used for acoustic monitoring. For example, was a hand-held unit used, a song meter or both?
8. Under 3.2.9.1 Diurnal Surveys on page 3.15, it is stated that “fieldwork was conducted at, or within, half an hour of sunrise”. This statement does not match dates and times listed in Table 3.7. Best results are achieved within half an hour of sunrise, especially in noisy urban environments, and especially in forested ecosystems. The first breeding bird survey was completed on June 12, 2018, which is very late for a first visit. Based on timing of field surveys, data should be interpreted accordingly (i.e. lack of record does not indicate absence). Please update the text, as appropriate.
9. Under 3.2.9.2 Crepuscular Surveys on page 3.16, mention of moon phase is not made. Were conditions appropriate for surveying crepuscular birds during site visits completed for bats? Refer to MNRF’s ‘Eastern Whip-poor-will and Common Nighthawk Survey Protocol’ for guidance.
10. Under 4.4.6 Amphibian Survey and Habitat Assessment on page 4.6, it is stated that suitable habitat for amphibian breeding was not present. This seems odd, given that the Torrance Creek PSW is located within the Study Area, which is known to provide woodland amphibian breeding habitat. Snow melt and a high groundwater table result in seasonal ponding within this wetland complex. Please clarify.
11. Under 4.4.14 Incidental Wildlife Observations, the DeKay’s Brownsnake observation from May 16, 2019 should be added to the list of incidental wildlife. This species was observed, along with several Eastern Gartersnake and a Red-bellied Snake during the feature staking exercise, with City staff. Further, please assess the significance of the snake records recorded with respect to

significant wildlife habitat and the potential for snake hibernacula to occur in the vicinity of the subject property.

12. Section 5.0 Significant Natural Heritage Features should be based on the natural heritage and water resources policies of the City of Guelph Official Plan (March 2018 Consolidation), in addition to the policies of the Provincial Policy Statement. Please update this section to address Official Plan policy.
13. Section 5.2 Significant Woodlands includes the following statement: "notwithstanding the criteria denoted in the OP excluding plantations". This statement is incorrect. *Plantations* is a defined term in the Official Plan. Cultural Plantation, per ELC, is not the same thing as *plantation* in the Official Plan. A cultural plantation unit must meet the Official Plan's definition of *plantation* to be excluded from the assessment of significant woodland. Please clarify this.
14. Section 5.2.1 Other Woodlands refers to a deciduous woodland and claims that it was excluded from Significant Woodland due to composition, origin and size. Please provide the analysis to support this. Do the Cultural Woodlands criteria of the Official Plan to this deciduous woodland? This assessment should also be included in a revised EIS.
15. What does the bolded text indicate in Table 5.1? For clarity, please uses bolded text consistently within each Table, and among Tables 5.1 through 5.4. Also, please update Tables 5.1 through 5.4 to accurately assess field data collected against MNRF's Ecoregion 6E Criteria to determine whether or not Candidate or Confirmed SWH is present within the Study Area and/or Subject Property.
16. Section 5.3.5 Locally Significant Species should be updated to include the names of the two locally significant plant species. Also, the list of locally significant bird species should be updated to include Northern Flicker. A total of six locally significant bird species were documented, based on field records.
17. Section 5.4.1 Butternut should be updated to indicate that an 'authorization' under the *Endangered Species Act* is sought. The EIS should be updated with information from the MECP and Natural Resource Solutions Inc. to reflect the current status of Butternut, ESA requirements and compensation plantings. Correspondence and supporting documentation should be included as an Appendix.
18. Section 5.4.3 Bat SAR, please provide a map showing the extent of bat species at risk habitat (roosting habitat, foraging habitat). Please also provide correspondence with MECP confirming support of the proposed approach.
19. Section 5.5 Significant Natural Heritage Features Summary, on page 5.8, please update the bullet list to include bat species at risk, and to note that honey locust is a planted specimen. Also, the statement "unable to confirm presence/absence" is incorrect. The field surveys were designed to enable an assessment of SWH. For example, breeding bird survey results in fact confirm the woodland as Woodland Area Sensitive Breeding Bird Habitat. Based on results of field surveys, it may or may not be possible to confirm SWH. Unconfirmed SWH would remain Candidate SWH in areas meeting the criteria of the schedules for 6E. Please clarify this in the text.
20. Section 5.5 Significant Natural Heritage Features Summary, on page 5.9, includes other woodlands (WODM4-4). Based on the ELC figure, the WODM4-4

vegetation community appears to be contiguous with an FOCM5 vegetation community. As per comment 14 above, please assess this woodland against the Official Plan’s criteria for Cultural Woodland and update the text on page 5.9 accordingly.

21. Section 6.1 Stormwater Management should reference stormwater targets prescribed in the Torrance Creek Subwatershed Study for infiltration rates. A portion of the site is located in Catchment 102, where the following targets apply:

    - infiltrate to enhance baseflow in Torrance Creek: 150mm/yr to 200mm/year or match pre- to post-
    - pre- to post- peak flow control for all design events (2 to 100-year events)
    - 24-hour extended detention for 25mm rainfall event
    - minimum 80% TSS removal

    Similarly, the Stormwater targets prescribed in the Hanlon Creek Subwatershed Study should be referenced in this section, as a portion of the site is located within the Hanlon Creek Subwatershed. The proposed stormwater outlet drains to Tributary D, where the following targets apply:

    - match pre- to post- peak flows for all storm events
    - implement infiltration best practice to the great extent feasible

22. The Functional Servicing Report (FSR)and Engineering Plans indicate that parking lot water as well as rooftop water will be directed to the infiltration trench. Further, stormwater management does not appear to be provided for a portion of the site, including drainage from the extension of Edinburgh Road. Lastly, sufficient capacity to accommodate flows from the proposed development is not available in the receiving stormwater management pond. Section 6.1 should be updated to provide an accurate and detailed description of the proposed stormwater management system so that all potential impacts can be identified in Section 7.0.

23. The first paragraph on page 6.2 states that “the total flow to Gordon Street (inclusive of rooftop-controlled flow) meets the predevelopment target rates”. Please provide supporting documentation or provide reference to specific values and/or sections of the FSR.

24. On page 6.2, a description of the infiltration trench is provided. Based on this description, it is unclear how groundwater levels factored into the design of the facility. For example, has 1m separation distance from the high-water level mark been factored in?

25. Section 6.1.2 Trail, references the Guelph Trail Master Plan and a proposed connection through the subject property. A recommendation is provided that the trail be completed as part of a broader trail design approach, to be completed by the City at a future date. This recommendation conflicts with the requirements set out in the Terms of Reference, which included an assessment of the trail route, recommendation for trail alignment consistent with Official Plan policy (i.e., consistent with permitted uses within the natural heritage system, demonstration of no negative impact, etc.) and identification of best management practices to provide the basis for basic trail design, which is to be

completed as part of the Environmental Implementation Report (refer to pages 18 and 20 of the approved TOR). The Active Transportation Network Study maps the portion of trail through the subject property as a desired Active Transportation route (i.e. for cycling). The feasibility of accommodating an Active Transportation route through the subject project is to be assessed based on Official Plan policy in the EIS. Lastly, a trail connection from the Park Block to the trail network is desired and should be assessed and evaluated through the EIS to inform the design.

26. Section 7.0 Potential Impacts of Development and Mitigation Recommendations, reference is made to “net environmental impact assessment”. This is not appropriate as the policy test is “no negative impact”. Please revise this statement and confirm that the analysis provided is based on the “no negative impact” test.
27. Section 7.1 Impacts on Significant Natural Features, given that two 12 storey buildings are proposed, the EIS should evaluate the potential for bird strike impacts, and inform the design, as appropriate. Lighting impacts may also result from the proposal; the EIS should make recommendations for lighting adjacent to the natural heritage system based on best management practices. Lastly, grading impacts should be assessed in the EIS. An analysis of the grading plan should be provided in the context of permitted uses within the natural heritage system. Please update section 7.1 accordingly.
28. In Section 7.1.1 Significant Wetlands, it is stated that “incidental runoff impacts associated with sediments, dust, as well as nutrient loads will be reduced by the natural polishing function of the vegetative zone between the feature ad development”. It is unclear what this statement means. The Stormwater system is designed to infiltrate the 25mm storm event via an infiltration trench. Surplus runoff will fill a storage tank and then outlet to the storm sewer on Gordon Street, which outlets to a stormwater pond, which discharges to the Hanlon Creek PSW. Further, the last sentence of the first paragraph in this section states that “all surface runoff from the proposed development is directed to the existing storm sewer on Gordon Street”. This statement is not consistent with section 6.1 of the EIS or the FSR. Please clarify.
29. Also in Section 7.1.1 Significant Wetlands, please demonstrate that infiltration rates and volumes have been matched, pre- to post- in the Torrance Creek and Hanlon Creek Subwatersheds. This section notes that infiltration will “match and likely notably exceed pre-development infiltration volumes” in the catchment that directs flows to Torrance Creek. Torrance PSW has both a recharge and discharge function, depending on the time of year. During periods of an elevated water table and an upward hydraulic gradient, are impacts associated with the infiltration trench anticipated? For example, if infiltration cannot occur due to a high-water table, surplus will fill the storage tank and discharge to Hanlon PSW, likely resulting in a negative impact to both PSWs. Please include an in-depth analysis of stormwater impacts on the natural heritage system’s features and functions.
30. On page 7.2, discussion is provided on the predicted impacts associated with reduced infiltration to the Hanlon Creek Subwatershed, with a conclusion of no negative impact drawn. Please provide the supporting analysis to support this

claim. For example, what is the difference in pre- to post- infiltration volumes and rates? If infiltration is reduced, is the potential for baseflow impacts in Hanlon Creek? If infiltration is reduced, will more runoff be directed to Hanlon PSW? In addition, the FSR indicates that this runoff would be directed to the storm sewer on Gordon. The EIS fails to address Stormwater impacts associated with unattenuated/untreated runoff from the catchment containing the extension of Valley Road/Edinburgh.

31. The Torrance Creek PSW has a recharge and discharge function. What impact does the proposed stormwater management system have on the recharge/discharge function of the wetland? Please update the EIS to include a comparison of pre- to post- monthly differences in vertical hydraulic gradients, infiltration, runoff, etc. Note that this is required to demonstrate no negative impact the PSW.

32. Section 7.1.5 Significant Habitat of Endangered and Threatened Species, please provide documentation of correspondence with MECP confirming the proposed mitigation measures for bat species at risk are acceptable. Please also update the Butternut paragraph to include details from NRSI, as requested above.

33. Section 7.1.6 Locally Significant Species, please clarify where the Yellow-billed Cuckoo was heard. The text appears to indicate that the Yellow-billed Cuckoo was heard singing from the development area of the site. Please provide an assessment based on the Official Plan’s policy on Habitat for Significant Species to establish whether or not this Natura Area designation applies.

34. In section 7.3.1.3 Wildlife Friendly Building Design, please note that the EIR should include more detailed guidance on bird-friendly building design to inform detailed design.

35. Environmental planning staff are supportive of the timing recommendations made for the removal of debris and woodchip piles to protect snakes. Consider including a recommendation to incorporate snake hibernacula and/or gestation site habitat structures in the buffer portion of the natural heritage system. The Environmental Implementation Report would then provide further information on location, design, etc. to assist with detailed design and implementation.

36. In section 7.3.4 on page 7.8, please update the paragraph on Butternut to reflect the outcome of the Butternut Health Assessment and authorization. NRSI should be contacted for this information.

37. The details included in the post-construction monitoring program are acceptable for the EIS; however, please note that a requirement of the forthcoming EIR will be to provide a detailed post-construction monitoring plan. Similarly, additional detail on vegetation plantings will also need to be provided in the EIR. Please update the EIS to include a summary section on EIR requirements and a proposed outline for the future report. Please note that this was included within the approved Terms of Reference.

38. The following major topics were omitted from the EIS and should be assessed in detail in a revised EIS as part of the next submission:

    - assessment of bat species at risk habitat and supporting documentation from MECP;
    - Butternut assessment details and supporting documentation from MECP;

  - assessment of Habitat for Significant Species;
  - assessment of Cultural Woodland;
  - assessment of the need for Established Buffers;
  - assessment of grading impacts;
  - assessment of wetland water balance, based on assessment of monthly differences, pre- to post-development, for lands draining to the Torrance PSW and Hanlon PSW, to determine whether or not ecological and/or hydrologic impacts resulting from the proposed development are anticipated; and
  - recommended scope for EIR.

39. Section 9.0 Policy Compliance should focus on the consistency of the proposal with the “no negative impact test”. As written, the focus appears to be on establishing feature-based constraints to development. This is not consistent with the PPS, and the natural heritage system’s approach to protecting, enhancing and restoring natural heritage in Ontario.

40. Section 10.1 Report Summary, please update the bullet on SWH to indicate Candidate vs Confirmed. Further, the bullet on the proposed stormwater management plan indicates that parking lot runoff will be infiltrated. This detail was not included in the description of the stormwater management system presented earlier in the EIS. Please ensure that all statements are consistent and coordinated with the engineering plans prepared for the proposed development. Please note that infiltration of parking lot water is not supported by the City. Lastly, the report summary should include changes to wetland hydrology and ecology, and removal of accessory habitat to list of potential impacts associated with the proposed development.

41. Please update section 10.2 Recommendations to include the erection of Tree Protection Fencing prior to the commencement of site alteration/construction.

42. Please update mapping provided in Appendix A to include the following:

  - established wetland buffer;
  - Ecological Land Classification vegetation community information for polygon adjacent to FOD5-6;
  - extent and type of Significant Wildlife Habitat features;
  - limit of the Natural Heritage System; and
  - Cultural Woodland and/or Habitat for Significant Species, as appropriate, based on the criteria-based assessment requested above.

Hydrogeological Assessment

43. In section 4.2.4.1, pre-treatment for TSS is suggested to eliminate a number of sediment-bound metals in the discharge effluent. City staff agree that the proposed pre-treatment approach would likely reduce these concentrations; however, please note that samples would still be required to be collected to confirm this assumption, prior to the discharge being authorized to City sewers.

44. Please update section 4.2.4.1 to clarify whether or not VOCs were sampled to confirm presence/absence. The City’s Sewer Use By-law prohibits discharge of VOC-impacted. Please note that VOC sampling may be required under a future discharge agreement with the City’s Wastewater Division.

45. The post-development water balance provided in section 5.3 does not appear to account for the lands fronting on Valley Road (0.27ha catchment shown on Figure 15). Please explain why this area was excluded from water balance calculations, or update the water balance to include this catchment. Further, the size of the catchment draining to Torrance provided in the water balance assessment is 1.73ha, which does not match the catchment area of 1.44 ha in the hydrologic model. Please update the calculations ensuring that consistent catchment areas are applied.

46. The EIS should refer to Section 6.0 Groundwater Dewatering Assessment and include recommendations for monitoring and best practice. This could be included as an item for the future EIR.

47. Section 6.1 – It appears that a safety factor was not considered in the calculations of dewatering volume estimation, nor was any basal seepage considered. Although the site typically has observed downward gradients, the hydrological assessment indicates that upward gradients are present. Please add a factor of safety to the calculations and account for basal seepage, or provide text to explain why these elements were not considered in the calculations.

48. An infiltration (rock) trench is proposed to address the infiltration deficit. The infiltration (rock) trench is located within the Torrance Creek Subwatershed. Please include an analysis of the post-development water balance per watershed. For example, with LID measures in place, the water balance should demonstrate that the infiltration rate/volume should roughly match pre- to post- rates/volumes within each Subwatershed (i.e. Torrance and Hanlon). A stormwater management design and supporting analysis demonstrate no negative impact to the receiving natural heritage system is required. This is typically achieved by demonstrating that the proposed development and stormwater management system matches pre- to post- monthly infiltration rates/volumes and monthly runoff rates/volumes. Hydrographs depicting monthly differences in runoff volumes and infiltration volumes are helpful in demonstrating consistency with the natural heritage system “no negative impact” policy test.

49. In Section 7.2 construction proximity to the nearby municipal well is accounted for; however, there is no discussion provided as to private residential wells in the area. During the filing of an application for PTTW or registration under the EASR, it is recommended that the proponent assess potential impacts to private residential wells.

Tree Preservation Plan

50. Please update the Tree Preservation Plan to include recommendations for the EIR and detailed design.

51. Environmental planning is generally supportive of using a polygon approach in certain situations; however, based on data provided in Appendix 1 Tree Inventory Data, it is unclear how the stem count column relates to the Polygon. For example, 1 stem is reported from each of Polygons A, B, C, E and F. Given the brief description provided on page 4 of the plan: “If trees were present in monoculture hedgerow features, a polygon method was used”. Based on this description, >1 stem per polygon would be expected. Please clarify.

52. Please update Map 2 of the Tree Inventory and Preservation Plan to show Tree Protection Fencing around the perimeter of the natural heritage system.

Functional Servicing Report

53. Please update section 5.1.2 Torrance Creek Subwatershed Study to accurately reflect recommended infiltration rates, which in the case of the proposed development is between 150mm/yr to 200 mm/yr.

54. The FSR indicates that the area outletting to Gordon Street (Hanlon Creek Subwatershed) will increase, post-development. The infiltration trench is proposed in the Torrance Creek Subwatershed, which means the majority of stormwater originating from the Hanlon Creek catching will be generated as runoff. Please clarify that the receiving stormwater pond has capacity to control the runoff volumes generated by the proposed development. Please note that surcharge of this facility is directed to the Hanlon PSW. Runoff volumes should match pre- to post- per the Hanlon Creek Subwatershed recommendations.

55. The description of Catchment 202 provided at the bottom of 5.6 indicates that roof-top water will be directed the storm sewer on Gordon Street, with the 25mm event being directed to the infiltration trench. Please clarify that up to and including the 25mm is intended to be directed to the infiltration trench. Events in excess of 25mm or when back to back events occur prior to draw-down would be directed to the storage tank, eventually draining to the storm sewer when capacity is reached. Environmental planning strongly encourages infiltration of ‘clean’ water to maintain infiltration and baseflow in Hanlon Creek to the greatest extent feasible. Please consider this comment when updating the FSR.

56. The EIS should include an analysis of the findings presented on page 5.8 which relate to pre- to post- differences in runoff and infiltration being directed to the Torrance and Hanlon Subwatersheds under the post-development scenario. Based on the analysis provided in the FSR, the EIS should provide an assessment as to whether or not impacts to the ecology or hydrology of the wetlands are anticipated.

57. How would the infiltration trench function in the event of back-to-back storms? Please clarify whether or not a safety factor was incorporated into the sizing and design of the infiltration trench.

58. In section 5.6 On-site Infiltration, on page 5.9, it is stated that “The infiltration gallery should only be intercepted by groundwater in spring-time”. How was this detail factored into the water balance? The EIS should provide an analysis of potential impacts arising from the proposed stormwater design. For example, if groundwater intercepts the infiltration trench during the spring, infiltration will not occur which would result in more runoff being directed to Hanlon Subwatershed. This is unacceptable and should be addressed in the next submission.

59. Please note that in situ permeameter testing is required to demonstrate that the proposed infiltration trench will function as anticipated. Please provide this information in the next submission.

60. Drawing SSP-2 Storm Drainage Area Plan – It is unclear how the Area IDs relate to the Catchments described in the FSR and Hydrological Investigation report's water balance calculations. Please ensure that this is clarified and coordinated among studies and drawings in the next submission.
61. Drawing GP-1 Grading Plan indicates that extensive grading is required adjacent to the natural heritage system. Please provide additional detail on grading requirements (e.g. spot elevations) to enable a proper assessment of consistency with Official Plan policy. Please note that a cross-section can be helpful in demonstrating how the required grading relates to the protection of the natural heritage system. At a minimum, please update GP-1 to show differences in grade adjacent to the natural heritage system, and slope, particularly at the southeast end of the site.
62. It is unclear how the proposed erosion and sediment control plan has been coordinated with the proposed grading plan. For example, tree protection fencing and silt fencing is proposed in an area identified for extensive grading on GP-1. Please clarify.

Landscape Concept

63. The Landscape Concept proposes the planting of coniferous and deciduous trees on top of the infiltration facility. Guelph's Engineering Development Manual specifies a minimum 1m offset of plant material from infiltration galleries. Please relocate the proposed trees outside of the infiltration gallery area.

Summary

A revised EIS is required to address the comments provided above. Revisions to the supporting studies, including the Tree Preservation Plan, Hydrological Assessment, Functional Servicing Report and Landscape Plan are required. Environmental planning encourages the applicant to meet with City staff to discuss the comments provided, prior to providing a second submission. Substantial work remains outstanding to adequately demonstrate no negative impact to the natural heritage system's ecological and hydrologic features and functions.

Please note that comments provided by Scott Cousins, City of Guelph Hydrologist, are incorporated into the comments provided under the Hydrogeological Assessment heading above.

Leah Lefler, Environmental Planner
Planning and Building Services, **Infrastructure, Development and Enterprise**
Location: City Hall
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leah.lefler@guelph.ca

Copy: Mohsin Talpur, Jyoti Pathak, Scott Cousins

APPENDIX F
FIELD NOTES

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

EAKJ - new planted area

Stantec

Legend

⬚	Study Area (120 m)
🟥	Subject Property
🟨	ELC Boundary
━	Approximate Wetland Boundary (Stantec 2019)
─	Watercourse (Permanent)
━	**Woodland Boundary**

ELC Communities

- CUM1- Mineral Cultural Meadow Ecosite
- CUP3-3- Scotch Pine Coniferous Plantation Type
- CUP3- Coniferous Plantation
- CUW- Cultural Woodland
- CVC-1- Business Sector
- CVI-1- Transportation
- CVI-3- Sewage and Water Treatment
- CVR-1- Low Density Residential
- CVR-2- High Density Residential
- CVR-3- Single Family Residential
- FOC2-2- Dry White Cedar Coniferous Forest Type
- FOCM5- Naturalized Coniferous Hedge-row Ecosite
- FOD5-6- Dry – Fresh Sugar Maple – Basswood Deciduous Forest Type
- HR- Hedge-row
- MAM2-2- Reed-canary Grass Graminoid Mineral Meadow Marsh Type
- MAS2-1- Cattail Mineral Shallow Marsh Type
- SWM3-2- Poplar-Conifer Deciduous Mixed Swamp
- WODM4-4- Dry- Fresh Black Walnut Deciduous Woodland Type

0 25 50 Metres

1:2,200 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery © First Base Solutions, 2020. Imagery flown in 2019.

Project Location
City of Guelph

161413684
Prepared by DH on 2020-05-11

Client/Project
TRICAR
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD

Figure No.
3

Title
Vegetation Communities

ELC **COMMUNITY DESCRIPTION & CLASSIFICATION**	**SITE** (project no./name): 1614136-84		**POLYGON:** C
	SURVEYOR(S): M STRAUS	**DATE:** June 2/21	**PHOTO No.:**
	START: 715	**END:** 800	**ZONE & UTM:**

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☒ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☒ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☒ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☒ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☒ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☒ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☒ OPEN ☒ SHRUB ☐ TREED		

STAND DESCRIPTION: ↙ only on new property doesnt includ Prev assess

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>>MUCH GREATER THAN; >GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	POPLAR < JUGNIGR >> ACENEGU
2	SUB-CANOPY	3	2	JUGNIGR
3	UNDERSTOREY	4	2	POPLAR
4	GRD. LAYER	5		grasses > forbs (agrostis > BROINER) > goldenrod

HT CODES: 1=>25m 2=10<HT≤25m 3=2<HT≤10m 4=1<HT≤2m 5=0.5<HT≤1m 6=0.2<HT≤0.5m 7=HT<0.2m

CVR CODES: 0=NONE 1=0%<CVR≤10% 2=10<CVR≤25% 3=25<CVR≤60% 4=CVR>60%

STAND COMPOSITION:								**BA:**
SIZE CLASS ANALYSIS:	O	<10	R	10 – 24	R	25 – 50	N	>50
STANDING SNAGS:	N	<10	N	10 – 24	N	25 – 50	N	>50
DEADFALL/LOGS:	N	<10	N	10 – 24	N	25 – 50	N	>50

ABUNDANCE CODES: N=NONE R=RARE O=OCCASIONAL A=ABUNDANT

COMM. AGE:	X	PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	**DEPTH TO MOTTLES/GLEY**	**g=**	**G=**
MOISTURE:	**DEPTH OF ORGANICS:**		**(cm)**
HOMOGENEOUS / VARIABLE	**DEPTH TO BEDROCK:**		**(cm)**

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:		**CODE:**
COMMUNITY SERIES:		**CODE:**
ECOSITE:		**CODE:**
VEGETATION TYPE:		**CODE:** CUM/[illegible]
☐ **INCLUSION**		**CODE:**
☐ **COMPLEX**		**CODE:**

Notes: (e.g. disturbance, surface water depths, etc.)

- Same as ELC'ed - plant list supplemental ū new access

Plant dumping

LAYERS: **1**=CANOPY>10m **2**=SUB-CANOPY **3**=UNDERSTOREY **4**=GROUND (GRD.) LAYER

ABUNDANCE CODES: **N**=NONE **R**=RARE **O**=OCCASIONAL **A**=ABUNDANT **D**=DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.
POPALB			R		
PICGLAU			R		
FRAAMER			R		
POPGRAN	R	R	O		
JUGNIGR					
Rdiscolor		R	R		
PINSYLV		R	R		
Norway Mpl			R		
ACENEGU	R				
RHACATH					
VIBOPUL					

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.
VICCIA ~~sp.~~ CRAC				O	
Fleabane sp.				O	
goldenrod sp.				A	
PACGLAU				A	
AGROSTIS				A	
BROINER				A	
VITRIPA				O	
DAUCARO				O	
yellow hawkweed				R	
oxeye daisy				R	
Virg. Creeper					

Page 1 of 1

Print Name: M STRAUS
(Field Notes Author)

Quality Control: This form is complete ☐ & legible ☐

Signature:
(Field Notes QA/QC personnel)

V:\01609\resource\Internal Info and Teams\FIELD FORMS\Vegetation\ELC\elc-wildlife-habitat-form-update_rev-02.docx / (DERIVED FROM LEE ET AL., 1998)

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Wildlife Habitat Assessment Form

Project Number: 61413684 Polygon No.: C

Assessment Type: ☐-Visual; no access/☒-Entire; walk through feature/☐-Partial access *(indicate on map)*

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (last 24 hrs):
	7	0	0	0	0

NOTES & SPECIES OBSERVATIONS (list species and type of observation, indicate on map):

→skunk

→cottontail

CA=carcass; DP=distinct ve parts; FE=feeding evidence; FY=eggs/nest; HO=house/den; OB=observed; SC=scat; SI=other sign; TK=track, VO=vocalization

Wildlife Habitat Type & Description	Site Assessment		Photo ID	Map ID	UTM Coordinates Zone	Easting	Northing
ALL SITES							
Bat Hibernacula: Caves, abandoned mines, underground foundations, karst features	Size of opening(s) Bedrock Type Depth of feature (if possible)						
Snake Hibernacula: Burrows, rock crevices, fissures that extend below the frost line (i.e. at least 1 m)	Number of access points Size of opening(s) Substrate	→1 rock pile not below frost- on top of ground →no access to bld.					
Bank / Cliff Colonial Bird Nesting Habitat: Exposed soil banks, undisturbed, naturally eroding, steep slopes, cliff faces with evidence of nests or burrows	Size of burrow Number of burrows						
Stick Nests: Stick nests found in any forest/ woodland/swamp; includes heron colonies and bald eagle/ osprey/other raptor nests	Tree species Nest size						
WOODLANDS							
Vernal Pools: Permanent or semi-permanent pool or pond. Evidence of holding water in most years through late spring (i.e. late May) or into summer	Number of features Feature size (diameter) Water depth						
Seeps and Springs: Locations where groundwater comes to the surface in forests (see document for indicator species)	Sub/emergent veg present Shrubs/logs at edge present Water permanency						
WETLANDS							
Turtle Wintering Areas: Permanent water bodies, large wetlands, bogs, or fens with soft substrates and deep enough not to freeze solid	Feature size (diameter) Water depth Substrate of water body Water permanency						
Turtle Nesting Habitat: Exposed mineral soil (sand or gravel) areas adjacent (<100 m) to MAM/SA/BOO/ FEO (note if man-made)	Type of substrate Distance to wetland Size of feature						
Terrestrial Crayfish Habitat: Edges of shallow marshes and meadows (no minimum size) with crayfish chimneys	Number of chimneys						

BATS

→2 trees >10cm assessed for bats

- ACENEGU has a hole from branch but has grown over

No roost trees

→Building - has vents + flight not in place could allow bats in.

Page 2 of 2

Print Name: H STRAUS
(Field Notes Author)

Quality Control: This form is complete ☐ & legible ☐

Signature:
(Field Notes QA/QC personnel

REV: 2014-04-17

Stantec **Stantec Consulting Ltd.**
1 - 70 Southgate Drive, Guelph ON N1G 4P5

Bat Hibernacula Exit Survey

Project Number: 161413684

Project Name: 1250 Gordon

Date: June 10, 21

Field Personnel: MSTRAUS

Weather Conditions:

TEMP (°C)	WIND	CLOUD	PPT (current)	PPT (last 24 hrs)
21	15Km/hr E	0	0	0

Feature ID: Monty's Place (indicate on map)

Start/End times (24 hr): Start 21:00 End 22:30

Tree No.: NE Corner

UTM Coordinates: Zone ___ Easting ___ Northing ___ NE Corner of house

Equipment ID # used: → Sm4-N

Bats Observed Exiting Hibernacula

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes

Flyovers

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes
?	21:45	?	?	?	heard in opening where bird used to be. Didn't see. Sounded bat-like.
?	22:05	?	?	?	Same as above. insects? bats?

* Northside Centre: Sm4-0

*

PAGE 1 OF 1

Print Name & Initial: MSTRAUS (field notes author)

Quality Control: This form is complete ☐ & legible ☐

Print Name & Initial: ___ (field notes QA/QC personnel)

Stantec **Stantec Consulting Ltd.**
1 - 70 Southgate Drive, Guelph ON N1G 4P5

Bat Hibernacula Exit Survey

Project Number: 161413684

Project Name: Montes Place - Exitsurvey - 1250 Gordon St.

Date: June 10/21

Field Personnel: N. Burnett

Weather Conditions: 21°C (TEMP (°C)) | 15 Km/hr E (WIND) | 0% (CLOUD) | None (PPT (current)) | None. (PPT (last 24 hrs))

Feature ID: Southeast and front of building. (indicate on map)

Start/End times (24 hr): 21:00 (Start) 22:30 (End)

~~Tree No.~~: Montes Place - House - 1250 Gordon St.

UTM Coordinates: Zone — Easting — Northing —

Equipment ID # used: SM4-5 - w̄ Nathan, SM4-1 - on front porch.

Bats Observed Exiting Hibernacula

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes
0					

Flyovers

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes
SM4-5 unit possibly					
picking up					
activity around	9:55-9:59pm				

PAGE 1 OF 1

Print Name & Initial: N. Burnett
(field notes author)

Quality Control: This form is complete ☐ & legible ☐

Print Name & Initial:
(field notes QA/QC personnel)

Stantec

Legend

- Study Area (120 m)
- Subject Property
- ELC Boundary
- Approximate Wetland Boundary (Stantec 2019)
- Watercourse (Permanent)
- **Woodland Boundary**

ELC Communities

- CUM1- Mineral Cultural Meadow Ecosite
- CUP3-3- Scotch Pine Coniferous Plantation Type
- CUP3- Coniferous Plantation
- CUW- Cultural Woodland
- CVC-1- Business Sector
- CVI-1- Transportation
- CVI-3- Sewage and Water Treatment
- CVR-1- Low Density Residential
- CVR-2- High Density Residential
- CVR-3- Single Family Residential
- FOC2-2- Dry White Cedar Coniferous Forest Type
- FOCM5- Naturalized Coniferous Hedge-row Ecosite
- FOD5-6- Dry – Fresh Sugar Maple – Basswood Deciduous Forest Type
- HR- Hedge-row
- MAM2-2- Reed-canary Grass Graminoid Mineral Meadow Marsh Type
- MAS2-1- Cattail Mineral Shallow Marsh Type
- SWM3-2- Poplar-Conifer Deciduous Mixed Swamp
- WODM4-4- Dry- Fresh Black Walnut Deciduous Woodland Type

0 25 50 Metres

1:2,200 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery © First Base Solutions, 2020. Imagery flown in 2019.

Project Location
City of Guelph

161413684
Prepared by DH on 2020-05-11

Client/Project
TRICAR
1242, 1250, 1260 GORDON ST AND 9 VALLEY RD

Figure No.
3

Title
Vegetation Communities

EAKJ - new planted area

Stantec

Breeding Bird Survey Observation Form

Project Number: 1614i3684
Date: June 2/ 21

Project Name: 1250 Golden
Field Personnel: MShami

Weather Conditions:

7°	0	0	0	0
TEMP (°C)	WIND	CLOUD	PPT (current)	PPT (last 24 hrs)

sunrise @ 5.42

Habitat No.	ELC Code(s) or Habitat Descriptions	TIME (HH:mm) Start	TIME (HH:mm) End
A	Former residence area	550	800
B	[illegible]	550	800
C	"New" Property (Marty's Place	550	800
D	meadow	545	730
E	Woodlot	555	630
F	CUP	555	630

→ Transects completed by 630AM but remained on site until 8

Breeding Evidence (BE) Codes (Breeding Bird Atlas of Ontario - http://www.birdsontario.org/atlas/codes.jsp?lang=en)

OBSERVED

X Species observed in its breeding season (no breeding evidence)

POSSIBLE

H Species observed in its breeding season in suitable nesting habitat

S Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season

PROBABLE

M At least 7 individuals singing or producing other sounds associated with breeding (e.g., calls or drumming), heard during the same visit to a single square and in suitable nesting habitat during the species' breeding season

P Pair observed in suitable nesting habitat in nesting season

T Permanent territory presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season. Use discretion when using this code

D Courtship or display, including interaction between a male and a female or two males, including courtship feeding or copulation

V Visiting probable nest site

A Agitated behaviour or anxiety calls of an adult

B Brood Patch on adult female or cloacal protuberance on adult male

N Nest-building or excavation of nest hole, except by a wren or a woodpecker

CONFIRMED

NB Nest-building or excavation of nest hole by a species other than a wren or a woodpecker

DD Distraction display or injury feigning

NU Used nest or egg shells found (occupied or laid during the survey)

FY Recently fledged young (nidicolous species) or downy young (nidifugous species), including incapable of sustained flight

AE Adult leaving or entering nest sites in circumstances indicating occupied nest

FS Adult carrying fecal sac

CF Adult carrying food for young

NE Nest containing eggs

NY Nest with young seen or heard

PAGE 1 OF 2

Print Name & Initial: MSHAMS MS
(field notes author)

Quality Control: This form is complete ☐ & legible ☐

Print Name & Initial:
(field notes QA/QC personnel)

CONTINUED SITE: 1360 Aberdon DATE: June 2/21 Breeding Bird Survey
Observation Form

Record location of all significant species on site map

Species	Habitats	BE*	Species	Habitats	BE*	Species	Habitats	BE*
Can. Goose	A	FLY	Red-bellied Wo.			**Gold-wing. Wa** † Ω**		
Wood Du. Ω			**Yell-bellied Sap. ‡ Ω**			Nashville Wa.		
Am. Black Duck Ω			Downy Wo.			Yellow Wa.		
Mallard Ω			Hairy Wo.			Chestnut-s. Wa.		
R. N. Pheasant			**No. Flicker †**	E2	S	**Magnolia Wa. ‡**		
Ruffed Grouse ‡			**Pileated Wo. ‡ Ω**			**Bl-thr Blue Wa. ‡ Ω**		
W. Turkey			**Ea. Wood-Pewee ** †**			**Yel-rumped Wa. ‡**		
Co. Loon ‡ Ω			Alder Fly.			**Bl-thr Gr. Wa. ‡ Ω**		
Pied-b. Grebe Ω			**Willow Fly. † Ω**			**Blackburnian Wa. ‡ Ω**		
D. C. Cormorant ‡			Least Fly.			**Pine Wa. ‡**		
Am. Bittern Ω			Ea. Phoebe			**Cerulean Wa** †‡ Ω**		
Least Bittern ‡**			Gr. Crested Fly.			**Bl-and-wh Wa. ‡**		
Gr. B. Heron Ω			**Ea. Kingbird †**	D - called 10x4 ft	S	**Am. Redstart ‡**		
Gr. Egret Ω			**Yellow-thr. Vireo ‡**			**Ovenbird ‡ Ω**		
Green Heron Ω			**Blue-headed Vireo ‡ Ω**			**No. Waterthrush ‡**		
T. Vulture			Warbling Vireo			**Mourning Wa. ‡**		
Osprey Ω			Red-eyed Vireo	E, A, D	S	Co. Yellowthroat		
N. Harrier †‡ Ω			Blue Jay	D	S	**Hooded Wa†‡****		
Sharp-sh. Hawk ‡ Ω			Am. Crow	B, F	FLY	**Canada Wa. †‡** Ω**		
Coopers Hawk ‡ Ω			Co. Raven			**Scarlet Tanager ‡ Ω**		
Red-shou. Hawk †‡ Ω			Horned Lark			**Eastern Towhee † Ω**		
Red-tailed Hawk			Purple Mart.			Chipping Sp.	C→A, F	P
Am. Kestrel †			Tree Swallow			**Clay-colored Sp. Ω**		
Virginia Rail Ω			**No. R. W. Swal. Ω**			**Field Sp. † Ω**		
Sora Ω			**Bank Swallow †** Ω**			**Vesper Sp. † Ω**		
Killdeer			**Cliff Swallow Ω**			**Savannah Sp. † Ω**		
Spot. Sandpiper			**Barn Swallow****			**Grasshopper Sp. †** Ω**		
Upla. Sandpiper ‡ Ω			Bl-capped Chickadee	A	S	Song Sp.	C	S
Wilson's Snipe			Tufted Titmouse			Swamp Sp.		
Am. Woodcock			**Red-br. Nuthatch Ω**			**Wh-throated Sp. ‡**		
Ring-b. Gull			Wh-br. Nuthatch	E2	S	No. Cardinal	C	S
Herring Gull			**Br. Creeper ‡**			**Rose-br. Grosbeak †**		
Caspian Tern			Carolina Wren.			Indigo Bunt.		
Black Tern ‡ Ω**			House Wren	A, D	S	**Bobolink †****		
Common Tern			**Winter Wren ‡ Ω**			Red-winged Bl.	B, 2,	H, Stage left
Rock Dove			**Sedge Wren Ω**			**Ea. Meadowlark †****		
Mourn. Dove	A	S	**Marsh Wren Ω**			Co. Grackle		
Yellow-b Cuckoo			**Golded-cr. Kinglet ‡**			Br-headed Cow.	A	S
Black-b Cuckoo † Ω			**B. G. Gnatcatcher ‡**			Orchard Oriole		
Ea. Screech Owl			Ea. Bluebird			**Baltimore Oriole †**	D	S
Gr. Horned Owl			**Veery Ω**			Purple Finch		
Barred Owl ‡ Ω			**Hermit Thrush ‡**			House Finch		
Long-eared Owl			**Wood Thrush †****			Pine Siskin		
No. Saw-whet Owl			Am. Robin	A	A	Am. Goldfinch	A	S
Co. Nighthawk**			Gray Catbird			House Sparrow		
Whip-poor-will †‡**			No. Mockingbird			Other Species ...		
Chimney Swift †**			**Br. Thrasher † Ω**			NOWA	E2	S
Yellow-b Cuckoo			European Starling	A	FY	C[illegible] faint		
Black-b Cuckoo † Ω			Cedar Waxwing	D	H			
Ea. Screech Owl			**Blue-wing. Wa. †**					

* Record highest Breeding Evidence (BE) observed over all habitat. Use codes as in Breeding Bird Atlas of Ontario (see opposite side of this page).
** Endangered, Threatened or Special Concern
† Partners In Flight
‡ Area Sensitive Species
Ω Significant Wildlife Habitat Indicator

PAGE 2 OF 2

Print Name & Initial: MS MAVS
(field notes author)

Quality Control: This form is complete ☐ & legible ☐
Print Name & Initial:
(field notes QA/QC personnel)

FORM 031 / REV: 2015-05-28

Stantec
Stantec Consulting Ltd.
1 - 70 Southgate Drive, Guelph ON N1G 4P5

Bat Hibernacula
Exit Survey

Project Number: 16 14 13684
Date: June 28/21
Project Name: 1250 Gordon.
Field Personnel: M Straus

Weather Conditions:

TEMP (°C)	WIND	CLOUD	PPT (current)	PPT (last 24 hrs)
26°	11 km/hr NW	20	0	0

Feature ID: (indicate on map)
Start/End times (24 hr): Start 21:05 End 22:35
Tree No.: House
UTM Coordinates: Zone Easting Northing Monty's Place
Equipment ID # used: ET - K

Bats Observed ~~Exiting Hibernacula~~ Flyover

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes
1	21:30 - 21:45	~~[illegible]~~	~~LABO~~ / EPFU		foraging where house was circling around - visible
1	2145		EPFU		
?	22 → 2234	various recordings - no visual - clearing? Not @ house	LACI, EPFU, LANO		
1	22:34	↳ LANO?			saw in opening + dived to get prey.

Flyovers

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes

---

Feature ID: (indicate on map)
Start/End times (24 hr): Start End
Tree No.:
UTM Coordinates: Zone Easting Northing
Equipment ID # used:

Bats Observed Exiting Hibernacula

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes

Flyovers

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes

---

PAGE 1 OF 1
Print Name & Initial: M Straus (field notes author)

Quality Control: This form is complete ☐ & legible ☐
Print Name & Initial: (field notes QA/QC personnel)

Stantec 1 - 70 Southgate Drive, Guelph ON N1G 4P5

Exit Survey

Project Number: 161413684
Date: June 28, 2021
Project Name: 1250 Gordon St.
Field Personnel: Kim Zupfer

Weather Conditions:

TEMP (°C)	WIND	CLOUD	PPT (current)	PPT (last 24 hrs)
27	1	20%	-	-

Feature ID: Monté's Place (indicate on map)
Start/End times (24 hr): Start 9:06pm End 10:36pm

Tree No.: —
UTM Coordinates: Zone Easting Northing

Equipment ID # used: ET - L

Bats Observed Exiting Hibernacula

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes
NONE OBSERVED					

Flyovers NONE OBSERVED - RECORDED ON ECHO METER

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes
𝍸 1	9:53 - 10:30		LACI		
1	10:06		EPFU		

Feature ID: (indicate on map)
Start/End times (24 hr): Start End

Tree No.:
UTM Coordinates: Zone Easting Northing

Equipment ID # used:

Bats Observed Exiting Hibernacula

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes

Flyovers

No. of Bats Observed	Time Recorded	Frequency Range(s)	Probable Species	Recording File No.	Notes

PAGE 1 OF 1
Print Name & Initial:
(field notes author)

Quality Control: This form is complete ☐ & legible ☐
Print Name & Initial:
(field notes QA/QC personnel)

APPENDIX G
BUTTERNUT DOCUMENTATION

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

September 16, 2020 2347B

Leah Lefler
City of Guelph
Planning and Building Services
Infrastructure, Design and Enterprise
1 Carden St., Guelph N1H 3A1

Dear: Leah Lefler

RE: 1242, 1250, 1260 Gordon Street, Guelph
Butternut Tree Removal Permit

Natural Resource Solutions Inc. (NRSI) was retained by The Tricar Group to prepare a tree permit application for the proposed removal of one Butternut (*Juglans cinerea*) and one Butternut Hybrid, and the proposed harm of one additional Butternut on the subject properties. The location of the butternuts is shown on Map 1. These removal and harm activities will occur in the fall of 2020, outside of the Migratory Bird and Active Bat windows (after September).

NRSI submitted a Butternut Health Assessment Report to the Ministry of Environment, Conservation and Parks (MECP) for these trees on July 12, 2020, and as such, the 30-day review window has passed. It is understood that the City of Guelph requires the landowner obtain a tree permit to remove/harm these butternuts and that a compensation plan must be prepared. Compensation planting and tending activities will follow the requirements of Section 23.7 of Ontario Regulation 242/08 of the Endangered Species Act (ESA 2007). A Notice of Activity has been submitted to MECP.

The following letter provides the details of the proposed compensation measures, including a planting plan that will be carried out on-site.

Tree Compensation

As per field surveys carried out by NRSI, 2 Butternuts and 1 Butternut Hybrid were identified on the subject property, as shown on Map 1. Compensation measures fall into the following categories:

- JUG-001: Category 1 Hybrid Butternut identified by NRSI, proposed for removal – does not require compensation plantings (as per ESA, and as per City of Guelph Private Tree By-law due to poor condition/potential hazard);
- JUG-002: Category 2 Butternut identified by NRSI, proposed for removal – requiring 20 Butternut seedling compensation plantings; and
- JUG-003: Category 2 Butternut identified by NRSI, proposed to be harmed – requiring 10 Butternut seedling compensation plantings.

As such, 30 Butternut seedling plantings are required. The ESA (2007) requires that an equal number of companion plantings also occur near the proposed Butternut seedling plantings to avoid a monoculture.

NRSI is proposing to plant an additional 10 butternut seedlings and 10 companion trees to account for some die-off, for a total of 40 butternut seedlings and 40 companion trees. The location of the proposed butternut seedlings and companion plantings is shown on Map 1. The planting area is located within more open areas within the significant woodland boundary and within the significant woodland buffer.

The Butternut replacement seedlings will be planted in accordance with the following conditions, as stated in Section 23.7 of the ESA:

- at least 3m from other planted Butternut seedlings,
- at least 2m from other trees or shrubs that are likely to be the same height or shorter than the Butternut tree at full growth,
- at least 4m from other trees or shrubs that are likely to be taller than the Butternut tree at full growth,
- at least 5m from the canopy dripline of trees that are greater than 4m in height at the time of planting, and
- at least 100m from a highway consisting of two (2) or more lanes in either direction.

The butternut seedling planting area will accommodate plantings spaced at 3m on-centre. The planting area shown on Map 1 is conceptual and the seedlings will be field-fit within the gaps of the woodland. An additional 15% planting area has been proposed to account for existing vegetation and stoniness of soils.

The companion tree plantings will be located within the gaps of the woodland and up to 5m from the woodland dripline within the buffer. These plantings will be intermixed with the tree violation plantings. Trees will be planted at 2.5m spacing on-centre. An additional 15% planting area has been proposed to account for existing vegetation and stoniness of the soils.

Exact locations of plantings will be determined based predominantly on soil moisture and shade tolerances for the respective species.

Plantings are proposed to be installed in Fall 2020 by NRSI. Herbivory will be a concern on this property, and, as such, smaller planting stock is recommended to allow for the use of 1.2m Tubex Combitube tree tubes.

The proposed species and sizes are listed in Table 1. Exact sizing is subject to change based on availability at the time of planting.

Table 1. Proposed Tree Plantings

Common Name	Scientific Name	Quantity	Size
Butternut	*Juglans cinerea*	40	40-75cm 2 gallon coco fibre
Black Cherry	*Prunus serotina*	10	40-75cm 1 gallon
Sugar Maple	*Acer saccharum*	20	40-60 2x5” plug
Red Oak	*Quercus rubra*	10	40-75cm 1 gallon

All plant material on-site is to:

- Conform to the latest edition of the *Canadian Nursery Trades Association Specifications and Standards, 8th Edition, 2008*.
- Be installed during the appropriate planting season (no later than May 20th or in early October) under ideal conditions to ensure their survival and decrease plant stress.
- Be installed by hand in order to minimize damage to the root zone of existing trees within the planting area.
- Be mulched using coconut mulch/weed mats.
- Be fitted with 1.2m Tubex Combitube tree tubes.

Maintenance and Monitoring

NRSI will tend to (i.e. maintain) each Butternut replacement seedling in accordance with the following conditions, as stated in Section 23.7 of the ESA:

- Tending activities will take place once per week from May 15 to September 20 (i.e. 19 visits) during the first growing season after the Butternut replacement seedlings are planted.
- Tending activities during the first growing season after the Butternut replacement seedlings are planted will include:
  - Maintenance of tree guards/tubes to protect the lower stems from rodents,
  - Vegetation control 60 cm around the base of the trees until the trees are above the herbaceous vegetation, and
  - Watering during drought or low rainfall periods.
- Tending activities will take place during the second growing season after the Butternut replacement seedlings are planted as required, to ensure that:
  - Vegetation is controlled 60 cm around the base of the trees until the trees are above the herbaceous vegetation, and
  - The trees are watered during drought or low rainfall periods. NRSI has assumed 5 site visits between May-September is sufficient to ensure the continued health of seedlings.

Typical monitoring of the companion plantings is recommended for a period of 2 years to ensure the survival of planted stock and the successful establishment of the plantings. It will occur at the one- and two-year mark following the inspection of plantings from the City of Guelph. Monitoring will be conducted by a qualified Certified Arborist from NRSI. It will consist of a visual inspection of the plantings at the end of the year following the installation of stock and any follow-up management will be determined. The City of Guelph requires the survival of at least 30 companion trees at the end of the two-year warranty period. A minimum survival of 30 butternut seedlings must also be met to satisfy the conditions of the ESA. Removal of guards will be done prior to the end of the two-year monitoring period, unless otherwise directed by City staff. A brief memo will be prepared and circulated to the City after the 1-year and 2-year monitoring inspections that summarizes the results of monitoring efforts and provides recommendations for re-plantings, if necessary. If re-plantings are required in Spring 2022, NRSI will meet onsite with City staff to confirm initial acceptance of the plants, as per the Tree Compensation Plan.

Cost

The cost required as a security deposit is $22,549.43. This includes a 5% contingency and HST (13%) as requested by the City of Guelph. A breakdown of costs is found in Table 2 and outlines the costs associated with the required 30 butternut seedling and 30 companion tree plantings.

Table 2. Cost Breakdown for Butternut Tree Compensation Plantings

Item	*Unit Price*	*Quantity*	*Total Cost*
Tree Installation & Tree Protection			
Juglans cinerea 50-75cm 2 gallon coco fibre pot	*$50.00*	*30*	*$1500.00*
Prunus serotina 40-75cm 1 gallon pot	*$25.00*	*10*	*$250.00*
Acer saccharum 40-60cm 2x5" plug	*$10.00*	*10*	*$100.00*
Quercus rubra 40-75cm 1 gallon pot	*$25.00*	*10*	*$250.00*
Coco fibre weed mats	*$3.00*	*60*	*$180.00*
Tree tubes	*$5.00*	*60*	*$300.00*
Wooden stakes	*$5.00*	*75*	*$375.00*
Landscape staples	*$50.00*	*1*	*$50.00*
Labour	-	-	*$3700.00*
Maintenance & Monitoring for 2 years			
Vehicle	*$50.00*	*24*	*$1200.00*
Labour (including reporting)	-	-	*$11100.00*
5% Contingency			*$638.05*
SUBTOTAL			***$19955.25***
HST (13%)			***$2594.18***
TOTAL			***$22549.43***

I trust that the above information is sufficient for addressing the compensation requirements for the proposed removal and harm of butternuts at 1242, 1250, and 1260 Gordon Street. Should you have any questions about this, please do not hesitate to contact the undersigned.

Sincerely,

Natural Resource Solutions Inc.

David Stephenson
Senior Biologist, Certified Arborist

Ken Burrell
Terrestrial Biologist

Laura Hockley

Laura Hockley
GIS Specialist/Environmental Analyst

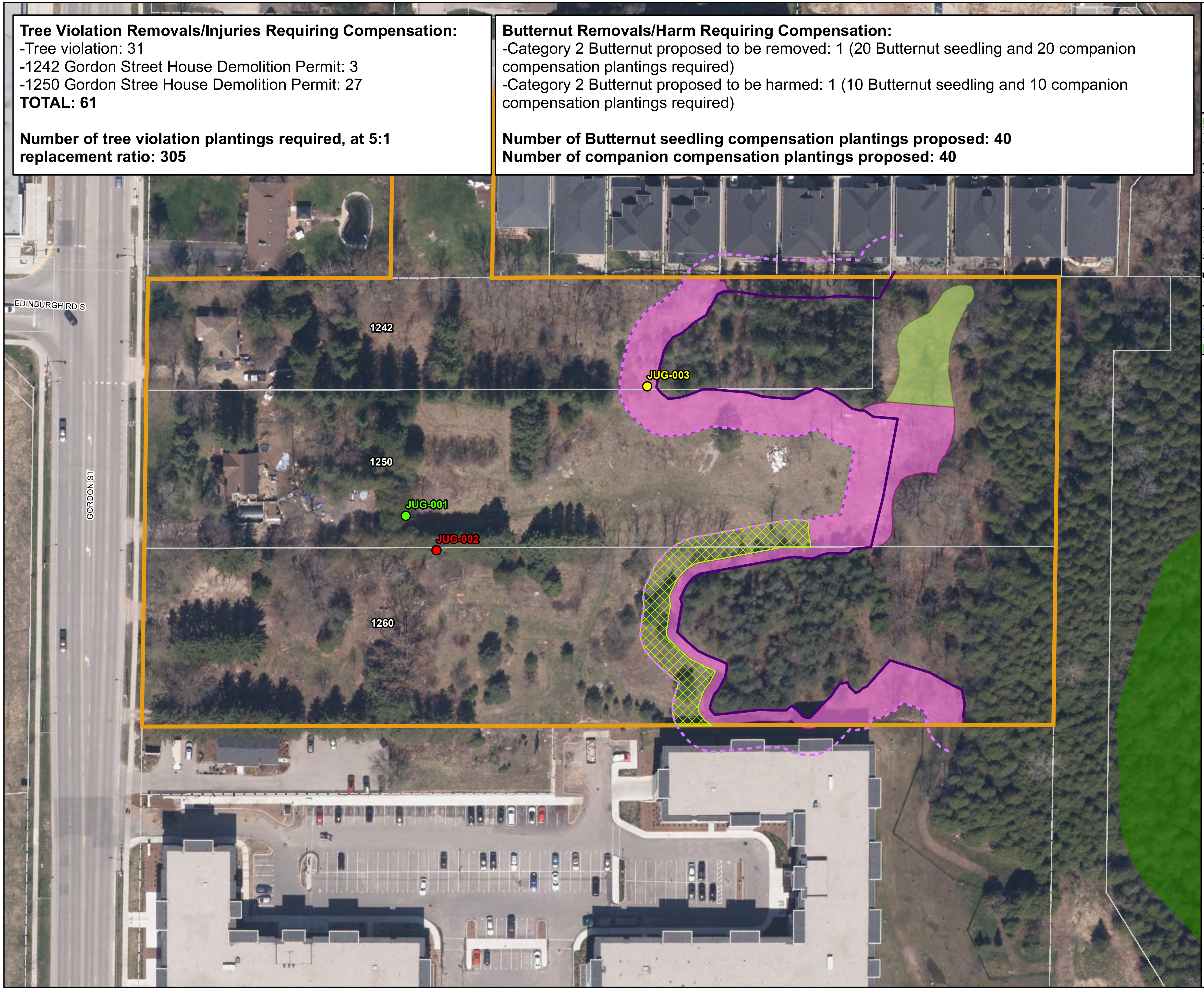
MAPS

Tree Violation Removals/Injuries Requiring Compensation:
-Tree violation: 31
-1242 Gordon Street House Demolition Permit: 3
-1250 Gordon Stree House Demolition Permit: 27
TOTAL: 61

Number of tree violation plantings required, at 5:1 replacement ratio: 305

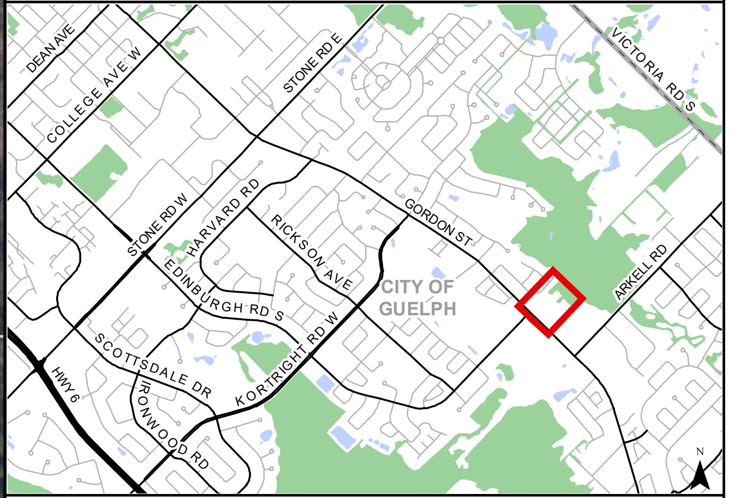
Butternut Removals/Harm Requiring Compensation:
-Category 2 Butternut proposed to be removed: 1 (20 Butternut seedling and 20 companion compensation plantings required)
-Category 2 Butternut proposed to be harmed: 1 (10 Butternut seedling and 10 companion compensation plantings required)

Number of Butternut seedling compensation plantings proposed: 40
Number of companion compensation plantings proposed: 40



Map 1

Tricar - Gordon Street
Tree Compensation



Legend

▭	Subject Property
⬚	Parcel Boundary
●	Category 1 Butternut Hybrid Proposed to be Removed
●	Category 2 Butternut Tree Proposed to be Removed
●	Category 2 Butternut Tree Proposed to be Harmed
■	Proposed Tree Violation Compensation and Butternut Companion Planting Area (0.248ha)*
■	Proposed Butternut Planting Area (0.041ha)†
▨	Additional Planting Area, as Required
- - -	Significant Woodland 10m Setback
—	Significant Woodland Boundary - City of Guelph (October 2014 and July 2017)
■	Provincially Significant Wetland (PSW)

*Tree violation and butternut companion planting area size calculated based on 2.5m spacing on-centre at 1,600/ha, with an additional 15% planting area to account for existing vegetation and stoniness of soils.

†Butternut planting area size calculated based on 3.0m spacing on-centre at 1111trees/ha. Butternuts will be planted at least 5.0m from existing tall trees and 4.0m from other planted trees, with an additional 15% planting area to account for existing vegetation and stoniness of soils.

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

Imagery: First Base Solutions Inc. (2019).

Project: 2347
Date: September 1, 2020

NAD83 - UTM Zone 17
Size: 11x17"
1:1,000

0 20 40 60 Metres

N

Path: X:\2347_TricarGordonStreet\NRSI_2347_Map1_TreeCompensation_1K_2020_09_01_LEH.mxd

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Memo

To: **Chris Leigh, Tricar Developments Inc.**
From: **Patrick Deacon, NRSI**
Date: **July 12, 2020**
Re: **Gordon Street, Guelph**
Butternut Health Assessment

Please find enclosed a Butternut Health Assessment Report for the 3 Butternut (*Juglans cinerea*) located at 1242, 1250 and 1260 Gordon Street in Guelph, Ontario.

The information for Tree 372 has been included in this report (based off a previous BHA by Stantec). This was done for clarity and to put all 3 Butternut trees into a single report.

A field hybridity test found Tree 390, to exhibit signs of hybridity, scoring a total of 4 (potentially 5) points in the field hybridity test as per *Identification of Butternuts and Butternut Hybrids* (Farlee et al., undated). Photographs of the traits that were scored are available upon request.

Based on the assessments completed to date, the site contains 2 trees considered Category 2 and subject to permitting and regulation under the Endangered Species Act (ESA), 2007, and 1 tree considered Category 1 (which was determined to be a hybrid and is not protected under the ESA).

Should you have any questions or comments regarding this proposal, please do not hesitate to contact the undersigned.

Sincerely,
Natural Resource Solutions Inc.

Patrick Deacon
Terrestrial and Wetland Biologist, Certified Butternut Health Assessor

Ministry of Natural
Resources and Forestry

Species At Risk
P.O. Box 7000, 300 Water Street
Peterborough ON K9J 8M5

Ministère des Richesses
naturelles et des Forêts

Espèces en péril
C.P. 7000, 300, rue Water
Peterborough ON K9J 8M5

Ontario

The enclosed Butternut Health Assessor's Report documents the results of the Butternut health assessment that was conducted by the designated Butternut Health Assessor (BHA) identified in the top section of the report. If there are other Butternut trees (of any size or age) at the site that may be affected by the activity and they are not identified in the enclosed BHA Report, they too must be assessed by a designated BHA.

Butternut is listed as an endangered species on the Species at Risk in Ontario List, and as such, it is protected under the *Endangered Species Act, 2007* (ESA) from being killed, harmed, or removed. If you are planning to undertake an activity that may affect Butternut, you may be eligible to follow the requirements set out in section 23.7 of Ontario Regulation 242/08 under the ESA, or you may need to seek an authorization under the ESA (e.g., a permit).

Please visit e-laws at the link provided below for the legal requirements of eligible activities under section 23.7 of Ontario Regulation 242/08 and conditions that must be fulfilled. Information about Butternut is also available at: http://www.ontario.ca/environment-and-energy/butternut-trees-your-property.

If you are eligible to kill, harm or take Butternut under section 23.7 of the regulation, your first step is to submit the BHA Report and the original data forms enclosed in this package to the local Ministry of Natural Resources and Forestry (MNRF) District Manager. Note that MNRF cannot accept photocopies or scanned electronic copies of the data forms.

Note regarding changes:

If the enclosed BHA Report does not identify which Butternut tree(s) are proposed to be killed, harmed, or taken in Table 1 (i.e., if "unknown" is indicated in the second last column of Table 1), or, if the information in the last two columns of Table 1 has changed since the date this BHA Report was produced, **do not make any edits to the BHA Report**. Instead, please attach a cover letter that identifies which Butternut tree(s) are proposed to be killed, harmed, or taken (by referencing the tree identification numbers) when you submit the enclosed BHA Report to the local MNRF District Manager.

The BHA Report must be submitted at least 30 days prior to registering an eligible activity to kill, harm, or remove a Butternut tree. During this 30 day period, no Butternut trees (of any category) may be killed, harmed, or removed, and MNRF may contact you for an opportunity to examine the trees. If MNRF chooses to examine the trees, a representative of MNRF will contact you using the information you supplied when you submitted the BHA Report.

If you are eligible to follow the rules in regulation under section 23.7, you may register your activity using the “Notice of Butternut Impact” form on the MNRF Registry **after the 30 day period has elapsed**.

If you are **not** eligible to follow the rules in regulation under section 23.7, please contact the local MNRF district office to determine whether you will need to seek an authorization (e.g., a permit). A link to the directory of MNRF offices is provided below.

Note that municipal by-laws and legislation other than the ESA may also be applicable to the removal or harming of trees.

Please retain this information and a copy of the BHA Report (including copies of all data forms) for your records, along with any other documentation you may receive from MNRF should an examination of the trees occur. If you have any questions, please contact your local MNRF district office.

Links:

Endangered Species Act, 2007:
http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm

Ontario Regulation 242/08 (refer to section 23.7):
http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_080242_e.htm

MNRF Office Locations:
https://www.ontario.ca/government/ministry-natural-resources-and-forestry-regional-and-district-offices

Butternut Health Assessor's Report Number: 523-026

Patrick Deacon #0523
Natural Resource Solutions Inc.
415 Phillip Street, Unit C
Waterloo, Ontario
N2L 3X2
(519) 725-2227 x407
pdeacon@nrsi.on.ca

Tricar Developments Inc.
3800 Colonel Talbot Road,
London, Ontario
N6P 1H5
(519) 652-8900 (ext 107)
cleigh@tricar.com

Site location: 1242, 1250 and 1260 Gordon St., Guelph, ON

Date(s) of Butternut health assessment: June 9, 2020
Date BHA Report prepared: July 12, 2020

Map datum used: ☒ NAD83 ☐ WGS84

Total number of trees assessed in this BHA Report: 3

The assessed trees were numbered on site using (white flagging tape). The numbers at the site correspond to the tree numbers referenced in this report.

This BHA Report includes the following tables:
- Table 1: Butternut Trees Assessed
- Table 2: Trees Determined by BHA to be Butternut Hybrids
- Table 3: Summary of Assessment Results

Table 1: Butternut Trees Assessed

Tree #	UTM coordinates	Category[1] (1, 2, or 3[2])	dbh[3] (cm)	Cultivated? (Y/N)	Proposed to be: (enter one: unknown[4], killed, harmed or taken)	If tree is proposed to be killed, harmed, or taken, indicate reason tree is proposed to be killed, harmed or taken:
372	17T 564536 4818551	2	18	N	Killed	Tree proposed to be

---

[1] The extent to which the tree is affected by Butternut Canker is presented in the Excel document titled, "BHA Tree Analysis" that accompanies this BHA Report.
[2] Category 3 trees are not eligible to be killed, harmed or taken under section 23.7 of Ontario Regulation 242/08.
[3] dbh: diameter at breast height, rounded to nearest cm (if tree is shorter than breast height, enter zero)
[4] In this column, "unknown" indicates that at the time of assessment, there are no proposals to kill, harm or take this tree that are known to the BHA.

Tree #	UTM coordinates	Category[1] (1, 2, or 3[2])	dbh[3] (cm)	Cultivated? (Y/N)	Proposed to be: (enter one: unknown[4], killed, harmed or taken)	If tree is proposed to be killed, harmed, or taken, indicate reason tree is proposed to be killed, harmed or taken:
						removed
390	17T 564517 4818480	1	15	N	Killed	Tree proposed to be removed
262	17T 564529 4818480	2	29	N	Killed	Tree proposed to be removed

Table 2: Trees Determined by BHA to be Butternut Hybrids

Tree #	UTM coordinates	Method used (genetic testing or field identification):
390	17T 564517 4818480	Field identification

Table 3: Summary of Assessment Results

Result:	**Total #:**	**Important information for persons planning activities that may affect Butternut:**
Category 1	0	• A Category 1 tree is one that is affected by butternut canker to such an advanced degree that retaining the tree would not support the protection or recovery of butternut in the area in which the tree is located; and is considered “non-retainable”. • During the 30 day period that follows your submission of this BHA Report to the MNRF District Manager, no Butternut trees (of Category 1, 2, or 3) may be killed, harmed, or taken, and MNRF may contact you for an opportunity to examine the trees. • Category 1 trees may be killed, harmed or taken **after** the 30 day period that follows submission of this BHA Report to the MNRF District Manager, unless the results of an MNRF examination indicate that the assessment has not been conducted in accordance with the document entitled “Butternut Assessment Guidelines: Assessment of Butternut Tree Health for the Purposes of the *Endangered Species Act, 2007”*.
Category 2	2	• A Category 2 tree is one that is not affected by Butternut Canker, or is affected by Butternut Canker but the degree to which it is affected is not too advanced and retaining the tree could support the protection or recovery of butternut in the area in which the tree is located, and is considered “retainable”. • During the 30 day period that follows your submission of this BHA Report to the MNRF District Manager, no Butternut trees (of Category 1, 2, or 3) may be killed, harmed, or taken,

Result:	**Total #:**	**Important information for persons planning activities that may affect Butternut:**
		and MNRF may contact you for an opportunity to examine the trees. • Activities that may kill, harm or take up to a **maximum of ten (10)** Category 2 trees may be eligible to follow the rules in section 23.7 of Ontario Regulation 242/08, in accordance with the conditions and requirements set out in the regulation. • Refer to e-Laws for the legal requirements of eligible activities under section 23.7 of Ontario Regulation 242/08 and conditions that must be fulfilled: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_080242_e.htm • Activities that may kill, harm or take more than ten (10) Category 2 trees are not eligible to follow the rules in section 23.7 of Ontario Regulation 242/08. Contact the local MNRF district office for information on how to seek an ESA authorization (e.g., a permit) or consider an alternative that would be eligible for the regulation.
Category 3	0	• A Category 3 tree is one that may be useful in determining sources of resistance to Butternut Canker, and is considered "archivable". • Category 3 trees are not eligible to be killed, harmed or taken under section 23.7 of Ontario Regulation 242/08. • Contact the local MNRF district office for information on how to seek an ESA authorization, or consider an alternative that will avoid killing, harming or taking any Category 3 trees.
Cultivated	0	• An activity that involves killing, harming, or taking a cultivated Butternut tree that was not required to be planted to fulfill a condition of an ESA permit or a condition of a regulation, may be eligible for the exemption provided by subsection 23.7 (11) of O. Reg. 242/08. • Prior to undertaking the activity, the owner or occupier of the land on which the Butternut is located (or person acting on their behalf) will need to determine whether the exemption for cultivated trees is applicable by determining whether or not the tree was cultivated as a result of the requirements for an exemption under O. Reg. 242/08 or a condition of a permit issued under the ESA. This information can be accessed by contacting the local MNRF district office. • The owner or occupier of the land on which the Butternut is located (or person acting on their behalf) is encouraged to append the details regarding whether the tree was planted to satisfy a requirement (e.g., the permit number or registration number) to this BHA Report for their records.
Hybrid	1	• Hybrid Butternut trees are not protected under the ESA, but their removal may be subject to municipal by-laws and other legislation.

Butternut Health Assessor's Comments:

The details for Tree 372 were taken from a previous BHA (Stantec). This was done for clarity to put all 3 trees on a single BHA and consolidate information as opposed to submitting various piecemeal reports for a single development site. Tree 372 was not re-assessed and is presumed to remain a Category 2 tree as per the previous assessment.

This concludes the summary of the BHA Report. A complete BHA Report must also include:

1. All original (hard copy) data forms (i.e., all completed sets of Form 1 and Form 2), and
2. Electronic and printed copies of the Excel data analysis spreadsheet.

BHA Tree Analysis (version: December 2013)

This table is to be completed by a designated Butternut Health Assessor (BHA).

BHA Report #	**26**	**Assessment Date(s)**	**9-Jun-20**	**Total # Butternut Trees in BHA Report**	**3**
BHA ID #	**523**	**BHA Name**	**Patrick Deacon**		
Landowner / Client Name	**Tricar Developments Inc.**				
Property Location	**1242, 1250 and 1260 Gordon St., Guelph, ON**				

input field data										automatic calculations from field data						**Categories:** **1: non-retainable, 2: retainable, 3: archivable**				
Tree #	Live Crown %	Tree dbh (cm)	# bole cankers				# root flare (RF) cankers		<40 m from cankered tree? **(Y or N)**	**Circ.** (cm) = Pi x dbh	total **bole canker width** (sooty x 2.5 + open x 5)	total **RF canker width** (sooty x 2.5 + open x 5)	bole canker **%** of circ.	RF canker **%** of circ.	total bole & root canker % of 2xCirc	LC% >/= 50 & BC% = 0	LC% >70 & BRC % <20	LC% >70 & BC % <20	**Preliminary tree call**	**FINAL TREE CALL** a Cat 2, dbh>20cm <40m from a Cat 1
			sooty (S) (will be assigned 2.5 cm per canker)		open (O) (will be assigned 5 cm per canker)															
			S **<**2 m	S **>**2 m	O **<**2 m	O **>**2 m	RF S	RF O		**Circ** (cm)	**BC** (cm)	**RC** (cm)	**BC%**	**RC%**	**BRC%**					
372	75	18	0	0	0	0	0	0	n	56.52	0.0	0.0	**0.0**	**0.0**	**0.0**	2	2	2	**2**	**2**
390	5	15	13	8	0	0	7	0	n	47.1	52.5	17.5	**111.5**	**37.2**	**74.3**	1	1	1	**1**	**1**
262	90	29	3	1	0	0	4	0	n	91.06	10.0	10.0	**11.0**	**11.0**	**11.0**	1	2	2	**2**	**2**
4										0	0.0	0.0	**#####**	**#####**	**#####**	####	###	###	**##**	**#DIV/0!**
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31										0	0.0	0.0	**#####**	**#####**	**#####**	####	###	###	**##**	**#DIV/0!**

0cm 3cm 15cm

Butternut Data Collection Form 1 - 2010 Edition

Surveyor ID or BHA # 0523

(PLEASE USE BLOCK LETTERS)

Date (dd/mm/yyyy) 09-06-2020

Shaded fields are mandatory for Butternut Health Assessments

Surveyor Contact
First PATRICK Last DEACON
Email pdeacon@nrsi.on.ca
Telephone (519)725-2227 Telephone Other ( ) - x

Property Owner (check if same as surveyor) ☐
First Last
or Company TRICAR DEVELOPMENTS
Email cleigh@tricar.com
Telephone (519)652-8900 Telephone Other ( ) - x

Property Owner's Mailing address
Address 3800 COL TALBOT ROAD
City LONDON
Postal Code N6P1H5 Prov. ON

Tree Location (if different from mailing address)
Address/(911#) 1242, 1250, 1260 GORDON STREET
Township Lot Con
Directions City GUELPH

☑ Yes ☐ No Can Share Location Information with other Butternut Recovery Organizations?
☑ Yes ☐ No Site visits OK? (prior arrangments will always be made for a site vist)

\> (Greater than)
< (Less than)

Butternut Trees Tally by Diameter Class

(Do a dot tally in blank space; write total# in box for each)

Tree Condition	< 3 cm	3-15 cm	16-30cm	>30 cm
Vigorous: > 50% Live Crown Minor or no cankers	00	00	02	00
Poor Vigor: <50% Live Crown or >50% Live Crown + heavily cankered stem	00	01	00	00
Dead	00	00	00	00

Historically, do some trees produce seeds? ☑ Y ☐ N ☐ Unkown

Estimated area containing butternut for properties > 1 acre (0.4 hectares) 002 ☐ Acres ☑ Hectares

Tree 372 part of previous BHA, included here to have all 3 trees on same file.

Overall Property Description (area(s) containing Butternut)
☐ Rolling Upland
☐ Valley Slope
☑ Tableland
☐ Bottomland
☐ Variable
☐ Unknown

Vegetation Community/ies
☐ Open
☐ Shrubland
☐ DeciduousForest
☐ ConiferForest
☐ MixedForest
☐ Fencerow
☐ Roadside
☐ Quary
☑ UrbanYard
☐ UrbanPark

Other

Soil Drainage
☐ Well Drained
☑ Moderately Drained
☐ Poorly Drained
☐ Unknown

Soil Depth
☑ > 1metre
☐ 30 - 99cm
☐ < 30cm
☐ Variable
☐ Unknown

Soil Texture
☐ Clay
☐ Clay Loam
☑ Loam
☐ Loamy Sand
☐ Sand
☐ Variable
☐ Unknown

Please enter matching numerical page link code on forms 1 and 2

Page Link 564517

(Contact Information follows all applicable privacy policies and guidelines)

Please return forms to:
Forest Gene Conservation Association
Suite 233, 266 Charlotte St.
Peterborough, ON, K9J 2V4
www.fgca.net

49731

Butternut Data Collection FORM 2 (2010 Edition) (PLEASE USE BLOCK LETTERS)

Shaded fields are mandatory for Butternut Health Assessments

Fill when Form 1 indicates canker is well established. The information opn Form 2 must be filled out for all trees when doing a Butternut Health Assessment.

Site Code(A,B,...Z, AA...): A

Surveyor ID or BHA #: 0523

Date (dd/mm/yyyy): 09-06-2020

Surveyor Last Name: DEACON

Tree ID Numbering: 1,2,3,...Starting from 1 for each site

Tree #: 390 **Zone**: 17 **Easting**: 564517 **Northing**: 4818480

Crown Class: 1
Live Crown %: 005
Main Stem Length(m) Below crown: 08
☑ Twig Dieback
☑ Branch Dieback
☐ Defoliation
☐ Discolouration
#Stems: 1
DBH(cm): 015
Butternut Origin: ☐ Natural ☐ Planted ☑ Unknown
Seed Signs: ☐ Male Flowers ☐ Female Flowers ☑ Seed Set ☐ None

Assess below live crown
#Epic-Live: 02
#Epic-Dead: 04
Bark Type: S
Callused Wounds: 01

	#Open	#Sooty
Root	00	07
=<2m	00	13
>2m	00	08

Metres from badly cankered tree: ☐ < 40 ☐ > 40 ☑ None Found

Competing Species: —

Field hybridity test indicates tree is a hybrid (scores 4 pts as per Farlee et al.)

Tree #: 262 **Zone**: 17 **Easting**: 564529 **Northing**: 4818480

Crown Class: 1
Live Crown %: 090
Main Stem Length(m) Below crown: 09
☑ Twig Dieback
☐ Branch Dieback
☐ Defoliation
☐ Discolouration
#Stems: 1
DBH(cm): 029
Butternut Origin: ☐ Natural ☐ Planted ☑ Unknown
Seed Signs: ☐ Male Flowers ☐ Female Flowers ☐ Seed Set ☑ None

Assess below live crown
#Epic-Live: 00
#Epic-Dead: 00
Bark Type: S
Callused Wounds: 01

	#Open	#Sooty
Root	00	04
=<2m	00	03
>2m	00	01

Metres from badly cankered tree: ☐ < 40 ☐ > 40 ☑ None Found

Competing Species: —

Tree #: 372 **Zone**: 17 **Easting**: 564536 **Northing**: 4818551

Crown Class: 1
Live Crown %: 075
Main Stem Length(m) Below crown: 04
☐ Twig Dieback
☐ Branch Dieback
☐ Defoliation
☐ Discolouration
#Stems: 1
DBH(cm): 018
Butternut Origin: ☐ Natural ☐ Planted ☑ Unknown
Seed Signs: ☐ Male Flowers ☐ Female Flowers ☐ Seed Set ☑ None

Assess below live crown
#Epic-Live: 00
#Epic-Dead: 00
Bark Type: S
Callused Wounds: 00

	#Open	#Sooty
Root	00	00
=<2m	00	00
>2m	00	00

Metres from badly cankered tree: ☐ < 40 ☐ > 40 ☑ None Found

Competing Species: —

Previous BHA by Stantec, data presented here.

Tree #: **Zone**: 1 **Easting**: **Northing**:

Crown Class:
Live Crown %:
Main Stem Length(m) Below crown:
☐ Twig Dieback
☐ Branch Dieback
☐ Defoliation
☐ Discolouration
#Stems:
DBH(cm):
Butternut Origin: ☐ Natural ☐ Planted ☐ Unknown
Seed Signs: ☐ Male Flowers ☐ Female Flowers ☐ Seed Set ☐ None

Assess below live crown
#Epic-Live:
#Epic-Dead:
Bark Type:
Callused Wounds:

	#Open	#Sooty
Root		
=<2m		
>2m		

Metres from badly cankered tree: ☐ < 40 ☐ > 40 ☐ None Found

Competing Species:

Tree #: **Zone**: 1 **Easting**: **Northing**:

Crown Class:
Live Crown %:
Main Stem Length(m) Below crown:
☐ Twig Dieback
☐ Branch Dieback
☐ Defoliation
☐ Discolouration
#Stems:
DBH(cm):
Butternut Origin: ☐ Natural ☐ Planted ☐ Unknown
Seed Signs: ☐ Male Flowers ☐ Female Flowers ☐ Seed Set ☐ None

Assess below live crown
#Epic-Live:
#Epic-Dead:
Bark Type:
Callused Wounds:

	#Open	#Sooty
Root		
=<2m		
>2m		

Metres from badly cankered tree: ☐ < 40 ☐ > 40 ☐ None Found

Competing Species:

Please enter matching page link code on forms 1 and 2

Page Link: 564517

(Contact Information follows all applicable privacy policies and guidelines)

Please return forms to:
Forest Gene Conservation Association
Suite 233, 266 Charlotte St.
Peterborough, ON, K9J 2V4
www.fgca.net

49731

APPENDIX H
FUNCTIONAL SERVICING REPORT

Functional Servicing Report for Gordon Street – Guelph ON

August 11, 2021

Prepared for:

Tricar Developments Inc.

Prepared by:

Stantec Consulting Ltd.
600-171 Queens Avenue
London ON N6A 5J7

This document entitled Functional Servicing Report for Gordon Street – Guelph ON was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Tricar Development Inc. (the “Client”) for submission to the City of Guelph for Zoning Bylaw Amendment Approval. Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________
(signature)

Derrick Rice, EIT

Reviewed by Claire Phelps ______________________________
(signature)

Claire Phelps, EIT

Approved by ______________________________
(signature)

Chris Hendriksen, P.Eng.

Table of Contents

1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

This Functional Servicing Report has been prepared in support of the Zoning and Official Plan amendment and the Site Plan Application for the proposed development located at 1242, 1250 & 1260 Gordon Street (Site) in the City of Guelph (City). The subject property is approximately 3.323 ha in size and is bounded to the northwest by existing residential subdivision, to the northeast by protected woodlot, to the southwest by Gordon Street, and to the southeast existing high-density development.

The conceptual site plan for the proposed development that forms the basis of this servicing assessment includes two 10 story apartment buildings consisting of 9 townhouse units and 368 apartment units. The bulk of site parking will be achieved through underground and at/above grade enclosed parking.

This report outlines how the proposed development can be supplied with adequate services, including sanitary, domestic water, storm drainage and includes the preliminary design of the infiltration and water quality facilities proposed to provide the required water quality and quantity controls and the preliminary erosion and sediment control strategy to be implemented during construction.

1.2 BACKGROUND INFORMATION

A variety of sources have been referenced during the preparation of this report, and the following should be read in conjunction with this Report:

- Geotechnical Engineering Report, Two 12-Storey Apartment Buildings 1242, 1250, 1260 Gordon Street, Guelph, Ontario (CMT Engineering Inc, April 2018)
- Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation Authority and Toronto and Region Conservation Authority, 2010)
- Erosion & Sediment Control Guideline for Urban Construction, (Greater Golden Horseshoe Area Conservation Authorities, December 2006)
- Stormwater Management Planning and Design Manual (SWMPD Manual), (Ontario Ministry of the Environment, March 2003)
- Development Engineering Manual, City of Guelph (City of Guelph Engineering and Transportation Services, January 2019)
- Groundwater Flow, Figure 14 of 1242, 1250, 1260 Gordon Street and 9 Valley Road Hydrogeological Assessment (Stantec Consulting Ltd., March 2020)
- Hanlon Creek Watershed Plan (Marshal Macklin Monaghan Ltd., LGL Ltd., October 1993)

- Torrance Creek Subwatershed Study- Management Strategy (Totten Sims Hubicki Associates, et al, September 1998)

1.3 EXISTING INFRASTRUCTURE

A summary of the municipal infrastructure that currently exists near the Site is as follows:

- A 200mm sanitary sewer located on Gordon Street.
- A 400mm watermain on Gordon.
- A 575mm storm sewer on Gordon Street.

Fully constructed municipal roads include Gordon Street to the west and Valley Road to the north.

2.0 OVERALL GRADING AND DRAINAGE

2.1 DESIGN CONSTRAINTS AND PROCEDURES

Using existing topographic information provided by BSR&D limited (dated November 2014), the proposed Site grading will be designed to generally meet the following criteria:

- Match existing grades at all site boundaries.
- Match existing grades at existing tree driplines wherever possible to facilitate tree retention.
- Extension of Edinburgh Road and Valley Road to municipal standards and match into existing road grades of Gordon Street and Valley Road.
- Account for future urbanization of adjacent lands.
- Have consideration for future pedestrian connections north of the site towards Valley Road.
- Provide adequate cover over underground services.
- Ensure all building openings are protected from flooding.
- Comply with Municipal standards for minimum and maximum grades.
- Provide major overland flow routes for flows exceeding the storm sewer capacity.
- Maintain drainage from Gordon Street right-of-way and neighboring properties to the north and south.

2.2 PROPOSED ROAD PROFILES AND OVERALL SITE GRADING

Road profiles within the subject site were established based on the proposed street pattern to satisfy the constraints outlined in the previous Section 2.1. The road profiles have been designed to accommodate the constraints set out by the site layout and underground parking limits with grades ranging from 0.5% to 8.0% with 3:1 and 4:1 transition slopes or retaining walls utilized to accommodate the various grade changes within the site and at various perimeter locations. The proposed centerline road elevations for the extension Landsdown Drive and Edinburgh Road and lot grades are illustrated on the Grading plan as well as the plan and profile provided for these extensions (Drawing No. 4 of 7 and 5 of 7) included in Appendix A. Existing grades and cross sections of Gordon Street and Valley Road have been considered fixed constraints in the development of the preliminary grading. The extension of Landsdown Drive and Edinburgh Road will be 8.4m back of curb to back of curb as per City of Guelph’s Linear Infrastructure Standard drawing SD-48a. Internal roads, consisting of 6.7m wide asphalt as the building has structured parking not subject to the standard 7.0m minimum width drive aisle.

3.0 SANITARY SERVICING

The City of Guelph is currently completing the Gordon Street Improvements EA and an overall Master Wastewater Servicing Plan that is considering an upgrade to the sanitary service capacity within Gordon Street fronting the site. Through correspondence with the City in 2019 and 2020, the proposed development will be incorporated in the design of the sanitary sewer upgrades. Confirmation of this has been received from Daryush Esmaili via email received June 28, 2019 and Reg Russwurm via email received March 4, 2020 (see email correspondence attached in Appendix A).

A 200mm extension of the municipal sanitary sewer east on the Edinburgh Road extension proposed as part of this redevelopment to provide service to the site. Sewers will be designed in accordance with the requirements of the Ontario Building Code and the City of Guelph. An illustration of the sanitary sewer layout can be found in the Sanitary Area Plan (Sheet No. 3 of 7) included in Appendix A.

4.0 WATER DISTRIBUTION

The existing water distribution system near the Site includes a 400mm watermain on Gordon Street. The primary source for the proposed development will be the Gordon Street watermain. It is anticipated that the following work to the existing municipal infrastructure will be made:

- Tapping sleeve and valve connection to the 400mm Gordon Street watermain (200mm connection).
- Extension of the municipal watermain along the Edinburgh Road extension to provide service to the Site.

Please refer to the Preliminary Servicing plan (Drawing No. 1 of 7) for an illustration of the watermain layout.

Based on building information currently available, a conservative fire flow requirement for the site is 150 L/s, based on typical OBC calculations as provided in Appendix B.

A 200 mm diameter watermain is proposed for the development with 200mm connections provided to each building. They are positioned as illustrated on the Preliminary Servicing plan (Drawing No. 1 of 7).

Fire protection will be provided via onsite hydrants, adequately spaced to ensure proper coverage to all buildings, in conjunction with standpipe connections for building sprinkler systems. The City of Guelph will confirm the pipe sizing proposed provides adequate pressure to meet MOE design criteria. No backflow prevention or pressure reducing valves (PRV) have been proposed for this development.

5.0 STORMWATER MANAGEMENT STRATEGY

5.1 STORMWATER MANAGEMENT CRITERIA

This site is covered by criteria from different documents. The documents and site criteria are discussed below.

5.1.1 HANLON CREEK WATERSHED PLAN (HCWP)

The HCWP states that for upper Hanlon Creek development no urban drainage will be permitted to the headwaters of Tributary E or F, except for lands that already have drainage outlets. All stormwater generated from the area must either infiltrate into the ground or evaporate (100-year infiltration and zero runoff). There is no discussion in the report on requirements for redeveloping lands within the existing development areas where this project is located.

5.1.2 TORRANCE CREEK SUBWATERSHED STUDY (TCSS)

The TCSS states that for Zone 2, where this site is located, the requirement is to detain the post-development flow to pre-development ratees for the 2- to 100-year events and to infiltrate 150 mm/yr.

5.1.3 CITY OF GUELPH DEVELOPMENT ENGINEERING MANUAL

The specific SWM Criteria for the Site from the City of Guelph Development Engineering Manual (January 2019) is outlined below.

Water Quantity Control

- Based on City Guidelines, on-site stormwater control should be sized to attenuate post-development peaks flows to the pre-development (existing) peak flows. This ‘post-to-pre’ control should be provided for the 2-year through to the 100-year storm events.

Water Quality Control

- Based on City guidelines, the feasibility of on-site infiltration should be investigated. All developments are required to provide a minimum of Enhanced water quality level protection (ie, 80% TSS removal). It is recommended for small development sites (approximately 2 ha) a treatment train approach be followed.

5.1.4 Criteria for the Site

The HCWP appears to be more applicable to development in the upper Hanlon Creek areas, with drainage to Tributaries E and F. The project site is located in the ‘existing development’ area within the study and is not specifically addressed within the plan and drains to Tributary D.

Additionally, the GRCA mapping for the site shows a recharge of 122-199 mm/year and runoff of 118-207 mm/year while sites within the Upper Hanlon Creek area have a recharge of 315-371 mm/year and a runoff of 0 mm/year, showing that the flow regime for the two areas is obviously different.

Based on the above information, it was decided that applying the TCSS criteria to the site was a reasonable approach based on the information available. The SWM criteria for the site are as follows:

- Attenuate post-development peak flows to pre-development rates for the 2-year though 100-year storm events
- Infiltrate, evaporate, or reuse 150 mm/yr
- Minimum of Enhanced Water Quality Protection.

5.2 SOILS INFORMATION

Site soil properties were confirmed using the Geotechnical Investigation Report (XCG Consulting Ltd., April 2018), which outlined soil conditions for the site as per tested boreholes. It was confirmed that site soils can be expected to be sand – silt with traces of clay, with overall good drainage properties. For this analysis, site soils were classified as BC, which was deemed to be a conservative estimate.

Infiltration rates for the site were determined to be approximately 23 mm/hr for the south portion of the site and 32 mm/hr for the east portion of the site. These design rates were calculated by Stantec Consulting Ltd. (Stantec) based on test pit and infiltration testing completed in June 2021.

A hydrogeologic assessment of the Site was completed by Stantec, and is documented in the Hydrogeological Report, 1242, 1250, 1260 Gordon Street, and 9 Valley Road, City of Guelph (Stantec, 2020). In the Site monitoring well MW5 – 18S a high water table elevation of 340.3 m was recorded. The groundwater flow follows a similar divide as surface water, with a portion flowing east as part of the Torrance Creek Watershed, and another portion flowing west as part of the Hanlon Creek Watershed.

5.3 HYDROLIC MODELING

A hydrologic model was prepared to simulate drainage conditions for the subject development. MIDUSS was used to predict flows for the existing and proposed development conditions and to design the SWM system to ensure the previously mentioned criteria were achieved.

To address the criteria, existing and post-development conditions were modeled for the 2 year, 5 year and 100 year 3-hour Chicago design storms, derived using the City of Guelph parameters as provided in Table 1.

Table 1: City of Guelph – Chicago Storm Parameters

Storm Event	a	b	c	Duration (hrs.)	Depth (mm)
2-year	743	6	0.798	3	34
5-year	1593	11	0.879		47
100-year	4688	17	0.925		87

5.4 EXISTING CONDITIONS

The existing 3.05 ha Site includes 3 residential properties with gravel/asphalt driveways. A large portion of the site is a woodlot area, and part of the Torrance Watershed, and generally has steep slopes (approximately 5.0 %). A portion of the properties drain to an existing storm sewer on Gordon Street. The drainage catchments are shown on Figure 1, attached, and are summarized below.

- **Catchment 101** – A 1.33 ha area that includes residential homes, with storm water out-letting to Gordon Street to the west.
- **Catchment 102** – A 1.72 ha undeveloped area, which discharges as shallow overland flow to the woodlot to the east, part of the Torrance Creek Swamp

5.5 PROPOSED CONDITIONS

The proposed site plan includes two 10-storey apartment buildings, one with one level of underground parking and one with one level of underground parking. The proposed drainage catchments are summarized in detail below and shown in Figure 2, attached. Generally, the proposed conditions will increase the area out-letting to Gordon Street to the west and will reduce the area out-letting to the Torrance watershed to the east. The development will also increase the impervious area and will produce an increase in stormwater flows to the downstream Gordon Street storm sewer.

- **Catchment 201** – A 0.09 ha building/landscaped area that will drain uncontrolled to Gordon Street to the west.
- **Catchment 202** – A 0.24 ha roof top area. Runoff from this area will be attenuated by a roof-top control system, and ultimately outlet to the downstream Gordon Street storm sewer. The 25 mm

rainfall event will be directed to a Permavoid infiltration trench, situated south of the developed area. Overflows will be conveyed to the Permavoid storage tank.

- **Catchment 203** – A 0.23 ha rooftop area. Runoff from this area will be attenuated by a roof-top control system and ultimately outlet to the Torrance Watershed, to the east. The 25 mm rainfall event will be directed to a LID infiltration trench, situated east of the developed area. Overflows from the infiltration trench will flow overland to the east.
- **Catchment 204** – A 0.57 ha area, including the parking area, lane-way and small portions of landscape. Runoff will be collected by catchbasins and conveyed via a storm sewer system to a Permavoid storage tank. The first 25 mm of the storm event will flow into the Permavoid infiltration trench, with overflow conveyed to the Permavoid storage.
- **Catchment 205** – A 0.21 ha designated park area draining uncontrolled east to the Torrance Watershed.
- **Catchment 206** – A 1.39 ha undeveloped woodlot area draining uncontrolled east to the Torrance Watershed.
- **Catchment 207** – A 0.14 ha landscaped area that will outlet to the Permavoid storage tank. The first 25 mm of the storm event will flow into the Permavoid infiltration trench, with overflow outletting to the Permavoid storage.
- **Catchment 208** – A 0.12 ha parking area, with minor flows collected via parking lot structure roof drains and conveyed south to the Permavoid infiltration trench, with overflow to the Permavoid storage tank. The major flows will outlet via overland flow to the Gordon Street storm sewer.
- **Catchment 209** – A 0.06 ha amenity area, which will flow uncontrolled to the Gordon Street storm sewer.

5.6 WATER QUANTITY CONTROL

5.7 PERMAVOID SYSTEM

Permavoid is a modular system made of polypropylene material, with a high 90% void ratio, and was selected to provide subsurface stormwater containment for the Site. Other stormwater management options, including subsurface storage and a surface storage pond were considered during the design process. Ultimately, the Permavoid system was selected as the modular feature can be more readily incorporated into the south landscaped area and is compatible with servicing and amenity area constraints. The Permavoid storage system was designed following the Permavoid Technical Manual (Polypipe, 2021).

5.8 TREATMENT TRAIN APPROACH

Stormwater runoff will be provided with water quantity control by a combination of rooftop controls over both the west and east building and a Permavoid storage tank located in the south landscaped area. The rooftop controls will provide flow attenuation to both building areas: Catchment 202 (West Building) and Catchment 203 (East Building). The rooftop controls will allow for 16.0 cm of ponding, and through a 75 mm diameter orifice will direct attenuated flows into a downspout system. The rooftop downspouts of Catchment 203 (East Building) will connect into an on-site infiltration trench in Catchment 206. Overflow from this system will outlet east to the Torrance Watershed. The roof downspouts of the West Building (Catchment 202) will connect to the Permavoid infiltration tank in Catchment 207. Overflow from the Permavoid infiltration tank will be directed into the Permavoid storage tank.

The Permavoid storage tank will also collect runoff from the on-site parking area, including total flows from Catchment 204 (south parking area) and minor flows from Catchment 208 (north parking area). A 75 mm orifice control (CBMH 6) will be provided on the downstream end, prior to discharge to the Gordon Street storm sewer. The Permavoid storage has been sized such that the post-development runoff flow rates to Gordon Street are attenuated to pre-development flow rates.

During the 100-year event a total of 310 m^3 of active storage will be utilized in the Permavoid storage tank, 136 m^3 of active storage will be provided on the West Building rooftop (Catchment 202) and 138 m^3 of active storage will be provided on the East Building rooftop (Catchment 203). As shown in Table 2 below, the pre-development targets are met for the two site outlets in the post-development condition.

Table 2: Pre-Development and Post-Development Flow Rates

Storm Event	**Existing Flow Rates to Outlet (m^3/s)**	
	Gordon Street (101)	**Torrance Creek Watershed (102)**
2-yr	0.011	0.002
5-yr	0.020	0.006
100-yr	0.051	0.042
Storm Event	**Proposed Flow Rates to Outlet (m^3/s)**	
	Gordon Street (201, 202, 203, 204, 207, 208, 209)	**Torrance Creek Watershed (205, 206)**
2-yr	0.008	0.002
5-yr	0.012	0.006
100-yr	0.045	0.041

For more details of the stormwater management strategy, including model parameters and inputs/outputs data files, please see the attachments.

5.9 ON-SITE INFILTRATION

The east on-site infiltration (rock) trench was sized to capture and infiltrate the 25 mm event over Catchment 203 (East Building roof area). The total controlled area is 2300 m^2 of rooftop and 110 m^2 of landscaped area. This infiltration trench will be located along the east portion of the development, in Catchment 206. The trench was sized to draw-down within 48 hours.

The south Permavoid infiltration trench was sized to capture and infiltrate the 25 mm event over parking areas (Catchment 208 and 204), the west building (Catchment 202) and the Permavoid area (Catchment 207). The total controlled area is 2400 m^2 of rooftop, 6900 m^2 of parking and 1400 m^2 of landscaped area. This Permavoid infiltration trench will be located along the south portion of the development, in Catchment 207. The Permavoid trench was sized to draw-down within 48 hours after roof-top ponding.

The characteristics of the on-site infiltration features are summarized in Table 3, below.

Table 3: Design Characteristics of On-Site Infiltration Features

Characteristic	Existing Flow Rates to Outlet (m^3/s)	
	East Infiltration Trench	South Permavoid Infiltration Trench
Surface Area	110 sq*m	425 sq*m
Subsurface Soil Infiltration Rate	32 mm/hr	23 mm/hr
Porosity	35 %	90 %
Trench Depth	0.40 m of clearstone, wrapped in filter fabric	0.40 m of Permavoid layer, wrapped in filter fabric
Soil Cover	0.30 m	0.30 m
Invert Elevation	340.06 m	340.43 m

Note: Subsurface soil infiltrate rate calculated by Stantec Hydrogeology team, based on on-site Test Pit and Guelph Permeameter Testing completed in June 2021.
The 0.30 m soil cover is minimum allowable cover for soil protection, following the CVC LID SWM Planning and Design Guide, 2010.

As shown in Table 3, the invert of the east infiltration gallery is 340.06 m. The high groundwater elevation in this vicinity is 339.06 m. The invert of the south Permavoid infiltration trench is 340.43 m, and the high groundwater elevation in this vicinity is 338.90 m. Therefore, > 1.0 m separation from the infiltration feature inverts to the reference groundwater elevation is expected to be provided. More details of the on-site infiltration and groundwater are provided in the Infiltration and Groundwater Mounding Assessment, East and South Infiltration Trenches, 1242, 1250 and 1260 Gordon Street and 9 Valley Road, City of Guelph *(*Stantec Consulting Ltd., 2021).

A Hydrogeological Report for this Site was completed by Stantec in 2020. It is noted that a 340.3 m groundwater elevation was the highest groundwater level observed on site at MW5-18(S), and other monitoring wells recorded lower groundwater elevations. The high groundwater elevations on-site generally ranged from 340.0 to 334.0 m across 5 monitoring wells. New monitoring wells will be installed mid-August 2021in the on-site infiltration feature footprints, to confirm high groundwater elevations.

The groundwater elevations were recorded in on-site monitoring well MW5-18(S) by Stantec from approximately July 2018 to January 2020. During this period, the high groundwater elevation exceeded 339.00 m from approximately beginning of April through to the end of June 2019 (a 3-month period). During other times the high groundwater table was consistently below 339.00 m. The groundwater level is shown to be below the invert of the on-site infiltration features, notably during summer periods when urban catchments would experience increased runoff from summer storms. In the event that the East infiltration feature is submerged, water will back up and overflow east to Torrance Watershed. In the event the South Permavoid infiltration tank is submerged, water will overflow to the Permavoid storage tank and ultimately outlet to the Gordon Street storm sewer.

For more details of the on-site infiltration trench, please see the attached calculation sheet.

5.10 WATER QUALITY CONTROL

By infiltrating the first 25 mm of every storm event, it is expected 80% TSS removal (enhanced level protection) will be provided to the runoff directed to the on-site infiltration features.

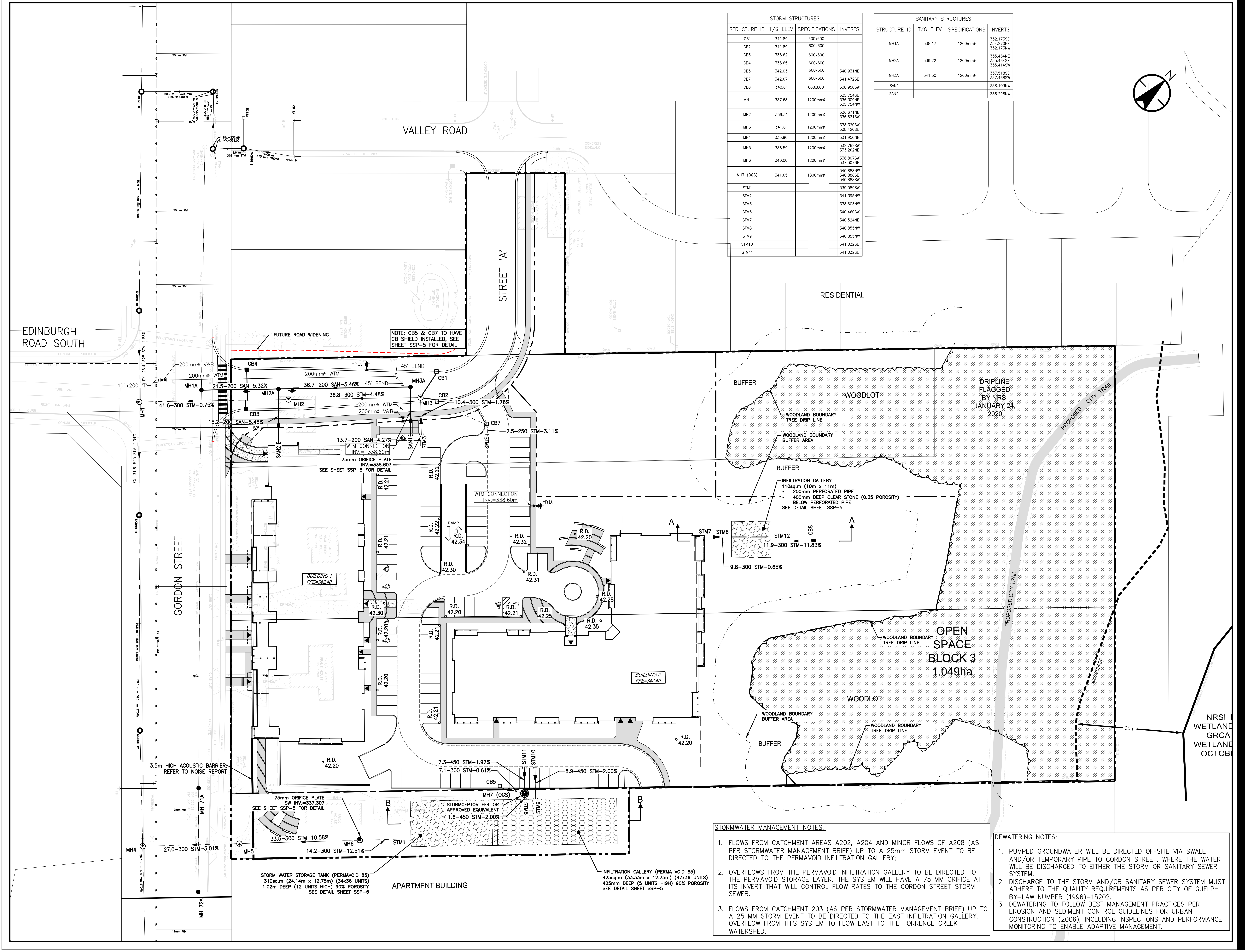
To comply with the City of Guelph 'treatment train' recommendation, an Oil-Grit Separator Unit (Stormceptor EF4) was sized also upstream of the Permavoid storage tank, to treat runoff produced over the parking area (Catchment 204 and 208). In addition, catchbasin shields will be provided on-site. As the Stormceptor EF 4 will provide approximately 90% TSS removal to contributing runoff, this approach will incorporate redundancy into the water quality system and it can be expected that the entire site will have approximately 80% TSS removal. For a detailed sizing report of the Stormceptor EF4, please see the attachment.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding report, the following conclusions can be drawn:

- Sanitary service is provided by the proposed upgrade to the municipal system located on Gordon Street just west of the site access.
- Water service is provided from the existing 400mm watermain on Gordon Street fronting this site.
- Enhanced (Level 1) water quality control will be provided for the site by a combination of OGS unit, and infiltration gallery. Adequate water quality volumes will be provided to meet the MOE water quality requirements associated with infiltration facilities.
- The proposed rooftop storage and Permavoid storage tank will detain the 2- to 100-year peak flows to predevelopment levels prior to discharge to Gordon Street.

PRELIMINARY CIVIL DRAWING PACKAGE



STORM STRUCTURES

STRUCTURE ID	T/G ELEV	SPECIFICATIONS	INVERTS
CB1	341.89	600x600	
CB2	341.89	600x600	
CB3	338.62	600x600	
CB4	338.65	600x600	
CB5	342.03	600x600	340.931NE
CB7	342.67	600x600	341.472SE
CB8	340.61	600x600	338.950SW
MH1	337.68	1200mmø	335.754SE 336.309NE 335.754NW
MH2	339.31	1200mmø	336.671NE 336.621SW
MH3	341.61	1200mmø	338.320SW 338.420SE
MH4	335.90	1200mmø	331.950NE
MH5	336.59	1200mmø	332.762SW 333.262NE
MH6	340.00	1200mmø	336.807SW 337.307NE
MH7 (OGS)	341.65	1800mmø	340.888NW 340.888SE 340.888SW
STM1			339.089SW
STM2			341.395NW
STM3			338.603NW
STM6			340.460SW
STM7			340.524NE
STM8			340.855NW
STM9			340.855NW
STM10			341.032SE
STM11			341.032SE

SANITARY STRUCTURES

STRUCTURE ID	T/G ELEV	SPECIFICATIONS	INVERTS
MH1A	338.17	1200mmø	332.173SE 334.270NE 332.173NW
MH2A	339.22	1200mmø	335.464NE 335.464SE 335.414SW
MH3A	341.50	1200mmø	337.518SE 337.468SW
SAN1			338.103NW
SAN2			336.298NW

STORMWATER MANAGEMENT NOTES:

1. FLOWS FROM CATCHMENT AREAS A202, A204 AND MINOR FLOWS OF A208 (AS PER STORMWATER MANAGEMENT BRIEF) UP TO A 25mm STORM EVENT TO BE DIRECTED TO THE PERMAVOID INFILTRATION GALLERY;

2. OVERFLOWS FROM THE PERMAVOID INFILTRATION GALLERY TO BE DIRECTED TO THE PERMAVOID STORAGE LAYER. THE SYSTEM WILL HAVE A 75 MM ORIFICE AT ITS INVERT THAT WILL CONTROL FLOW RATES TO THE GORDON STREET STORM SEWER.

3. FLOWS FROM CATCHMENT 203 (AS PER STORMWATER MANAGEMENT BRIEF) UP TO A 25 MM STORM EVENT TO BE DIRECTED TO THE EAST INFILTRATION GALLERY. OVERFLOW FROM THIS SYSTEM TO FLOW EAST TO THE TORRENCE CREEK WATERSHED.

DEWATERING NOTES:

1. PUMPED GROUNDWATER WILL BE DIRECTED OFFSITE VIA SWALE AND/OR TEMPORARY PIPE TO GORDON STREET, WHERE THE WATER WILL BE DISCHARGED TO EITHER THE STORM OR SANITARY SEWER SYSTEM.
2. DISCHARGE TO THE STORM AND/OR SANITARY SEWER SYSTEM MUST ADHERE TO THE QUALITY REQUIREMENTS AS PER CITY OF GUELPH BY-LAW NUMBER (1996)-15202.
3. DEWATERING TO FOLLOW BEST MANAGEMENT PRACTICES PER EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION (2006), INCLUDING INSPECTIONS AND PERFORMANCE MONITORING TO ENABLE ADAPTIVE MANAGEMENT.

V:\01614\active\161413684\design\drawing\civil\model_files\plan\161413684_C-C8.dwg
2021-8-24 1:50 PM by: Childs, Jason

ORIGINAL SHEET - ANSI D

Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Liability Note:

Notes

1. <u>CITY OF GUELPH BENCHMARK 225</u>
   <u>ELEVATION 338.665</u> LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER

Legend

▬ · · ▬ · · ▬	SITE LIMIT
— — ◄ — —	EX. STORM SEWER
▬ ▬ ◄ ▬ ▬	PROPOSED STORM SEWER
——◄——	EX. SANITARY SEWER
━━◄━━	PROPOSED SANITARY SEWER
● S2	PROPOSED SANITARY MANHOLE
⦿ R2	PROPOSED STORM MANHOLE
⊡ CBMH1	PROPOSED CATCHBASIN MANHOLE
☐ CB or CICB	PROPOSED CATCHBASIN
⦿ EX. MH	EX. MANHOLE
☐ EX. CB	EX. CATCHBASIN
━ - ━ - ━	PROPOSED WATERMAIN
— - — - —	EX. WATERMAIN
▶◀—⌖	PROPOSED 3-WAY FIRE HYDRANT C/W STORZ CONNECTION
▷◁—⌖	EX. FIRE HYDRANT
━ - ▶◀ - ━	PROPOSED WATER VALVE
— - ▷◁ - —	EX. WATER VALVE
Ⓜ	BULK WATER METER

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

File Name: 161413684_c-db	JAC	CJH	JAC	21.07.23
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

C. J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

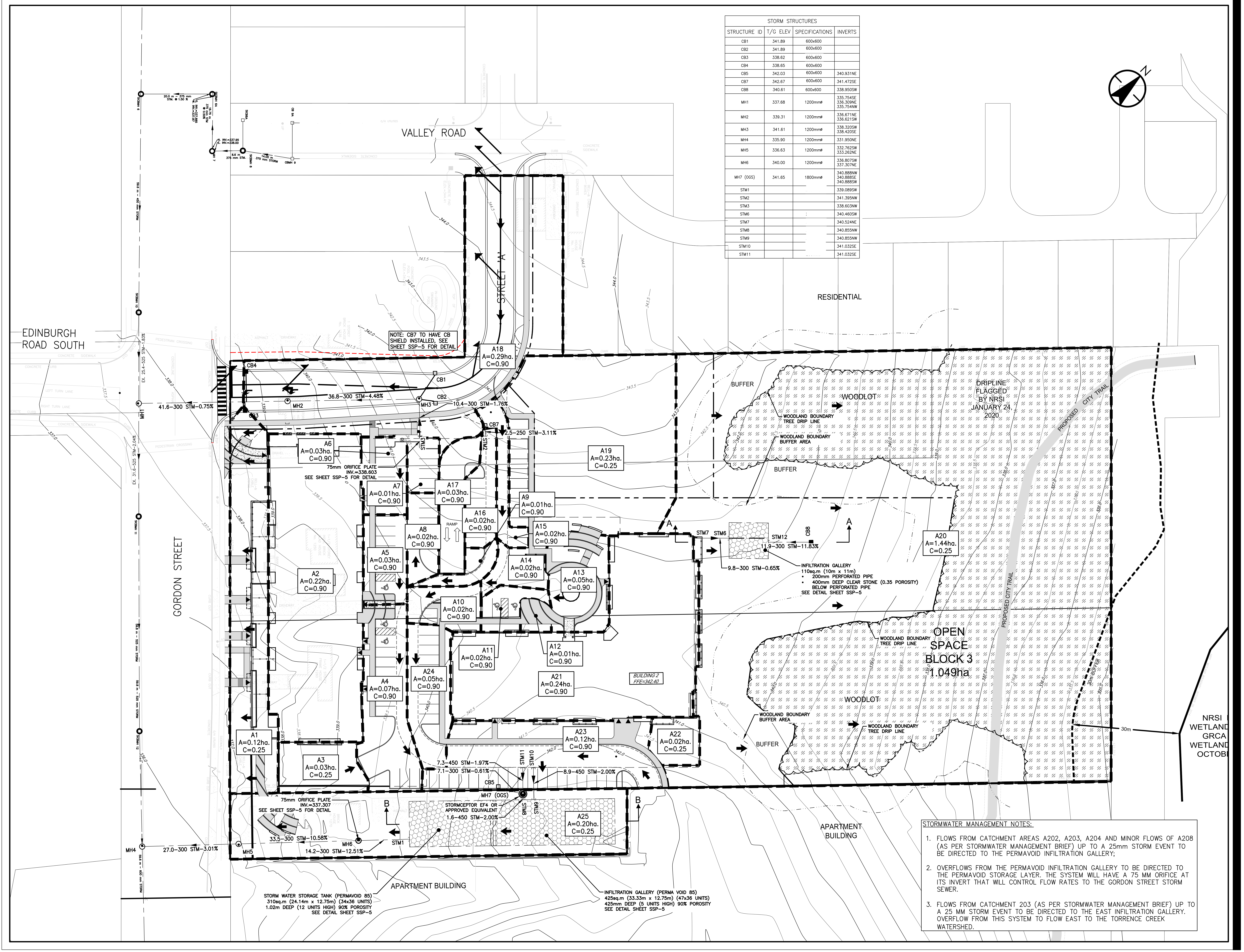
Title

SERVICING PLAN

Project No. 161413684

Scale 1:500 0 5 15 25m

Drawing No.	Sheet	Revision
SSP-1	1 of 7	0



STORM STRUCTURES			
STRUCTURE ID	T/G ELEV	SPECIFICATIONS	INVERTS
CB1	341.89	600x600	
CB2	341.89	600x600	
CB3	338.62	600x600	
CB4	338.65	600x600	
CB5	342.03	600x600	340.931NE
CB7	342.67	600x600	341.472SE
CB8	340.61	600x600	338.950SW
MH1	337.68	1200mmø	335.754SE 336.309NE 335.754NW
MH2	339.31	1200mmø	336.671NE 336.621SW
MH3	341.61	1200mmø	338.320SW 338.420SE
MH4	335.90	1200mmø	331.950NE
MH5	336.63	1200mmø	332.762SW 333.262NE
MH6	340.00	1200mmø	336.807SW 337.307NE
MH7 (OGS)	341.65	1800mmø	340.888NW 340.888SE 340.888SW
STM1			339.089SW
STM2			341.395NW
STM3			338.603NW
STM6			340.460SW
STM7			340.524NE
STM8			340.855NW
STM9			340.855NW
STM10			341.032SE
STM11			341.032SE

STORMWATER MANAGEMENT NOTES:

1. FLOWS FROM CATCHMENT AREAS A202, A203, A204 AND MINOR FLOWS OF A208 (AS PER STORMWATER MANAGEMENT BRIEF) UP TO A 25mm STORM EVENT TO BE DIRECTED TO THE PERMAVOID INFILTRATION GALLERY;
2. OVERFLOWS FROM THE PERMAVOID INFILTRATION GALLERY TO BE DIRECTED TO THE PERMAVOID STORAGE LAYER. THE SYSTEM WILL HAVE A 75 MM ORIFICE AT ITS INVERT THAT WILL CONTROL FLOW RATES TO THE GORDON STREET STORM SEWER.
3. FLOWS FROM CATCHMENT 203 (AS PER STORMWATER MANAGEMENT BRIEF) UP TO A 25 MM STORM EVENT TO BE DIRECTED TO THE EAST INFILTRATION GALLERY. OVERFLOW FROM THIS SYSTEM TO FLOW EAST TO THE TORRENCE CREEK WATERSHED.

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2021-8-24 1:51 PM By: Childs, Jason

ORIGINAL SHEET - ANSI D

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Liability Note:

Notes

1. CITY OF GUELPH BENCHMARK 225
ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER

Legend

A1 A=0.23ha. C=0.25	AREA ID CONTRIBUTING AREA (ha) RUNOFF COEFFICIENT
↑	MAJOR OVERLAND FLOW ROUTE
- - - -	DRAINAGE BOUNDARY

Revision	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24
Issued	By	Appd.	YY.MM.DD

File Name: 161413684_c-sd	JAC	CJH	JAC	21.07.23
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

C.J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD

GUELPH, ON

Title

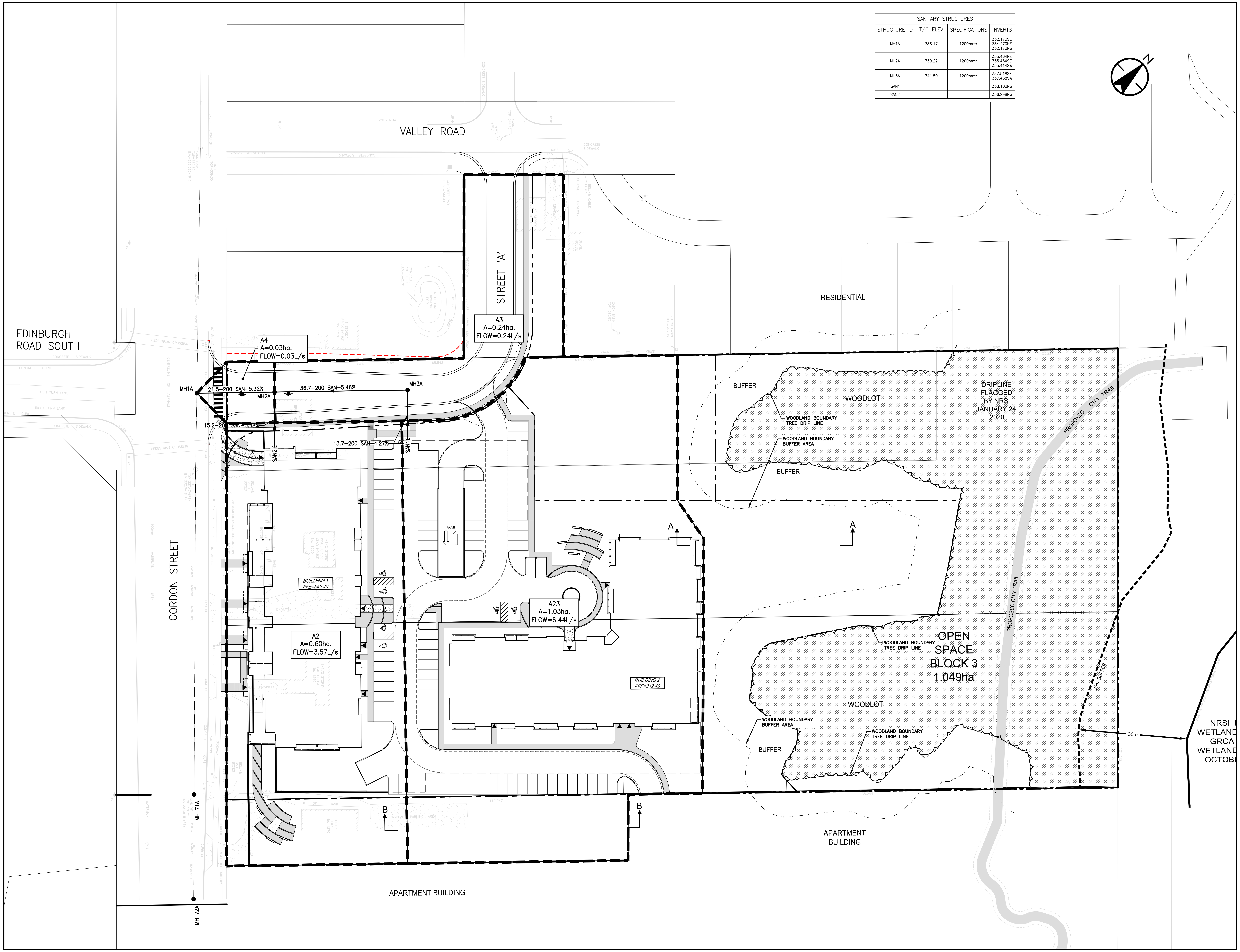
STORM DRAINAGE AREA PLAN

Project No. 161413684

Scale 1:400 0 4 12 20m

Drawing No.	Sheet	Revision
SSP-2	2 of 7	0

SANITARY STRUCTURES			
STRUCTURE ID	T/G ELEV	SPECIFICATIONS	INVERTS
MH1A	338.17	1200mmø	332.173SE 334.270NE 332.173NW
MH2A	339.22	1200mmø	335.464NE 335.464SE 335.414SW
MH3A	341.50	1200mmø	337.518SE 337.468SW
SAN1			338.103NW
SAN2			336.298NW



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Liability Note:

The Contractor shall verify and be responsible for all dimensions.
DO NOT scale the drawing - any errors or omissions shall be
reported to Stantec without delay.

Notes

1. CITY OF GUELPH BENCHMARK 225
ELEVATION 338.665 LOCATION: 1221 GORDON STREET
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Legend

A1	AREA ID
A=0.92ha.	CONTRIBUTING AREA (ha)
FLOW=6.44L/s	FLOW RATE (7L/s/ha. APARTMENTS–1L/s/ha. RESIDENTIAL)
▬ ▬ ▬	DRAINAGE BOUNDARY

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

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File Name: 161413684_c-ss	JAC	CJH	JAC	21.07.23

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C. J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

Title

SANITARY DRAINAGE AREA PLAN

Project No. 161413684

Scale 1:500 0 5 15 25m

Drawing No. SSP-3

Sheet 3 of 7

Revision 0

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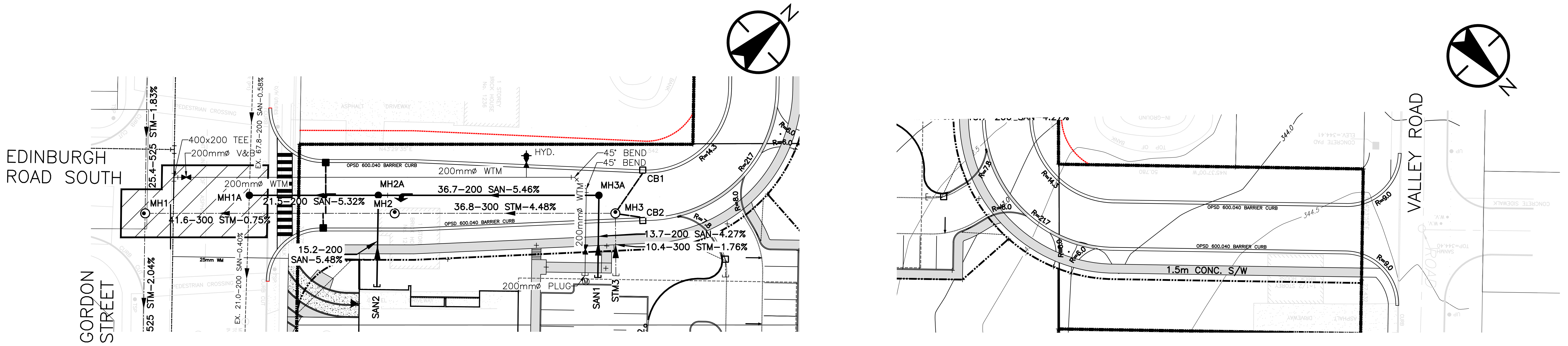
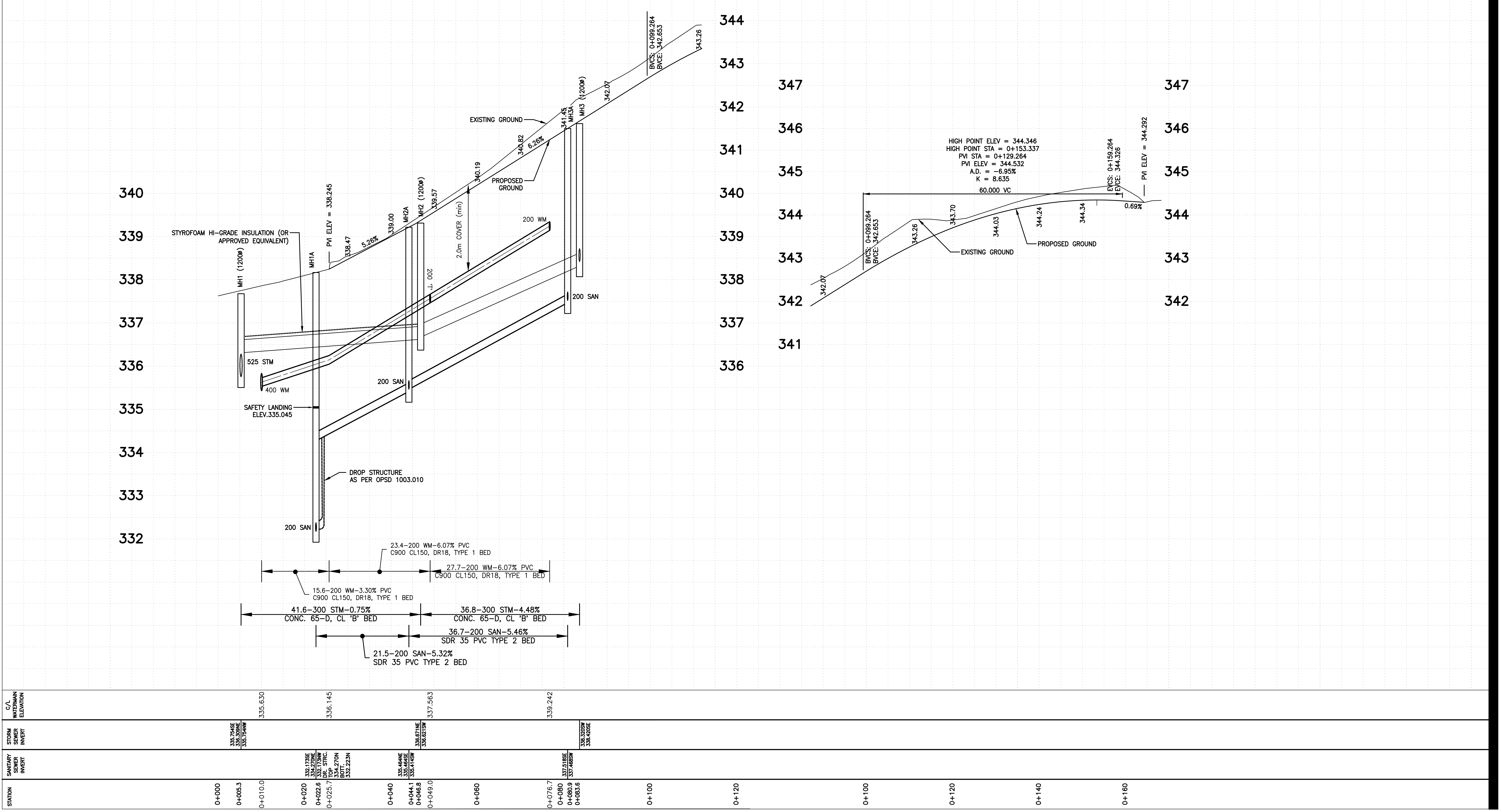


STREET 'A'

OPSD 600.040 CONCRETE BARRIED CURB WITH STANDARD GUTTER



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Notes

1. CITY OF GUELPH BENCHMARK 225 ELEVATION 338.665 LOCATION: 1221 GORDON STREET
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Legend

	SITE LIMIT
	EX. STORM SEWER
	PROPOSED STORM SEWER
	EX. SANITARY SEWER
	PROPOSED SANITARY SEWER
● S2	PROPOSED SANITARY MANHOLE
⊙ R2	PROPOSED STORM MANHOLE
⊙ CBMH1	PROPOSED CATCHBASIN MANHOLE
☐ CB or CICB	PROPOSED CATCHBASIN
⊙ EX. MH	EX. MANHOLE
☐ EX. CB	EX. CATCHBASIN
	PROPOSED WATERMAIN
	EX. WATERMAIN
	PROPOSED 3-WAY FIRE HYDRANT C/W STORZ CONNECTION
	EX. FIRE HYDRANT
	PROPOSED WATER VALVE
	EX. WATER VALVE
▨	RESTORATION LIMITS WITH LAP JOINT PER 509.010

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

File Name: 161413684_c-st	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	JAC	CJH	JAC	21.07.23

Permit-Seal

C. J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

Title

STREET 'A'
PLAN & PROFILE

Project No. 161413684

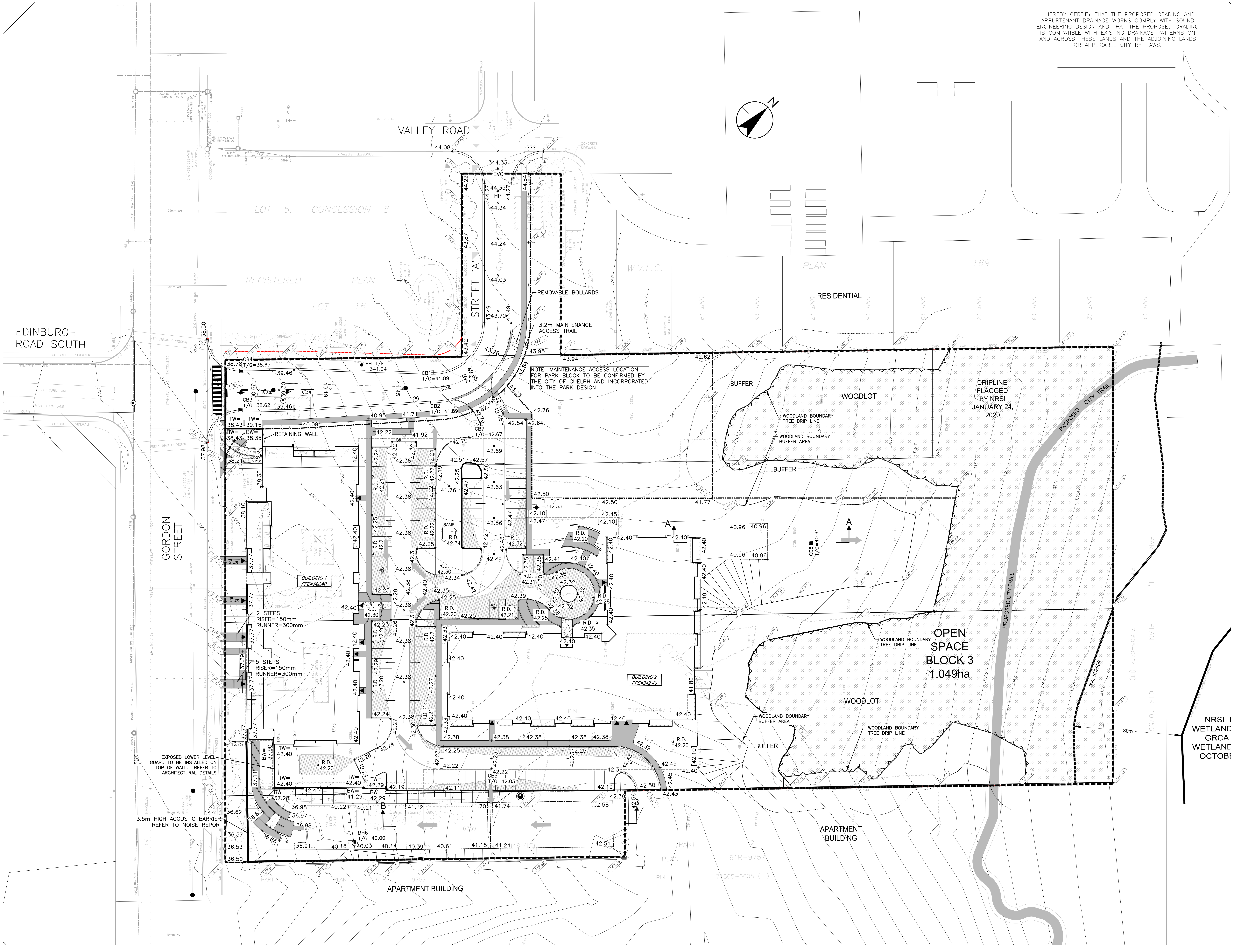
Scale 1:500 (0 5 15 25m)

Drawing No. SSP-4

Sheet 4 of 7

Revision 0

I HEREBY CERTIFY THAT THE PROPOSED GRADING AND APPURTENANT DRAINAGE WORKS COMPLY WITH SOUND ENGINEERING DESIGN AND THAT THE PROPOSED GRADING IS COMPATIBLE WITH EXISTING DRAINAGE PATTERNS ON AND ACROSS THESE LANDS AND THE ADJOINING LANDS OR APPLICABLE CITY BY–LAWS.



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Notes

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Legend

←	PROPOSED SWALE
⊙	PROPOSED STORM MANHOLE
▣	PROPOSED STORM CATCH BASIN MANHOLE
●	PROPOSED SANITARY MANHOLE
⊙	EX. STORM MANHOLE
⊙	EX. SANITARY MANHOLE
☐	PROPOSED CATCH BASIN
☐	EX. CATCH BASIN
•75.95	PROPOSED GRADES
•75.95 (SP)	PROPOSED OVERLAND FLOW SPILL POINT
(75.95) +	EXISTING GRADES
⇦	MAJOR OVERLAND FLOW ROUTE
▬ ▪ ▪ ▬	SITE BOUNDARY
• 71.77 (SW)	PROPOSED SWALE GRADE
180.5	EXISTING CONTOURS
←	FLOW DIRECTION
⌖	HYDRANTS

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

File Name: 161413684_c-fb	JAC	CJH	JAC	21.07.23
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

Title

GRADING PLAN

Project No. 161413684

Scale 1:500 (0 5 15 25m)

Drawing No. GP-1

Sheet 5 of 7

Revision 0

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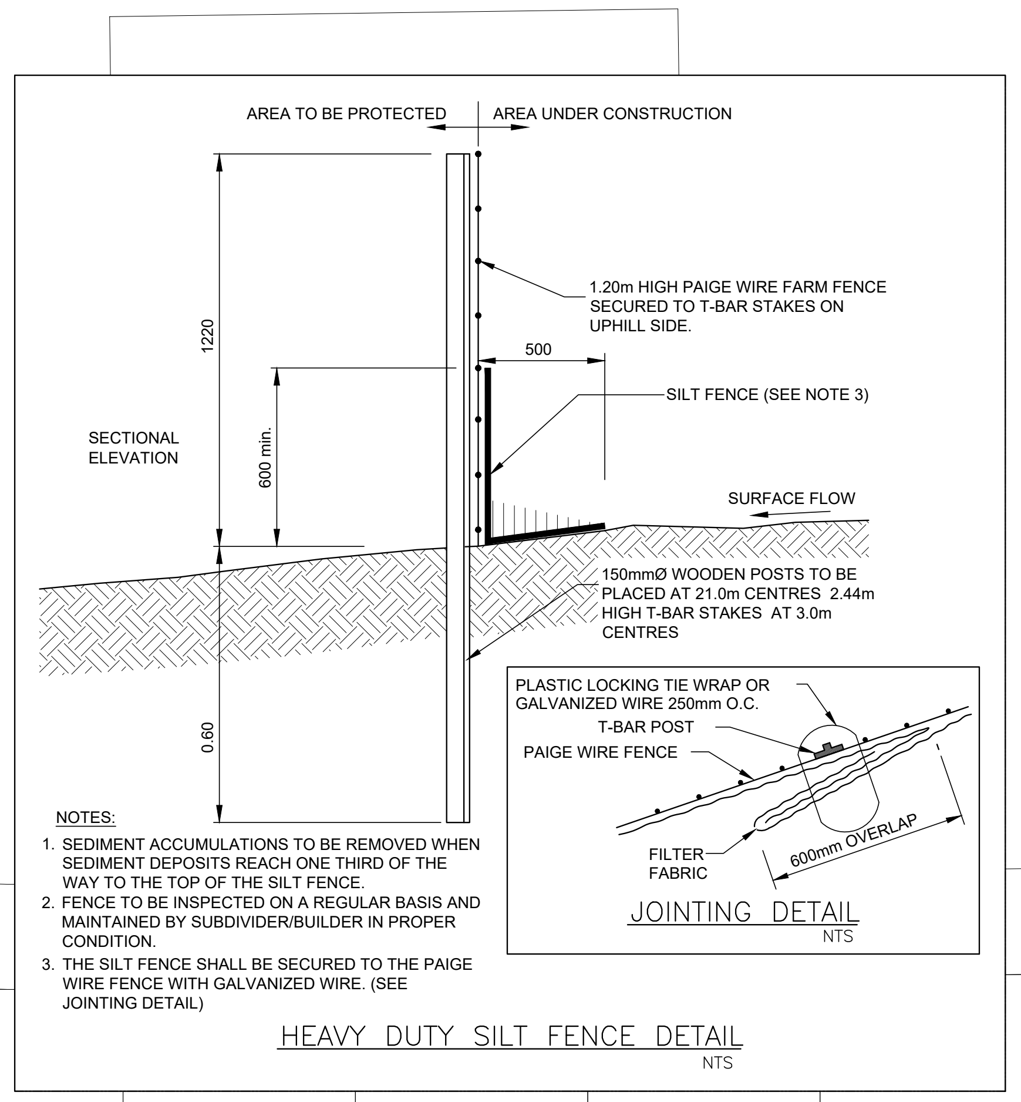


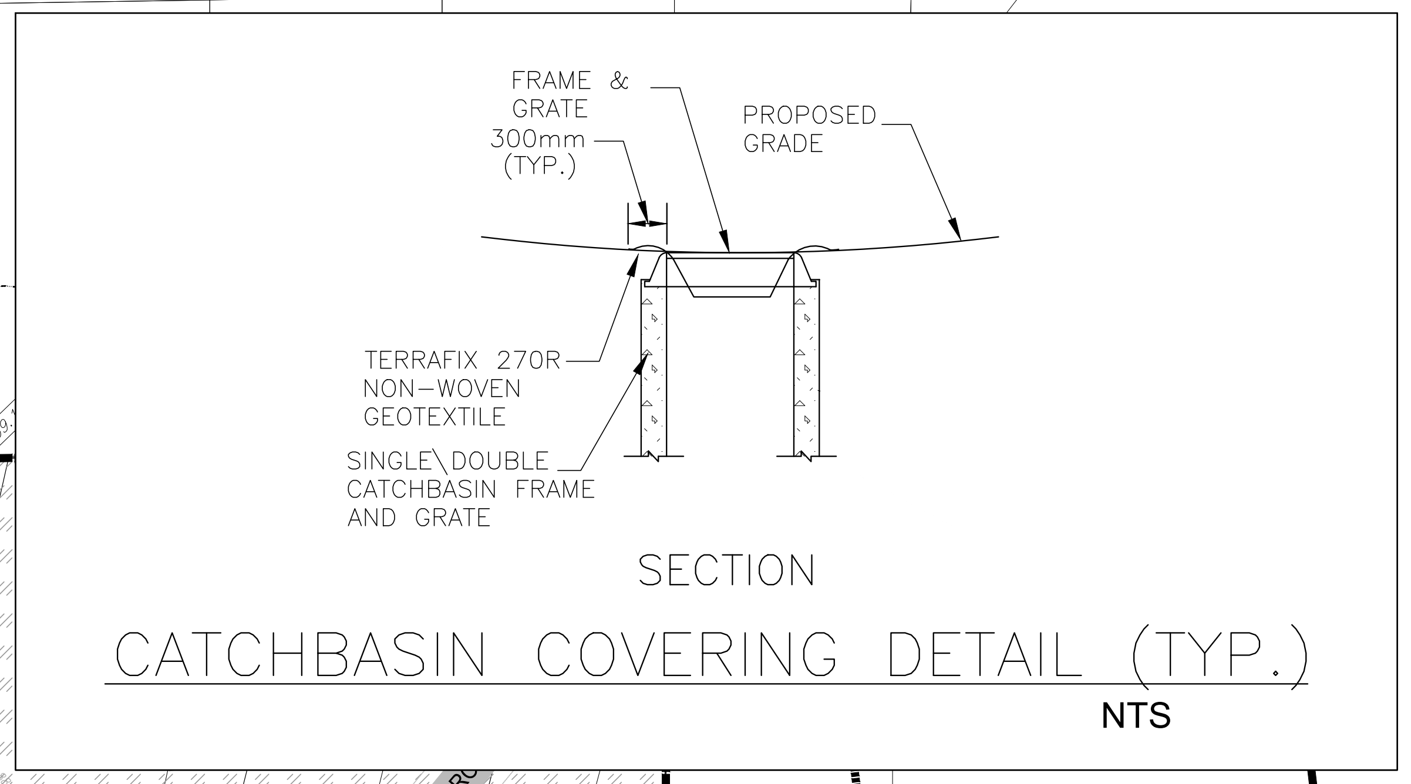
NOTES:

1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAIGE WIRE FENCE WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)

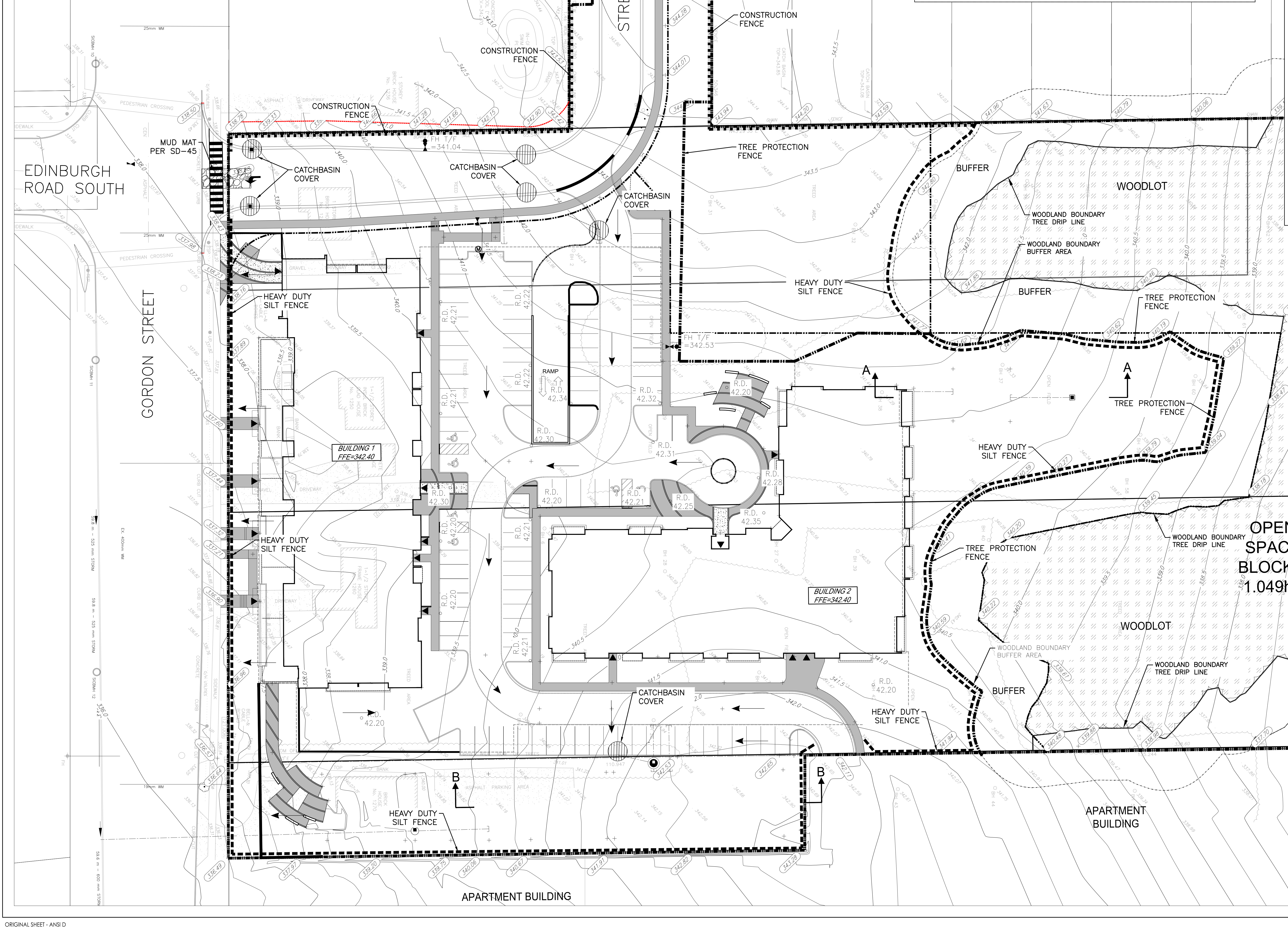
HEAVY DUTY SILT FENCE DETAIL
NTS

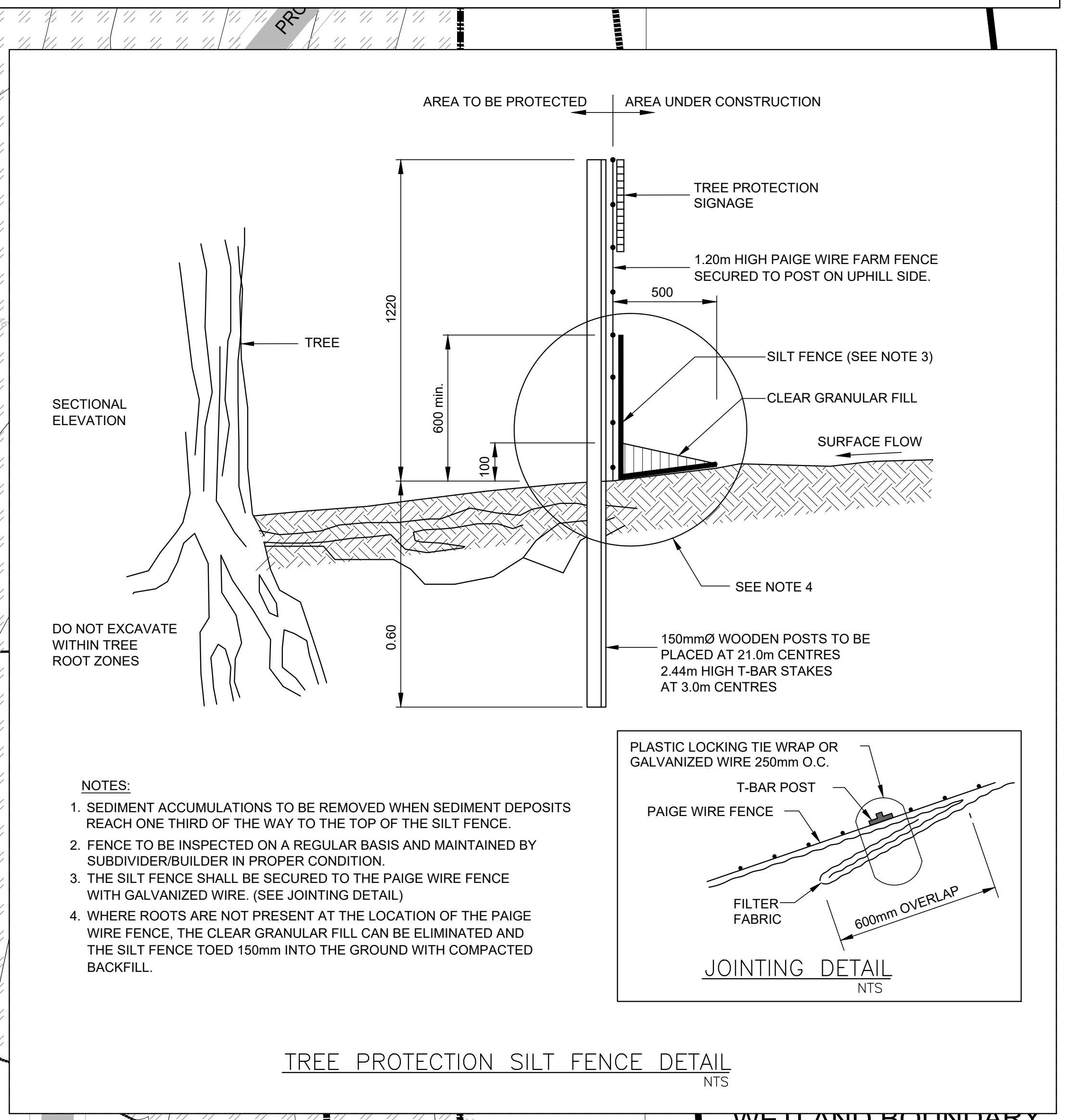
IMPLEMENTATION SCHEDULE AND DETAILS FOR EROSION AND SEDIMENTATION CONTROL MEASURES

PRIOR TO ANY SITE WORKS	– INSTALL ALL SILT FENCE AND PROTECTIVE FENCING AS SHOWN ON THE PLANS AND MAINTAIN DURING CONSTRUCTION. – MONTHLY EROSION AND SEDIMENT CONTROL REPORTS (QUARTERLY DURING PERIODS OF INACTIVITY OR HOUSE CONSTRUCTION) ARE TO BE SUBMITTED TO THE AUTHORITY UNTIL THE SITE HAS BEEN BUILT OUT (90%–100%) AND STABILIZED. REPORTS TO BE BASED ON FREQUENT INSPECTIONS PARTICULARLY AFTER SIGNIFICANT EVENTS.
DURING TOPSOIL STRIPPING	– CONSTRUCT TEMPORARY SEDIMENT CONTROL BASINS, DIVERSION SWALES & BERMS – CONSTRUCT TEMPORARY DIVERSION BERMS/SWALES/ROCK CHECK DAMS – SURPLUS TOPSOIL IS BE STOCKPILED IN LOCATIONS SHOWN
DURING AREA GRADING	– ALL DIVERSION BERMS/SWALES TO BE CHECKED REGULARLY AND AFTER EACH SIGNIFICANT RAINFALL AS GRADING PROCEEDS. DIVERSION BERMS/SWALES TO BE RECONSTRUCTED/RELOCATED AS NECESSARY TO ENSURE THAT THEY DIRECT FLOWS INTO BASINS. – SILT FENCE TO BE CHECKED REGULARLY AND AFTER EACH RAINFALL FOR UNDERMINING OR DETERIORATION OF THE FABRIC. SEDIMENT SHALL BE REMOVED WHEN THE LEVEL OF SEDIMENT DEPOSITION REACHES ONE THIRD OF THE WAY TO THE TOP OF THE BARRIER. – SEDIMENT CONTROL BASINS TO BE CHECKED REGULARLY AND AFTER EACH RAINFALL AND CLEANED OUT WHEN THE LEVEL OF SEDIMENT BUILDUP HAS REDUCED THE VOLUME OF THE DEAD STORAGE BY ONE HALF.
AFTER AREA GRADING	– ALL AREAS (INCLUDING STOCKPILES) WHERE ACTIVE CONSTRUCTION IS NOT EXPECTED FOR 30 DAYS, SHALL BE REVEGETATED WITH 50mm OF TOPSOIL AND HYDROSEEDED IN ACCORDANCE WITH OPSS 572.
DURING SERVICING AND ROADWORKS CONSTRUCTION	– MAINTAIN FUNCTION OF SEDIMENT CONTROLS – ENSURE GRADED AREAS DRAIN TO SEDIMENT BASINS – INSTALL ROCK CHECK DAMS IN LOW POINT OF AREAS CUT OFF BY ROADS AS DIRECTED BY THE ENGINEER. – INSTALL STORM SERVICE OUTLETS AT ALL LOW POINTS (SEE DETAILS) – CATCHBASINS TO BE SEALED UNTIL ROADS ARE PAVED. – INSTALL FILTER FABRIC UNDER CATCHBASIN GRATES
DURING HOUSE CONSTRUCTION	– SEDIMENTATION BASINS CONFLICTING WITH HOUSE CONSTRUCTION ARE TO BE FILLED AND STORM SERVICE OUTLETS ARE TO BE INSTALLED (SEE DETAIL). – STREETS TO BE KEPT CLEAN.
FOLLOWING SITE STABILIZATION	– REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%–100%) AND SITE STABILIZATION.



CATCHBASIN COVERING DETAIL (TYP.)
NTS





NOTES:

1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAIGE WIRE FENCE WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)
4. WHERE ROOTS ARE NOT PRESENT AT THE LOCATION OF THE PAIGE WIRE FENCE, THE CLEAR GRANULAR FILL CAN BE ELIMINATED AND THE SILT FENCE TOED 150mm INTO THE GROUND WITH COMPACTED BACKFILL.

TREE PROTECTION SILT FENCE DETAIL
NTS

WETLAND BOUNDARY
OCTOBER 29, 2014

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2021-8-24 1:56 PM by: Childs, Jason

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Liability Note:

Notes

1. CITY OF GUELPH BENCHMARK 225 ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
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Legend

▪▪▪▪▪▪▪▪	SILT FENCE (SD–74B)
▪▫▪▫▪▫▪▫	CONSTRUCTION FENCE
▬▪▪▬▪▪▬	TREE PROTECTION FENCE (SD–90A)
←	SURFACE FLOW DIRECTION
▨	CATCHBASIN COVERING

Revision	By	Appd.	YY.MM.DD

	By	Appd.	YY.MM.DD
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	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

C. J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

Title

EROSION & SEDIMENT CONTROL PLAN

Project No.
161413684

Scale
1:400
0 4 12 20m

Drawing No.
GP-2

Sheet
6 of 7

Revision
0

NOTES AND SPECIFICATIONS:

A. GENERAL:

1. BUILDINGS ARE NOT TO BE SITED WITH THIS DRAWING. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE SITE SERVICING PLANS (SSP SERIES) & THE GRADING PLAN (GP SERIES) PREPARED BY STANTEC CONSULTING.
2. THESE PLANS FOR CONSTRUCTION ONLY WHEN APPROVED BY THE CITY OF GUELPH AND SEALED BY THE ENGINEER.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL WORK WITHIN THE RIGHTS-OF-WAY OR CITY EASEMENTS ARE TO BE INSTALLED BY CITY OF GUELPH AT THE OWNER'S EXPENSE UNLESS OTHERWISE NOTED.
5. ANY PROPOSED CHANGES SHALL BE APPROVED BY THE ENGINEER AND CITY OF GUELPH.
6. ALL UNDERGROUND SERVICING TO BE INSPECTED BY STANTEC CONSULTING LTD. AND CERTIFIED FOR THE CITY OF GUELPH. CONTRACTOR SHALL COORDINATE WITH STANTEC AND SHALL CONTACT SAME AT LEAST 48 HOURS PRIOR TO INSTALLATION OF SERVICES.
7. CONTRACTOR SHALL COORDINATE WITH STANTEC AND SHALL CONTACT SAME AT LEAST 48 HOURS PRIOR TO INSTALLATION OF SERVICES.
8. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
9. THE PROPERTY OWNER IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY TO CITY OF GUELPH STANDARDS.
10. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE DEVELOPMENT & TECHNICAL SERVICES – ENGINEERING DEVELOPMENT DIVISION, PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.

B. UNDERGROUND SERVICES:

1. CONTRACTOR SHALL VERIFY ELEVATION AND LOCATION OF EXISTING SANITARY AND STORM SEWERS AND WATERMAINS PRIOR TO COMMENCING SITE WORK AND SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BETWEEN EXISTING AND PROPOSED SERVICES.
2. THE CONTRACTOR TO MAKE CONNECTIONS TO SERVICES AT STUB LOCATION FOR SANITARY, STORM SEWERS, WATERMAIN AND TO RESTORE ALL OFF-SITE AFFECTED PROPERTY TO ORIGINAL CONDITION.
3. ON-SITE SERVICING SHALL NOT BE UNDERTAKEN PRIOR TO COMPLETION OF SERVICE CONNECTIONS WITHIN THE ROAD R.O.W.'S.
4. ALL UNDERGROUND SERVICES TO BE IN COMPLIANCE WITH THE LATEST REVISED BUILDING CODE, CITY OF GUELPH ENGINEERING STANDARDS, ONTARIO PROVINCIAL STANDARDS (OPSS, OPSD) AND WITH THE LATEST REGULATIONS OF THE ONTARIO PLUMBING CODE AND SUPPLEMENT SPECIFICATION FOR MUNICIPAL SERVICES (DGSSMS) AND INSPECTED BY CITY STAFF/CONSULTANT PRIOR TO BACKFILLING.
5. UNDERGROUND SERVICES TO TERMINATE 1.5m FROM BUILDING LINE, PLUGGED OR CAPPED C/W MARKER EXTENDING FROM INVERT TO 1.0M ABOVE FINISHED GRADE.
6. ALL BEDDING TO BE AS NOTED BELOW. TRENCH BACKFILL TO BE APPROVED NATIVE MATERIAL COMPACTED IN 200mm MAX. LIFTS TO 95% STANDARD PROCTOR DENSITY.
7. ALL SERVICES SHALL BE TESTED AS SPECIFIED IN THE APPLICABLE OPSS (OPSS 410 & 441).
8. ALL SERVICES, UTILITIES AND CATCHBASIN LEADS ARE TO BE SUPPORTED AS PER OPSD 1007.01 DURING TRENCHING ACTIVITIES. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL EXISTING UTILITIES PRIOR TO AND DURING CONSTRUCTION. LOCATION OF EXISTING UTILITIES TO BE VERIFIED IN THE FIELD.
9. ANY UTILITY RELOCATION DUE TO THIS DEVELOPMENT TO BE UNDERTAKEN AT THE EXPENSE OF THE OWNER/DEVELOPER.

C. SEWERS/APPURTENANCES:

4. STORM SEWERS:
   - LESS THAN 200mmø – PVC DR-28
   - 200mmø TO 375mmø – PVC DR-35
– PVC RIBBED PIPE (ULTRA-RIB OR EQUIVALENT)
– CL-3 CONCRETE
   - 450mmø TO 600mmø – PVC RIBBED PIPE (ULTRA-RIB OR EQUIVALENT)
– 65D CONCRETE
   - 450mmø TO 600mmø – 65D CONCRETE
5. SANITARY SEWERS:
   - LESS THAN 200mmø – PVC DR-28
   - 200mmø OR LARGER – PVC DR-35
   - 2.5m MINIMUM COVER FOR SANITARY SEWERS.
3. SEWER BEDDING:
   - CITY OF GUELPH SD-29
   - 150mm (MIN) GRAN 'A' TO 98% S.P.D.
4. STORM MANHOLES:
   - OPSD 701.010 (1200mmø)
   - OPSD 701.011 (1500mmø)
   - OPSD 701.012 (1800mmø)
   - OPSD 701.013 (2400mmø)
   - OPSD 701.014 (3000mmø)
6. SANITARY MAINTENANCE HOLE:
   - OPSD 701.010 (1200mmø)
7. MAINTENANCE HOLE BENCHING:
   - CITY OF GUELPH SD-44
   - CBMH'S WITH AN OUTLET PIPE GREATER THAN 450mmø SHOULD BE BENCHED. 450mmø OR LESS SHALL BE PROVIDED WITH A 600mm SUMP.
8. CATCHBASINS/CATCHBASIN LEADS:
   - OPSD 705.01 (SINGLE)
   - OPSD 705.02 (DOUBLE)
   - OPSD 705.03 (DITCH INLET – 3:1 SLOPE)
   - MINIMUM LEAD DIAMETER. 200mmø FOR SINGLE, 300mmø FOR DOUBLE CATCHBASINS.
9. FRAMES AND GRATES/COVERS:
   - OPSD 400.10 (CB'S & CBMH'S)
   - OPSD 401.01 TYPE 'A' (SANITARY AND STORM MH'S)
   - CITY OF GUELPH SD-15 (RLCB'S)
   - CITY OF GUELPH SD-16 (DICB'S)
   - CITY OF GUELPH SD-9 (SAFETY GRATE FOR MH'S)
   - ALL FRAMES ON STRUCTURES TO BE SET USING PRECAST CONCRETE ADJUSTMENT UNITS

D. WATER SERVICES/APPURTENANCES:

1. WATERMAIN
   - 100mmø TO 300mmø – AWWA C-900 PVC SDR-18
   - 350mmø TO 600mmø – AWWA C905 PVC SDR-25
   - 2.0m MINIMUM COVER
   - FITTINGS TO AWWA C-907
   - WHERE CONFLICT ARISES AT WATERMAIN/SERVICE CROSSING OTHER UNDERGROUND SERVICES, WATERMAIN/SERVICES SHALL BE LOWERED TO MAINTAIN 0.50m VERTICAL SEPARATION.
2. PIPE BEDDING:
   - CITY OF GUELPH SD-29
   - 150mm (MIN) GRANULAR 'A' 98% S.P.D.
3. THRUST BLOCKING:
   - CITY OF GUELPH SD-27
4. TRACER WIRE:
   - CITY OF GUELPH SD-54A
5. HYDRANTS:
   - CITY OF GUELPH SD-25A (OPEN RIGHT)
6. VALVES:
   - ALL VALVES TO OPEN COUNTER-CLOCKWISE AND COMPLY WITH A.W.W.A. SPEC.
   - CITY OF GUELPH SD-24
7. WATER SERVICES
   - 25mmø TYPE K COPPER PIPING WET TAPPED TO PVC WATERMAIN WITH APPROVED SADDLE
   - CITY OF GUELPH SD-54B
8. WATER METERS:
   - BUILDING UNITS TO HAVE INDIVIDUAL WATER METERS TO THE SATISFACTION OF CITY OF GUELPH WATERWORKS DEPARTMENT
9. MAINTAIN SPATIAL SEPARATION FOR SITE SERVICES PER BUILDING CODE PART 7.3.5.6
10. ALL NEW WATER PIPING INSTALLATIONS AS PER AWWA C651-05
11. CATHODIC PROTECTION IN ACCORDANCE WITH CITY OF GUELPH STANDARDS.
12. A WATERMAIN COMMISSIONING PLAN IN ACCORDANCE WITH DGSSMS WILL BE REQUIRED.

E. GRADING:

1. COMPLETE ALL EXCAVATION, GRADING, TRIMMING AND COMPACTION AS REQUIRED TO FACILITATE THE WORK, ALL SUBGRADE AREAS SHALL BE PROOF ROLLED TO 98% S.D.P. PRIOR TO GRANULAR SUBBASE PLACEMENT.
2. DISPOSE OF ALL SURPLUS AND UNSUITABLE MATERIAL OFFSITE.
3. SAWCUT ASPHALT IN NEAT LINES AT ALL MATCH LINES.
4. MATCH EXISTING GRADES AT ADJACENT PROPERTY LINES.
5. TRANSITION SLOPES TO BE MAXIMUM 3:1 (HORIZONTAL TO VERTICAL) UNLESS OTHERWISE NOTED.

F. SURFACE WORKS:

1. CURBS:
   - OPSD 600.040 (CONCRETE BARRIER CURB WITH STANDARD GUTTER)
   - OPSD 600.070 (CONCRETE BARRIER CURB WITH STANDARD GUTTER, TWO STAGE CONSTRUCTION)
   - OPSD 600.080 (CONCRETE BARRIER CURB WITH NARROW GUTTER)
   - OPSD 600.110 (CONCRETE BARRIER CURB)
2. ASPHALT PAVEMENT: (PARKING AREA)
   - 40mm HL 3 (SURFACE ASPHALT) 97% MARSHALL
   - 50mm HL4 (BASE ASPHALT) 97% S.P.D.
   - 150mm GRANULAR 'A' BASE 100% S.P.D.
   - 300mm GRANULAR 'B' SUB-BASE 100% S.P.D.
3. ASPHALT PAVEMENT: (ABOVE PARKING GARAGE)
   - CONCRETE DECK
   - ROOFING MEMBRANE
   - PROTECTION BOARD
   - 40MM HL 3 (SURFACE ASPHALT) 97% MARSHALL
   - 50MM HL4 (BASE ASPHALT) 97% S.P.D.
4. PAVEMENT: (HEAVY DUTY/FIRE ROUTE)
   - 50mm HL-3 SURFACE ASPHALT 97% MARSHALL – (WHERE IN PLACE)
   - 60mm HL-4 BASE ASPHALT 97% MARSHALL
   - 150mm GRANULAR 'A' 100% S.P.D.
   - 400mm GRANULAR 'B' 100% S.P.D.
   - SAW CUT CLEAN EDGES AT ALL MATCH LINES AND APPLY TACK COAT.
5. CONCRETE SIDEWALKS:
   - CITY OF GUELPH SD-2, 1.5m WIDE (CONCRETE SIDEWALK)
   - CITY OF GUELPH SD-4 (SIDEWALK RAMPS)
6. SITE AREAS DISTURBED BY CONSTRUCTION AND NOT INDICATED FOR REMOVAL TO BE RESTORED TO ORIGINAL CONDITIONS.

G. EROSION CONTROL:

1. ALL SILT FENCING TO BE INSTALLED PRIOR TO COMMENCEMENT OF ANY AREA GRADING, EXCAVATION OR DEMOLITION.
2. EROSION CONTROL FENCE TO BE PLACED AROUND THE BASE OF ALL STOCKPILES. ALL STOCKPILES TO BE KEPT A MINIMUM OF 2.5m FROM ALL PROPERTY LINES.
3. P-250 FILTER FABRIC UNDERLYING CONSTRUCTION VEHICLE ENTRANCE TO CONSIST OF CLEANED OR REPLACED 200mm THICK, 50mmø STONE. STONE TO BE TAKEN UP AND WHEN ACCUMULATIONS COVER 50% OF TOP OF STONE (SEE DETAIL).
4. EROSION PROTECTION TO BE PROVIDED AROUND ALL STORM AND SANITARY MANHOLES AND/OR CATCHBASINS.
5. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE DEVELOPMENT PROGRESSES. CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES.
6. EROSION CONTROL STRUCTURES TO BE MONITORED REGULARLY BY STANTEC CONSULTING LTD. AND ANY DAMAGE REPAIRED IMMEDIATELY. SEDIMENTS TO BE REMOVED WHEN ACCUMULATIONS REACH A MAXIMUM OF ONE THIRD (1/2) THE HEIGHT OF THE SILT FENCE.
7. ALL EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RE-STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
8. NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY STANTEC CONSULTING LTD. AND THE CITY OF GUELPH'S WORKS DEPARTMENT
9. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SEDIMENTS FROM THE MUNICIPAL ROAD AND SIDEWALKS AT THE END OF EACH WORK DAY.
10. MUD MATS TO BE PROVIDED ON SITE AT ALL LOCATIONS WHERE CONSTRUCTION VEHICLES EXIT THE SITE. MUD MATS SHALL BE A MINIMUM OF 3.0m WIDE, 15.0m LONG (LENGTH MAY VARY DEPENDING ON SITE LAYOUT) AND 0.3m DEEP AND SHALL CONSIST OF 20mm CLEAR STONE MATERIAL OR APPROVED EQUIVALENT. CONTRACTOR TO ENSURE ALL VEHICLES LEAVE THE SITE VIA THE MUD MAT AND THAT THE MAT IS MAINTAINED IN A MANNER TO MAXIMIZE ITS EFFECTIVENESS AT ALL TIMES.
11. STANTEC CONSULTING LTD. TO MONITOR THE SITE DEVELOPMENT TO ENSURE ALL EROSION CONTROLS ARE INSTALLED AND MAINTAINED TO CITY REQUIREMENTS. CONTRACTOR TO COMPLY WITH THE ENGINEER'S INSTRUCTIONS TO INSTALL, MODIFY, OR MAINTAIN EROSION CONTROL WORKS.

H. RETAINING WALLS:

1. RETAINING WALL TO BE CONSTRUCTED AS DESIGNED BY OTHERS. APPROPRIATE CONSTRUCTION DETAILS SHALL BE PROVIDED FOR RETAINING WALLS HIGHER THAN 0.80m. DETAILS SHALL BE DESIGNED AND SEALED BY A PROFESSIONAL ENGINEER UPON APPROVAL. GUARD RAIL IS REQUIRED WHEN HEIGHT EXCEEDS 0.80m.
2. CONTRACTOR TO CONTACT GEOTECHNICAL ENGINEER 48 HOURS PRIOR TO CONSTRUCTION OF RETAINING WALL TO ALLOW FOR INSPECTION OF SOIL CONDITIONS.
3. ANY CHANGES IN WALL HEIGHT MUST BE APPROVED BY THE ENGINEER.
4. BUILDING PERMIT MUST BE OBTAINED FOR RETAINING WALL

I. DEWATERING NOTES:

1. PUMPED GROUNDWATER WILL BE DIRECTED OFFSITE VIA SWALE AND/OR TEMPORARY PIPE TO POPPY DRIVE EAST, WHERE THE WATER WILL BE DISCHARGED TO EITHER THE STORM OR SANITARY SEWER SYSTEM.
2. DISCHARGE TO THE STORM AND/OR SANITARY SEWER SYSTEM MUST ADHERE TO THE QUALITY REQUIREMENTS AS PER CITY OF GUELPH BY-LAW NUMBER (1996)-15202.

J. MISCELLANEOUS:

1. WHERE COVER OVER SEWERS IS LESS THAN 1.2m IN PAVED AREAS, OR LESS THAN 0.90m IN GRASSED AREAS INSTALL INSULATION AS PER DETAIL. INSULATION TO BE 60mm THICK x 1800mm WIDE UNLESS OTHERWISE NOTED. INSTALL LONGITUDINALLY OVER CENTERLINE OF PIPE WITH OVERLAPPING JOINTS.
2. IT IS THE SITE OWNERS' RESPONSIBILITY TO ENSURE THAT ALL SEDIMENT CONTROLS ARE IMPLEMENTED AND MAINTAINED IN ACCORDANCE WITH THE ABOVE CRITERIA.

UNDERGROUND STORAGE AND INFILTRATION TRENCHES

1 PRIOR TO INSTALLATION

- EFFORTS SHOULD BE MADE TO AVOID COMPACTION BY NOT USING THE FACILITY LOCATION AS:
- LAYDOWN OR STOCKPILE LOCATIONS;
- EQUIPMENT STORAGE;
- TRAFFIC FLOW OR SITE ACCESS.
- MATERIAL TO BE USED IN THE CONSTRUCTION OF THE FACILITY SHOULD NOT BE BROUGHT ON SITE PRIOR TO IT BEING NEEDED. IF THIS MATERIAL IS ON SITE PRIOR TO FINAL PLACEMENT, IT SHALL BE STOCKPILED SEPARATELY FROM ANY OTHER CONSTRUCTION MATERIALS AND ADEQUATELY PROTECTED (AS DIRECTED BY THE LID INSPECTOR).

2 INSTALLATION

- TRENCH FLOOR TO BE SCARIFIED TO A DEPTH OF 0.15M UNLESS THE LID INSPECTOR DIRECTS GREATER DEPTHS OF SCARIFICATION.
- ONCE THE AREA IS SCARIFIED, AT LEAST 2 LOCATIONS IN EACH FACILITY ARE TO BE TESTED FOR IN-SITU INFILTRATION RATE. ADDITIONAL SCARIFICATION MAY BE REQUIRED FOLLOWING THESE TESTS, AFTER WHICH THE TESTS SHOULD BE COMPLETED AGAIN IN OTHER LOCATIONS.
- SHOULD THE TRENCH WORK BE COMPLETED IN ADVANCE ON THE INSTALLATION OF THE GEOTEXTILE AND STONE, THE TRENCH SHOULD BE PROTECTED IN THE EVENT OF RAIN.
- THE OVERLAP ON THE GEOTEXTILE SHALL BE A MINIMUM OF 0.3M. THE GEOTEXTILE SHALL BE WRAPPED OVERTOP OF THE STONE STORAGE AT THE MINIMUM OVERLAP.
- ALL STONE INSTALLED IS TO BE TRIPLE WASHED TO PREVENT DUST FROM CLOGGING THE FABRIC AND SOIL PORES. STONE IS TO BE INSTALLED IN LIFTS OF 0.3M MAXIMUM. THESE LIFTS SHOULD BE LIGHTLY WORKED TO SETTLE THE STONE BUT MECHANICAL COMPACTION IS NOT TO BE USED.
- ALL UNDERDRAIN PIPES ARE TO BE WRAPPED IN A SEDIMENT SOCK.
- IF THE FACILITY IS COMPLETED PRIOR TO SITE STABILIZATION, RUNOFF SHOULD BE DIRECTED AWAY FROM THE FACILITY TO PREVENT HEAVY SEDIMENTATION. EROSION CONTROLS SHOULD BE INSTALLED AS PER THE DIRECTION OF THE LID INSPECTOR.

3 MAINTENANCE

- REMOVE ANY DEBRIS, GARBAGE, LEAVES, STICKS, OR OTHER ITEMS FROM THE FACILITY INLETS. THIS SHOULD BE DONE BIANNUALLY WITH SPECIAL ATTENTION IN FALL TO REMOVE FALLEN LEAVES;
- REMOVE ACCUMULATED SEDIMENT FROM THE BOTTOM OF THE FACILITY AS NEEDED BY FLUSHING;
- MONITOR PERFORMANCE; OBSERVE WATER DEPTHS IN THE FACILITY DURING RAIN EVENTS BIANNUALLY.

OIL GRIT SEPARATOR

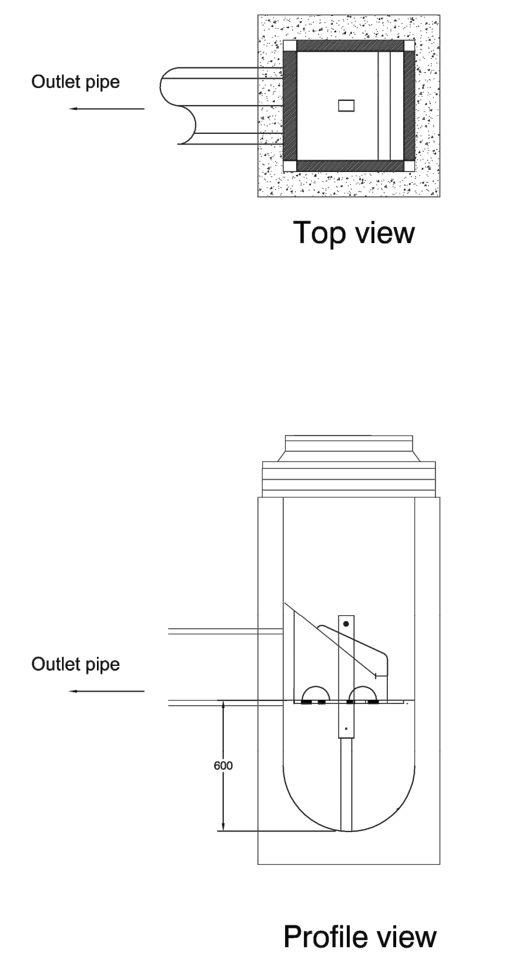
1 INSTALLATION

- ONCE INSTALLED, THE INLET TO THE OGS SHOULD BE SURROUNDED BY A FILTER SOCK RING TO REMOVE THE HEAVIEST SEDIMENT LOADS. THE OGS SHOULD BE INSPECTED BIWEEKLY DURING CONSTRUCTION AND CLEANED BY VACUUM TRUCK WHEN THE SUMP IS 50% FULL OF SILT.
- WHEN CONSTRUCTION IS COMPLETE, THE OGS SHOULD BE CLEANED OF ANY SEDIMENT.

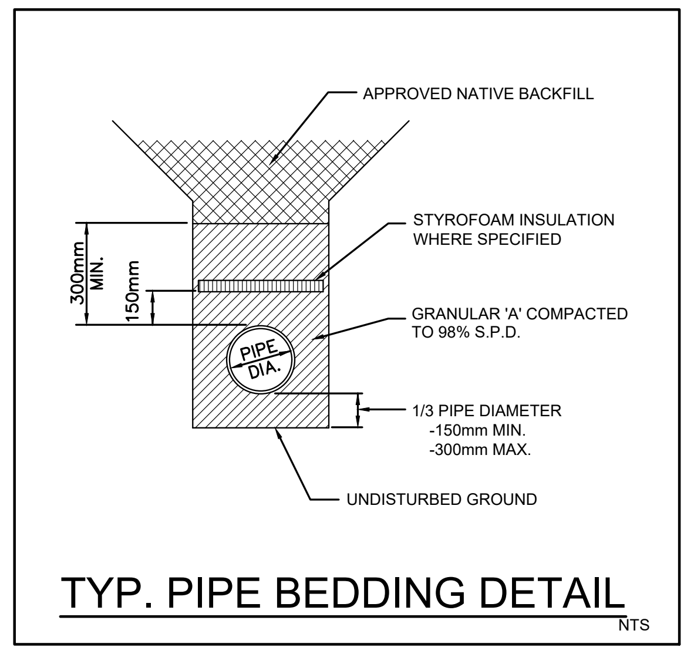
2 MAINTENANCE

- INSPECTION SHOULD BE DONE BIANNUALLY;
- REMOVE ACCUMULATED SEDIMENT FROM THE BOTTOM OF THE FACILITY WHEN 50% FULL BY VACUUM TRUCK;
- REMOVAL OF ANY OILS OR FLOATABLES AS NEEDED, WITH SPECIAL ATTENTION PAID IN THE EVENT OF A DELETERIOUS SPILL.

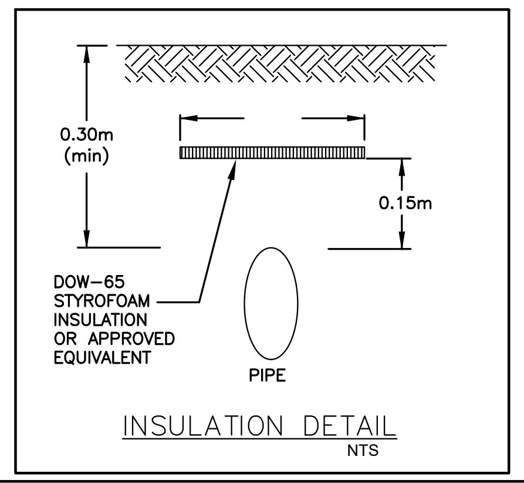
Notes
1. CB Shield can be installed at any time. In a non frozen condition.
2. The frame and cover should be well aligned with the catchbasin for proper installation
3. The catchbasin sump must be clean before installation
4. The grate should be at the same level as the standing water in the sump.



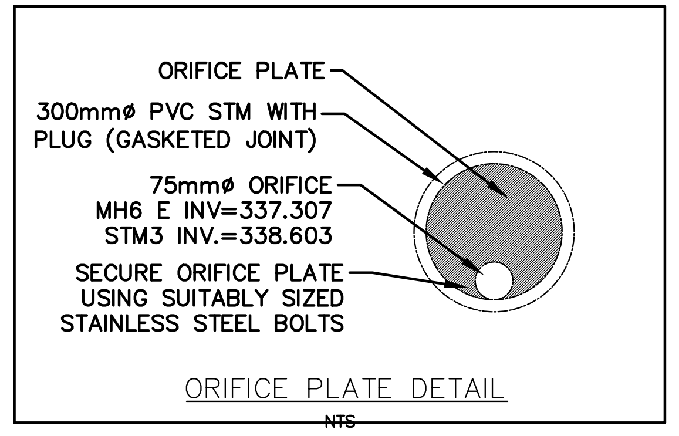
CB Shield (600mm Sump)



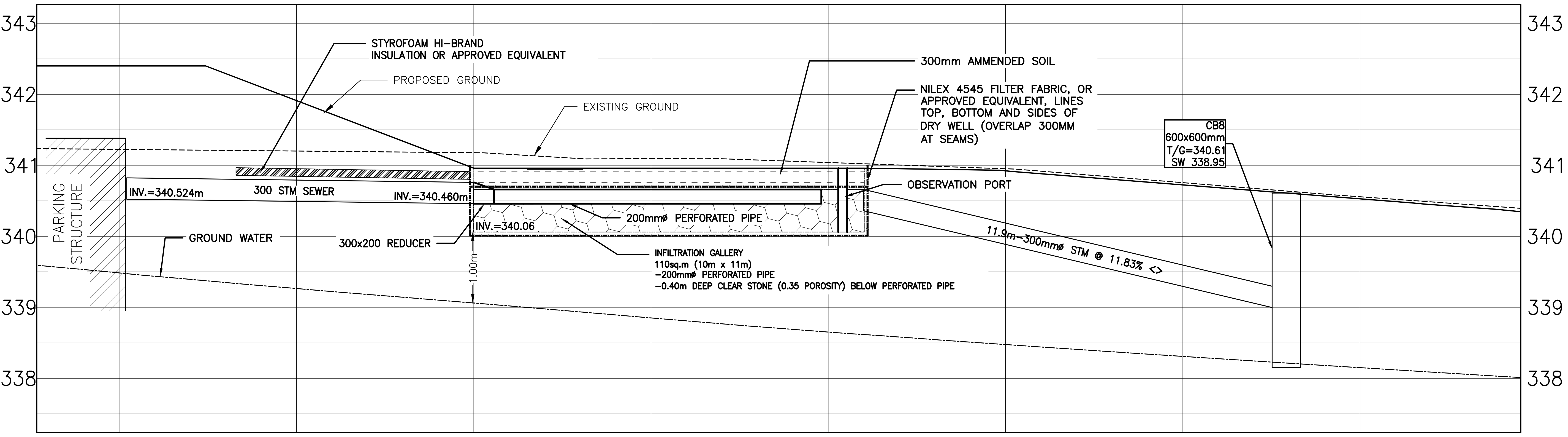
TYP. PIPE BEDDING DETAIL
NTS



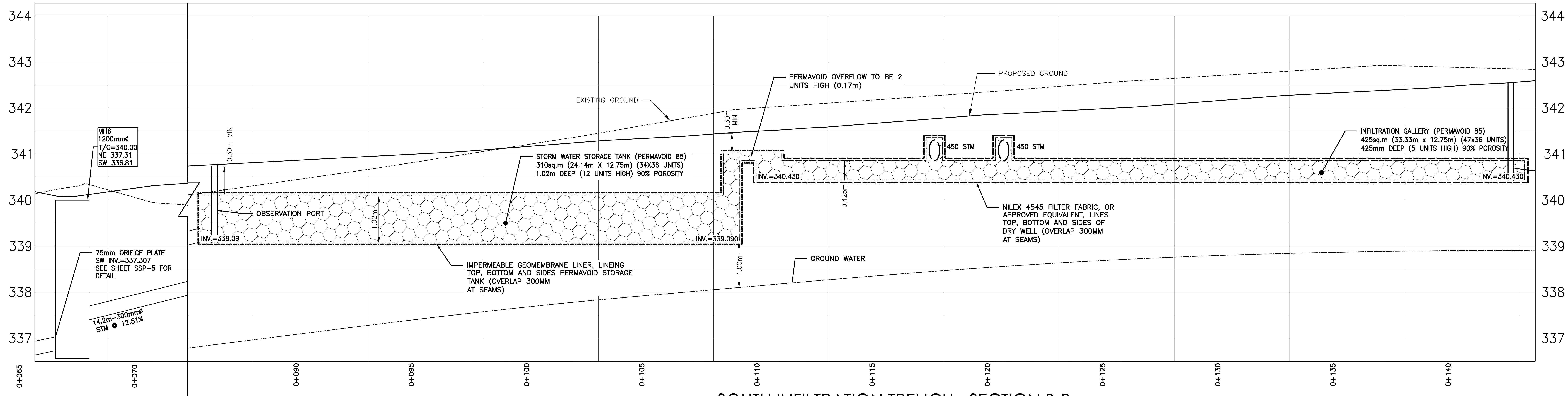
INSULATION DETAIL
NTS



ORIFICE PLATE DETAIL
NTS



EAST INFILTRATION TRENCH - SECTION A-A
VERT - 1:50 HORZ - 1:100



SOUTH INFILTRATION TRENCH - SECTION B-B
VERT - 1:50 HORZ - 1:100

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ORIGINAL SHEET - ANSI D

Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Liability Note:
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

Notes
1. CITY OF GUELPH BENCHMARK 225 ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER

Legend

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

	Dwn.	Chkd.	Dsgn.	YY.MM.DD
File Name: 161413684_c-dt	JAC	CJH	JAC	21.07.23

Permit-Seal
C. J. HENDRIKSEN
100125181
Aug 24/21

Client/Project
TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

Title
NOTES & DETAILS

Project No. 161413684
Scale 1:100

Drawing No. SSP-5
Sheet 7 of 7
Revision 0

FIGURE 1 – EXISTING STORM DRAINAGE CONDITIONS

Stantec

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London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

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Notes

1. CITY OF GUELPH BENCHMARK 225 ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER
4. SITE PLAN PREPARED BY STANTEC, DATED JANUARY, 2020.

101 / A=1.73 AREA ID / CONTRIBUTING AREA (ha)

↑ MAJOR OVERLAND FLOOD ROUTE

- - - - DRAINAGE BOUNDARY

Revision	By	Appd.	YY.MM.DD
1. SITE PLAN REVISIONS	JAC	CJH	21.05.14

Issued	By	Appd.	YY.MM.DD
2. FOR SITE PLAN APPROVAL	JAC	CJH	21.05.14
1. FOR SITE PLAN APPROVAL	JAC	CJH	20.03.24

	Dwn.	Chkd.	Dsgn.	YY.MM.DD
File Name: 161413684_c-sd_ex	JAC	CJH	JAC	19.05.31

Permit-Seal

Client/Project

TRICAR DEVELOPMENTS INC.

1250 GORDON STREET

GUELPH, ON

Title

EXISTING STORM DRAINAGE CONDITIONS

Project No. 161413684

Scale 1:400 0 4 12 20m

Drawing No. 1

Sheet 1 of 2

Revision 1

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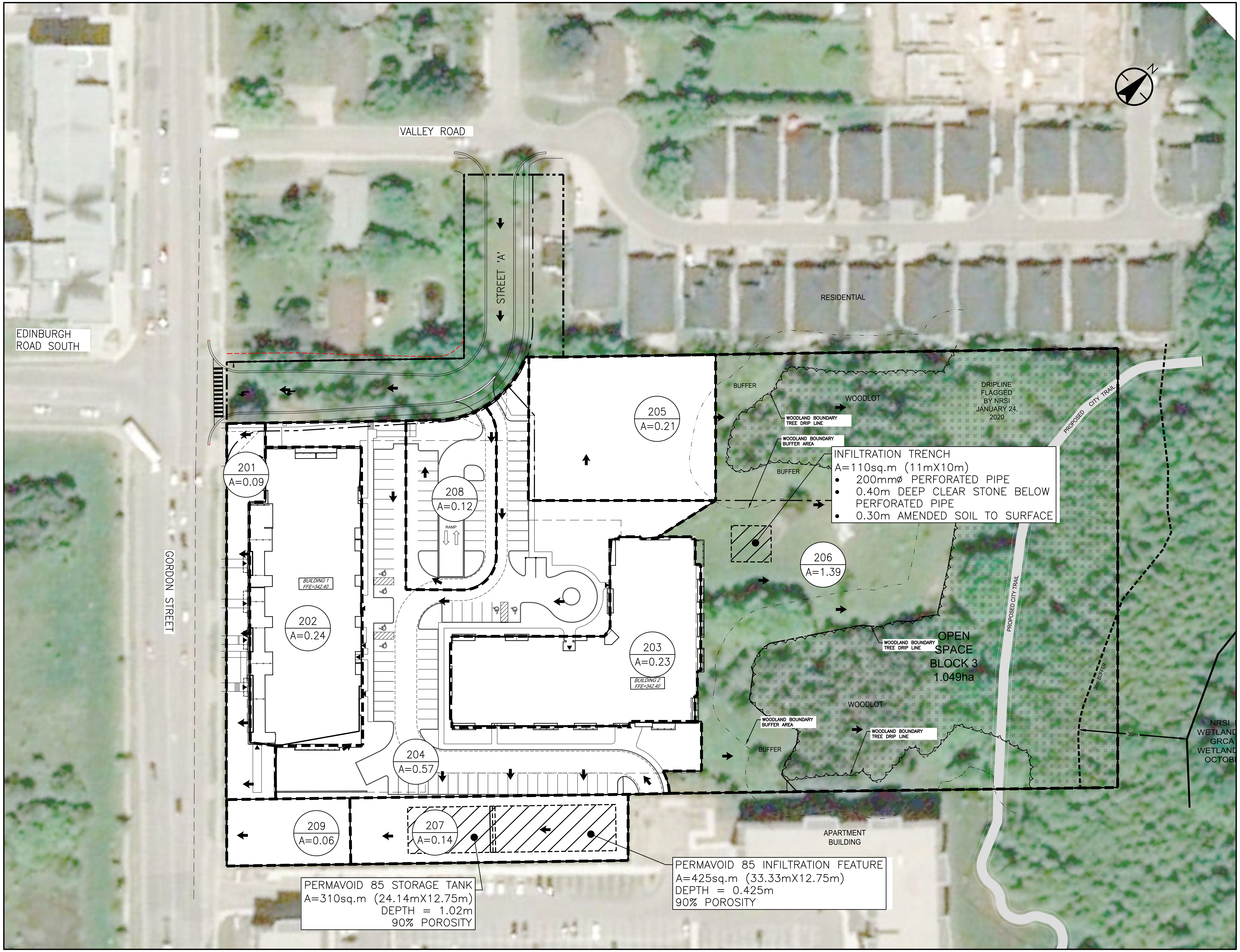
FIGURE 2 - PROPOSED STORM DRAINAGE CONDITIONS



INFILTRATION TRENCH
A=110sq.m (11mX10m)
- 200mmø PERFORATED PIPE
- 0.40m DEEP CLEAR STONE BELOW PERFORATED PIPE
- 0.30m AMENDED SOIL TO SURFACE

PERMAVOID 85 STORAGE TANK
A=310sq.m (24.14mX12.75m)
DEPTH = 1.02m
90% POROSITY

PERMAVOID 85 INFILTRATION FEATURE
A=425sq.m (33.33mX12.75m)
DEPTH = 0.425m
90% POROSITY

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ORIGINAL SHEET - ANSI D

Stantec

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www.stantec.com

Liability Note:

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

Notes

1. CITY OF GUELPH BENCHMARK 225 ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER
4. SITE PLAN PREPARED BY STANTEC, DATED JANUARY, 2020.

Legend

201	AREA ID
A=0.12	CONTRIBUTING AREA (ha)
↑	MAJOR OVERLAND FLOOD ROUTE
▬ ▬ ▬	DRAINAGE BOUNDARY

2. SITE PLAN REVISIONS	JAC	CJH	21.07.30
1. SITE PLAN REVISIONS	JAC	CJH	21.05.14
Revision	By	Appd.	YY.MM.DD

File Name: 161413684_c-sd_prop	DRR	CJH	DRR	19.05.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

TRICAR DEVELOPMENTS INC.

1250 GORDON STREET

GUELPH, ON

Title

PROPOSED STORM DRAINAGE CONDITIONS

Project No. 161413684

Scale 1:400 0 4 12 20m

Drawing No. 2

Sheet 2 of 2

Revision 2

HYDROLOGIC MODELLING PARAMETERS

1250 Gordon Street [161413684]
MIDUSS Parameters

Table 1: CN Values

Land Use		Hydrologic Soil Type							Source
		A	AB	B	BC	C	CD	D	
Meadow	"Good"	30	44	58	65	71	75	78	USDA
Woodlot	"Fair"	36	48	60	67	73	76	79	USDA
Lawns	"Good"	39	50	61	68	74	77	80	USDA
Pasture/Range		49	55	60	70	79	82	84	USDA
Crop		64	70	74	79	81	84	85	USDA
Gravel		76	81	85	87	89	90	91	USDA
Bare Soil (Fallow)		77	82	86	89	91	93	94	USDA
Impervious		98	98	98	98	98	98	98	USDA

USDA - United States Department of Agriculture (2004), National Engineering Handbook, Part 630 Hydrology,

Table 2: Pre-Development Parameters

Area Description	Catchment Number	Area (ha)	Curve Number	Runoff Coefficient (C)	Flow Path Length (m)	Slope (%)	Imperviousness (%)	Initial Abstraction - Pervious (mm)
To Gordon Street	101	1.330	68	0.27	140.00	3.00	10.0	5.0
To Torrence Watershed	102	1.720	68	0.21	150.00	5.00	1.0	5.0
TOTAL AREA		**3.05**						

Table 3: Post-Development Parameters

Area Description	Catchment Number	Area (ha)	Curve Number	Runoff Coefficient (C)	Flow Path Length (m)	Slope (%)	Imperviousness (%)	Initial Abstraction - Pervious (mm)
Uncontrolled to Gordon	201	0.090	68	0.69	10.00	2.00	70.0	5.0
Building West	202	0.240	68	0.89	80.00	0.50	99.0	5.0
Building East	203	0.230	68	0.89	70.00	0.50	99.0	5.0
Main Parking	204	0.570	68	0.83	100.00	2.00	90.0	5.0
Park Area	205	0.210	68	0.21	70.00	1.00	1.0	5.0
East Woodlot Area	206	1.390	68	0.21	130.00	4.00	1.0	5.0
South Landscaped Area	207	0.140	68	0.21	60.00	2.00	2.0	5.0
North Parking Area	208	0.120	68	0.83	50.00	2.00	90.0	5.0
West Amenity Area	209	0.060	68	0.21	40.00	2.00	2.0	5.0
TOTAL AREA		**3.05**						

Notes:

Slope measure from topographic contours and pre-development drainage plan
Imperviousness estimated from development plan (existing buildings imperviousness estimated to be 99%)
Assume graded areas have a slope of 1.5 - 2.0%
Curve Number is for Pervious Area, as per MIDUSS modelling requirements
Manning n for parking lot surface taken as 0.010; 0.05 for brush areas; and 0.03 for lawn areas; from Manning n for Channels
R.C assumed to be 0.2 for undeveloped areas, where Impervious is 2.0 %. This follows Guelph Development Engineering Manual Table 5.5.1.3.
R.C assumed to be 0.9 for developed areas, where Impervious is > 98 %. This follows Guelph Development Engineering Manual Table 5.5.1.3.
The RC value assinged to each catchment is weighted between impervious and pervious percent coverage

1250 Gordon Street [161413684]
SWM Storage Tank Stage-Storage-Discharge

West Building - Catchment 202 **Building Area** **0.240** **ha**
2,400 **m^2**

	Rating Curve for MIDUSS					
	Elevation	Discharge	Active Storage	Active Storage	Drawdown (hrs)	
	(m)	(m^3/s)	(m^3)	(ha*m)	Increment	Total
Orifice Elev.	0.06	0.001	0	0.0000		
	0.08	0.002	42	0.0042	9.9	0.0
	0.10	0.002	84	0.0084	5.6	0.0
	0.12	0.003	126	0.0126	4.4	0.0
	0.14	0.003	168	0.0168	3.7	0.0
Top of Tank Elev.	0.16	0.004	210	0.0210	3.3	0.0

Volume Estimation			
	Total Pond		Total
Elevation	Area	Act Vol	Act Vol
(m)	(m^2)	(m^3)	(m^3)
0.00	2100	0.00	0
0.02	2100	42.00	42
0.04	2100	42.00	84
0.06	2100	42.00	126
0.08	2100	42.00	168
0.10	2100	42.00	210
0.12	2100	42.00	252
0.14	2100	42.00	294
0.16	2100	42.00	336

Outlet Controls		
Elevation	Orifice 1	Total Flow
(m)	(m^3/s)	(m^3/s)
0.00		
0.02	0.000	0.000
0.04	0.000	0.000
0.06	0.001	0.001
0.08	0.002	0.002
0.10	0.002	0.002
0.12	0.003	0.003
0.14	0.003	0.003
0.16	0.004	0.004

Parameters	
Orifce 1 in Junction Box	
Orifice Invert Elev. (m)	Orifice Coeff.
0.02	0.60
Orifice Mid-point Elev. (m)	Perimeter (m)
0.06	0.24
Orifice Diam.(mm)	Area (m^2)
75	0.004
Weir Coeff. (semi-circular)	Orientation
1.62	Vertical

East Building - Catchment 203 **Building Area** **0.230** **ha**
2,300 **m^2**

	Rating Curve for MIDUSS					
	Elevation	Discharge	Active Storage	Active Storage	Drawdown (hrs)	
	(m)	(m^3/s)	(m^3)	(ha*m)	Increment	Total
Orifice Elev.	0.06	0.000	0	0.0000		
	0.08	0.000	46	0.0046	96.9	0.0
	0.10	0.001	92	0.0092	22.9	0.0
	0.12	0.002	138	0.0138	9.7	0.0
	0.14	0.003	184	0.0184	5.4	0.0
Top of Tank Elev.	0.16	0.004	230	0.0230	3.4	0.0

Volume Estimation			
	Total Pond		Total
Elevation	Area	Act Vol	Act Vol
(m)	(m^2)	(m^3)	(m^3)
0.00	2300	0.00	0
0.02	2300	46.00	46
0.04	2300	46.00	92
0.06	2300	46.00	138
0.08	2300	46.00	184
0.10	2300	46.00	230
0.12	2300	46.00	276
0.14	2300	46.00	322
0.16	2300	46.00	368
			368

Outlet Controls		
Elevation	Orifice 1	Total Flow
(m)	(m^3/s)	(m^3/s)
0.00		
0.02	0.000	0.000
0.04	0.000	0.000
0.06	0.000	0.000
0.08	0.000	0.000
0.10	0.001	0.001
0.12	0.002	0.002
0.14	0.003	0.003
0.16	0.004	0.004

Parameters	
Orifce 1 in Junction Box	
Orifice Invert Elev. (m)	Orifice Coeff.
0.02	0.60
Orifice Mid-point Elev. (m)	Perimeter (m)
0.06	0.24
Orifice Diam.(mm)	Area (m^2)
75	0.004
Weir Coeff. (semi-circular)	Orientation
1.62	Vertical

Storage

	Rating Curve for MIDUSS					
	Elevation	Discharge	Active Storage	Active Storage	Drawdown (hrs)	
	(m)	(m^3/s)	(m^3)	(ha*m)	Increment	Total
Orifice Elev.	339.09	0.003	0	0.0000		
	339.29	0.005	62	0.0062	4.6	4.6
	339.49	0.007	123	0.0123	2.9	7.5
	339.69	0.009	185	0.0185	2.2	9.7
	340.11	0.012	314	0.0314	3.5	13.2

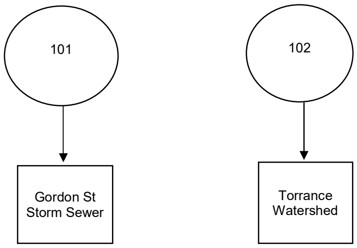
Volume Estimation			
	Total Pond		Total
Elevation	Area	Act Vol	Act Vol
(m)	(m^2)	(m^3)	(m^3)
339.09	308	0.00	0
339.29	308	61.56	62
339.49	308	61.56	123
339.69	308	61.56	185
340.11	308	129.27	314

Outlet Controls		
Elevation	Orifice 1	Total Flow
(m)	(m^3/s)	(m^3/s)
339.09	0.003	0.003
339.29	0.005	0.005
339.49	0.007	0.007
339.69	0.009	0.009
340.11	0.012	0.012

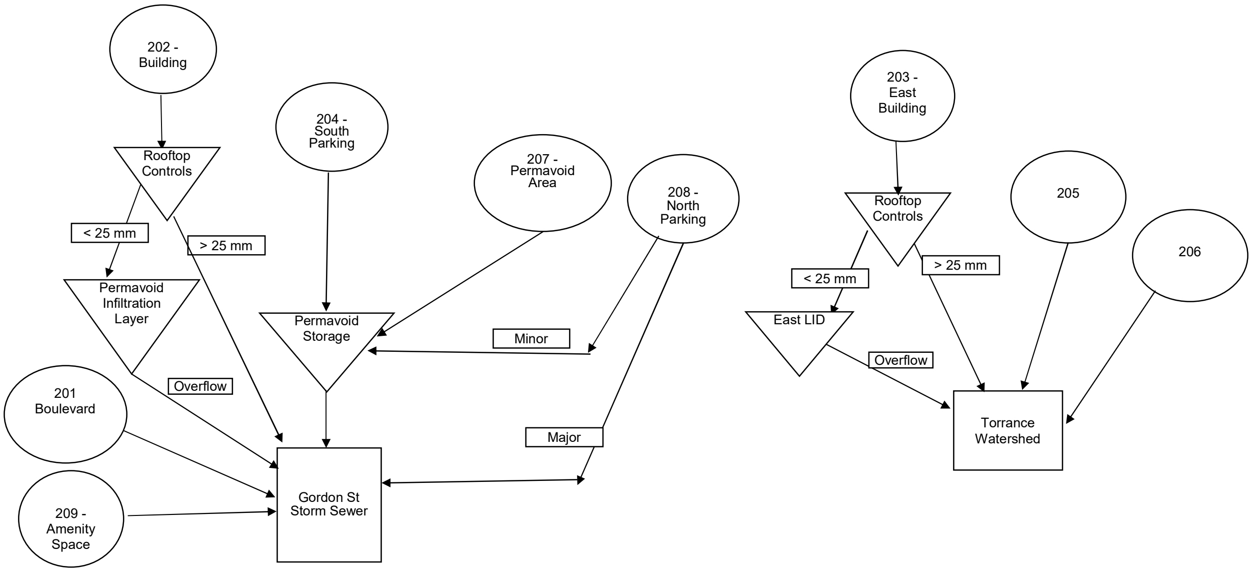
Parameters	
Orifce 1 in Junction Box	
Orifice Invert Elev. (m)	Orifice Coeff.
339.09	0.60
Orifice Mid-point Elev. (m)	Perimeter (m)
339.13	0.24
Orifice Diam.(mm)	Area (m^2)
75	0.004
Weir Coeff. (semi-circular)	Orientation
1.62	Vertical

1250 Gordon Street [161413684]

Pre-Development Drainage Schematic



Post-Development Drainage Schematic



MIDUSS MODELING FILES

```
       Output File (4.7) GORPR2.out   opened 2021-08-04  15:27
       Units used are defined by G =    9.810
          300   600    15.000        are MAXDT MAXHYD & DTMIN values
       Licensee: Paragon Engineering Limited
35     COMMENT
      5     line(s) of comment
       ********************************
       1250 Gordon Street - 1614-13684
       Stormwater Management Modelling
       July 2021 - C. Phelps
       ********************************
35     COMMENT
      5     line(s) of comment
       **********************


       2-yr STORM

14     START
      1     1=Zero; 2=Define
 2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     743.000     Coefficient  a
       6.000     Constant  b    (min)
        .799     Exponent  c
        .400     Fraction to peak  r
     180.000     Duration ó 4500 min
                34.242 mm     Total depth
 3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .015     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
       1.500     Initial Abstraction
35     COMMENT
      3     line(s) of comment
       **********************
       To Gordon Street
       **********************
 4     CATCHMENT
     101.000     ID No.ó 99999
       1.330     Area in hectares
     140.000     Length (PERV) metres
       3.000     Gradient (%)
      10.000     Per cent Impervious
       5.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
```

```
          .030     Manning "n"
        67.000     SCS Curve No or C
          .100     Ia/S Coefficient
         5.000     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .011       .000       .000       .000 c.m/s
                .009       .182       .026     C perv/imperv/total
15     ADD RUNOFF
                .011       .011       .000       .000 c.m/s
35     COMMENT
        3     line(s) of comment
       **********************
       To Torrance Watershed
       **********************
 4     CATCHMENT
       102.000     ID No.ó 99999
         1.720     Area in hectares
       150.000     Length (PERV) metres
         5.000     Gradient (%)
         1.000     Per cent Impervious
         1.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .030     Manning "n"
        68.000     SCS Curve No or C
          .100     Ia/S Coefficient
         5.000     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .002       .011       .000       .000 c.m/s
                .010       .164       .011     C perv/imperv/total
15     ADD RUNOFF
                .002       .013       .000       .000 c.m/s
20     MANUAL
```

```
        Output File (4.7) GORPR5.out   opened 2021-07-29  10:56
        Units used are defined by G =    9.810
           300   600    15.000        are MAXDT MAXHYD & DTMIN values
        Licensee: Paragon Engineering Limited
 35     COMMENT
       5     line(s) of comment
        ********************************
        1250 Gordon Street - 1614-13684
        Stormwater Management Modelling
        July 2021 - C. Phelps
        ********************************
 35     COMMENT
       5     line(s) of comment
        **********************



        5-yr STORM

 14     START
       1     1=Zero; 2=Define
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    1593.000     Coefficient  a
      11.000     Constant  b    (min)
        .879     Exponent  c
        .400     Fraction to peak  r
     180.000     Duration ó 4500 min
              47.219 mm     Total depth
  3     IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .015     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
       1.500     Initial Abstraction
 35     COMMENT
       3     line(s) of comment
        **********************
        To Gordon Street
        **********************
  4     CATCHMENT
     101.000     ID No.ó 99999
       1.330     Area in hectares
     140.000     Length (PERV) metres
       3.000     Gradient (%)
      10.000     Per cent Impervious
       5.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
```

```
        .030     Manning "n"
      67.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .020       .000       .000       .000 c.m/s
              .018       .206       .037     C perv/imperv/total
15     ADD RUNOFF
              .020       .020       .000       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       **********************
       To Torrance Watershed
       **********************
 4     CATCHMENT
     102.000     ID No.ó 99999
       1.730     Area in hectares
     150.000     Length (PERV) metres
       5.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .006       .020       .000       .000 c.m/s
              .019       .190       .020     C perv/imperv/total
15     ADD RUNOFF
              .006       .023       .000       .000 c.m/s
20     MANUAL
```

```
       Output File (4.7) GORPR1.out   opened 2021-08-04  15:26
       Units used are defined by G =    9.810
          300   600    15.000        are MAXDT MAXHYD & DTMIN values
       Licensee: Paragon Engineering Limited
35     COMMENT
      5     line(s) of comment
       ********************************
       1250 Gordon Street - 1614-13684
       Stormwater Management Modelling
       July 2021 - C. Phelps
       ********************************
35     COMMENT
      5     line(s) of comment
       **********************



       100-yr STORM

14     START
      1     1=Zero; 2=Define
 2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    4688.000     Coefficient  a
      17.000     Constant  b    (min)
        .963     Exponent  c
        .400     Fraction to peak  r
     180.000     Duration ó 4500 min
                86.766 mm     Total depth
 3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .015     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
       1.500     Initial Abstraction
35     COMMENT
      3     line(s) of comment
       **********************
       To Gordon Street
       **********************
 4     CATCHMENT
     101.000     ID No.ó 99999
       1.330     Area in hectares
     140.000     Length (PERV) metres
       3.000     Gradient (%)
      10.000     Per cent Impervious
       5.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
```

```
      .030     Manning "n"
    67.000     SCS Curve No or C
      .100     Ia/S Coefficient
     5.000     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .051       .000       .000       .000 c.m/s
            .044       .237       .063     C perv/imperv/total
15     ADD RUNOFF
            .051       .051       .000       .000 c.m/s
35     COMMENT
     3     line(s) of comment
       **********************
       To Torrance Watershed
       **********************
 4     CATCHMENT
   102.000     ID No.ó 99999
     1.720     Area in hectares
   150.000     Length (PERV) metres
     5.000     Gradient (%)
     1.000     Per cent Impervious
     1.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .030     Manning "n"
    68.000     SCS Curve No or C
      .100     Ia/S Coefficient
     5.000     Initial Abstraction
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .042       .051       .000       .000 c.m/s
            .046       .229       .048     C perv/imperv/total
15     ADD RUNOFF
            .042       .077       .000       .000 c.m/s
20     MANUAL
```

```
       Output File (4.7) GORPO2.out   opened 2021-08-05   9:30
       Units used are defined by G =    9.810
          300   600    15.000        are MAXDT MAXHYD & DTMIN values
       Licensee: Paragon Engineering Limited
35     COMMENT
      5     line(s) of comment
       *******************************
       1250 Gordon Street - 1614-13884
       Stormwater Management Modelling
       June 2021 - C. Phelps
       *******************************
14     START
      1     1=Zero; 2=Define
35     COMMENT
      5     line(s) of comment
       **********************


       2-yr STORM - PROPOSED CONDITIONS

 2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     743.000     Coefficient  a
       6.000     Constant  b    (min)
        .799     Exponent  c
        .400     Fraction to peak  r
     180.000     Duration ó 4500 min
                34.242 mm     Total depth
 3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .010     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
       1.500     Initial Abstraction
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ***********************************
       Uncontrolled Flow to Gordon Street - from West
       ***********************************
 4     CATCHMENT
     201.000     ID No.ó 99999
        .090     Area in hectares
       1.000     Length (PERV) metres
       2.000     Gradient (%)
      70.000     Per cent Impervious
      10.000     Length (IMPERV)
```

```
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .030     Manning "n"
       68.000     SCS Curve No or C
         .100     Ia/S Coefficient
        5.000     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .005       .000       .000       .000 c.m/s
               .009       .185       .132     C perv/imperv/total
 15     ADD RUNOFF
               .005       .005       .000       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        ***********************************
        Uncontrolled Flow to Gordon Street- from South
        ***********************************
  4     CATCHMENT
      209.000     ID No.ó 99999
         .060     Area in hectares
        1.000     Length (PERV) metres
        2.000     Gradient (%)
        2.000     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .030     Manning "n"
       68.000     SCS Curve No or C
         .100     Ia/S Coefficient
        5.000     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .000       .005       .000       .000 c.m/s
               .009       .187       .013     C perv/imperv/total
 15     ADD RUNOFF
               .000       .005       .000       .000 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .000       .005       .005       .000 c.m/s
 17     COMBINE
    500     Junction Node No.
               .000       .005       .005       .005 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
```

```
      3     line(s) of comment
       ****************************
       West Building - Roof Area
       ****************************
 4     CATCHMENT
     202.000     ID No.ó 99999
        .240     Area in hectares
       2.000     Length (PERV) metres
        .500     Gradient (%)
      99.000     Per cent Impervious
      80.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .015       .000       .005       .005 c.m/s
              .009       .187       .185     C perv/imperv/total
15     ADD RUNOFF
              .015       .015       .005       .005 c.m/s
35     COMMENT
      3     line(s) of comment
       *********************************
       West Building - Rooftop Control
       *********************************
10     POND
      4 Depth - Discharge - Volume sets
          .000        .000          .0
          .080      .00200        42.0
          .120      .00300       126.0
          .160      .00400       210.0
       Peak Outflow    =      .002 c.m/s
       Maximum Depth   =      .063 metres
       Maximum Storage =       33. c.m
              .015       .015       .002       .005 c.m/s
17     COMBINE
    500     Junction Node No.
              .015       .015       .002       .005 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ****************************
       East Building - Roof Area
       ****************************
 4     CATCHMENT
```

```
     203.000     ID No.ó 99999
        .230     Area in hectares
       2.000     Length (PERV) metres
        .500     Gradient (%)
      99.000     Per cent Impervious
      70.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .014       .000       .002       .005 c.m/s
              .009       .188       .186     C perv/imperv/total
15     ADD RUNOFF
              .014       .014       .002       .005 c.m/s
35     COMMENT
      3     line(s) of comment
       ********************************
       East Building - Rooftop Control
       ********************************
10     POND
      4 Depth - Discharge - Volume sets
          .000        .000           .0
          .100      .00100         92.0
          .120      .00200        138.0
          .160      .00400        230.0
       Peak Outflow    =      .000 c.m/s
       Maximum Depth   =      .043 metres
       Maximum Storage =       40. c.m
              .014       .014       .000       .005 c.m/s
35     COMMENT
      3     line(s) of comment
       *********************************************
       East Roof-top Flow to Torrence Watershed
       *********************************************
17     COMBINE
    600     Junction Node No.
              .014       .014       .000       .000 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       *********************
       North Parking Area
       *********************
 4     CATCHMENT
```

```
     208.000     ID No.ó 99999
        .120     Area in hectares
       2.000     Length (PERV) metres
       2.000     Gradient (%)
      90.000     Per cent Impervious
      90.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .007       .000       .000       .000 c.m/s
              .009       .189       .171     C perv/imperv/total
15     ADD RUNOFF
              .007       .007       .000       .000 c.m/s
35     COMMENT
        3     line(s) of comment
       **********************
       MOVE DOWNSTREAM
       **********************
14     START
        1     1=Zero; 2=Define
35     COMMENT
        3     line(s) of comment
       **********************
       South Parking Area
       **********************
 4     CATCHMENT
     204.000     ID No.ó 99999
        .570     Area in hectares
       2.000     Length (PERV) metres
       2.000     Gradient (%)
      90.000     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .033       .000       .000       .000 c.m/s
              .009       .190       .172     C perv/imperv/total
15     ADD RUNOFF
              .033       .033       .000       .000 c.m/s
35     COMMENT
```

```
      3     line(s) of comment
       **********************
       South Landscaped Area
       **********************
 4     CATCHMENT
     207.000    ID No.ó 99999
        .140    Area in hectares
      60.000    Length (PERV) metres
       2.000    Gradient (%)
       2.000    Per cent Impervious
       2.000    Length (IMPERV)
        .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030    Manning "n"
      68.000    SCS Curve No or C
        .100    Ia/S Coefficient
       5.000    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .000       .033       .000       .000 c.m/s
              .010       .167       .013     C perv/imperv/total
15     ADD RUNOFF
              .000       .033       .000       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       ***************************
       Storage - Permavoid
       ***************************
10     POND
      4 Depth - Discharge - Volume sets
       339.090        .000          .0
       339.290      .00500        62.0
       339.690      .00900       185.0
       340.110       .0120       314.0
       Peak Outflow    =      .005 c.m/s
       Maximum Depth   =   339.303 metres
       Maximum Storage =       66. c.m
              .000       .033       .005       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       **************************************
       Total Flow to Gordon St. Storm Sewer
       *************************************
17     COMBINE
    500     Junction Node No.
              .000       .033       .005       .008 c.m/s
18     CONFLUENCE
    500     Junction Node No.
              .000       .008       .005       .000 c.m/s
```

```
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       *********************************************
       Undeveloped Area - Flow to Torrance Watershed
       *********************************************
 4     CATCHMENT
     206.000     ID No.ó 99999
       1.390     Area in hectares
     130.000     Length (PERV) metres
       4.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .001       .000       .005       .000 c.m/s
              .010       .163       .011     C perv/imperv/total
15     ADD RUNOFF
              .001       .001       .005       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       *********************************************
       Park Area - to Torrance Watershed
       *********************************************
 4     CATCHMENT
     205.000     ID No.ó 99999
        .210     Area in hectares
      70.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .000       .001       .005       .000 c.m/s
              .010       .165       .011     C perv/imperv/total
15     ADD RUNOFF
              .000       .002       .005       .000 c.m/s
```

```
35     COMMENT
     3     line(s) of comment
       *********************************************
       Total to Torrence
       *********************************************
 9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .000       .002       .002       .000 c.m/s
17     COMBINE
   600     Junction Node No.
              .000       .002       .002       .002 c.m/s
18     CONFLUENCE
   600     Junction Node No.
              .000       .002       .002       .000 c.m/s
14     START
     1     1=Zero; 2=Define
20     MANUAL
```

```
       Output File (4.7) GORPO5.out   opened 2021-08-05   9:31
       Units used are defined by G =    9.810
          300   600    15.000        are MAXDT MAXHYD & DTMIN values
       Licensee: Paragon Engineering Limited
35     COMMENT
      5     line(s) of comment
       *******************************
       1250 Gordon Street - 1614-13884
       Stormwater Management Modelling
       June 2021 - C. Phelps
       *******************************
14     START
      1     1=Zero; 2=Define
35     COMMENT
      5     line(s) of comment
       **********************


       5-yr STORM - PROPOSED CONDITIONS

 2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    1593.000     Coefficient  a
      11.000     Constant  b    (min)
        .879     Exponent  c
        .400     Fraction to peak  r
     180.000     Duration ó 4500 min
                47.219 mm     Total depth
 3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .010     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
       1.500     Initial Abstraction
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ***********************************
       Uncontrolled Flow to Gordon Street - from West
       ***********************************
 4     CATCHMENT
     201.000     ID No.ó 99999
        .090     Area in hectares
       1.000     Length (PERV) metres
       2.000     Gradient (%)
      70.000     Per cent Impervious
      10.000     Length (IMPERV)
```

```
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .009       .000       .000       .000 c.m/s
              .018       .212       .154     C perv/imperv/total
15     ADD RUNOFF
              .009       .009       .000       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       ***********************************
       Uncontrolled Flow to Gordon Street- from South
       ***********************************
 4     CATCHMENT
     209.000     ID No.ó 99999
        .060     Area in hectares
       1.000     Length (PERV) metres
       2.000     Gradient (%)
       2.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .001       .009       .000       .000 c.m/s
              .018       .218       .022     C perv/imperv/total
15     ADD RUNOFF
              .001       .010       .000       .000 c.m/s
 9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .001       .010       .010       .000 c.m/s
17     COMBINE
    500     Junction Node No.
              .001       .010       .010       .010 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
```

```
      3     line(s) of comment
       ****************************
       West Building - Roof Area
       ****************************
 4     CATCHMENT
     202.000     ID No.ó 99999
        .240     Area in hectares
       2.000     Length (PERV) metres
        .500     Gradient (%)
      99.000     Per cent Impervious
      80.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .027       .000       .010       .010 c.m/s
              .018       .221       .219     C perv/imperv/total
15     ADD RUNOFF
              .027       .027       .010       .010 c.m/s
35     COMMENT
      3     line(s) of comment
       *********************************
       West Building - Rooftop Control
       *********************************
10     POND
      4 Depth - Discharge - Volume sets
          .000        .000          .0
          .080      .00200        42.0
          .120      .00300       126.0
          .160      .00400       210.0
       Peak Outflow    =      .002 c.m/s
       Maximum Depth   =      .087 metres
       Maximum Storage =       57. c.m
              .027       .027       .002       .010 c.m/s
17     COMBINE
    500     Junction Node No.
              .027       .027       .002       .010 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ****************************
       East Building - Roof Area
       ****************************
 4     CATCHMENT
```

```
      203.000     ID No.ó 99999
         .230     Area in hectares
        2.000     Length (PERV) metres
         .500     Gradient (%)
       99.000     Per cent Impervious
       70.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .030     Manning "n"
       68.000     SCS Curve No or C
         .100     Ia/S Coefficient
        5.000     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .025       .000       .002       .010 c.m/s
               .018       .221       .219     C perv/imperv/total
 15     ADD RUNOFF
               .025       .025       .002       .010 c.m/s
 35     COMMENT
       3     line(s) of comment
        *********************************
        East Building - Rooftop Control
        *********************************
 10     POND
       4 Depth - Discharge - Volume sets
           .000        .000           .0
           .100      .00100         92.0
           .120      .00200        138.0
           .160      .00400        230.0
        Peak Outflow    =      .001 c.m/s
        Maximum Depth   =      .071 metres
        Maximum Storage =       65. c.m
               .025       .025       .001       .010 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************************************
        East Roof-top Flow to Torrence Watershed
        **********************************************
 17     COMBINE
     600     Junction Node No.
               .025       .025       .001       .001 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        **********************
        North Parking Area
        **********************
  4     CATCHMENT
```

```
    208.000     ID No.ó 99999
       .120     Area in hectares
      2.000     Length (PERV) metres
      2.000     Gradient (%)
     90.000     Per cent Impervious
     90.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .030     Manning "n"
     68.000     SCS Curve No or C
       .100     Ia/S Coefficient
      5.000     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .012       .000       .001       .001 c.m/s
             .018       .216       .196     C perv/imperv/total
15     ADD RUNOFF
             .012       .012       .001       .001 c.m/s
35     COMMENT
     3     line(s) of comment
       **********************
       MOVE DOWNSTREAM
       **********************
14     START
     1     1=Zero; 2=Define
35     COMMENT
     3     line(s) of comment
       **********************
       South Parking Area
       **********************
 4     CATCHMENT
    204.000     ID No.ó 99999
       .570     Area in hectares
      2.000     Length (PERV) metres
      2.000     Gradient (%)
     90.000     Per cent Impervious
    100.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .030     Manning "n"
     68.000     SCS Curve No or C
       .100     Ia/S Coefficient
      5.000     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .059       .000       .001       .001 c.m/s
             .018       .217       .198     C perv/imperv/total
15     ADD RUNOFF
             .059       .059       .001       .001 c.m/s
35     COMMENT
```

```
      3     line(s) of comment
       **********************
       South Landscaped Area
       **********************
 4     CATCHMENT
     207.000     ID No.ó 99999
        .140     Area in hectares
      60.000     Length (PERV) metres
       2.000     Gradient (%)
       2.000     Per cent Impervious
       2.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .001       .059       .001       .001 c.m/s
              .019       .192       .022     C perv/imperv/total
15     ADD RUNOFF
              .001       .059       .001       .001 c.m/s
35     COMMENT
      3     line(s) of comment
       ***************************
       Storage - Permavoid
       ***************************
10     POND
      4 Depth - Discharge - Volume sets
       339.090        .000          .0
       339.290      .00500        62.0
       339.690      .00900       185.0
       340.110       .0120       314.0
       Peak Outflow    =      .007 c.m/s
       Maximum Depth   =   339.465 metres
       Maximum Storage =      116. c.m
              .001       .059       .007       .001 c.m/s
35     COMMENT
      3     line(s) of comment
       **************************************
       Total Flow to Gordon St. Storm Sewer
       *************************************
17     COMBINE
    500     Junction Node No.
              .001       .059       .007       .012 c.m/s
18     CONFLUENCE
    500     Junction Node No.
              .001       .012       .007       .000 c.m/s
```

```
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ***********************************************
       Undeveloped Area - Flow to Torrance Watershed
       ***********************************************
 4     CATCHMENT
     206.000     ID No.ó 99999
       1.390     Area in hectares
     130.000     Length (PERV) metres
       4.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .005       .000       .007       .000 c.m/s
              .019       .190       .020     C perv/imperv/total
15     ADD RUNOFF
              .005       .005       .007       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       ***********************************************
       Park Area - to Torrance Watershed
       ***********************************************
 4     CATCHMENT
     205.000     ID No.ó 99999
        .210     Area in hectares
      70.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .001       .005       .007       .000 c.m/s
              .019       .191       .020     C perv/imperv/total
15     ADD RUNOFF
              .001       .005       .007       .000 c.m/s
```

```
35     COMMENT
     3     line(s) of comment
       *********************************************
       Total to Torrence
       *********************************************
 9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .001       .005       .005       .000 c.m/s
17     COMBINE
    600     Junction Node No.
              .001       .005       .005       .006 c.m/s
18     CONFLUENCE
    600     Junction Node No.
              .001       .006       .005       .000 c.m/s
14     START
     1     1=Zero; 2=Define
20     MANUAL
```

```
       Output File (4.7) GORPO1_2.out opened 2021-08-05   9:28
       Units used are defined by G =    9.810
          300   600    15.000        are MAXDT MAXHYD & DTMIN values
       Licensee: Paragon Engineering Limited
35     COMMENT
      5     line(s) of comment
       *******************************
       1250 Gordon Street - 1614-13884
       Stormwater Management Modelling
       June 2021 - C. Phelps
       *******************************
14     START
      1     1=Zero; 2=Define
35     COMMENT
      5     line(s) of comment
       **********************


       100-yr STORM - PROPOSED CONDITIONS

 2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    4688.000     Coefficient  a
      17.000     Constant  b    (min)
        .963     Exponent  c
        .400     Fraction to peak  r
     180.000     Duration ó 4500 min
                86.766 mm     Total depth
 3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .010     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
       1.500     Initial Abstraction
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ***********************************
       Uncontrolled Flow to Gordon Street - from West
       ***********************************
 4     CATCHMENT
     201.000     ID No.ó 99999
        .090     Area in hectares
       1.000     Length (PERV) metres
       2.000     Gradient (%)
      70.000     Per cent Impervious
      10.000     Length (IMPERV)
```

```
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .030     Manning "n"
       68.000     SCS Curve No or C
         .100     Ia/S Coefficient
        5.000     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .023       .000       .000       .000 c.m/s
               .043       .247       .186     C perv/imperv/total
 15     ADD RUNOFF
               .023       .023       .000       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        ***********************************
        Uncontrolled Flow to Gordon Street- from South
        ***********************************
  4     CATCHMENT
      209.000     ID No.ó 99999
         .060     Area in hectares
        1.000     Length (PERV) metres
        2.000     Gradient (%)
        2.000     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .030     Manning "n"
       68.000     SCS Curve No or C
         .100     Ia/S Coefficient
        5.000     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .003       .023       .000       .000 c.m/s
               .043       .262       .047     C perv/imperv/total
 15     ADD RUNOFF
               .003       .025       .000       .000 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .003       .025       .025       .000 c.m/s
 17     COMBINE
     500     Junction Node No.
               .003       .025       .025       .025 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
```

```
      3     line(s) of comment
       ****************************
       West Building - Roof Area
       ****************************
 4     CATCHMENT
     202.000     ID No.ó 99999
        .240     Area in hectares
       2.000     Length (PERV) metres
        .500     Gradient (%)
      99.000     Per cent Impervious
      80.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .063       .000       .025       .025 c.m/s
              .046       .261       .258     C perv/imperv/total
15     ADD RUNOFF
              .063       .063       .025       .025 c.m/s
35     COMMENT
      3     line(s) of comment
       *********************************
       West Building - Rooftop Control
       *********************************
10     POND
      4 Depth - Discharge - Volume sets
          .000        .000          .0
          .080      .00200        42.0
          .120      .00300       126.0
          .160      .00400       210.0
       Peak Outflow    =      .003 c.m/s
       Maximum Depth   =      .125 metres
       Maximum Storage =      136. c.m
              .063       .063       .003       .025 c.m/s
17     COMBINE
    500     Junction Node No.
              .063       .063       .003       .026 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       ****************************
       East Building - Roof Area
       ****************************
 4     CATCHMENT
```

```
     203.000     ID No.ó 99999
        .230     Area in hectares
       2.000     Length (PERV) metres
        .500     Gradient (%)
      99.000     Per cent Impervious
      70.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .060       .000       .003       .026 c.m/s
              .046       .258       .256     C perv/imperv/total
15     ADD RUNOFF
              .060       .060       .003       .026 c.m/s
35     COMMENT
      3     line(s) of comment
       *********************************
       East Building - Rooftop Control
       *********************************
10     POND
      4 Depth - Discharge - Volume sets
          .000        .000          .0
          .100      .00100        92.0
          .120      .00200       138.0
          .160      .00400       230.0
       Peak Outflow    =      .002 c.m/s
       Maximum Depth   =      .120 metres
       Maximum Storage =      138. c.m
              .060       .060       .002       .026 c.m/s
35     COMMENT
      3     line(s) of comment
       **********************************************
       East Roof-top Flow to Torrence Watershed
       **********************************************
17     COMBINE
    600     Junction Node No.
              .060       .060       .002       .002 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       **********************
       North Parking Area
       **********************
 4     CATCHMENT
```

```
     208.000     ID No.ó 99999
        .120     Area in hectares
       2.000     Length (PERV) metres
       2.000     Gradient (%)
      90.000     Per cent Impervious
      90.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .028       .000       .002       .002 c.m/s
              .045       .261       .240     C perv/imperv/total
15     ADD RUNOFF
              .028       .028       .002       .002 c.m/s
35     COMMENT
      3     line(s) of comment
       **********************
       DIVERSION OF FLOW TO SOUTH PERMAVOID
       **********************
12     DIVERT
         208     U/S Node No.ó 99999
        .012     Threshold Discharge
        .012     Max. Outflow reqd.
            Qmax & Vol.Diverted =      .016 c.m/s        27.7 c.m
               35     COMMENT
              .028       .028       .012       .002 c.m/s
35     COMMENT
      3     line(s) of comment
       **********************
       MINOR TO PERMAVOID
       **********************
17     COMBINE
    400     Junction Node No.
              .028       .028       .012       .012 c.m/s
35     COMMENT
      3     line(s) of comment
       **********************
       MOVE DOWNSTREAM
       **********************
18     CONFLUENCE
    400     Junction Node No.
              .028       .012       .012       .000 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
```

```
       3     line(s) of comment
        *********************
        South Parking Area
        *********************
  4     CATCHMENT
     204.000     ID No.ó 99999
        .570     Area in hectares
       2.000     Length (PERV) metres
       2.000     Gradient (%)
      90.000     Per cent Impervious
     100.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .136       .000       .012       .000 c.m/s
              .045       .260       .239     C perv/imperv/total
 15     ADD RUNOFF
              .136       .136       .012       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        *********************
        South Landscaped Area
        *********************
  4     CATCHMENT
     207.000     ID No.ó 99999
        .140     Area in hectares
      60.000     Length (PERV) metres
       2.000     Gradient (%)
       2.000     Per cent Impervious
       2.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .004       .136       .012       .000 c.m/s
              .046       .229       .049     C perv/imperv/total
 15     ADD RUNOFF
              .004       .140       .012       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **************************
```

```
       Storage - Permavoid
       ***************************
10     POND
      4 Depth - Discharge - Volume sets
       339.090        .000          .0
       339.290      .00500        62.0
       339.690      .00900       185.0
       340.110       .0120       314.0
       Peak Outflow    =      .012 c.m/s
       Maximum Depth   =   340.041 metres
       Maximum Storage =      293. c.m
              .004       .140       .012       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       **************************************
       Total Flow to Gordon St. Storm Sewer
       *************************************
17     COMBINE
    500     Junction Node No.
              .004       .140       .012       .031 c.m/s
22     FILE HYDROGRAPH
      1     1=READ: 2=WRITE
     12     DIV00208.5YR         is Filename
      3     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
              .004       .140       .016       .031 c.m/s
17     COMBINE
    500     Junction Node No.
              .004       .140       .016       .045 c.m/s
18     CONFLUENCE
    500     Junction Node No.
              .004       .045       .016       .000 c.m/s
14     START
      1     1=Zero; 2=Define
35     COMMENT
      3     line(s) of comment
       **********************************************
       Undeveloped Area - Flow to Torrance Watershed
       **********************************************
 4     CATCHMENT
     206.000     ID No.ó 99999
       1.390     Area in hectares
     130.000     Length (PERV) metres
       4.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
```

```
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .035       .000       .016       .000 c.m/s
              .046       .230       .048     C perv/imperv/total
15     ADD RUNOFF
              .035       .035       .016       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       ***********************************************
       Park Area - to Torrance Watershed
       ***********************************************
 4     CATCHMENT
     205.000     ID No.ó 99999
        .210     Area in hectares
      70.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
       1.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .030     Manning "n"
      68.000     SCS Curve No or C
        .100     Ia/S Coefficient
       5.000     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .005       .035       .016       .000 c.m/s
              .046       .228       .048     C perv/imperv/total
15     ADD RUNOFF
              .005       .040       .016       .000 c.m/s
35     COMMENT
      3     line(s) of comment
       ***********************************************
       Total to Torrence
       ***********************************************
 9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .005       .040       .040       .000 c.m/s
17     COMBINE
    600     Junction Node No.
              .005       .040       .040       .041 c.m/s
18     CONFLUENCE
```

```
    600     Junction Node No.
              .005       .041       .040       .000 c.m/s
14     START
      1     1=Zero; 2=Define
20     MANUAL
```

ROCK TRENCH SIZING CALCULATIONS

Month #	Month	Days	Monthly Evap (mm)
1	Jan	31	
2	Feb	28	
3	Mar	31	
4	Apr	30	
5	May	31	
6	Jun	30	
7	Jul	31	
8	Aug	31	
9	Sep	30	
10	Oct	31	
11	Nov	30	
12	Dec	31	

		Roof Area			Infiltration Gallery 2 (South)			
		Impervious area	**2400**	sq.m	Roof area	**2400**	sq.m	
					Grassed Area	**1400**	sq.m	
					Directly to Tench	**6900**	sq.m	9300
Area Check (m^2)	9300	Total area:	2400	sq.m	Total area:	10700	sq.m	
Developed area					Trench surf. area:	**425**	sq.m	
					Trench depth:	**0.4**	m	
					Trench porosity:	**0.9**		
					Trench full:	153	cu.m	
Developed area (ha)	0.21				Trench initial vol:	**0**	cu.m	
	0.23				Subsoil exfil. rate:	**23**	mm/hr	
	0.85				Soil depth:		mm	
	1.29				Soil porosity:			
					Soil field cap:			
					Soil wilt point:			
					Soil infil. rate		mm/hr	
					Soil wilt point vol:		cu.m	
		depth of rain	0.023		Soil porosity vol:		cu.m	
		Rain Volume	56.0		Soil field cap vol:		cu.m	
		P volume	391.2		Soil initial vol:		cu.m	
		Ponding	0.163	m	Ponding		m	
		Orifice	75.00	mm	I/P	16.2		
		max ponding	0.019	m	Safety Factor			
		P volume	45.43	sq.m	Area with SF			

Summary	**Roof (1+5)**	**IG 2**
Total evaporation		0.0
Total exfiltration		232.7
Total drainflow	60.1	0.0
Total runoff	0.0	0.0
Total Reused		
Sum	60.1	232.7
Total rainfall	60.1	327.8
% Treated	100%	100%
% untreated	0%	0%
% Captured	0%	100%
EIA	100%	0%

				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
				15.0	15.0	44.9	0.019	0.5	0.0	23.7	43.5	23.7	0.0	0.0	23.7	0.0	0.0	0.0	0.0	150.7	0.8	0.00	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						Roof Area										**Infiltration Gallery 2 (South)**							
				All in cubic metres						**All in cubic metres**													
						Beginning	Depth						Beginning				Beginning			Beginning			
		25.02		Rain Water	Rain into	Ponding Vol	Ponding	out	Overflow	Rain Wate	Rain Water	Rain into	Ponding Vol	out	Unsaturated	Rain into	Soil Water	Water from Soil	Water that	Trench Water	Trench	Underdrain	
			Kitchener	onto roof	Ponding			ponding		into Swale	Directly to trench	Ponding		ponding	Runoff	Soil	Volume	to Trench	Stays in Soil	Volume	Exfiltration	Drainflow	Evaporation
Month	30-06-1964 23:55	cip (mm)	ETO		0.00000	0.00000		0.00000	0.00000			0.00000	0.00000	0.00000		0.00000	0.00000	0.00000	0.00000	0.00000		0.00000	0.00000
7	01-07-1964 00:00	0.12	0.000	0.29329	0.29329	0.00000	0.00012	0.04026	0.00000	0.46437	0.88345	0.46437	0.00000	0.00000	0.46437	0.00000	0.00000	0.00000	0.00000	0.00000	0.81458	0.00000	0.00000
7	01-07-1964 00:05	0.13	0.000	0.30836	0.30836	0.25303	0.00023	0.05570	0.00000	0.48824	0.94223	0.48824	0.00000	0.00000	0.48824	0.00000	0.00000	0.00000	0.00000	0.06887	0.81458	0.00000	0.00000
7	01-07-1964 00:10	0.14	0.000	0.32528	0.32528	0.50569	0.00035	0.06776	0.00000	0.51502	1.00293	0.51502	0.00000	0.00000	0.51502	0.00000	0.00000	0.00000	0.00000	0.19652	0.81458	0.00000	0.00000
7	01-07-1964 00:15	0.14	0.000	0.34440	0.34440	0.76321	0.00046	0.07823	0.00000	0.54530	1.06839	0.54530	0.00000	0.00000	0.54530	0.00000	0.00000	0.00000	0.00000	0.38486	0.81458	0.00000	0.00000
7	01-07-1964 00:20	0.15	0.000	0.36622	0.36622	1.02938	0.00058	0.08782	0.00000	0.57984	1.14069	0.57984	0.00000	0.00000	0.57984	0.00000	0.00000	0.00000	0.00000	0.63867	0.81458	0.00000	0.00000
7	01-07-1964 00:25	0.16	0.000	0.39135	0.39135	1.30778	0.00071	0.09690	0.00000	0.61963	1.22202	0.61963	0.00000	0.00000	0.61963	0.00000	0.00000	0.00000	0.00000	0.96477	0.81458	0.00000	0.00000
7	01-07-1964 00:30	0.18	0.000	0.42064	0.42064	1.60223	0.00084	0.10572	0.00000	0.66601	1.31505	0.66601	0.00000	0.00000	0.66601	0.00000	0.00000	0.00000	0.00000	1.37220	0.81458	0.00000	0.00000
7	01-07-1964 00:35	0.19	0.000	0.45525	0.45525	1.91714	0.00099	0.11449	0.00000	0.72081	1.42333	0.72081	0.00000	0.00000	0.72081	0.00000	0.00000	0.00000	0.00000	1.87267	0.81458	0.00000	0.00000
7	01-07-1964 00:40	0.21	0.000	0.49681	0.49681	2.25789	0.00115	0.12338	0.00000	0.78662	1.55171	0.78662	0.00000	0.00000	0.78662	0.00000	0.00000	0.00000	0.00000	2.48142	0.81458	0.00000	0.00000
7	01-07-1964 00:45	0.23	0.000	0.54772	0.54772	2.63133	0.00132	0.13254	0.00000	0.86723	1.70724	0.86723	0.00000	0.00000	0.86723	0.00000	0.00000	0.00000	0.00000	3.21854	0.81458	0.00000	0.00000
7	01-07-1964 00:50	0.25	0.000	0.61161	0.61161	3.04651	0.00152	0.14217	0.00000	0.96838	1.90055	0.96838	0.00000	0.00000	0.96838	0.00000	0.00000	0.00000	0.00000	4.11120	0.81458	0.00000	0.00000
7	01-07-1964 00:55	0.29	0.000	0.69427	0.69427	3.51595	0.00175	0.15253	0.00000	1.09926	2.14855	1.09926	0.00000	0.00000	1.09926	0.00000	0.00000	0.00000	0.00000	5.19716	0.81458	0.00000	0.00000
7	01-07-1964 01:00	0.34	0.000	0.80557	0.80557	4.05769	0.00203	0.16393	0.00000	1.27549	2.47995	1.27549	0.00000	0.00000	1.27549	0.00000	0.00000	0.00000	0.00000	6.53113	0.81458	0.00000	0.00000
7	01-07-1964 01:05	0.40	0.000	0.96370	0.96370	4.69934	0.00236	0.17689	0.00000	1.52586	2.94753	1.52586	0.00000	0.00000	1.52586	0.00000	0.00000	0.00000	0.00000	8.19649	0.81458	0.00000	0.00000
7	01-07-1964 01:10	0.50	0.000	1.20620	1.20620	5.48614	0.00279	0.19230	0.00000	1.90982	3.66013	1.90982	0.00000	0.00000	1.90982	0.00000	0.00000	0.00000	0.00000	10.32944	0.81458	0.00000	0.00000
7	01-07-1964 01:15	0.68	0.000	1.62433	1.62433	6.50004	0.00339	0.21188	0.00000	2.57186	4.88183	2.57186	0.00000	0.00000	2.57186	0.00000	0.00000	0.00000	0.00000	13.17499	0.81458	0.00000	0.00000
7	01-07-1964 01:20	1.04	0.000	2.50764	2.50764	7.91250	0.00434	0.23995	0.00000	3.97043	7.44942	3.97043	0.00000	0.00000	3.97043	0.00000	0.00000	0.00000	0.00000	17.24223	0.81458	0.00000	0.00000
7	01-07-1964 01:25	2.27	0.000	5.44487	5.44487	10.18018	0.00651	0.29383	0.00000	8.62104	15.94782	8.62104	0.00000	0.00000	8.62104	0.00000	0.00000	0.00000	0.00000	23.87707	0.81458	0.00000	0.00000
7	01-07-1964 01:30	6.24	0.000	14.98563	14.98563	15.33121	0.01263	0.40929	0.00000	#######	43.49298	23.72725	0.00000	0.00000	23.72725	0.00000	0.00000	0.00000	0.00000	39.01031	0.81458	0.00000	0.00000
7	01-07-1964 01:35	2.62	0.000	6.28811	6.28811	29.90755	0.01508	0.44722	0.00000	9.95617	18.52552	9.95617	0.00000	0.00000	9.95617	0.00000	0.00000	0.00000	0.00000	81.68870	0.81458	0.00000	0.00000
7	01-07-1964 01:40	1.40	0.000	3.36703	3.36703	35.74844	0.01630	0.46491	0.00000	5.33113	10.14511	5.33113	0.00000	0.00000	5.33113	0.00000	0.00000	0.00000	0.00000	99.39964	0.81458	0.00000	0.00000
7	01-07-1964 01:45	0.95	0.000	2.27363	2.27363	38.65056	0.01705	0.47553	0.00000	3.59991	7.01221	3.59991	0.00000	0.00000	3.59991	0.00000	0.00000	0.00000	0.00000	108.73017	0.81458	0.00000	0.00000
7	01-07-1964 01:50	0.71	0.000	1.71421	1.71421	40.44866	0.01757	0.48268	0.00000	2.71417	5.41103	2.71417	0.00000	0.00000	2.71417	0.00000	0.00000	0.00000	0.00000	114.92779	0.81458	0.00000	0.00000
7	01-07-1964 01:55	0.57	0.000	1.37767	1.37767	41.68019	0.01794	0.48777	0.00000	2.18131	4.44857	2.18131	0.00000	0.00000	2.18131	0.00000	0.00000	0.00000	0.00000	119.52424	0.81458	0.00000	0.00000
7	01-07-1964 02:00	0.48	0.000	1.15392	1.15392	42.57009	0.01822	0.49153	0.00000	1.82704	3.80906	1.82704	0.00000	0.00000	1.82704	0.00000	0.00000	0.00000	0.00000	123.15822	0.81458	0.00000	0.00000
7	01-07-1964 02:05	0.41	0.000	0.99472	0.99472	43.23248	0.01843	0.49435	0.00000	1.57497	3.35416	1.57497	0.00000	0.00000	1.57497	0.00000	0.00000	0.00000	0.00000	126.15270	0.81458	0.00000	0.00000
7	01-07-1964 02:10	0.36	0.000	0.87573	0.87573	43.73284	0.01859	0.49648	0.00000	1.38658	3.01421	1.38658	0.00000	0.00000	1.38658	0.00000	0.00000	0.00000	0.00000	128.69227	0.81458	0.00000	0.00000
7	01-07-1964 02:15	0.33	0.000	0.78346	0.78346	44.11210	0.01871	0.49807	0.00000	1.24047	2.75051	1.24047	0.00000	0.00000	1.24047	0.00000	0.00000	0.00000	0.00000	130.89190	0.81458	0.00000	0.00000
7	01-07-1964 02:20	0.30	0.000	0.70979	0.70979	44.39749	0.01879	0.49925	0.00000	1.12383	2.53988	1.12383	0.00000	0.00000	1.12383	0.00000	0.00000	0.00000	0.00000	132.82783	0.81458	0.00000	0.00000
7	01-07-1964 02:25	0.27	0.000	0.64959	0.64959	44.60803	0.01886	0.50008	0.00000	1.02851	2.36764	1.02851	0.00000	0.00000	1.02851	0.00000	0.00000	0.00000	0.00000	134.55312	0.81458	0.00000	0.00000
7	01-07-1964 02:30	0.25	0.000	0.59945	0.59945	44.75754	0.01890	0.50063	0.00000	0.94913	2.22405	0.94913	0.00000	0.00000	0.94913	0.00000	0.00000	0.00000	0.00000	136.10618	0.81458	0.00000	0.00000
7	01-07-1964 02:35	0.23	0.000	0.55703	0.55703	44.85636	0.01892	0.50094	0.00000	0.88197	2.10240	0.88197	0.00000	0.00000	0.88197	0.00000	0.00000	0.00000	0.00000	137.51564	0.81458	0.00000	0.00000
7	01-07-1964 02:40	0.22	0.000	0.52066	0.52066	44.91246	0.01893	0.50105	0.00000	0.82438	1.99794	0.82438	0.00000	0.00000	0.82438	0.00000	0.00000	0.00000	0.00000	138.80346	0.81458	0.00000	0.00000
7	01-07-1964 02:45	0.20	0.000	0.48911	0.48911	44.93207	0.01893	0.50098	0.00000	0.77442	1.90716	0.77442	0.00000	0.00000	0.77442	0.00000	0.00000	0.00000	0.00000	139.98682	0.81458	0.00000	0.00000
7	01-07-1964 02:50	0.19	0.000	0.46147	0.46147	44.92020	0.01891	0.50076	0.00000	0.73066	1.82749	0.73066	0.00000	0.00000	0.73066	0.00000	0.00000	0.00000	0.00000	141.07940	0.81458	0.00000	0.00000
7	01-07-1964 02:55	0.18	0.000	0.43705	0.43705	44.88091	0.01888	0.50041	0.00000	0.69200	1.75693	0.69200	0.00000	0.00000	0.69200	0.00000	0.00000	0.00000	0.00000	142.09231	0.81458	0.00000	0.00000
7	01-07-1964 03:00	0.173	0	0.41530	0.41530	44.81755	0.01885	0.49994	0.00000	0.65756	1.69394	0.65756	0.00000	0.00000	0.65756	0.00000	0.00000	0.00000	0.00000	143.03465	0.81458	0.00000	0.00000
7	01-07-1964 03:05	0.165	0	0.39581	0.39581	44.73292	0.01880	0.49936	0.00000	0.62670	1.63732	0.62670	0.00000	0.00000	0.62670	0.00000	0.00000	0.00000	0.00000	143.91401	0.81458	0.00000	0.00000
7	01-07-1964 03:10	0.158	0	0.37823	0.37823	44.62936	0.01875	0.49869	0.00000	0.59887	1.58612	0.59887	0.00000	0.00000	0.59887	0.00000	0.00000	0.00000	0.00000	144.73675	0.81458	0.00000	0.00000
7	01-07-1964 03:15	0.151	0	0.36229	0.36229	44.50891	0.01870	0.49794	0.00000	0.57363	1.53953	0.57363	0.00000	0.00000	0.57363	0.00000	0.00000	0.00000	0.00000	145.50828	0.81458	0.00000	0.00000
7	01-07-1964 03:20	0.145	0	0.34777	0.34777	44.37326	0.01863	0.49710	0.00000	0.55064	1.49695	0.55064	0.00000	0.00000	0.55064	0.00000	0.00000	0.00000	0.00000	146.23323	0.81458	0.00000	0.00000

7	01-07-1964 03:25	0.139	0	0.33448	0.33448	44.22393	0.01857	0.49620	0.00000	0.52959	1.45783	0.52959	0.00000	0.00000	0.52959	0.00000	0.00000	0.00000	0.00000	146.91559	0.81458	0.00000	0.00000
7	01-07-1964 03:30	0.134	0	0.32227	0.32227	44.06221	0.01849	0.49523	0.00000	0.51025	1.42174	0.51025	0.00000	0.00000	0.51025	0.00000	0.00000	0.00000	0.00000	147.55884	0.81458	0.00000	0.00000
7	01-07-1964 03:35	0.130	0	0.31100	0.31100	43.88925	0.01842	0.49420	0.00000	0.49242	1.38833	0.49242	0.00000	0.00000	0.49242	0.00000	0.00000	0.00000	0.00000	148.16600	0.81458	0.00000	0.00000
7	01-07-1964 03:40	0.125	0	0.30057	0.30057	43.70605	0.01834	0.49312	0.00000	0.47591	1.35727	0.47591	0.00000	0.00000	0.47591	0.00000	0.00000	0.00000	0.00000	148.73974	0.81458	0.00000	0.00000
7	01-07-1964 03:45	0.121	0	0.29090	0.29090	43.51351	0.01825	0.49198	0.00000	0.46059	1.32831	0.46059	0.00000	0.00000	0.46059	0.00000	0.00000	0.00000	0.00000	149.28242	0.81458	0.00000	0.00000
7	01-07-1964 03:50	0.117	0	0.28188	0.28188	43.31242	0.01816	0.49080	0.00000	0.44632	1.30122	0.44632	0.00000	0.00000	0.44632	0.00000	0.00000	0.00000	0.00000	149.79615	0.81458	0.00000	0.00000
7	01-07-1964 03:55	0.114	0	0.27347	0.27347	43.10350	0.01807	0.48958	0.00000	0.43300	1.27581	0.43300	0.00000	0.00000	0.43300	0.00000	0.00000	0.00000	0.00000	150.28278	0.81458	0.00000	0.00000
7	01-07-1964 04:00		0	0.00000	0.00000	42.88740	0.01787	0.48681	0.00000	0.00000	0.48681	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	150.74401	0.81458	0.00000	0.00000
7	01-07-1964 04:05		0	0.00000	0.00000	42.40060	0.01767	0.48403	0.00000	0.00000	0.48403	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	150.41623	0.81458	0.00000	0.00000
7	01-07-1964 04:10		0	0.00000	0.00000	41.91656	0.01747	0.48126	0.00000	0.00000	0.48126	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	150.08569	0.81458	0.00000	0.00000
7	01-07-1964 04:15		0	0.00000	0.00000	41.43530	0.01726	0.47849	0.00000	0.00000	0.47849	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	149.75237	0.81458	0.00000	0.00000
7	01-07-1964 04:20		0	0.00000	0.00000	40.95681	0.01707	0.47572	0.00000	0.00000	0.47572	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	149.41628	0.81458	0.00000	0.00000
7	01-07-1964 04:25		0	0.00000	0.00000	40.48108	0.01687	0.47295	0.00000	0.00000	0.47295	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	149.07742	0.81458	0.00000	0.00000
7	01-07-1964 04:30		0	0.00000	0.00000	40.00813	0.01667	0.47018	0.00000	0.00000	0.47018	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	148.73578	0.81458	0.00000	0.00000
7	01-07-1964 04:35		0	0.00000	0.00000	39.53795	0.01647	0.46741	0.00000	0.00000	0.46741	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	148.39138	0.81458	0.00000	0.00000
7	01-07-1964 04:40		0	0.00000	0.00000	39.07054	0.01628	0.46464	0.00000	0.00000	0.46464	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	148.04421	0.81458	0.00000	0.00000
7	01-07-1964 04:45		0	0.00000	0.00000	38.60590	0.01609	0.46187	0.00000	0.00000	0.46187	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	147.69426	0.81458	0.00000	0.00000
7	01-07-1964 04:50		0	0.00000	0.00000	38.14404	0.01589	0.45910	0.00000	0.00000	0.45910	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	147.34155	0.81458	0.00000	0.00000
7	01-07-1964 04:55		0	0.00000	0.00000	37.68494	0.01570	0.45633	0.00000	0.00000	0.45633	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	146.98606	0.81458	0.00000	0.00000
7	01-07-1964 05:00		0	0.00000	0.00000	37.22861	0.01551	0.45355	0.00000	0.00000	0.45355	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	146.62780	0.81458	0.00000	0.00000
7	01-07-1964 05:05		0	0.00000	0.00000	36.77506	0.01532	0.45078	0.00000	0.00000	0.45078	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	146.26677	0.81458	0.00000	0.00000
7	01-07-1964 05:10		0	0.00000	0.00000	36.32428	0.01514	0.44801	0.00000	0.00000	0.44801	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	145.90297	0.81458	0.00000	0.00000
7	01-07-1964 05:15		0	0.00000	0.00000	35.87627	0.01495	0.44524	0.00000	0.00000	0.44524	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	145.53640	0.81458	0.00000	0.00000
7	01-07-1964 05:20		0	0.00000	0.00000	35.43103	0.01476	0.44247	0.00000	0.00000	0.44247	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	145.16706	0.81458	0.00000	0.00000
7	01-07-1964 05:25		0	0.00000	0.00000	34.98856	0.01458	0.43970	0.00000	0.00000	0.43970	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	144.79494	0.81458	0.00000	0.00000
7	01-07-1964 05:30		0	0.00000	0.00000	34.54886	0.01440	0.43693	0.00000	0.00000	0.43693	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	144.42005	0.81458	0.00000	0.00000
7	01-07-1964 05:35		0	0.00000	0.00000	34.11194	0.01421	0.43415	0.00000	0.00000	0.43415	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	144.04240	0.81458	0.00000	0.00000
7	01-07-1964 05:40		0	0.00000	0.00000	33.67778	0.01403	0.43138	0.00000	0.00000	0.43138	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	143.66197	0.81458	0.00000	0.00000
7	01-07-1964 05:45		0	0.00000	0.00000	33.24640	0.01385	0.42861	0.00000	0.00000	0.42861	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	143.27877	0.81458	0.00000	0.00000
7	01-07-1964 05:50		0	0.00000	0.00000	32.81779	0.01367	0.42584	0.00000	0.00000	0.42584	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	142.89279	0.81458	0.00000	0.00000
7	01-07-1964 05:55		0	0.00000	0.00000	32.39195	0.01350	0.42307	0.00000	0.00000	0.42307	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	142.50405	0.81458	0.00000	0.00000
7	01-07-1964 06:00		0	0.00000	0.00000	31.96888	0.01332	0.42029	0.00000	0.00000	0.42029	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	142.11253	0.81458	0.00000	0.00000
7	01-07-1964 06:05		0	0.00000	0.00000	31.54859	0.01315	0.41752	0.00000	0.00000	0.41752	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	141.71824	0.81458	0.00000	0.00000
7	01-07-1964 06:10		0	0.00000	0.00000	31.13107	0.01297	0.41475	0.00000	0.00000	0.41475	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	141.32118	0.81458	0.00000	0.00000
7	01-07-1964 06:15		0	0.00000	0.00000	30.71631	0.01280	0.41198	0.00000	0.00000	0.41198	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	140.92135	0.81458	0.00000	0.00000
7	01-07-1964 06:20		0	0.00000	0.00000	30.30434	0.01263	0.40921	0.00000	0.00000	0.40921	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	140.51875	0.81458	0.00000	0.00000
7	01-07-1964 06:25		0	0.00000	0.00000	29.89513	0.01246	0.40643	0.00000	0.00000	0.40643	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	140.11337	0.81458	0.00000	0.00000
7	01-07-1964 06:30		0	0.00000	0.00000	29.48869	0.01229	0.40366	0.00000	0.00000	0.40366	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	139.70522	0.81458	0.00000	0.00000
7	01-07-1964 06:35		0	0.00000	0.00000	29.08503	0.01212	0.40089	0.00000	0.00000	0.40089	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	139.29430	0.81458	0.00000	0.00000
7	01-07-1964 06:40		0	0.00000	0.00000	28.68414	0.01195	0.39812	0.00000	0.00000	0.39812	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	138.88061	0.81458	0.00000	0.00000
7	01-07-1964 06:45		0	0.00000	0.00000	28.28602	0.01179	0.39535	0.00000	0.00000	0.39535	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	138.46414	0.81458	0.00000	0.00000
7	01-07-1964 06:50		0	0.00000	0.00000	27.89068	0.01162	0.39257	0.00000	0.00000	0.39257	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	138.04490	0.81458	0.00000	0.00000
7	01-07-1964 06:55		0	0.00000	0.00000	27.49811	0.01146	0.38980	0.00000	0.00000	0.38980	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	137.62289	0.81458	0.00000	0.00000
7	01-07-1964 07:00		0	0.00000	0.00000	27.10831	0.01130	0.38703	0.00000	0.00000	0.38703	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	137.19811	0.81458	0.00000	0.00000
7	01-07-1964 07:05		0	0.00000	0.00000	26.72128	0.01113	0.38425	0.00000	0.00000	0.38425	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	136.77055	0.81458	0.00000	0.00000
7	01-07-1964 07:10		0	0.00000	0.00000	26.33702	0.01097	0.38148	0.00000	0.00000	0.38148	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	136.34022	0.81458	0.00000	0.00000
7	01-07-1964 07:15		0	0.00000	0.00000	25.95554	0.01081	0.37871	0.00000	0.00000	0.37871	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	135.90712	0.81458	0.00000	0.00000
7	01-07-1964 07:20		0	0.00000	0.00000	25.57683	0.01066	0.37594	0.00000	0.00000	0.37594	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	135.47125	0.81458	0.00000	0.00000
7	01-07-1964 07:25		0	0.00000	0.00000	25.20090	0.01050	0.37316	0.00000	0.00000	0.37316	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	135.03260	0.81458	0.00000	0.00000
7	01-07-1964 07:30		0	0.00000	0.00000	24.82773	0.01034	0.37039	0.00000	0.00000	0.37039	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	134.59118	0.81458	0.00000	0.00000
7	01-07-1964 07:35		0	0.00000	0.00000	24.45734	0.01019	0.36762	0.00000	0.00000	0.36762	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	134.14699	0.81458	0.00000	0.00000

7	01-07-1964 07:40	0	0.00000	0.00000	24.08973	0.01004	0.36484	0.00000	0.00000	0.36484	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	133.70002	0.81458	0.00000	0.00000
7	01-07-1964 07:45	0	0.00000	0.00000	23.72488	0.00989	0.36207	0.00000	0.00000	0.36207	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	133.25028	0.81458	0.00000	0.00000
7	01-07-1964 07:50	0	0.00000	0.00000	23.36281	0.00973	0.35930	0.00000	0.00000	0.35930	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	132.79777	0.81458	0.00000	0.00000
7	01-07-1964 07:55	0	0.00000	0.00000	23.00352	0.00958	0.35652	0.00000	0.00000	0.35652	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	132.34248	0.81458	0.00000	0.00000
7	01-07-1964 08:00	0	0.00000	0.00000	22.64700	0.00944	0.35375	0.00000	0.00000	0.35375	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	131.88442	0.81458	0.00000	0.00000
7	01-07-1964 08:05	0	0.00000	0.00000	22.29325	0.00929	0.35098	0.00000	0.00000	0.35098	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	131.42359	0.81458	0.00000	0.00000
7	01-07-1964 08:10	0	0.00000	0.00000	21.94227	0.00914	0.34820	0.00000	0.00000	0.34820	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	130.95998	0.81458	0.00000	0.00000
7	01-07-1964 08:15	0	0.00000	0.00000	21.59407	0.00900	0.34543	0.00000	0.00000	0.34543	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	130.49360	0.81458	0.00000	0.00000
7	01-07-1964 08:20	0	0.00000	0.00000	21.24864	0.00885	0.34265	0.00000	0.00000	0.34265	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	130.02444	0.81458	0.00000	0.00000
7	01-07-1964 08:25	0	0.00000	0.00000	20.90599	0.00871	0.33988	0.00000	0.00000	0.33988	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	129.55251	0.81458	0.00000	0.00000
7	01-07-1964 08:30	0	0.00000	0.00000	20.56611	0.00857	0.33711	0.00000	0.00000	0.33711	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	129.07781	0.81458	0.00000	0.00000
7	01-07-1964 08:35	0	0.00000	0.00000	20.22900	0.00843	0.33433	0.00000	0.00000	0.33433	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	128.60033	0.81458	0.00000	0.00000
7	01-07-1964 08:40	0	0.00000	0.00000	19.89467	0.00829	0.33156	0.00000	0.00000	0.33156	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	128.12008	0.81458	0.00000	0.00000
7	01-07-1964 08:45	0	0.00000	0.00000	19.56311	0.00815	0.32878	0.00000	0.00000	0.32878	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	127.63705	0.81458	0.00000	0.00000
7	01-07-1964 08:50	0	0.00000	0.00000	19.23433	0.00801	0.32601	0.00000	0.00000	0.32601	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	127.15125	0.81458	0.00000	0.00000
7	01-07-1964 08:55	0	0.00000	0.00000	18.90832	0.00788	0.32323	0.00000	0.00000	0.32323	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	126.66268	0.81458	0.00000	0.00000
7	01-07-1964 09:00	0	0.00000	0.00000	18.58508	0.00774	0.32046	0.00000	0.00000	0.32046	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	126.17133	0.81458	0.00000	0.00000
7	01-07-1964 09:05	0	0.00000	0.00000	18.26463	0.00761	0.31768	0.00000	0.00000	0.31768	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	125.67721	0.81458	0.00000	0.00000
7	01-07-1964 09:10	0	0.00000	0.00000	17.94694	0.00748	0.31491	0.00000	0.00000	0.31491	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	125.18031	0.81458	0.00000	0.00000
7	01-07-1964 09:15	0	0.00000	0.00000	17.63203	0.00735	0.31213	0.00000	0.00000	0.31213	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	124.68063	0.81458	0.00000	0.00000
7	01-07-1964 09:20	0	0.00000	0.00000	17.31990	0.00722	0.30936	0.00000	0.00000	0.30936	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	124.17818	0.81458	0.00000	0.00000
7	01-07-1964 09:25	0	0.00000	0.00000	17.01054	0.00709	0.30658	0.00000	0.00000	0.30658	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	123.67296	0.81458	0.00000	0.00000
7	01-07-1964 09:30	0	0.00000	0.00000	16.70395	0.00696	0.30381	0.00000	0.00000	0.30381	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	123.16496	0.81458	0.00000	0.00000
7	01-07-1964 09:35	0	0.00000	0.00000	16.40015	0.00683	0.30103	0.00000	0.00000	0.30103	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	122.65419	0.81458	0.00000	0.00000
7	01-07-1964 09:40	0	0.00000	0.00000	16.09911	0.00671	0.29826	0.00000	0.00000	0.29826	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	122.14064	0.81458	0.00000	0.00000
7	01-07-1964 09:45	0	0.00000	0.00000	15.80085	0.00658	0.29548	0.00000	0.00000	0.29548	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	121.62431	0.81458	0.00000	0.00000
7	01-07-1964 09:50	0	0.00000	0.00000	15.50537	0.00646	0.29271	0.00000	0.00000	0.29271	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	121.10521	0.81458	0.00000	0.00000
7	01-07-1964 09:55	0	0.00000	0.00000	15.21267	0.00634	0.28993	0.00000	0.00000	0.28993	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	120.58333	0.81458	0.00000	0.00000
7	01-07-1964 10:00	0	0.00000	0.00000	14.92274	0.00622	0.28715	0.00000	0.00000	0.28715	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	120.05868	0.81458	0.00000	0.00000
7	01-07-1964 10:05	0	0.00000	0.00000	14.63558	0.00610	0.28438	0.00000	0.00000	0.28438	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	119.53125	0.81458	0.00000	0.00000
7	01-07-1964 10:10	0	0.00000	0.00000	14.35121	0.00598	0.28160	0.00000	0.00000	0.28160	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	119.00104	0.81458	0.00000	0.00000
7	01-07-1964 10:15	0	0.00000	0.00000	14.06960	0.00586	0.27882	0.00000	0.00000	0.27882	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	118.46806	0.81458	0.00000	0.00000
7	01-07-1964 10:20	0	0.00000	0.00000	13.79078	0.00575	0.27605	0.00000	0.00000	0.27605	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	117.93230	0.81458	0.00000	0.00000
7	01-07-1964 10:25	0	0.00000	0.00000	13.51473	0.00563	0.27327	0.00000	0.00000	0.27327	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	117.39377	0.81458	0.00000	0.00000
7	01-07-1964 10:30	0	0.00000	0.00000	13.24146	0.00552	0.27049	0.00000	0.00000	0.27049	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	116.85246	0.81458	0.00000	0.00000
7	01-07-1964 10:35	0	0.00000	0.00000	12.97097	0.00540	0.26772	0.00000	0.00000	0.26772	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	116.30837	0.81458	0.00000	0.00000
7	01-07-1964 10:40	0	0.00000	0.00000	12.70325	0.00529	0.26494	0.00000	0.00000	0.26494	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	115.76150	0.81458	0.00000	0.00000
7	01-07-1964 10:45	0	0.00000	0.00000	12.43831	0.00518	0.26216	0.00000	0.00000	0.26216	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	115.21186	0.81458	0.00000	0.00000
7	01-07-1964 10:50	0	0.00000	0.00000	12.17614	0.00507	0.25939	0.00000	0.00000	0.25939	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	114.65944	0.81458	0.00000	0.00000
7	01-07-1964 10:55	0	0.00000	0.00000	11.91676	0.00497	0.25661	0.00000	0.00000	0.25661	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	114.10424	0.81458	0.00000	0.00000
7	01-07-1964 11:00	0	0.00000	0.00000	11.66015	0.00486	0.25383	0.00000	0.00000	0.25383	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	113.54626	0.81458	0.00000	0.00000
7	01-07-1964 11:05	0	0.00000	0.00000	11.40632	0.00475	0.25105	0.00000	0.00000	0.25105	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	112.98551	0.81458	0.00000	0.00000
7	01-07-1964 11:10	0	0.00000	0.00000	11.15527	0.00465	0.24827	0.00000	0.00000	0.24827	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	112.42198	0.81458	0.00000	0.00000
7	01-07-1964 11:15	0	0.00000	0.00000	10.90700	0.00454	0.24550	0.00000	0.00000	0.24550	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	111.85567	0.81458	0.00000	0.00000
7	01-07-1964 11:20	0	0.00000	0.00000	10.66150	0.00444	0.24272	0.00000	0.00000	0.24272	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	111.28658	0.81458	0.00000	0.00000
7	01-07-1964 11:25	0	0.00000	0.00000	10.41878	0.00434	0.23994	0.00000	0.00000	0.23994	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	110.71471	0.81458	0.00000	0.00000
7	01-07-1964 11:30	0	0.00000	0.00000	10.17885	0.00424	0.23716	0.00000	0.00000	0.23716	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	110.14007	0.81458	0.00000	0.00000
7	01-07-1964 11:35	0	0.00000	0.00000	9.94169	0.00414	0.23438	0.00000	0.00000	0.23438	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	109.56264	0.81458	0.00000	0.00000
7	01-07-1964 11:40	0	0.00000	0.00000	9.70731	0.00404	0.23160	0.00000	0.00000	0.23160	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	108.98244	0.81458	0.00000	0.00000
7	01-07-1964 11:45	0	0.00000	0.00000	9.47571	0.00395	0.22882	0.00000	0.00000	0.22882	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	108.39946	0.81458	0.00000	0.00000
7	01-07-1964 11:50	0	0.00000	0.00000	9.24689	0.00385	0.22604	0.00000	0.00000	0.22604	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	107.81370	0.81458	0.00000	0.00000

7	01-07-1964 11:55	0	0.00000	0.00000	9.02084	0.00376	0.22326	0.00000	0.00000	0.22326	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	107.22515	0.81458	0.00000	0.00000
7	01-07-1964 12:00	0	0.00000	0.00000	8.79758	0.00367	0.22048	0.00000	0.00000	0.22048	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	106.63383	0.81458	0.00000	0.00000
7	01-07-1964 12:05	0	0.00000	0.00000	8.57710	0.00357	0.21770	0.00000	0.00000	0.21770	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	106.03973	0.81458	0.00000	0.00000
7	01-07-1964 12:10	0	0.00000	0.00000	8.35940	0.00348	0.21492	0.00000	0.00000	0.21492	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	105.44285	0.81458	0.00000	0.00000
7	01-07-1964 12:15	0	0.00000	0.00000	8.14448	0.00339	0.21214	0.00000	0.00000	0.21214	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	104.84319	0.81458	0.00000	0.00000
7	01-07-1964 12:20	0	0.00000	0.00000	7.93234	0.00331	0.20936	0.00000	0.00000	0.20936	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	104.24074	0.81458	0.00000	0.00000
7	01-07-1964 12:25	0	0.00000	0.00000	7.72298	0.00322	0.20658	0.00000	0.00000	0.20658	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	103.63552	0.81458	0.00000	0.00000
7	01-07-1964 12:30	0	0.00000	0.00000	7.51640	0.00313	0.20380	0.00000	0.00000	0.20380	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	103.02751	0.81458	0.00000	0.00000
7	01-07-1964 12:35	0	0.00000	0.00000	7.31261	0.00305	0.20101	0.00000	0.00000	0.20101	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	102.41672	0.81458	0.00000	0.00000
7	01-07-1964 12:40	0	0.00000	0.00000	7.11159	0.00296	0.19823	0.00000	0.00000	0.19823	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	101.80316	0.81458	0.00000	0.00000
7	01-07-1964 12:45	0	0.00000	0.00000	6.91336	0.00288	0.19545	0.00000	0.00000	0.19545	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	101.18680	0.81458	0.00000	0.00000
7	01-07-1964 12:50	0	0.00000	0.00000	6.71791	0.00280	0.19267	0.00000	0.00000	0.19267	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	100.56767	0.81458	0.00000	0.00000
7	01-07-1964 12:55	0	0.00000	0.00000	6.52524	0.00272	0.18988	0.00000	0.00000	0.18988	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	99.94575	0.81458	0.00000	0.00000
7	01-07-1964 13:00	0	0.00000	0.00000	6.33536	0.00264	0.18710	0.00000	0.00000	0.18710	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	99.32105	0.81458	0.00000	0.00000
7	01-07-1964 13:05	0	0.00000	0.00000	6.14826	0.00256	0.18432	0.00000	0.00000	0.18432	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	98.69357	0.81458	0.00000	0.00000
7	01-07-1964 13:10	0	0.00000	0.00000	5.96394	0.00248	0.18153	0.00000	0.00000	0.18153	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	98.06331	0.81458	0.00000	0.00000
7	01-07-1964 13:15	0	0.00000	0.00000	5.78241	0.00241	0.17875	0.00000	0.00000	0.17875	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	97.43026	0.81458	0.00000	0.00000
7	01-07-1964 13:20	0	0.00000	0.00000	5.60366	0.00233	0.17597	0.00000	0.00000	0.17597	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	96.79442	0.81458	0.00000	0.00000
7	01-07-1964 13:25	0	0.00000	0.00000	5.42769	0.00226	0.17318	0.00000	0.00000	0.17318	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	96.15580	0.81458	0.00000	0.00000
7	01-07-1964 13:30	0	0.00000	0.00000	5.25451	0.00219	0.17039	0.00000	0.00000	0.17039	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	95.51440	0.81458	0.00000	0.00000
7	01-07-1964 13:35	0	0.00000	0.00000	5.08412	0.00212	0.16761	0.00000	0.00000	0.16761	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	94.87021	0.81458	0.00000	0.00000
7	01-07-1964 13:40	0	0.00000	0.00000	4.91651	0.00205	0.16482	0.00000	0.00000	0.16482	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	94.22324	0.81458	0.00000	0.00000
7	01-07-1964 13:45	0	0.00000	0.00000	4.75169	0.00198	0.16204	0.00000	0.00000	0.16204	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	93.57348	0.81458	0.00000	0.00000
7	01-07-1964 13:50	0	0.00000	0.00000	4.58965	0.00191	0.15925	0.00000	0.00000	0.15925	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	92.92093	0.81458	0.00000	0.00000
7	01-07-1964 13:55	0	0.00000	0.00000	4.43040	0.00185	0.15646	0.00000	0.00000	0.15646	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	92.26560	0.81458	0.00000	0.00000
7	01-07-1964 14:00	0	0.00000	0.00000	4.27394	0.00178	0.15368	0.00000	0.00000	0.15368	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	91.60748	0.81458	0.00000	0.00000
7	01-07-1964 14:05	0	0.00000	0.00000	4.12026	0.00172	0.15089	0.00000	0.00000	0.15089	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	90.94657	0.81458	0.00000	0.00000
7	01-07-1964 14:10	0	0.00000	0.00000	3.96937	0.00165	0.14810	0.00000	0.00000	0.14810	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	90.28288	0.81458	0.00000	0.00000
7	01-07-1964 14:15	0	0.00000	0.00000	3.82127	0.00159	0.14531	0.00000	0.00000	0.14531	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	89.61639	0.81458	0.00000	0.00000
7	01-07-1964 14:20	0	0.00000	0.00000	3.67596	0.00153	0.14252	0.00000	0.00000	0.14252	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	88.94712	0.81458	0.00000	0.00000
7	01-07-1964 14:25	0	0.00000	0.00000	3.53344	0.00147	0.13973	0.00000	0.00000	0.13973	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	88.27505	0.81458	0.00000	0.00000
7	01-07-1964 14:30	0	0.00000	0.00000	3.39371	0.00141	0.13694	0.00000	0.00000	0.13694	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	87.60020	0.81458	0.00000	0.00000
7	01-07-1964 14:35	0	0.00000	0.00000	3.25677	0.00136	0.13415	0.00000	0.00000	0.13415	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	86.92256	0.81458	0.00000	0.00000
7	01-07-1964 14:40	0	0.00000	0.00000	3.12263	0.00130	0.13136	0.00000	0.00000	0.13136	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	86.24212	0.81458	0.00000	0.00000
7	01-07-1964 14:45	0	0.00000	0.00000	2.99127	0.00125	0.12856	0.00000	0.00000	0.12856	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	85.55889	0.81458	0.00000	0.00000
7	01-07-1964 14:50	0	0.00000	0.00000	2.86271	0.00119	0.12577	0.00000	0.00000	0.12577	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	84.87287	0.81458	0.00000	0.00000
7	01-07-1964 14:55	0	0.00000	0.00000	2.73694	0.00114	0.12298	0.00000	0.00000	0.12298	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	84.18406	0.81458	0.00000	0.00000
7	01-07-1964 15:00	0	0.00000	0.00000	2.61396	0.00109	0.12018	0.00000	0.00000	0.12018	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	83.49246	0.81458	0.00000	0.00000
7	01-07-1964 15:05	0	0.00000	0.00000	2.49378	0.00104	0.11739	0.00000	0.00000	0.11739	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	82.79805	0.81458	0.00000	0.00000
7	01-07-1964 15:10	0	0.00000	0.00000	2.37639	0.00099	0.11459	0.00000	0.00000	0.11459	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	82.10086	0.81458	0.00000	0.00000
7	01-07-1964 15:15	0	0.00000	0.00000	2.26180	0.00094	0.11179	0.00000	0.00000	0.11179	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	81.40087	0.81458	0.00000	0.00000
7	01-07-1964 15:20	0	0.00000	0.00000	2.15001	0.00090	0.10900	0.00000	0.00000	0.10900	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	80.69808	0.81458	0.00000	0.00000
7	01-07-1964 15:25	0	0.00000	0.00000	2.04101	0.00085	0.10620	0.00000	0.00000	0.10620	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	79.99249	0.81458	0.00000	0.00000
7	01-07-1964 15:30	0	0.00000	0.00000	1.93481	0.00081	0.10340	0.00000	0.00000	0.10340	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	79.28410	0.81458	0.00000	0.00000
7	01-07-1964 15:35	0	0.00000	0.00000	1.83142	0.00076	0.10060	0.00000	0.00000	0.10060	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	78.57292	0.81458	0.00000	0.00000
7	01-07-1964 15:40	0	0.00000	0.00000	1.73082	0.00072	0.09779	0.00000	0.00000	0.09779	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	77.85893	0.81458	0.00000	0.00000
7	01-07-1964 15:45	0	0.00000	0.00000	1.63302	0.00068	0.09499	0.00000	0.00000	0.09499	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	77.14214	0.81458	0.00000	0.00000
7	01-07-1964 15:50	0	0.00000	0.00000	1.53803	0.00064	0.09219	0.00000	0.00000	0.09219	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	76.42255	0.81458	0.00000	0.00000
7	01-07-1964 15:55	0	0.00000	0.00000	1.44584	0.00060	0.08938	0.00000	0.00000	0.08938	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	75.70015	0.81458	0.00000	0.00000
7	01-07-1964 16:00	0	0.00000	0.00000	1.35646	0.00057	0.08658	0.00000	0.00000	0.08658	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	74.97495	0.81458	0.00000	0.00000
7	01-07-1964 16:05	0	0.00000	0.00000	1.26989	0.00053	0.08377	0.00000	0.00000	0.08377	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	74.24695	0.81458	0.00000	0.00000

7	01-07-1964 16:10	0	0.00000	0.00000	1.18612	0.00049	0.08096	0.00000	0.00000	0.08096	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	73.51613	0.81458	0.00000	0.00000
7	01-07-1964 16:15	0	0.00000	0.00000	1.10516	0.00046	0.07815	0.00000	0.00000	0.07815	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	72.78250	0.81458	0.00000	0.00000
7	01-07-1964 16:20	0	0.00000	0.00000	1.02702	0.00043	0.07533	0.00000	0.00000	0.07533	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	72.04606	0.81458	0.00000	0.00000
7	01-07-1964 16:25	0	0.00000	0.00000	0.95169	0.00040	0.07252	0.00000	0.00000	0.07252	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	71.30681	0.81458	0.00000	0.00000
7	01-07-1964 16:30	0	0.00000	0.00000	0.87917	0.00037	0.06970	0.00000	0.00000	0.06970	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	70.56475	0.81458	0.00000	0.00000
7	01-07-1964 16:35	0	0.00000	0.00000	0.80947	0.00034	0.06688	0.00000	0.00000	0.06688	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	69.81986	0.81458	0.00000	0.00000
7	01-07-1964 16:40	0	0.00000	0.00000	0.74259	0.00031	0.06406	0.00000	0.00000	0.06406	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	69.07216	0.81458	0.00000	0.00000
7	01-07-1964 16:45	0	0.00000	0.00000	0.67853	0.00028	0.06123	0.00000	0.00000	0.06123	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	68.32163	0.81458	0.00000	0.00000
7	01-07-1964 16:50	0	0.00000	0.00000	0.61730	0.00026	0.05840	0.00000	0.00000	0.05840	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	67.56828	0.81458	0.00000	0.00000
7	01-07-1964 16:55	0	0.00000	0.00000	0.55890	0.00023	0.05557	0.00000	0.00000	0.05557	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	66.81210	0.81458	0.00000	0.00000
7	01-07-1964 17:00	0	0.00000	0.00000	0.50333	0.00021	0.05274	0.00000	0.00000	0.05274	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	66.05309	0.81458	0.00000	0.00000
7	01-07-1964 17:05	0	0.00000	0.00000	0.45059	0.00019	0.04990	0.00000	0.00000	0.04990	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	65.29124	0.81458	0.00000	0.00000
7	01-07-1964 17:10	0	0.00000	0.00000	0.40069	0.00017	0.04705	0.00000	0.00000	0.04705	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	64.52656	0.81458	0.00000	0.00000
7	01-07-1964 17:15	0	0.00000	0.00000	0.35364	0.00015	0.04420	0.00000	0.00000	0.04420	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	63.75903	0.81458	0.00000	0.00000
7	01-07-1964 17:20	0	0.00000	0.00000	0.30943	0.00013	0.04135	0.00000	0.00000	0.04135	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	62.98865	0.81458	0.00000	0.00000
7	01-07-1964 17:25	0	0.00000	0.00000	0.26808	0.00011	0.03849	0.00000	0.00000	0.03849	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	62.21542	0.81458	0.00000	0.00000
7	01-07-1964 17:30	0	0.00000	0.00000	0.22960	0.00010	0.03562	0.00000	0.00000	0.03562	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	61.43932	0.81458	0.00000	0.00000
7	01-07-1964 17:35	0	0.00000	0.00000	0.19398	0.00008	0.03274	0.00000	0.00000	0.03274	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	60.66035	0.81458	0.00000	0.00000
7	01-07-1964 17:40	0	0.00000	0.00000	0.16124	0.00007	0.02985	0.00000	0.00000	0.02985	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	59.87851	0.81458	0.00000	0.00000
7	01-07-1964 17:45	0	0.00000	0.00000	0.13139	0.00005	0.02694	0.00000	0.00000	0.02694	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	59.09378	0.81458	0.00000	0.00000
7	01-07-1964 17:50	0	0.00000	0.00000	0.10444	0.00004	0.02402	0.00000	0.00000	0.02402	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	58.30614	0.81458	0.00000	0.00000
7	01-07-1964 17:55	0	0.00000	0.00000	0.08042	0.00003	0.02108	0.00000	0.00000	0.02108	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	57.51558	0.81458	0.00000	0.00000
7	01-07-1964 18:00	0	0.00000	0.00000	0.05934	0.00002	0.01811	0.00000	0.00000	0.01811	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	56.72207	0.81458	0.00000	0.00000
7	01-07-1964 18:05	0	0.00000	0.00000	0.04123	0.00002	0.01509	0.00000	0.00000	0.01509	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	55.92560	0.81458	0.00000	0.00000
7	01-07-1964 18:10	0	0.00000	0.00000	0.02614	0.00001	0.01202	0.00000	0.00000	0.01202	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	55.12611	0.81458	0.00000	0.00000
7	01-07-1964 18:15	0	0.00000	0.00000	0.01412	0.00001	0.00883	0.00000	0.00000	0.00883	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	54.32354	0.81458	0.00000	0.00000
7	01-07-1964 18:20	0	0.00000	0.00000	0.00529	0.00000	0.00529	0.00000	0.00000	0.00529	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	53.51779	0.81458	0.00000	0.00000
7	01-07-1964 18:25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	52.70850	0.81458	0.00000	0.00000
7	01-07-1964 18:30	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	51.89392	0.81458	0.00000	0.00000
7	01-07-1964 18:35	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	51.07933	0.81458	0.00000	0.00000
7	01-07-1964 18:40	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	50.26475	0.81458	0.00000	0.00000
7	01-07-1964 18:45	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	49.45016	0.81458	0.00000	0.00000
7	01-07-1964 18:50	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	48.63558	0.81458	0.00000	0.00000
7	01-07-1964 18:55	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	47.82100	0.81458	0.00000	0.00000
7	01-07-1964 19:00	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	47.00641	0.81458	0.00000	0.00000
7	01-07-1964 19:05	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	46.19183	0.81458	0.00000	0.00000
7	01-07-1964 19:10	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	45.37725	0.81458	0.00000	0.00000
7	01-07-1964 19:15	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	44.56267	0.81458	0.00000	0.00000
7	01-07-1964 19:20	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	43.74808	0.81458	0.00000	0.00000
7	01-07-1964 19:25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	42.93350	0.81458	0.00000	0.00000
7	01-07-1964 19:30	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	42.11891	0.81458	0.00000	0.00000
7	01-07-1964 19:35	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	41.30433	0.81458	0.00000	0.00000
7	01-07-1964 19:40	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	40.48975	0.81458	0.00000	0.00000
7	01-07-1964 19:45	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	39.67516	0.81458	0.00000	0.00000
7	01-07-1964 19:50	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	38.86058	0.81458	0.00000	0.00000
7	01-07-1964 19:55	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	38.04600	0.81458	0.00000	0.00000
7	01-07-1964 20:00	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	37.23142	0.81458	0.00000	0.00000
7	01-07-1964 20:05	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	36.41683	0.81458	0.00000	0.00000
7	01-07-1964 20:10	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	35.60225	0.81458	0.00000	0.00000
7	01-07-1964 20:15	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	34.78766	0.81458	0.00000	0.00000
7	01-07-1964 20:20	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	33.97308	0.81458	0.00000	0.00000

7	01-07-1964 20:25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	33.15850	0.81458	0.00000	0.00000
7	01-07-1964 20:30	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	32.34391	0.81458	0.00000	0.00000
7	01-07-1964 20:35	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	31.52933	0.81458	0.00000	0.00000
7	01-07-1964 20:40	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	30.71475	0.81458	0.00000	0.00000
7	01-07-1964 20:45	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	29.90017	0.81458	0.00000	0.00000
7	01-07-1964 20:50	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	29.08558	0.81458	0.00000	0.00000
7	01-07-1964 20:55	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	28.27100	0.81458	0.00000	0.00000
7	01-07-1964 21:00	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	27.45641	0.81458	0.00000	0.00000
7	01-07-1964 21:05	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	26.64183	0.81458	0.00000	0.00000
7	01-07-1964 21:10	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	25.82725	0.81458	0.00000	0.00000
7	01-07-1964 21:15	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	25.01266	0.81458	0.00000	0.00000
7	01-07-1964 21:20	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	24.19808	0.81458	0.00000	0.00000
7	01-07-1964 21:25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	23.38350	0.81458	0.00000	0.00000
7	01-07-1964 21:30	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	22.56892	0.81458	0.00000	0.00000
7	01-07-1964 21:35	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	21.75433	0.81458	0.00000	0.00000
7	01-07-1964 21:40	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	20.93975	0.81458	0.00000	0.00000
7	01-07-1964 21:45	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	20.12516	0.81458	0.00000	0.00000
7	01-07-1964 21:50	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	19.31058	0.81458	0.00000	0.00000
7	01-07-1964 21:55	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	18.49600	0.81458	0.00000	0.00000
7	01-07-1964 22:00	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	17.68141	0.81458	0.00000	0.00000
7	01-07-1964 22:05	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	16.86683	0.81458	0.00000	0.00000
7	01-07-1964 22:10	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	16.05225	0.81458	0.00000	0.00000
7	01-07-1964 22:15	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	15.23767	0.81458	0.00000	0.00000
7	01-07-1964 22:20	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	14.42308	0.81458	0.00000	0.00000
7	01-07-1964 22:25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	13.60850	0.81458	0.00000	0.00000
7	01-07-1964 22:30	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.79391	0.81458	0.00000	0.00000
7	01-07-1964 22:35	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.97933	0.81458	0.00000	0.00000
7	01-07-1964 22:40	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.16475	0.81458	0.00000	0.00000
7	01-07-1964 22:45	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.35016	0.81458	0.00000	0.00000
7	01-07-1964 22:50	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.53558	0.81458	0.00000	0.00000
7	01-07-1964 22:55	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.72100	0.81458	0.00000	0.00000
7	01-07-1964 23:00	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.90642	0.81458	0.00000	0.00000
7	01-07-1964 23:05	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.09183	0.81458	0.00000	0.00000
7	01-07-1964 23:10	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.27725	0.81458	0.00000	0.00000
7	01-07-1964 23:15	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.46266	0.81458	0.00000	0.00000
7	01-07-1964 23:20	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	4.64808	0.81458	0.00000	0.00000
7	01-07-1964 23:25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.83350	0.81458	0.00000	0.00000
7	01-07-1964 23:30	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.01891	0.81458	0.00000	0.00000
7	01-07-1964 23:35	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	2.20433	0.81458	0.00000	0.00000
7	01-07-1964 23:40	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.38975	0.81458	0.00000	0.00000
7	01-07-1964 23:45	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.57517	0.57517	0.00000	0.00000

		Roof Area			Infiltration Gallery 1 (East)						
nm)		Impervious area	**2300**	sq.m	Roof area	**2300**	sq.m				
					RG Area	**110**	sq.m				
					Directly to Tench	**0**	sq.m	2300			
Area Check (m^2)	2300	Total area:	2300	sq.m	Total area:	2410	sq.m		**Summary**	**Roof (1+5)**	**IG 2**
Developed area					Trench surf. area:	**110**	sq.m	new SA	Total evaporation		0.0
					Trench depth:	**0.4**	m		Total exfiltration		57.6
					Trench porosity:	**0.35**			Total drainflow	57.6	0.0
					Trench full:	15.4	cu.m		Total runoff	0.0	0.0
Developed area (ha)	0.21				Trench initial vol:	**0**	cu.m		Total Reused		
	0.23				Subsoil exfil. rate:	**32**	mm/hr				
	0.85				Soil depth:		mm		Sum	57.6	57.6
	1.29				Soil porosity:				Total rainfall	57.6	117.9
					Soil field cap:				% Treated	100%	100%
					Soil wilt point:				% untreated	0%	0%
					Soil infil. rate		mm/hr		% Captured	0%	100%
					Soil wilt point vol:		cu.m		EIA	100%	0%
		depth of rain	0.023		Soil porosity vol:		cu.m				
		Rain Volume	53.7		Soil field cap vol:		cu.m				
		P volume	374.9		Soil initial vol:		cu.m				
		Ponding	0.163	m	Ponding		m				
		Orifice	75.00	mm	I/P	0.0					
		max ponding	0.019	m	Safety Factor						
		P volume	43.18	sq.m	Area with SF						

0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
14.4	14.4	42.7	0.019	0.5	0.0	15.0	0.5	15.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	12.1	0.3	0.00	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Roof Area											**Infiltration Gallery 1 (East)**						
All in cubic metres						**All in cubic metres**													
Rain Water onto roof	Rain into Ponding	Beginning Ponding Vol	Depth Ponding	out ponding	Overflow	Rain Water into Swale	Rain Water Directly to trench	Rain into Ponding	Beginning Ponding Vol	out ponding	Unsaturated Runoff	Rain into Soil	Beginning Soil Water Volume	Water from Soil to Trench	Water that Stays in Soil	Beginning Trench Water Volume	Trench Exfiltration	Underdrain Drainflow	Evaporation
	0.00000	0.00000		0.00000	0.00000			0.00000	0.00000	0.00000		0.00000	0.00000	0.00000	0.00000	0.00000		0.00000	0.00000
0.28107	0.28107	0.00000	0.00012	0.04026	0.00000	0.29451	0.04026	0.29451	0.00000	0.00000	0.29451	0.00000	0.00000	0.00000	0.00000	0.00000	0.04026	0.00000	0.00000
0.29551	0.29551	0.24081	0.00023	0.05561	0.00000	0.30964	0.05561	0.30964	0.00000	0.00000	0.30964	0.00000	0.00000	0.00000	0.00000	0.00000	0.05561	0.00000	0.00000
0.31172	0.31172	0.48071	0.00034	0.06759	0.00000	0.32663	0.06759	0.32663	0.00000	0.00000	0.32663	0.00000	0.00000	0.00000	0.00000	0.00000	0.06759	0.00000	0.00000
0.33005	0.33005	0.72484	0.00046	0.07799	0.00000	0.34584	0.07799	0.34584	0.00000	0.00000	0.34584	0.00000	0.00000	0.00000	0.00000	0.00000	0.07799	0.00000	0.00000
0.35096	0.35096	0.97690	0.00058	0.08750	0.00000	0.36774	0.08750	0.36774	0.00000	0.00000	0.36774	0.00000	0.00000	0.00000	0.00000	0.00000	0.08750	0.00000	0.00000
0.37504	0.37504	1.24036	0.00070	0.09651	0.00000	0.39298	0.09651	0.39298	0.00000	0.00000	0.39298	0.00000	0.00000	0.00000	0.00000	0.00000	0.09651	0.00000	0.00000
0.40311	0.40311	1.51889	0.00084	0.10527	0.00000	0.42239	0.10527	0.42239	0.00000	0.00000	0.42239	0.00000	0.00000	0.00000	0.00000	0.00000	0.10527	0.00000	0.00000
0.43628	0.43628	1.81673	0.00098	0.11398	0.00000	0.45714	0.11398	0.45714	0.00000	0.00000	0.45714	0.00000	0.00000	0.00000	0.00000	0.00000	0.11398	0.00000	0.00000
0.47611	0.47611	2.13903	0.00114	0.12279	0.00000	0.49888	0.12279	0.49888	0.00000	0.00000	0.49888	0.00000	0.00000	0.00000	0.00000	0.00000	0.12279	0.00000	0.00000
0.52490	0.52490	2.49235	0.00131	0.13190	0.00000	0.55000	0.13190	0.55000	0.00000	0.00000	0.55000	0.00000	0.00000	0.00000	0.00000	0.00000	0.13190	0.00000	0.00000
0.58612	0.58612	2.88535	0.00151	0.14148	0.00000	0.61416	0.14148	0.61416	0.00000	0.00000	0.61416	0.00000	0.00000	0.00000	0.00000	0.00000	0.14148	0.00000	0.00000
0.66534	0.66534	3.32999	0.00174	0.15178	0.00000	0.69716	0.15178	0.69716	0.00000	0.00000	0.69716	0.00000	0.00000	0.00000	0.00000	0.00000	0.15178	0.00000	0.00000
0.77201	0.77201	3.84356	0.00201	0.16313	0.00000	0.80893	0.16313	0.80893	0.00000	0.00000	0.80893	0.00000	0.00000	0.00000	0.00000	0.00000	0.16313	0.00000	0.00000
0.92355	0.92355	4.45243	0.00234	0.17606	0.00000	0.96772	0.17606	0.96772	0.00000	0.00000	0.96772	0.00000	0.00000	0.00000	0.00000	0.00000	0.17606	0.00000	0.00000
1.15594	1.15594	5.19992	0.00276	0.19143	0.00000	1.21123	0.19143	1.21123	0.00000	0.00000	1.21123	0.00000	0.00000	0.00000	0.00000	0.00000	0.19143	0.00000	0.00000
1.55665	1.55665	6.16443	0.00336	0.21099	0.00000	1.63110	0.21099	1.63110	0.00000	0.00000	1.63110	0.00000	0.00000	0.00000	0.00000	0.00000	0.21099	0.00000	0.00000
2.40316	2.40316	7.51008	0.00431	0.23908	0.00000	2.51809	0.23908	2.51809	0.00000	0.00000	2.51809	0.00000	0.00000	0.00000	0.00000	0.00000	0.23908	0.00000	0.00000
5.21800	5.21800	9.67416	0.00647	0.29303	0.00000	5.46755	0.29303	5.46755	0.00000	0.00000	5.46755	0.00000	0.00000	0.00000	0.00000	0.00000	0.29303	0.00000	0.00000
14.36123	14.36123	14.59913	0.01259	0.40863	0.00000	15.04807	0.40863	######	0.00000	0.00000	15.04807	0.00000	0.00000	0.00000	0.00000	0.00000	0.29333	0.00000	0.00000
6.02610	6.02610	28.55172	0.01503	0.44651	0.00000	6.31431	0.44651	6.31431	0.00000	0.00000	6.31431	0.00000	0.00000	0.00000	0.00000	0.11530	0.29333	0.00000	0.00000
3.22674	3.22674	34.13131	0.01624	0.46411	0.00000	3.38106	0.46411	3.38106	0.00000	0.00000	3.38106	0.00000	0.00000	0.00000	0.00000	0.26848	0.29333	0.00000	0.00000
2.17889	2.17889	36.89393	0.01699	0.47465	0.00000	2.28310	0.47465	2.28310	0.00000	0.00000	2.28310	0.00000	0.00000	0.00000	0.00000	0.43926	0.29333	0.00000	0.00000
1.64278	1.64278	38.59818	0.01750	0.48169	0.00000	1.72135	0.48169	1.72135	0.00000	0.00000	1.72135	0.00000	0.00000	0.00000	0.00000	0.62057	0.29333	0.00000	0.00000
1.32027	1.32027	39.75928	0.01786	0.48668	0.00000	1.38341	0.48668	1.38341	0.00000	0.00000	1.38341	0.00000	0.00000	0.00000	0.00000	0.80892	0.29333	0.00000	0.00000
1.10584	1.10584	40.59286	0.01813	0.49034	0.00000	1.15873	0.49034	1.15873	0.00000	0.00000	1.15873	0.00000	0.00000	0.00000	0.00000	1.00227	0.29333	0.00000	0.00000
0.95327	0.95327	41.20837	0.01833	0.49305	0.00000	0.99886	0.49305	0.99886	0.00000	0.00000	0.99886	0.00000	0.00000	0.00000	0.00000	1.19928	0.29333	0.00000	0.00000
0.83925	0.83925	41.66859	0.01848	0.49507	0.00000	0.87938	0.49507	0.87938	0.00000	0.00000	0.87938	0.00000	0.00000	0.00000	0.00000	1.39899	0.29333	0.00000	0.00000
0.75081	0.75081	42.01276	0.01859	0.49656	0.00000	0.78672	0.49656	0.78672	0.00000	0.00000	0.78672	0.00000	0.00000	0.00000	0.00000	1.60073	0.29333	0.00000	0.00000
0.68021	0.68021	42.26702	0.01867	0.49762	0.00000	0.71274	0.49762	0.71274	0.00000	0.00000	0.71274	0.00000	0.00000	0.00000	0.00000	1.80395	0.29333	0.00000	0.00000
0.62252	0.62252	42.44960	0.01873	0.49835	0.00000	0.65229	0.49835	0.65229	0.00000	0.00000	0.65229	0.00000	0.00000	0.00000	0.00000	2.00824	0.29333	0.00000	0.00000
0.57447	0.57447	42.57378	0.01876	0.49879	0.00000	0.60195	0.49879	0.60195	0.00000	0.00000	0.60195	0.00000	0.00000	0.00000	0.00000	2.21325	0.29333	0.00000	0.00000
0.53382	0.53382	42.64947	0.01878	0.49899	0.00000	0.55935	0.49899	0.55935	0.00000	0.00000	0.55935	0.00000	0.00000	0.00000	0.00000	2.41871	0.29333	0.00000	0.00000
0.49897	0.49897	42.68430	0.01878	0.49899	0.00000	0.52283	0.49899	0.52283	0.00000	0.00000	0.52283	0.00000	0.00000	0.00000	0.00000	2.62436	0.29333	0.00000	0.00000
0.46873	0.46873	42.68428	0.01876	0.49881	0.00000	0.49115	0.49881	0.49115	0.00000	0.00000	0.49115	0.00000	0.00000	0.00000	0.00000	2.83001	0.29333	0.00000	0.00000
0.44224	0.44224	42.65420	0.01874	0.49849	0.00000	0.46339	0.49849	0.46339	0.00000	0.00000	0.46339	0.00000	0.00000	0.00000	0.00000	3.03549	0.29333	0.00000	0.00000
0.41884	0.41884	42.59795	0.01870	0.49803	0.00000	0.43887	0.49803	0.43887	0.00000	0.00000	0.43887	0.00000	0.00000	0.00000	0.00000	3.24065	0.29333	0.00000	0.00000
0.39800	0.39800	42.51877	0.01866	0.49745	0.00000	0.41703	0.49745	0.41703	0.00000	0.00000	0.41703	0.00000	0.00000	0.00000	0.00000	3.44534	0.29333	0.00000	0.00000
0.37932	0.37932	42.41932	0.01861	0.49676	0.00000	0.39746	0.49676	0.39746	0.00000	0.00000	0.39746	0.00000	0.00000	0.00000	0.00000	3.64945	0.29333	0.00000	0.00000
0.36247	0.36247	42.30188	0.01855	0.49598	0.00000	0.37981	0.49598	0.37981	0.00000	0.00000	0.37981	0.00000	0.00000	0.00000	0.00000	3.85288	0.29333	0.00000	0.00000
0.34720	0.34720	42.16837	0.01849	0.49512	0.00000	0.36380	0.49512	0.36380	0.00000	0.00000	0.36380	0.00000	0.00000	0.00000	0.00000	4.05553	0.29333	0.00000	0.00000
0.33328	0.33328	42.02046	0.01841	0.49417	0.00000	0.34922	0.49417	0.34922	0.00000	0.00000	0.34922	0.00000	0.00000	0.00000	0.00000	4.25731	0.29333	0.00000	0.00000
0.32054	0.32054	41.85957	0.01834	0.49316	0.00000	0.33587	0.49316	0.33587	0.00000	0.00000	0.33587	0.00000	0.00000	0.00000	0.00000	4.45815	0.29333	0.00000	0.00000
0.30884	0.30884	41.68695	0.01826	0.49208	0.00000	0.32361	0.49208	0.32361	0.00000	0.00000	0.32361	0.00000	0.00000	0.00000	0.00000	4.65797	0.29333	0.00000	0.00000
0.29804	0.29804	41.50371	0.01817	0.49094	0.00000	0.31230	0.49094	0.31230	0.00000	0.00000	0.31230	0.00000	0.00000	0.00000	0.00000	4.85672	0.29333	0.00000	0.00000
0.28805	0.28805	41.31081	0.01809	0.48975	0.00000	0.30183	0.48975	0.30183	0.00000	0.00000	0.30183	0.00000	0.00000	0.00000	0.00000	5.05432	0.29333	0.00000	0.00000
0.27878	0.27878	41.10911	0.01799	0.48850	0.00000	0.29211	0.48850	0.29211	0.00000	0.00000	0.29211	0.00000	0.00000	0.00000	0.00000	5.25074	0.29333	0.00000	0.00000
0.27014	0.27014	40.89938	0.01790	0.48721	0.00000	0.28306	0.48721	0.28306	0.00000	0.00000	0.28306	0.00000	0.00000	0.00000	0.00000	5.44591	0.29333	0.00000	0.00000
0.26208	0.26208	40.68231	0.01780	0.48588	0.00000	0.27461	0.48588	0.27461	0.00000	0.00000	0.27461	0.00000	0.00000	0.00000	0.00000	5.63979	0.29333	0.00000	0.00000
0.00000	0.00000	40.45851	0.01759	0.48299	0.00000	0.00000	0.48299	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.83234	0.29333	0.00000	0.00000
0.00000	0.00000	39.97552	0.01738	0.48010	0.00000	0.00000	0.48010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.02199	0.29333	0.00000	0.00000
0.00000	0.00000	39.49542	0.01717	0.47721	0.00000	0.00000	0.47721	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.20876	0.29333	0.00000	0.00000
0.00000	0.00000	39.01822	0.01696	0.47431	0.00000	0.00000	0.47431	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.39263	0.29333	0.00000	0.00000
0.00000	0.00000	38.54390	0.01676	0.47142	0.00000	0.00000	0.47142	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.57361	0.29333	0.00000	0.00000
0.00000	0.00000	38.07248	0.01655	0.46853	0.00000	0.00000	0.46853	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.75170	0.29333	0.00000	0.00000
0.00000	0.00000	37.60395	0.01635	0.46564	0.00000	0.00000	0.46564	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.92690	0.29333	0.00000	0.00000
0.00000	0.00000	37.13831	0.01615	0.46275	0.00000	0.00000	0.46275	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.09920	0.29333	0.00000	0.00000
0.00000	0.00000	36.67556	0.01595	0.45985	0.00000	0.00000	0.45985	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.26862	0.29333	0.00000	0.00000
0.00000	0.00000	36.21571	0.01575	0.45696	0.00000	0.00000	0.45696	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.43514	0.29333	0.00000	0.00000
0.00000	0.00000	35.75875	0.01555	0.45407	0.00000	0.00000	0.45407	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.59877	0.29333	0.00000	0.00000
0.00000	0.00000	35.30468	0.01535	0.45118	0.00000	0.00000	0.45118	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.75950	0.29333	0.00000	0.00000
0.00000	0.00000	34.85350	0.01515	0.44829	0.00000	0.00000	0.44829	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.91735	0.29333	0.00000	0.00000
0.00000	0.00000	34.40521	0.01496	0.44539	0.00000	0.00000	0.44539	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.07230	0.29333	0.00000	0.00000
0.00000	0.00000	33.95982	0.01477	0.44250	0.00000	0.00000	0.44250	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.22436	0.29333	0.00000	0.00000
0.00000	0.00000	33.51732	0.01457	0.43961	0.00000	0.00000	0.43961	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.37353	0.29333	0.00000	0.00000
0.00000	0.00000	33.07771	0.01438	0.43672	0.00000	0.00000	0.43672	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.51981	0.29333	0.00000	0.00000
0.00000	0.00000	32.64099	0.01419	0.43382	0.00000	0.00000	0.43382	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.66319	0.29333	0.00000	0.00000
0.00000	0.00000	32.20717	0.01400	0.43093	0.00000	0.00000	0.43093	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.80368	0.29333	0.00000	0.00000
0.00000	0.00000	31.77623	0.01382	0.42804	0.00000	0.00000	0.42804	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.94128	0.29333	0.00000	0.00000
0.00000	0.00000	31.34820	0.01363	0.42515	0.00000	0.00000	0.42515	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.07598	0.29333	0.00000	0.00000
0.00000	0.00000	30.92305	0.01344	0.42225	0.00000	0.00000	0.42225	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.20780	0.29333	0.00000	0.00000
0.00000	0.00000	30.50080	0.01326	0.41936	0.00000	0.00000	0.41936	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.33672	0.29333	0.00000	0.00000
0.00000	0.00000	30.08143	0.01308	0.41647	0.00000	0.00000	0.41647	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.46274	0.29333	0.00000	0.00000
0.00000	0.00000	29.66497	0.01290	0.41357	0.00000	0.00000	0.41357	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.58588	0.29333	0.00000	0.00000
0.00000	0.00000	29.25139	0.01272	0.41068	0.00000	0.00000	0.41068	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.70612	0.29333	0.00000	0.00000
0.00000	0.00000	28.84071	0.01254	0.40779	0.00000	0.00000	0.40779	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.82347	0.29333	0.00000	0.00000
0.00000	0.00000	28.43292	0.01236	0.40490	0.00000	0.00000	0.40490	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.93792	0.29333	0.00000	0.00000
0.00000	0.00000	28.02803	0.01219	0.40200	0.00000	0.00000	0.40200	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.04949	0.29333	0.00000	0.00000
0.00000	0.00000	27.62602	0.01201	0.39911	0.00000	0.00000	0.39911	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.15816	0.29333	0.00000	0.00000
0.00000	0.00000	27.22692	0.01184	0.39622	0.00000	0.00000	0.39622	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.26393	0.29333	0.00000	0.00000
0.00000	0.00000	26.83070	0.01167	0.39332	0.00000	0.00000	0.39332	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.36681	0.29333	0.00000	0.00000
0.00000	0.00000	26.43738	0.01149	0.39043	0.00000	0.00000	0.39043	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.46680	0.29333	0.00000	0.00000
0.00000	0.00000	26.04695	0.01132	0.38753	0.00000	0.00000	0.38753	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.56390	0.29333	0.00000	0.00000
0.00000	0.00000	25.65941	0.01116	0.38464	0.00000	0.00000	0.38464	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.65810	0.29333	0.00000	0.00000
0.00000	0.00000	25.27477	0.01099	0.38175	0.00000	0.00000	0.38175	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.74941	0.29333	0.00000	0.00000
0.00000	0.00000	24.89303	0.01082	0.37885	0.00000	0.00000	0.37885	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.83782	0.29333	0.00000	0.00000
0.00000	0.00000	24.51417	0.01066	0.37596	0.00000	0.00000	0.37596	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.92334	0.29333	0.00000	0.00000
0.00000	0.00000	24.13821	0.01049	0.37307	0.00000	0.00000	0.37307	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.00597	0.29333	0.00000	0.00000
0.00000	0.00000	23.76515	0.01033	0.37017	0.00000	0.00000	0.37017	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.08570	0.29333	0.00000	0.00000
0.00000	0.00000	23.39498	0.01017	0.36728	0.00000	0.00000	0.36728	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.16254	0.29333	0.00000	0.00000
0.00000	0.00000	23.02770	0.01001	0.36438	0.00000	0.00000	0.36438	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.23648	0.29333	0.00000	0.00000
0.00000	0.00000	22.66332	0.00985	0.36149	0.00000	0.00000	0.36149	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.30753	0.29333	0.00000	0.00000
0.00000	0.00000	22.30183	0.00970	0.35859	0.00000	0.00000	0.35859	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.37568	0.29333	0.00000	0.00000
0.00000	0.00000	21.94324	0.00954	0.35570	0.00000	0.00000	0.35570	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.44094	0.29333	0.00000	0.00000
0.00000	0.00000	21.58754	0.00939	0.35280	0.00000	0.00000	0.35280	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.50331	0.29333	0.00000	0.00000
0.00000	0.00000	21.23473	0.00923	0.34991	0.00000	0.00000	0.34991	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.56278	0.29333	0.00000	0.00000
0.00000	0.00000	20.88482	0.00908	0.34701	0.00000	0.00000	0.34701	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.61935	0.29333	0.00000	0.00000
0.00000	0.00000	20.53781	0.00893	0.34412	0.00000	0.00000	0.34412	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.67304	0.29333	0.00000	0.00000
0.00000	0.00000	20.19369	0.00878	0.34122	0.00000	0.00000	0.34122	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.72382	0.29333	0.00000	0.00000
0.00000	0.00000	19.85247	0.00863	0.33833	0.00000	0.00000	0.33833	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.77171	0.29333	0.00000	0.00000
0.00000	0.00000	19.51414	0.00848	0.33543	0.00000	0.00000	0.33543	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.81671	0.29333	0.00000	0.00000
0.00000	0.00000	19.17870	0.00834	0.33254	0.00000	0.00000	0.33254	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.85881	0.29333	0.00000	0.00000
0.00000	0.00000	18.84616	0.00819	0.32964	0.00000	0.00000	0.32964	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.89801	0.29333	0.00000	0.00000

0.00000	0.00000	18.51652	0.00805	0.32675	0.00000	0.00000	0.32675	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.93432	0.29333	0.00000	0.00000
0.00000	0.00000	18.18977	0.00791	0.32385	0.00000	0.00000	0.32385	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.96774	0.29333	0.00000	0.00000
0.00000	0.00000	17.86592	0.00777	0.32096	0.00000	0.00000	0.32096	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.99826	0.29333	0.00000	0.00000
0.00000	0.00000	17.54497	0.00763	0.31806	0.00000	0.00000	0.31806	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.02588	0.29333	0.00000	0.00000
0.00000	0.00000	17.22691	0.00749	0.31516	0.00000	0.00000	0.31516	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.05060	0.29333	0.00000	0.00000
0.00000	0.00000	16.91174	0.00735	0.31227	0.00000	0.00000	0.31227	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.07243	0.29333	0.00000	0.00000
0.00000	0.00000	16.59948	0.00722	0.30937	0.00000	0.00000	0.30937	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.09137	0.29333	0.00000	0.00000
0.00000	0.00000	16.29011	0.00708	0.30647	0.00000	0.00000	0.30647	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.10741	0.29333	0.00000	0.00000
0.00000	0.00000	15.98363	0.00695	0.30358	0.00000	0.00000	0.30358	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.12055	0.29333	0.00000	0.00000
0.00000	0.00000	15.68005	0.00682	0.30068	0.00000	0.00000	0.30068	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.13079	0.29333	0.00000	0.00000
0.00000	0.00000	15.37937	0.00669	0.29778	0.00000	0.00000	0.29778	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.13814	0.29333	0.00000	0.00000
0.00000	0.00000	15.08159	0.00656	0.29489	0.00000	0.00000	0.29489	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.14259	0.29333	0.00000	0.00000
0.00000	0.00000	14.78670	0.00643	0.29199	0.00000	0.00000	0.29199	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.14414	0.29333	0.00000	0.00000
0.00000	0.00000	14.49471	0.00630	0.28909	0.00000	0.00000	0.28909	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.14280	0.29333	0.00000	0.00000
0.00000	0.00000	14.20562	0.00618	0.28620	0.00000	0.00000	0.28620	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.13856	0.29333	0.00000	0.00000
0.00000	0.00000	13.91942	0.00605	0.28330	0.00000	0.00000	0.28330	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.13142	0.29333	0.00000	0.00000
0.00000	0.00000	13.63613	0.00593	0.28040	0.00000	0.00000	0.28040	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.12139	0.29333	0.00000	0.00000
0.00000	0.00000	13.35573	0.00581	0.27750	0.00000	0.00000	0.27750	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.10845	0.29333	0.00000	0.00000
0.00000	0.00000	13.07823	0.00569	0.27460	0.00000	0.00000	0.27460	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.09262	0.29333	0.00000	0.00000
0.00000	0.00000	12.80362	0.00557	0.27171	0.00000	0.00000	0.27171	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.07389	0.29333	0.00000	0.00000
0.00000	0.00000	12.53192	0.00545	0.26881	0.00000	0.00000	0.26881	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.05226	0.29333	0.00000	0.00000
0.00000	0.00000	12.26311	0.00533	0.26591	0.00000	0.00000	0.26591	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.02774	0.29333	0.00000	0.00000
0.00000	0.00000	11.99720	0.00522	0.26301	0.00000	0.00000	0.26301	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	12.00031	0.29333	0.00000	0.00000
0.00000	0.00000	11.73419	0.00510	0.26011	0.00000	0.00000	0.26011	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.96999	0.29333	0.00000	0.00000
0.00000	0.00000	11.47408	0.00499	0.25721	0.00000	0.00000	0.25721	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.93677	0.29333	0.00000	0.00000
0.00000	0.00000	11.21687	0.00488	0.25431	0.00000	0.00000	0.25431	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.90065	0.29333	0.00000	0.00000
0.00000	0.00000	10.96255	0.00477	0.25141	0.00000	0.00000	0.25141	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.86162	0.29333	0.00000	0.00000
0.00000	0.00000	10.71114	0.00466	0.24851	0.00000	0.00000	0.24851	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.81970	0.29333	0.00000	0.00000
0.00000	0.00000	10.46263	0.00455	0.24561	0.00000	0.00000	0.24561	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.77488	0.29333	0.00000	0.00000
0.00000	0.00000	10.21701	0.00444	0.24271	0.00000	0.00000	0.24271	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.72717	0.29333	0.00000	0.00000
0.00000	0.00000	9.97430	0.00434	0.23981	0.00000	0.00000	0.23981	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.67655	0.29333	0.00000	0.00000
0.00000	0.00000	9.73449	0.00423	0.23691	0.00000	0.00000	0.23691	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.62303	0.29333	0.00000	0.00000
0.00000	0.00000	9.49757	0.00413	0.23401	0.00000	0.00000	0.23401	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.56661	0.29333	0.00000	0.00000
0.00000	0.00000	9.26356	0.00403	0.23111	0.00000	0.00000	0.23111	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.50728	0.29333	0.00000	0.00000
0.00000	0.00000	9.03245	0.00393	0.22821	0.00000	0.00000	0.22821	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.44506	0.29333	0.00000	0.00000
0.00000	0.00000	8.80424	0.00383	0.22531	0.00000	0.00000	0.22531	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.37994	0.29333	0.00000	0.00000
0.00000	0.00000	8.57893	0.00373	0.22241	0.00000	0.00000	0.22241	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.31191	0.29333	0.00000	0.00000
0.00000	0.00000	8.35652	0.00363	0.21951	0.00000	0.00000	0.21951	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.24099	0.29333	0.00000	0.00000
0.00000	0.00000	8.13702	0.00354	0.21660	0.00000	0.00000	0.21660	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.16716	0.29333	0.00000	0.00000
0.00000	0.00000	7.92042	0.00344	0.21370	0.00000	0.00000	0.21370	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.09043	0.29333	0.00000	0.00000
0.00000	0.00000	7.70672	0.00335	0.21080	0.00000	0.00000	0.21080	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	11.01080	0.29333	0.00000	0.00000
0.00000	0.00000	7.49592	0.00326	0.20790	0.00000	0.00000	0.20790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.92826	0.29333	0.00000	0.00000
0.00000	0.00000	7.28802	0.00317	0.20499	0.00000	0.00000	0.20499	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.84282	0.29333	0.00000	0.00000
0.00000	0.00000	7.08303	0.00308	0.20209	0.00000	0.00000	0.20209	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.75448	0.29333	0.00000	0.00000
0.00000	0.00000	6.88094	0.00299	0.19918	0.00000	0.00000	0.19918	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.66324	0.29333	0.00000	0.00000
0.00000	0.00000	6.68176	0.00291	0.19628	0.00000	0.00000	0.19628	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.56909	0.29333	0.00000	0.00000
0.00000	0.00000	6.48548	0.00282	0.19338	0.00000	0.00000	0.19338	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.47204	0.29333	0.00000	0.00000
0.00000	0.00000	6.29210	0.00274	0.19047	0.00000	0.00000	0.19047	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.37208	0.29333	0.00000	0.00000
0.00000	0.00000	6.10163	0.00265	0.18757	0.00000	0.00000	0.18757	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.26922	0.29333	0.00000	0.00000
0.00000	0.00000	5.91406	0.00257	0.18466	0.00000	0.00000	0.18466	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.16345	0.29333	0.00000	0.00000
0.00000	0.00000	5.72940	0.00249	0.18176	0.00000	0.00000	0.18176	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	10.05478	0.29333	0.00000	0.00000
0.00000	0.00000	5.54765	0.00241	0.17885	0.00000	0.00000	0.17885	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.94320	0.29333	0.00000	0.00000
0.00000	0.00000	5.36880	0.00233	0.17594	0.00000	0.00000	0.17594	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.82872	0.29333	0.00000	0.00000
0.00000	0.00000	5.19285	0.00226	0.17304	0.00000	0.00000	0.17304	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.71133	0.29333	0.00000	0.00000
0.00000	0.00000	5.01982	0.00218	0.17013	0.00000	0.00000	0.17013	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.59103	0.29333	0.00000	0.00000
0.00000	0.00000	4.84969	0.00211	0.16722	0.00000	0.00000	0.16722	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.46782	0.29333	0.00000	0.00000
0.00000	0.00000	4.68247	0.00204	0.16431	0.00000	0.00000	0.16431	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.34171	0.29333	0.00000	0.00000
0.00000	0.00000	4.51816	0.00196	0.16140	0.00000	0.00000	0.16140	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.21269	0.29333	0.00000	0.00000
0.00000	0.00000	4.35675	0.00189	0.15849	0.00000	0.00000	0.15849	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	9.08076	0.29333	0.00000	0.00000
0.00000	0.00000	4.19826	0.00183	0.15558	0.00000	0.00000	0.15558	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.94592	0.29333	0.00000	0.00000
0.00000	0.00000	4.04268	0.00176	0.15267	0.00000	0.00000	0.15267	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.80817	0.29333	0.00000	0.00000
0.00000	0.00000	3.89000	0.00169	0.14976	0.00000	0.00000	0.14976	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.66751	0.29333	0.00000	0.00000
0.00000	0.00000	3.74024	0.00163	0.14685	0.00000	0.00000	0.14685	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.52394	0.29333	0.00000	0.00000
0.00000	0.00000	3.59338	0.00156	0.14394	0.00000	0.00000	0.14394	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.37746	0.29333	0.00000	0.00000
0.00000	0.00000	3.44944	0.00150	0.14103	0.00000	0.00000	0.14103	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.22807	0.29333	0.00000	0.00000
0.00000	0.00000	3.30842	0.00144	0.13812	0.00000	0.00000	0.13812	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	8.07576	0.29333	0.00000	0.00000
0.00000	0.00000	3.17030	0.00138	0.13520	0.00000	0.00000	0.13520	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.92055	0.29333	0.00000	0.00000
0.00000	0.00000	3.03510	0.00132	0.13229	0.00000	0.00000	0.13229	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.76241	0.29333	0.00000	0.00000
0.00000	0.00000	2.90281	0.00126	0.12937	0.00000	0.00000	0.12937	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.60137	0.29333	0.00000	0.00000
0.00000	0.00000	2.77344	0.00121	0.12646	0.00000	0.00000	0.12646	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.43741	0.29333	0.00000	0.00000
0.00000	0.00000	2.64698	0.00115	0.12354	0.00000	0.00000	0.12354	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.27053	0.29333	0.00000	0.00000
0.00000	0.00000	2.52344	0.00110	0.12062	0.00000	0.00000	0.12062	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	7.10074	0.29333	0.00000	0.00000
0.00000	0.00000	2.40282	0.00104	0.11770	0.00000	0.00000	0.11770	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.92803	0.29333	0.00000	0.00000
0.00000	0.00000	2.28511	0.00099	0.11479	0.00000	0.00000	0.11479	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.75240	0.29333	0.00000	0.00000
0.00000	0.00000	2.17033	0.00094	0.11187	0.00000	0.00000	0.11187	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.57385	0.29333	0.00000	0.00000
0.00000	0.00000	2.05846	0.00089	0.10894	0.00000	0.00000	0.10894	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.39238	0.29333	0.00000	0.00000
0.00000	0.00000	1.94952	0.00085	0.10602	0.00000	0.00000	0.10602	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.20799	0.29333	0.00000	0.00000
0.00000	0.00000	1.84350	0.00080	0.10310	0.00000	0.00000	0.10310	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	6.02068	0.29333	0.00000	0.00000
0.00000	0.00000	1.74040	0.00076	0.10017	0.00000	0.00000	0.10017	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.83045	0.29333	0.00000	0.00000
0.00000	0.00000	1.64022	0.00071	0.09725	0.00000	0.00000	0.09725	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.63729	0.29333	0.00000	0.00000
0.00000	0.00000	1.54298	0.00067	0.09432	0.00000	0.00000	0.09432	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.44120	0.29333	0.00000	0.00000
0.00000	0.00000	1.44865	0.00063	0.09139	0.00000	0.00000	0.09139	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.24219	0.29333	0.00000	0.00000
0.00000	0.00000	1.35726	0.00059	0.08846	0.00000	0.00000	0.08846	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	5.04025	0.29333	0.00000	0.00000
0.00000	0.00000	1.26880	0.00055	0.08553	0.00000	0.00000	0.08553	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	4.83538	0.29333	0.00000	0.00000
0.00000	0.00000	1.18327	0.00051	0.08260	0.00000	0.00000	0.08260	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	4.62758	0.29333	0.00000	0.00000
0.00000	0.00000	1.10067	0.00048	0.07966	0.00000	0.00000	0.07966	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	4.41685	0.29333	0.00000	0.00000
0.00000	0.00000	1.02100	0.00044	0.07673	0.00000	0.00000	0.07673	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	4.20318	0.29333	0.00000	0.00000
0.00000	0.00000	0.94428	0.00041	0.07379	0.00000	0.00000	0.07379	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.98657	0.29333	0.00000	0.00000
0.00000	0.00000	0.87049	0.00038	0.07085	0.00000	0.00000	0.07085	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.76702	0.29333	0.00000	0.00000
0.00000	0.00000	0.79964	0.00035	0.06790	0.00000	0.00000	0.06790	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.54454	0.29333	0.00000	0.00000
0.00000	0.00000	0.73174	0.00032	0.06495	0.00000	0.00000	0.06495	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.31910	0.29333	0.00000	0.00000
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0.00000	0.00000	0.60478	0.00026	0.05905	0.00000	0.00000	0.05905	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	2.85940	0.29333	0.00000	0.00000
0.00000	0.00000	0.54573	0.00024	0.05609	0.00000	0.00000	0.05609	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	2.62512	0.29333	0.00000	0.00000
0.00000	0.00000	0.48964	0.00021	0.05313	0.00000	0.00000	0.05313	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	2.38788	0.29333	0.00000	0.00000
0.00000	0.00000	0.43650	0.00019	0.05017	0.00000	0.00000	0.05017	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	2.14768	0.29333	0.00000	0.00000
0.00000	0.00000	0.38633	0.00017	0.04720	0.00000	0.00000	0.04720	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.90451	0.29333	0.00000	0.00000
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0.00000	0.00000	0.29492	0.00013	0.04124	0.00000	0.00000	0.04124	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.40926	0.29333	0.00000	0.00000
0.00000	0.00000	0.25368	0.00011	0.03825	0.00000	0.00000	0.03825	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.15717	0.29333	0.00000	0.00000
0.00000	0.00000	0.21544	0.00009	0.03524	0.00000	0.00000	0.03524	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.90208	0.29333	0.00000	0.00000
0.00000	0.00000	0.18019	0.00008	0.03223	0.00000	0.00000	0.03223	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.64399	0.29333	0.00000	0.00000
0.00000	0.00000	0.14796	0.00006	0.02921	0.00000	0.00000	0.02921	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.38289	0.29333	0.00000	0.00000
0.00000	0.00000	0.11875	0.00005	0.02617	0.00000	0.00000	0.02617	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.11876	0.14493	0.00000	0.00000
0.00000	0.00000	0.09258	0.00004	0.02310	0.00000	0.00000	0.02310	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02310	0.00000	0.00000
0.00000	0.00000	0.06948	0.00003	0.02002	0.00000	0.00000	0.02002	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02002	0.00000	0.00000
0.00000	0.00000	0.04946	0.00002	0.01689	0.00000	0.00000	0.01689	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01689	0.00000	0.00000
0.00000	0.00000	0.03258	0.00001	0.01371	0.00000	0.00000	0.01371	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01371	0.00000	0.00000
0.00000	0.00000	0.01887	0.00001	0.01043	0.00000	0.00000	0.01043	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01043	0.00000	0.00000
0.00000	0.00000	0.00844	0.00000	0.00698	0.00000	0.00000	0.00698	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00698	0.00000	0.00000
0.00000	0.00000	0.00146	0.00000	0.00146	0.00000	0.00000	0.00146	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00146	0.00000	0.00000

STORMCEPTOR SIZING REPORT

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/30/2021

Province:	Ontario
City:	Guelph
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
NCDC Rainfall Station Id:	9387
Years of Rainfall Data:	34
Site Name:	1250 Gordon Street
Drainage Area (ha):	0.69
% Imperviousness:	98.00

Runoff Coefficient 'c': 0.88

Project Name:	1250 Gordon Street
Project Number:	161413684
Designer Name:	Claire Phelps
Designer Company:	Stantec
Designer Email:	Claire.Phelps@stantec.com
Designer Phone:	519-575-4125
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	>75 micron
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	
Estimated Water Quality Flow Rate (L/s):	
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	96
EF6	98
EF8	99
EF10	99
EF12	99

Recommended Stormceptor EF Model: **EF4**

Estimated Net Annual Sediment (TSS) Load Reduction (%): **96**

THIRD-PARTY TESTING AND VERIFICATION

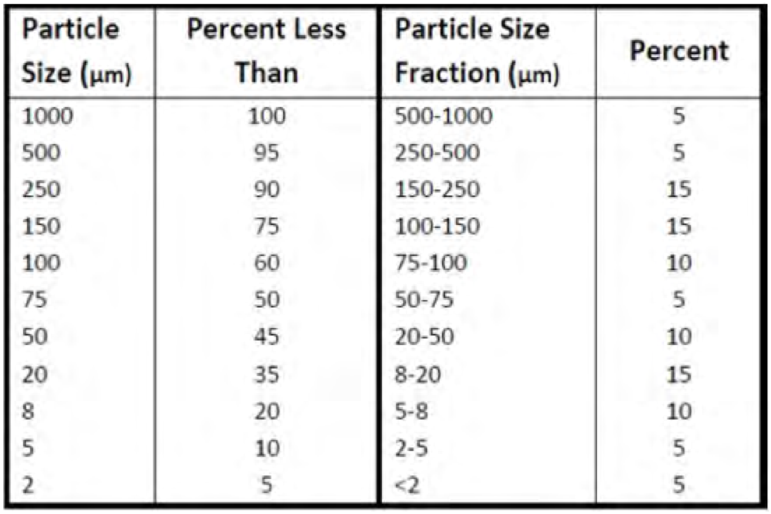
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

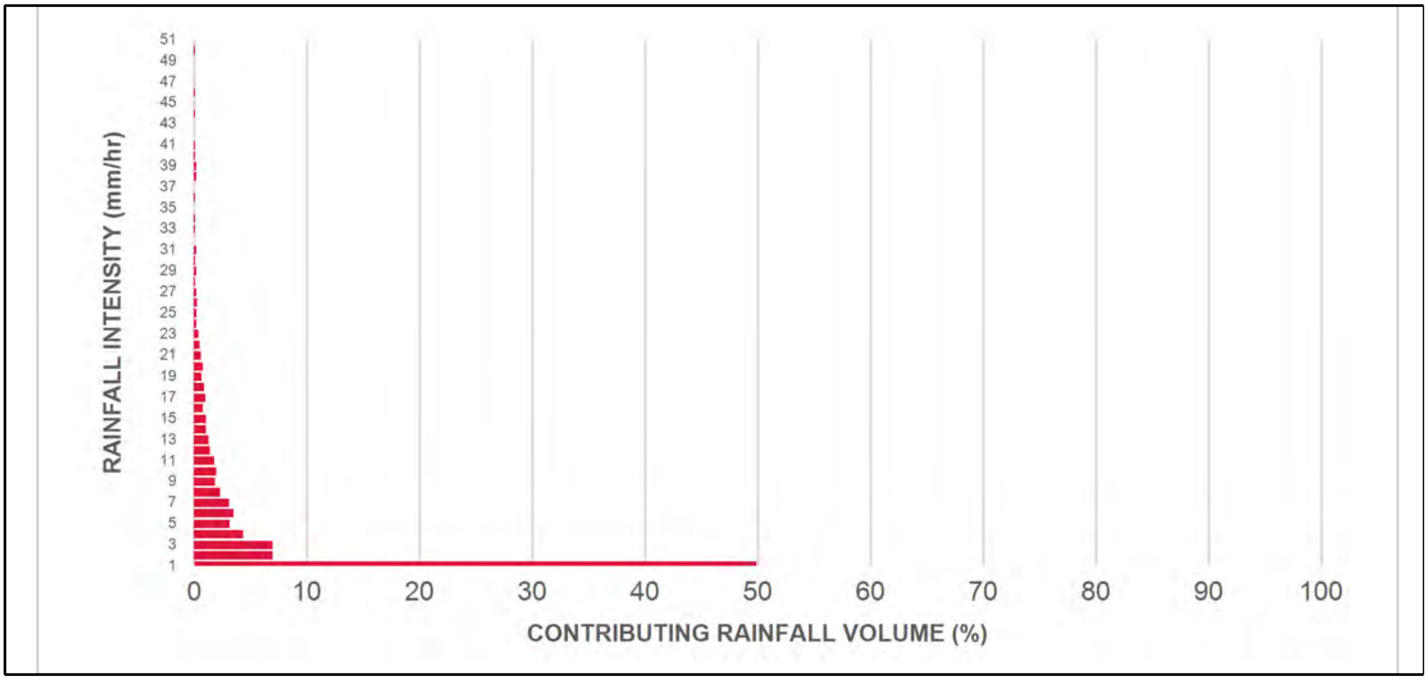


Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

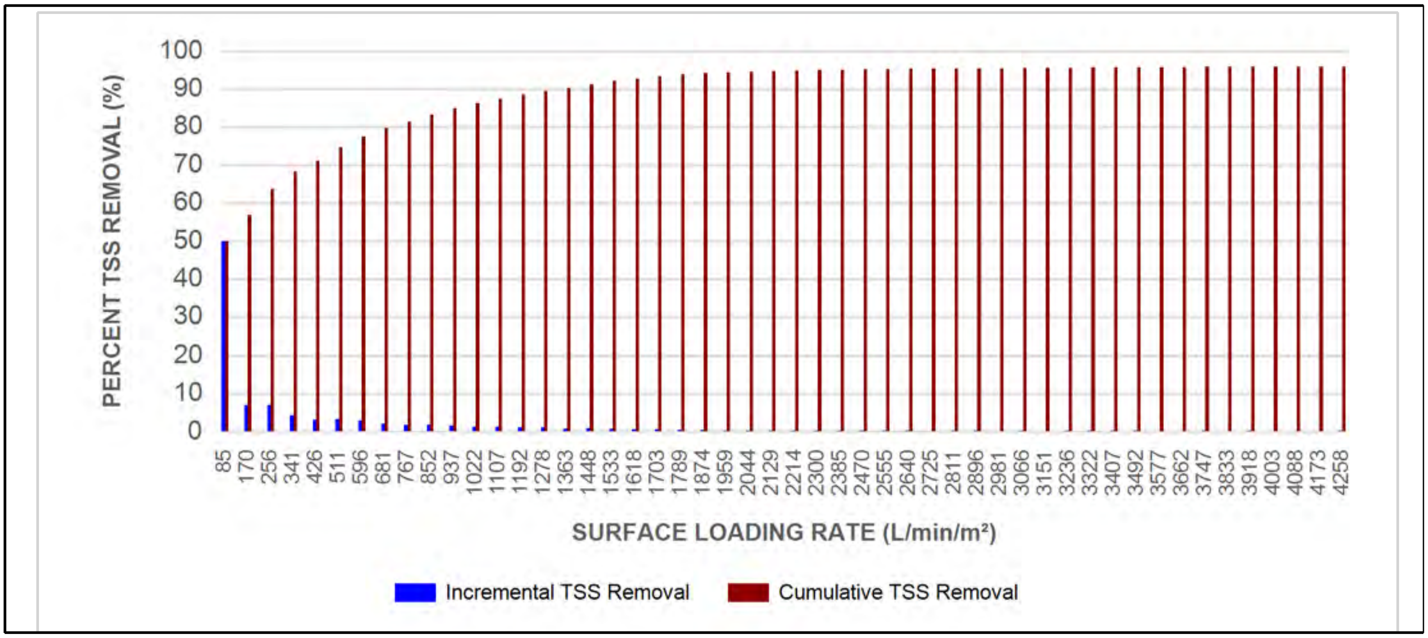
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	49.9	49.9	1.70	102.0	85.0	100	49.9	49.9
2	7.0	56.9	3.41	204.0	170.0	100	7.0	56.9
3	7.0	63.9	5.11	307.0	256.0	99	6.9	63.8
4	4.4	68.3	6.81	409.0	341.0	98	4.3	68.2
5	3.2	71.5	8.52	511.0	426.0	97	3.1	71.2
6	3.5	75.0	10.22	613.0	511.0	95	3.3	74.6
7	3.1	78.1	11.92	715.0	596.0	94	2.9	77.5
8	2.3	80.4	13.63	818.0	681.0	93	2.1	79.7
9	1.9	82.3	15.33	920.0	767.0	93	1.8	81.4
10	2.0	84.3	17.03	1022.0	852.0	92	1.8	83.3
11	1.8	86.1	18.74	1124.0	937.0	92	1.6	84.9
12	1.4	87.5	20.44	1226.0	1022.0	91	1.3	86.2
13	1.3	88.8	22.14	1329.0	1107.0	93	1.2	87.4
14	1.1	89.9	23.85	1431.0	1192.0	95	1.0	88.4
15	1.1	91.0	25.55	1533.0	1278.0	96	1.1	89.5
16	0.8	91.8	27.25	1635.0	1363.0	98	0.8	90.3
17	1.0	92.8	28.96	1737.0	1448.0	96	1.0	91.2
18	0.9	93.7	30.66	1840.0	1533.0	91	0.8	92.1
19	0.7	94.4	32.36	1942.0	1618.0	86	0.6	92.7
20	0.8	95.2	34.07	2044.0	1703.0	82	0.7	93.3
21	0.6	95.8	35.77	2146.0	1789.0	78	0.5	93.8
22	0.5	96.3	37.47	2248.0	1874.0	74	0.4	94.2
23	0.4	96.7	39.18	2351.0	1959.0	71	0.3	94.4
24	0.2	96.9	40.88	2453.0	2044.0	68	0.1	94.6
25	0.2	97.1	42.58	2555.0	2129.0	65	0.1	94.7

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.3	97.4	44.29	2657.0	2214.0	63	0.2	94.9
27	0.2	97.6	45.99	2759.0	2300.0	60	0.1	95.0
28	0.1	97.7	47.69	2862.0	2385.0	58	0.1	95.1
29	0.2	97.9	49.40	2964.0	2470.0	56	0.1	95.2
30	0.1	98.0	51.10	3066.0	2555.0	54	0.1	95.2
31	0.2	98.2	52.80	3168.0	2640.0	53	0.1	95.3
32	0.0	98.2	54.51	3270.0	2725.0	51	0.0	95.3
33	0.1	98.3	56.21	3373.0	2811.0	50	0.1	95.4
34	0.1	98.4	57.91	3475.0	2896.0	50	0.1	95.4
35	0.0	98.4	59.62	3577.0	2981.0	48	0.0	95.4
36	0.1	98.5	61.32	3679.0	3066.0	46	0.0	95.5
37	0.0	98.5	63.02	3781.0	3151.0	45	0.0	95.5
38	0.2	98.7	64.73	3884.0	3236.0	43	0.1	95.6
39	0.2	98.9	66.43	3986.0	3322.0	42	0.1	95.7
40	0.1	99.0	68.13	4088.0	3407.0	41	0.0	95.7
41	0.1	99.1	69.84	4190.0	3492.0	41	0.0	95.7
42	0.0	99.1	71.54	4292.0	3577.0	40	0.0	95.7
43	0.0	99.1	73.24	4395.0	3662.0	39	0.0	95.7
44	0.1	99.2	74.95	4497.0	3747.0	37	0.0	95.8
45	0.0	99.2	76.65	4599.0	3833.0	36	0.0	95.8
46	0.1	99.3	78.35	4701.0	3918.0	36	0.0	95.8
47	0.0	99.3	80.06	4803.0	4003.0	35	0.0	95.8
48	0.0	99.3	81.76	4906.0	4088.0	35	0.0	95.8
49	0.0	99.3	83.46	5008.0	4173.0	34	0.0	95.8
50	0.1	99.4	85.17	5110.0	4258.0	33	0.0	95.8
							Estimated Net Annual Sediment (TSS) Load Reduction =	**96 %**

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

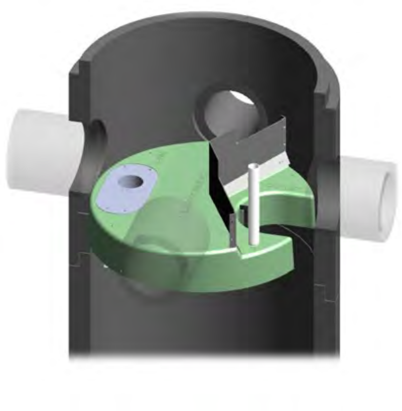
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

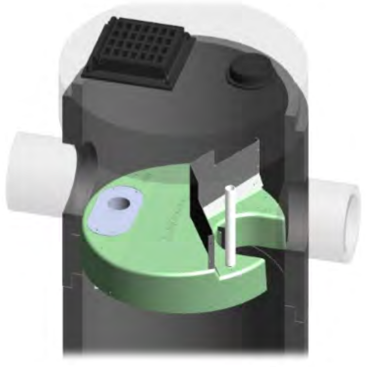
DESIGN FLEXIBILITY

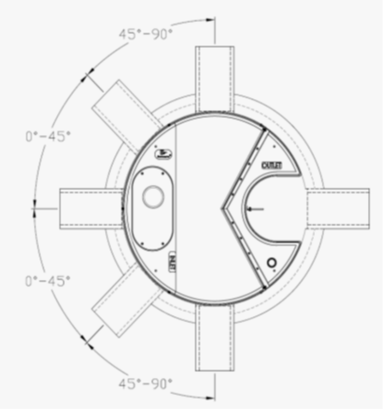
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

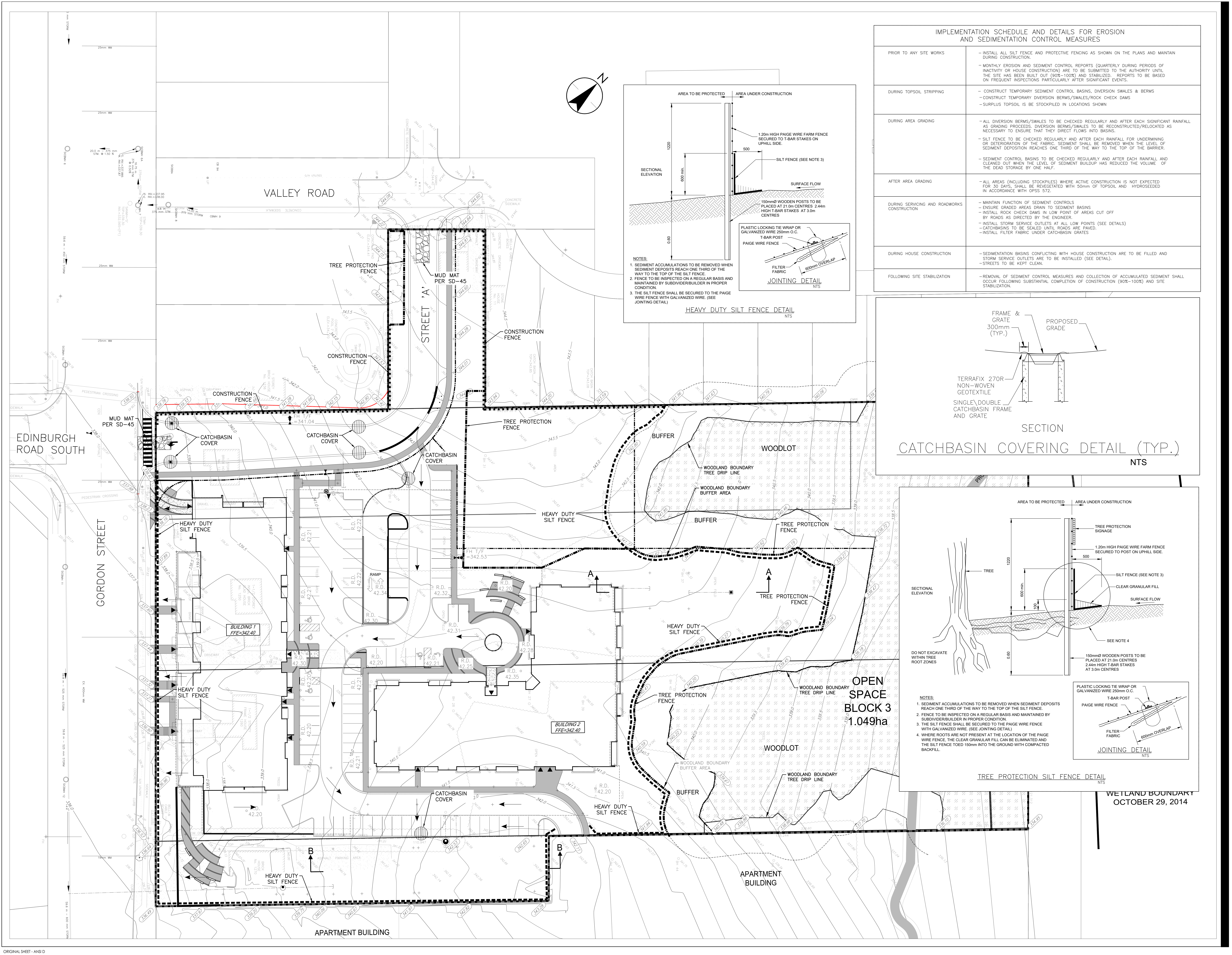
The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

APPENDIX I
GRADING AND EROSION AND SEDIMENT CONTROL PLANS



HEAVY DUTY SILT FENCE DETAIL

NTS

NOTES:

1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAIGE WIRE FENCE WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)

IMPLEMENTATION SCHEDULE AND DETAILS FOR EROSION AND SEDIMENTATION CONTROL MEASURES

PRIOR TO ANY SITE WORKS	– INSTALL ALL SILT FENCE AND PROTECTIVE FENCING AS SHOWN ON THE PLANS AND MAINTAIN DURING CONSTRUCTION. – MONTHLY EROSION AND SEDIMENT CONTROL REPORTS (QUARTERLY DURING PERIODS OF INACTIVITY OR HOUSE CONSTRUCTION) ARE TO BE SUBMITTED TO THE AUTHORITY UNTIL THE SITE HAS BEEN BUILT OUT (90%–100%) AND STABILIZED. REPORTS TO BE BASED ON FREQUENT INSPECTIONS PARTICULARLY AFTER SIGNIFICANT EVENTS.
DURING TOPSOIL STRIPPING	– CONSTRUCT TEMPORARY SEDIMENT CONTROL BASINS, DIVERSION SWALES & BERMS – CONSTRUCT TEMPORARY DIVERSION BERMS/SWALES/ROCK CHECK DAMS – SURPLUS TOPSOIL IS BE STOCKPILED IN LOCATIONS SHOWN
DURING AREA GRADING	– ALL DIVERSION BERMS/SWALES TO BE CHECKED REGULARLY AND AFTER EACH SIGNIFICANT RAINFALL AS GRADING PROCEEDS. DIVERSION BERMS/SWALES TO BE RECONSTRUCTED/RELOCATED AS NECESSARY TO ENSURE THAT THEY DIRECT FLOWS INTO BASINS. – SILT FENCE TO BE CHECKED REGULARLY AND AFTER EACH RAINFALL FOR UNDERMINING OR DETERIORATION OF THE FABRIC. SEDIMENT SHALL BE REMOVED WHEN THE LEVEL OF SEDIMENT DEPOSITION REACHES ONE THIRD OF THE WAY TO THE TOP OF THE BARRIER. – SEDIMENT CONTROL BASINS TO BE CHECKED REGULARLY AND AFTER EACH RAINFALL AND CLEANED OUT WHEN THE LEVEL OF SEDIMENT BUILDUP HAS REDUCED THE VOLUME OF THE DEAD STORAGE BY ONE HALF.
AFTER AREA GRADING	– ALL AREAS (INCLUDING STOCKPILES) WHERE ACTIVE CONSTRUCTION IS NOT EXPECTED FOR 30 DAYS, SHALL BE REVEGETATED WITH 50mm OF TOPSOIL AND HYDROSEEDED IN ACCORDANCE WITH OPSS 572.
DURING SERVICING AND ROADWORKS CONSTRUCTION	– MAINTAIN FUNCTION OF SEDIMENT CONTROLS – ENSURE GRADED AREAS DRAIN TO SEDIMENT BASINS – INSTALL ROCK CHECK DAMS IN LOW POINT OF AREAS CUT OFF BY ROADS AS DIRECTED BY THE ENGINEER. – INSTALL STORM SERVICE OUTLETS AT ALL LOW POINTS (SEE DETAILS) – CATCHBASINS TO BE SEALED UNTIL ROADS ARE PAVED. – INSTALL FILTER FABRIC UNDER CATCHBASIN GRATES
DURING HOUSE CONSTRUCTION	– SEDIMENTATION BASINS CONFLICTING WITH HOUSE CONSTRUCTION ARE TO BE FILLED AND STORM SERVICE OUTLETS ARE TO BE INSTALLED (SEE DETAIL). – STREETS TO BE KEPT CLEAN.
FOLLOWING SITE STABILIZATION	– REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%–100%) AND SITE STABILIZATION.

CATCHBASIN COVERING DETAIL (TYP.)

NTS

TREE PROTECTION SILT FENCE DETAIL

NTS

NOTES:

1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAIGE WIRE FENCE WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)
4. WHERE ROOTS ARE NOT PRESENT AT THE LOCATION OF THE PAIGE WIRE FENCE, THE CLEAR GRANULAR FILL CAN BE ELIMINATED AND THE SILT FENCE TOED 150mm INTO THE GROUND WITH COMPACTED BACKFILL.

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Tel. 519-645-2007
www.stantec.com

Liability Note:

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

Notes

1. CITY OF GUELPH BENCHMARK 225
   ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER

Legend

▪▪▪▪▪▪▪▪	SILT FENCE (SD–74B)
▪▫▪▫▪▫▪▫	CONSTRUCTION FENCE
▬▪▬▪▬▪	TREE PROTECTION FENCE (SD–90A)
←	SURFACE FLOW DIRECTION
▨	CATCHBASIN COVERING

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

	Dwn.	Chkd.	Dsgn.	YY.MM.DD
File Name: 161413684_c-esc	JAC	CJH	JAC	21.07.23

Permit-Seal

C. J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD

GUELPH, ON

Title

EROSION & SEDIMENT CONTROL PLAN

Project No. 161413684

Scale 1:400 0 4 12 20m

Drawing No. GP-2

Sheet 6 of 7

Revision 0

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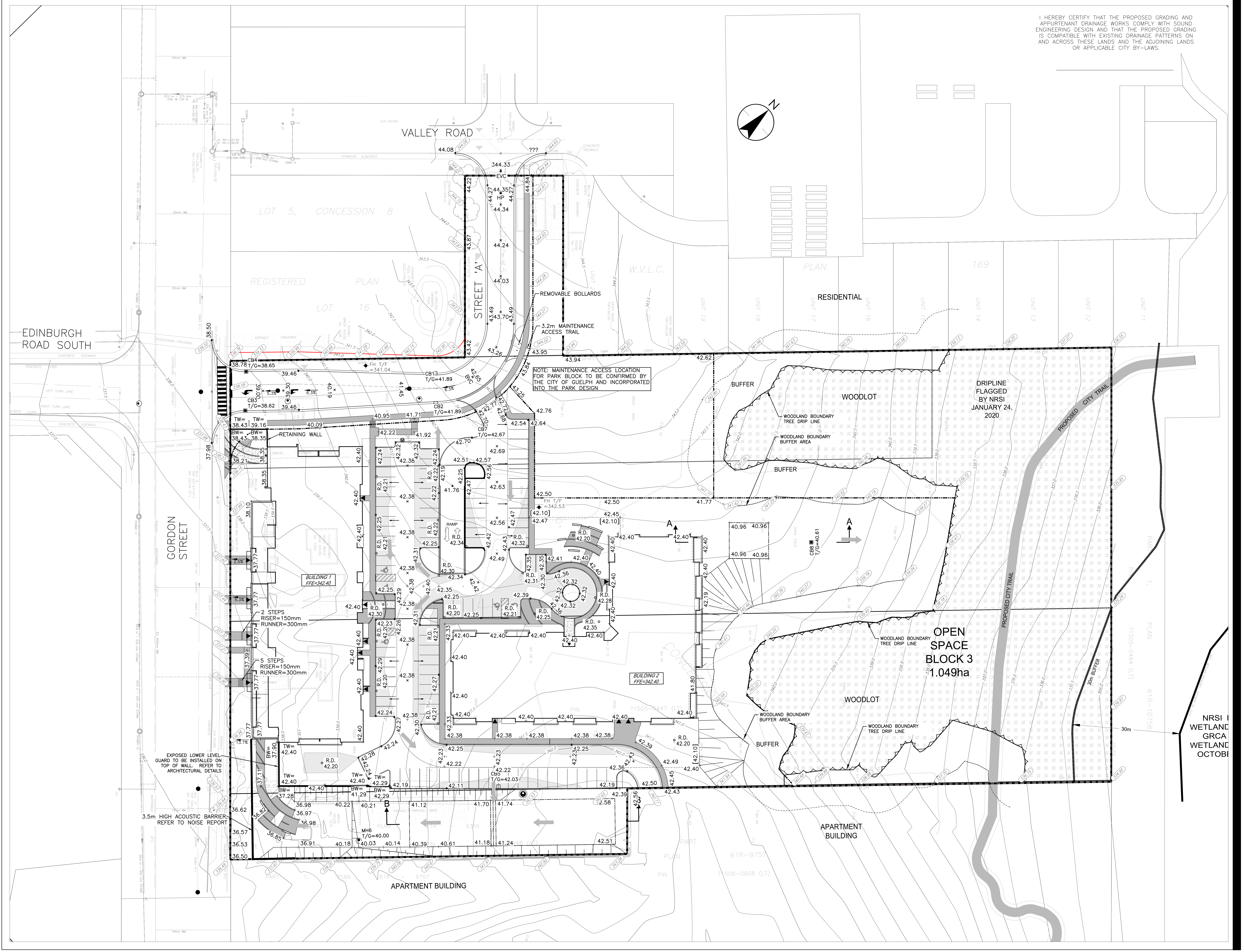
2021-8-24 1:56 PM By: Childs, Jason

ORIGINAL SHEET - ANSI D



I HEREBY CERTIFY THAT THE PROPOSED GRADING AND APPURTENANT DRAINAGE WORKS COMPLY WITH SOUND ENGINEERING DESIGN AND THAT THE PROPOSED GRADING IS COMPATIBLE WITH EXISTING DRAINAGE PATTERNS ON AND ACROSS THESE LANDS AND THE ADJOINING LANDS OR APPLICABLE CITY BY–LAWS.

V:\01614\active\161413684\design\drawing\civil\model_files\surfaces\161413684_C-FB.dwg
2021-8-24 1:55 PM by: Childs, Jason

ORIGINAL SHEET - ANSI D

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Tel. 519-645-2007
www.stantec.com

Liability Note:

Notes

1. CITY OF GUELPH BENCHMARK 225
ELEVATION 338.665 LOCATION: 1221 GORDON STREET
2. EXISTING SURVEY COMPLETED BY BSR&D (NOVEMBER, 4 2014)
3. THE CONTRACTOR IS TO VERIFY ALL EXISTING ELEVATIONS AND EXISTING CONDITIONS AND TO REPORT ANY DISCREPANCIES TO THE CONSULTING ENGINEER

Legend

←	PROPOSED SWALE
⊙	PROPOSED STORM MANHOLE
⊡	PROPOSED STORM CATCH BASIN MANHOLE
●	PROPOSED SANITARY MANHOLE
⊙	EX. STORM MANHOLE
⊙	EX. SANITARY MANHOLE
□	PROPOSED CATCH BASIN
□	EX. CATCH BASIN
• 75.95	PROPOSED GRADES
• 75.95 (SP)	PROPOSED OVERLAND FLOW SPILL POINT
(75.95) +	EXISTING GRADES
⇦	MAJOR OVERLAND FLOW ROUTE
▬ ▮ ▮ ▬	SITE BOUNDARY
• 71.77 (SW)	PROPOSED SWALE GRADE
180.5	EXISTING CONTOURS
←	FLOW DIRECTION
✦	HYDRANTS

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
1. ISSUED FOR DRAFT PLAN APPROVAL	JAC	CJH	21.08.24

File Name: 161413684_c-fb	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	JAC	CJH	JAC	21.07.23

Permit-Seal

C.J. HENDRIKSEN
100125181
Aug 24/21

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
GUELPH, ON

Title

GRADING PLAN

Project No. 161413684

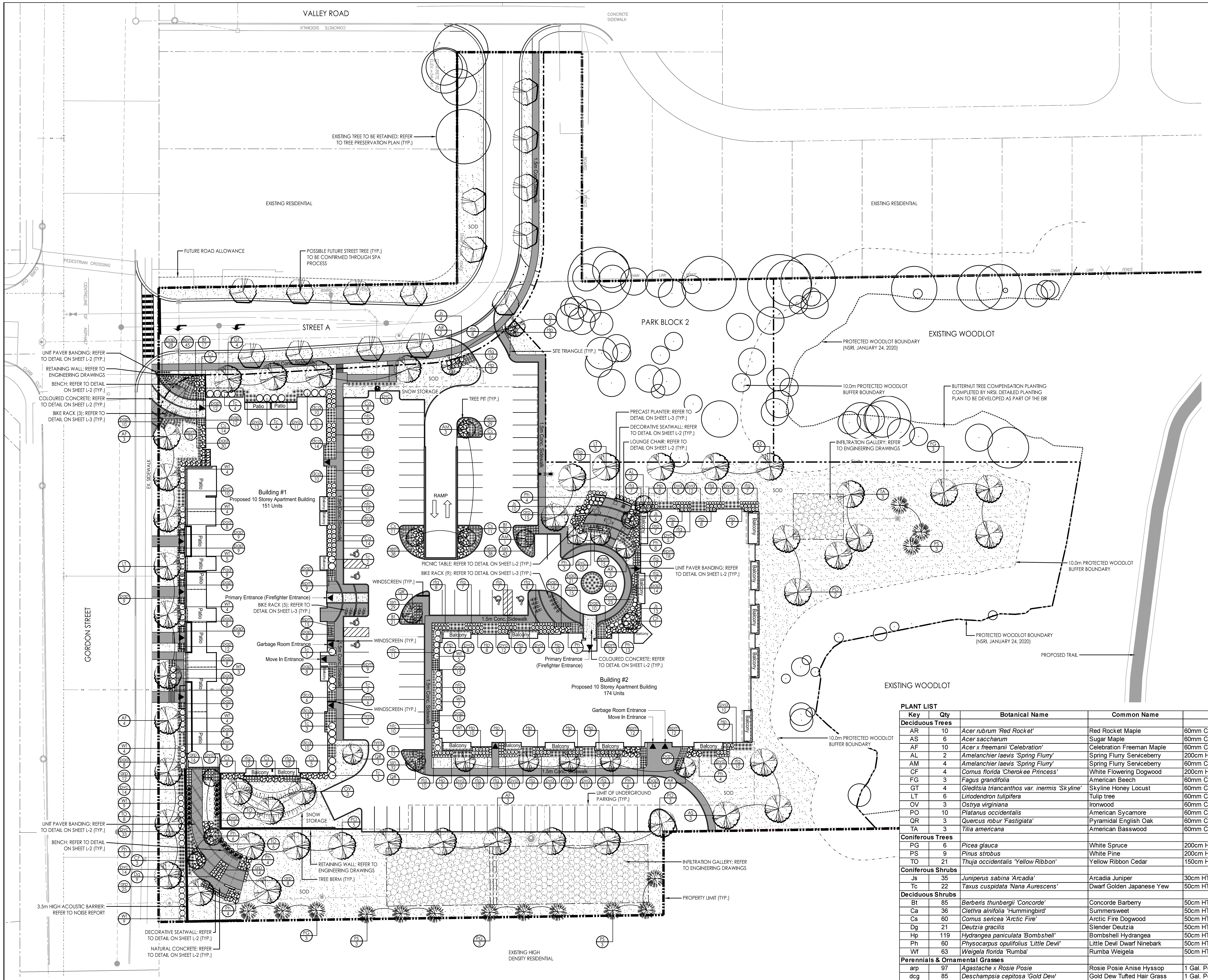
Scale 1:500 0 5 15 25m

Drawing No. GP-1

Sheet 5 of 7

Revision 0

APPENDIX J
LANDSCAPE PLAN



PLANT LIST

Key	Qty	Botanical Name	Common Name	Size & Condition	Spacing
Deciduous Trees					
AR	10	*Acer rubrum 'Red Rocket'*	Red Rocket Maple	60mm CALIPER, W.B.	
AS	6	*Acer saccharum*	Sugar Maple	60mm CALIPER, W.B.	
AF	10	*Acer x freemanii 'Celebration'*	Celebration Freeman Maple	60mm CALIPER, W.B.	
AL	2	*Amelanchier laevis 'Spring Flurry'*	Spring Flurry Serviceberry	200cm Ht., W.B., Multi-stem	
AM	4	*Amelanchier laevis 'Spring Flurry'*	Spring Flurry Serviceberry	60mm CALIPER, W.B. Treeform	
CF	4	*Cornus florida 'Cherokee Princess'*	White Flowering Dogwood	200cm Ht., W.B., Multi-stem	
FG	3	*Fagus grandifolia*	American Beech	60mm CALIPER, W.B.	
GT	4	*Gleditsia triancanthos var. inermis 'Skyline'*	Skyline Honey Locust	60mm CALIPER, W.B.	
LT	6	*Liriodendron tulipifera*	Tulip tree	60mm CALIPER, W.B.	
OV	3	*Ostrya virginiana*	Ironwood	60mm CALIPER, W.B.	
PO	10	*Platanus occidentalis*	American Sycamore	60mm CALIPER, W.B.	
QR	3	*Quercus robur 'Fastigiata'*	Pyramidal English Oak	60mm CALIPER, W.B.	
TA	3	*Tilia americana*	American Basswood	60mm CALIPER, W.B.	
Coniferous Trees					
PG	6	*Picea glauca*	White Spruce	200cm Ht. W.B.	
PS	9	*Pinus strobus*	White Pine	200cm Ht. W.B.	
TO	21	*Thuja occidentalis 'Yellow Ribbon'*	Yellow Ribbon Cedar	150cm Ht. Potted	
Coniferous Shrubs					
Js	35	*Juniperus sabina 'Arcadia'*	Arcadia Juniper	30cm HT. 3 Gal. Pot	Approx. 1.25m O/C
Tc	22	*Taxus cuspidata 'Nana Aurescens'*	Dwarf Golden Japanese Yew	50cm HT. 3 Gal. Pot	Approx. 1.5m O/C
Deciduous Shrubs					
Bt	85	*Berberis thunbergii 'Concorde'*	Concorde Barberry	50cm HT. 3 Gal. Pot	Approx. 0.6m O/C
Ca	36	*Clethra alnifolia* 'Hummingbird'	Summersweet	50cm HT. 3 Gal. Pot	Approx. 1.0m O/C
Cs	60	*Cornus sericea 'Arctic Fire'*	Arctic Fire Dogwood	50cm HT. 3 Gal. Pot	Approx. 1.25m O/C
Dg	21	*Deutzia gracilis*	Slender Deutzia	50cm HT. 3 Gal. Pot	Approx. 0.8m O/C
Hp	119	*Hydrangea paniculata 'Bombshell'*	Bombshell Hydrangea	50cm HT. 3 Gal. Pot	Approx. 0.8m O/C
Ph	60	*Physocarpus opulifolius 'Little Devil'*	Little Devil Dwarf Ninebark	50cm HT. 3 Gal. Pot	Approx. 1.25m O/C
Wf	63	*Weigela florida* 'Rumba'	Rumba Weigela	50cm HT. 3 Gal. Pot	Approx. 1.25m O/C
Perennials & Ornamental Grasses					
arp	97	*Agastache x Rosie Posie*	Rosie Posie Anise Hyssop	1 Gal. Pot	Approx. 0.6m O/C
dcg	85	*Deschampsia cepitosa 'Gold Dew'*	Gold Dew Tufted Hair Grass	1 Gal. Pot	Approx. 0.6m O/C
epm	192	*Echinacea purpurea 'Merlot'*	Merlot Coneflower	1 Gal. Pot	Approx. 0.6m O/C
hem	105	Hemerocallis 'Purple D'Oro'	Purple D'Oro Daylily	1 Gal. Pot	Approx. 0.6m O/C
hms	41	Hosta 'Moonstruck'	Moonstruck Hosta	1 Gal. Pot	Approx. 0.6m O/C
nfc	68	*Nepeta faassenii* 'Cat's Pajamas'	Cat's Pajamas Catmint	1 Gal. Pot	Approx. 0.6m O/C
pva	175	*Panicum virgatum 'Apache Rose'*	Apache Rose Switch Grass	1 Gal. Pot	Approx. 0.8m O/C
pvc	107	*Panicum virgatum 'Cheyenne Sky'*	Cheyenne Sky Switch Grass	1 Gal. Pot	Approx. 0.7m O/C
pap	276	*Pennisetum alopecuroides 'Piglet'*	Dwarf Fountain Grass	1 Gal. Pot	Approx. 0.5m O/C
pad	99	*Perovskia artiplicifolia 'Denim 'n Lace'*	Denim 'n Lace Russian Sage	1 Gal. Pot	Approx. 0.6m O/C
rfg	200	*Rudbeckia fulgida 'Goldstrum'*	Black-Eyed Susan	1 Gal. Pot	Approx. 0.6m O/C
ssn	104	*Sedum spectabile 'Neon'*	Neon Showy Stonecrop	1 Gal. Pot	Approx. 0.6m O/C

NOTES:

1. THE PROPERTY DEMARCATION WILL CONSIST OF 1.5m BLACK VINYL CHAIN LINK FENCE PER CITY OF GUELPH STANDARD CONTRACT SPEC SS-24 AND/OR PROPERTY MARKERS IN ACCORDANCE WITH THE CITY'S DEMARCATION POLICY AND SPECIFICATIONS (REFER TO DETAIL ON SHEET L-2) AND CITY APPROVED DEMARCATION PLAN WILL BE INCLUDED IN EIR.
2. PLANTING SOIL DEPTHS ON PARKING DECK TO BE ACHIEVED WITH A COMBINATION OF RAISED PLANTER CURBS AND TREE PITS.

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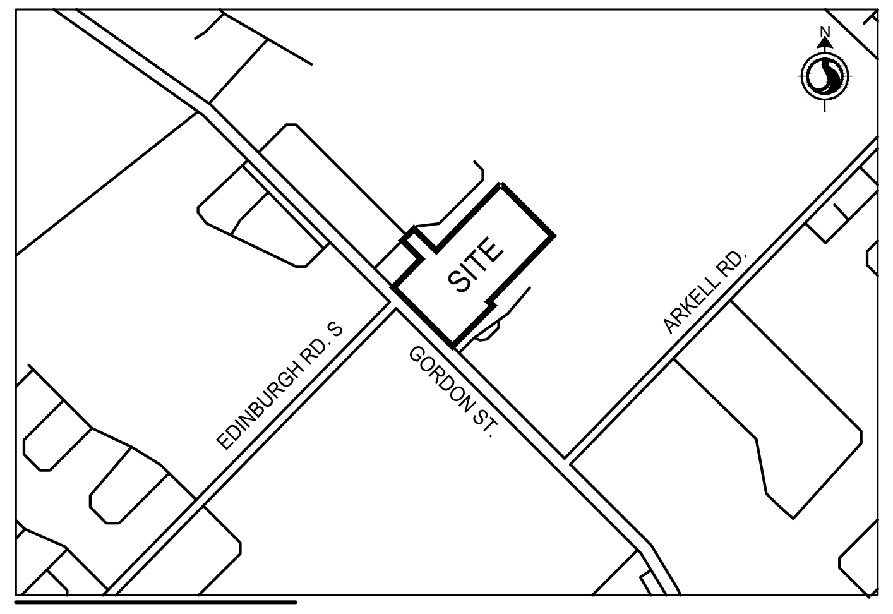
Consultants

Key Map NTS.



Legend

- ▬ ▪ ▪ ▬ PROPERTY LIMIT
- – · · – · · – WOODLOT BUFFER
- ┈┈┈ PROTECTED WOODLOT BOUNDARY
- ○ EXISTING TREE
- ❀ DECIDUOUS TREE
- ✱ CONIFEROUS TREE
- ⬡ POSSIBLE FUTURE STREET TREE
- ❀ SHRUBS, PERENNIALS & ORNAMENTAL GRASSES
- - - - - LIMIT OF MULCHED PLANTING BED
- ⬚ TREE PIT
- ▨ SOD
- ■ NATURAL CONCRETE PAVING
- ▨ COLOURED CONCRETE PAVING WITH UNIT PAVER BANDING
- ▤ BENCHES, LOUNGE CHAIRS, AND PICNIC TABLES
- ⧺ BIKE RACK
- ▭ DECORATIVE SEATWALL

Notes

1. ALL DRAWINGS SHOULD BE REVIEWED WITH REFERENCE TO COMPLETE CONTRACT DOCUMENTS.
2. DRAWINGS NOT INTENDED FOR CONSTRUCTION

1. PER UPDATED SITE PLAN	SU	HE	21.08.20
Revision	By	Appd.	YY.MM.DD

2. ISSUED FOR DRAFT PLAN APPROVAL	SU	HE	21.08.20
1. ISSUED FOR DRAFT PLAN APPROVAL	SU	HS	21.08.11
Issued	By	Appd.	YY.MM.DD

File Name: 161413684_l-ps	SU	HS	HS	21.07.29
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
HILLARY S. EPPEL
OALA
Aug. 20, 2021
161413684
MEMBER
Hillary Eppel

Client/Project

TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
Guelph, ON Canada

Title

LANDSCAPE PLAN

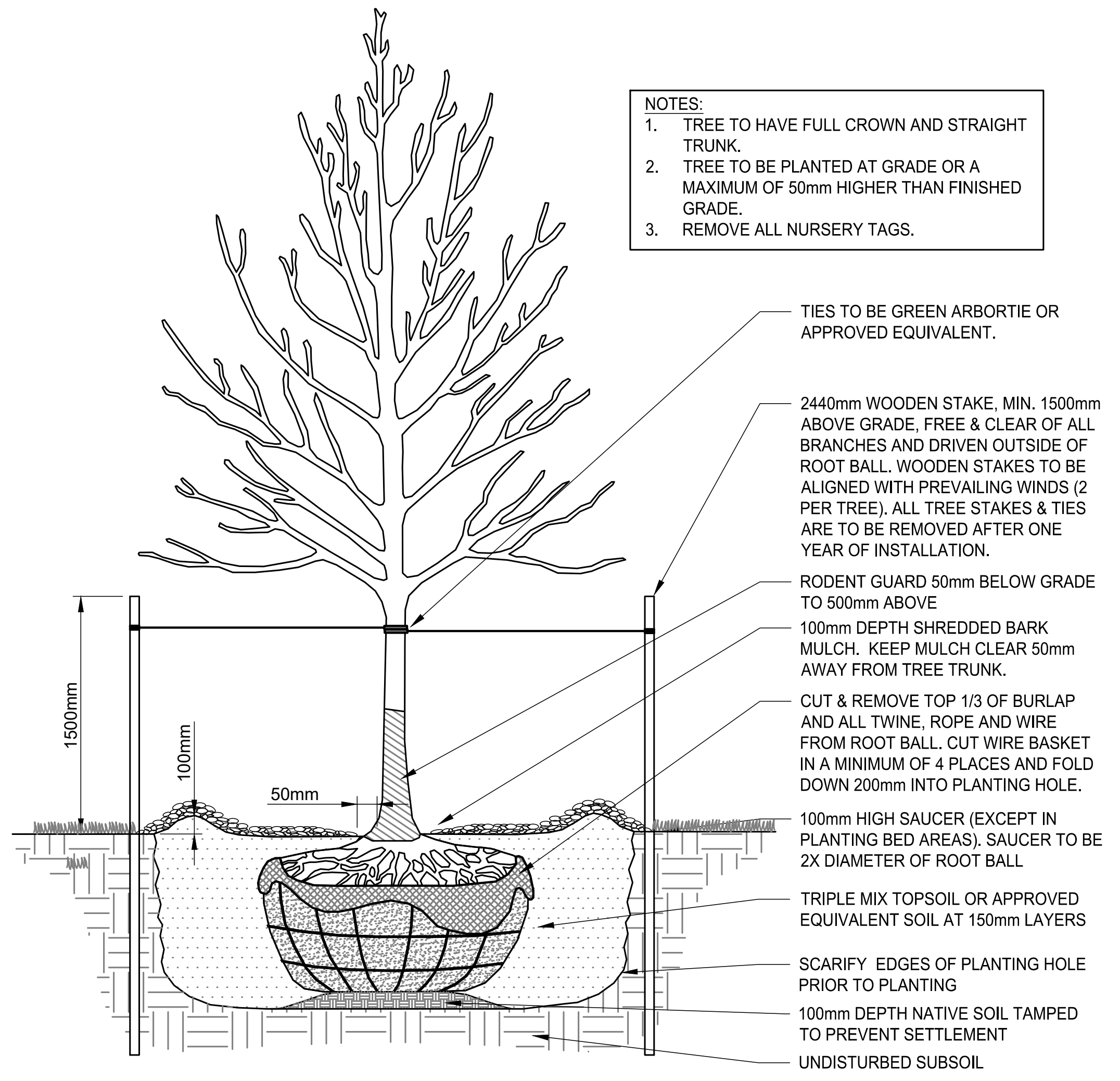
Project No. 161413684

Scale 4 0 8m
1 : 400

Drawing No. L-1

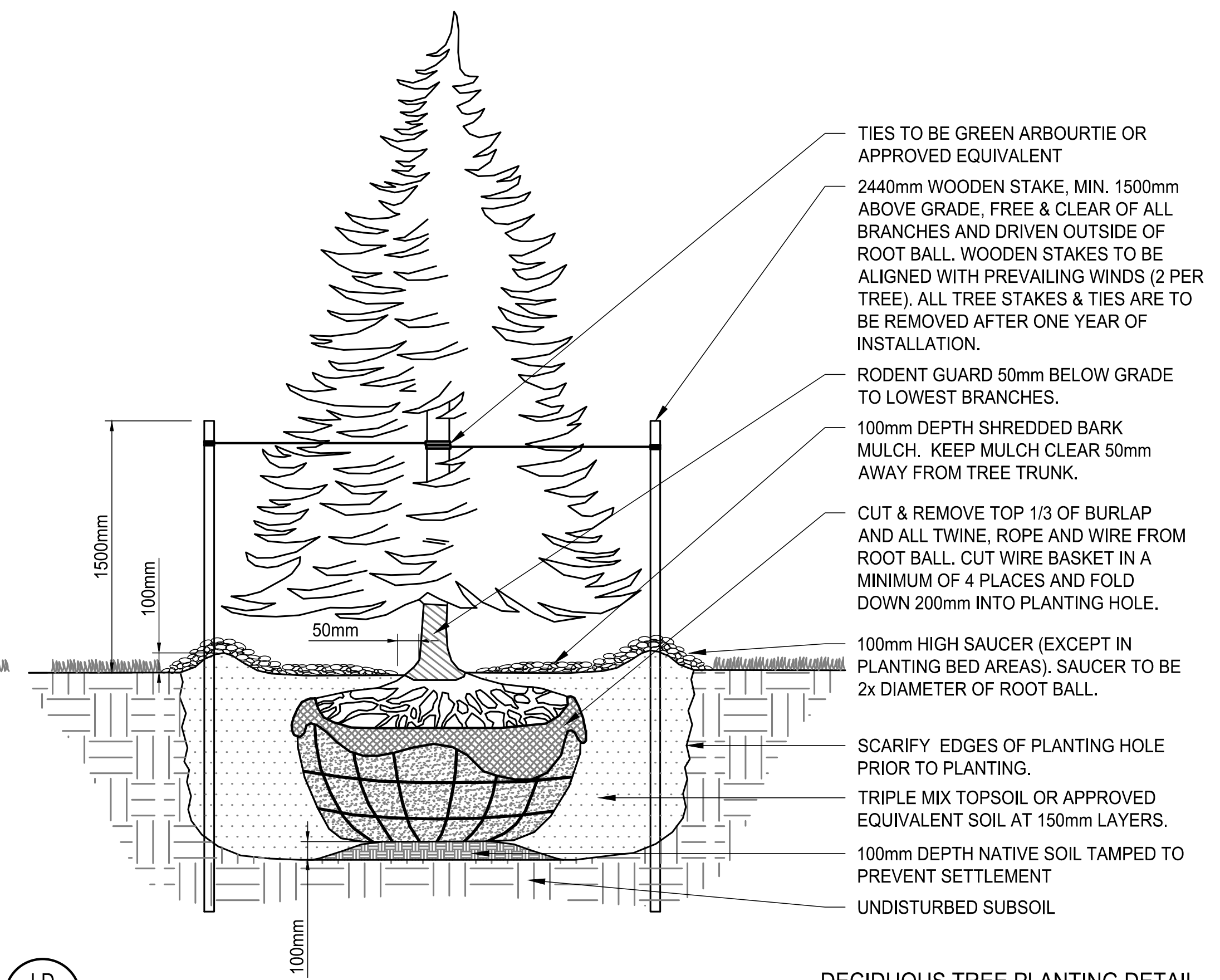
Sheet 1 of 3

Revision 1



NOTES:
1. TREE TO HAVE FULL CROWN AND STRAIGHT TRUNK.
2. TREE TO BE PLANTED AT GRADE OR A MAXIMUM OF 50mm HIGHER THAN FINISHED GRADE.
3. REMOVE ALL NURSERY TAGS.

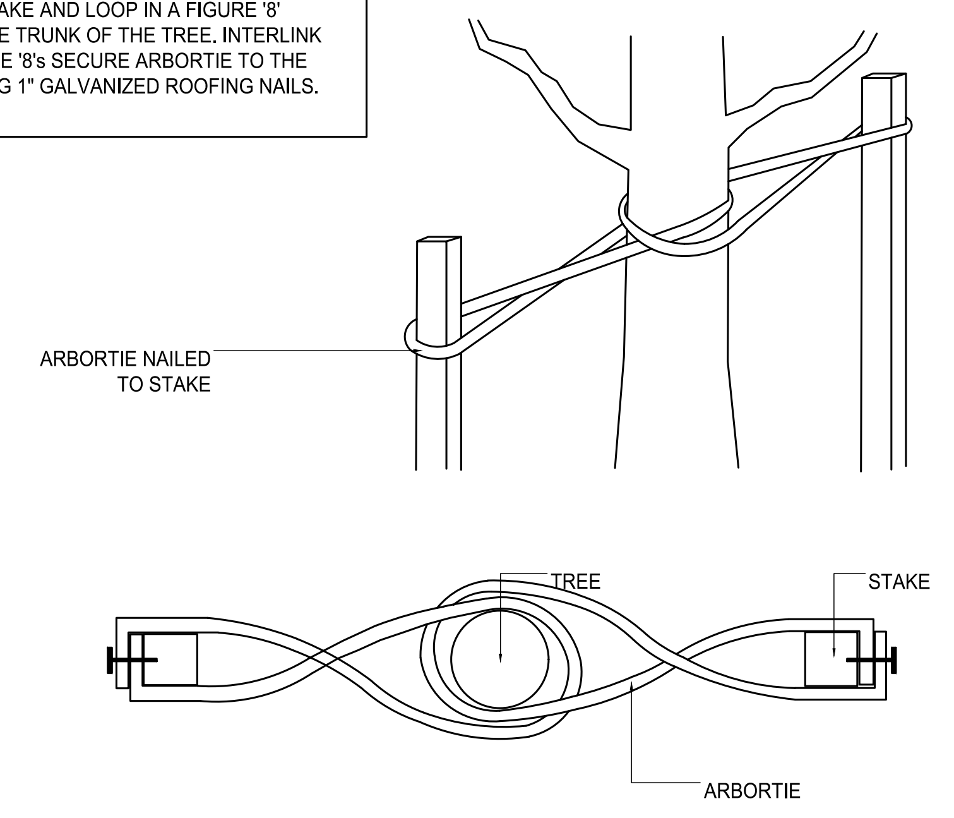
LD 1 DECIDUOUS TREE PLANTING DETAIL
N.T.S.



NOTES:
1. TREE TO HAVE FULL CROWN AND STRAIGHT TRUNK.
2. TREE TO BE PLANTED AT GRADE OR A MAXIMUM OF 50mm HIGHER THAN FINISHED GRADE.
3. REMOVE ALL NURSERY TAGS.

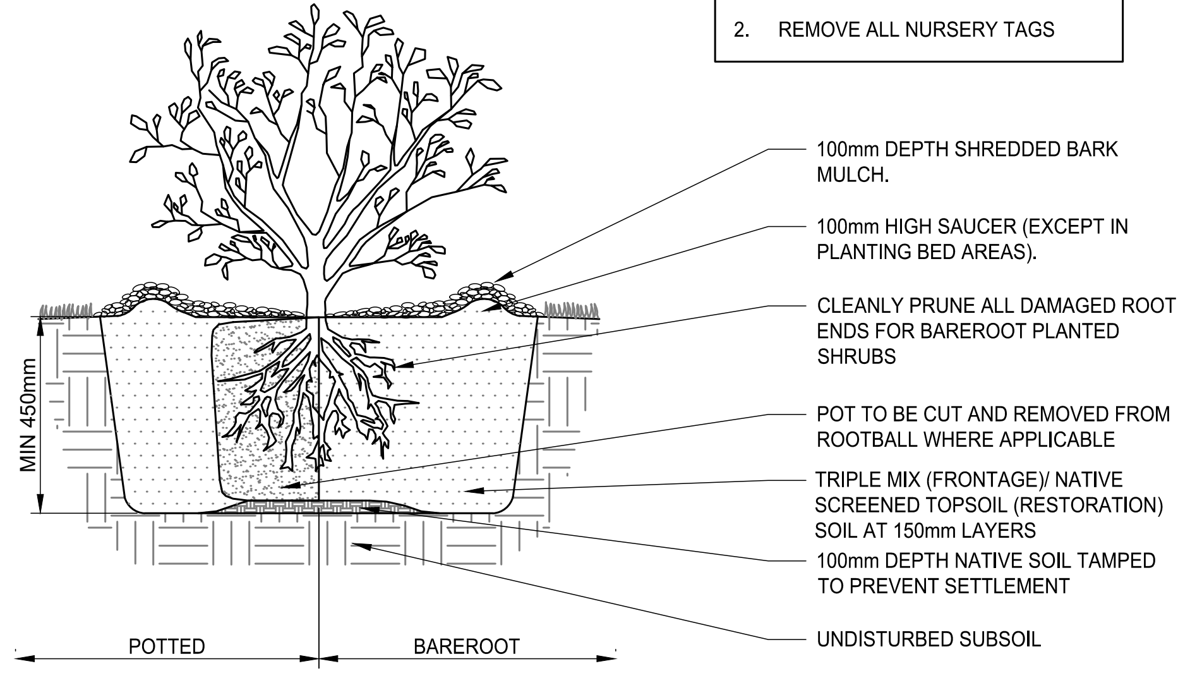
LD 2 DECIDUOUS TREE PLANTING DETAIL
N.T.S.

NOTES:
TIES TO BE GREEN ARBORTIE, OR APPROVED EQUIVALENT. TIES SHALL FORM A LOOSE LOOP AROUND STAKE AND LOOP IN A FIGURE '8' AROUND THE TRUNK OF THE TREE. INTERLINK BOTH FIGURE '8's SECURE ARBORTIE TO THE STAKE USING 1" GALVANIZED ROOFING NAILS.

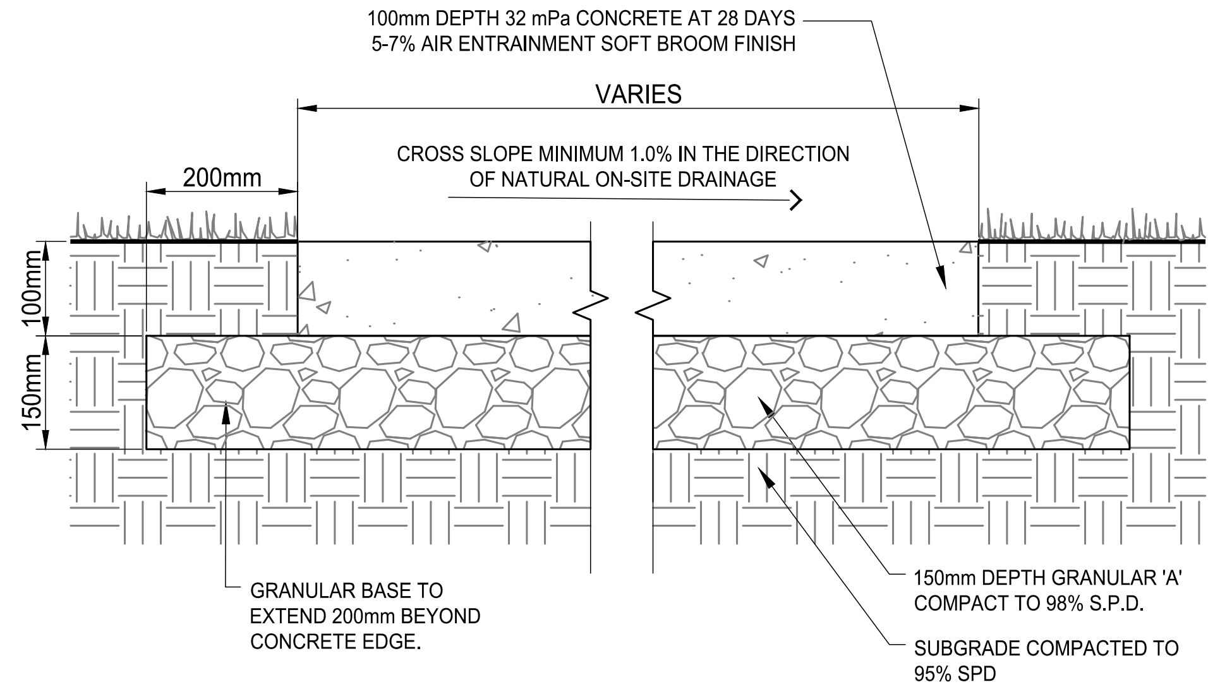


LD 3 ARBOURTIE DETAIL
N.T.S.

NOTES:
1. SHRUB TO BE PLANTED AT GRADE OR A MAXIMUM OF 50mm HIGHER THAN FINISHED GRADE.
2. REMOVE ALL NURSERY TAGS



LD 4 SHRUB PLANTING DETAIL
N.T.S.

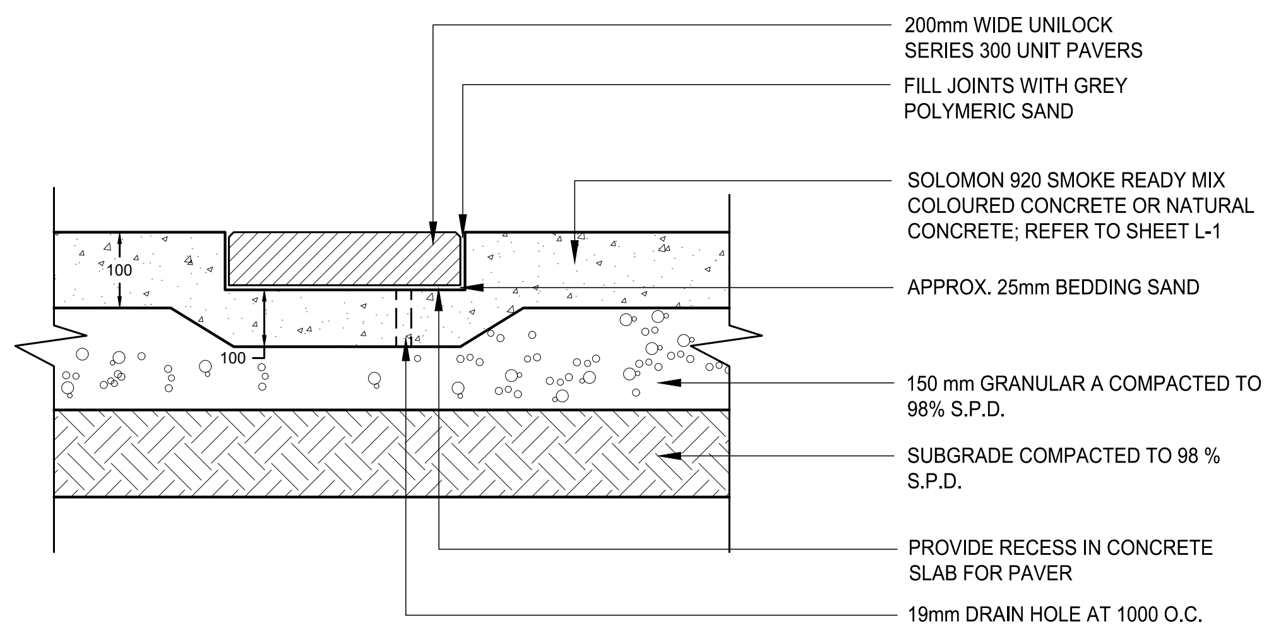


NOTES:
1. EXCAVATE SPECIFIED MINIMUM DEPTH OR GREATER TO ENSURE REMOVAL OF ALL TOPSOIL AND UNSUITABLE SUBGRADE MATERIAL.
2. REFER TO OPSD 310.010 FOR EXPANSION JOINT DETAILS.
3. ALL DIMENSIONS ARE IN MILLIMETRES.

LD 5 CONCRETE PAVING DETAIL
N.T.S.

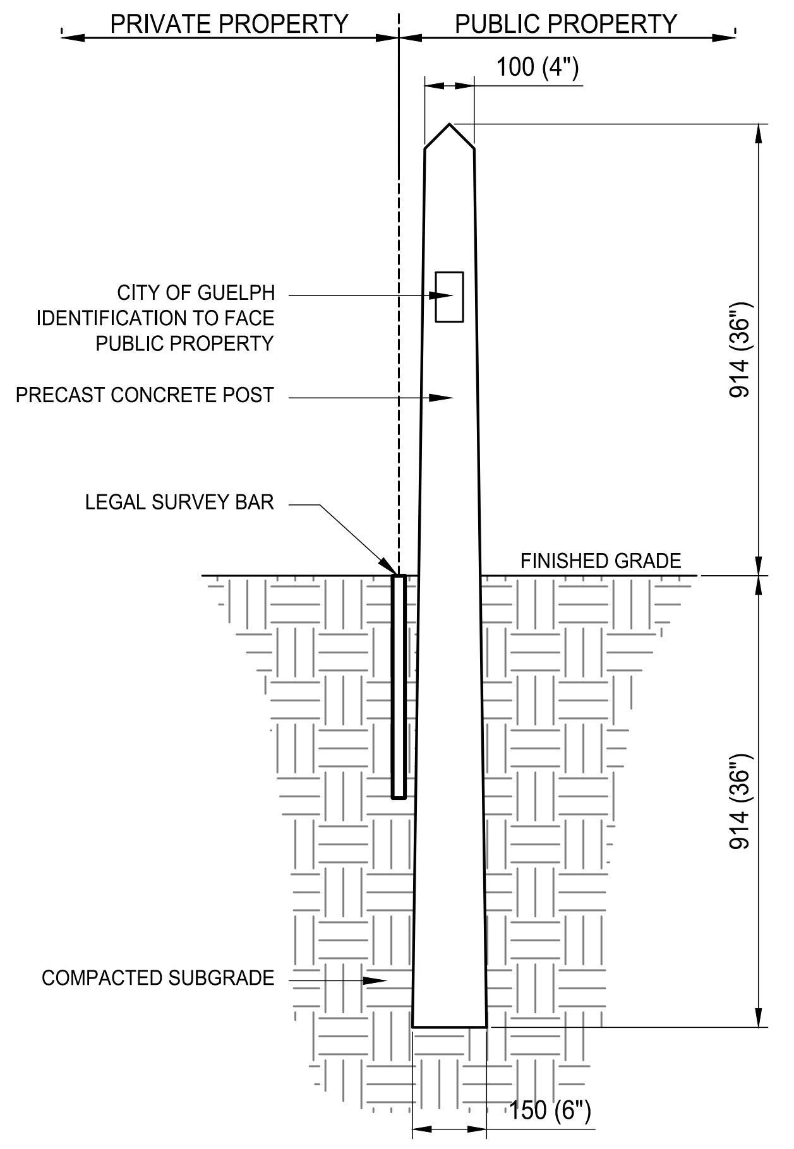
UNILOCK SERIES 70mm BLACK GRANITE PAVERS, 100mm X 200mm SIZE

SOLOMON 920 SMOKE READY MIX CONCRETE COLOUR



LD 6 CONCRETE WITH UNIT PAVING BANDING DETAIL
UNILOCK SERIES 3000 PAVERS, BLACK GRANITE COLOUR, 4" X 8" SIZE- N.T.S.

LD 7 CONCEPTUAL SEAT WALL DETAIL
N.T.S.

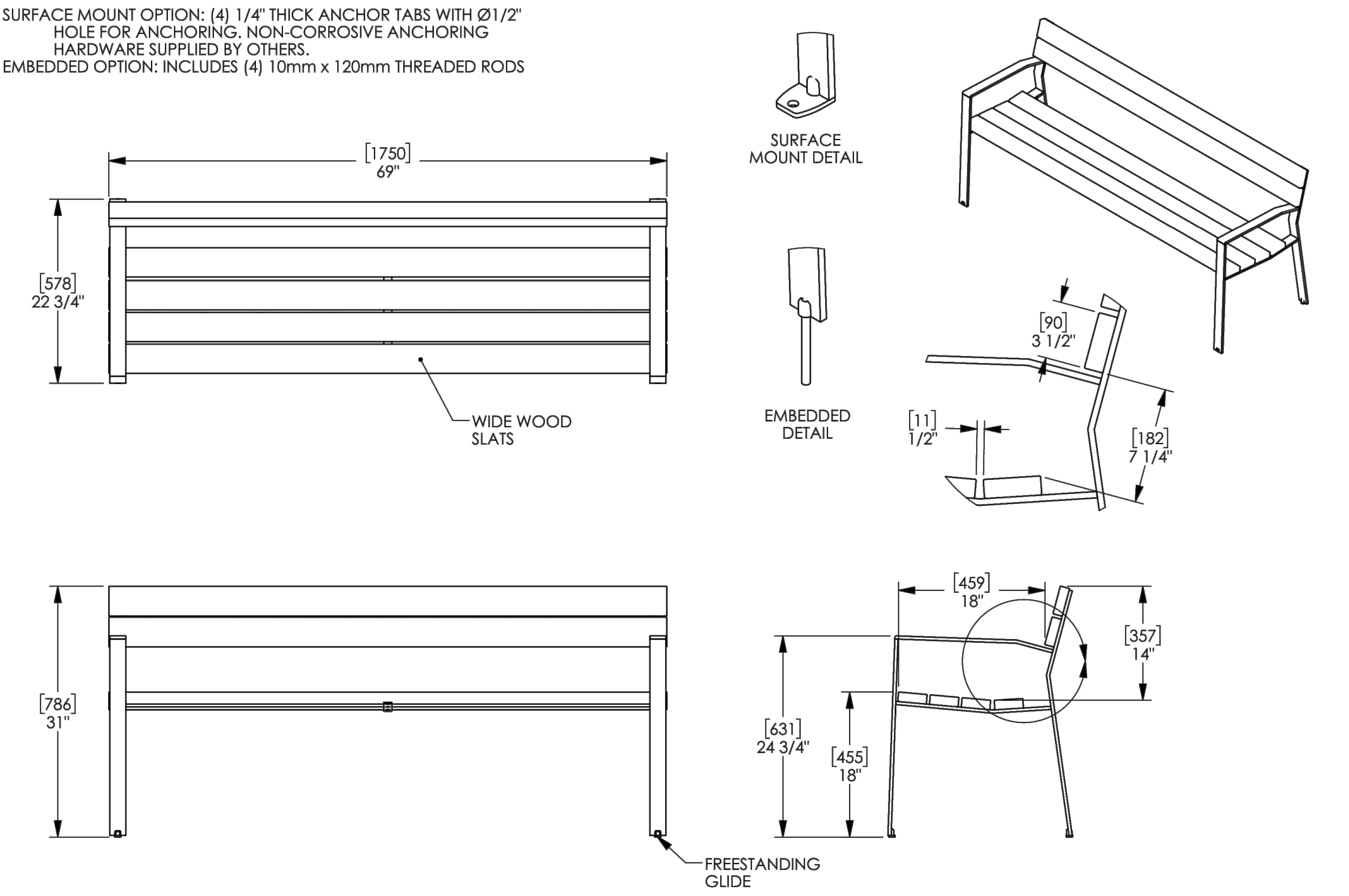


NOTES:
1. MARKERS TO BE INSTALLED AT 30M O.C. MAX. INTERVALS STARTING AT EACH END OF THE PROPERTY FABRIC AND EVERY DIRECTIONAL CHANGE OF THE PROPERTY LINE; REFER TO LANDSCAPE PLAN.
2. SHOP DRAWING TO BE PROVIDED TO THE LANDSCAPE ARCHITECT FOR APPROVAL PRIOR TO ORDERING.

LD 8 CITY OF GUELPH PROPERTY DEMARCATION POST
N.T.S.

SANTA&COLE urbidermis **Harpo** Backed bench, 69in length, wide wood slats
Product Drawing
Date: 9/6/2020
www.landscapeforms.com Ph: 800.521.2546

SURFACE MOUNT OPTION: (4) 1/4" THICK ANCHOR TABS WITH Ø1/2" HOLE FOR ANCHORING. NON-CORROSIVE ANCHORING HARDWARE SUPPLIED BY OTHERS.
EMBEDDED OPTION: INCLUDES (4) 10mm x 120mm THREADED RODS



landscapeforms Drawing: AX204-01
Dimensions are in inches [mm]

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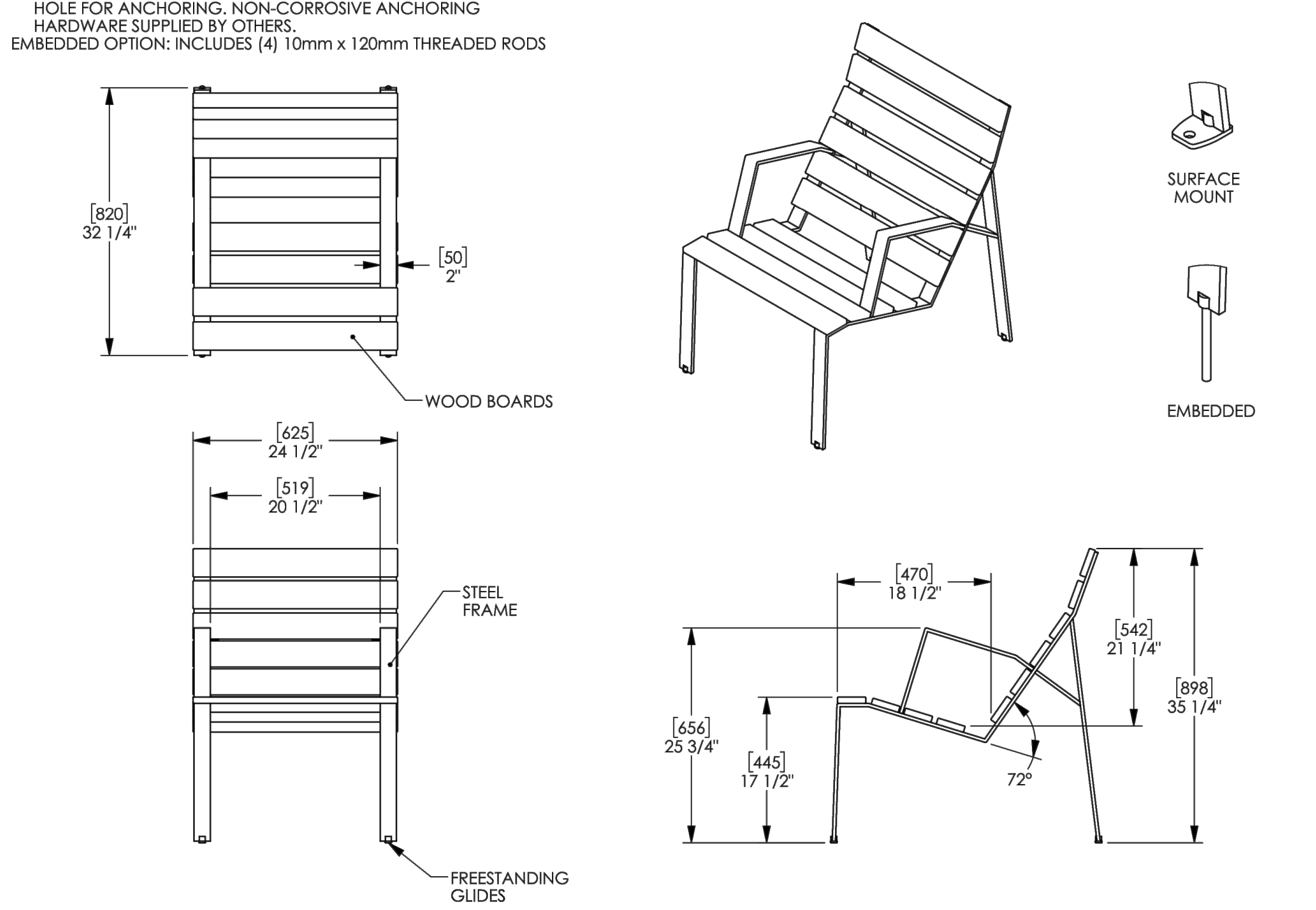
LD 9 LANDSCAPE FORMS HARPO BACKED BENCH DETAIL
JARRAH WOOD BACK AND SEAT, POWDERCOATED STEEL COLOUR, SURFACE MOUNTED - N.T.S.

SANTA&COLE urbidermis **Harpo** Lounge Chair
Product Drawing
Date: 09/06/2020
www.landscapeforms.com Ph: 800.521.2546

SURFACE MOUNT OPTION: (4) 1/4" THICK ANCHOR TABS WITH Ø1/2" HOLE FOR ANCHORING. NON-CORROSIVE ANCHORING HARDWARE SUPPLIED BY OTHERS.
EMBEDDED OPTION: INCLUDES (4) 10mm x 120mm THREADED RODS



landscapeforms Drawing: AX300-01
Dimensions are in inches [mm]

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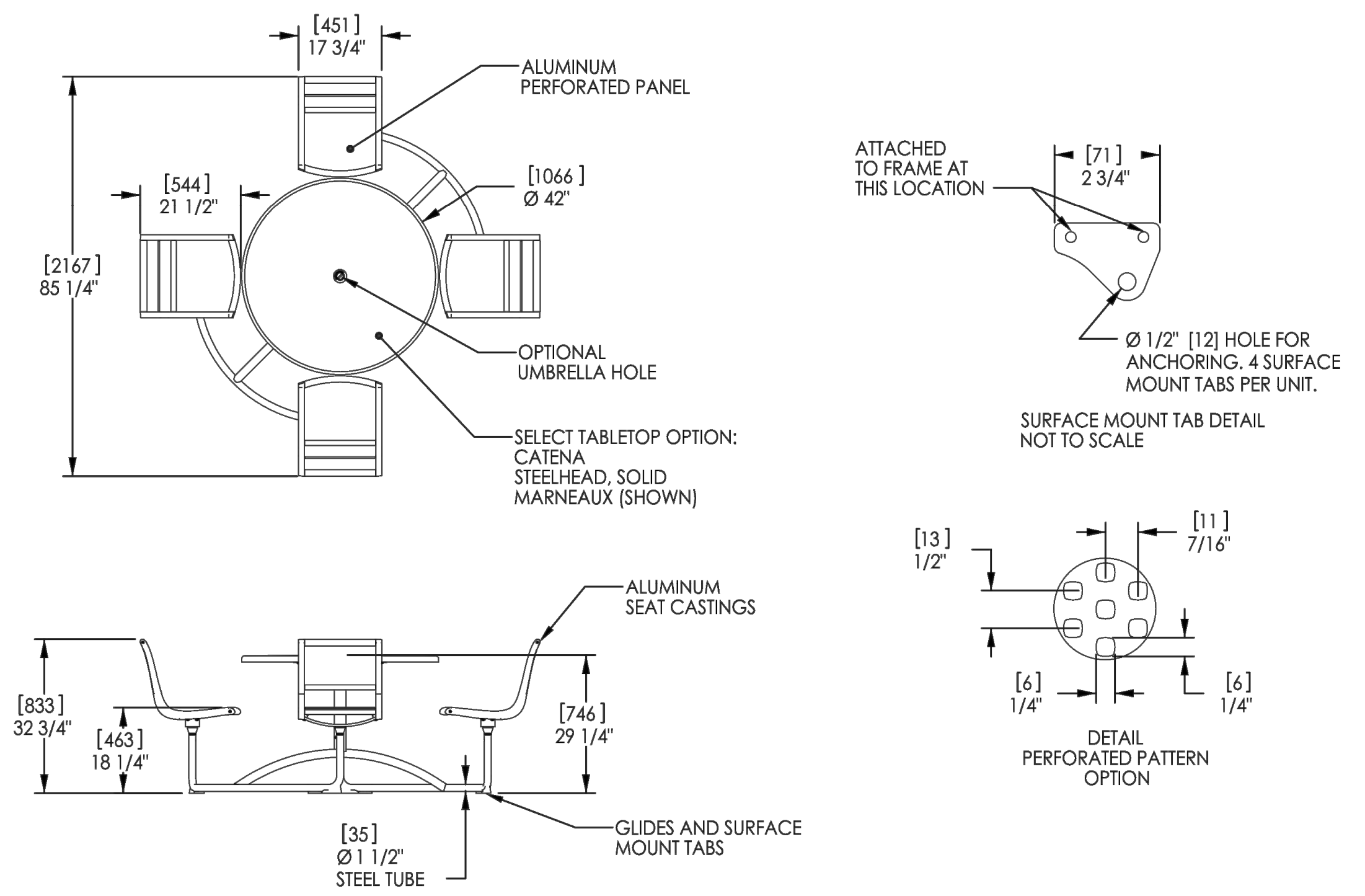
LD 10 LANDSCAPE FORMS HARPO LOUNGE CHAIR DETAIL
JARRAH WOOD BACK AND SEAT, POWDER COATED STEEL COLOUR, SURFACE MOUNTED - N.T.S.

Mingle® Table, Backed 4 seat, Surface mount, Perf
Product Drawing
Date: 12/19/2019
www.landscapeforms.com Ph: 800.521.2546



NOTE: ALL TABLES WITH NON-COLLAPSABLE UMBRELLA OPTION MUST BE SURFACE MOUNTED.

landscapeforms Drawing: MG614-04
Dimensions are in inches [mm]
U.S. Patent Nos.: D513,566; D542,060

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LD 11 LANDSCAPE FORMS MINGLE TABLE DETAIL
4 BACK SEATS, POWDER COATED STEEL COLOUR, SURFACE MOUNTED, WITH CAMPANION SHADE UMBRELLA - N.T.S.

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2021-8-26 2:29 PM by: Ursprung, Shane

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Tel. 519-645-2007

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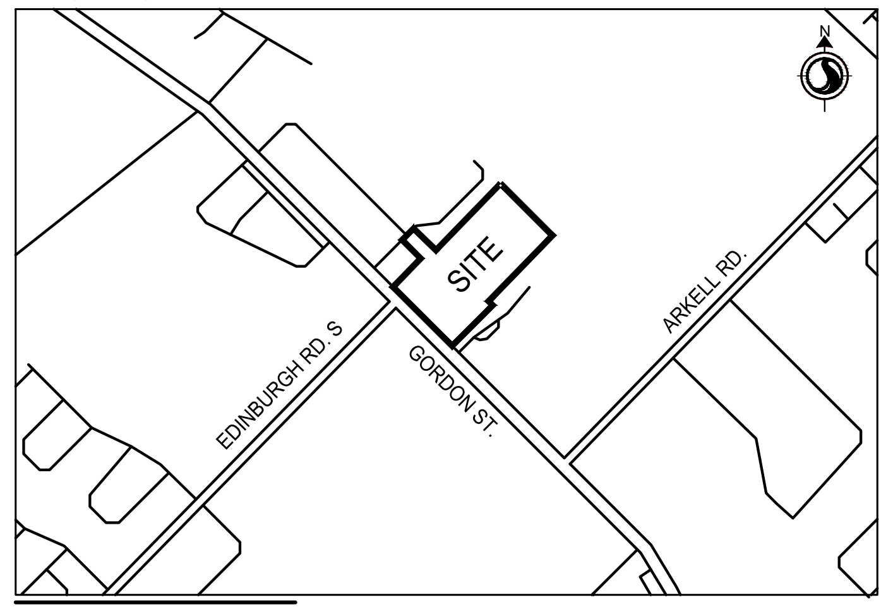
Key Map NTS.



Legend

Notes
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2. DRAWINGS NOT INTENDED FOR CONSTRUCTION

1. PER UPDATED SITE PLAN	SU	HE	21.08.20
Revision	By	Appd.	YY.MM.DD

2. ISSUED FOR DRAFT PLAN APPROVAL	SU	HE	21.08.20
1. ISSUED FOR DRAFT PLAN APPROVAL	SU	HS	21.08.11
Issued	By	Appd.	YY.MM.DD

File Name: 161413684_l-ps	SU	HS	HS	21.07.29
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
HILLARY S. EPPEL
Hillary Eppel
OALA
Aug. 20, 2021
161413684
MEMBER

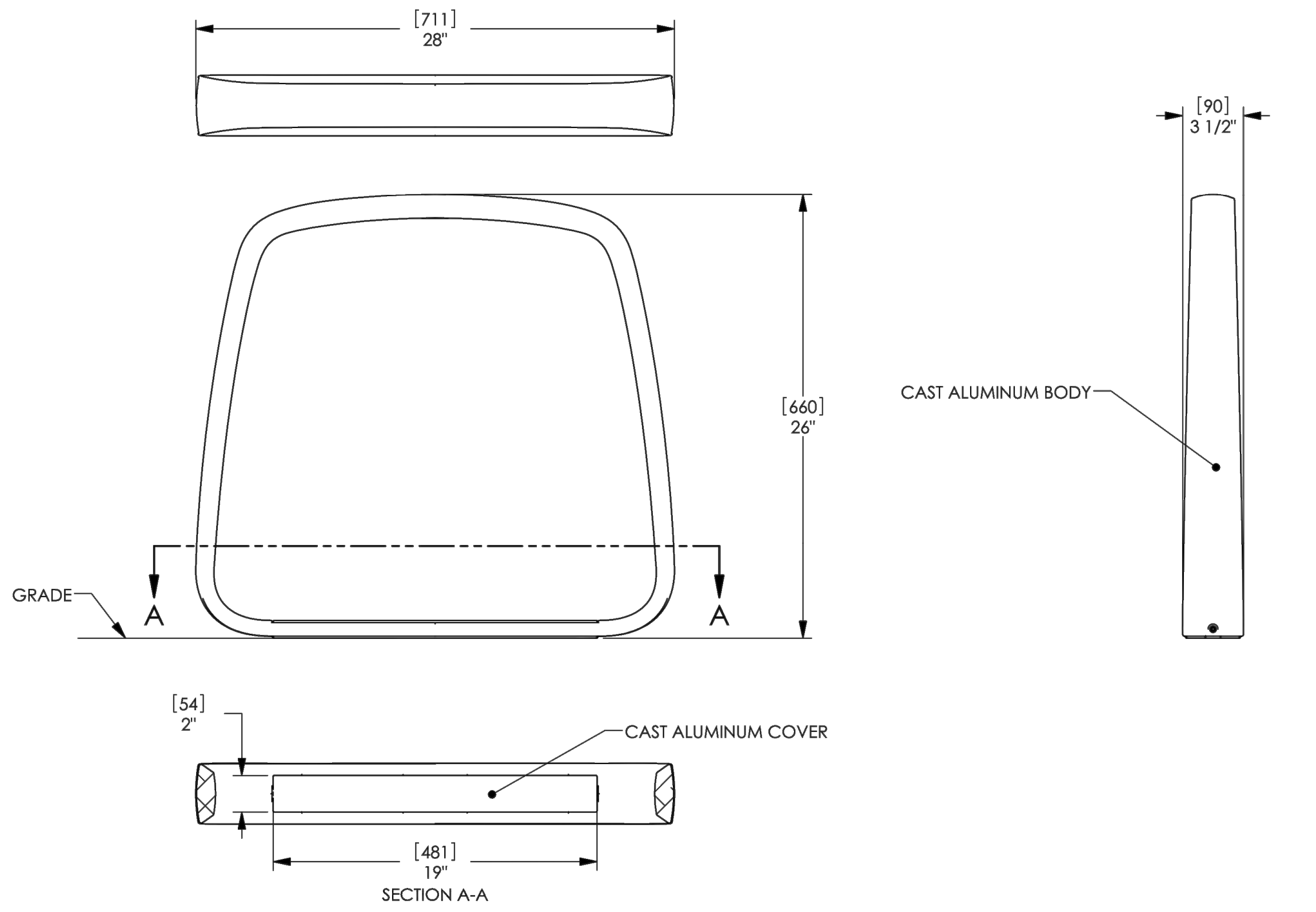
Client/Project
TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
Guelph, ON Canada

Title
LANDSCAPE DETAILS

Project No. 161413684
Scale SCALE AS SHOWN
Drawing No. L-2
Sheet 2 of 3
Revision 1

Ride™ Bike Rack, Surface Mount
Product Drawing
Date: 5/7/2010
www.landscapeforms.com Ph: 800.521.2546



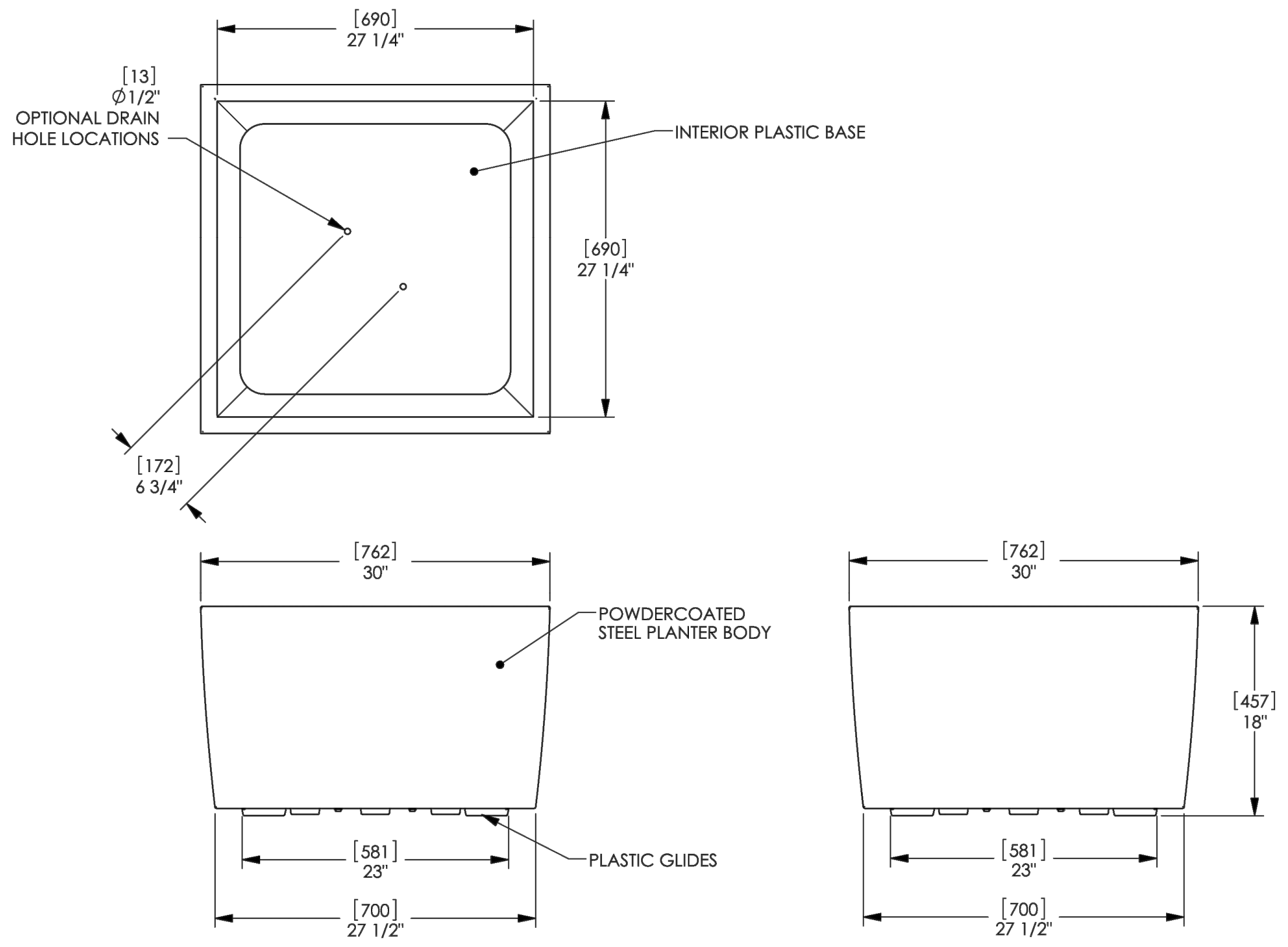
landscapeforms
Drawing: RI665-01
Dimensions are in inches [mm]
U.S. Patent No.: D613,646

LD
12

LANDSCAPE FORMS RIDE BIKE RACK DETAIL

POWDER COATED STEEL COLOUR, SURFACE MOUNTED - N.T.S.

Sorella Planter, 30"w x 30"d x 18"h, powder coated steel
Product Drawing
Date: 6/9/2015
www.landscapeforms.com Ph: 800.521.2546



landscapeforms
Drawing: SR107-01
Dimensions are in inches [mm]

LD
13

LANDSCAPE FORMS SORELLA PRECAST PLANTER DETAIL

30" X 30" X 18" SIZE, POWDER COATED STEEL COLOUR - N.T.S.

GENERAL NOTES

1. Contractor to have existing utilities located prior to start of any construction.
2. This drawing to be read in conjunction with the written specifications, drawings and details for the project.
3. Any ambiguity in this drawing or accompanying details is to be reported to the Landscape Architect for direction. Contractor not to proceed in uncertainty.
4. Limits of work to be clearly understood by the contractor prior to any work taking place on site. Contractor to contact Landscape Architect for clarification if required.
5. Contractor to visit site to confirm all site conditions prior to submitting bids. Discrepancies to be reported to Landscape Architect for clarification.
6. Contractor to verify all dimensions and report any discrepancies to the Landscape Architect.
7. Contractor is responsible for the hoarding of all trees within or adjacent to construction areas.
8. Contractor is responsible for the adjustment of all existing catch basins, catch-basin manholes, manholes, water valves, hydrants, etc. to match proposed grades.
9. Contractor is responsible for hauling of all excess materials off the site.
10. Contractor is responsible for general site clean up.
11. Contractor is responsible for any damage to landscaped areas and must make all necessary restorations and repairs.
12. All ancillary work normally associated with this type of construction shall be deemed to be part of the contract.
13. Layout to be approved by landscape architect prior to construction starting.
14. All dimensions are in meters unless otherwise noted.
15. Contractor shall supply all materials in quantities sufficient to complete work shown on these drawings. Any discrepancies shall be reported to the Landscape Architect for direction.
16. No substitutions of materials, products or quantities without prior consent of Landscape Architect.
17. The vegetation and hard landscaping within the sight triangles must provide clear sight distance, excluding tree trunks, between an elevation of 0.8m and 2.7m above the elevation of the nearest point on the nearest adjacent roadway.

TOPSOIL NOTES:

1. Topsoil to be friable, neither heavy clay nor of very light sandy nature, containing a minimum of 4% organic matter for clay loams and 2% for sandy loams to a maximum of 20% volume. Free from subsoil, roots, grass, weeds, toxic materials, stones, foreign objects and with an acidity range / ph of 5.5 to 7.5. Topsoil containing crabgrass, coughgrass or noxious weeds is not acceptable.
2. All topsoil is to be stockpiled separately from subsoil during the excavation period.
3. All subsoil compacted during construction activities to be scarified to the satisfaction of the Landscape Architect prior to placement of topsoil.
4. All areas disturbed by construction to be restored with topsoil and seed, as required.
5. Topsoil from on-site stockpile to be placed at a minimum depth of 150mm in all disturbed areas.

SOD NOTES:

1. Any lawn areas disturbed by construction shall be re-sodded and repaired to original condition or better.
2. Sod and sodding operations to be in accordance with OPSS 803, except as noted below.
3. Sod to be delivered to project within 24 hours of being harvested and laid within 36 hours thereafter.
4. Rough graded and compacted soil shall be scarified to a minimum depth of 150 mm free of all stones, roots, branches, larger than 25 mm diameter. Topsoil to be spread at a minimum depth of 150 mm compacted to 85% S.P.D.
5. Place sod on prepared topsoil with staggered joints and butt tightly. Machine roll to ensure contact with topsoil. Repair minor grade deficiencies and irregularities.
6. Water sod immediately after laying to obtain moisture penetration to a minimum of 100 mm depth within topsoil. Maintain sod per OPSS 803. Sod must be cut a minimum of two times for Final Acceptance at the discretion of the Landscape Architect.

PLANTING NOTES:

1. The Contractor must notify the Landscape Architect prior to the commencement of any planting. Contractor shall supply all plants and materials in quantities sufficient to complete work shown on this drawing. Any discrepancies between quantities shall be reported to the Landscape Architect for direction.
2. The Landscape Architect is to be contacted for inspection and written approval prior to plant material arriving on site. The Landscape Architect reserves the right to reject any plant materials that have not been inspected and approved.
3. Plant material collected from wild sources will not be accepted. The Landscape Architect reserves the right to require that supplier invoices be submitted for inspection and approval prior to acceptance.
4. Staking (layout) of plant materials to be approved by Landscape Architect prior to installation. Drawing may be scaled for approximate layout of individual trees and planting beds.
5. All frontage plant materials will be planted in 450mm min depth approved triple mix. All restoration plant materials will be installed in 450mm min depth approved screened native topsoil. No additional soils or additives will be permitted unless by the Landscape Architect at no additional cost to the project. Planting soil to be free from weeds, subsoil, roots, stones, lumps of clay and toxic material.
6. Plant materials specified for this project will conform to the Canadian Nursery Landscape Association (CNLA) for size, variety, and condition as indicated on the plant schedule shown on these drawings. Any plant materials that do not conform (in the sole opinion of the Landscape Architect) will be promptly removed from the site and replaced by the Contractor at no additional cost to the Owner or project.
7. Do not make substitutions of materials, products or quantities without the prior written permission of the Landscape Architect.
8. Remove dead and/or damaged branches on trees or shrubs. All pruning shall be performed in accordance with standard horticultural practices and appropriate timing for each species.
9. Plants are not to be installed during extreme heat, drought, or other undesirable conditions. Thoroughly water all plants immediately after installation. Contractor not to proceed in uncertainty. Contact Landscape Architect for direction.
10. The Contractor is required to water plant material regularly or as directed by the Landscape Architect during construction and the two year warranty period. Plants will be watered within 48 hours of a written request by the Landscape Architect. Failure to do so after the second request will result in this work being undertaken by others. The cost of this work shall be deducted from the total contract price.
11. Do not plant in drainage swales. Where proposed drainage swales conflict with proposed plantings, contact the Landscape Architect for direction.
12. All trees and shrubs are to be planted in accordance with the planting details included in this drawing set.
13. Minor field adjustments to plant material locations may be necessary to respond to the locations of existing plants. Contractor to review with Landscape Architect where relocations are necessary. Contractor must receive approval from Landscape Architect prior to installation.
14. Shredded pine mulch or an approved other will be spread uniformly in all planting beds and around the base of all trees and shrubs to a depth of 100mm. Do not place mulch in direct contact with trunks; allow a 50mm mulch free ring around trunks. Provide a sample of mulch to the Landscape Architect for approval prior to installation.
15. All landscape works will be guaranteed for a period of two years following inspection substantial completion. Plant material, which is not in a healthy growing condition two years after inspection, shall be replaced to the satisfaction of the Landscape Architect / Client.
16. The Contractor is responsible for location of all underground services prior to excavation of tree pits and shrub beds.
17. All wood stakes and associated ties to be removed at the conclusion of the warranty period.
18. Contractor to identify with owner and Landscape Architect any maintenance requirements necessary for warranty purposes.
19. The Landscape Architect reserves the right to refuse acceptance of any plant material displaying poor growth habits, injury or disease. Any plant material rejected by the Landscape Architect will be promptly removed from the site and replaced with material of acceptable quality at no additional cost to the project.
20. The Landscape Architect reserves the right to extend contractor's warranty responsibilities for an additional year if, at the end of initial warranty period, leaf development and growth is not sufficient to ensure future survival as determined by the Landscape Architect.

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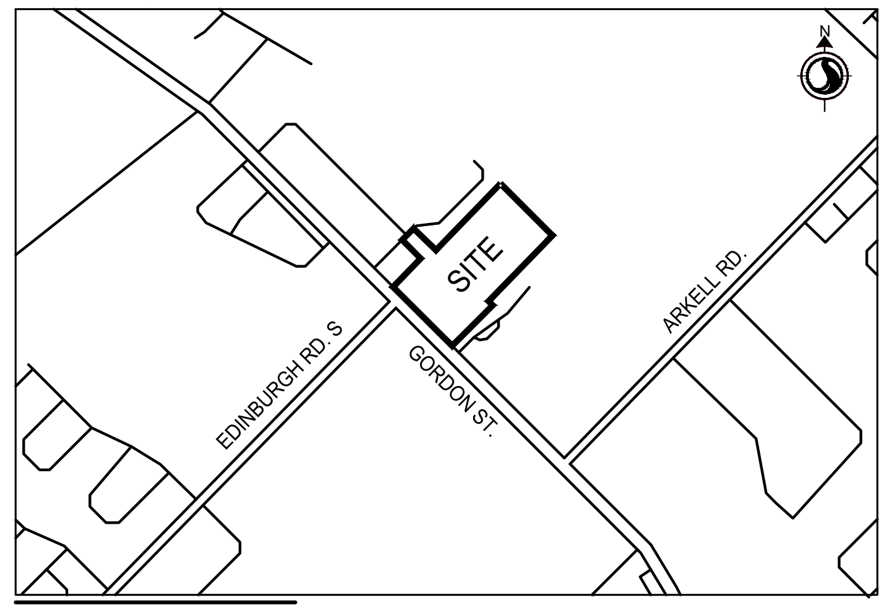

Legend

Notes
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	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

HILLARY S. EPPEL
Aug. 20, 2021
161413684

Client/Project
TRICAR DEVELOPMENTS INC.

1242, 1250, 1260 GORDON STREET
& 9 VALLEY ROAD
Guelph, ON Canada

Title
LANDSCAPE DETAILS AND NOTES

Project No.
161413684

Scale
SCALE AS SHOWN

Drawing No.
L-3

Sheet
3 of 3

Revision
1

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