MASONGSONG ASSOCIATES
ENGINEERING SUSTAINABLE FUTURES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

Hyatt Dual Brand – HH & HP
Proposed Mixed-Use Building (9-Storey)
380 Hagey Boulevard • City of Waterloo
Kothari Group Inc.



April 2025 • MAEL Project 25-159

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REPORT TITLE: **Functional Servicing and Stormwater Management Report**

PROJECT TITLE: Hyatt Dual Brand – HH & HP
Proposed Mixed-Use Building (9-Storey)

PROJECT ADDRESS: 380 Hagey Boulevard, City of Waterloo

CLIENT: Kothari Group Inc.

MAEL PROJECT NO: 25-159

NO.	DATE (YY.MM.DD)	DESCRIPTION OF ISSUE AND/OR REVISION
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APPENDICES

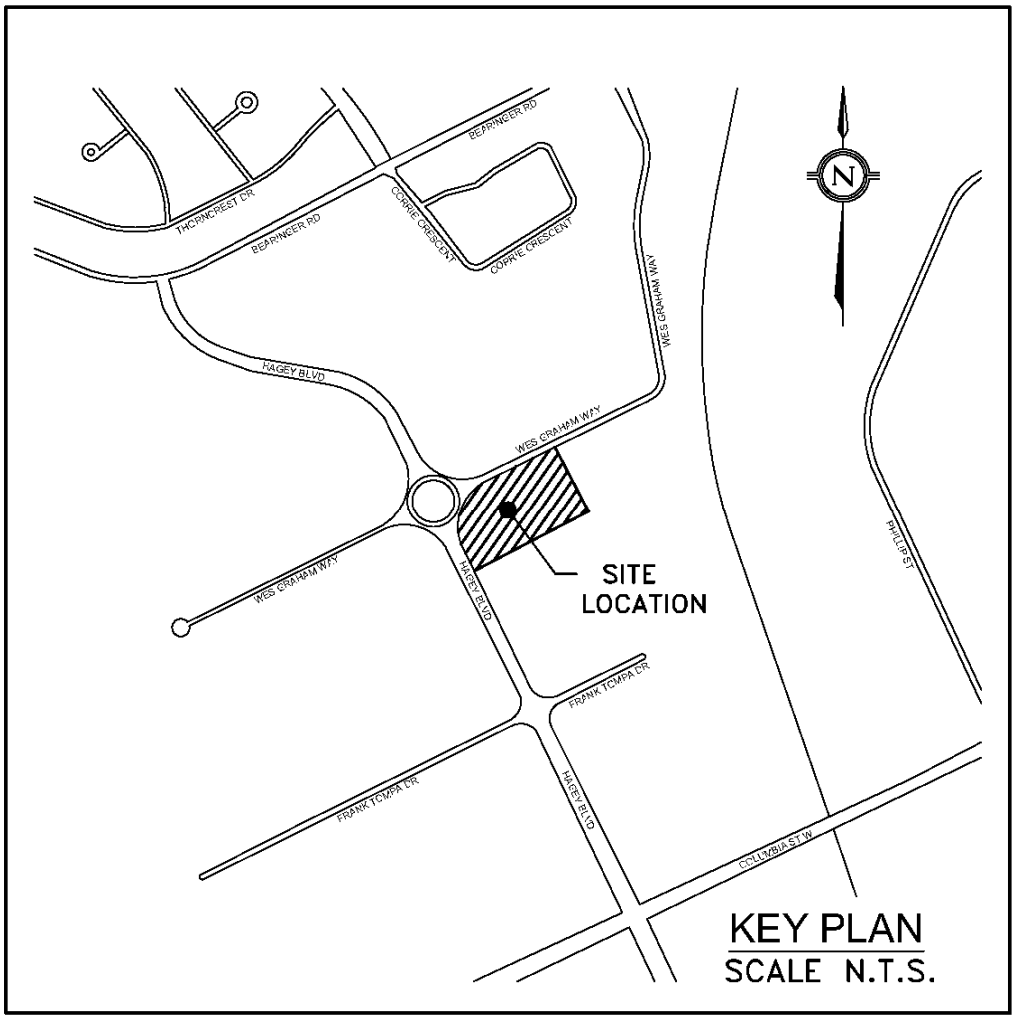
Appendix A: Site Plan & Site Statistics
Appendix B: Watermain Analysis
Appendix C: Stormwater Management Calculations
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Appendix Drawings: Detailed Plans

1.0 INTRODUCTION

1.1 Study Objectives and Location

Masongsong Associates Engineering Limited has been retained by Kothari Group Inc. to provide engineering services in support of a proposed 9-storey hotel located at 380 Hagey Boulevard (at Wes Graham Way) in the City of Waterloo. Figure 1 below illustrates the location of the proposed development.

Figure 1 *Site Location Key Plan*



The objective of this report is to identify the requirements for site servicing and stormwater management as it relates to current City of Waterloo criteria, and to demonstrate how this proposed site will function within the framework of existing infrastructure.

1.2 Background

The subject development is approximately 1.61 hectares (3.98 acres) and is located at 380

Hagey Boulevard, southeast of Hagey Boulevard and Wes Graham Way. The site is currently vacant, within the University of Waterloo Research and Technology Park. The site is bounded to the east by a multi-tenant office building, and to the south is the University of Waterloo Toby Jenkins Building.

The necessary spine services (roadways, storm sewers, sanitary sewers, water main and telecom) have been constructed and are operational to accommodate the subject site.

1.3 Proposed Development Plan

The development proposal will comprise a 9-storey mixed-use building with 216 guestrooms and 7,000 ft^2 (650 m^2) of conference space. Parking spaces are provided entirely at ground level without any below-grade structured parking. Primary vehicular access to the site will be from Hagey Boulevard and Wes Graham Way.

The proposed Site Plan and statistics prepared by Chamberlain Architects is attached in Appendix A.

2.0 PREVIOUS STUDIES

The development block was supported by several studies, notably including the *University of Waterloo Research and Technology Park SWM Brief, dated Sept. 2022 by Stantec.*

This current report for the subject block relies on the acceptance of the above report and drawings as the basis for receiving system capacity and stormwater control targets.

2.1 Existing Municipal Services

The subject block is currently serviced by full municipal services within Hagey Boulevard, including watermain, sanitary and storm laterals. The existing service connections is enclosed in Appendix A as Drawing No. 5-2083 obtained from the City of Waterloo.

2.0 SANITARY SERVICING

2.1 Existing Sanitary Servicing

There is existing 200mm diameter sanitary sewer running along Hagey Boulevard, flowing from north to south. The development block is presently serviced with an existing 200m diameter sanitary lateral connection off Hagey Boulevard.

2.2 Proposed Sanitary Servicing

A control maintenance hole will be installed on the existing service connection at the property line and a new 200mm diameter sanitary sewer will be extended to the west end of the building in accordance with the City of Waterloo Design Criteria.

Refer to Drawing SS-1 attached in Appendix Drawings for sanitary connection details.

2.3 Sanitary Sewage Flow Estimates

Using the Ministry of Environment, Conservation and Parks (MECP) Design Guidelines, the estimated sanitary demand is summarized below.

Proposed Site Design Flow:

Peak Flow Design Parameters

Commercial Avg. Peak Flow	= 28 m^3/gross ha/d
Hotels	= 225 L/day per bed space

Calculation of Peak Design Flows:

The proposed mixed-use building consists of 216 guestrooms with 7000 sq.f (0.065 ha) of conference space. Therefore:

Design flow, $Q_{SANITARY}$ *= (commercial avg. peak flow * Floor Area) + (225 l/day x 216 x 2*) * assuming 2 beds per room*

= (28 m^3/gross ha/d * (0.0650 ha) x (225 L/d x 216 room x 2beds)
= 0.021 + 1.125 (L/s)
= 1.15 L/s

Therefore, the peak sanitary flow from the development site has been calculated to be **1.15 L/s.** The 200 mm diameter sanitary sewer can easily accommodate this flow rate.

2.4 Receiving System Capacity

The sanitary modeling is maintained by the City of Waterloo, and therefore a detailed downstream sanitary analysis is not included in this report. However, we provided the discharge flow rate from the subject block in the report so city can input into the City's model to determine if there is any downstream system capacity constraints.

3.0 WATER SERVICING

3.1 Existing Water Servicing

There is existing 300mm diameter watermain located at the west boulevard (far-side) of Hagey Boulevard. The development block is presently serviced with an existing 200m diameter watermain lateral connection off Hagey Boulevard.

3.2 Proposed Water Servicing

A 200mm diameter fireline and a 100mm diameter domestic waterline is proposed to service the proposed building. Both fire and domestic lines will be provided with shut-off valves at the streetline. The proposed watermains will be extended to the building's mechanical room, where meters will be installed inside the building in accordance with the City of Waterloo Design Criteria.

Refer to Drawing SS-1 in Appendix Drawings for watermain connection details.

3.3 Proposed Water Demands

Using the MECP Design Guidelines for Drinking Water Systems (2008), the estimated water demand is summarized in Table 1 below.

Table 1.0: *Domestic Water Demands (Mixed Usel)*

Use	Total Beds/GFA	Daily Average	Average Demand (L/s)
216 Rooms	432 (2 beds per room)	225 L/bed-day	1.125
Conference Area	0.065 ha.	28m^3/ha-day	0.021
Total			**1.146**

The proposed domestic demand for the proposed development is calculated at 1.146 **L/s** or 69 L/min. which is a fraction of the supply capacity of the existing 200 mm diameter lateral connection provided for the subject block. Therefore, domestic demand is not a constraint.

However, the fire flow is much more critical. Based on the more stringent Fire Underwriters Survey (FUS) calculations in Tables F2 & F3 (Appendix B), the required fire flow is estimated at 7,000 L/min. for the proposed building.

A hydrant flow test, enclosed in Appendix B, was performed on April 03, 2025 to ascertain the available municipal supply on Hagey Boulevard. Two hydrants are within close proximity to the site. Both hydrants are confirmed to be in good working order at the time of the testing.

Detailed hydrant flows are calculated in Table F1 in Appendix B, confirming that the existing Hagey Boulevard system is capable of delivering a fire flow of **13,665 L/min at a minimum pressure of 140 kPa**, which satisfies the FUS fire flows superimposed on the max-day domestic consumption rate of 69 L/min.

- **Based on the hydrant testing results and modeling, the existing main has adequate supply and pressures to meet the critical high-demand flow for fire-fighting plus the maximum-day domestic consumption rate, in accordance with the Fire Underwriters Survey model calculations. Therefore, the existing municipal water main is sufficient to support the proposed development.**

4.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

4.1 Existing Storm Sewers and Allowable Discharge

There is an existing 1350 mm diameter storm sewer running along Hagey Boulevard that directs runoff southeast towards the stormwater management facility located southeast of the subject development (at the north of South Boundary Road). The development block is presently serviced with an existing 300m diameter storm lateral connection off Hagey Boulevard.

The subject site is part of the existing downstream Stormwater Management (SWM) Facility constructed as part of the University of Waterloo Research and Technology Parking. As excerpted from the Stantec SWM report:

"The stormwater management approach includes a treatment train approach where stormwater runoff passes through a series of measures designed to improve runoff quality prior to discharge to the downstream system. For the Research and Technology Park, the following features are incorporated into the treatment train approach:

- *Roof runoff, generally considered to be "clean" water, will be connected to storm sewers and conveyed to the stormwater management facilities*
- *Some parking lot runoff will be directed via surface flow to grassed swales by parking lot grades.*
- *Common area swales will collect runoff from parking lots and direct flow to the stormwater management basins*

"A swale is proposed along the west limits of the east SWM Facility to provide conveyance of storm flows from the rear of sites fronting Hagey Boulevard and Wes Graham Drive. The swale is designed to convey flows from up to and including the 5 year storm, with flows being routed through ditch inlets located at the end of the swale and connecting with the proposed storm servicing, which ultimately outlets into the East SWM facility.

"The proposed Stomwater Management (SWM) Facility located at the southeast corner of the proposed development limits, just north of South Boundary Road, is designed as a constructed wetland to provide water quality and water quantity control. The facility receives both major and minor storm system from the post development subcatchments (SC) 800, 801.1, 901 and 902 and only minor storm drainage from SC 801.7 for a total drainage area of 32.30 ha. All runoff from the catchment lands during storm events up to and including the 5 year storm are conveyed into the basin at separate outlets located at the south and north limits of the pond, via a treatment train approach which consists of drainage swales and storm sewers, as previously discussed. Flows in excess of the 5 year storm event will be conveyed along the proposed road system, which discharges into the SWM Basin via overland flow easement."

4.2 Post-development Discharge and Overland Flow

Roof runoff will be discharged into the storm sewer on Hagey Boulevard and conveyed to the East SWM facility. Parking lot runoff will be directed via surface flow to the southeast of the site, which will be collected by common area swales and ultimately direct flow to the SWM facility as per SCS SWM brief.

As the entire site block sheet drains to the southeast, there is no surface ponding within the parking area. It is also noted that the lowest building elevation is 1.55 m higher than the overland flow route elevation. Therefore, overflow flow will have no impact on the proposed building.

4.3 Stormwater Quality Control

Quality control from the subject block is not required as the SWM facility was constructed to provide water quality control.

"A swale is proposed along the west limits of the east SWM Facility to provide conveyance of storm flows from the rear of sites fronting Hagey Boulevard and West Graham Drive. The swale is designed to convey flows from up to and including the 5 year storm, with flows being routed through ditch inlets located at the end of the swale and connecting with the proposed storm servicing, which ultimately outlets into the East SWM facility."

5.0 GROUNDWATER CONSIDERATION

As indicated in the Hydrological Assessment by Harden Environmental, long-term (permanent dewatering) is not anticipated, as the proposed footings will sit above the groundwater table.

Construction dewatering may be required up to approximately 168,00 L/s (1.94 L/s) to facilitate subsurface construction activities. The selection and method of dealing with the construction dewatering will need to be provided by the dewatering contractor at the time of construction. It should be noted that prior to the discharge of any construction dewatering, the dewatering contractor needs to ensure that it complies with the City and Region Use By-laws.

The Hydrological Assessment is attached in Appendix D.

6.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control should be implemented for all construction activities within the subject site, and for each consecutive phase and stage of construction, including earthworks, servicing and building activities. The basic principles considered for minimizing erosion, sedimentation, and resultant negative environmental impacts include:

- Minimize local disturbance activities (e.g. grading);
- Expose the smallest possible land area to erosion for the shortest possible time;
- Implement erosion and sediment control measures before the outset of construction activities; and,
- Carry out regular inspections of erosion and sediment control measures and repair or maintain as necessary.
- Erection of silt fences around all site perimeters;
- Provide sediment traps (e.g. rock check dams, straw bales, scour basins) along interceptor swales at the site boundaries (most notably the southerly and easterly limits of the site);
- Inlet controls at catchbasins, comprising filter cloth overlain with rip-rap;
- Implement a weekly street sweeping and cleaning program for any mudtracking onto the adjacent municipal roadways;
- Provide gravel “mud mats” at construction vehicle access points to minimize off-site tracking of sediments; and,
- Confine refueling/servicing equipment to areas well away from inlets to the minor system or major system elements.
- All waste and unused building materials (including garbage, cleaning wastes, wastewater, toxic materials, or hazardous materials) shall be properly disposed of and not allowed to be mixed with and carried off by runoff from the site into a receiving watercourse or storm sewer.

Removal of the erosion and sediment controls should be done once construction is completed and sediment run-off from the construction activities has stabilized. Erosion and Sediment Plan will be provided at the SPA.

7.0 CONCLUSIONS AND SUMMARY RECOMMENDATIONS

This functional servicing and stormwater management report demonstrates that the proposed 9–storey mixed-use building can be accommodated by the existing local infrastructure. Specifically:

- **Water Service** will be accommodated by the existing 300 mm diameter municipal watermain located on Hagey Boulevard. A 200 mm fireline and a 100 mm domestic waterline are proposed to service the building. Hydrant flow test and analysis confirm there is adequate supply and pressure for fire-fighting purposes.

- **Sanitary Service** will be accommodated by the existing 200 mm diameter sanitary sewer on Hagey Boulevard. A 200mm diameter sewer line is proposed, with a maintenance hole at the streetline to service the site.

- **Storm Drainage** from the rooftop area will be collected by roof drains and discharged into the existing 1300mm storm on Hagey Boulevard. Parking lot runoff will be directed via surface flow to the southeast of the site, which ultimately goes into the SWM facility. Quality control from the subject block is not required as the SWM facility was constructed to provide water quality control.

- **Groundwater Discharge** is not anticipated for the long-term as the footing elevations sit above the groundwater table elevations. Construction dewatering may be required up to approximately 168,00 L/s (1.94 L/s) to facilitate subsurface construction activities.

- **Erosion and Sediment Controls** will need to be implemented during development until the site has been stabilized with ground cover.

We trust you will find this submission is complete and in order. Should you have any questions or require additional information, please contact the undersigned.

Respectfully Submitted,

MASONGSONG ASSOCIATES ENGINEERING LIMITED

Professional Engineers Ontario
Limited Licensee
Name: K. K. LO
Number: 100209166
Category: CIVIL
Limitations:
This licence is subject to the limitations as detailed on the certificate.
Association of Professional Engineers of Ontario

LICENSED PROFESSIONAL ENGINEER
W. C. IP
April 14, 2025
PROVINCE OF ONTARIO

Ken Lo, LEL
Principal

Andrew Ip, P.Eng
Principal

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Appendix A

Site Plan & Site Statistics

Hagey Boulevard Plan & Profile

Zoning Matrix Table – 380 Hagey Blvd

Topic	Required	Provided
	Exception C74 - University of Waterloo Research and Technology Park	
	SECTION 6 – PARKING, DRIVEWAYS, LOADING (Parking Area A)	
6.1.3 PARKING - USE SPECIFIC PARKING RATES	**TABLE 6A: PARKING - SPECIFIC USES** Use: HOTEL — PARKING SPACE Requirement (minimum): 1 PARKING SPACE per guest room, plus 5 PARKING SPACES per 100 square metres of BUILDING FLOOR AREA for commercial, conference and or convention space 216 parking spaces + 33 parking spaces = 249 parking spaces (min)	271 spaces
6.3 ELECTRIC VEHICLE PARKING, HYDRAULIC LIFT PARKING	**TABLE 6C: ELECTRIC VEHICLE PARKING –SURFACE PARKING SPACES** 0 – 19: 0 20 – 49: 1 50 – 84: 2 85 – 119: 3 120 – 149: 4 150 or more: 3% of total required parking "Electric Vehicle Parking Space" means a PARKING SPACE constructed with a minimum Level 2 Electric Vehicle Charging Device. = 8 EV parking spaces	8 Provided
6.4 ACCESSIBLE PARKING	**TABLE 6D: ACCESSIBLE PARKING SPACES** 1–25: 1 / 0 26 – 50: 1 / 1 51 – 75: 1 / 2 76 – 100: 2 / 2 101 – 133: 2 / 3 134-166: 3 / 3 167-250: 3 / 4 251-300: 4 / 4 301-350: 4 / 5 351-400: 5 / 5 401-450: 5 / 6 451-500: 6 / 6 501 - 550: 6 / 7 551 - 600: 7 / 7 601 - 650: 7 / 8 651 - 700: 8 / 8 701 - 750: 8 / 9 751 - 800: 9 / 9 801 - 850: 9 / 10 851 - 900: 10 / 10 900 - 950: 10 / 11 951 – 1000: 11 / 11 1001+: 11 plus 1% of the total number of PARKING SPACES Type A = 3 accessible parking spaces Type B = 4 accessible parking spaces	7 spaces 3 Type-A spaces 4 Type-B spaces
NOTE: Subject property is located within the R+T Park LRT Station PMTSA		

Topic	Required	Provided
6.6 BICYCLE PARKING SPACES	BICYCLE PARKING spaces - minimum rate of 40% of the required motor vehicle PARKING SPACES. This requirement may be satisfied as TYPE A BICYCLE PARKING and or TYPE B BICYCLE PARKING, except as specified in section 6.6.2.c.).i.).B.). = 40% of 249 parking spaces (min) = 99.6 bicycle parking spaces B.) where non-residential BUILDING FLOOR AREA exceeds 2,400 square metres, a minimum of 50% of the required BICYCLE PARKING shall be provided as TYPE A BICYCLE PARKING. = 50% of 72 bicycle parking spaces = 50 type A bicycle parking spaces	60 Provided
6.8 DRIVEWAY REGULATIONS	**TABLE 6H: DRIVEWAY DIMENSIONS** Driveway Type: LOT containing ten (10) or more PARKING SPACES — Driveway Dimension: Width (minimum): 6.1 metres; Width (maximum): 7.6 metres where a DRIVEWAY is to/from a REGIONAL HIGHWAY, and 7.0 metres in all other instances	Driveway width: 6.1m
	6.8.6 Notwithstanding anything to the contrary, on a CORNER LOT, the DRIVEWAY shall be located a minimum six metres (6m) from the STREET LINE tangent point of intersection	
6.9 LOADING REGULATIONS	**TABLE 6I: LOADING SPACE DIMENSIONS** Type A LOADING SPACE: Width (minimum) 3.0 metres; Length (minimum) 7.0 metres; Vertical Clearance (minimum) 3.0 metres Type B LOADING SPACE: Width (minimum) 3.0 metres; Length (minimum) 12 metres; Vertical Clearance (minimum) 4.5 metres Type C LOADING SPACE: Width (minimum) 3.0 metres; Length (minimum) 23.5 metres; Vertical Clearance (minimum) 4.5 metres *NOTES:* • *Type A Spaces accommodate smaller vehicles such as delivery vans* • *Type B Spaces accommodate traditional vehicles such as cube vans and small transport trucks* • *Type C Spaces accommodate larger vehicles, such as standard transport trucks*	Width: 3.0m Length: 12.0m

Topic	Required	Provided
	TABLE 6J: LOADING SPACES – Non-Residential USES 0 – 249: (none required) 250 – 2,500: Type B: 1 2,501 – 4,000: Type B: 2 4,001 – 10,000: Type B: 3 10,001 – 28,000: Type B: 4 28,001 or more: Type B: 5 2 Type B required	2 Type B Loading spaces provided:
	UNIVERSITY COLLEGE (UC) – UC-81	
Performance Standards	**Table 9K: Regulations – UNIVERSITY COLLEGE (UC) – BEYOND MAIN CAMPUS** STREET LINE setback (minimum): 5.0 metres SIDE YARD setback (minimum): 5.0 metres REAR YARD setback (minimum): 7.5 metres LOW RISE RESIDENTIAL LOT LINE setback (minimum): 7.5 metres or half the height of the BUILDING, whichever is greater LANDSCAPED OPEN SPACE (minimum): 15% Number of BUILDINGS on a LOT (maximum): More than one (1) main BUILDING permitted *1E: BICYCLE PARKING requirements are contained in section 6.6. LOADING SPACE requirements are contained in section 6.9.*	Street line setback: 5.0m Side yard setback: 7.5m Rear yard setback: 7.5m Landscaped open space: 30% # of buildings on lot: 1 building
	9.4.6 The LANDSCAPED BUFFER in section 9.4.5 shall be a minimum average depth of 3m, and at no point less than 1.5m	Landscape buffers dimensioned and annotated
	9.4.7 The LANDSCAPED BUFFER in section 9.4.5 shall contain plant materials that form a visual screen and are not less than 1.5m in height.	Dimension not provided
	9.4.13 Notwithstanding anything to the contrary, PARKING SPACES shall not be permitted within five metres (5m) of the STREET LINE.	Achieved
	UC-81 — Building Height (maximum): 81 metres and 25 STOREYS	29.72 metres and 9 STOREYS
	UC-81 — Density (maximum): 750 BEDROOMS per hectare	N/A
	UC-81 — PODIUM height (maximum): 21 metres and 6 STOREYS	5.0 metres and 1 STOREY

Topic	Required	Provided
	UC-81 — TOWER STEPBACK above podium (including balconies), where a BUILDING FAÇADE or part of a BUILDING FAÇADE is within 15 metres from the STREET LINE (minimum): 3 metres	0 metres

Chamberlain Architects Constructors Managers

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NO.	ISSUED	DATE
	CLIENT REVIEW	2024-06-15
	ZBA SUBMISSION	2025-04-11

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SEAL

HYATT DUAL BRAND - HH & HP

WES GRAHAM WAY & HAGEY BLVD. WATERLOO

SHEET NAME

ZONING STATISTICS

START DATE: NOVEMBER 2022
DRAWN BY: HK/MR
CHECKED BY: CMC
SCALE:
PROJECT NO.: 122065
DRAWING: A001d

C:\Users\mraz2\Documents\Revit Local Files\122065 - Waterloo Hyatt - Site - R24 - 2024_08_13_mraz.WTLO.rvt
4/7/2025 11:14:40 AM

LANDSCAPED OPEN SPACE
Means a portion of a LOT predominantly used for the growth of trees, shrubs, grasses, and or other vegetation (the "Green Space"). Includes COMMON OUTDOOR AREA and outdoor hardscapes that are ACCESSORY to the Green Space, such as a surface walkway for the Green Space, common patio for the exclusive use of residential uses on the LOT, or common DECK for the exclusive use of residential uses on the LOT. Exclusions include, but are not limited to:

a.)BUILDINGS and STRUCTURES (except for a common DECK for the exclusive use of the residential uses on the LOT)
b.)parking areas, including parking decks
c.)DRIVEWAYS
d.)LOADING SPACES
e.)BICYCLE PARKING
f.)curbs and retaining walls
g.)garbage enclosures
h.)rooftop AMENITY AREAS, rooftop decks, rooftop terraces constructed after the effective date of this BY-LAW, unless otherwise stated in this BY-LAW
i.)stairs and ramps
j.)utilities

HEIGHT:
For all other BUILDINGS and STRUCTURES, means the vertical distance from the finished ground level abutting the FRONT BUILDING FAÇADE, measured as the average of five (5) points equally spaced apart adjacent to the entire FRONT BUILDING FAÇADE to:

a.)for a flat roof, the highest point of:•the roof's surface; or
•the parapet, where the parapet exceeds 1.2 metres in height,whichever is higher;.,.
The following shall be disregarded when calculating BUILDING HEIGHT:
•chimney
•church spire, church steeple, church belfry, and the like
•rooftop mechanical, ventilation, electrical, utility and service equipment not exceeding four metres in height•enclosed stairwell roof access not exceeding four metres in height
•elevator penthouse not exceeding six metres in height•rooftop architectural feature (see section 3.A.5)
•mechanical and service equipment noise barriers
•elevator penthouse
•stairway structure
•non-habitable and unenclosed rooftop amenity structures
•safety guards
•ornamental domes, skylights, and cupolas
•telecommunication equipment

BUILDING FLOOR AREA:
Means the gross floor area of a BUILDING measured between the outside of all exterior walls. Incluccdes an attic with a clear ceiling height of two-point-one-five metres (2.15m) for at least fifty percent (50%) of the attic floor area.

Excludes STRUCTURED PARKING.

GROSS LEASABLE AREA:
Means the floor area designed for tenant occupancy and exclusive use, measured from the outside of exterior wall faces and from the center line of joint partition walls. Includes basements, upper floors and mezzanines.

Excludes:
a.)boiler rooms, maintenance rooms, mechanical and electrical rooms
b.)common hallways, stairwells, elevators, escalators
c.)common gathering spaces
d.)common loading and unloading areas
e.)parking areas
f.)common washroom facilities

SITE STATISTICS

DESCRIPTION	AREA (SM)	AREA (SF)	AREA (HA)	%
BUILDING FOOTPRINT				
HYATT DUAL BRAND & CONFERENCE CENTRE	3,501.4 m²	37,689 ft²	0.35 hectare	21.7%
	3,501.4 m²	37,689 ft²	0.35 hectare	21.7%
HARD LANDSCAPE				
ASPHALT	7,802.9 m²	83,990 ft²	0.78 hectare	48.4%
CURB	235.6 m²	2,536 ft²	0.02 hectare	1.5%
PAVERS	574.3 m²	6,182 ft²	0.06 hectare	3.6%
SIDEWALK	1,371.5 m²	14,763 ft²	0.14 hectare	8.5%
	9,984.4 m²	107,471 ft²	1.00 hectare	61.9%
SOFT LANDSCAPE				
LANDSCAPING	2,648.4 m²	28,507 ft²	0.26 hectare	16.4%
	2,648.4 m²	28,507 ft²	0.26 hectare	16.4%
	16,134.2 m²	173,667 ft²	1.61 hectare	100.0%
OVERALL SITE	16,126.8 m²	173,587 ft²	1.61 hectare	100.0%

PARKING SCHEDULE

Type	COUNT
ACCESSIBLE - TYPE A (3.7M X 5.5M)	3
ACCESSIBLE - TYPE B (2.4M X 5.5M)	4
ELECTRIC VEHICLE PARKING (2.8M X 5.5M)	8
TYPICAL PARKING (2.8M X 5.5M)	256
	271

PARKING REQUIREMENTS:

HOTEL:
- 1 PARKING SPACE PER GUEST ROOM
- 5 PARKING SPACES PER 100SM OF BUILDING FLOOR AREA FOR COMMERCIAL, CONFERENCE AND/OR CONVENTION SPACE

GUESTROOM PARKING REQUIRED
216 x 1 = 216 PARKING SPACES

CONFERENCE ROOM PARKING REQUIRED
650SM x 0.05 = 33 PARKING SPACES

TOTAL PARKING REQUIRED 216 + 33 = 249 PARKING

ACCESSIBLE PARKING REQUIRMENTS:

PARKING GTY.	TYPE A	TYPE B
167-250	3	4

TOTAL ACCESSIBLE PARKING REQUIRED
3 (A) + 4 (B) = 7 ACCESSIBLE PARKING SPACES

ELECTRICAL VEHICLE PARKING REQUIREMENTS:

TOTAL PARKING QTY.	EV PARKING SPACES
150 OR MORE	3% (8 SPACES)

NOT WITHSTANDING ANYTHING TO THE CONTRARY, A REQUIRED TYPE B ACCESSIBLE PARKING SPACE MAY BE SATISFIED AS A TYPE A ACCESSIBLE PARKING SPACE.

BIKE PARKING SCHEDULE

Type	Description	Size	Count
TYPE B - SHORT TERM BIKE PARKING	DOUBLE SIDED RACK	3.0m x 0.6m	60

GFA BY LEVEL

Name	Area (m2)	Area
LVL 1		
BAR	26 m²	275 ft²
BAR/CAFE	71 m²	765 ft²
CACF	5 m²	52 ft²
CART STORAGE	15 m²	159 ft²
COMPUTER	10 m²	105 ft²
CONFERENCE ROOM 1	325 m²	3500 ft²
CONFERENCE ROOM 2	325 m²	3500 ft²
CORRIDOR	84 m²	901 ft²
ELEC/MEC/ WATER METER	101 m²	1092 ft²
ELEV	18 m²	196 ft²
FEMALE WR	39 m²	420 ft²
FITNESS	102 m²	1098 ft²
FOOD PREP	283 m²	3041 ft²
FREEZER/COOLER	42 m²	448 ft²
GM OFFICE	14 m²	152 ft²
GUEST KITCHEN	56 m²	598 ft²
GUEST LAUNDRY	13 m²	145 ft²
LAUNDRY & STORAGE	109 m²	1178 ft²
LOBBY	299 m²	3220 ft²
LOBBY SPILL OUT SPACE	44 m²	473 ft²
LOUNGE 1	135 m²	1458 ft²
LUGGAGE	13 m²	136 ft²
MAINT. OFFICE	16 m²	173 ft²
MALE WR	31 m²	332 ft²
MARKETPLACE	16 m²	175 ft²
MEETING ROOM 1	82 m²	878 ft²
MEETING ROOM 2	75 m²	808 ft²
POOL	232 m²	2494 ft²
POOL EQUIPMENT	17 m²	181 ft²
POOL STORAGE	7 m²	76 ft²
PREFUNCTION	439 m²	4728 ft²
SALES	17 m²	183 ft²
STAFF ROOM	48 m²	520 ft²
STAIRS	41 m²	440 ft²
STORAGE	83 m²	897 ft²
SUNROOM	180 m²	1936 ft²
VESTIBULE	49 m²	527 ft²
WORK ROOM	21 m²	223 ft²
WR	8 m²	84 ft²
LVL 1: 48	3490 m²	37568 ft²
LVL 2		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	705 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1163 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 2: 33	1468 m²	15799 ft²
LVL 3		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 3: 33	1468 m²	15804 ft²
LVL 4		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 4: 33	1468 m²	15804 ft²

GFA BY LEVEL

Name	Area (m2)	Area
LVL 5		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 5: 33	1468 m²	15804 ft²
LVL 6		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 6: 33	1468 m²	15804 ft²
LVL 7		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 7: 33	1468 m²	15804 ft²
LVL 8		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 8: 33	1468 m²	15804 ft²
LVL 9		
CORRIDOR	150 m²	1610 ft²
ELECTRICAL RM	9 m²	101 ft²
ELEV	17 m²	184 ft²
HH - K	66 m²	708 ft²
HH - KA	66 m²	715 ft²
HH - KD	43 m²	459 ft²
HH - KS.1	134 m²	1439 ft²
HH - KS.2	109 m²	1169 ft²
HH - QD	77 m²	827 ft²
HH - QS	108 m²	1166 ft²
HP - KA	345 m²	3713 ft²
HP - QA	192 m²	2062 ft²
HP - QC	64 m²	689 ft²
LINEN	39 m²	418 ft²
STAIRS	50 m²	543 ft²
LVL 9: 33	1468 m²	15804 ft²
	15236 m²	163996 ft²

GUESTROOM SCHEDULE BY LEVEL

Name	Count	% of Total
LVL 2		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 3		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 4		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 5		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 6		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 7		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 8		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%
LVL 9		
HH - K	1	0%
HH - KA	1	0%
HH - KD	1	0%
HH - KS.1	3	1%
HH - KS.2	2	1%
HH - QD	2	1%
HH - QS	2	1%
HP - KA	9	4%
HP - QA	5	2%
HP - QC	1	0%
	27	13%

OVERALL GFA

Level	Area	Area (m2)
LVL 1	37568 ft²	3490 m²
LVL 2	15799 ft²	1468 m²
LVL 3	15804 ft²	1468 m²
LVL 4	15804 ft²	1468 m²
LVL 5	15804 ft²	1468 m²
LVL 6	15804 ft²	1468 m²
LVL 7	15804 ft²	1468 m²
LVL 8	15804 ft²	1468 m²
LVL 9	15804 ft²	1468 m²
Grand total: 312	163996 ft²	15236 m²

HYATT HOUSE ROOM MIX

Name	Count	Count %
HYATT HOUSE		
HH - K	8	8%
HH - KA	8	8%
HH - KD	8	8%
HH - KS.1	24	25%
HH - KS.2	16	17%
HH - QD	16	17%
HH - QS	16	17%
	96	100%

HYATT PLACE ROOM MIX

Name	Count	Count %
HYATT PLACE		
HP - KA	72	60%
HP - QA	40	33%
HP - QC	8	7%
	120	100%

OVERALL ROOM MIX

Name	Count	% of Total
HYATT HOUSE		
HH - K	8	4%
HH - KA	8	4%
HH - KD	8	4%
HH - KS.1	24	11%
HH - KS.2	16	7%
HH - QD	16	7%
HH - QS	16	7%
	96	44%
HYATT PLACE		
HP - KA	72	33%
HP - QA	40	19%
HP - QC	8	4%
	120	56%
Grand total: 216	216	100%

FEE: 347.70

MAXIMUM HEIGHT: 29.72m

FIRST FLOOR HEIGHT: 5.03M

TOTAL BUILDING AREA (BFA): 37,689 ft²

BFA FOR CONFERENCE SPACE: 7,000 ft²

FLOOR AREA RATIO (FAR): 0.217118

GROSS LEASABLE AREA: 103,580 ft²

Chamberlain Architects Constructors Managers

Chamberlain Architect Services Limited

4671 Palladium Way (Unit 1)
Burlington, Ontario. L7M 0W9
CANADA

Phone: 905.631.7777

www.chamberlainIPD.com

NO.	ISSUED	DATE
1	CLIENT REVIEW	2025-02-21
2	CLIENT REVIEW	2025-02-26
3	ZBA SUBMISSION	2025-04-11

DO NOT SCALE DRAWINGS. USE ONLY DRAWINGS MARKED "ISSUED FOR CONSTRUCTION". VERIFY CONFIGURATIONS AND DIMENSIONS ON SITE BEFORE BEGINNING WORK. NOTIFY ARCHITECT IMMEDIATELY OF ANY ERRORS, OMISSIONS OR DISCREPANCIES.

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SEAL

CONSTRUCTION NORTH TRUE NORTH

HYATT DUAL BRAND - HYATT HOUSE & HYATT PLACE

WES GRAHAM WAY & HAGEY BLVD. WATERLOO

SHEET NAME

PROJECT STATS

START DATE	NOVEMBER 2022
DRAWN BY	MR
CHECKED BY	CMC
SCALE	
PROJECT NO.	122065
DRAWING	A002

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Chamberlain

Architects
Constructors
Managers

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4671 Palladium Way (Unit 1)
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SEAL

CONSTRUCTION NORTH TRUE NORTH

HYATT DUAL BRAND - HYATT HOUSE & HYATT PLACE

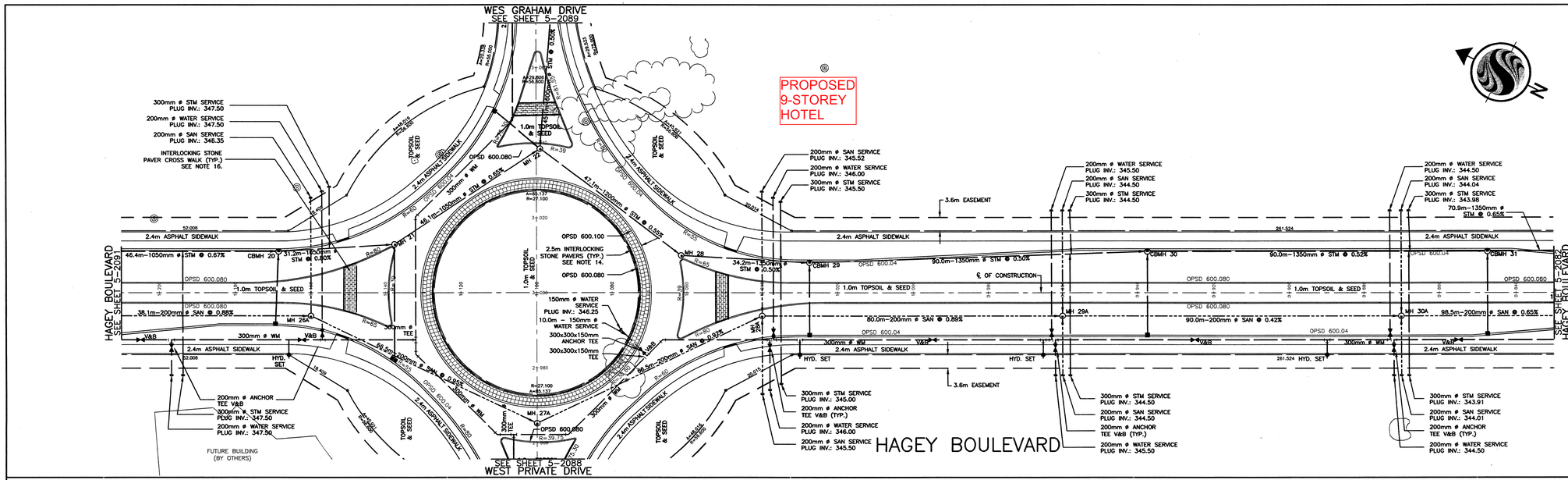
WES GRAHAM WAY & HAGEY BLVD. WATERLOO

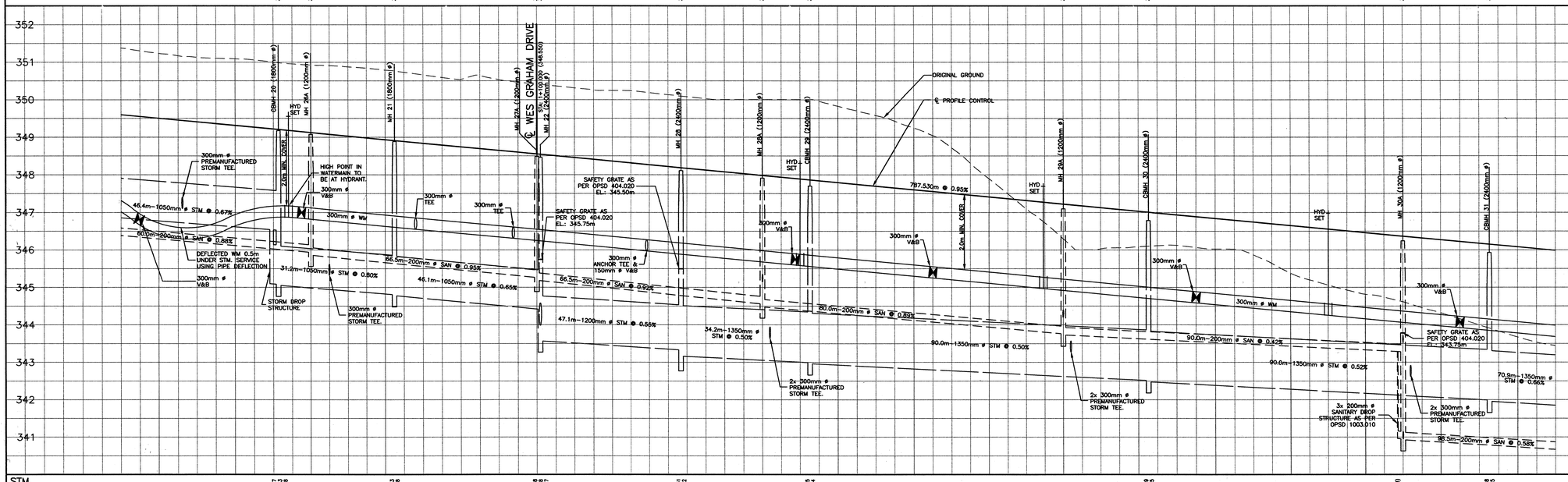
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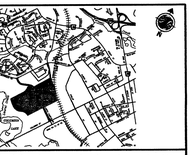
GROUND FLOOR PLAN

START DATE	NOVEMBER 2022
DRAWN BY	HK/MR
CHECKED BY	CMC
SCALE	1 : 150
PROJECT NO.	122065
DRAWING	A100

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The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them. Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

NOTES:

1. BENCHMARKS: WA–48 (RMW 145)
   TABLET IS SET HORIZONTALLY ON BUILDING #160 ON THE NORTH SIDE OF COLUMBIA ST., 0.15 km EAST OF CNR. TABLET IS SET ON THE SOUTH FACE OF THE BUILDING 0.21m EAST OF THE SOUTHWEST CORNER AND 0.40m ABOVE GROUND LEVEL.
   ELEV.: 337.577m
2. SANITARY SEWER
   – 200mm ø PIPE TO BE SDR 35 PVC
   – 300mm ø PIPE TO BE 140–D CONCRETE
3. SANITARY SEWER MANHOLES
   – OPSD 701.010 (1200mm ø)
4. STORM SEWERS
   – > 600mm ø TO BE 65–D UNLESS OTHERWISE NOTED
5. STORM MANHOLES
   – OPSD 701.012 (1800mm ø)
   – OPSD 701.013 (2400mm ø)
6. CATCHBASINS: SINGLE – OPSD 705.010
   DOUBLE – OPSD 705.020
7. CATCHBASIN LEADS: SINGLE – 250mm ø
   DOUBLE – 300mm ø
   LEADS ARE ULTRARIB @ 1.0% MINIMUM.
8. WATERMAIN
   – CLASS 150 AWWA C–900 PVC PIPE
   – MINIMUM COVER 2.0m
   – MINIMUM VERTICAL CLEARANCE BETWEEN WATERMAIN AND OTHER SERVICES = 0.5m
9. PAVEMENT CONSTRUCTION:

HAGEY BOULEVARD:	ALL OTHER ROADS:
–35mm HL3 (N.I.C)	–35mm HL3 (N.I.C)
–90mm HL8	–65mm HL8
–200mm G.B.C. 'A'	–150mm G.B.C. 'A'
–600mm G.B.C. 'B'	–450mm G.B.C. 'B'

10. ALL HYDRANTS
    – 2–65mm and 1–100mm (STORZ) NOZZLES
    – 150mm MECHANICAL JOINT INLET
    c/w 300x300x200mm ANCHOR TEE AND V&B
11. ALL SERVICE LATERALS GREATER THAN 4.0m DEEP HAS INCORPORATEED A RISER (OPSD 1006.02) MODIFIED, SUCH THAT THE SERVICE LATERAL AT PROPERTY LINE IS NOT DEEPER THAN 3.5m
12. ROAD CROSS–SECTION
    – SEE TYPICAL SECTION DRAWING 4–346
13. SEWER BEDDING HAS CONFORMED TO CITY OF WATERLOO DWG # 15–244 CLASS "B", EXCEPT THE BEDDING AND COVER SHALL CONSIST OF GRANULAR "A" FOR ALL PVC PIPES.
14. INTERLOCKING STONE PAVERS TO BE 100x200x80/mm PAVESTONE PLUS – RED COBBLE 100 PAVING STONE OR APPROVED EQUIVALENT (SEE DETAIL, DRAWING 4–346)

Stantec

INT.	YY.MM.DD	REVISION
T.N.H.	03.03.24	AS RECORDED
T.N.H.	02.09.12	ISSUED FOR CONSTRUCTION
T.N.H.	02.08.19	ISSUED FOR TENDER
T.N.H.	02.08.02	CITY COMMENTS
T.N.H.	02.06.26	FIRST SUBMISSION

CITY OF WATERLOO

REGISTERED PROFESSIONAL ENGINEER T. E. LEVECK 100165 PROVINCE OF ONTARIO
SEAL

TITLE:
RESEARCH AND TECHNOLOGY PARK
UNIVERSITY OF WATERLOO
PHASE 1
HAGEY BOULEVARD
Sta. 0+830 to Sta. 1+210

DATE: JUNE 2002		DESIGNED BY: K.R.B.	
SCALE :	HOR=1:500 VERT=1:50	DRAWN BY: B.J.M.	
		CHECKED BY: T.N.H.	
FILE NO.		DRAWING NO.	
FIELD BK.	PAGE	DATE	5–2083

AS BUILT

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2020–01–27 10:54:44 By: mwhitmore

Appendix B

Watermain Analysis

"Fire Protection with Intelligence"
BRUCE Fire Engineering

Bruce Fire Engineering Ltd.

400 Applewood Crescent, Suite 100
Vaughan, Ontario
L4K 0C3

Phone: 905 482 4678
Fax: 905 581 3203
Toll Free Phone/Fax: 1 800 260 0187

Email: artem@brucefire.ca

Professional Engineers Ontario

HYDRANT FLOW TEST REPORT

TEST DATE: **Apr 3, 2025.** **TIME:** **10:30 am**

LOCATION: **380 Hagey Blvd, Waterloo, ON N2L 0A4**

TESTED BY: **Artem Matthew – Bruce Fire Engineering**

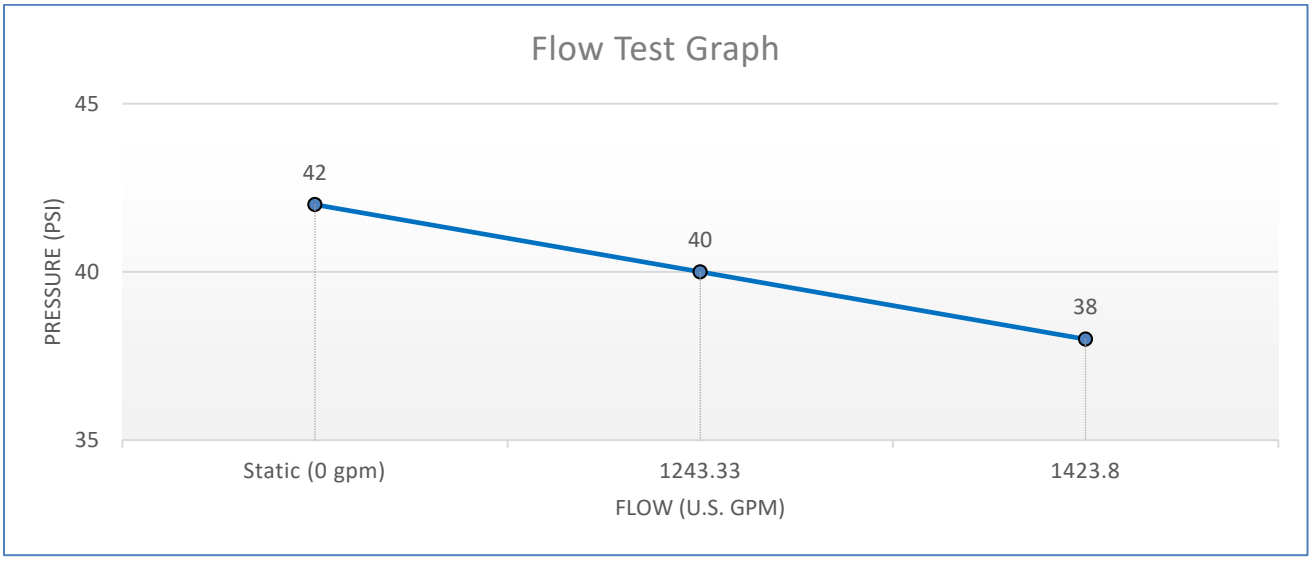
TEST RESULTS:

STATIC PRESSURE (psi)	42

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (inch)	DISCHARGE COEFFICIENT	RESIDUAL PRESSURE (psi)	PITOT PRESSURE (psi)	DISCHARGE (gpm)
1	1	2½"	0.9	40	36	1243.33
2	2	2½"	0.9	38	18/18	1423.8

Flow test done as per NFPA 291 recommendations.

Calculated Flow 3573 gpm @ 20 psi



AREA MAP

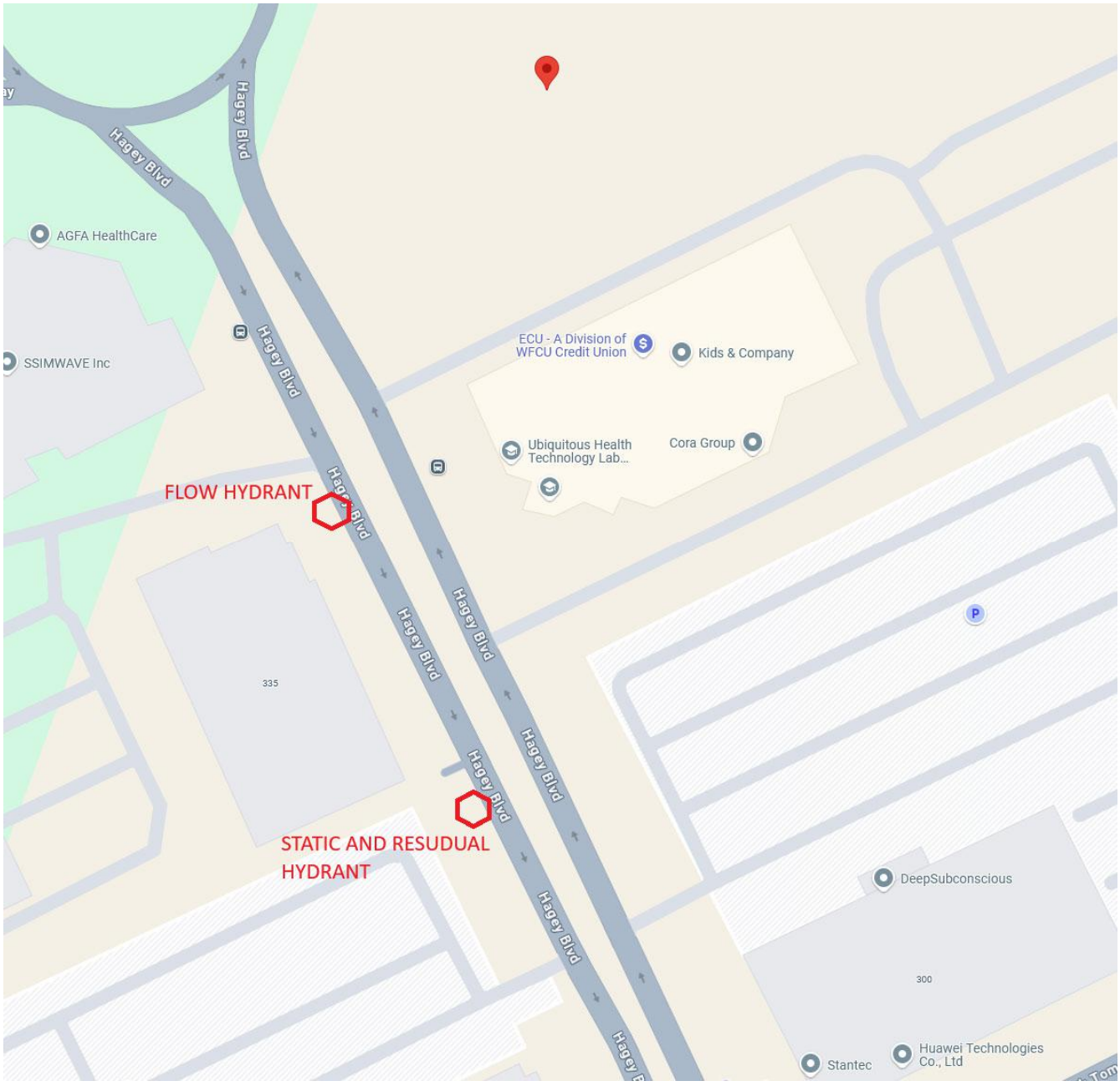

Hagey Blvd
AGFA HealthCare
SSIMWAVE Inc
ECU - A Division of WFCU Credit Union
Kids & Company
Ubiquitous Health Technology Lab...
Cora Group
FLOW HYDRANT
335
STATIC AND RESUDUAL HYDRANT
DeepSubconscious
300
Stantec
Huawei Technologies Co., Ltd

Table F1 Available Fire Flow Calculations

Project:	**380 Hagey Boulevard, City of Waterloo**
Client:	**Kothari Group Inc.**

Outlet diameter:	**2.5**	in, one port	Location:	**380 Hagey Boulevard**
Static pressure:	**42**	psi	Date of Test:	**03-Apr-25**
Resid. pressure:	**40**	psi, one port	Operator:	**Bruce Fire Protection**

• **Observed Flow** $Q_F = 29.83 \times C \times (d^2) \times (p^{0.5})$

where	C =	**0.90**	Coefficient
	d =	**2.50**	in, Outlet diameter
	p =	**36.00**	psi, Pitot Pressure
⇨	Q_F =	**989**	USGPM
		3,743	L/min

• **Available Flow** $Q_R = Q_F \times (h_R^{0.54}) / (h_F^{0.54})$

where	h_F =	2.00	psi, Pressure difference, static to measured residual
	h_R =	22.00	psi, Pressure difference, static to required residual
	Required =	**20.00**	psi
⇨	Q_F =	**3,610**	USGPM
		13,665	L/min

Table F2 Required Fire Flow Calculations

Project: **380 Hagey Boulevard, City of Waterloo**
Client: **Kothari Group Inc.**

• Base Flow

$F_B = 220 \times C_C \times A^{0.5}$

where C_C = 0.70 — from Table F3

A = 4223 m^2 — from Table F3

⇨ F_B = 10,008 L/min

11,000 L/min — rounded to nearest 1,000 L/min

• Occupancy Factor

C_O = **-25%** — from Table F3

$F_O = F_B + (F_B \times C_O)$

= 8,250 L/min

• Sprinkler Factor

C_S = **-30%** — from Table F3

$f_S = F_O \times C_S$

= -2,475 L/min

• Exposure Factor

C_E = **20%** — from Table F3

$f_E = F_O \times C_E$

= 1,650 L/min

• Total Required Flow

$F = F_O + f_S + f_E$

= 7,425 L/min

= **7,000** L/min — rounded to nearest 1,000 L/min

Table F3 Building Area and Coefficients

Project: **380 Hagey Boulevard, City of Waterloo**
Client: **Kothari Group Inc.**

- **Area of Building** **4,223** m^2

The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

For fire-resistive buildings, consider the two largest adjoining floors plus 50 percent of each of any floors immediately above them up to eight, when the vertical openings are inadequately protected.

✓ ***If the vertical openings and exterior vertical communications are property protected (one hour rating), consider only the area of the largest floor plus 25 percent of each of the two immediately adjoining floors.***

- **Construction Coefficient** floors. **0.70** ⇔

1.50	Wood Frame
1.00	Ordinary Construction
0.80	Non-Combustible
0.70	**Fire Resistive (<2 hrs)**
0.60	Fire Resistive (>2 hrs)

- **Occupancy Coefficient** C_O = **-25%** ⇔

-25%	**Non-Combustible**
-15%	Limited Combustible
0%	Combustible
15%	Free Burning
25%	Rapid Burning

- **Sprinkler Coefficient** C_S = **-30%** ⇔

-30%	**NFPA 13 standard**
-40%	+ fully supervised
-50%	+ std water supply

- **Exposure Coefficient** C_E = **20%** ⇔

N	30.0m	5%
S	30.0m	5%
E	30.0m	5%
W	30.0m	5%

25%	0 - 3m separation
20%	3.1- 10m separation
15%	10.1- 20m separation
10%	20.1- 30m separation
5%	> 30m separation
	percentages counted per side, max 75%

Appendix C

Excerpts from Stantec SWM Report

Stormwater Management Calculations

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Stantec

September 20, 2002
File: 602-10333/29

Tel: (519) 585-7446
Fax: (519) 579-6733
sbrown@stantec.com

Grand River Conservation Authority
400 Clyde Road
P.O. Box 729
Cambridge, ON N1R 5W6

Attention: Ms. Nancy Davy

Dear Ms. Davy:

Reference: University of Waterloo Research and Technology Park
Final Stormwater Management Design Brief *(revised)*
City of Waterloo

We are pleased to present the following information as the revised final stormwater management design brief for the University of Waterloo Research and Technology Park. The reasons for the revisions include:

- More detailed geotechnical information relating to the infiltration potential for the subject lands. Additional test pits on the site contradicted the previous studies, and concluded that there is limited potential for infiltration of stormwater runoff. In light of this information, and in consultation with the GRCA, the stormwater management concept has been revised, but maintains the treatment train approach for the site

- Changes to the location of the southern boundary of the park area require alterations to the grading and outlet design of the Upper West stormwater management facility

- Minor revisions to the drainage concept were required to accommodate the phasing of the Park desired by the Partnership (City of Waterloo, University of Waterloo and the Region of Waterloo), which was driven in part by the site location chosen by the first tenant (Sybase).

The general design is still based on the preliminary work completed in December 2001 for the subject lands and subsequent discussions with agency staff regarding design criteria.

Buildings
Environment
Industrial
Transportation
Urban Land

Reference: **University of Waterloo Research and Technology Park**
Final Stormwater Management Design Brief (revised)
City of Waterloo

The background information for the subject lands is available in earlier studies and therefore will not be repeated in this document. These previous reports include:

- *Subwatershed Plan, Subwatershed 311, Final Report* (Stantec Consulting Limited, formerly Paragon Engineering Limited), February 1995
- *Scoped Subwatershed Management Plan* (Marshall Macklin Monaghan Limited), September 2001
- *Stormwater Management Plan, Waterloo Research and Technology Park* (Marshall Macklin Monaghan Limited), December 2001
- *Proposed Infiltration Gallery, University of Waterloo Research & Technology Park* (Naylor Engineering Associates Limited), July 2002.

Design Objectives

The design objectives for the Research and Technology Park include:

- Provide level 1 water quality control according to the MOEE guidelines
- Control peak flows and runoff volume to match existing conditions as closely as possible
- Use a treatment train approach to stormwater management
- Provide extended detention for volume control as required in the Subwatershed 311 study
- Prevent any increase in flows to the existing subdivision north of the site (Corrie Crescent)

Water Balance

Based on the latest soil information, it has been concluded that the infiltration rates of site soils are below the MOEE recommended minimum allowable rates for the successful implementation of infiltration facilities. Due to this limited potential for infiltration of stormwater runoff, water balance calculations have not been completed for this site.

Stormwater Management Approach

The final design of the stormwater management facilities is based on the objectives summarized earlier in this document, conceptual designs from the previous reports and modified according to the final grading plans and discussions with agency staff.

This includes a treatment train approach where stormwater runoff passes through a series of measures designed to improve runoff quality prior to discharge to the

Reference: **University of Waterloo Research and Technology Park**
Final Stormwater Management Design Brief (revised)
City of Waterloo

downstream systems. For the Research and Technology Park, the following features are incorporated into the treatment train approach:

- Roof runoff, generally considered to be "clean" water, will be connected to storm sewers and conveyed to the stormwater management facilities
- Some parking lot runoff will be directed via surface flow to grassed swales by parking lot grades. Where grades do not permit the use of these grassed swales, parking lot runoff will be connected to the storm sewers and the stormwater management basins
- Common area swales will collect runoff from parking lots and direct flow to the stormwater management basins
- Three stormwater management basins will provide final "end-of-pipe" treatment before flows are released to downstream systems

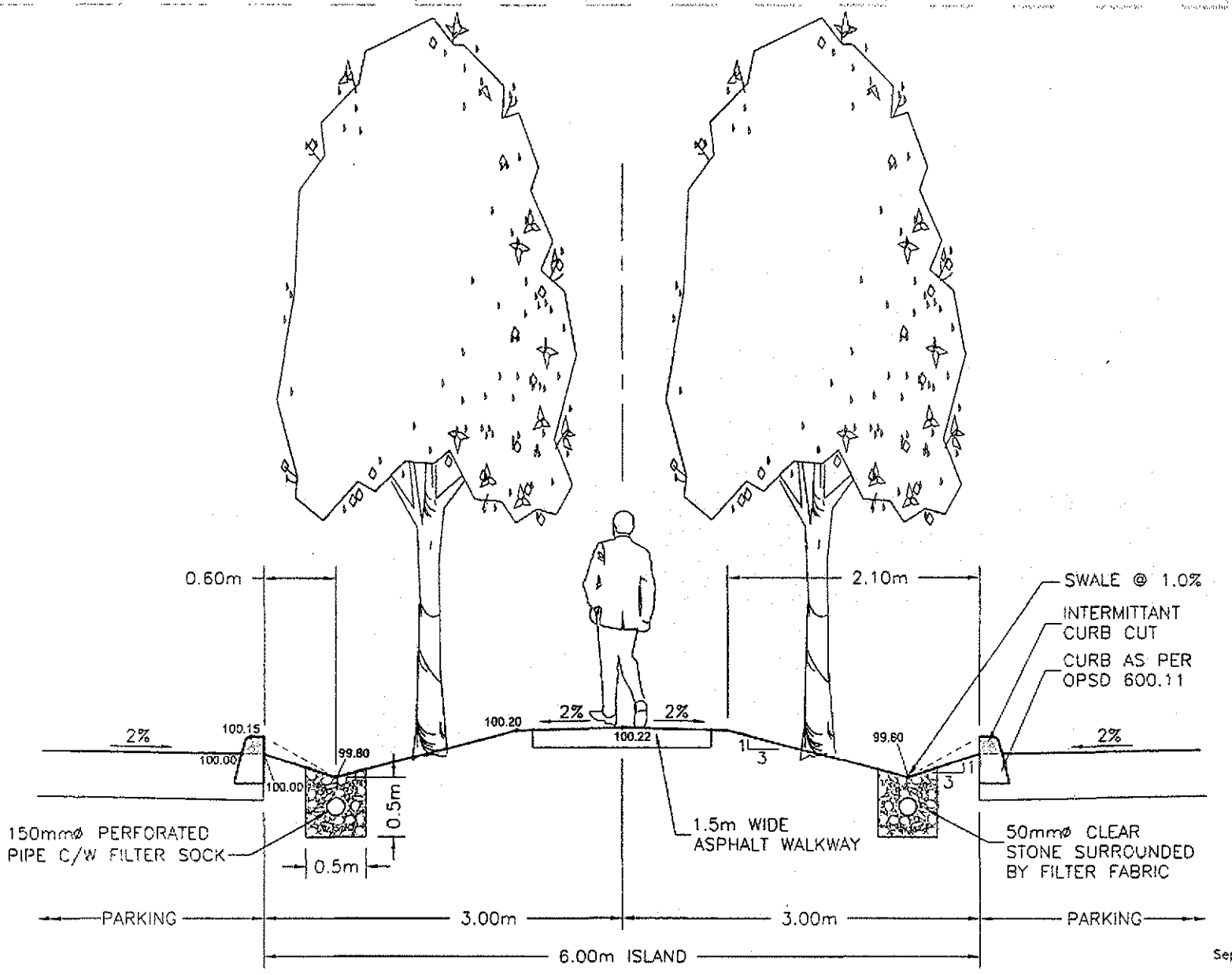
Grassed Swale Design

As part of the treatment train approach to stormwater management on the Research and Technology Park grassed swales will provide some water quality enhancement and flow attenuation by conveying flows through vegetated areas before the stormwater management basins. These swales will be incorporated into the proposed walkway corridors between individual sites throughout the Research and Technology Park.

The walkway/swale systems will have the following features (refer to Figure 1.0).:

- Minimum width of 6 m
- 1.5 m wide walkway
- Intermittent cuts in parking lot curbs to allow runoff to enter the swale
- Shallow vegetated swale on both sides of the walkway with a minimum longitudinal slope of 1%
- Stone sub-drain trench with perforated pipe to minimize standing water
- Landscape plantings
- Ditch inlet catchbasin at downstream end if necessary

In addition to the walkway/swale system, a series of drainage swales have been incorporated into the overall grading plan to provide both treatment and conveyance of minor and major storm flows. The following provides a brief overview of the swale locations and design characteristics. All functional calculations have been provided in Appendix A.



September 2002
602-10333

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Stantec

1:50 0 0.5 1.5 2.5m

Client/Project
UNIVERSITY OF WATERLOO
RESEARCH & TECHNOLOGY PARK

Figure No.
1.0

Title
CONCEPTUAL WALKWAY / SWALE SECTION

ORIGINAL SHEET - ANSI A V:\01602\Active\602-10333\design\drawing\concept\60310333 Trail Concept.dwg
2002-09-18 08:23AM By: KSteMori

Reference: **University of Waterloo Research and Technology Park**
Final Stormwater Management Design Brief (revised)
City of Waterloo

- To reduce the extent of grading within the northwest corner of site, a drainage swale is proposed to facilitate the drainage from the future development block (SC 801.5) and the rear of sites fronting West Private Road (SC 801.2). As shown on the details provided on Drawing C-1 the swale is routed west along the back of the lots facing West Private Road for a distance of approximately 400 m and is then extended south along the west limits of the site for a distance of approximately 200 m, eventually discharging into the lower west SWM facility. The swale is designed to convey flows for storm events up to and including the 100 year storm. Details of the swale configuration are provided on Drawing C-1.

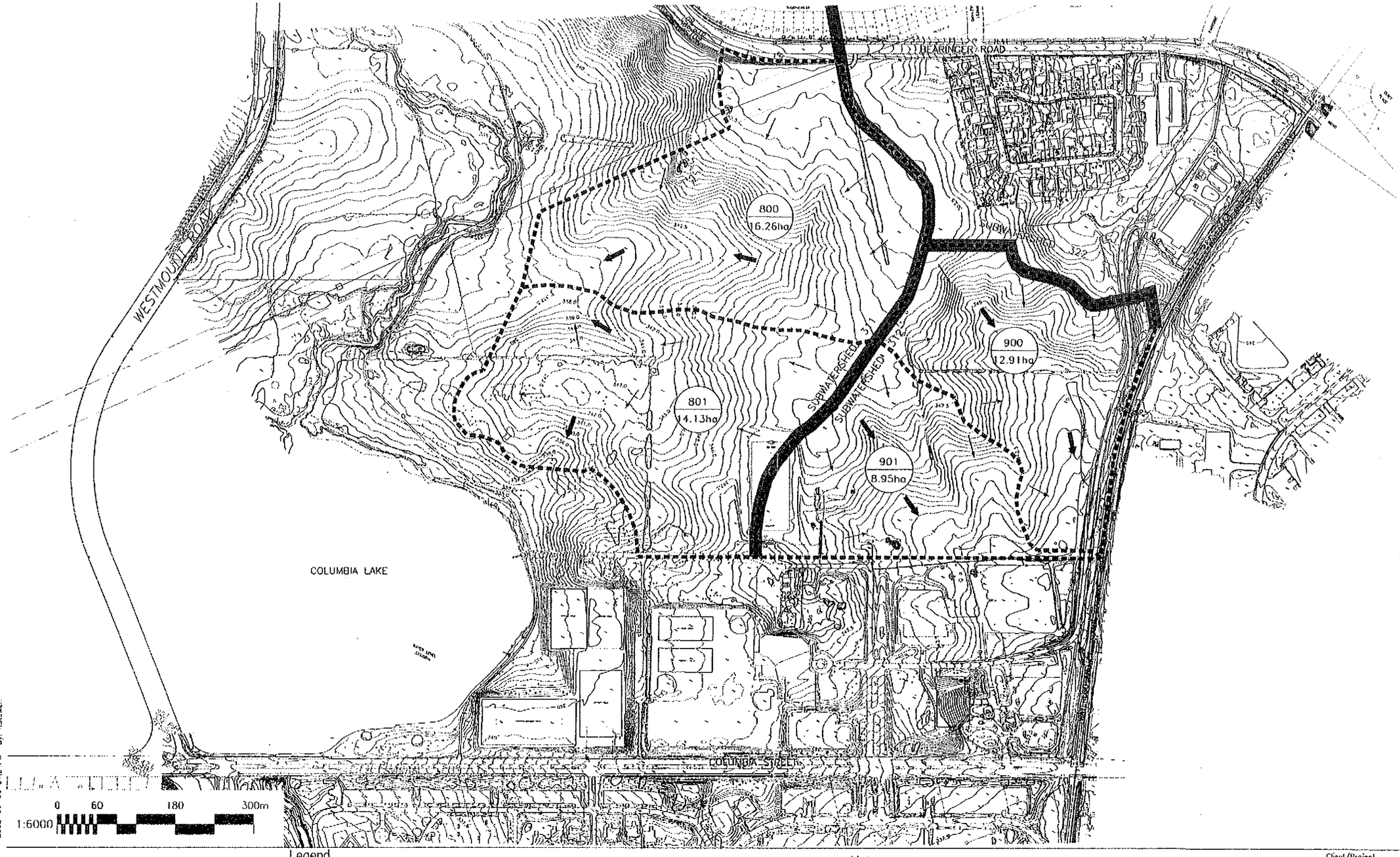
- The proposed conceptual grading plan for the future block located along South Boundary Road, just east of the west easement (SC 801.4) recommends that the rear parking lot areas be graded to drain north to a proposed drainage swale, as shown on Drawing C-1. The swale, located within the designated Park Block, extends from the east limits of the Park Block for a distance of approximately 320 m m west, ending at the limits of the west easement. It is designed to provide conveyance of both major and minor storm flows. A ditch inlet catchbasin (DICB), located approximately 20 m east of the west easement, has been sized to capture flows for storms up to and including the 5 year event and route flows through a 600 mm diameter storm pipe that connects with the servicing along the west easement, and ultimately discharges into the lower West SWM facility. Flows generated from storm events greater than the 5 year storm overtop the DICB and spill into the Upper West SWM facility.

- A swale is proposed along the west limits of the east SWM Facility to provide conveyance of storm flows from the rear of sites fronting Hagey Boulevard and Wes Graham Drive. The swale is designed to convey flows from up to and including the 5 year storm, with flows being routed through ditch inlets located at the end of the swale and connecting with the proposed storm servicing, which ultimately outlets into the East SWM facility. Details of the swale are illustrated on Drawing E-2.

Stormwater Management Basin Design

The final design of the stormwater management basins has been confirmed with the use of hydrologic models to assess basin performance under a range of events from the 25 mm to 100 year storms and the Regional Storm event (Hurricane Hazel).

The hydrologic analysis also included both SCS and Chicago style rainfall events to ensure that the proposed design functions properly, regardless of rainfall conditions. This analysis concluded that the Chicago storm results in the most conservative design and has therefore been used in the SWM analyses. The existing and post development drainage conditions have been illustrated on Figures 2 and 3 respectively. In addition, Figure 4 has been provided to illustrate the modelling schematic developed to reflect the post development hydrology. The following provides an overview of the proposed SWM plan.



V:\31622\Active\602-10333\design\drawing\SWMFIGURES\602103333 Drainage Areas.dwg
2002-09-20 3:54PM By: KSteiner
ORIGINAL SHEET - B

Stantec Consulting Ltd.
871 Victoria Street North
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Legend

- Proposed Drainage Boundary
- Approximate Property Limit
- Major Flow Direction
- Minor Flow Direction
- Sub Watershed Drainage Boundary
- Subcatchment Number 901
- Subcatchment Area (Ha) 17.98ha

Notes

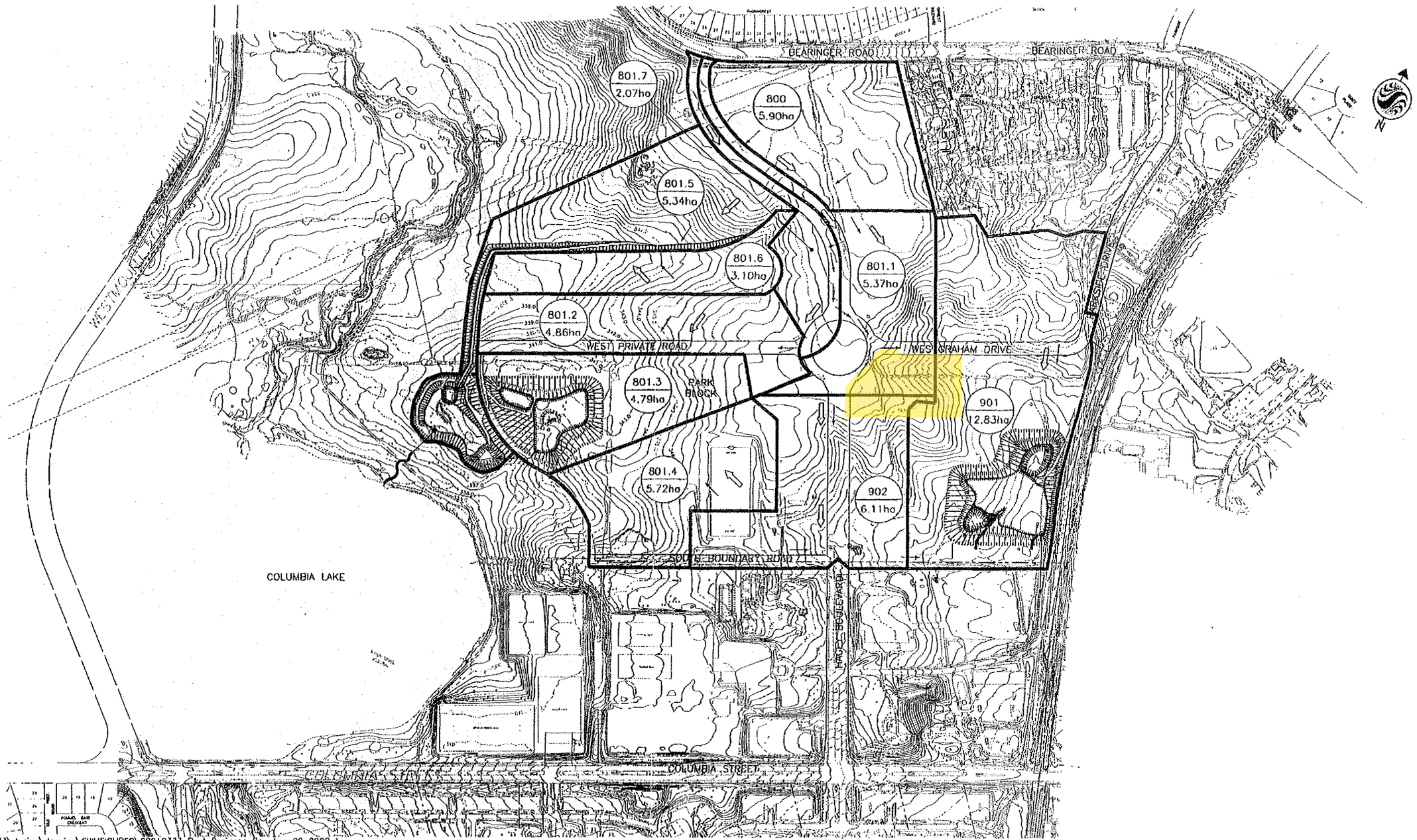
EXISTING TOPOGRAPHICAL INFORMATION PROVIDED BY THE REGIONAL MUNICIPALITY OF WATERLOO (2002)

April, 2002
602-10333

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RESEARCH AND TECHNOLOGY PARK

Figure No.
2.0

Title
PRE-DEVELOPMENT
DRAINAGE PLAN



V:\01602\Active\602-10333\design\drawing\SWMFIGURES\60210333 Post Drainage Rev Aug 29 2002.dwg
2002-09-19 02:08PM By: DMahaney

April, 2002
60210333

ORIGINAL SHEET - ANSI B

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Legend

- LEGAL LOT LINE
- PROPOSED DRAINAGE BOUNDARY
- MAJOR STORM FLOW DIRECTION
- MINOR STORM FLOW DIRECTION
- 801.4 / 5.28ha — SUB CATCHMENT ID / AREA (ha)

Notes

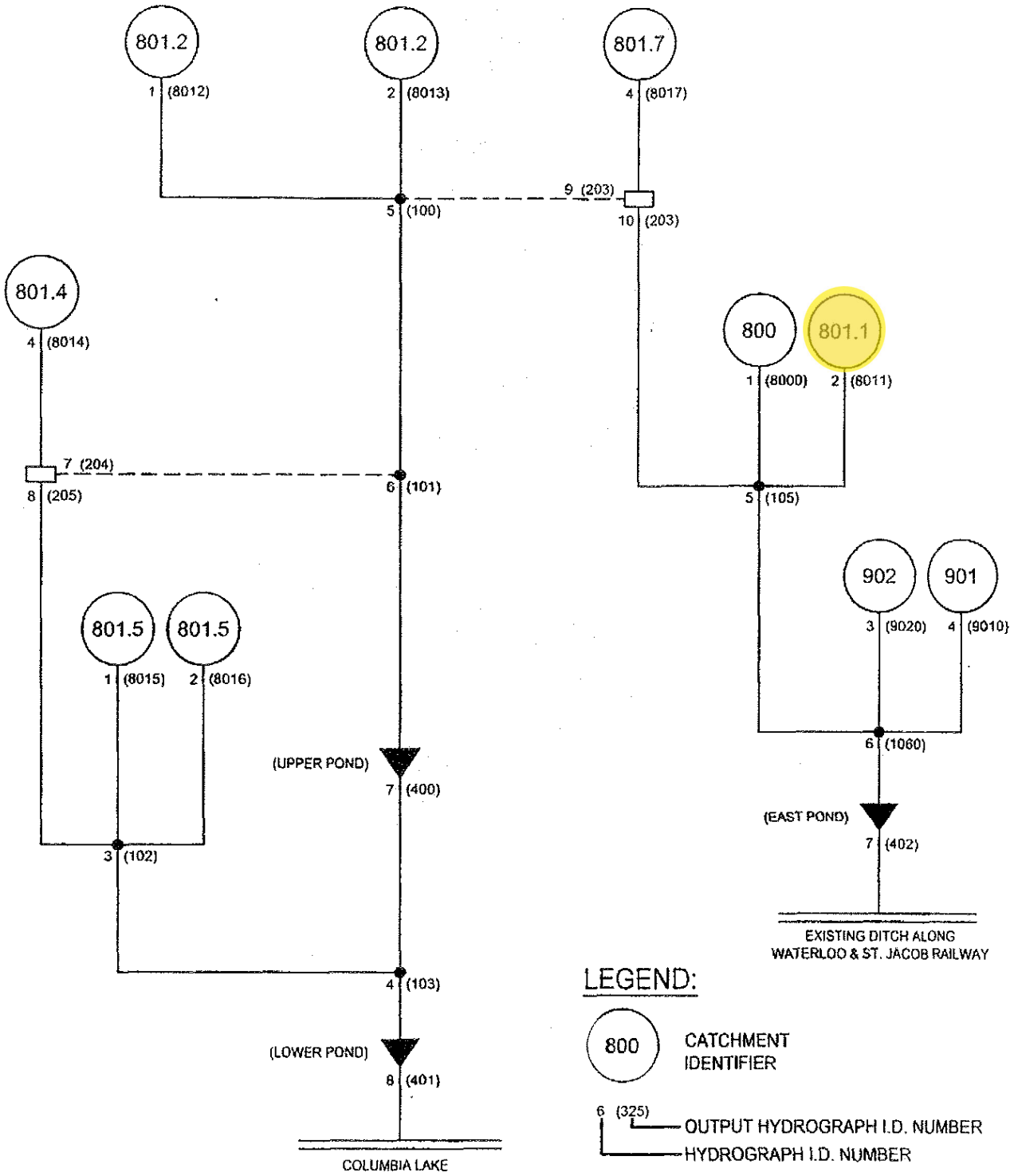
1. EXISTING TOPOGRAPHICAL INFORMATION PROVIDED BY THE REGIONAL MUNICIPALITY OF WATERLOO (2002)

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1:6000

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Figure No.
3.0

Title
POST DEVELOPMENT DRAINAGE PLAN



LEGEND:

- 800 — CATCHMENT IDENTIFIER
- 6 (325) — OUTPUT HYDROGRAPH I.D. NUMBER / HYDROGRAPH I.D. NUMBER
- STORMWATER MANAGEMENT FACILITY
- DIVERT HYDROGRAPH
- MAJOR STORM FLOW DIVERSION

V:\01602\Active\602-10333\design\drawing\SWMFIGURES\0210333schem.dwg
2002-09-19 02:26PM By: KSteMari

ORIGINAL SHEET - ANSI A

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Figure No.
4.0

Title
MODELLING SCHEMATIC
STORM DRAINAGE PLAN

Reference: **University of Waterloo Research and Technology Park**
Final Stormwater Management Design Brief (revised)
City of Waterloo

West Facility

Tributary to Columbia Lake, the West SWM Basin, located at the west edge of the development, has been constructed as a two-tiered pond, in series. The 'Upper Cell' of the facility, located just east of the extension of the west easement, is designed as a wet pond to provide water quality and quantity control for approximately 9.65 ha of development (SC 801.2 and 801.3). The 'Lower Cell', designed as a wetland, will provide water quality and attenuation storage for approximately 14.16 ha of land (SC 801.4, 801.5 and 801.6), in addition to providing further water quality polishing for flows from the Upper Cell. The following provides an overview of the operational characteristics of both facilities.

West Facility – Upper Cell

Designed as wet pond, the facility has a permanent water depth of 1.0 m, providing a permanent pool storage volume of 5,714 m^3 which exceeds the required volume of 1,004 m^3 as stipulated in the MOEE SWMP Manual for Level 1 water quality protection. In addition to the permanent pool function, the wet pond provides sufficient extended detention storage (elevation 338.8 m) to release the erosion control volume (increase in 100 year storm runoff volume) over a period of 48 hours. The facility has been designed with a sediment forebay, located at the storm sewer inlet, with a water depth of 1.0 m to allow for the accumulation of sediment (0.5 m maximum).

At the permanent pool elevation of 338.50 m, the basin will begin discharging via a 130 mm diameter orifice plate, installed within a low flow outlet structure consisting of a 1,500 mm diameter perforated CSP riser, and surrounded by a clear stone jacket to prevent clogging of the CSP riser and orifice mechanism. The 130 mm diameter orifice plate will control storm events up to and including the 25 year storm and will provide the necessary extended detention storage to release the erosion control volume (1,759 m^3) over a period of 48 hours, as recommended in the Subwatershed 311 study. Once the elevation of 339.2 m is exceeded, flows begin to enter a ditch inlet catchbasin manhole (DICBMH) connected to a 525 mm diameter storm pipe (installed with a 460 mm dia. orifice plate) which controls storms up to and including the 100 year event. Flows will be conveyed into a manhole located within the limits of the west easement allowance, for discharge into the lower cell pond via a storm pipe sized to convey the peak 100 year flow (0.06 m^3/s) from the pond and the 5 year peak flow from SC 801.4. The sizing and location of the servicing infrastructure is illustrated on the servicing design drawings, previously submitted.

Table 1, found in Appendix B summarizes the characteristics of the wet pond facility with corresponding functional calculations and modelling output (SWMhymo) provided in Appendix C and D, respectively. The proposed Basin configuration and outlet details have been incorporated on Drawing No. W-1 (Back pocket).

West Facility – Lower Cell

Due to grading constraints, an additional facility was required to service storm flows from the northwest and southwest corners of the development. As discussed previously,

storm flows from the buildings fronting South Boundary Road will be serviced via the storm system that extends along the west easement allowance, in addition to flows conveyed along the swale located along the south limits of the Park Block and conveyed to the proposed facility via a storm pipe sized to convey flows from both SC 801.4 and the Upper Cell SWM Pond. Storm flows from SC 801.5 and SC 801.6, located at the north limits of the development, will be conveyed to the lower cell via a swale. The proposed facility (lower cell) was designed as a wetland feature to provide the necessary water quality and quantity controls through the provisions of permanent pool and extended detention volumes. The facility has a maximum water depth of 0.3 m with a storage volume of 1,449 m^3 which exceeds the MOEE requirement of 1,004 m^3 for Level 1 protection. In addition, sufficient extended detention storage is provided to maintain the drawdown of the erosion control volume over a 48 hour period.

Similar to the Upper Cell, the outlet consists of a 150 mm diameter orifice plate installed within a vertical riser, sized to control the release of the extended detention storage and control the release rate of flows from events up to and including the 5 year storm to the identified subwatershed target rate. A DICBMH has been installed to control the less frequent events to the established target rates. The outlet of this facility consists of a 600 mm diameter storm pipe that discharges to a gabion upwelling trench. Minor storm flows will disperse through the upwelling trench, while major storm flows (greater than 5 year storm) will surcharge through the ditch inlet catchbasin. Subsequently, flows will enter a proposed channel that conveys storm flows to Columbia Lake. The channel will be 64 m long with a depth of 0.4 m. The bottom and side slopes of the channel will be lined with cobblestones to eliminate erosion. Final details of the channel have been included within the Final Landscaping design, submitted under separate cover.

Table 2 (Appendix B) provides an overview of the functional characteristics of the West (Lower Cell) SWM facility in terms of both water quantity and quality objectives. All functional design calculations for the Basin and modelling output (SWMhymo) have been provided in Appendix C and D, respectively. Drawing No. W-1 (back pocket) illustrates the Basin configuration and outlet details.

East Facility

The proposed Stormwater Management (SWM) Facility located at the southeast corner of the proposed development limits, just north of South Boundary Road, is designed as a constructed wetland to provide water quality and water quantity control. The facility receives both major and minor storm system runoff from the post development subcatchments (SC) 800, 801.1, 901 and 902 and only minor storm drainage from SC 801.7 for a total drainage area of 32.30 ha. All runoff from the catchment lands during storm events up to and including the 5 year storm are conveyed into the basin at separate outlets located at the south and north limits of the pond, via a treatment train approach which consists of drainage swales and storm sewers, as previously discussed. Flows in excess of the 5 year storm event will be conveyed along the proposed road system, which discharges into the SWM Basin via overland flow easements.

The facility has a maximum permanent pool depth of 0.3 m, with a storage volume of 3,384 m^3 which exceeds the MOEE requirement of approximately 3,000 m^3 of storage for

Level 1 protection. Two (2) sediment forebays, located at the inlet of the proposed storm sewer system, have been designed to allow for the storage of sediment accumulation (maximum 0.5 m). However, the north forebay has a maximum water depth of 2.0 m to reduce the required sediment dispersion length and eliminate the potential for sediment resuspension. The basin outlet structure is designed with a 300 mm diameter vertical orifice, set at the permanent pool elevation of 337.70 m. This orifice plate will control storm events up to and including the 5 year storm and will maintain the 24 hour drawdown of the extended detention storage volumes for water quality (MOEE). This low flow outlet structure will be constructed within a 1,500 mm diameter perforated CSP riser, and surrounded by a clear stone jacket to prevent clogging of the CSP riser and orifice mechanism. During less frequent storm events, runoff in excess of the 5 year storm will enter a ditch inlet catchbasin manhole (DICBMH), set with a grate elevation of 338.60 m, for attenuation and subsequent release through a 750 mm diameter storm pipe at 0.50 % slope. The outlet pipe from this facility discharges to the existing ditch that runs south, parallel with the Waterloo and St. Jacob Railway.

Table 3 (Appendix B) provides an overview of the functional characteristics of the East SWM facility in terms of both water quantity and quality objectives. All functional design calculations for the East Basin and modelling output (SWMhymo) have been provided in Appendix C and D, respectively. Drawing No. E-2 (Back pocket) illustrates the Basin configuration and outlet details.

Monitoring

The monitoring program for the Laurel Creek Watershed has been established in the Laurel Creek Watershed Study and the subsequent subwatershed studies. The City of Waterloo is also in the process of finalizing a guideline for development monitoring programs and the recommendations within this report are intended to reflect the current state of those guidelines. The program has three stages that are the responsibility of the developer, which include:

- Pre construction monitoring where background data is collected on the receiving system before any disturbance occurs on the property to establish baseline conditions. This stage generally lasts for approximately two years

- During construction monitoring focuses on the mitigation measures put in place during the active (grading and servicing) construction period. This stage lasts throughout the construction period until base asphalt is completed

- Post construction monitoring is the final stage of monitoring a site to evaluate the performance of the stormwater management facilities constructed on the site. This stage lasts from the end of the during construction monitoring program to the end of the guarantee period for the stormwater management facilities two years following substantial (90%) completion and stabilization of the site.

The following sections provide the appropriate details and discussion for all stages of monitoring.

Reference: **University of Waterloo Research and Technology Park**
Final Stormwater Management Design Brief (revised)
City of Waterloo

Pre Construction Monitoring

Pre construction monitoring generally involves the collection of in stream water quality samples upstream and downstream of the subject lands. In the case of the Research and Technology Park project, the City of Waterloo's System monitoring program has already collected data upstream (Westmount Road crossing – Station 10) and downstream (Columbia Street crossing – Station 7) since 1997. The collected data consists of twice per week water chemistry samples including temperature, dissolved oxygen, total phosphorus and total suspended solids. The City has also collected benthic invertebrate samples just upstream of Columbia Lake (Station 9) immediately adjacent to the site.

Because of the existing long term monitoring data available for the site, additional pre construction monitoring is not required.

During Construction Monitoring

During construction monitoring typically involves monitoring the effectiveness of erosion and sediment control measures installed during the construction process.

One item is the weekly inspection of all erosion and sediment control measures and the submission of checklist style reports to the City and GRCA. These reports are prepared weekly, or following significant rainfall events (whichever is shorter) and summarize the condition of all erosion and sediment control measures implemented across the site including silt fence, temporary sediment basins, swales, etc.

The second item is actual water quality sampling from the erosion and sediment control facilities. This monitoring will start with the initiation of construction (since the temporary erosion control ponds will be constructed first) and continue until approximately 90% of the site is stabilized. Grab samples from the facility outlets will be taken monthly from March until November within 24 hours following rainfall events, since there will be no flow during dry periods. Samples will be analyzed for flow and TSS. Sample timing should be coordinated with the in-stream samples from Laurel Creek. Once the site servicing is completed and flows are entering the facilities via the storm sewer network, additional samples will be obtained at the inlets. Photographic documentation of the appearance of the facilities will also be recorded during this period.

In previous reports, it was recommended that groundwater monitoring also be conducted on the subject lands to monitor changes to groundwater levels and quality over time. Permanent water monitoring wells should be established in both the east and west stormwater management blocks through the construction process to ensure that the locations will be accessible. Water levels should be monitored seasonally (spring, summer and fall) and water quality samples should be analyzed annually.

As part of the EIS, additional terrestrial and aquatic habitat monitoring adjacent to the subject lands is also proposed. Since these items are not directly related to the stormwater management design for the Research and Technology Park, the details of these programs are documented under separate cover.

Annual reports will be submitted to the City of Waterloo and the GRCA summarizing the monitoring results and making any appropriate recommendations for future monitoring activities.

Post Construction Monitoring

Post construction monitoring focuses on the performance of the stormwater management facilities constructed on the site. This stage starts with the completion of the during construction monitoring and extends for a two year period. Monitoring involves seasonal (spring, summer, fall) grab samples from the inlet and outlet of both stormwater management facilities within 24 hours following a rainfall event. If possible, samples should be coordinated to occur at the same time as in-stream samples from Laurel Creek as part of the City's System Monitoring program. Dry weather samples are not appropriate since there is no flow anticipated from the facilities unless it rains. Samples will be analyzed for flows, temperature, dissolved oxygen, total phosphorus, total suspended solids and bacteria.

The groundwater monitoring program outlined previously should be continued through the post construction period. Additionally, as the soakaway pits are connected to the individual buildings in the Research and Technology Park, they should also be monitored seasonally (spring, summer and fall) to ensure that drawdown times are according to the design. Monitoring involves measuring the depth of water in the facility immediately following a rainfall event and again 24-48 hours later. With this data it will be possible to confirm any changes in facility performance over time.

The terrestrial and aquatic habitat monitoring noted previously will also continue during this period. The details of this program are included in the EIS.

In addition to the water quality sampling, regular monitoring must also consider the general maintenance and operation of the stormwater management facilities following the completion of final grading and landscaping. Regular inspections will include the following items:

- Observe the condition of the inlets and outlets quarterly for signs of erosion, ponding or silt accumulation and repair as appropriate
- Observe the drawdown times within the facility during and after rainfall events. Conclusions of the observations will direct the need for any maintenance or modification to the facility outlet structure
- Monitor (photograph) vegetation health within and around the facilities annually to ensure that the landscaping is developing appropriately. Any damage to vegetation should be repaired or restored
- Monitor sediment accumulation in the sediment forebay areas annually and remove as necessary

- Observe the condition of each facility, particularly for areas of rill erosion along the side slopes. Exposed soils should be reseeded to re-establish ground cover as quickly as possible to minimize additional erosion. In addition, sediment accumulation within the clear stone jacket surrounding the CSP should also be inspected and flushed with a high pressure hose if required

- Visual inspection of surface drainage swales for signs of debris and sediment accumulation and to monitor vegetation health

An annual report will be submitted to the City and GRCA summarizing the findings and drawing appropriate conclusions.

Conclusions and Recommendations

Based on the preceding analysis, the following conclusions are drawn:

- The stormwater management facilities adhere to the approved conceptual design for the University of Waterloo Research and Technology Park

- Target flow rates and erosion control volumes will be met via the implementation of the east and west SWM Basins

- Level 1 water control according to the MOEE guidelines will be exceeded in the proposed stormwater management strategy

- There will be no flow increase to Corrie Crescent, located just north of the site. The grading of the proposed site has reduced the drainage area to the north by approximately 1.0 ha

It is recommended that:

- The stormwater management facilities be constructed as described in this report and as illustrated on the design drawings

- The monitoring program be implemented as outlined in this report to observe and evaluate the measures implemented for the subject lands

- A comprehensive planting and landscaping plan be developed and implemented for the stormwater management facilities and proposed outlet channel to Columbia Lake.

Reference: **University of Waterloo Research and Technology Park**
Final Stormwater Management Design Brief (revised)
City of Waterloo

All of which is respectfully submitted,

Sincerely,

STANTEC CONSULTING LTD.

Steve Brown, MBA, P.Eng.
Senior Water Resources Engineer

Nathan Jamieson, BSc (Eng.)
EIT, Water Resources

Attachment

c. Mr. Phil Hewitson, City of Waterloo
Mr. Eric Hodgins, Region of Waterloo
Mr. Al Sandilands, ESG International
Mr. Garry Leveck/Mr. Tim Harvey, Stantec Consulting Ltd.

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Appendix D

Excerpts of Hydrogeological Assessment

HARDEN ENVIRONMENTAL SERVICES LIMITED

Hydrogeological Assessment

Proposed Commercial Development
380 Hagey Boulevard
Waterloo, Ontario

Prepared For:

Kothari Group
141 Brunel Road, Suite 201,
Mississauga, Ontario
L4Z 1X3

April 14, 2025

Harden File No. 2501

Record of Revisions

Revision	Date	Description of Changes
0	April 4, 2025	Submission to Client
1	April 14, 2025	Minor edits to text and reduction in trench depth from 3.0 m to 2.5 m

Report Prepared By:



Stan Denhoed, P.Eng., M.Sc.
President and Senior Hydrogeologist

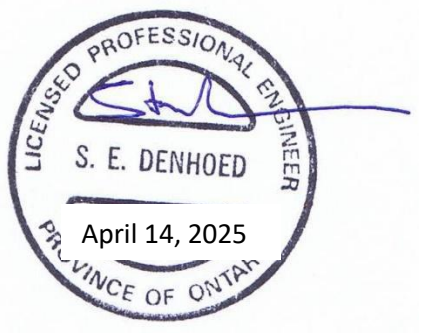


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Statement of Limitations

Harden Environmental Services Ltd. (HARDEN) conducted the work associated with this report in accordance with the scope of services, time and budget limitations imposed for this work. The work has been conducted according to reasonable and generally accepted local standards for an environmental consultant at the time of the work. No other warranty or representation, expressed or implied, is included or intended in this report.

It should be noted that subsurface conditions might vary at locations and depths other than those locations where borings, surveys or explorations were made by HARDEN or others. Other contaminants, not tested for in this work, may also potentially be present on the Site. Even with exhaustive investigation, it is not possible to warranty the Site will be free of other contaminants. Should conditions, not observed during the work, become apparent, HARDEN should be immediately notified to assess the situation and conduct additional work, where required. The findings of this report are based on conditions as they were observed at the time of the work. No assurance is made regarding changes in conditions subsequent to the time of the work.

Regulatory statutes are subject to interpretation. These statutes and their interpretation may change over time, thus these issues should be reviewed with appropriate legal counsel. HARDEN relied on information provided by others in this report. HARDEN cannot guarantee the accuracy, completeness and reliability of the information provided by others, although HARDEN staff attempted to seek clarification on information provided and verifies authenticity, where practical. The report and its attachments were prepared for and made available for the use of the client, their agents, the Region of Waterloo and the City of Waterloo. HARDEN will not be responsible for any use or interpretation of the information contained in this report by any other party without the prior expressed written consent of HARDEN.

1.0 Introduction

Harden Environmental Services Ltd. (Harden) was retained by the Kothari Group to complete a Hydrogeological Assessment for the proposed development at 380 Hagey Boulevard (the Site; Figure 1). The Site is located on the south side of Wes Graham Way, in an industrial research complex.

The hydrogeological assessment is required as part of an application for Site Plan approval with the City of Waterloo. The purpose of the assessment is to characterize the existing groundwater conditions on the Site, identify potential impacts to the local groundwater regime and provide recommendations related to groundwater control/management.

1.1 Proposed Development

The Site is approximately 1.61 ha and is presently vacant. A topographic property survey and site plan illustrating the proposed development are provided in Appendix A.

Surrounding land use is commercial to the north, east, south and west (Figures 2 and 3).

The proposed development is a hotel and conference facility. The new building will cover a total area of 3,223 m^2 of the 16,127 m^2 lot. Pavement areas including sidewalks and parking lot are proposed to be 9,395 m^2 and landscaping (grass and tree areas) is 3,509 m^2.

1.2 Study Scope

The objectives of the hydrogeological assessment included:

- Define the local hydrogeological setting.
- Determine the local water table elevation.
- Assess the extent of local groundwater / surface water interaction.
- Estimate the volume of groundwater / surface water dewatering that may be required during construction (short-term) and following construction (long-term).
- Assess the potential impact of development on all environmental receptors.
- Assess potential impact on the source water (quality and quantity) of nearby municipal wells.
- Prepare a water balance for the site.
- Estimate infiltration values to assist in the sizing of future infiltration galleries.
- Recommend measures to minimize any significant impacts identified.

1.3 Assessment Approach

Harden's completion of this study included the following tasks:

- Review of available environmental and geological background reports for the Site.
- Review of supporting background information sources including geological mapping from the Ontario Geological Survey (OGS), Ministry of the Environment, Conservation and Parks (MECP) Water Well Records and various publications available through the Grand River Conservation Authority (GRCA) and others.
- Installation of four new groundwater monitoring wells at the Site with 1.52 metre length well screens constructed to bottom depths between 6.6 and 10.7 m below ground surface (mbgs).
- Groundwater level monitoring on three occasions from March 18, 2025 to April 1, 2025.
- In situ rising/falling head recovery testing of onsite monitoring wells to estimate the hydraulic conductivity of the subsurface soils.
- Assessment of impacts to nearby environmental receptors and existing infrastructure.
- Recommendations for mitigation of potential impacts.

The collected information has been summarized with analysis and interpretation by a qualified hydrogeologist. The report was completed in general accordance with applicable provincial legislation, Ontario Water Resources Act, Ontario Regulation 387/04, R.R.O. 1990, Regulation 903: Wells and applicable municipal hydrogeological assessment guidance documents.

1.4 Summary of Previous Reports

1.4.1 Geotechnical Investigation

A geotechnical investigation was completed by Sola Engineering (Sola, 2025). Five boreholes were advanced at the Site on March 14, 2025 to depths of 6.6 to 10.7 mbgs. The borehole logs are provided in Appendix B. The stratigraphic results are summarized within this report.

1.5 Drainage, Topography and Environmental Features

The topography of the site is flat, with an elevation of approximately 347.5m AMSL (Figure 4). In general, the local land surface slopes gently to the southwest to Columbia Lake.

The Site is in the Laurel Creek subwatershed, Grand River watershed. There are no wetlands or surface water features on the site. The nearest natural surface water feature is Columbia Lake located seven hundred metres southwest of the site. The elevation of Columbia Lake is approximately 333 m AMSL. The site does not occur within the Regulated Area of the Grand River Conservation Authority (Figure 5).

1.6 Regional Geology

The site is in the Oxford Till Plain physiographic region, characterized by beveled and drumlinized till plains (Chapman and Putnam, 1984, 2007) (Figure 6). Kame moraines and outwash deposits also occur nearby.

Regional surficial quaternary geology is characterized by Tavistock Till, a silt to clayey silt till with low stone content and stratified interbeds (Figure 7; OGS, 2010). MECP (2023b) water well records within 250 m of the Site indicate clay soils near surface (Table C-2, Appendix C).

Bedrock geology mapping indicates that bedrock in the vicinity of the Site is comprised of dolostone and shales of the Salina Formation (OGS, 2011). The depth to bedrock is approximately forty metres.

1.7 Regional Hydrogeology

A search of MECP (2023b) water well records identified sixty-eight records within 500 m of the Site (Figure 8), including water supply wells, monitoring wells and well abandonment records (Table C-1, Appendix C). No water supply wells have been drilled since 1979 and none are likely to be active given the availability of municipal water. The proposed development and all surrounding properties are municipally serviced.

MECP well records within 500 m of the Site encountered primarily clay at or near ground surface, consistent with surficial geology. Most former water supply wells obtained water from the shale bedrock, however there are some nearby wells that obtained water from sand and gravel units within the clay/sit glacial till deposits.

Regional groundwater flow will be southwesterly toward Laurel Creek which is ten metres lower in elevation than the site.

1.8 Source Protection

The site is not located within a wellhead protection area (WHPA), highly vulnerable aquifer (HVA) or significant groundwater recharge area (SGRA) (Figure 9). The local Source Water Protection group stated "Currently, the Region's WHPA-Q1 has a low risk so there are no policies under the Source Protection Plan. Balancing the water budget is considered a beneficial practice and the Region supports infiltration of clean runoff and not from impervious surfaces being salted."

2.0 Site Investigation and Results

The site investigation included verifying the subsurface materials identified and assisting with the design and installation of monitoring wells.

2.1 Site Stratigraphy

Sola drilled five boreholes on the site in 2025 (Figure 10), including:

- Six boreholes advanced, using 4" diameter solid stem augers and split-spoon sampling, to depths of 6.6 mbgs, three of which were completed as monitoring wells with flush-mount casings. Each monitoring well has a 3.05 m long screen.
- One borehole advanced using 4" diameter solid stem augers and split spoon sampling to a depth of 10.7 mbgs. This monitoring well has a screen length of 1.52 m.

Harden Environmental was on-site for the drilling of BH2 (the deepest borehole) and based on those observations and the well records for the other boreholes, we summarize the near surface geology as follows.

Fill (to 0.8-1.5 m)

All boreholes were drilled through approximately 0.8 to 1.5 m of fill material with varying consistency from clayey silt to silt and some gravel.

Sandy Silt / Sandy Silt Till (to approximately 0.8-3 m)

Sandy silt to sandy silt till, trace clay to clayey, trace to some gravel, light brown to grey with oxidizations/mottles in the upper zone, moist.

Fine Sand, Silt and Clay Layers(3 to 9.6 m)

Distinct layers of fine sand, silt and clay indicative of a lacustrine environment are found below a depth of three metres.

2.2 Monitoring Well and Piezometer Installations

Groundwater monitoring wells were installed by Sola at BH2, BH3, BH4 and BH5 (Figure 11).

The following table summarizes the details of the groundwater monitoring well and piezometer installations, with locations of each monitor depicted on Figure 11.

The elevation of the top of monitors was determined using a hydrant elevation of 348.73 m AMSL from the Chamberlain Architect Services Ltd. drawing A0001.

Table 1 Monitor Installation Details

Monitor	Installation Date	Well Pipe Inside Diameter	Top of Pipe Elevation	Stick-up (m)	Ground Elevation (m AMSL)	Monitor Depth (mbct)	Monitor Depth (mbgs)	Auger Diameter (mm)	Screen Length (m)	Sand Pack Length (m)
BH2	March 13, 2024	2"/51mm	347.785	1.04	346.75	9.91	8.87	140	1.50	1.80
BH3	March 13, 2024	2"/51mm	349.125	1.03	348.10	6.73	5.70	140	1.50	1.80
BH4	March 13, 2024	2"/51mm	348.592	1.00	347.59	7.25	6.25	140	1.50	1.80
BH5	March 13, 2024	2"/51mm	349.215	1.03	348.19	7.66	6.63	140	1.50	1.80

2.3 Soil Hydraulic Conductivity

Harden completed in situ falling head recovery tests in all the groundwater monitors on March 27,2025 to estimate the hydraulic conductivity of the screened materials.

Monitoring wells were developed by purging with a Waterra™ inertial pumping system prior to conducting the field tests. The well recovery tests were conducted by adding a known volume of water to each monitor and measuring the rate of decline of the water level in the monitoring well.

An estimate of the hydraulic conductivity was determined using the following method (Hvorslev, 1951):

$$K = r^2 \ln(L/R) / 2LT_o$$

Where:

k = hydraulic conductivity (m/s)
r = radius of the well (m)
L = length of screen (m)
R = radius of borehole (m)
T_o = lag time obtained from graph (s)

The analyses are provided in Appendix D and summarized below.

Table 2: Hydraulic Conductivity – In Situ Well Response Tests

Well ID	Screened Stratigraphy	Screened Interval (mbgs)	Hydraulic Conductivity (m/s)
BH2	Sandy Silt/Clay Silt Till	7.37 to 8.87	1.3E-05
BH3	Clay Silt Till	4.2 to 5.7	1.1E-06
BH4	Clay Silt Till	4.75 to 6.35	1.0E-06
BH5	Clay Silt Till	5.13 to 6.63	6.6E-07

The calculated hydraulic conductivity for the shallow soils ranged from 6.6 x 10^{-7} to 1.1 x 10^{-6}m/s with a geometric mean of 9.1 x 10^{-7} m/s for clay silt till. The sandier sediments at a slightly greater depth have a hydraulic conductivity approximately one order of magnitude greater at 1.3 x 10^{-5} m/s.

2.4 Groundwater Levels

Harden measured groundwater levels in all accessible monitoring wells using a battery-operated water level meter on six occasions between March 2025 and April 2025 (Tables 3 and 4).

Table 3: Water Levels Below Ground Surface (m)

Monitor	Ground Elevation (m)	Water Level (mbgs)	Water Level (mbgs)	Water Level (mbgs)
		18-Mar-25	27-Mar-25	01-Apr-25
BH2	346.75	5.94	5.93	5.85
BH3	348.10	2.26	2.41	2.23
BH4	347.59	2.52	2.54	2.36
BH5	348.19	3.70	3.80	3.61
mbgs - metres below ground surface				

Table 4: Water Levels Geodetic (Metres above Mean Sea Level)

Monitor	Ground Elevation (m AMSL)	Water Level (mAMSL)	Water Level (mAMSL)	Water Level (mAMSL)
		18-Mar-25	27-Mar-25	01-Apr-25
BH2	346.75	340.805	340.82	340.90
BH3	348.10	345.835	345.69	345.87
BH4	347.59	345.072	345.05	345.23
BH5	348.19	344.485	344.39	344.58

Shallow groundwater elevations ranged from 2.2 to 3.7 metres below ground surface (mbgs) over the monitoring period from March 18, 2025 to April 1, 2025. Monitor BH2 was installed to a depth of approximately 2.5 metres deeper than the other monitors and has consistently lower groundwater levels at about six metres below ground surface. This monitor is not indicative of the water table.

The lower groundwater levels within the deeper wells represent a downward vertical gradient between the upper and lower sediments across the site.

The April 1, 2025 readings are interpreted to be representative of the 2025 seasonal groundwater high, with groundwater levels within 2.2 meters of the existing grade. It is estimated that the highest water table is 0.5 m higher than measured in 2025, resulting in an estimated high water table depth of 1.8 metres below grade.

2.5 Groundwater Quality

No water quality sample was taken.

2.6 Infiltration Testing

Infiltration values are estimated from the hydraulic testing conducted in the groundwater monitors. The relationship between hydraulic conductivity and infiltration is based on the Supplementary Guidelines to the Ontario Building Code, SG-6 Percolation Time and Soil Descriptions (Ontario Ministry of Municipal Affairs and Housing, 1997), as presented by TRCA (2012).

The infiltration test results are summarized in the following table.

Table 3: Soil Infiltration Test Results

Location	Test Material	K Saturation in cm/s	Percolation Rate mm/hour	Safety Factor	Design Infiltration Rate mm/hr
BH2	Sandy Silt Till	1.34E-03	93	2.5	37
BH3	Clay Silt Till	1.14E-04	48	2.5	19
BH4	Clay Silt Till	1.02E-04	46	2.5	19
BH5	Clay Silt Till	6.58E-05	41	2.5	17

We recommend a safety factor of 2.5, therefore depending on where infiltration galleries are located, the infiltration rate will range from 17 to 19 mm/hour. Infiltration galleries should not be installed at greater than 1.5 metres depth.

3.0 Construction and Short-Term Dewatering

The proposed building is a slab-on-grade hotel with no basement. There will be an elevator pit that extends approximately 1.5 metres below grade (Figure 12). As such, the elevator pit is expected to be above the groundwater table. No perimeter drain is designed for the elevator pit, however, a sump pump to address water accumulation at the base of the pit will be installed. Assuming a 0.15 m slab at the base of the elevator pit and 0.15 m of gravel, the maximum depth of excavation for the elevator pit will be 1.82 metres. The water table was measured 2.2 metres below grade with an estimated seasonal high-water table at 1.8 m below grade. It is unlikely that construction dewatering will be necessary for the proposed building.

The depth of service trenches had not been determined at the time of this report submission. We have assumed a maximum depth of three metres to calculate an estimate of groundwater ingress to the trench.

Table 4: Construction Dewatering Assumptions – Servicing Trenches

Parameter	Assumed Value	Notes
Existing Grade Elevation	347.5 m AMSL	Existing elevations on servicing profile drawings (Appendix E)
Lowest Servicing Invert Elevation	345.0 m AMSL	Estimated
Dewatering Elevation Target	344 m AMSL	Assumed 1.0 m below lowest servicing invert
Excavation Length	20 m	Estimated
Excavation Area – Clinton Drive	120 m^2	Assumed 2 m trench width along total excavation length
Groundwater Elevation - High	346.2 m AMSL	Groundwater level data plus 0.5 m buffer
Hydraulic Conductivity (K) - High	1 x 10^{-6} m/s	Highest K from hydraulic conductivity tests
Base of Aquifer	333.5 m AMSL	Estimated to be 10 metres below dewatering elevation

The dewatering calculations for servicing trenches assume an open excavation two metres wide.

A rainfall allowance for a 50 mm rain event has been included in the construction dewatering calculations for each trench length.

Based on the assumed aquifer parameters and excavation dimensions, an estimated maximum volume of 36,726 L/day per 20 metres of trench may require pumping and discharge to facilitate subsurface construction activities. These estimates are based on worst-case groundwater conditions and incorporate a safety factor of 2. The linear equivalent radius of influence is estimated at up to 6.6 m.

3.1 Storm Event Accumulation of Water

There may be a need to pump out precipitation that falls or runs off into the building excavation during construction. The entire excavation is estimated to be an area of 3,223 m^2. In the unlikely event of a 52.1 mm (2”) storm, the volume of water captured in the excavation would be 168 m^3 (168,000 L). This is a highly conservative number as a 52.1 mm rain events are rare and unlikely to occur during the open excavation period of this development.

During excavation, the volume of water that may need to be handled is as follows;

The Region of Waterloo application for temporary dewatering during construction need not exceed 168,000 liters per day and can be less should storm water be retained on site for several days.

It is the responsibility of the contractor to ensure dry conditions are maintained within the excavation. Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events.

3.2 Discharge Permits

Water takings over 50,000 L/day up to 400,000 L/day require registration on the Environmental Activity and Sector Registry (EASR), and water takings over 400,000 L/day require a Permit To Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks in accordance with the Ontario Water Resources Act. Should a significant rainfall occur, an EASR may be necessary if the schedule does allow for the time for water to infiltrate.

Approval from the Region of Waterloo is required prior to any discharge to the municipal storm and/or sanitary systems. Approval is required for both short term (i.e., construction dewatering) and long term (i.e., building dewatering) discharge.

Monitoring during construction dewatering activities may be required by the Region of Waterloo and will be specified within the discharge permit. Typically, daily water taking volumes and flow rates must be logged using a flow meter and flow totalizer. Water quality monitoring requirements may also be included.

4.0 Water Balance

The general water balance for the developable portion of the subject lands is described as;

$P = I + E + RO \pm \Delta S$

Where

P -precipitation (mm/year)

I -infiltration (mm/year)

ET -evapotranspiration / evaporation(mm/year)

RO - runoff (mm/year) and

ΔS - change in storage.

Where;

Precipitation (P) – direct input of rainfall and snow. The precipitation estimates are obtained from the Environment Canada Kitchener-Waterloo weather station. The average annual precipitation from 1991 to 2020 of 851 mm was used for the analysis.

Evapotranspiration (ET) – component of water returned to the atmosphere via evapo-transpiration processes. The evapotranspiration from the open spaces at the Site is estimated to be 543 mm/year. (Appendix E). The evaporation from impervious surfaces is estimated to be 20% of precipitation, or 170 mm/year. This includes evaporation from the rooftops.

Infiltration (I) – component of water infiltrating the ground surface. Using the MECP Storm Water Planning and Design Manual (Table 3.1) the infiltration factor is estimated to be 0.6 (Appendix E).

Runoff (RO) – component of water flowing overland and to offsite locations. The runoff component on the Site.

4.1 Existing Impervious Surface Area

The site has an area of 1.61 hectares. This is a greenfield site with no impervious surface area. The developable area of the site is 1.61 hectares.

4.2 Future Impervious Surface Area

The proposed impervious areas are broken down as building rooftops and lot level hard surfaces (sidewalks and parking).

Total Developable = 1.61 ha

Rooftop of Buildings = 0.3223 ha

Hardscaping = 0.9395 ha

Total Impervious Post Development = 1.2591 ha

Total Pervious Post Development= 0.3509 ha

Table 5 Summary of Impervious Surfaces Pre and Post Development

	Impervious Surface Areas (ha)
Pre-Development	
No impervious Surfaces	0.0
Post Development	
Buildings	0.3223
Paved area and Permanent Pool of SWM	0.9395
Post Development Impervious Total	**1.2591**

The introduction of impervious surfaces to the site has the potential to both reduce infiltration and increase runoff.

Details of the pre and post water balance for the site is found in Appendix E and a summary of the potential hydrologic changes at the site are found in Table 6. It is assumed that there is 20% evaporation (of total precipitation) on all impervious surfaces.

Table 6 Summary of Water Balance Pre and Post Development

	Area	Precipitation	Evapotranspiration/ Evaporation	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Pre Development Summary	1.61	13,696	8,746	1,980	2,970
Post Development Summary	1.61	13,696	4,048	9,001	647
Potential Difference without LID Strategies	-	-	- 4,697.19	7,020	- 2,323

In the absence of LID strategies, there will be a 2,323 m^3/year loss of infiltration at the site.

There is an opportunity to infiltrate roof water at this site. Assuming the capture of 80% of rooftop water, there is the opportunity to infiltrate 2,841 m^3 of water annually as shown in Table 7.

Table 7 Potential Infiltration Including Low Impact Development Strategies

	Area	Precipitation	Evapotranspiration/ Evaporation	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Roof Leader Infiltration (0.3223 hectare of rooftop x 80% x 851 mm/year precipitation)					2,193
Infiltration on Pervious Surface Post Development					647
Total Potential Infiltration with Roof Water					2,841

5.0 Environmental Impact

5.1 Surface Water features

As discussed in Section 1.5, the Site is located within the Laurel Creek subwatershed and the nearest surface water features and wetlands are six hundred and fifty metres southwest of the site (Figure 4). No impacts to surface water features are expected because of the proposed development.

5.2 Groundwater Sources

As discussed in Section 1.7, no water supply wells were identified within 500 m of the site and no active PTTW are mapped within 1 km of the site. The site and all surrounding properties are municipally serviced.

No interference to nearby groundwater users is anticipated as a result of the proposed development.

5.3 Geotechnical Considerations

It is unlikely that lowering the water table will be necessary for the foundations or the elevator pit. If dewatering is required, it will be temporary and very limited in potential area of influence. It is our opinion that there will be no off-site impacts from the minor dewatering occurring at the site.

5.4 Source Water Protection Considerations

The site is in a WHPA-Q1. Currently, the Region's WHPA-Q1 has a low risk so there are no policies under the Source Protection Plan. Balancing the water budget is considered a beneficial practice and the Region supports infiltration of clean runoff and not from impervious surfaces being salted. No groundwater recharge facilities are being considered at the time of writing this report.

6.0 Conclusions

The findings of the hydrogeological assessment are summarized as follows:

- The proposed development of the 1.61 ha site includes construction of a 3,223 m^2 commercial building. The site and surrounding area are municipally serviced.
- The shallow groundwater table at the site was measured to be approximately 2.2 metres below ground surface during springtime conditions in March 2025. The March 2025 readings are indicative of the seasonal high-water table for 2025.
- The average hydraulic conductivity of the saturated silt till/clay till soils on the Site was 9.3×10^{-7} m/s.
- Construction dewatering may be required up to approximately 168,000 L/day to facilitate subsurface construction activities. This would only be needed after a 52.1 mm storm event.
- No construction dewatering for the elevator pit is expected to be needed. In the event of a major storm event, up to 168,000 liters of precipitation may need to be removed from the excavation.
- Up to 36,726 liters of water per day will need to be removed from a two and a half metre deep (below grade) trench that is 20 metres in length.
- Long-term dewatering is not anticipated for the proposed slab-on-grade building.
- There are no wetlands or surface water features in the vicinity of the site.
- There are no known private water supply wells in the vicinity of the site.

7.0 Recommendations

Harden provides the following recommendations:

1. Approval from the Region of Waterloo is required prior to any discharge to the municipal storm and/or sanitary systems.

2. If proposed excavation dimensions exceed those estimated within this report, or if any basement/subsurface areas are added to the proposed building design, the dewatering calculations should be updated.

3. All unused monitoring wells must be decommissioned in accordance with R.R.O. 1990, Reg. 903 as part of the development.

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Figures

Appendix A

Development Plan and Topographic Survey

Appendix B

Borehole Logs

Appendix C

MECP Water Well Records

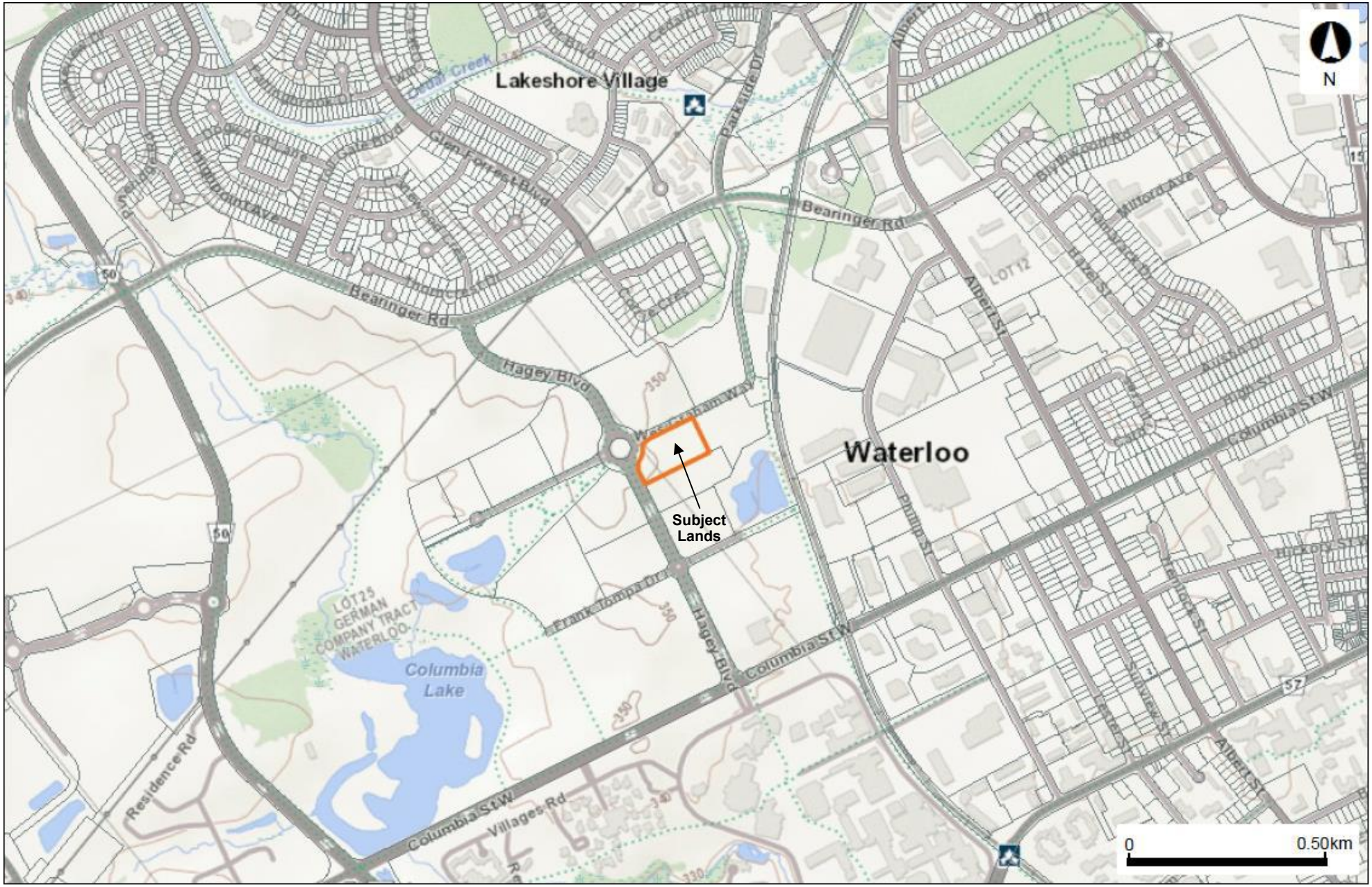
Appendix D

Hydraulic Conductivity Test Results

Appendix E

Water Balance and Dewatering Calculations

Figures



Source: MECP

HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard	**Figure 1: Location of Subject Lands**
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT	
	Drawn By: AR		

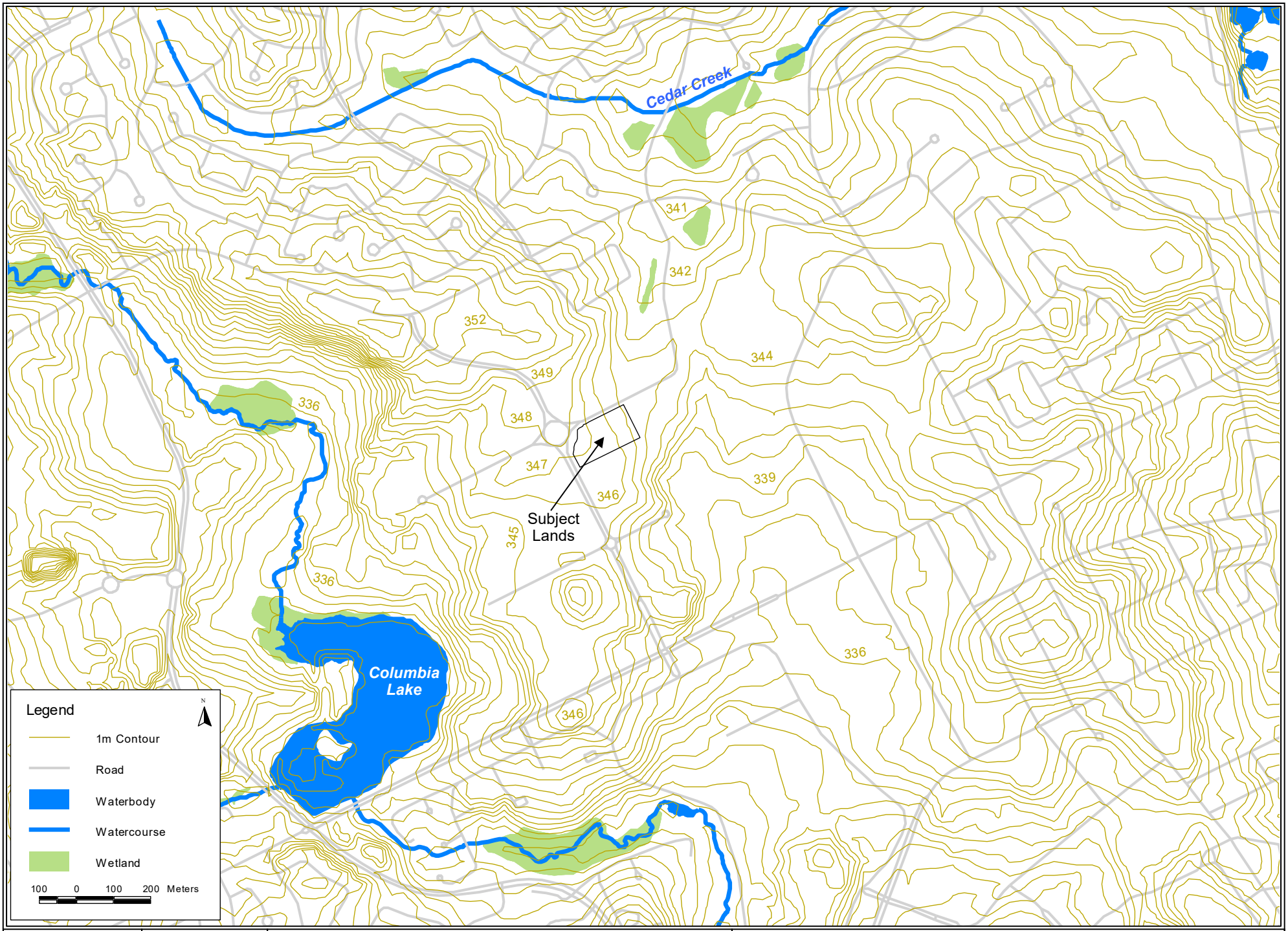


Source: MECP

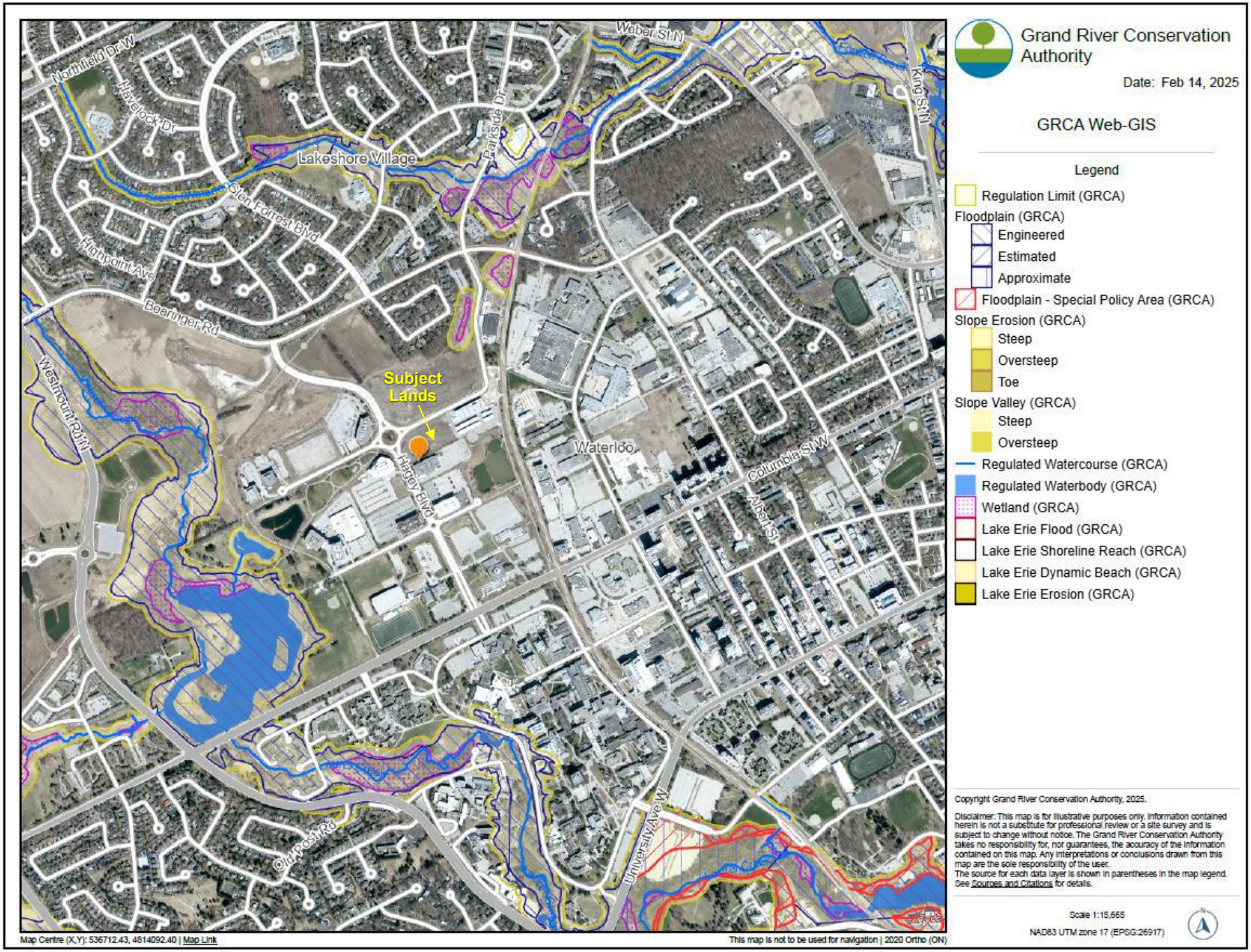
HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard	**Figure 2: Surrounding Land Use**
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT	
	Drawn By: AR		



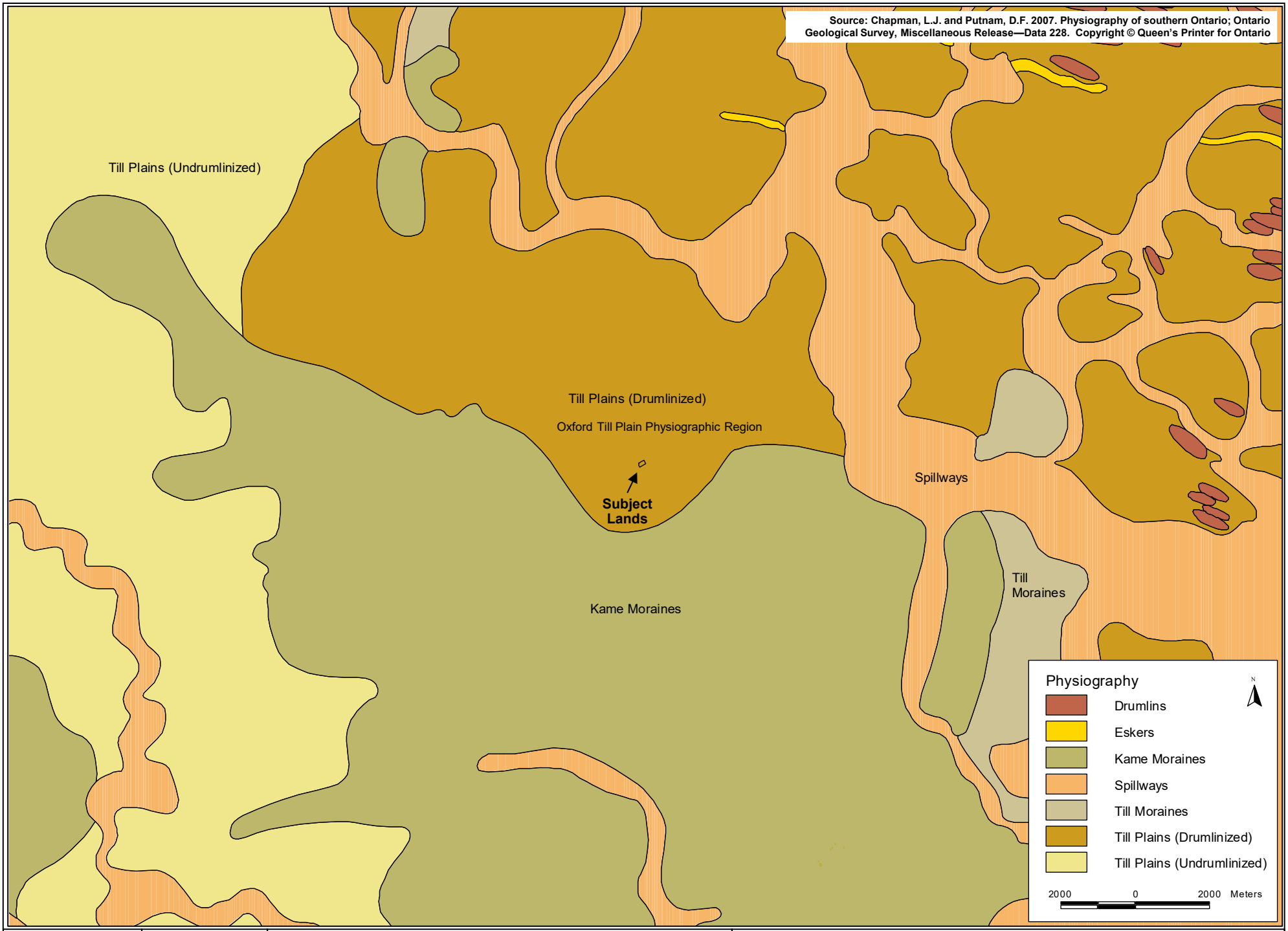
HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard	**Figure 3: Aerial Imagery 2022**
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT	
	Drawn By: AR		



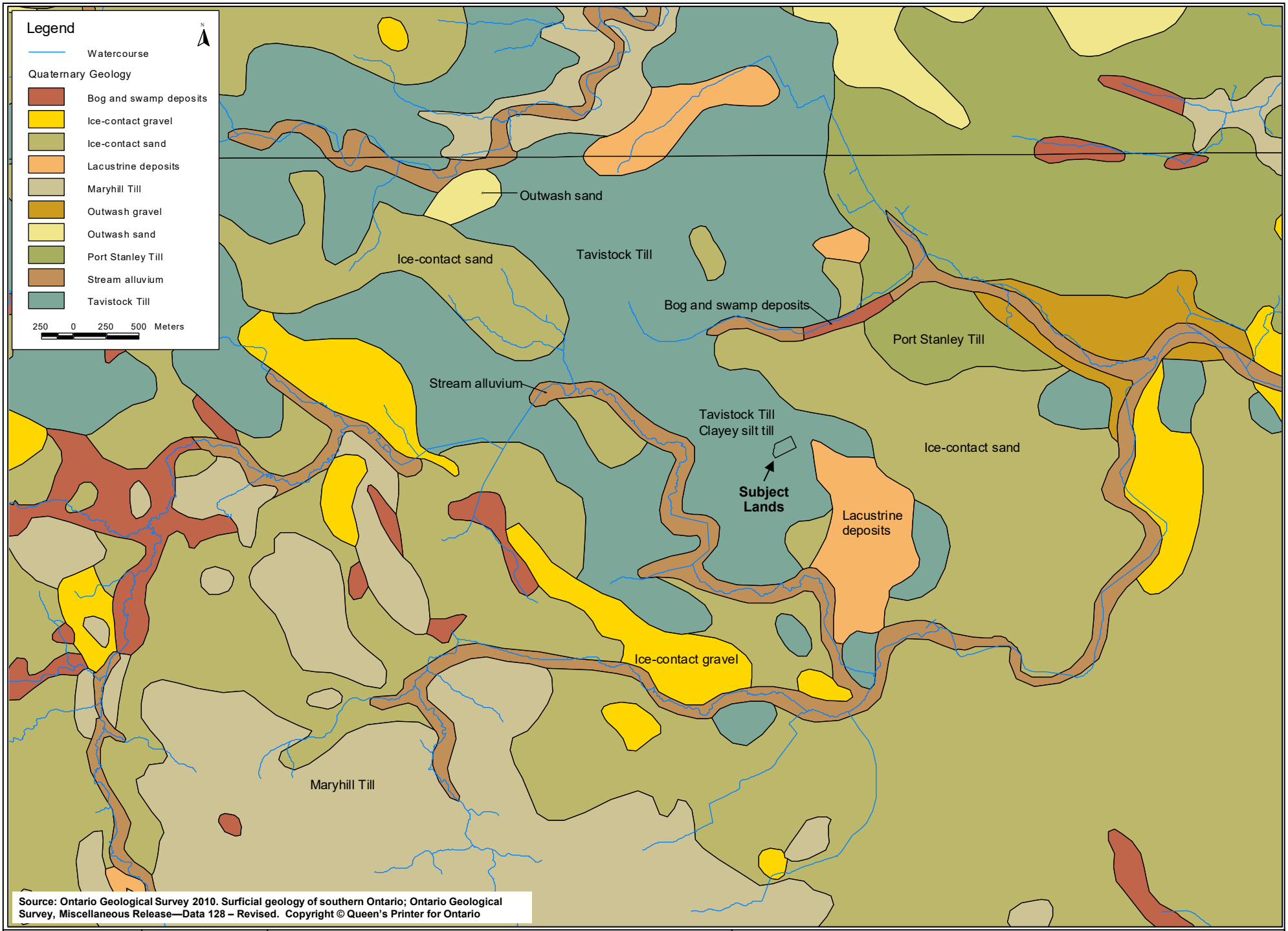
HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT
	Drawn By: AR	**Figure 4: Environmental Features**



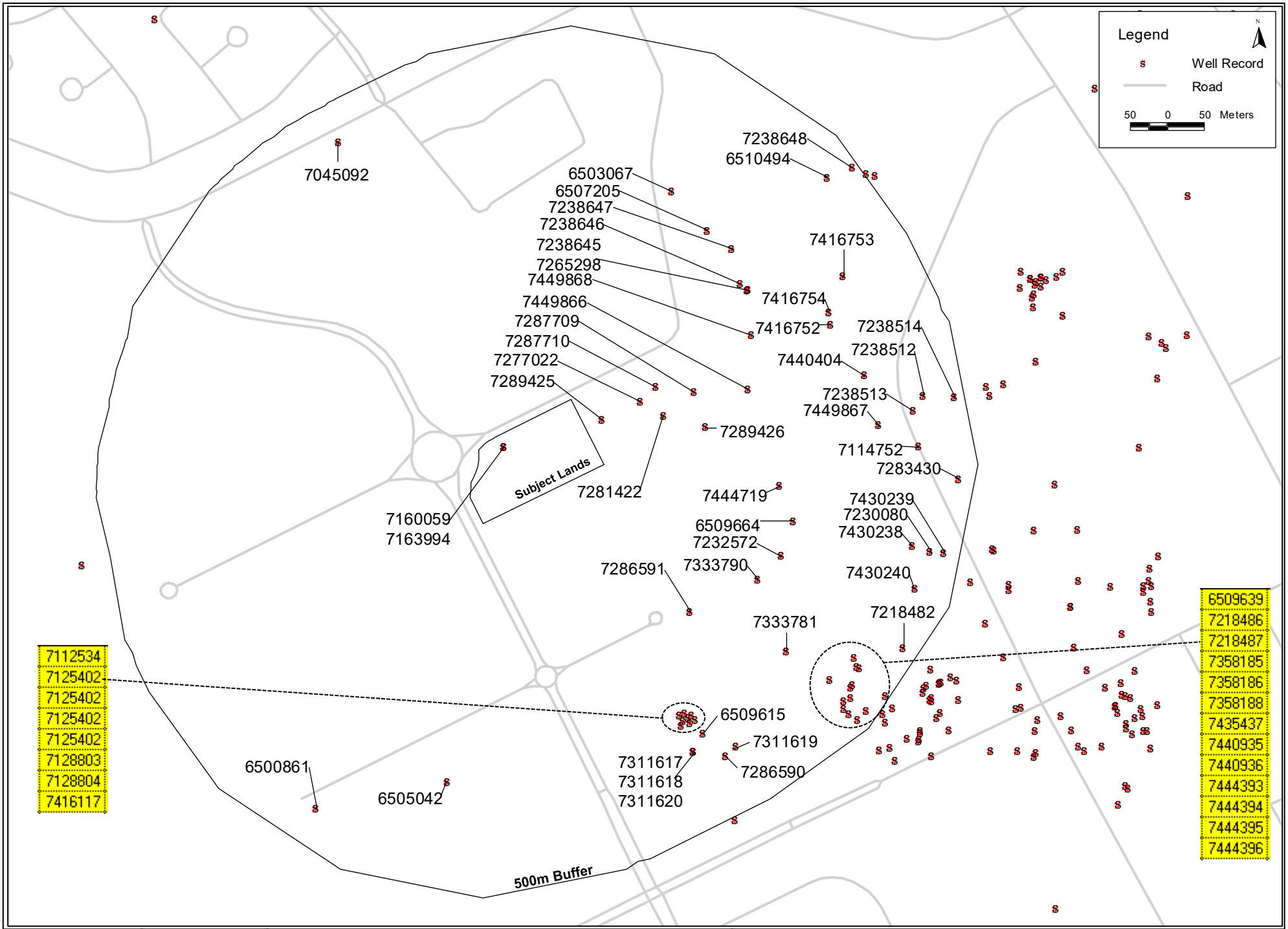
HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard	**Figure 5: GRCA Regulated Area**
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT	
	Drawn By: AR		



HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT
	Drawn By: AR	**Figure 6: Physiography**



HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard	**Figure 7: Quaternary Geology**
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT	
	Drawn By: AR		



HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT
	Drawn By: AR	**Figure 8: Well Records Within 500m**

Ontario **Source Protection Information Atlas**
Ministry of the Environment, Conservation and Parks

- [x] Intake Protection Zone 1
- [x] Intake Protection Zone 2
- [x] Intake Protection Zone 3
- [x] Highly Vulnerable Aquifers
- [x] WHPA-E

Surface Water

- [x] Event Based Areas

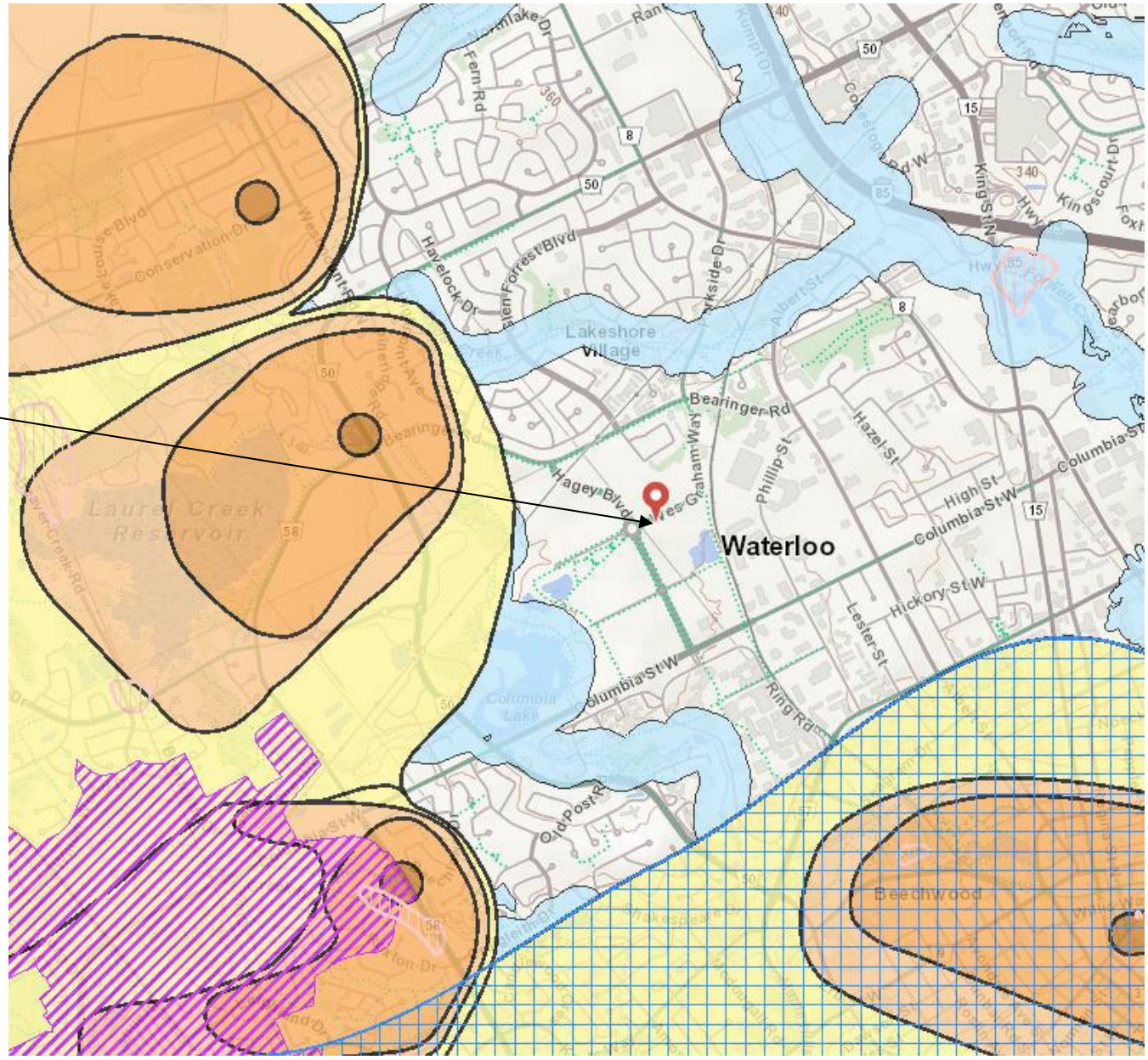
Location Information

Zoom in to confirm your location and results

Latitude: **43.48002** Longitude: **-80.54841**
UTM Zone: **17**
Easting: **536520.92** Northing: **4814221.64**
Upper Tier Municipality: **REGIONAL MUNICIPALITY OF WATERLOO**
Lower Tier Municipality: **CITY OF WATERLOO**
Township Concession and Lot: **WATERLOO LOT 12 GERMAN COMPANY TRACT**
Assessment Parcel Address: **380 Hagey Boulevard**
Assessment Roll #: **30160412500640700000**
MECP District: **Guelph**
MECP Region: **West Central Region**

Source Protection Details for Location

Source Protection Area: **Grand River**
View Source Protection Plan
Wellhead Protection Area: **No**
Wellhead Protection Area (WHPA-E): **No**
Issue Contributing Area: **No**
Significant Groundwater Recharge Area: **No**
Highly Vulnerable Aquifer: **No**
Event Based Area: **No**
Wellhead Protection Area Q1: **Yes** Stress: **Low**
Wellhead Protection Area Q2: **Yes** Stress: **Low**
Intake Protection Zone Q: **No**
Information is current as of: **December 12, 2024**



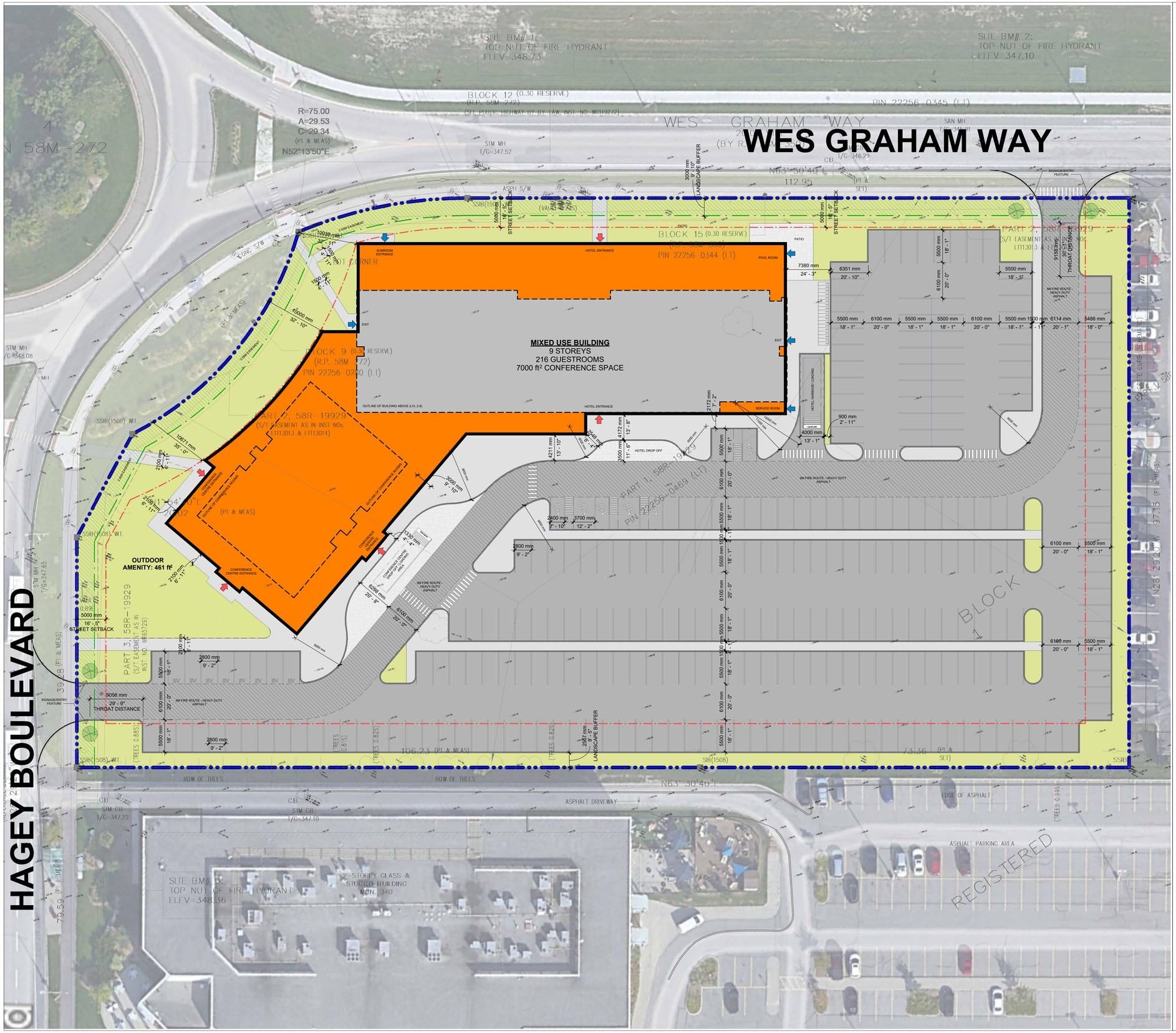
HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT
	Drawn By: AR	**Figure 9: Source Water Protection**



HARDEN Environmental	**Project No:** 2501	Hydrogeological Assessment 380 Hagey Boulevard	**Figure 10: Monitoring Well and Borehole Locations**
	Date: Feb 2025	City of Waterloo, Regional Municipality of Waterloo WATERLOO LOT 12 GERMAN COMPANY TRACT	
	Drawn By: AR		

Appendix A

Development Plan and Topographic Survey



PARKING REQUIREMENTS:

HOTEL:
- 1 PARKING SPACE PER GUEST ROOM
- 5 PARKING SPACES PER 100SM OF BUILDING FLOOR AREA FOR COMMERCIAL, CONFERENCE AND/OR CONVENTION SPACE

GUESTROOM PARKING REQUIRED
216 x 1 = 216 PARKING SPACES

CONFERENCE ROOM REQUIRED
650m² x 0.05 = 33 PARKING SPACES

TOTAL PARKING REQUIRED 216 + 33 = **249 PARKING SPACES**

ACCESSIBLE PARKING REQUIRMENTS:

PARKING QTY.	TYPE A	TYPE B
167-250	3	4

TOTAL ACCESSIBLE PARKING REQUIRED
3(A) + 4(B) = 7 ACCESSIBLE PARKING SPACES

ELECTRIC VEHICLE PARKING REQUIRMENTS:

TOTAL PARKING QTY.	EV PARKING SPACES
150 OR MORE	3% (8 SPACES)

NOTWITHSTANDING ANYTHING TO THE CONTRARY, A REQUIRED TYPE B ACCESSIBLE PARKING SPACE MAY BE SATISFIED AS A TYPE A ACCESSIBLE PARKING SPACE

SITE STATISTICS				
DESCRIPTION	AREA (SM)	AREA (SF)	AREA (HA)	%
BUILDING FOOTPRINT				
HYATT DUAL BRAND & CONFERENCE CENTRE	3,501.4 m²	37,689 ft²	0.35 hectare	21.7%
	3,501.4 m²	37,689 ft²	0.35 hectare	21.7%
HARD LANDSCAPE				
ASPHALT	7,802.9 m²	83,990 ft²	0.78 hectare	48.4%
CURB	235.6 m²	2,536 ft²	0.02 hectare	1.5%
PAVERS	290.2 m²	3,124 ft²	0.03 hectare	1.8%
SIDEWALK	1,382.4 m²	14,880 ft²	0.14 hectare	8.6%
	9,711.2 m²	104,530 ft²	0.97 hectare	60.2%
SOFT LANDSCAPE				
LANDSCAPING	2,922.9 m²	31,462 ft²	0.29 hectare	18.1%
	2,922.9 m²	31,462 ft²	0.29 hectare	18.1%
	16,135.5 m²	173,681 ft²	1.61 hectare	100.0%
OVERALL SITE	16,126.8 m²	173,587 ft²	1.61 hectare	100.0%

PARKING SCHEDULE	
Type	COUNT
ACCESSIBLE - TYPE A (3.7M X 5.5M)	3
ACCESSIBLE - TYPE B (2.4M X 5.5M)	4
ELECTRIC VEHICLE PARKING (2.8M X 5.5M)	8
TYPICAL PARKING (2.8M X 5.5M)	256
	271

BIKE PARKING SCHEDULE			
Type	Description	Size	Count
TYPE B - SHORT TERM BIKE PARKING	DOUBLE SIDED RACK	3.0m x 0.6m	36

1 / A001 Site Plan
1 : 300

Chamberlain Architects Constructors Managers

Chamberlain Architect Services Limited

4671 Palladium Way (Unit 1)
Burlington, Ontario. L7M 0W9
CANADA

Phone: 905.631.7777

www.chamberlainIPD.com

NO.	ISSUED	DATE
	CLIENT REVIEW	2024-07-26
	CLIENT REVIEW	2024-08-15
	CLIENT REVIEW	2025-02-26
	ZBA SUBMISSION	2025-04-11

DO NOT SCALE DRAWINGS. USE ONLY DRAWINGS MARKED "ISSUED FOR CONSTRUCTION". VERIFY CONFIGURATIONS AND DIMENSIONS ON SITE BEFORE BEGINNING WORK. NOTIFY ARCHITECT IMMEDIATELY OF ANY ERRORS, OMISSIONS OR DISCREPANCIES.

CHAMBERLAIN ARCHITECT SERVICES LIMITED AND CHAMBERLAIN CONSTRUCTION SERVICES LIMITED HAVE SIMILAR OWNERSHIP.

CHAMBERLAIN ARCHITECT SERVICES LIMITED HAS COPYRIGHT. CONSTRUCTING A SUBSTANTIALLY SIMILAR BUILDING WITHOUT PERMISSION MAY INFRINGE THE COPYRIGHT OWNER'S RIGHTS. MAKING MINOR CHANGES TO PLANS DOES NOT NECESSARILY AVOID COPYRIGHT INFRINGEMENT. INNOCENT INFRINGEMENT IS NOT A DEFENSE TO COPYRIGHT INFRINGEMENT. ©

SEAL

CONSTRUCTION NORTH

TRUE NORTH

HYATT DUAL BRAND - HH & HP

WES GRAHAM WAY &
HAGEY BLVD. WATERLOO

SHEET NAME

SITE PLAN

START DATE	NOVEMBER 2022
DRAWN BY	HK/SR/MW/MR
CHECKED BY	CMC
SCALE	1 : 300
PROJECT NO.	122065
DRAWING	A001

C:\Users\hkerim\Documents\122065_Waterloo Hyatt_Site_R24_2024.08.13_hkerimAKPP.rvt

3/18/2025 11:38:06 AM

Appendix B

Borehole Logs

ENCLOSURE No. 2

RECORD OF BOREHOLE No. BH1 1 OF 1 METRIC

PROJECT NUMBER 11425 LOCATION 380 Hagey, Waterloo, Ontario ORIGINATED BY CC

PROJECT NAME Proposed Hotel CLIENT Kothari Group Inc METHOD Solid Stem Augers COMPILED BY RT

DATUM Geodetic DATE 2025.03.13 - 2025.03.13 NORTHING EASTING CHECKED BY RT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
346.9	Topsoil										
0.0 / 346.7	TOPSOIL - 200 mm thick										
0.2	FILL - sandy silt, trace gravel, brown, moist		1	SS	18		346				
			2	SS	31						
345.4											
1.5	FINE SANDY SILT - trace to some clay, trace gravel, brown, compact to dense, wet		3	SS	31		345				
			4	SS	25						
343.9							344				
3.0	SILT - trace clay, trace sand, brown, compact, very moist		5	SS	27						
342.3							343				
4.6	SILTY CLAY - brownish grey, stiff, very moist		6	SS	12		342				
340.8							341				
6.1	CLAYEY SILT - trace sand, grey, very stiff, wet		7	SS	28						
340.3											
6.6	End of Borehole at Targeted Depth; Borehole Was Open and Water at 5.5 m Below Existing Ground Surface Upon Completion of Drilling Period.										

DRAFT

This log is based on the log and test results provided.

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE No. 3

RECORD OF BOREHOLE No. BH2

1 OF 2

METRIC

PROJECT NUMBER 11425 | LOCATION 380 Hagey, Waterloo, Ontario | ORIGINATED BY CC

PROJECT NAME Proposed Hotel | CLIENT Kothari Group Inc | METHOD Solid Stem Augers | COMPILED BY RT

DATUM Geodetic | DATE 2025.03.13 - 2025.03.13 | NORTHING | EASTING | CHECKED BY RT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
346.4	Topsoil										
0.0 / 346.2	TOPSOIL - 150 mm thick										
0.2	FILL - silty sand, trace gravel, trace clay, brown, moist		1	SS	16		346				
			2	SS	23		345				
			3	SS	24						
344.1											
2.3	SANDY SILT - trace clay, brown, compact, moist		4	SS	25		344				
343.4											
3.0	SILT - trace clay, brown, compact, very moist		5	SS	21		343				
341.8							342				
4.6	SILTY CLAY - brownish grey, stiff, very moist		6	SS	12		341				

DRAFT

This log is based on the log and test results provided.

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No. BH2

2 OF 2 **METRIC**

PROJECT NUMBER 11425 LOCATION 380 Hagey, Waterloo, Ontario ORIGINATED BY CC

PROJECT NAME Proposed Hotel CLIENT Kothari Group Inc METHOD Solid Stem Augers COMPILED BY RT

DATUM Geodetic DATE 2025.03.13 - 2025.03.13 NORTHING EASTING CHECKED BY RT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
340.3											
6.1	SANDY SILT - trace clay, brownish grey, compact to very dense, wet		7	SS	40		340				
			8	SS	15		339				
			9	SS	53		338				
336.8							337				
9.6	End of Borehole at Targeted Depth; Borehole Caved at 7.0 m and Water at 5.8 m Below Existing Ground Surface Upon Completion of Drilling Period.										

DRAFT

This log is based on the log and test results provided.

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE No. 4

RECORD OF BOREHOLE No. BH3

1 OF 1

METRIC

PROJECT NUMBER 11425 | LOCATION 380 Hagey, Waterloo, Ontario | ORIGINATED BY CC

PROJECT NAME Proposed Hotel | CLIENT Kothari Group Inc | METHOD Solid Stem Augers | COMPILED BY RT

DATUM Geodetic | DATE 2025.03.13 - 2025.03.13 | NORTHING | EASTING | CHECKED BY RT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; 20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
348.1	Topsoil										
348.0 / 0.0	TOPSOIL - 125 mm thick						348				
0.1	FILL - clayey silt, trace gravel, trace rootlets, brown, moist		1	SS	11						
			2	SS	8		347				
346.6											
1.5	CLAYEY SILT - trace gravel, brown, very stiff, moist		3	SS	19						
345.8							346				
2.3	FINE SANDY SILT - brown, compact, wet		4A / 4B	SS	22						
345.5											
2.6	CLAYEY SILT - brown, very stiff to hard, moist		5	SS	20		345				
			6	SS	23		344				
							343				
			7	SS	36		342				
341.5											
6.6	End of Borehole at Targeted Depth; Borehole Caved at 6.0 m and Water at 5.8 m Below Existing Ground Surface Upon Completion of Drilling Period.										

DRAFT

This log is based on the log and test results provided.

$+^3$, $\times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

ENCLOSURE No. 5

RECORD OF BOREHOLE No. BH4 1 OF 1 METRIC

PROJECT NUMBER 11425 LOCATION 380 Hagey, Waterloo, Ontario ORIGINATED BY CC

PROJECT NAME Proposed Hotel CLIENT Kothari Group Inc METHOD Solid Stem Augers COMPILED BY RT

DATUM Geodetic DATE 2025.03.13 - 2025.03.13 NORTHING EASTING CHECKED BY RT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
347.3	Topsoil										
0.0 / 347.1	TOPSOIL - 175 mm thick										
0.2	FILL - silty clay, trace gravel, brown, moist		1	SS	9		347				
			2	SS	15		346				
345.8											
1.5	CLAYEY SILT - brown, very stiff, moist to wet		3	SS	20						
			4	SS	25		345				
	- trace sand		5	SS	20		344				
342.7							343				
4.6	FINE SANDY SILT - trace clay, brown, dense, wet		6	SS	37						
341.2							342				
6.1	SILT - brown, very dense, moist		7	SS	53		341				
340.7											
6.6	End of Borehole at Targeted Depth; Borehole Was Open and Water at 5.3 m Below Existing Ground Surface Upon Completion of Drilling Period.										

DRAFT

This log is based on the log and test results provided.

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE No. 6

RECORD OF BOREHOLE No. BH5 1 OF 1 METRIC

PROJECT NUMBER 11425 LOCATION 380 Hagey, Waterloo, Ontario ORIGINATED BY CC

PROJECT NAME Proposed Hotel CLIENT Kothari Group Inc METHOD Solid Stem Augers COMPILED BY RT

DATUM Geodetic DATE 2025.03.13 - 2025.03.13 NORTHING EASTING CHECKED BY RT

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
347.9	Topsoil										
0.0 / 347.7	TOPSOIL - 150 mm thick										
0.2	FILL - clayey silt, trace gravel, brown, moist		1	SS	18		347				
			2	SS	26						
346.4											
1.5	CLAYEY SILT - trace gravel, trace sand, brown, very stiff, moist		3	SS	25		346				
345.6											
2.3	GLACIAL TILL - clayey silt, trace gravel, greyish brown, very stiff to hard, moist		4	SS	29		345				
			5	SS	39						
343.3							344				
4.6	SILT - some clay, greyish brown, very dense, moist		6	SS	53		343				
341.8											
6.1	FINE SANDY SILT - some clay, greyish brown, very dense, wet		7	SS	79/ 28 cm		342				
341.4											
6.5	End of Borehole at Targeted Depth; Borehole Was Open and Dry Upon Completion of Drilling Period.										

DRAFT

This log is based on the log and test results provided.

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

KEY TO SYMBOLS

Enclosure No.: 7

PROJECT NUMBER 11425

PROJECT NAME Proposed Hotel

LOCATION 380 Hagey boulevard, Waterloo, Ontario

CLIENT Kothari Group Inc

LITHOLOGIC SYMBOLS (Unified Soil Classification System)


CL-SL: clayey silt


CL-SL-TL: clayey silt till


FILL: TTC Fill (made ground)


SL: silt


SL-CL: silty clay


SN-SL: sandy silt


TOPSOIL: Topsoil/peat/organics

SAMPLER SYMBOLS


Split Spoon Sample

WELL CONSTRUCTION SYMBOLS


Bentonite Seal: 1 pipe group, 1 pipe


Concrete: 1 pipe group, 1 pipe


Filter Pack: 1 pipe group, 1 pipe


Slotted Pipe: 1 pipe group, 1 pipe


Slough at bottom of hole

DRAFT

Notes:

Terms describing RELATIVE DENSITY, based on Standard Penetration Test "N"-Value for COURSE GRAINED soils (major portion retained on No. 200 seive):

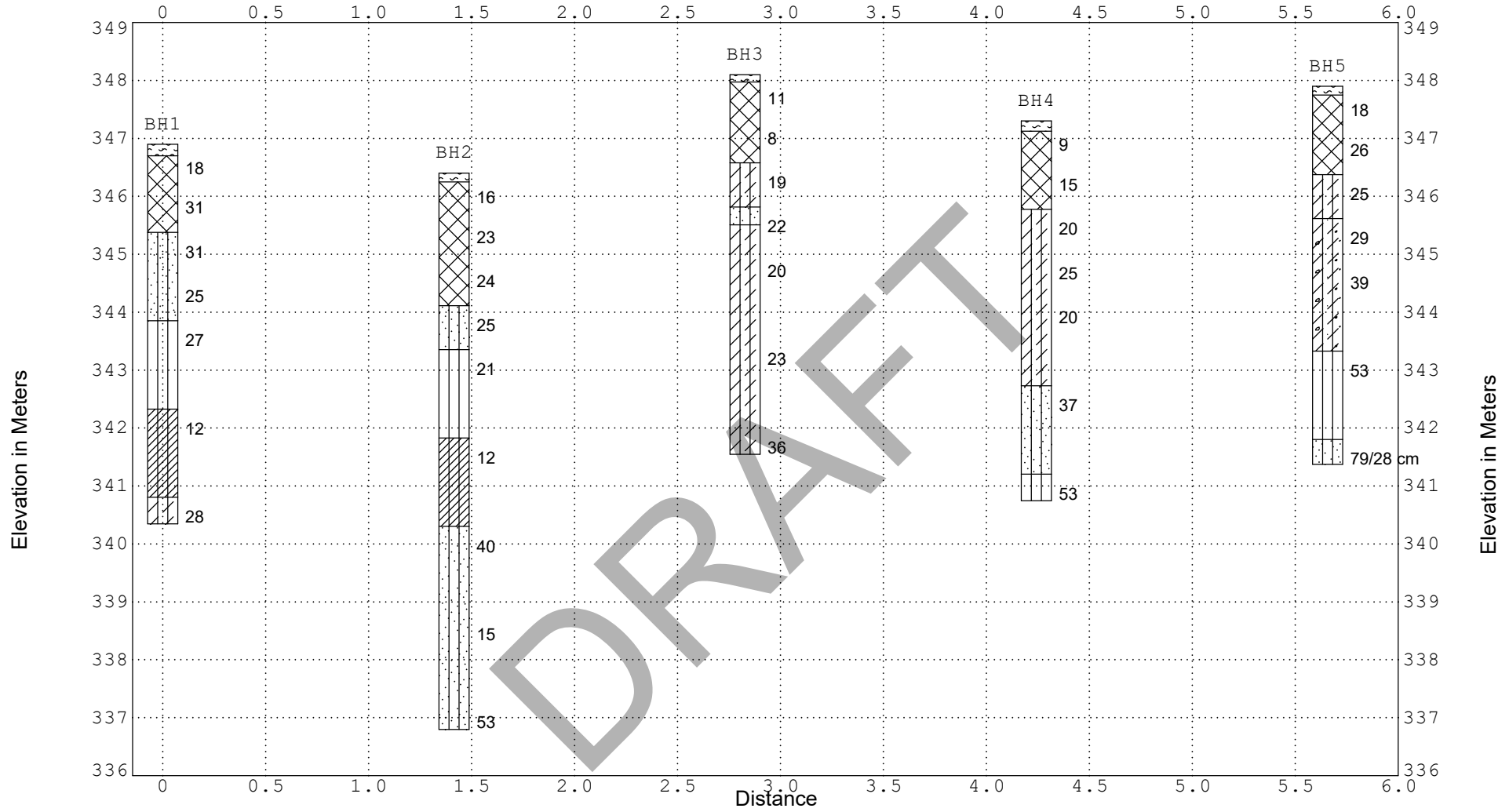
DESCRIPTIVE TERM ["N"-Value (blows/0.3m), Relative Density (%)]

- **Very Loose [less than 4, less than 15]**
- **Loose [4 to 10, 15 to 35]**
- **Compact or Medium [10 to 30, 35 to 65]**
- **Dense [30 to 50, 65 to 85]**
- **Very Dense [greater than 50, greater than 85]**

Terms describing CONSISTENCY, based on Standard Penetration Test "N"-Value for FINE GRAINED soils (major portion passing No. 200 sieve):

DESCRIPTIVE TERM [Unconfined Compressive Strength (kPa), "N"-Value (blows/0.3m)]

- **Very Soft [less than 25, less than 2]**
- **Soft [25 to 50, 2 to 4]**
- **Firm [50 to 100, 4 to 8]**
- **Stiff [100 to 200, 8 to 15]**
- **Very Stiff [200 to 400, 15 to 30]**
- **Hard [greater than 400, greater than 30]**



DRAFT

Plan View

SOLA ENGINEERING

SOLA ENGINEERING INC.
CONCEPTUAL SOIL PROFILE

Horizontal Scale:	Drawn By:	
Vertical Scale:	Approved By:	

Proposed Hotel
380 Hagey boulevard, Waterloo, Ontario

Project Number: 11425 | Enclosure No.: 8

Appendix C

MECP Water Well Records

Well Records within 500m

Well ID	Date Completed	Depth (m)	Depth to Bedrock (m)	Static Water Level (m)	TAG	Final Status	Use 1	Use 2
6500861	1/23/56	75.3	67.1	13.7		Water Supply	Domestic	
6503067	7/31/69	21.3		4.6		Water Supply	Commerical	
6505042	10/04/79	15.8		8.5		Water Supply	Domestic	
6507205	10/03/91	70.1	68.0			Observation Wells	Not Used	
6509615	2/11/04	59.9	55.5		A000156	Observation Wells		
6509639	3/31/04				A008927	Observation Wells		
6509664	4/05/04	5.0			A010222	Observation Wells		
6510494	10/07/05					Abandoned-Other		
7045092	6/01/07	6.0			A048754	Observation Wells		
7112534	4/25/08	18.0			A069641	Test Hole	Other	
7114752	10/21/08						Other	
7125402					A059236	Test Hole	Monitoring	
7125402								
7125402								
7125402	12/11/07	16.3						
7128803	8/21/09	12.2			A082745	Monitoring and Test Hole	Test Hole	
7128804	5/21/09	12.2			A082713	Monitoring and Test Hole	Test Hole	
7160059	2/14/11				A097904			
7163994	5/27/11				A097904	Abandoned-Other		
7218482	2/24/14	4.6			A159522	Test Hole	Test Hole	
7218486	2/26/14	4.6			A159517	Test Hole	Test Hole	
7218487	2/26/14	4.6			A159518	Test Hole	Test Hole	
7230080	9/03/14				A171635			
7232572	10/27/14				A144501		Test Hole	
7238512	1/21/15	6.1			A161934	Observation Wells	Monitoring and Test Hole	
7238513	1/21/15	5.4			A161935	Observation Wells	Monitoring and Test Hole	
7238514	1/21/15	4.5			A162162	Observation Wells	Monitoring and Test Hole	
7238645	1/22/15	5.8			A176670	Observation Wells	Monitoring and Test Hole	
7238646	1/22/15	4.9			A176671	Observation Wells	Monitoring and Test Hole	
7238647	1/22/15	4.9			A176672	Observation Wells	Monitoring and Test Hole	
7238648	1/15/15	4.9			A177264		Monitoring	
7265298	6/02/16	6.1			A176775	Monitoring and Test Hole	Monitoring and Test Hole	
7277022	11/12/16	6.1			A156790	Observation Wells	Monitoring	
7281422	2/06/17	160.0		19.2	A216958	Observation Wells	Commerical	
7283430	2/10/17	4.2			A216733	Observation Wells	Monitoring	
7286590	4/27/17	8.2			A222245	Observation Wells	Monitoring	
7286591	4/27/17	9.1			A222243	Observation Wells	Monitoring	
7287709	4/17/17				A156790	Abandoned-Other		
7287710	4/17/17				A156790	Abandoned-Other		
7289425	6/12/17	160.0		31.4	A216958	Water Supply	Commerical	Cooling And A/C
7289426	6/12/17	160.0		20.7	A216959	Recharge Well	Commerical	Other
7311617	4/26/18	7.6			A237277			
7311618	4/26/18	9.1			A237279			
7311619	4/26/18	9.1			A237276	Observation Wells	Monitoring	
7311620	4/26/18	7.6			A237278	Observation Wells	Monitoring	
7333781	4/25/19	6.7			A266352	Observation Wells	Monitoring	
7333790	4/25/19	8.5			A266353	Observation Wells	Monitoring	
7358185	3/02/20	4.0			A290423	Monitoring and Test Hole	Monitoring and Test Hole	
7358186	3/02/20	4.0			A290422	Monitoring and Test Hole	Monitoring and Test Hole	
7358188	3/02/20	4.0			A290421	Monitoring and Test Hole	Test Hole	
7416117	4/22/22	9.1			A346132	Observation Wells	Monitoring	
7416752	3/17/22				A341022			
7416753	3/17/22				A341021			
7416754	3/17/22				A341023			
7430238	9/13/22	4.6		1.5	A362454	Observation Wells	Monitoring	
7430239	9/12/22	4.6			A362455	Observation Wells	Monitoring	
7430240	9/12/22	4.6		1.5	A362456	Observation Wells	Monitoring	

Well ID	Date Completed	Depth (m)	Depth to Bedrock (m)	Static Water Level (m)	TAG	Final Status	Use 1	Use 2
7435437	11/16/22	4.6			A358298	Monitoring and Test Hole	Test Hole	
7440404	2/07/23	6.1			A368885	Monitoring and Test Hole	Test Hole	
7440935	11/15/22				A361246			
7440936	11/15/22				A364541			
7444393	3/29/23	12.2			A373764	Observation Wells	Monitoring	
7444394	3/29/23	12.2			A373765	Observation Wells	Monitoring	
7444395	3/29/23	12.2			A373766	Observation Wells	Monitoring	
7444396	3/30/23	17.8			A373767	Observation Wells	Monitoring	
7444719	2/07/23				A368884			
7449866	2/28/23				A368842			
7449867	2/28/23				A368846			
7449868	2/28/23				A368849			

Well Records within 500m Stratigraphy

Well ID	Thickness (m)	Colour	Material 1	Material 2	Material 3	Depth (m)
6500861	2.44		PREVIOUSLY DUG			2.44
6500861	3.05	YELLOW	MEDIUM SAND			5.49
6500861	18.90	BLUE	CLAY			24.38
6500861	17.68		HARDPAN			42.06
6500861	5.18	RED	CLAY	MEDIUM SAND		47.24
6500861	3.05	BLUE	CLAY	MEDIUM SAND		50.29
6500861	16.76		CLAY	MEDIUM SAND		67.06
6500861	4.57		SHALE			71.63
6500861	3.05	BLUE	ROCK			74.68
6500861	0.61		LIMESTONE			75.29
6503067	8.23		CLAY	MEDIUM SAND		8.23
6503067	9.45	GREY	CLAY			17.68
6503067	0.91		MEDIUM SAND	CLAY	GRAVEL	18.59
6503067	0.61		CLAY			19.20
6503067	1.22		MEDIUM SAND	GRAVEL		20.42
6503067	0.91		CLAY	STONES		21.34
6505042	1.22	BROWN	CLAY			1.22
6505042	3.96	GREY	CLAY			5.18
6505042	0.61	GREY	SAND			5.79
6505042	3.05	BLUE	CLAY			8.84
6505042	0.91	BLUE	CLAY	SANDY		9.75
6505042	3.35		SAND			13.11
6505042	0.91	BLUE	CLAY			14.02
6505042	1.83		CLAY	SANDY		15.85
6507205	0.61	BLACK	TOPSOIL			0.61
6507205	7.62	BROWN	SAND	SILT	FINE SAND	8.23
6507205	44.20	BROWN	CLAY	STONES	HARD	52.43
6507205	5.49	BROWN	SAND	FINE SAND	COARSE SAND	57.91
6507205	3.66	GREY	SILT			61.57
6507205	6.40	RED	CLAY			67.97
6507205	2.13	WHITE	LIMESTONE	ROCK		70.10
6509615	0.80		FILL			0.80
6509615	1.90		SILT	CLAY	SAND	2.70
6509615	2.20		SAND	SILT	CLAY	4.90
6509615	1.60		SILT	CLAY		6.50
6509615	1.40		GRAVEL	SAND		7.90
6509615	1.70		CLAY	SILT		9.60
6509615	2.70		SAND	SILT	CLAY	12.30
6509615	4.60		CLAY	SILT	TILL	16.90
6509615	5.80		SAND	SILT	TILL	22.70
6509615	0.80		CLAY	SILT	TILL	23.50
6509615	12.00		SAND	SILT	TILL	35.50
6509615	0.60		SAND	GRAVEL		36.10
6509615	2.20		SAND	SILT	TILL	38.30
6509615	1.80		SILT	CLAY	SAND	40.10
6509615	3.00		SAND	SILT	TILL	43.10
6509615	1.10		GRAVEL	SAND	SILTY	44.20
6509615	1.20		SILT	GRAVEL		45.40
6509615	3.10		SAND	SILT	TILL	48.50
6509615	2.10		CLAY	SILT		50.60
6509615	1.40		CLAY	SILT	TILL	52.00
6509615	3.60		SAND	SILT	TILL	55.60
6509615	3.10		SHALE			58.70

Well Records within 500m Stratigraphy

Well ID	Thickness (m)	Colour	Material 1	Material 2	Material 3	Depth (m)
6509615	1.20		UNKNOWN TYPE			59.90
6509664	0.60	BROWN	GRAVEL	SAND		0.60
6509664	4.40	BROWN	SILT	SAND		5.00
7045092	6.00	BROWN	CLAY	SILT	SAND	6.00
7112534	0.30	BROWN	SILT	SAND	FILL	0.30
7112534	2.70	BROWN	FINE SAND	SILT	LOOSE	3.00
7112534	4.00	GREY	FINE SAND	SILT	LOOSE	7.00
7112534	4.00	GREY	SILT	SAND		11.00
7112534	3.00	BROWN	SAND	GRAVEL	LOOSE	14.00
7112534	4.00	GREY	CLAY	SILT		18.00
7125402	0.50	BROWN	SAND	SILT		0.50
7125402	9.50	BROWN	SAND	GRAVEL		10.00
7125402	5.00	GREY	SILT	GRAVEL	TILL	15.00
7125402	1.30	GREY	SAND	GRAVEL		16.30
7128803	0.76	BROWN	TOPSOIL			0.76
7128803	1.98	BROWN	CLAY		LOOSE	2.74
7128803	2.59	BROWN	FINE SAND	SILT	LOOSE	5.33
7128803	1.68	GREY	CLAY	SILT	HARD	7.01
7128803	0.61	BROWN	FINE SAND	SILT	LOOSE	7.62
7128803	1.52	BROWN	CLAY		SOFT	9.14
7128803	1.53	BROWN	SAND	SILT	CLAY	10.67
7128803	1.21	BROWN	SAND	SILT	GRAVEL	11.88
7128803	0.34	BROWN	CLAY		TILL	12.22
7128804	0.76	BLUE	TOPSOIL			0.76
7128804	2.90	BROWN	CLAY	SILT	SAND	3.66
7128804	0.91	BROWN	FINE SAND	SILT	LOOSE	4.57
7128804	2.44	GREY	CLAY	SILT	HARD	7.01
7128804	0.61	BROWN	FINE SAND		LOOSE	7.62
7128804	1.52	GREY	CLAY	SILT	SOFT	9.14
7128804	2.44	GREY	FINE SAND	SILT	GRAVEL	11.58
7128804	0.64	BROWN	CLAY	TILL		12.22
7218482	1.80	BROWN	SAND	GRAVEL	FILL	1.80
7218482	1.50	BROWN	SAND	SILT	WATER-BEARING	3.30
7218482	1.30	GREY	SILT		WATER-BEARING	4.60
7218486	1.80	BROWN	SAND	GRAVEL	FILL	1.80
7218486	1.50	BROWN	SAND	SILT	WATER-BEARING	3.30
7218486	1.30	GREY	SILT	SAND	WATER-BEARING	4.60
7218487	1.80	BROWN	SAND	GRAVEL	FILL	1.80
7218487	1.50	BROWN	SAND	SILT	WATER-BEARING	3.30
7218487	1.30	GREY	SILT	SAND	WATER-BEARING	4.60
7238512	0.15	BLACK			HARD	0.15
7238512	5.94	BROWN	FINE SAND	SILT	SOFT	6.10
7238513	1.00	BROWN	TOPSOIL	SAND	SOFT	1.00
7238513	4.40	BROWN	SAND	SILT	GRAVEL	5.40
7238514	0.10	BLACK			SOFT	0.10
7238514	1.40	BROWN	SAND	GRAVEL	SOFT	1.50
7238514	3.00	BROWN	SAND	SILT	SOFT	4.50
7238645	3.05	BROWN	SILT	SAND		3.05
7238645	2.74	BROWN	SILT	SAND	WATER-BEARING	5.79
7238646	3.05	BROWN	SAND	SILT		3.05
7238646	1.83	BROWN	SAND	SILT	WATER-BEARING	4.88
7238647	3.05	BROWN	SAND	SILT		3.05
7238647	1.83	BROWN	SILT	SAND	WATER-BEARING	4.88

Well Records within 500m Stratigraphy

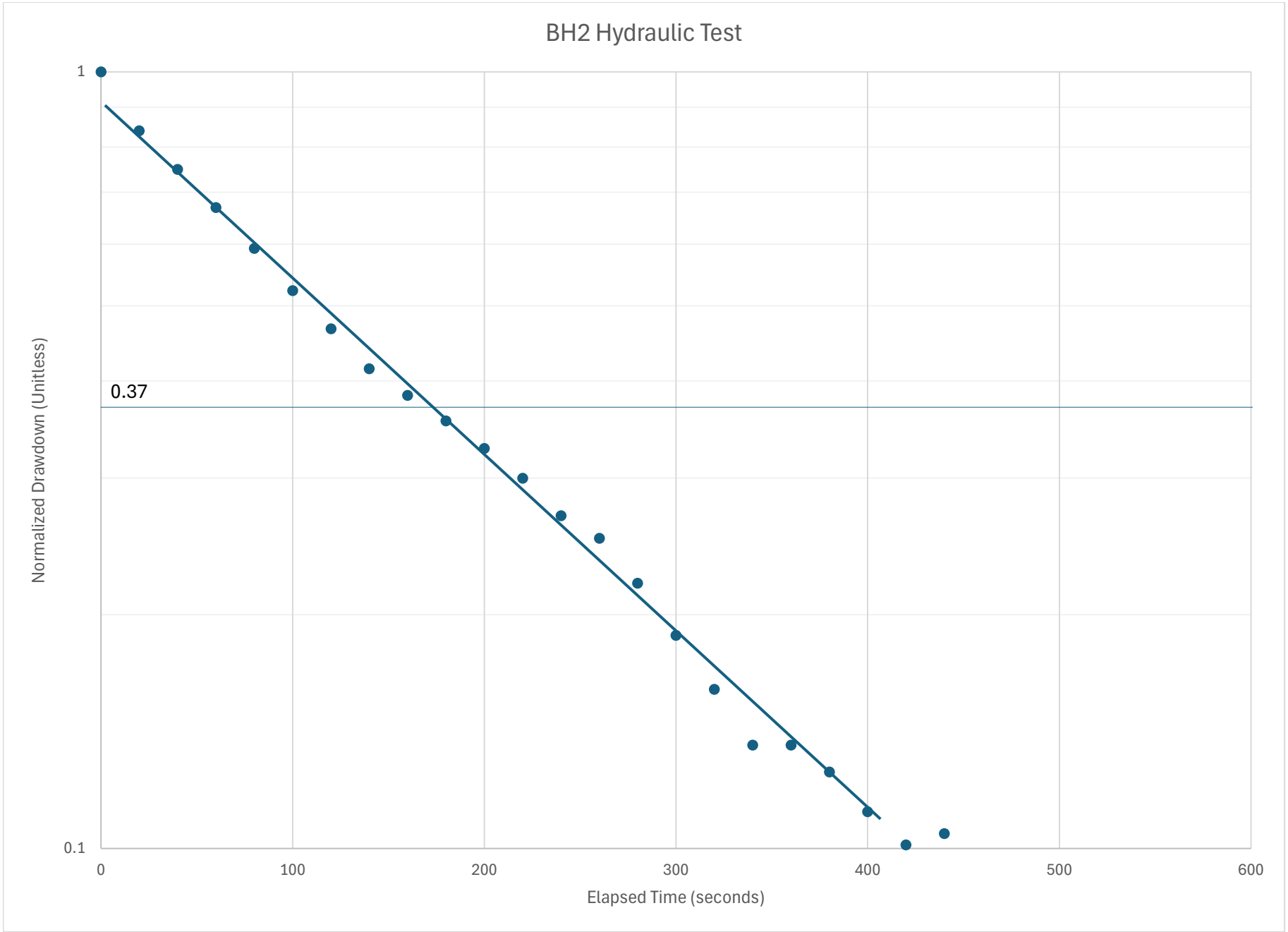
Well ID	Thickness (m)	Colour	Material 1	Material 2	Material 3	Depth (m)
7238648	1.52	GREY	GRAVEL	ROCK	SAND	1.52
7238648	3.35	BROWN	SILT	SAND	WATER-BEARING	4.88
7265298	0.30	BLACK	TOPSOIL	FINE SAND	SOFT	0.30
7265298	2.74	BROWN	FINE SAND	TILL	SOFT	3.05
7265298	3.05	GREY	SILT	FINE SAND	SOFT	6.10
7277022	3.05	GREY	CLAY	SILT	DENSE	3.05
7277022	3.05	GREY	SILT	SAND	DENSE	6.10
7281422	3.35	BROWN	CLAY			3.35
7281422	20.73	BROWN	CLAY	STONES		24.08
7281422	12.50	GREY	MEDIUM GRAVEL		FINE SAND	36.58
7281422	8.23	GREY	CLAY	STONES	SAND	44.81
7281422	14.02	GREY	HARDPAN			58.83
7281422	8.23	BROWN	SHALE			67.06
7281422	3.05	BROWN	LIMESTONE			70.10
7281422	10.67	GREY	SHALE			80.77
7281422	79.25	BROWN	LIMESTONE			160.02
7283430	0.60	BROWN	FILL			0.60
7283430	3.60	BROWN	SAND			4.20
7286590	0.10		TOPSOIL			0.10
7286590	8.13		SAND	SILT	CLAY	8.23
7286590	0.00					
7286591	0.10		TOPSOIL			0.10
7286591	9.04		SAND	SILT	CLAY	9.14
7287709	0.00					
7287710	0.00					
7289425	3.96	BROWN	CLAY		SOFT	3.96
7289425	5.79	BROWN	SAND			9.75
7289425	10.97	GREY	CLAY	STONES		20.73
7289425	15.85	GREY	SAND		SILTY	36.58
7289425	7.01	GREY	HARDPAN			43.59
7289425	14.33	GREY	CLAY	STONES		57.91
7289425	3.66	GREY	GRAVEL			61.57
7289425	3.35	GREY	LIMESTONE	MARL	SOFT	64.92
7289425	95.10	BLUE	LIMESTONE	SHALE	LAYERED	160.02
7289426	8.53	BROWN	CLAY		SOFT	8.53
7289426	14.33	BROWN	SAND	CLAY	STONES	22.86
7289426	2.74	GREY	GRAVEL		SILTY	25.60
7289426	24.38	GREY	CLAY	STONES	SILT	49.99
7289426	4.88	GREY	CLAY	STONES		54.86
7289426	1.52	GREY	GRAVEL			56.39
7289426	22.86	GREY	LIMESTONE	SHALE	LAYERED	79.25
7289426	57.91	BROWN	LIMESTONE			137.16
7289426	22.86	BROWN	LIMESTONE			160.02
7311617	1.52		TOPSOIL	FILL	DRY	1.52
7311617	1.83		CLAY	SILTY	DRY	3.35
7311617	4.27		SILT	SANDY	WATER-BEARING	7.62
7311618	1.52		TOPSOIL	FILL	DRY	1.52
7311618	3.05		CLAY	SILTY	DRY	4.57
7311618	1.52		SILT	WATER-BEARING		6.10
7311618	1.52		SAND	SILTY	WATER-BEARING	7.62
7311618	1.52		SAND		WATER-BEARING	9.14
7311619	6.10		CLAY			6.10
7311619	1.52		SILT			7.62

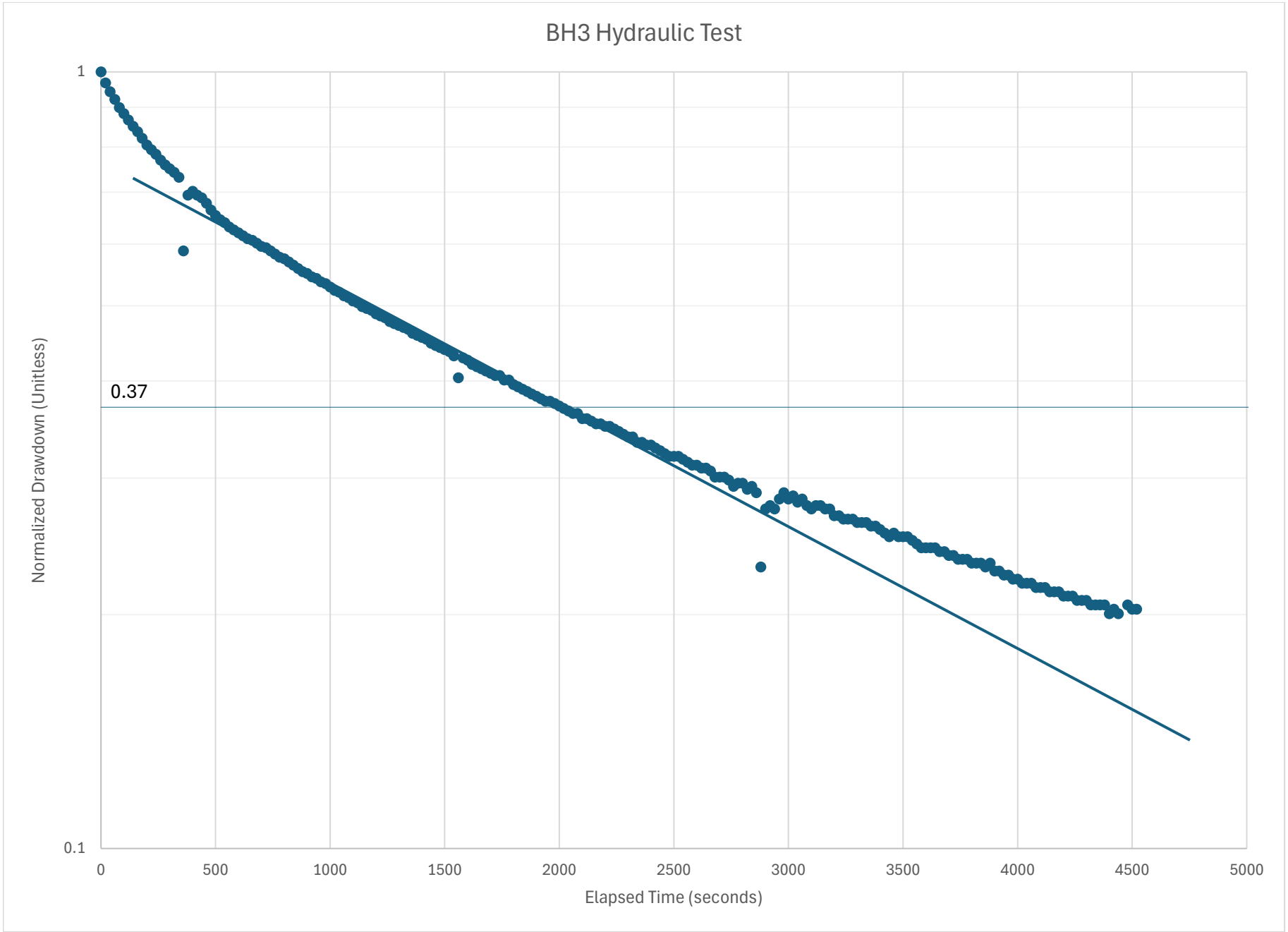
Well Records within 500m Stratigraphy

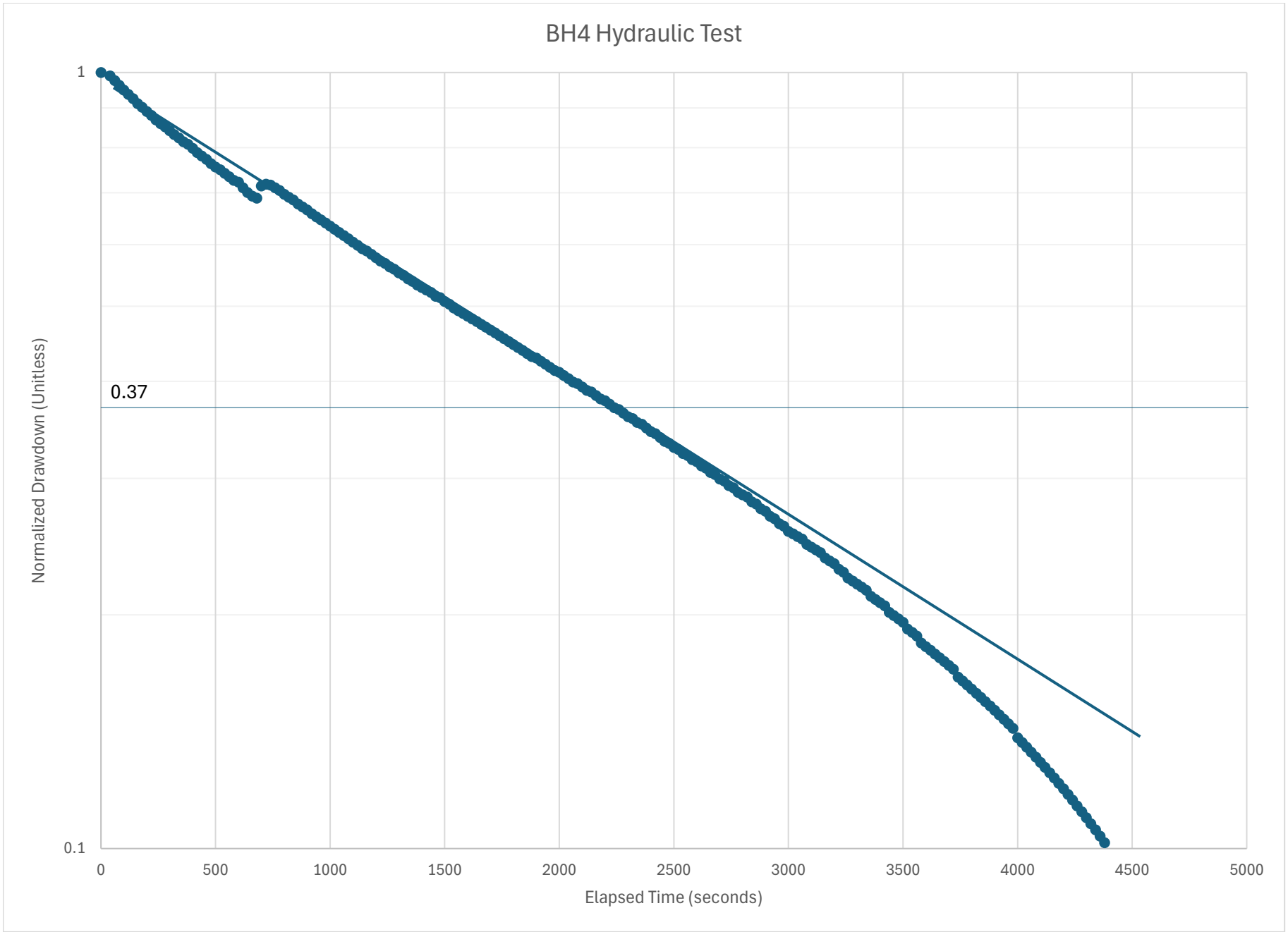
Well ID	Thickness (m)	Colour	Material 1	Material 2	Material 3	Depth (m)
7311619	1.52		SAND			9.14
7311620	4.57		CLAY			4.57
7311620	1.52		SILT			6.10
7311620	1.52		SAND			7.62
7333781	6.71		SILT	CLAY	STONES	6.71
7333790	8.53		SILT	CLAY	STONES	8.53
7358185	1.22	BROWN	SAND	GRAVEL		1.22
7358185	0.91	BROWN	SAND	SILT		2.13
7358185	1.83	GREY	SILT	CLAY		3.96
7358186	1.52	BROWN	SAND	GRAVEL		1.52
7358186	0.61	BROWN	SILT	SAND		2.13
7358186	1.83	GREY	SILT	CLAY		3.96
7358188	1.52	BROWN	SAND	GRAVEL		1.52
7358188	0.61	BROWN	SAND	SILT		2.13
7358188	1.83	GREY	SILT	CLAY		3.96
7416117	0.61		TOPSOIL			0.61
7416117	2.44		TILL	SANDY		3.05
7416117	6.10		SAND	SILTY		9.14
7430238	0.05	BLACK	TOPSOIL			0.05
7430238	0.26	BROWN	SAND	GRAVEL	LOOSE	0.30
7430238	4.27	GREY	SILT	FINE SAND	DENSE	4.57
7430239	0.05	BLACK			HARD	0.05
7430239	0.41	BROWN	SAND	GRAVEL	LOOSE	0.46
7430239	1.37	GREY	SILT	SAND	FILL	1.83
7430239	1.22	BROWN	SILT	SAND	DENSE	3.05
7430239	1.52	GREY	SILT	SAND	SOFT	4.57
7430240	0.08	BLACK			HARD	0.08
7430240	0.69	BROWN	SAND	GRAVEL	LOOSE	0.76
7430240	2.29	BROWN	SILT	FINE SAND	DENSE	3.05
7430240	1.52	GREY	SILT	FINE SAND	DENSE	4.57
7435437	0.60	BROWN	SAND	GRAVEL	FILL	0.60
7435437	3.06	BROWN	SAND	SILT		3.66
7435437	0.91	GREY	CLAY			4.57
7440404	0.61	BROWN	SAND	GRAVEL	FILL	0.61
7440404	3.99	BROWN	SAND			4.60
7440404	1.50	BROWN	SAND			6.10
7444393	0.61	BROWN	SAND	GRAVEL	DENSE	0.61
7444393	2.44	BROWN	SILT	CLAY	DENSE	3.05
7444393	9.14	GREY	SILT	CLAY	DENSE	12.19
7444394	0.76	BROWN	SAND	GRAVEL	DENSE	0.76
7444394	2.90	BROWN	SILT	CLAY	DENSE	3.66
7444394	8.53	GREY	SILT	CLAY	DENSE	12.19
7444395	0.91	BROWN	SAND	GRAVEL	DENSE	0.91
7444395	3.05	BROWN	SILT	CLAY	DENSE	3.96
7444395	8.23	GREY	SILT	CLAY	DENSE	12.19
7444396	0.91	BROWN	SAND	GRAVEL	DENSE	0.91
7444396	2.74	BROWN	SILT	CLAY	DENSE	3.66
7444396	7.01	GREY	SILT	CLAY	DENSE	10.67
7444396	7.16	GREY	TILL	SILT	HARD	17.83

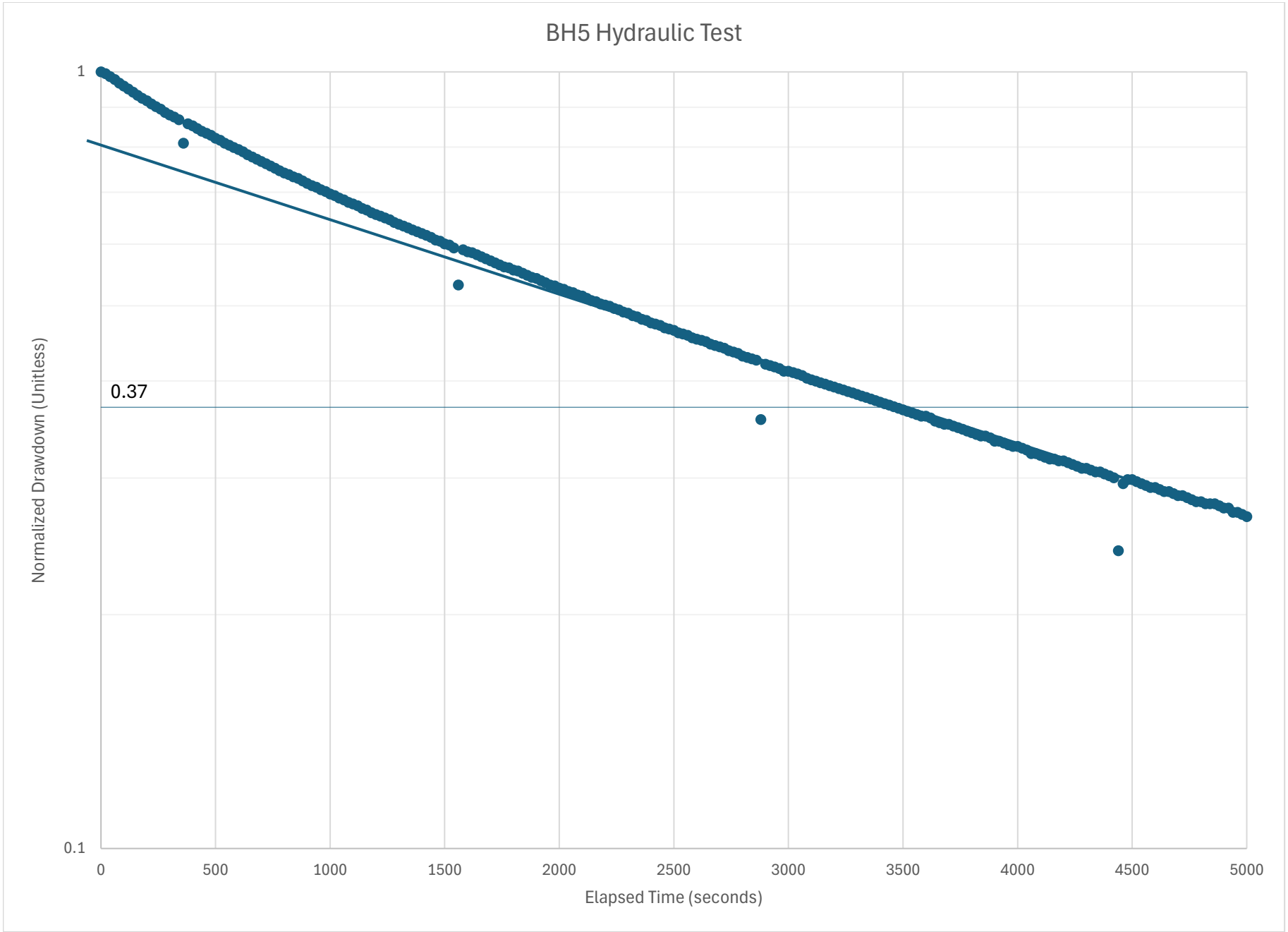
Appendix D

Hydraulic Conductivity Test Results


BH2 Hydraulic Test
1
0.37
0.1
Normalized Drawdown (Unitless)
0
100
200
300
400
500
600
Elapsed Time (seconds)


BH3 Hydraulic Test
1
0.37
0.1
Normalized Drawdown (Unitless)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Elapsed Time (seconds)


BH4 Hydraulic Test
1
0.37
0.1
Normalized Drawdown (Unitless)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Elapsed Time (seconds)


BH5 Hydraulic Test
1
0.37
0.1
Normalized Drawdown (Unitless)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Elapsed Time (seconds)

Appendix E

Water Balance and Dewatering Calculations

Thornthwaite and Mather Components - Waterloo Ontario

August 21, 2024

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 100 mm

Climate data from Kitchener Waterloo Climate Station (1991 - 2020)

POTENTIAL EVAPOTRANSPIRATION CALCULATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C) [1]	-6.3	-5.9	-0.8	5.9	12.6	17.8	20.2	19.1	15.2	8.8	2.6	-2.8	**8.1**
Precipitation (P) [1]	66.3	46.1	57	81.2	80.2	80.5	96.2	67.2	75.2	71	74.9	54.9	**851**
Heat index: i = (t/5)$^{1.514}$	0.00	0.00	0	1.28	4.05	6.84	8.28	7.61	5.38	2.35	0.37	0.00	**36.2**
Adjusting Factor for U (Latitude 43 N)	0.81	0.82	1.02	1.12	1.26	1.28	1.29	1.2	1.04	0.95	0.81	0.77	
Unadjusted Daily Potential Evapotranspiration U (mm)	0	0	0	27	61	88	100	95	74	41	11	0	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	30	76	112	130	114	77	39	9	0	**588**
P - PET	66	46	57	51	4	-32	-33	-46	-2	32	66	55	263
APWL	0	0	0	0	0	-32	-65	-112	-114	0	0	0	
Soil Moisture Storage max 100 mm	166	146	157	100	100	73	51	32	31	63	100	155	
Soil Moisture Deficit max 100 mm	0	0	0	0	0	5	11	27	1	0	0	0	
Change in Soil Moisture Storage	0	0	0	0	0	-27	-22	-19	-1	32	37	0	
Actual Evapotranspiration (AET) (mm)	0	0	0	30	76	108	118	86	76	39	9	0	**543**
Surplus Water (P-AET) (mm) - for infiltraiton or runoff	66	46	57	51	4	0	0	0	0	0	28	55	**308**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	40	28	34	31	2	0	0	0	0	0	17	33	**185**
Potential Direct Surface Water Runoff (independent of temperature)	27	18	23	20	1	0	0	0	0	0	11	22	**123**
IMPERVIOUS COMPONENTS - WATER SURPLUS (RUNOFF AND EVAPORATION)													
Precipitation (P) (mm)	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Potential Evaporation (PE); Assume 15% (mm)	10	7	9	12	12	12	14	10	11	11	11	8	**128**
Potential Surface Water Runoff (P-PE) (mm)	56	39	48	69	68	68	82	57	64	60	64	47	**723**

Assume January storage is 100% of Soil Moisture Storage

Soil Moisture Storage [3] - pasture and shrubs in fine sandy loam soils: 100 mm

MOE SWM infiltration calculations [4]

topography -flat	0.3
Soils - medium	0.2
cover - cultivated land (wetland/pasture)	0.1
Infiltration factor	**0.6**

Latitude of site (or climate station): 43 ^{O} N

Notes:

1. Environment Canada Climate Normals (Stouffville WCPC, 1971-2000)
2. Lorente, J.M. 1961. Pg. 206 "Adjusting Factors for U".
3. MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.
4. MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.

380 Hagey Boulevard, Waterloo, Ontario
Water Balance April 4, 2025

Feature	Description	Factor
Cover	Cultivated	0.1
Cover	Woodland	0.2
Soil	Medium	0.2
Soil	Open Sandy	0.4
Soil	Tight	0.1
Topo	Flat	0.3
Topo	Hilly	0.1
Topo	Rolling	0.2
Infiltration Factor		0.6

Pre Development Conditions

	Value	Units	
Precipitation Rate	851	mm/year	
Evapotranspiration Rate	543	mm/year	
Open Water Evaporation Rate	652	mm/year	
Impervious Surface Evaporation Rate	170	mm/year	20% of PT
Impervious Surface Runoff Rate	681	mm/year	
Total Area	1.6100	hectare	
Wetland Area	0.00	hectare	

Pre-Development Water Balance

	Area	Precipitation	Evapotranspiration/ Evaporation	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Pervious	1.61	13,696	8,746	1,980	2,970
Impervious	-	-	-	-	-
Pre Development Summary	1.6100	13,696	8,746	1,980	2,970

Impervious Areas (assume 20% evaporation)

Post Development Conditions

		Units		
Precipitation	851	mm/year		
Evapotranspiration Landscaped Area	543	mm/year		
Impervious Surface Evaporation	170	mm/year		
Impervious Surface Runoff	681	mm/year		
Total Area	1.6100	hectare	Infiltration Factor	
Pervious	0.3509	hectare	0.6	Based on Cultivated, Medium Soil and Flat Topo
Impervious	1.2591	hectare		
Total Area	1.6100			
Roof Top	0.3223			

Post Development Water Balance

	Area	Precipitation	Evapotranspiration/ Evaporation	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Development Pervious	0.35	2,985	1,906	432	647
Impervious	1.26	10,711	2,142	8,569	-
Post Development Summary	1.6100	13,696	4,048	9,001	647

Summary of Pre to Post Development Water Balance

	Area	Precipitation	Evapotranspiration/ Evaporation	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Pre Development Summary	1.61	13,696	8,746	1,980	2,970
Post Development Summary	1.61	13,696	4,048	9,001	647
Potential Difference without LID Strategies	-	-	- 4,697.19	7,020	- 2,323

Summary of Pre to Post Development Water Balance including Low Impact Development Strategies

	Area	Precipitation	Evapotranspiration/ Evaporation	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Roof Leader Infiltration (0.3223 hectare of rooftop x 80% x 851 mm/year precipitation)					2,193
Infiltration on Pervious Surface Post Development					647
Total Potential Infiltration with Roof Water					2,841

HARDEN

APPENDIX F
Groundwater Dewatering Calculations

SERVICING TRENCHES

Construction Dewatering Calcuations (Worst-Case Conditions Estimate)

Dupuit-Forchheimer equation to calculate flow from a line source into a trench or linear excavation in an unconfined aquifer:

$$Q = \frac{xK(H^2 - h^2)}{L}$$

Note: forumla estimates flow from both sides of the linear excavation

Where:

- Q = pumping rate (m^3/s)
- x = length of the trench (m)
- K = hydraulic conductivity (m/s)
- H = hydraulic head of the original water table (m)
- h = hydraulic head at the base of the trench (m)
- L = equivalent radius of influence for a line source (m)
- R_o = radius of influence of Well or Point Source (m)

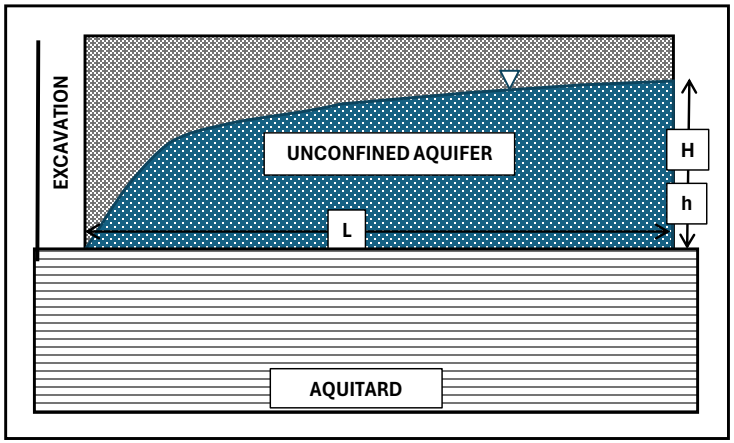
Sichart and Kryieleis equation to estimate the equivalent radius of influence (R_o) from a line source (L):

$$R_o = 3000(H - h)\sqrt{K}$$

Equivalent distance to linear source (L) from radius of influence (Ro):

$$L = R_o$$

Unconfined flow from a line source to a drainage trench



Input Parameters:

Ground Surface Elevation	347.50	masl	
Static Water Elevation	346.20	masl	highest GW level
Excavation Invert	345.00	masl	
Dewatering Base Elevation	344.00	masl	
Dewatering Drawdown	2.20	m	
Base of Aquifer	333.50	masl	
Hydraulic Conductivity K =	1.00E-06	m/s	Highest K
Excavation Length x =	20	m	Estimated total for servicing
Excavation Area =	200	m^2	assumes 2m trench width

Calculated Flow Q for Construction Dewatering:

Q =	0.00015	m^3/s	Flow from both sides of trench
Q =	13	m^3/day	Flow from both sides of trench
	13,363	**L/day**	**Estimated peak daily flow**
	26,726	**L/day**	**Incorporates x2 safety factor**
Rainwater Allowance	50	mm/day	
Rainwater Volume	10,000	L/day	
Total Estimated Q =	**23,363**	**L/day**	
	36,726	**L/day**	**Incorporates x2 safety factor plus rainwater allowance**

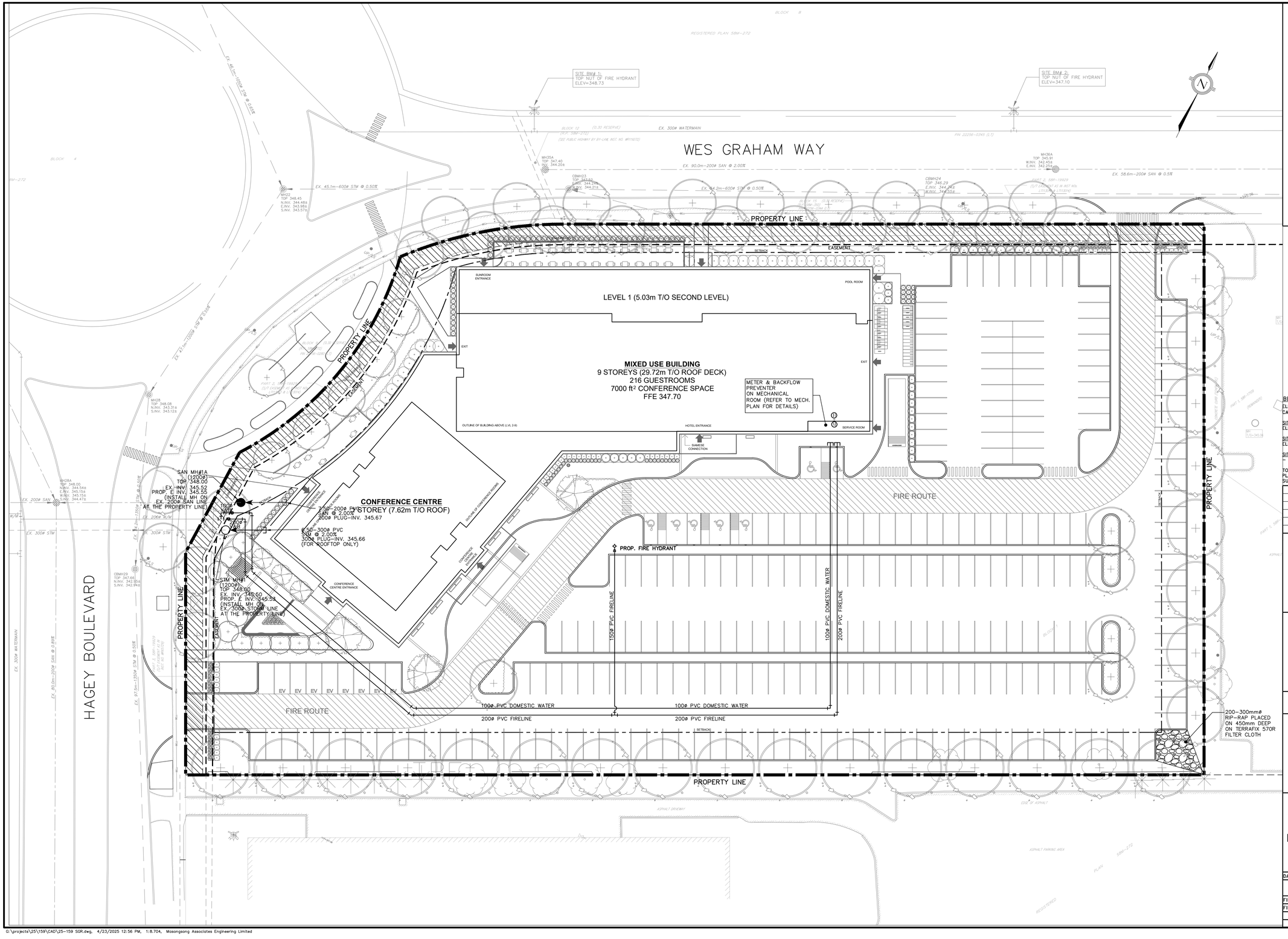
Calculated Parameters:

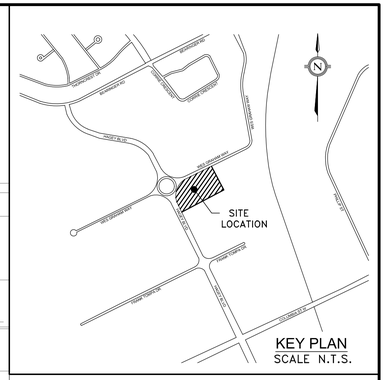
Saturated aquifer thickness (static)	H =	12.7	m
Saturated aquifer thickness (pumping)	h =	10.5	m
Radius of Dewatering Influence	**R_o =**	**6.6**	**m**
Dewatering Influence - Line Source Distance	**L =**	**6.6**	**m**

Reference:

Powers, J.P., A.B. Corwin, P.C. Schmall and W.E. Kaeck, 2007. Construction dewatering and groundwater control, new methods and approaches, 3rd ed. John Wiley & Sons, Inc.

Appendix Drawing





LEGEND:

- PROP. SANITARY MANHOLE
- PROP. STORM MANHOLE
- PROP. CATCHBASIN
- PROP. WATER VALVE & BOX
- PROP. HYDRANT
- WATER METER LOCATION
- BACKFLOW PREVENTER LOCATION
- EXISTING CATCHBASIN
- EXISTING SANITARY MANHOLE
- EXISTING STORM MANHOLE
- EXISTING HYDRANT
- EXISTING VALVE & BOX
- EXISTING UTILITY POLE
- EXISTING EASEMENT
- PROPERTY LINE

BENCHMARK:

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM GPS OBSERVATIONS CAN–NET NETWORK NAD '83 (CGVD 2013) AND ARE RELATED TO:

SITE BM #1 – TOP NUT OF FIRE HYDRANT, NORTHERLY LIMIT OF WES GRAHAM ELEVATION – 348.73

SITE BM #2 – TOP NUT OF FIRE HYDRANT, NORTHERLY LIMIT OF WES GRAHAM ELEVATION – 347.10

SITE BM #3 – TOP NUT OF FIRE HYDRANT, EASTERLY LIMIT OF HAGEY BLVD. ELEVATION – 348.36

TOPO INFORMATION TAKEN FROM PLAN OF SURVEY OF PART OF BLOCK 1, REGISTERED PLAN 58M–272 IN THE CITY OF WATERLOO. PLAN OF SURVEY PREPARED BY McKECHNIE SURVEYING LTD., OLS; COMPLETED ON THE 27TH OF FEBRUARY, 2025.

INT.	DATE	REVISIONS
1.	04/14/25	ISSUED FOR ZBA

MASONGSONG ASSOCIATES
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APR. 14/25
PROVINCE OF ONTARIO

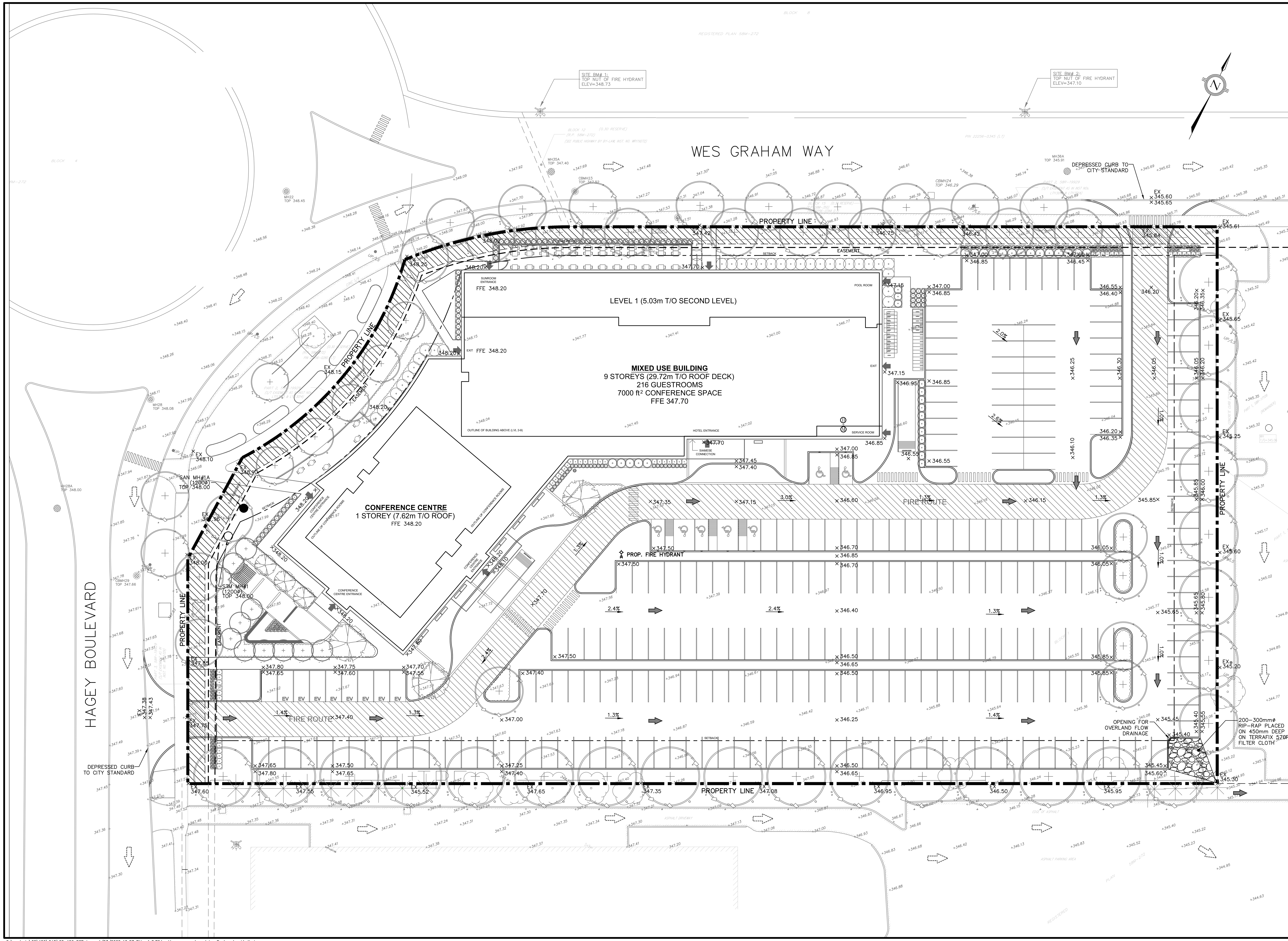
THE CITY OF Waterloo

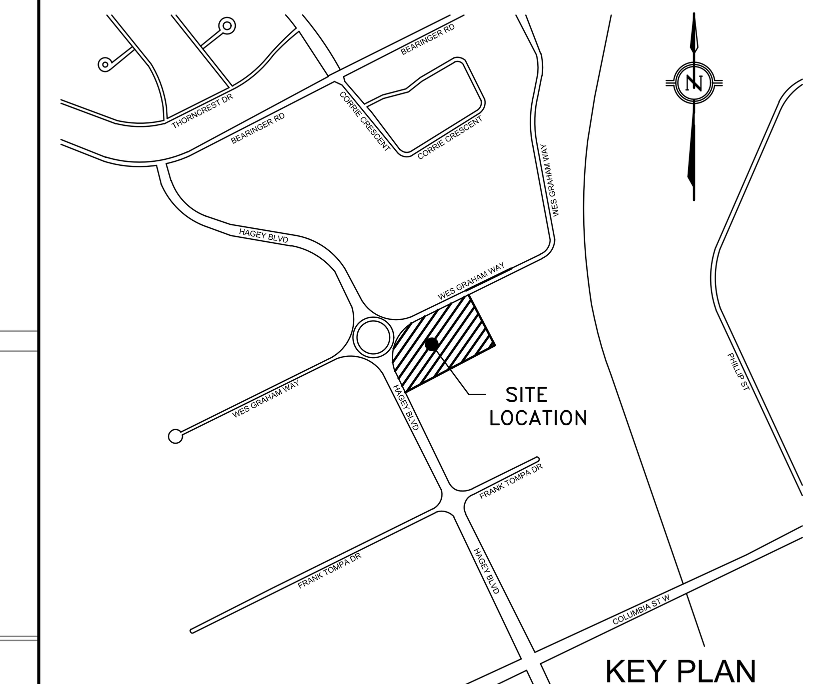
PRELIMINARY SITE SERVICING PLAN

HAYATT DUAL BRAND – HH & HP
PROP. 9–STOREY MIXED–USE BUILDING

380 HAGEY BLVD, WATERLOO

DATE: APRIL 2025	DESIGNED BY: J.K.
SCALE: 1:300	DRAWN BY: J.K.
	CHECKED BY: K.L.
FILE NO: 30T–XXXXXX	PROJECT No: 25–159
FILED BK. / PAGE / DATE	SS–1





KEY PLAN
SCALE N.T.S.

LEGEND:

176.40	PROPOSED ELEVATION	176.00	EXISTING ELEVATION
176.44 TC / 176.31 BC	PROPOSED TOP OF WALL / PROPOSED BOTTOM OF WALL	(dashed arrow)	EXTERNAL OVERLAND FLOW DIRECTION
EX. 175.93	EXISTING ELEVATION TO REMAIN		EXISTING CATCHBASIN
●	PROP. SANITARY MANHOLE		EXISTING SANITARY MANHOLE
○	PROP. STORM MANHOLE		EXISTING STORM MANHOLE
□	PROP. CATCHBASIN		EXISTING HYDRANT
⊗	PROP. WATER VALVE & BOX		EXISTING VALVE & BOX
	PROP. HYDRANT	UP/L	EXISTING UTILITY POLE
Ⓜ	WATER METER LOCATION		EXISTING EASEMENT
2.0%	DRAINAGE FLOW		PROPERTY LINE
	OVERLAND FLOW DIRECTION		SETBACK

BENCHMARK:

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THE CITY OF Waterloo

PRELIMINARY SITE GRADING PLAN

HAYATT DUAL BRAND – HH & HP
PROP. 9-STOREY MIXED-USE BUILDING

380 HAGEY BLVD, WATERLOO

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FILED BK. / PAGE / DATE	GR-1

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