FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

IN SUPPORT OF OFFICIAL PLAN AND ZONING BY-LAW AMENDMENT

170 Northfield Drive West

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Prepared For:

Forgestone Capital Management LP

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EXECUTIVE SUMMARY

This Functional Servicing and Stormwater Management Report has been prepared by Counterpoint Engineering Inc. (CPE) on behalf of Forgestone Capital Management LP to support the proposed severance, Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBA) and redevelopment of the existing site at 170 & 180 Northfield Drive and 595-630 Parkside Drive in the City of Waterloo (the "Subject Lands") for or high density residential, commercial and employment uses. The subject site is bounded by Northfield Drive West to the south, the Canadian National Railway (CNR) corridor to the east, Weber Street North to the west and industrial sites to the north. The servicing strategy for the proposed development is summarized as follows:

Water Servicing:

There are existing 300 mm and 600 mm watermains on the Northfield Drive road allowance, a private 250 mm watermain within the subject site and a 300 mm watermain on Weber Street North. The Retained Lands "A" parcel will continue to be serviced by the existing connections to Weber Street. The Severed Lands parcel will be serviced by the existing 250 mm watermain connection to the Northfield Drive watermain. The development lands will be serviced by a new 300 mm watermain connection to the Northfield Drive watermain. Peak domestic daily water demands for the development lands are estimated to be 1,919 L/min and the maximum day plus fire flows were determined to be 12,919 L/min. Confirmation of the pressure district by Region of Waterloo staff and a hydrant test will be required to confirm the system pressure will be adequate to support the proposed development. A watermain model will be required to confirm whether additional watermain connections for the Severed Lands and Retained Lands "A" parcels will be required. Further consultation with Region of Waterloo staff will be necessary to confirm watermain looping requirements.

Sanitary Servicing:

The Retained Lands "A" parcels will be serviced by a new 250 mm sanitary sewer connection to the Northfield Drive West sanitary sewer. The Severed Parcel will be serviced by the existing sanitary connection to the Northfield Drive West sewer. The Retained Lands Parcel "B" will be provided with one connection to the existing municipal sanitary sewer system on Northfield Drive. The sanitary peak flow for Retained Lands "B" is **52.05 L/s**. The design sanitary peak flow for the ultimate development condition is **84.10 L/s**. The peak sanitary flows from the initial phase of development (Buildings A-D) will be **45.57 L/s**. The available capacity of the downstream sanitary trunk sewer will need to be confirmed with the

City of Waterloo staff. The development phasing will be dependent on sanitary allocation to be confirmed by the City of Waterloo staff.

Storm Servicing and Stormwater Management (SWM):

Stormwater quantity control is to be designed based on the City and Region of Waterloo's post-to-pre-development control approach. Two post-development storm drainage outlets are proposed – one to the Northfield Drive storm sewer via Parkside Drive and another to the Northfield Drive storm sewer via a proposed storm sewer easement on Waterloo Fire Station # 3 property. Quantity control will be implemented using oversized storm sewers, manholes and underground storage chambers within the private roadways and parking lots and in stormwater management cisterns in the underground parking structures of Buildings A-D. Oil grit separator units are proposed to meet the MECP 'Enhanced' level of protection (80% TSS removal). The subject lands fall within the Forwell Creek Subwatershed, which has an infiltration target of 12.5mm. Water balance mitigation shall be provided through infiltration facilities within the parking areas for commercial/industrial buildings, landscaped areas and onsite reuse in Buildings A-D. The existing storm servicing for the Retained Lands "A" parcel will remain and a sewer easement is proposed on the Severed Lands parcel to permit conveyance of stormwater to the Northfield Drive storm sewer.

Grading

The existing grades at the existing buildings and parking lot within the Retained Lands "A" and Severed Lands parcels will remain. The site grading and storm servicing will be designed to capture overland flows in excess of the storm sewer capacity and up to the 1:100 year storm event and direct flows to Northfield Drive. Overland flows from storm events great than the 1:100 year return period will spill onto the CNR corridor.

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1.0 INTRODUCTION

1.1 BACKGROUND

Forgestone Capital Management LP (Forgestone) has retained Counterpoint Engineering Inc. (CPE) to prepare this Functional Servicing and Stormwater Management Report (FSSR) to support the Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBA) for the lands municipally known as 170 & 180 Northfield Drive and 595-630 Parkside Drive in Waterloo (the 'subject lands').

Under existing conditions, the subject site consists of single-storey commercial buildings on the southwest side, surface parking accessible from Parkside Drive and vacant lands along the east and north sides.

The subject site is 16.05 ha in area and is bounded by Northfield Drive to the south, the Canadian National Railway (CNR) corridor to the east, Weber Street North to the west and commercial buildings to the north. It is anticipated that one consent application will sever the lands into three parcels. The Retained Lands "A" parcel will remain unchanged. The Retained Lands "B" parcel is to be redeveloped and while the Severed Lands are to remain as per the existing conditions, future redevelopment has been considered in this report.

Approximately 0.04 Ha of the subject site will be reserved for the road widening of Northfield Drive.

Refer to **Figure 1** for the location of the subject lands within the City of Waterloo and **Figure 2** for the land severance schematic.

1.2 PROPOSED DEVELOPMENT

The proposed development is a mix of residential, employment and commercial uses with high-density housing being the predominant land use. The residential portion of the proposed development will be comprised of high rise buildings and associated multi-storey above-ground and underground parking structures, private roadways and park spaces. The commercial portion of the proposed development will consist of industrial/commercial buildings and associated parking and loading dock areas. A 20 m wide landscaped buffer is proposed along the east property limit and adjacent to the CNR corridor.

Refer to the Site Plan included in **Appendix A** for the development concept.

1.3 PURPOSE OF THE REPORT AND STUDY PARAMETERS

The intent of this report is to demonstrate the viability of water and wastewater servicing, storm drainage and stormwater management with respect to applicable guidelines, policies and design criteria. This report will demonstrate the impact of the proposed development on the infrastructure capacity of the area. The SWM section of this report will identify the rate, quantity and quality impacts of stormwater discharge on existing infrastructure and/or downstream receivers, due to the change in existing conditions. The report will determine if improvements to any private and/or public municipal servicing infrastructure are required to support the proposed development and where applicable, provide strategies for reducing or eliminating negative impacts through mitigation measures.

This report has been prepared based on a review of the topographic survey, background studies and record drawings provided by the City of Waterloo and the Region of Waterloo. The conceptual design is documented in functional servicing plans which are contained in **Appendix A**. The following were referenced in the preparation of this report:

- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS), February 2022
- Development Charges Background Study, Hemson Consulting, January 2020
- The City of Waterloo Comprehensive Engineering and Landscape Manual, Volume 5 – Underground Servicing, Grading and Utilities, Volume 6 – Stormwater Management
- Design Guidelines for Drinking-Water Systems, Updated May 2023 (MOE Guidelines)
- MECP Stormwater Management Planning and Design Manual (SWMPD, 2003)
- Fire Underwriters Survey (FUS), Water Supply for Public Fire Protection Manual 2020

2.0 WATER SUPPLY

2.1 EXISTING WATER SUPPLY

Based on available City of Waterloo and Region of Waterloo records, the existing municipal watermains along the adjacent rights-of-way include the following:

- Existing 600 mm feeder watermain on the north side of Northfield Drive.
- Existing 300 mm watermain on the south side of Northfield Drive.
- Existing 300 mm watermain on Weber Street.
- Existing 300 mm watermain located south of Northfield Drive along Parkside Drive stubbed at the Northfield and Parkside Drive intersection.

- The existing 300 mm watermain on Parkside Drive is situated between on private roadway (Parkside Drive) and terminates at an existing hydrant east of the single-storey commercial building (#180 Northfield Drive).

The existing commercial buildings are supplied by the existing 250 mm private watermain with connections to the Weber Street and Northfield Drive watermains. There are also existing hydrants within the site supplied by the existing private watermain. Refer to **Drawing C-100 – Existing Servicing Plan** for the existing watermain layout.

2.2 DOMESTIC AND FIRE FLOW DEMAND

The DGSSMS states that governing flows shall be the greater of a) maximum day demand plus fire flow, or b) maximum hour demand. Due to a lack of historical data for the subject lands, average daily consumption rates and peaking factors were determined following MECP design guidelines for drinking water systems. For residential demand, an average daily consumption rate of 300 L/c/day and peaking factors of 3.0 and 2.0 were used to determine maximum hour and maximum day demand, respectively. Commercial/Industrial water demand was assumed to be 55 cu.m/day/ha (0.64 L/s/ha) and peaking factors of 2.0 and 4.0 were used to determine maximum hour and maximum day demand. The combined residential and industrial demands are as follows:

- Maximum Hour = 3,232 L/min (development area only)
- Maximum Day + Fireflow = 12,919 L/min (development area only)

The Fire Underwriter's Survey (FUS) guidelines were used to estimate the required fire flow for the development area. The governing building is assumed to be **Building L**, which will require a fire flow of 11,000 L/min, resulting in a maximum day demand plus fire flow of 12,919 L/min. A hydrant flow test will be completed at a later date once the pressure district is confirmed by Region of Waterloo staff to ensure the following pressure criteria are met:

<u>System Pressures</u>

Per the DGSSMS, the preferred design pressure ranges are:

- Average Day and Maximum Day: 350 kPa (50 psi) to 550 kPa (80 psi)
- Minimum Hour and Peak Hour: 275 kPa (40 psi) to 700 kPa (100 psi)

Pressures outside of these ranges are acceptable to the following limits:

- Maximum static pressure (All Scenarios) = 700 kPa (100 psi)
- Minimum pressure (Non-Fire Scenarios) = 140 kPa (20 psi)
- Minimum pressure (Fire Flow + Maximum Day) = 140 kPa (20 psi).

Refer to **Appendix B** for water demand calculations.

2.3 PROPOSED WATER SERVICING STRATEGY

2.3.1 RETAINED LANDS "A"

The existing commercial plaza within the Retained Lands "A" parcel will continue to be serviced by the existing connections to Weber Street and Northfield Drive watermains. The internal water services within this parcel will be disconnected from the water services from other parcels.

Refer to **Drawing C-100 – Existing Servicing Plan** for the existing watermain layout for the Retained Lands "A". Refer to **Drawing C-101WA – Water Servicing Plan** for the proposed watermain layout for the Retained Lands "A" parcel.

2.3.2 RETAINED LANDS "B"

A new 300 mm watermain connection to the existing 300 mm watermain that is currently stubbed at the Northfield Drive and Parkside Drive intersection. The new 300mm watermain will be situated within the new private road (Parkside Drive). The Retained Lands "B" parcel will be provided with a domestic /fireline split at the streetline (300mm fireline and 150mm domestic), a meter in chamber on the domestic line and backflow preventor in chamber on the fireline. Given the heights of most of the proposed buildings will exceed 84 m, a secondary 200mm fireline will be provided for the residential portion of the Retained Lands "B" parcel. A water meter in chamber will be provided on the domestic watermain. Each residential building will be provided with separate connections to the internal fireline/domestic line within the private roadway (150mm domestic/200mm fireline for each residential building). Each commercial building will be provided with a 200mm fireline and 150mm domestic connection to the internal watermains. The proposed internal watermains will terminate at a hydrant and autoflusher. Further consultation with Region of Waterloo staff will be necessary to confirm watermain looping requirements for the proposed Retained Lands "B" parcel. Refer to **Drawing C-101WA – Water Servicing Plan** for the proposed watermain layout for the Retained Lands "B" parcel.

2.3.3 SEVERED LANDS

The Severed Lands parcel (office existing buildings) will use the existing 250mm watermain connection to the existing 300mm watermain on Northfield Drive. The existing water service within the Severed Lands parcel will be disconnected from the water services from other parcels. Furthermore, east of the existing building, the existing water service will be relocated to be fully within the parcel limits. Further

consultation with Region of Waterloo staff will be necessary to confirm watermain looping requirements for Severed Parcel "A".

Refer to **Drawing C-101WA – Water Servicing Plan** for the proposed watermain layout for Severed Lands parcel.

3.0 SANITARY SERVICING

3.1 EXISTING SANITARY SERVICING

There is an existing 375mm sanitary sewer draining west to east along Northfield Drive and east of Parkside Drive. West of Parkside Drive, the sanitary sewer is 300mm and it extends beyond Weber Street. The commercial buildings including Sobeys to the west are serviced by a 250mm sanitary sewer that traverses both the Retained Lands "A" and Severed Lands parcel. The existing buildings (#180 Northfield Drive and 595 Parkside Drive) are connected to this sewer. Refer to **Drawing C-100 – Existing Servicing Plan** for the layout of the existing sanitary sewers

As per the City of Waterloo Sanitary Master Plan (2015) and the Region of Waterloo Wastewater Treatment Master Plan (2018), the subject lands are situated within the Waterloo Waste Water Treatment Plant (WWTP) service area. Sanitary flows from the Northfield Drive sanitary sewer are discharged into the Forwell sanitary trunk sewer just west of Highway 85. The Forwell sanitary trunk sewer traverses the west side of Highway 85 and Forwell Creek valleylands and ultimately discharges into Waterloo WWTP which is located just northwest of the Highway 85 interchange with University Avenue. A map excerpted from the City Sanitary Master Plan indicating the location of subject lands within the Waterloo WWTP service area including the Forwell sanitary trunk sewer is included in **Appendix C**.

In preconsultation with the City of Waterloo staff, concerns over the capacity of the downstream Laurel Creek Trunk Sanitary Sewer and local sewers adjacent to the vicinity of the rail corridor were raised. It is understood that the sewer capacity is to be confirmed by the City of Waterloo staff once the ZBA application is received and intensification of the area including other proposed developments in the surrounding area is considered. Counterpoint has reviewed available existing sanitary drainage plans of the area surrounding the subject site and has determined that the existing 300 mm sanitary sewer on Northfield Drive has a design capacity of 124 L/s at a slope of 0.50%. The existing sanitary design sheet

indicates an existing sanitary design flow of 65 L/s and available capacity of 59 L/s. Refer to the existing sanitary drainage plan and design sheet included in **Appendix C**.

3.2 PROPOSED SANITARY SERVICING

3.2.1 RETAINED LANDS "A"

A new 250mm sanitary connection to the Northfield Drive sewer is proposed for Retained Lands "A". A small segment of existing sanitary pipe from MH PRV44B to MH PRV 444A will be removed to allow separation of the sanitary servicing for Retained Lands "A" and Severed Lands. As there are no proposed site changes within the Retained Lands "A" parcel, there will be no change in the sanitary flows and the existing sanitary flow conditions will be maintained.

Refer to **Drawing C-101SA – Sanitary Servicing Plan** for the location of the proposed sanitary sewer connection.

3.2.2 SEVERED LANDS

The existing sanitary service for No. 595 Parkside Drive building will be rerouted to be fully within the limits of the Severed Lands. This will require a new 200mm pipe to run immediately east of the severance line to connect to the existing sanitary sewer at the south west corner of No.180 Northfield Drive West building as indicated on **Drawing C-101SA – Sanitary Servicing Plan.** The existing sanitary service for No.180 Northfield Drive West building will remain unchanged.

As there are no proposed site changes within the Severed Lands parcel or the existing office buildings within this parcel, there will be no change in the sanitary flows and the existing sanitary flow conditions will be maintained.

3.2.3 RETAINED LANDS "B"

As per the DGSSMS, the sanitary servicing within the Retained Lands "B" parcel shall be designed to meet the following criteria:

- 2.07 persons per unit (Apartments)
- Average Flow – 275 L/c/d (Residential)
- Average Flow – 0.40 L/s/ha (Commercial/Industrial)
- Harmon's peaking factor (Residential)
- Infiltration Allowance of 0.25 L/s/ha

The Retained Lands “B” parcel will be provided with a new 300 mm sanitary sewer connection to the existing 375mm sanitary sewer on Northfield Drive at an existing manhole (F31-4).

The sanitary drainage area for the Retained Lands “B” parcel is 6.31 ha., which consists of a commercial/industrial tributary area of 3.70 ha., a residential area of 2.61 ha and an equivalent residential population of 4,266 persons, which has been determined from the conceptual site plans prepared by Turner Fleischer Architects Inc.. The resulting sanitary peak flow is **52.05 L/s**. Refer to the sanitary design sheet and drainage area plan included in **Appendix C**.

The sanitary drainage area for the ultimate development area (Severed Lands + Retained Lands “B”) is 11.07 ha. The future development lands are anticipated to consist of 1,591 residential units and 2.28 ha of commercial area. The resulting sanitary peak flow for the ultimate development condition is **84.10 L/s**. Refer to the ultimate design sanitary flow calculation sheet included in **Appendix C**.

The Retained Lands “B” parcel will be serviced with a new 300 mm sanitary sewer connection to the Northfield Drive sewer at an existing manhole. An internal sanitary sewer system will be situated within the private roadways of the residential areas to convey flows to the sanitary sewer on the proposed private road. Refer to **Figure C-101SA – Sanitary Servicing Plan** for the proposed sanitary servicing layout.

4.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

4.1 STORMWATER MANAGEMENT CRITERIA

SWM criteria for the subject lands have been established based on several background documents including:

- Grand River Conservation Authority: Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulations
- MECP Stormwater Management Planning and Design Manual (SWMPD, 2003)
- TRCA Low Impact Development SWM Planning and Design Guide (2010)
- City of Waterloo Engineering Design Criteria (Volume 6 – Stormwater management)
- Forwell Creek Functional Drainage Study Class EA, 2001
- DGSSMS

4.1.1 QUANTITY CONTROL

Quantity control is to be designed based on the City and Region of Waterloo's post-to-pre-development control approach. Additionally, the available capacity of the existing Northfield Drive sewer is to be considered. The subject lands are to be outside of the Northland Industrial Area (Phases I, II, III & IV) and Dearborn Industrial Area and as such the unit release rates for those lands are not applicable.

4.1.2 QUALITY CONTROL

In accordance with the SWMPD Manual, an Enhanced Level of protection is required for SWM quality control. This requirement is consistent with the City of Waterloo Design Criteria.

4.1.3 WATER BALANCE

In accordance with the Grand River Source Protection Plan, water balance measures will be incorporated into the design of the subject lands. The objective of the water balance criteria is to capture and manage annual rainfall on-site to preserve the pre-development hydrology. Water balance consists of runoff, infiltration and evapotranspiration. Per the City of Waterloo Stormwater Management criteria, the designs for all development shall strive to match pre-development water balance conditions. As per the Forwell Creek Functional Drainage Study, the runoff volume to be infiltrated or evapotranspirated is based on a 12.5mm rainfall depth over the proposed impervious area of the development area.

4.2 EXISTING HYDROGEOLOGICAL AND GEOTECHNICAL CONDITIONS

The following documents were prepared for the subject site:

- Preliminary Geotechnical Investigation report prepared by Pinchin Limited, dated November 22, 2023
- Preliminary Hydrogeotechnical Assessment report prepared by Pinchin Limited, dated January 24, 2024

The reports state the following findings:

- The highest groundwater level elevation is 346.65 masl measured September 12, 2023.
- Short-term dewatering estimates for the construction within the development area range from 6,902 L/day to 85,972 L/day. An EASR registration will be required for the construction dewatering activities and a PTTW may not be needed.
- The long-term dewatering estimates for most of the development area ranges up to 62,990 L/day, with a PTTW being required for the building within Building A.
- A groundwater quality assessment completed as per the Waterloo Region Sewer Use Bylaw indicated no exceedances for the analyzed parameters, except for an exceedance of the Storm Sewer By Law for TSS.

4.3 EXISTING STORMWATER DRAINAGE

According to the City of Waterloo Stormwater Management Master Plan (SWMP), the subject lands are situated within the Forwell Creek subwatershed area. There are no watercourses or regulated floodplains within the subject lands and the closest watercourse is Forwell Creek which is approximately 400m to the east. Forwell Creek is a tributary of Laurel Creek which ultimately discharges into the Grand River.

A map excerpted from the City's SWMP that shows the location of the subject lands within the Forwell Creek subwatershed area is included in **Appendix D**.

Under pre-development conditions, drainage from the subject site is directed towards two outlet locations namely the CNR corridor and the Northfield Drive storm sewer. The pre-development drainage patterns and areas are indicated on **Figure 3 – Pre-Development Drainage Plan.** Drainage Area A101 represents the area tributary to the CNR corridor and Drainage Area 102 represents the area tributary to the existing Northfield Drive storm sewer. Drainage area A103 represents the portion of the Severed Lands parcel that will continue draining towards the existing Northfield Drive storm sewer and has been considered in the assessment of stormwater management for the Retained Lands "B". Drainage area RW represents the portion of the subject lands that will be ceded to the road widening of Northfield Drive and as such is excluded from the SWM analysis. It should be noted that there are earthen material stockpiles at the northeast corner of the subject lands and they have no impact on the overall drainage patterns within the subject site. Drainage Area 104 represents the Retained Lands "A" parcel whose drainage (minor and major system) is conveyed towards Northfield Drive.

Drainage to the CNR corridor is conveyed by sheetflow over the existing asphalt and softscape surfaces. There is a ditch within the CNR corridor between the track and pathway that drains towards Northfield Drive. Drainage from the adjacent properties to the north is self-contained (no external drainage from the north) and overland flow drainage from the adjacent property to the west is conveyed by the existing driveway along the property line. The storm sewer conveying minor system drainage from the Retained Lands "A" traverses a portion of the Severed Lands parcel just west of the existing building (#180 Northfield Drive). The predevelopment drainage and peak flows are summarized on **Table 4.1** as follows:

Table 4.1: Existing Drainage Conditions

Area ID	Area (Ha)	Runoff Coefficient	Outlet	5-Year Peak Flow Rate (L/s)	100-Year Peak Flow Rate (L/s)
A101	4.24	0.50*	CNR Lands	526	1,198
A102	3.79	0.50*	Northfield Drive	573	1,306
A103	2.57	0.50*	Northfield Drive	497	1,133
A104	5.40	0.85	Northfield Drive	1,388	3,163

** Maximum RC of 0.5 used to calculate the allowable release rate. Actual RC is higher.*

There is an existing 300 mm storm sewer that drains north to south on Weber Street North. This existing storm sewer turns onto Northfield Drive and continues to drain eastwards where it increases to 525mm and 750mm east and west of Parkside Drive, respectively. There is a storm sewer system that services the Retained Lands "A" parcel and a portion of the Severed Lands parcel. This storm sewer system connects to the existing Northfield Drive storm sewer just west of the existing building (#180 Northfield Drive). The majority of the Severed Lands parcel including the existing Parkside Drive roadway is serviced by a separate storm system that connects to the existing Northfield Drive West storm sewer at the Parkside Drive intersection. There are two OGS units at the property lines for each of the existing storm sewer system that provides quality control for their respective service areas. The remainder of the subject site drains by sheet flows towards Northfield Drive and the CNR corridor.

Refer to the existing storm servicing indicated on **Drawing C-100 - Existing Servicing Plan**.

4.4 QUANTITY CONTROL

Per the City of Waterloo stormwater management guidelines, post-development peak flows shall be attenuated to be less than or equal to pre-development levels. As per the received Region of Waterloo comments, no drainage onto the rail corridor will be permitted and as such all drainage will be directed to Northfield Drive. To maintain a balanced earthwork cut and fill for the Retained Lands "B", the proposed SWM strategy will implement two drainage outlets to – one draining to Northfield Drive via Parkside Drive (Outlet 1) and the other draining to Northfield Drive via a proposed storm sewer easement on Waterloo Fire Station #3 property (Outlet 2).

The SWM strategy for the lands tributary to the Northfield Drive shall be to control post-development peak flows for all storms up to and including the 100-year storm to the 5-year pre-development peak flow rate. The 5-year flows will be further restricted to the available capacity of the receiving storm sewer. The Retained Lands "A" parcel (Area A104) will remain unchanged in the post-development condition.

Refer to **Appendix D** for allowable release rate calculations and **Figure 4 – Post Development Drainage Plan** proposed drainage patterns, areas and runoff coefficients**.**

4.4.1 NORTHFIELD DRIVE OUTLET 1

Major and minor flows from the proposed development that are tributary to the Northfield Drive Outlet 1 will be captured and conveyed by storm sewers and catchbasins within the private road (Parkside Drive) and driveways.

Within the private road, oversized pipes are proposed to provide detention storage and multi-orifice controls at MH.103 are proposed to restrict flows to less than or equal to the allowable release rate. In the 100 year storm event, the 100-year orifice control will restrict flows to **877.1 L/s**, which is less than the allowable release rate to Northfield Drive Outlet 1. In the 5 year event, the 5-year orifice control will restrict flows to **237.2 L/s**, which is less than the allowable release rate to Northfield Drive Outlet 1. As a result, in the 100-year storm event, the orifice control at MH103 will require **343 m^3** of detention storage, and the total available underground storage of **350 m^3** as indicated on **Drawing C101ST – Storm Servicing Plan**. Refer to **Appendix D** for orifice sizing calculations, as well as available and required storage calculations.

Each building will be provided with stormwater management controls and control flows will be discharged into the storm sewer within the private roadways.

Buildings A-D will discharge onto the storm sewer on the proposed private road at a combined **350 L/s** for the 1:100 return period storm event and approximately **450 m^3** of detention storage will be required and provided through cisterns located within the underground parking structures.

In the post-development condition, a portion of the Severed Lands parcel (Drainage Area 203 on **Figure 4A – Post Development Drainage Plan**) will continue to drain towards the Northfield Drive Outlet 1 through the Retained Lands “B” parcel. Area 203, which comprises of the existing office buildings and parking lot will be provided with SWM controls (interim drainage conditions) so that a maximum of 200 L/s is discharged to the Retained Lands “B” parcel for the interim drainage condition. A control orifice is proposed at MH.1 to restrict parking lot and building storm flows and detention storage will be provided through the parking lot surface, existing and proposed manholes, sewers and catch basins for a total of **300 m^3** of storage as indicated on **Drawing C101ST – Storm Servicing Plan**.

Additional SWM controls will be required for full buildout of the office lands and will be detailed under a separate cover. The ultimate drainage conditions are indicated on **Figure 4B – Post Development Drainage Plan.**

Providing controlled flows and detention storage within the residential buildings/underground parking structures allows for a reduced volume of detention storage within the private roadway and as such no stormwater management facility (SWM pond) will be required for the Northfield Drive outlet.

The south portion of the office building (Area 204) will drain uncontrolled towards Northfield Drive.

4.4.2 NORTHFIELD DRIVE OUTLET 2

Stormwater management will be applied to the portion of the Retained Lands "B" parcel that is tributary to Northfield Drive Outlet 2 to ensure post-development drainage outletting to the receiving storm sewer equal to or less than pre-development conditions.

Stormwater is proposed to be captured and conveyed by storm sewers and outlet to Northfield Drive via a proposed storm sewer easement to be located within Waterloo Fire Station #3 property. The Retained Lands "B" parcel will be provided with SWM controls to attenuate stormwater flows to the allowable discharge rates.

Measures such as an underground storage facility (Cultec system), rooftop detention (Buildings J and L) and oversized storm sewers and manholes on the private roadways will be implemented to provide the required stormwater storage and as such no SWM facility will be required for Northfield Drive Outlet 2.

The SWM strategy for Northfield Drive Outlet 2 assumes the Retained Lands "B" will discharge stormwater to the allowable release rates for the 100 year storm event and to the available capacity of the receiving storm sewer for the 5 year event. Oversized pipes within the private roadways will provide detention storage and control manholes with orifice/weir controls are proposed to restrict flows to be less than or equal to the respective allowable release rate.

Building J (SWM Area 303) and associated parking areas will be provided with onsite SWM controls that will discharge at **185 L/s** into MH.400 and approximately **253 m^3** of storage will be required for the 1:100-year return period storm event.

Building L (SWM Area 304) and associated parking areas will be provided with onsite SWM controls that will discharge at **250 L/s** into MH.304 and approximately **747 m^3** of storage will be required for the 1:100-year return period storm event.

The 1:100 year discharge from Uncontrolled SWM Area 305 is 83 L/s and the combined 1:100 year discharge at the Northfield Drive Outlet 2 will be **669 L/s** which is less than the allowable rate of **1,213 L/s**.

Refer to **Appendix D** for orifice sizing calculations, as well as available and required storage calculations.

4.5 QUALITY CONTROL AND WATER BALANCE

4.5.1 RETAINED LANDS "A"

Given that the proposed severance or development will require no changes to the stormwater management for the Retained Lands "A" parcel, there will be no additional quality control or water balance measures required.

4.5.2 SEVERED LANDS (EXISTING OFFICE LANDS)

In the interim , the Severed Lands parcel will remain unchanged. Interim drainage will be directed towards the Retained Lands "B" parcel and quality control will be provided as described in **Section 4.5.3**. No onsite quality control and water balance measures are proposed within the Severed Lands parcel (Areas 202 & 204).

4.5.3 RETAINED LANDS "B"

The Retained Lands "B" parcel will be provided with an OGS device downstream of each control manhole to meet the MECP 'Enhanced' level of protection (80% TSS removal).

- OGS device (OGS1) for the Northfield Drive Outlet 1 will be a CDS-CS-4 unit. The OGS device will be situated within the private roadway and will service the residential areas (Area 201), the private roadway (SWM Areas 202 + 302) and existing office lands (Area 203 + 301).
- Buildings J and L (SWM Areas 303 and 304) will each be provided with OGS devices that will be sized for their respective service areas. Refer to the **Drawing C101 – General Servicing Plan** for the location of the proposed OGS devices.

The subject lands fall within the Forwell Creek Subwatershed, which has an infiltration target of 12.5mm across the development area. Water balance measures will only be applied within the residential areas (Area 201) and the commercial areas (Areas 303 and 304).

To retain the 12.5mm event throughout the development area requires **1,385 m^3** of water balance retention storage. Water balance shall be provided through infiltration and onsite reuse as follows:

- Landscaping – Initial Abstraction (5mm initial abstraction): **62.5 m^3**
- Onsite Reuse – Buildings A-D (30mm initial abstraction): **574.6 m^3**
- Buildings J & L Infiltration Galleries (40mm initial abstraction): **768.4 m^3**

Refer to **Figure 5 – Water Balance Plan** for the delineation of areas used in the water balance assessment. The details of quality control/water balance mitigation measures for the proposed development shall be provided at the SPA/detail design stages. Preliminary designs for OGS units and water balance calculations are included in **Appendix D**.

4.6 STORM DRAINAGE FOR RETAINED LANDS "A"

In the interim post-development condition, the Retained Lands "A" parcel (Drainage Area 104 which includes the parking lot on the west side of the buildings within the Severed Lands parcel will continue to drain towards the Northfield Drive storm sewer as per the existing condition and no additional quantity controls will be required. The existing storm servicing for the Retained Lands "A" parcel will remain and a sewer easement is proposed on the Severed Lands parcel to permit conveyance of stormwater to the Northfield Drive storm sewer. Refer to **Drawing C101 – General Servicing Plan** for the location of the proposed storm sewer servicing for the commercial plaza. In the ultimate post-development condition, the servicing for the Retained Lands "A" parcel will be relocated to within that parcel's limits to accommodate the future development of high-rise buildings and underground parking structures within the Severed Lands.

5.0 GRADING

Based on a review of the topographic survey, the subject lands (Retained Lands "B" parcel) slopes from an elevation of 349.55m at the southwest corner of the Retained Lands "A" parcel down to 339.08m at the south-east corner of the development parcel equating to a differential of 10.47m and an average slope of 2.6%.

The design grades along the southern limit of the Retained Lands "B" parcel will be established based on the existing grades. The design grades along the CNR corridor are assumed to match existing grades and will need to be coordinated with the City of Waterloo with regards to the potential northward extension of the multi-use pathway.

Given that the existing commercial buildings (#180 Northfield Drive and 595 Parkside Drive) are proposed to remain, a temporary retaining wall and transition sloping on the adjacent lands will be required on the west side of the Retained Lands "B" parcel. The existing grades at the existing buildings and parking lot within the Retained Lands "A" and Severed Lands parcels will remain. A key element in the grading strategy of the Retained Lands "B" parcel is to maintain existing drainage patterns as much

as possible. Overland flows from the private roadways within the south half of the Retained Lands "B" parcel will be directed towards Northfield Drive. The site grading and storm servicing will be designed to capture overland flows in excess of the storm sewer capacity and up to the 1:100 year storm event and direct flows to Northfield Drive. Overland flows from storm events great than the 1:100 year return period will spill onto the CNR corridor.

Elsewhere, existing grades will be maintained at the property lines/development limits. The subject lands are to be graded in accordance with the City of Waterloo engineering guidelines, which require that paved areas range from 0.5% to 5.0% and that sodded slopes range from 2.0% to 5.0%. For large grade differentials, a maximum slope of 3H:1V can be used for embankments. Based on a review of the GRCA regulation mapping, the subject site is not located in an area that is regulated by the GRCA.

The preliminary grading design (**Drawing C-201 General Grading Plan** and **Drawing C-202 Grading Sections**) is included in **Appendix A**. It should be noted that a separate servicing/grading plan and a stormwater management report will be provided when the Severed Lands are developed.

6.0 DEVELOPMENT PHASING

The applicant intends to proceed with the development of Buildings A-D in the initial phase of development (Phase 1). It is assumed the development of the commercial area (Buildings J & L) will proceed after the approval of Buildings A-D (Phase 2) and Phase 3 will be a full buildout of the Severed Lands and Retained Lands "B" parcels.

For sanitary servicing, the sanitary flows shall be phased as follows:

- Phase 1 (Buildings A-D) – **45.57 L/s**. The existing Severed Lands parcel will continue to discharge to the Northfield Drive sanitary sewer using the existing sanitary connection. The existing 300mm Northfield Drive sanitary sewer has an available capacity of 59 L/s (equivalent to approximately 2,700 residential units) and as such it may be sufficient to service Phase 1 (assuming sanitary flows from other developments within the sanitary drainage area are excluded and available capacity in the Laurel Creek Trunk Sanitary Sewer is confirmed).
- Phase 2 (Buildings J & L) – **6.48 L/s**
- Phase 3 **(**Buildings E, F, G, H, I and K on Severed Lands) – **40.22 L/s**
- Phases 1-3 (Full buildout of the Severed Lands and Retained Lands "B" parcels, including Buildings I, J, K, & L) – **84.10 L/s**. Refer to the annotated Site Plan included in **Appendix A** for development phasing.

The development of Phases 2 and 3 will require upgrading of the existing sanitary sewer on Northfield Drive. Phase 1 may also require upgrading of the existing sanitary sewer should other developments within the sanitary drainage area be allocated the available capacity. The available capacity of the sanitary trunk sewer will need to be confirmed with the City of Waterloo staff. The development phasing will depend on the sanitary allocation for the trunk sewer to be confirmed by the City of Waterloo staff.

For storm sewer servicing and SWM, development phasing shall be as follows:

- Phase 1 (Northfield Drive storm sewer outlet) – controlled at 1,213 L/s maximum for the 1:100-year event. The existing commercial building (#180 Northfield Drive and parking lot only) will continue to discharge to the Northfield Drive storm sewer through the development parcel.
- Phase 1 (CNR corridor outlet) – a temporary SWM facility (located near the level spreader outlet) may be necessary to provide the required level of SWM quantity and quality for that outlet as determined in **Section 4**. Drainage from the existing building (595 Parkside Drive) and the private road will be directed towards that temporary SWM facility.
- In Phase 2, for both the Northfield Drive and CNR corridor outlet, Phase 2 SWM controls (not outlined in this report) will be implemented to meet the requirements outlined in **Section 4**.
- In Phase 3, the subject site will be provided with permanent SWM controls to meet the requirements outlined in **Section 4.**

7.0 EROSION AND SEDIMENT CONTROLS

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff, measures for erosion and sediment control are required for construction sites. The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities (GHACA). In December 2006, the GHACA released the document titled “Erosion & Sediment Control Guidelines for Urban Construction”. This document provides guidance for the preparation of effective erosion and sediment control plans. The following is a summary of ESC measures to be implemented:

- Silt fences are to be installed adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.

- Mud mat is to be installed at the construction entrance prior to commencing earthworks to minimize the tracking of mud onto municipal roads.
- Sediment traps are to be installed at all catchbasin and area drain locations once the storm sewer system has been constructed to prevent silt-laden runoff from entering the municipal storm sewer system.
- For the topsoil stripping and earthworks stages of construction, a temporary sediment control basin (TCSB) will be implemented to clarify silt-laden stormwater runoff by promoting sedimentation of the suspended particles in the runoff through long detention times. The sediment basins are typically sized based on a required storage volume of 250 m^3 per hectare of disturbed area (125 m^3/ha of permanent pool and 125 m^3/ha of active storage). The outlet for TSCB will be provided with a pump and a flexible pipe to discharge clarified stormwater to a suitable outlet along the CNR corridor.

8.0 CONCLUSIONS

Our conclusions as they relate to the proposed land severance, and more specifically, the submission requirements required in connection with the application to amend the Zoning By-law, are as follows:

- There are available municipal watermains to service the existing and proposed developments. A hydrant test will be completed to confirm if there is adequate system pressure to service the proposed development. Further consultation with Region of Waterloo staff to confirm watermain looping requirements.
- Sanitary flow allocation/development phasing will need to be confirmed with the City of Waterloo staff through additional consultation.
- The existing storm servicing can support the existing and proposed development.
- There are two storm drainage outlets to Northfield Drive: Outlet 1 is through Parkside Drive and Outlet 2 via Waterloo Fire Station #3. SWM quantity controls within the Retained Lands “B” parcel are proposed to meet the applicable SWM criteria.
- Water balance will be achieved through onsite reuse measures, landscaping surfaces and infiltration galleries.
- Stormwater quantity controls to achieve an Enhanced Level of protection will be implemented within the Retained Lands “B” parcel.
- Site grading will be designed in accordance with the City of Waterloo design criteria.
- Erosion and sediment controls are to be implemented during construction to prevent silt laden runoff from leaving the site.

Based on the assessment provided above, the proposed land severance and development can meet all applicable engineering criteria of the City of Waterloo, the Region of Waterloo and the Grand River Conservation Authority. Sanitary flow allocation/development phasing will need to be confirmed with the City of Waterloo staff through additional consultation.

We trust the information provided in the report meets your requirements. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Engineering Inc.



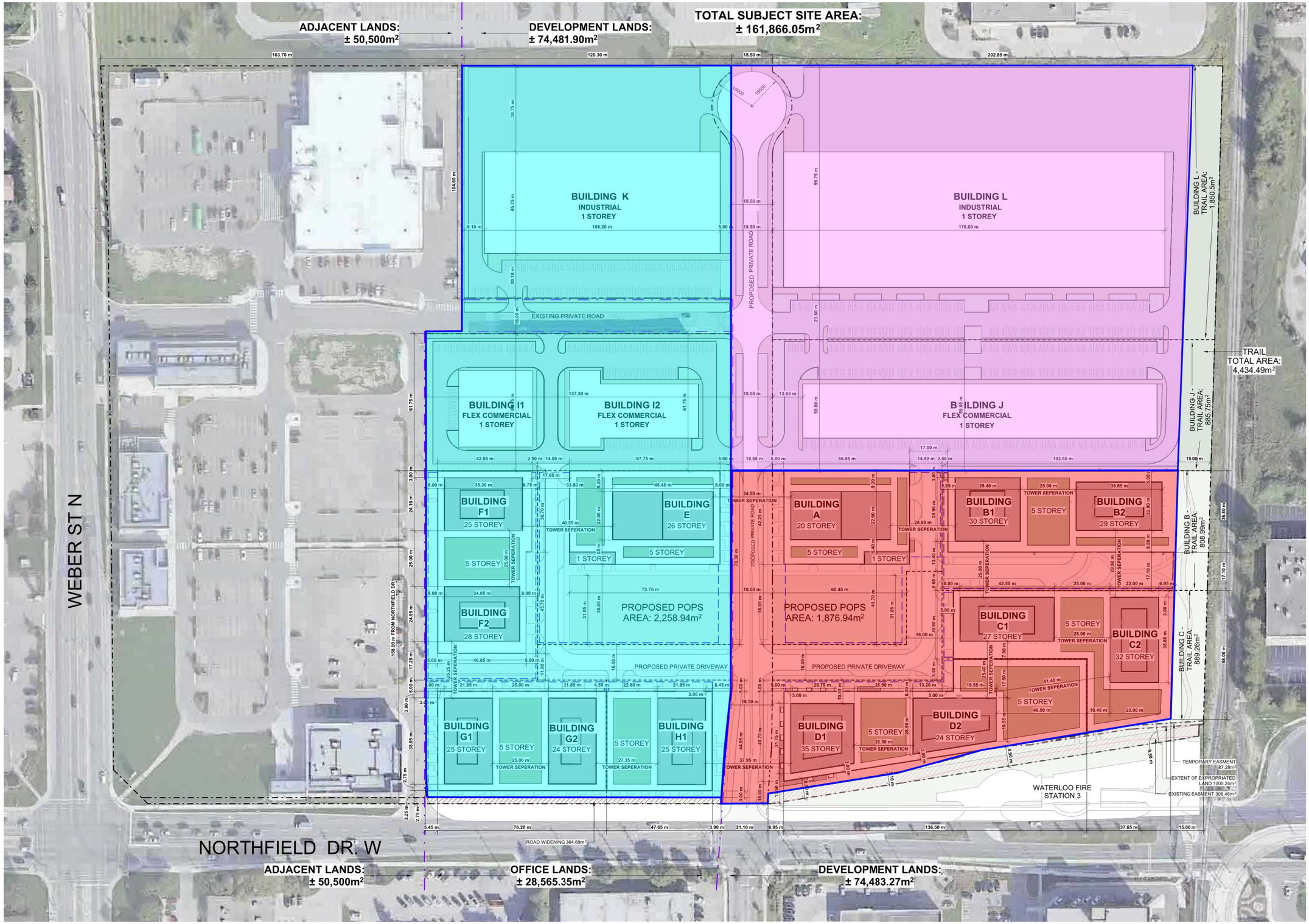
Pula Mathumo, P.Eng
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APPENDIX A

Site Plan, Development Statistics and Drawings/Figures

Project No.: 22051



TURNER FLEISCHER

Turner Fleischer Architects Inc.

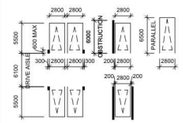
67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

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TYPICAL PARKING DIMENSIONS:

AISLE WIDTH: MIN 6.1m

TYPICAL PARKING SPACE:
MIN 2.8 x 5.5 x 2.0m HIGH



TYPICAL BARRIER FREE SPACE:

TYPE A: MIN 3.7 x 5.5 x 2.1m HIGH
TYPE B: MIN 2.4 x 5.5 x 2.1m HIGH



PHASE 1

PHASE 2

PHASE 3

#	DATE	DESCRIPTION	BY
2	2025-01-17	ISSUED FOR RESUBMISSION (DRAFT)	DVI
1	2024-02-28	ISSUED FOR REZONING	DVI

PROJECT
170 Northfield Drive West, Waterloo

170 Northfield Drive West, Waterloo, Ontario

DRAWING
OVERALL SITE PLAN

PROJECT NO.	22.237P01
PROJECT DATE	2024-02-28
DRAWN BY	DVI
CHECKED BY	RMM
SCALE	1:750

DRAWING NO. RZ013 | REV. 2

2025-01-17 4:49:01 PM

BUILDING AREA SUMMARY	m²	ft²	% GROSS SURVEY SITE AREA
DEVELOPMENT LANDS SUMMARY			
BUILDING A	5,458.05	58,758	3.37%
BUILDING B	6,482.02	69,772	4.01%
BUILDING C	5,345.41	57,538	3.31%
BUILDING D	5,988.38	64,458	3.70%
BUILDING J	11,707.48	126,018	7.24%
BUILDING K	13,173.74	141,802	8.15%
BUILDING L	24,564.51	264,419	15.19%
SERVICING EASEMENT	1,751.02	18,849	1.08%
DEVELOPMENT LANDS SUB-TOTAL	**74,470.61**	**801,595**	**46.05%**
OFFICE LANDS SUMMARY			
BUILDING E	6,831.58	73,535	4.22%
BUILDING F	4,685.96	50,426	2.90%
BUILDING G	4,288.10	46,157	2.65%
BUILDING H	2,842.65	30,598	1.76%
BUILDING I	8,437.84	90,824	5.22%
SERVICING EASEMENT	1,395.98	15,026	0.86%
OFFICE LANDS SUBTOTAL	**28,482.11**	**306,576**	**17.61%**
ROADS AND PUBLIC LANDS SUMMARY			
PARKSIDE DRIVE PRIVATE ROAD	6,179.27	66,513	3.82%
PARKSIDE DRIVE CUL-DE-SAC (TEMP)	392.63	4,226	0.24%
NORTHFIELD DR ROAD WIDENING	759.94	8,180	0.47%
EXPROPRIATED LANDS	1,026.63	11,051	0.63%
EXISTING EASEMENT	309.92	3,336	0.19%
PUBLIC LANDS SUB-TOTAL	**8,668.39**	**93,306**	**5.36%**
ADJACENT LANDS	**50,107.29**	**539,350**	**30.98%**
GROSS SITE AREA	**161,728.40**	**1,740,830**	**100.00%**

DEFINITIONS:

CITY OF WATERLOO ZONING BY-LAW 2018-050:

BUILDING FLOOR AREA
means the gross floor area of a BUILDING measured between the outside of all exterior walls, includes an attic with a clear ceiling of 2.15m for at least 50% of the attic floor area. Excludes STRUCTURED PARKING.

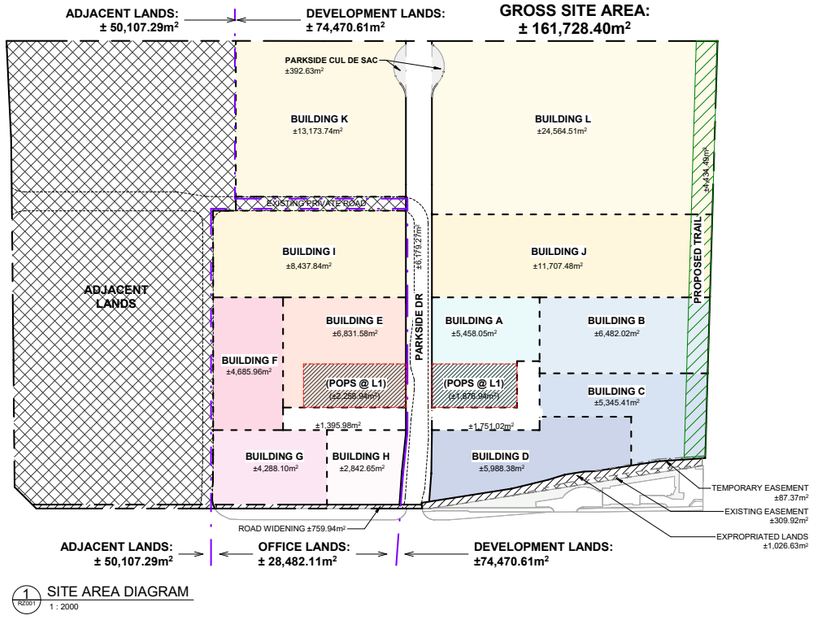
BUILDING HEIGHT
means the vertical distance from the finished ground level abutting the FRONT BUILDING FACADE, measured as the average of five (5) points CITY OF WATERLOO ZBL-2018 - 050 PAGE 1.6 equally spaced apart adjacent to the entire FRONT BUILDING FACADE to:

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;

b.) for a mansard roof, the roof deck line;
c.) for a gable, hipped, cottage, gambrel, or peaked roof, the mid-point measured between the eaves and the ridges.

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

FLOOR AREA RATIO



1 RZ001 SITE AREA DIAGRAM
1 : 2000

BUILDING LEGEND
- BUILDING A
- BUILDING B
- BUILDING C
- BUILDING D
- BUILDING E
- BUILDING F
- BUILDING G
- BUILDING H
- BUILDING I
- BUILDING J
- BUILDING K
- BUILDING L

BLOCK SEPARATION LEGEND
- PROPERTY BOUNDARY
- BUILDING DELINEATION
- EASMENT DELINEATION

PHASE	BUILDING	GROSS BUILDING AREA: RESIDENTIAL BFA m2	RESIDENTIAL BFA ft2	COMMERCIAL BFA m2	COMMERCIAL BFA ft2	TOTAL BFA m2	TOTAL BFA ft2	FAR	AMENITY BREAKDOWN (INCLUDED IN BFA): INDOOR PROVIDED m2	INDOOR PROVIDED PER UNIT	OUTDOOR PROVIDED m2	OUTDOOR PROVIDED PER UNIT	GROSS CONSTRUCTION AREA m2	GROSS CONSTRUCTION AREA ft2
PHASE 1	BUILDING A (TOWER A (20 STY))	22,248	239,481			22,248	239,481	4.08	791.2	3.3	405.5	1.7	31,040	334,118
	BUILDING B (TOWER B1 (16 STY) TOWER B2 (16 STY))	57,103	614,654			57,103	614,654	8.81	2,208.0	3.3	744.0	1.1	70,557	821,848
	BUILDING C (TOWER C1 (11 STY) TOWER C2 (12 STY))	51,196	550,640			51,156	550,640	9.57	1,917.6	3.4	691.8	1.2	70,822	762,333
	BUILDING D (TOWER D1 (15 STY) TOWER D2 (18 ETY))	55,452	596,883	341.9	3,680.3	55,452	596,883	9.26	1,999.2	3.3	748.2	1.2	74,931	806,559
	TOTAL	**185,958.6**	**2,001,658**	**341.9**	**3,680**	**185,958.6**	**2,001,658**	**7.43**	**6,916.0**	**3.4**	**2,589.5**	**1.3**	**253,331.2**	**2,726,857**
PHASE 2	BUILDING E (TOWER E (26 STY))	28,943	311,542			28,943	311,542	4.24	1,036.3	3.1	464.8	1.5	40,291	433,691
	BUILDING F (TOWER F1 (23 ETY) TOWER F2 (26 STY))	41,865	450,635			41,865	450,635	8.93	1,627.0	3.3	620.8	1.2	58,458	629,238
	BUILDING G (TOWER G1 (26 STY) TOWER G2 (26 STY))	41,577	447,534			41,577	447,534	9.70	1,685.5	3.4	973.5	1.9	57,277	616,528
	BUILDING H (TOWER H1 (27 STY))	22,165	238,580			22,165	238,580	7.80	825.6	3.2	467.2	1.8	31,040	334,115
	TOTAL	**134,549.5**	**1,448,291**			**134,549.5**	**1,448,291**	**6.71**	**5,174.4**	**3.3**	**2,566.4**	**1.6**	**187,065.3**	**2,013,571**
PHASE	**BUILDING**	**RESIDENTIAL BFA**		**COMMERCIAL BFA**		**TOTAL BFA**		**FAR**	**INDOOR PROVIDED**		**OUTDOOR PROVIDED**		**TOTAL GCA**	
PHASE 1+2	GRAND TOTAL	320,508.1	3,449,949	341.9	3,680	320,508.1	3,449,949	7.11	12,090.5	3.3	5,155.9	1.4	440,396.5	4,740,428
PHASE 3	BUILDING I			2,691.1	28,967.0	2,691	28,967	2.12					2,691	28,967
	BUILDING J			3,890.5	41,877.3	3,891	41,877	0.33					3,828	41,307
	BUILDING K			4,855.5	52,264.6	4,856	52,265	0.37					4,856	52,265
	BUILDING L			10,460.4	112,595.7	10,460	112,596	0.43					10,460	112,596
	TOTAL			**21,897.5**	**235,705**	**21,897.5**	**235,705**	**0.38**					**21,835.2**	**235,034**
PHASE	**BUILDING**	**RESIDENTIAL BFA**		**COMMERCIAL BFA**		**TOTAL BFA**		**FAR**	**INDOOR PROVIDED**		**OUTDOOR PROVIDED**		**TOTAL GCA**	
ALL PHASES	GRAND TOTAL	320,508.1	3,449,949	22,239.4	239,385	342,405.6	3,685,654	3.07	12,090.5	3.3	5,155.9	1.4	462,231.7	4,975,462

PARKING BREAKDOWN	REQUIRED #	PROVIDED #	PER UNIT #	VISITOR RATE #	RESIDENT RATE #
BUILDING A (TOWER A (20 STY))	191	191	0.80	0.10	0.70
BUILDING B (TOWER B1 (16 STY) TOWER B2 (16 STY))	528	528	0.80	0.10	0.70
BUILDING C (TOWER C1 (11 STY) TOWER C2 (12 STY))	448	448	0.80	0.10	0.70
BUILDING D (TOWER D1 (15 STY) TOWER D2 (18 ETY))	480	480	0.80	0.10	0.70
	1,647	**1,647**	**0.80**	**0.10**	**0.70**
BUILDING E (TOWER E (26 STY))	269	269	0.80	0.10	0.70
BUILDING F (TOWER F1 (23 ETY) TOWER F2 (26 STY))	398	401	0.81	0.10	0.71
BUILDING G (TOWER G1 (26 STY) TOWER G2 (26 STY))	401	401	0.80	0.10	0.70
BUILDING H (TOWER H1 (27 STY))	209	209	0.80	0.10	0.70
	1,271	**1,274**	**0.80**	**0.10**	**0.70**
	REQUIRED	**PROVIDED**	**PER UNIT**	**VISITOR RATE**	**RESIDENT RATE**
	2,918	**2,921**	**0.80**	**0.10**	**0.70**
	REQUIRED	**PROVIDED**	**PER 100SF**		
	41	73	2.71		
	59	157	4.04		
	73	69	1.42		
	157	104	0.99		
	330	**405**	**1.84**		

UNIT BREAKDOWN	UNITS #	STUDIO #	1B #	1B+D #	2B #	2B+D #	3B #	3B+D #
BUILDING A (TOWER A (20 STY))	239	14	74	28	80	30	13	
BUILDING B (TOWER B1 (16 STY) TOWER B2 (16 STY))	660	60	130	120	150	120	60	
BUILDING C (TOWER C1 (11 STY) TOWER C2 (12 STY))	561	51				51	53	
BUILDING D (TOWER D1 (15 STY) TOWER D2 (18 ETY))	601	55	143	106	212	34	51	
	2,061	**180**	**185**	**443**	**302**	**646**	**231**	**175**
		8.7%	**821**			**881**		**175**
			90.0%			**42.7%**		**8.5%**
BUILDING E (TOWER E (26 STY))	329	20	80	88	112	20	11	
BUILDING F (TOWER F1 (23 ETY) TOWER F2 (26 STY))	498	41					41	
BUILDING G (TOWER G1 (26 STY) TOWER G2 (26 STY))	502	40	80	123	308	2	41	4
BUILDING H (TOWER H1 (27 STY))	262	21	106	21	105			9
	1,591	**122**	**122**	**416**	**312**	**615**	**22**	**91**
		7.7%	**728**			**637**		**106**
			85.8%			**39.9%**		**6.7%**
TOTAL	**3,652**	**STUDIO** **302** **8%**	**1B** **859**	**1B+D** **694** **41%**	**2B** **1,259** **42%**	**2B+D** **257**	**3B** **268** **8%**	**3B+D** **13**

PROPOSED UNIT COUNT FOR THIS SUBMISSION

PROPOSED UNIT COUNT FOR FUTURE DEVELOPMENT

TOTAL UNITS FOR ENTIRE SITE (ULTIMATE CONDITIONS)

ORIGINAL RZ:	STUDIO	1B	1B+D	2B:	2B+D:	3B:	3B+D:
	307	1,804	264	1,360	72	460	n/a
	7%	48%		34%		11%	n/a

TOTAL UNITS:	4,267

TURNER FLEISCHER

Turner Fleischer Architects Inc.

67 Lesmill Road
Toronto, ON. M3B 2T6
T 416 425 2222
turnerfleischer.com

This drawing, as an instrument of service, is provided by and is the property of Turner Fleischer Architects Inc. The contractor must verify and accept responsibility for all dimensions and conditions on site and must notify Turner Fleischer Architects Inc. of any variations from the supplied information. This drawing is not to be scaled. The architect is not responsible for the accuracy of digital files or reproductions of original drawings issued previously to this project. The contractor is to coordinate all consultant's drawings before proceeding with the work. Construction must conform to all applicable codes and requirements of authorities having jurisdiction. The contractor working from drawings not specifically marked 'For Construction' must assume full responsibility and bear costs for any corrections or damages resulting from his work.

DRAWING LIST

DRAWING NUMBER	DRAWING NAME	Revision Date
RZ000	COVER SHEET	2025-01-17
RZ001	STATISTICS-SUMMARY	2025-01-17
RZ002	STATISTICS-BLOCK A	2025-01-17
RZ003	STATISTICS-BLOCK B	2025-01-17
RZ004	STATISTICS-BLOCK C	2025-01-17
RZ005	STATISTICS-BLOCK D	2025-01-17
RZ006	STATISTICS-BLOCK E	2025-01-17
RZ007	STATISTICS-BLOCK F	2025-01-17
RZ008	STATISTICS-BLOCK G	2025-01-17
RZ009	STATISTICS-BLOCK H	2025-01-17
RZ010	CONTEXT PLAN	2025-01-17
RZ011	SURVEY	2025-01-17
RZ012	MASTERBLOCK PLAN	2025-01-17
RZ013	OVERALL SITE PLAN	2025-01-17
RZ014	SITE PLAN / ROOF PLAN - RESIDENTIAL	2025-01-17
RZ021	LANDSCAPE OPEN SPACE DIAGRAM	2025-01-17
RZ022	FLOOR 01 - ACTIVE USES DIAGRAM	2025-01-17
RZ101	UNDERGROUND LEVEL 01	2025-01-17
RZ151	FLOOR 01	2025-01-17
RZ152	FLOOR 02	2025-01-17
RZ153	FLOOR 03-05 (TYPICAL)	2025-01-17
RZ154	FLOOR 06	2025-01-17
RZ155	FLOOR 07 (TYPICAL)	2025-01-17
RZ161	SITE PLAN / ROOF PLAN - COMMERCIAL	2025-01-17
RZ162	FLOOR 01 - COMMERCIAL	2025-01-17
RZ301	ELEVATIONS	2025-01-17
RZ302	ELEVATIONS	2025-01-17
RZ303	ELEVATIONS	2025-01-17
RZ304	ELEVATIONS	2025-01-17
RZ401	BUILDING SECTIONS	2025-01-17
RZ402	BUILDING SECTIONS	2025-01-17
RZ403	BUILDING SECTIONS	2025-01-17
RZ901	3D PERSPECTIVE	2025-01-17
RZ902	3D PERSPECTIVE	2025-01-17
RZ903	3D PERSPECTIVE	2025-01-17
RZ911	SHADOW STUDIES	2025-01-17
RZ912	SHADOW STUDIES	2025-01-17
RZ913	SHADOW STUDIES	2025-01-17
RZ914	SHADOW STUDIES	2025-01-17
RZ915	SHADOW STUDIES	2025-01-17
RZ916	SHADOW STUDIES	2025-01-17
RZ917	SHADOW STUDIES	2025-01-17
RZ918	SHADOW STUDIES	2025-01-17
RZ919	SHADOW STUDIES	2025-01-17
RZ920	SHADOW STUDIES	2025-01-17

#	DATE	DESCRIPTION	BY
2	2025-01-17	ISSUED FOR REZONING #2	DRO
1	2024-02-28	ISSUED FOR REZONING	DVI

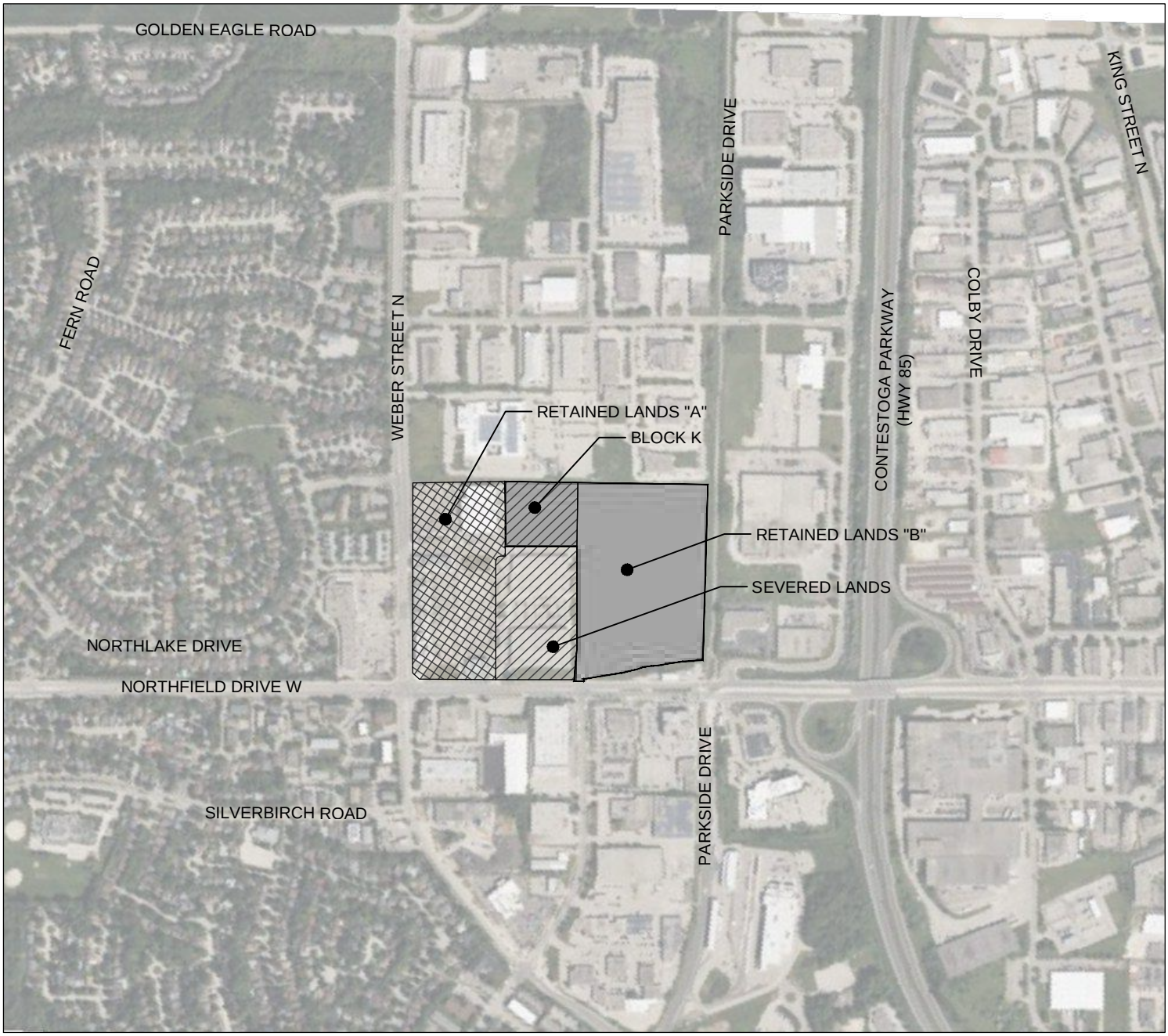
PROJECT
PROPOSED MIXED-USE DEVELOPMENT
170 Northfield Drive West, Waterloo, Ontario

DRAWING
STATISTICS-SUMMARY

PROJECT NO. 22.237P01
PROJECT DATE 2025-02-25
DRAWN BY DVI
CHECKED BY RMM
SCALE As indicated

DRAWING NO. RZ001 REV. 2

2025-02-28 9:46:32 AM





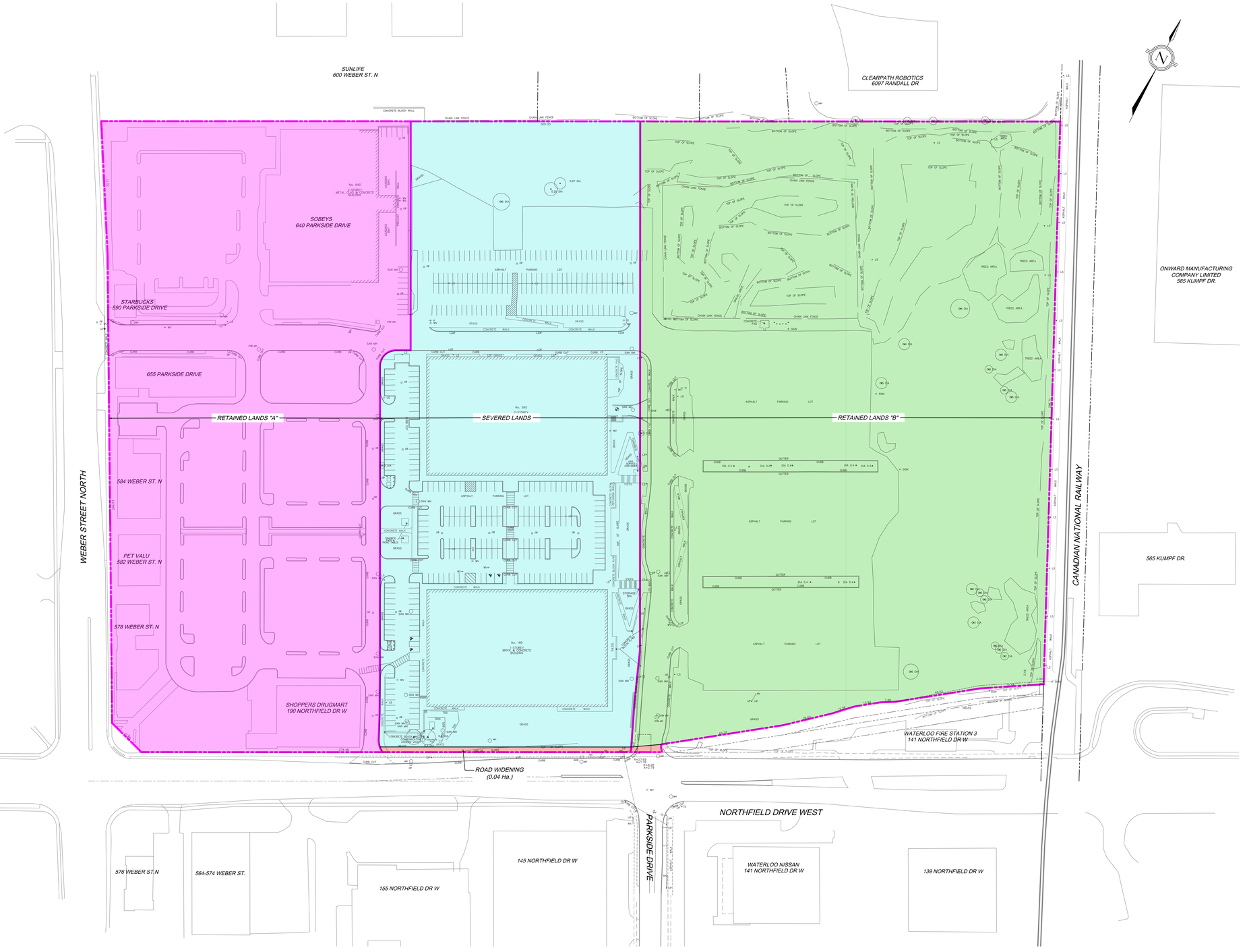
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170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

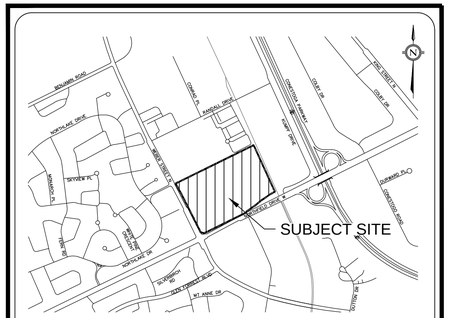
SITE LOCATION PLAN

DESIGNED BY: ML	DATE: NOV 13, 2023
CHECKED BY: PM	PROJECT No. 22051
DRAWING BY: ML	
CHECKED BY: PM	FIGURE No. 1
SCALE: NTS	

Z:\Shared\Projects\2022\22051_Forgestone_Waterloo\Design\Drawings\Figures\22051_Location Plan.dwg



Z:\Shared\Projects\22022\22051_Forgestone_Waterloo\Design\Drawings\Figures\22051_Land Severance Schematic.dwg



KEY PLAN

LEGEND

- PROPERTY LINE
- SEVERANCE LINE
- RETAINED LANDS "A"
- RETAINED LANDS "B"
- SEVERED LANDS
- ROAD WIDENING

LEGAL & TOPOGRAPHY

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BENCHMARK:

ELEVATIONS ARE GEODETIC ORIGIN (CGVD-1928: 1978), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0.

LOCAL BENCHMARK: FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

ELEVATION 346.94m.

FIRE HYDRANT LOCATED AT THE REAR OF BUILDING No.595, ALONG THE NORTH LIMITS OF PARKSIDE DRIVE AND THE EAST SIDE OF THE PARKING LOT ENTRANCE, AS SHOWN ON THE FACE OF THE PLAN.

ELEVATION: 350.43m

LEGAL DESCRIPTION:

SKETCH SHOWING TOPOGRAPHIC DETAIL 170 & 180 NORTHFIELD DRIVE, 360 & 595 PARKSIDE DRIVE, PARKSIDE DRIVE, AND PART OF NORTHFIELD DRIVE WEST, IN THE CITY OF WATERLOO, REGIONAL MUNICIPALITY OF WATERLOO.

FIELD SURVEY COMPLETED ON THE 27th DAY OF JULY, 2023.

No.	REVISIONS/ISSUED	DATE	BY	CITY
9.0	--	--		
8.0	--	--		
7.0	--	--		
6.0	--	--		
5.0	--	--		
4.0	SECOND SUBMISSION REZONING	2025-03-26	PM	
3.0	REVISED SEVERANCE PLAN	2024-10-18	PM	
2.0	FIRST SUBMISSION REZONING	2024-03-25	PM	
1.0	DRAFT - FOR CLIENT REVIEW	2024-02-16	PM	

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ENGINEER'S STAMP

APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

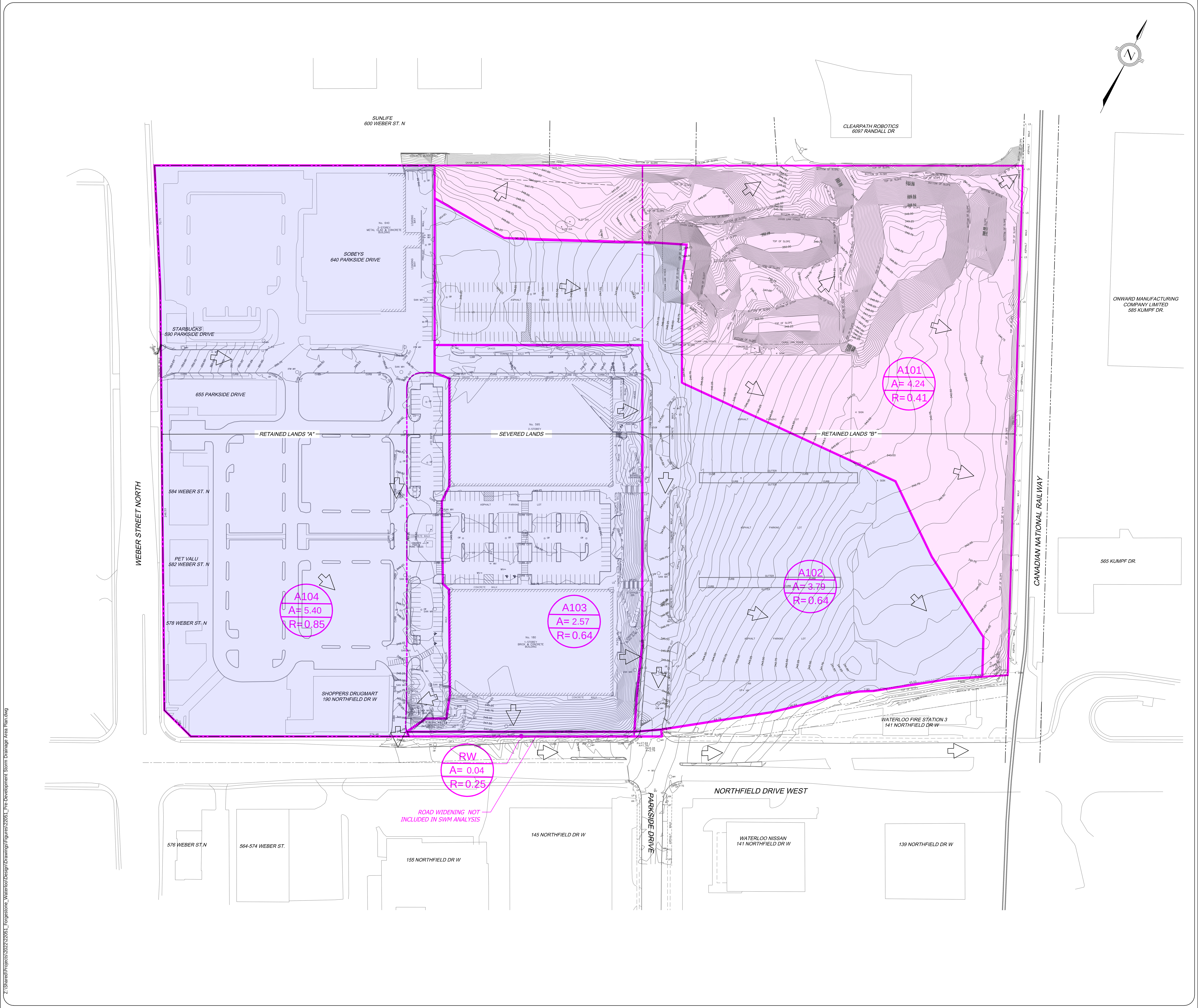
SITE LOCATION:

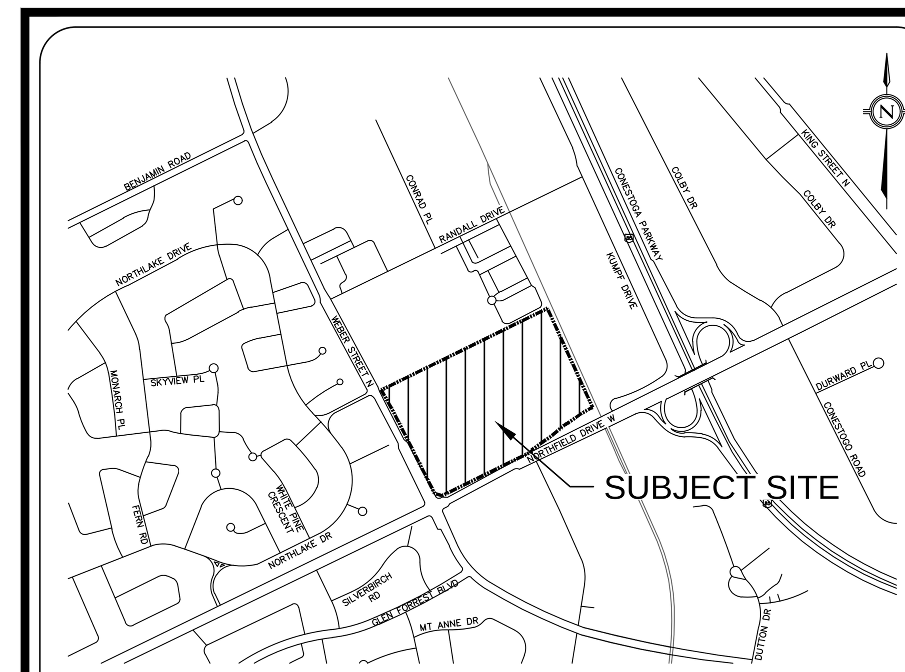
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

SEVERANCE SCHEMATIC

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:1000 (20 0m 20 40 60)		DRAWING NO.	FIG.2

REGION FILE No.:





KEY PLAN

LEGEND

A101 — AREA ID
A=0.13 — CATCHMENT AREA (Ha)
R=0.50 — RUNOFF COEFFICIENT

CATCHMENT PERIMETER

OVERLAND FLOW ROUTE

CNR CORRIDOR OUTLET

NORTHFIELD DR. STORM SEWER OUTLET

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LOCAL BENCHMARK FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

ELEVATION 346.94m.

FIRE HYDRANT LOCATED AT THE REAR OF BUILDING No.595, ALONG THE NORTH LIMITS OF PARKSIDE DRIVE AND THE EAST SIDE OF THE PARKING LOT ENTRANCE, AS SHOWN ON THE FACE OF THE PLAN.

ELEVATION: 350.43m

LEGAL DESCRIPTION:

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FIELD SURVEY COMPLETED ON THE 27th DAY OF JULY, 2023.

No.	REVISIONS/ISSUED	DATE	BY	CITY
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7.0	--	--		
6.0	--	--		
5.0	--	--		
4.0	SECOND SUBMISSION REZONING	2025–03–26	PM	
3.0	REVISED SEVERANCE PLAN	2024–10–18	PM	
2.0	FIRST SUBMISSION REZONING	2024–03–25	PM	
1.0	DRAFT – FOR CLIENT REVIEW	2024–02–16	PM	

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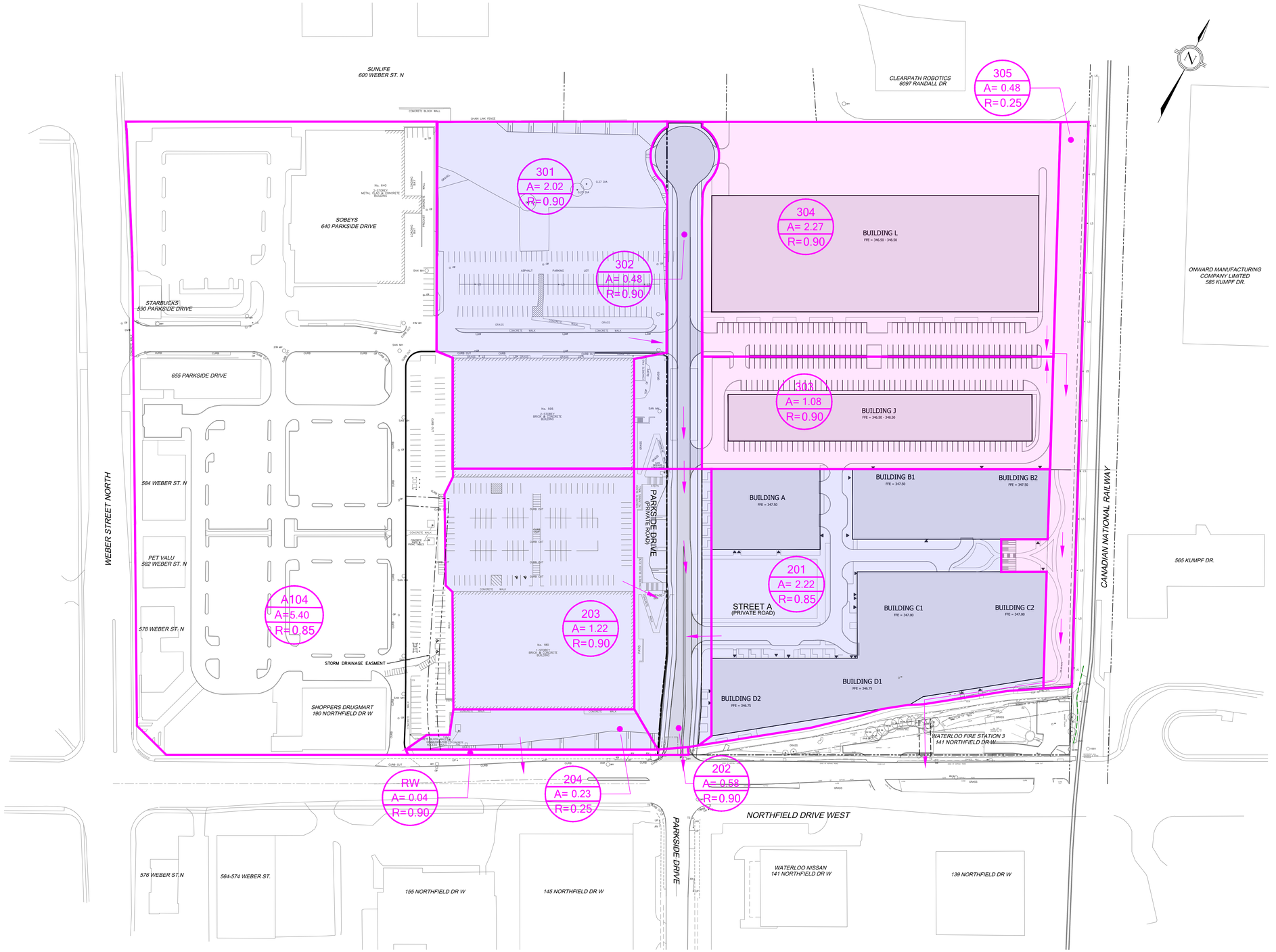
APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

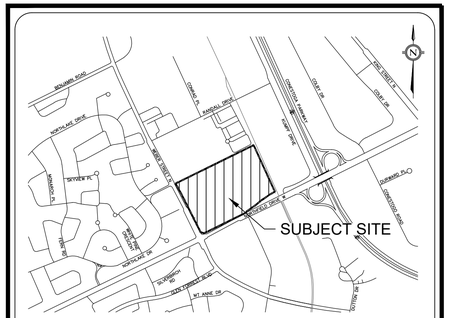
SITE LOCATION:
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

PRE DEVELOPMENT DRAINAGE PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO. 22051
SWM BY: PM	CHECKED BY: PW	
SCALE: 1:1000 (20 0m 20 40 60)		DRAWING NO. FIG.3

REGION FILE No.:





KEY PLAN

LEGEND

- A101 / A=0.13 / R=0.50 — AREA ID, CATCHMENT AREA (Ha), RUNOFF COEFFICIENT
- CATCHMENT PERIMETER
- OVERLAND FLOW ROUTE
- DRAINAGE DIRECTION
- NORTHFIELD DRIVE OUTLET 2
- NORTHFIELD DRIVE OUTLET 1

LEGAL & TOPOGRAPHY

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LOCAL BENCHMARK FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

ELEVATION 346.94m.

FIRE HYDRANT LOCATED AT THE REAR OF BUILDING No.595, ALONG THE NORTH LIMITS OF PARKSIDE DRIVE AND THE EAST SIDE OF THE PARKING LOT ENTRANCE, AS SHOWN ON THE FACE OF THE PLAN.

ELEVATION: 350.43m

LEGAL DESCRIPTION:

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FIELD SURVEY COMPLETED ON THE 27th DAY OF JULY, 2023.

No.	REVISIONS/ISSUED	DATE	BY	CITY
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7.0	--	--		
6.0	--	--		
5.0	THIRD SUBMISSION REZONING	2026-08-20	PM	
4.0	SECOND SUBMISSION REZONING	2025-03-26	PM	
3.0	REVISED SEVERANCE PLAN	2024-10-18	PM	
2.0	FIRST SUBMISSION REZONING	2024-03-25	PM	
1.0	DRAFT - FOR CLIENT REVIEW	2024-02-16	PM	

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APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

SITE LOCATION:

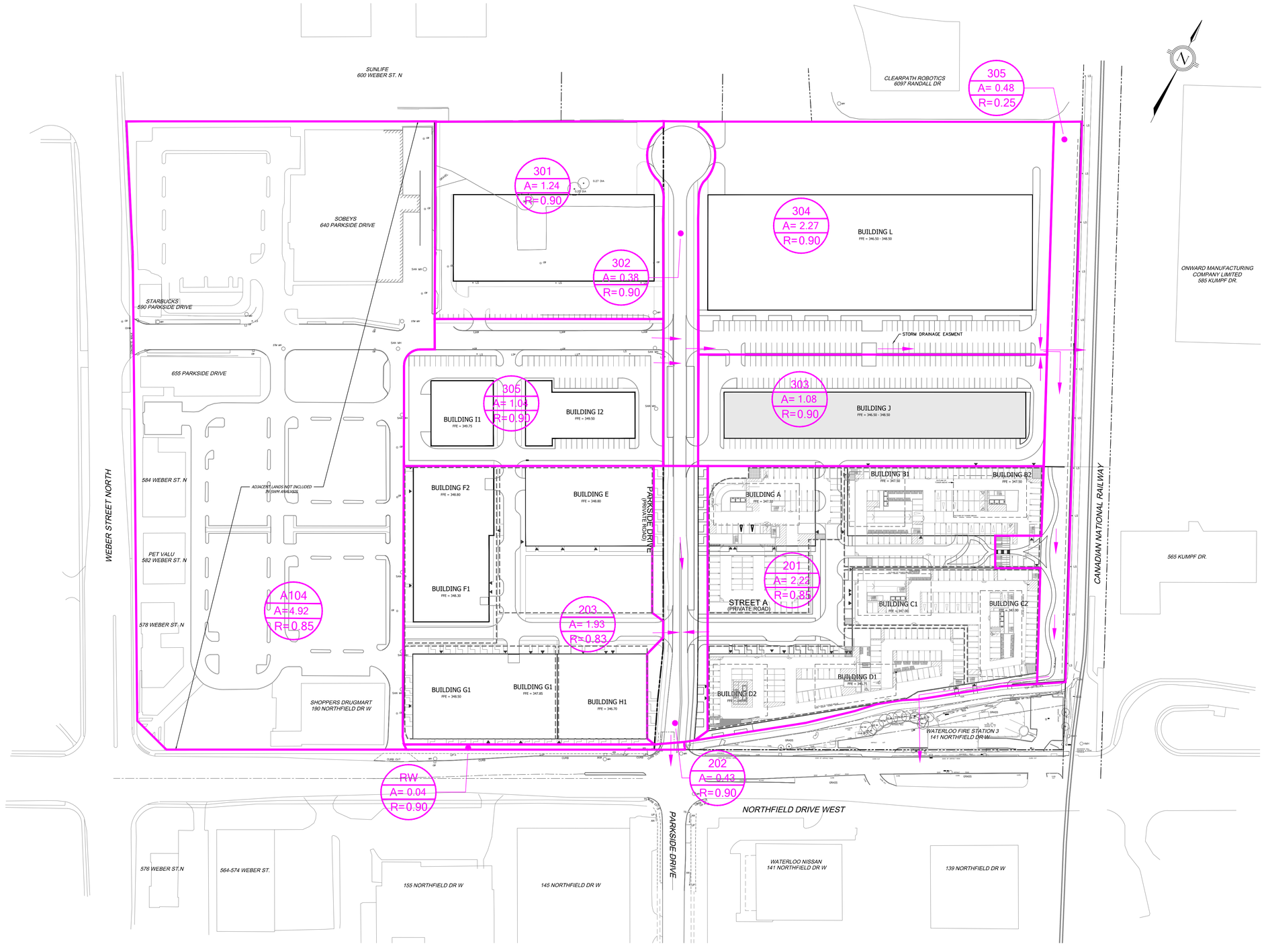
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

POST DEVELOPMENT DRAINAGE PLAN -INTERIM

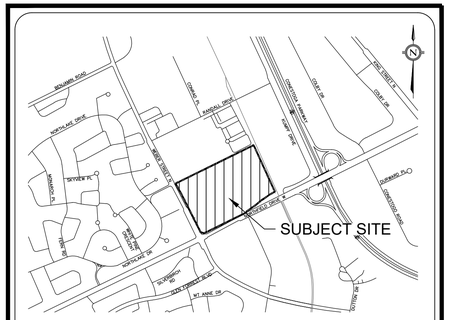
DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:1000 (20 0m 20 40 60)		DRAWING NO.	FIG.4A

REGION FILE No.:

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KEY PLAN

LEGEND

A101
A=0.13
R=0.50

AREA ID
CATCHMENT AREA (Ha)
RUNOFF COEFFICIENT

CATCHMENT PERIMETER

OVERLAND FLOW ROUTE

DRAINAGE DIRECTION

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ELEVATION 346.94m.

FIRE HYDRANT LOCATED AT THE REAR OF BUILDING No.595, ALONG THE NORTH LIMITS OF PARKSIDE DRIVE AND THE EAST SIDE OF THE PARKING LOT ENTRANCE, AS SHOWN ON THE FACE OF THE PLAN.

ELEVATION: 350.43m

LEGAL DESCRIPTION:

SKETCH SHOWING TOPOGRAPHIC DETAIL 170 & 180 NORTHFIELD DRIVE, 360 & 595 PARKSIDE DRIVE, PARKSIDE DRIVE, AND PART OF NORTHFIELD DRIVE WEST, IN THE CITY OF WATERLOO, REGIONAL MUNICIPALITY OF WATERLOO.

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4.0	SECOND SUBMISSION REZONING	2025-03-26	PM	
3.0	REVISED SEVERANCE PLAN	2024-10-18	PM	
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1.0	DRAFT - FOR CLIENT REVIEW	2024-02-16	PM	

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ENGINEER'S STAMP

APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

SITE LOCATION:

170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

POST DEVELOPMENT DRAINAGE PLAN- ULTIMATE

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:1000 (20 0m 20 40 60)		DRAWING NO.	FIG.4B

REGION FILE No.:

counterpoint ENGINEERING

SWM DESIGN CALCULATIONS
Airport Method TC / Tp Calculations

Project Name: 150-170 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Aug-26

Prepared by: PM
Last Revised: 20-Aug-26

Input Data

Runoff Coefficient [C]	0.70
L (m)	750.0
Sw (%)	1.0

Calculated Values:

Tc (min) =	35.7
Tp (min) =	23.9

$$Tc = \frac{3.26(1.1-CL^{0.5})}{Sw^{0.33}}$$

Tc = Time of Concentrarion (min)
C = Runoff Coefficient
L = Watershed lengthW(m)
Sw = Watershed Slope (%)

Tp = (0.67*Tc)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 6-Mar-24

Prepared by: LC
Checked by: PM
Last Revised: 20-Aug-26

Rainfall Data

Location:	Waterloo, On	a	1755
Event	5-year	b	12.347
		c	0.895

Site Data

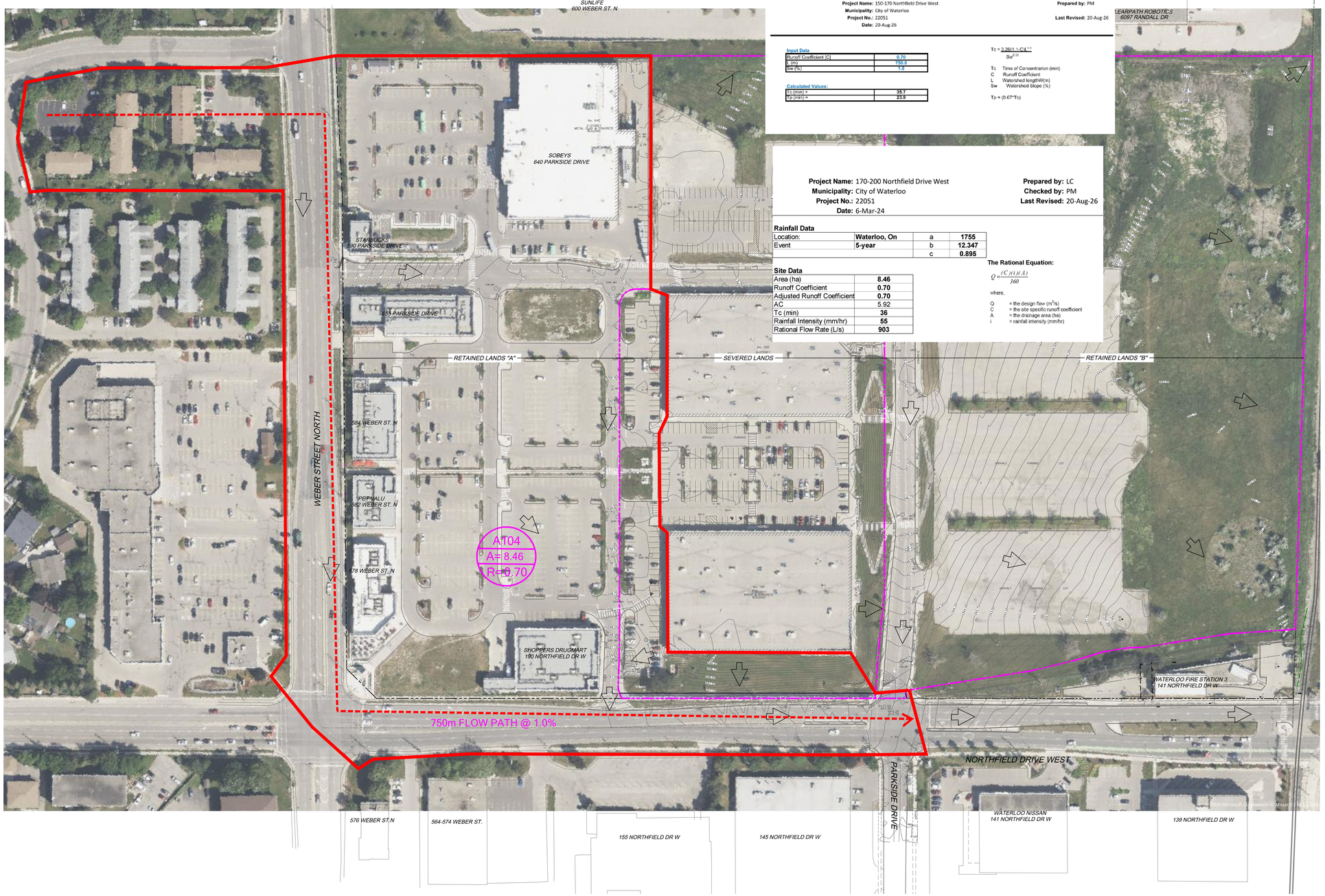
Area (ha)	8.46
Runoff Coefficient	0.70
Adjusted Runoff Coefficient	0.70
AC	5.92
Tc (min)	36
Rainfall Intensity (mm/hr)	55
Rational Flow Rate (L/s)	903

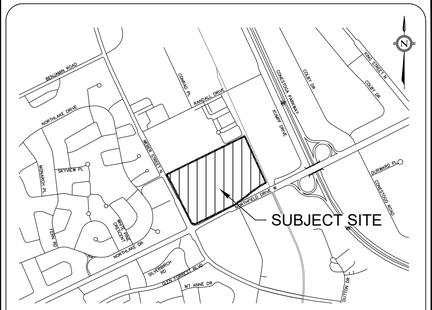
The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)





KEY PLAN

LEGEND

A101
A= 0.13
R= 0.50

AREA ID
CATCHMENT AREA (Ha)
RUNOFF COEFFICIENT
CATCHMENT PERIMETER
OVERLAND FLOW ROUTE OR DRAINAGE DIRECTION

LEGAL & TOPOGRAPHY

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ELEVATION 346.94m.

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ELEVATION: 350.43m

LEGAL DESCRIPTION:

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FIELD SURVEY COMPLETED ON THE 27th DAY OF JULY, 2023.

No.	REVISIONS/ISSUED	DATE	BY	CITY
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8.0	--	--		
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5.0	THIRD SUBMISSION REZONING	2026-08-20	PM	
4.0	SECOND SUBMISSION REZONING	2025-03-26	PM	
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ENGINEER'S STAMP

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TORONTO, ON
M5C 1T4

SITE LOCATION:

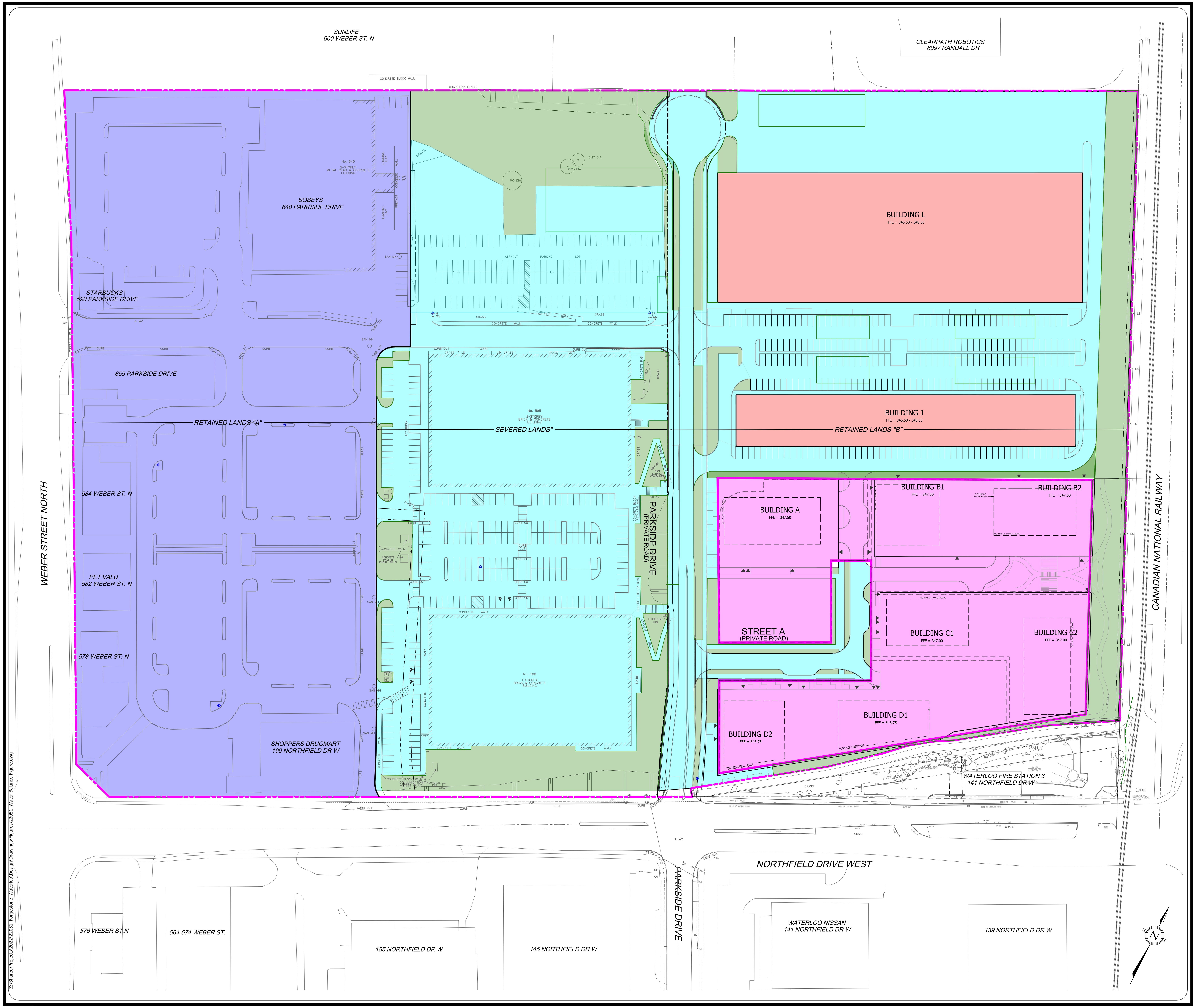
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

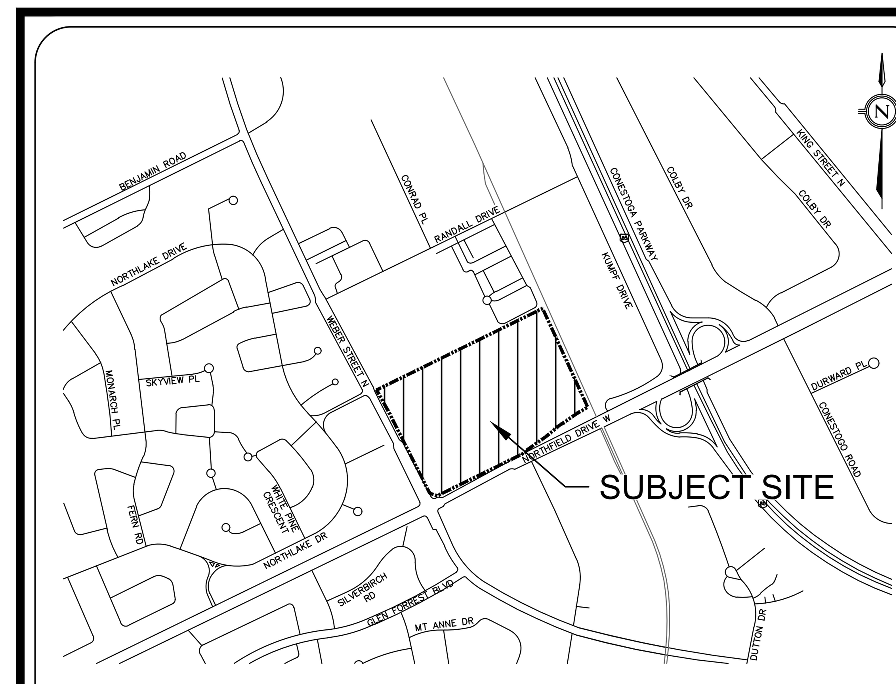
EXTERNA STORM DRAINAGE PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:1000 (20 0m 20 40 60)		DRAWING NO.	FIG.4C

REGION FILE No.:

S:\Shared\Project Delivery\Projects\2022\22051_Forgestone_Waterloo\Design\Drawings\Figures\22051_Pre-Development Storm Drainage Area Plan (DS Sewer Analysis).dwg





KEY PLAN

LEGEND

- PROPERTY LINE
- LANDSCAPED AREA (5mm IA)
- WATER RESUSE CISTERN TRIBUTARY AREA (30mm IA)
- IMPERVIOUS AREA WITH NO WATER BALANCE MITIGATION
- ROOF AREA TRIBUTARY TO INFILTRATION TRENCHES (40mm IA)
- RETAINED LANDS EXCLUDED FROM WATER BALANCE ANALYSIS
- LIMIT OF UNDERGROUND PARKING

WATER BALANCE AREA BREAKDOWN

SECTION NAME	AREA (Ha.)
LANDSCAPED AREA (5mm IA)	1.25 Ha
WATER REUSE CISTERN TRIBUTARY AREA (30mm IA)	1.92 Ha
IMPERVIOUS AREA WITH NO WATER BALANCE MITIGATION	5.99 Ha
ROOF AREA TRIBUTARY TO INFILTRATION TRENCHES (40mm IA)	1.92 Ha
TOTAL	11.08 Ha

LEGAL & TOPOGRAPHY

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BENCHMARK:

ELEVATIONS ARE GEODETIC ORIGIN (CGVD-1928: 1978), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0.

LOCAL BENCHMARK FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

ELEVATION 346.94m.

FIRE HYDRANT LOCATED AT THE REAR OF BUILDING No.595, ALONG THE NORTH LIMITS OF PARKSIDE DRIVE AND THE EAST SIDE OF THE PARKING LOT ENTRANCE, AS SHOWN ON THE FACE OF THE PLAN.

ELEVATION: 350.43m

LEGAL DESCRIPTION:

SKETCH SHOWING TOPOGRAPHIC DETAIL 170 & 180 NORTHFIELD DRIVE, 360 & 595 PARKSIDE DRIVE, PARKSIDE DRIVE, AND PART OF NORTHFIELD DRIVE WEST, IN THE CITY OF WATERLOO, REGIONAL MUNICIPALITY OF WATERLOO.

FIELD SURVEY COMPLETED ON THE 27th DAY OF JULY, 2023.

No.	REVISIONS/ISSUED	DATE	BY	CITY
9.0	--	--		
8.0	--	--		
7.0	--	--		
6.0	--	--		
5.0	THIRD SUBMISSION REZONING	2026-08-20	PM	
4.0	SECOND SUBMISSION REZONING	2025-03-26	PM	
3.0	REVISED SEVERANCE PLAN	2024-10-18	PM	
2.0	FIRST SUBMISSION REZONING	2024-03-25	PM	
1.0	DRAFT - FOR CLIENT REVIEW	2024-02-16	PM	

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ENGINEER'S STAMP

APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

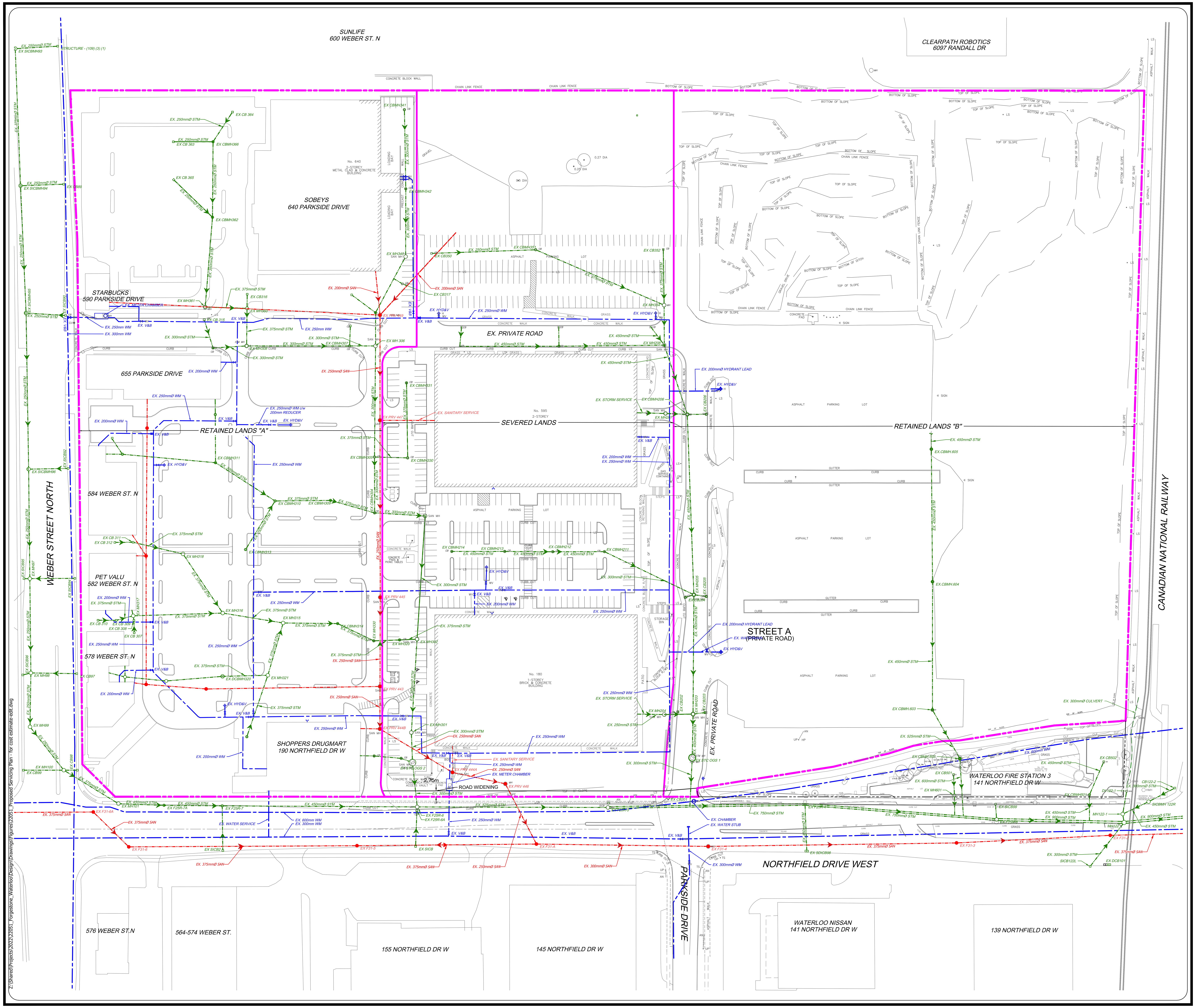
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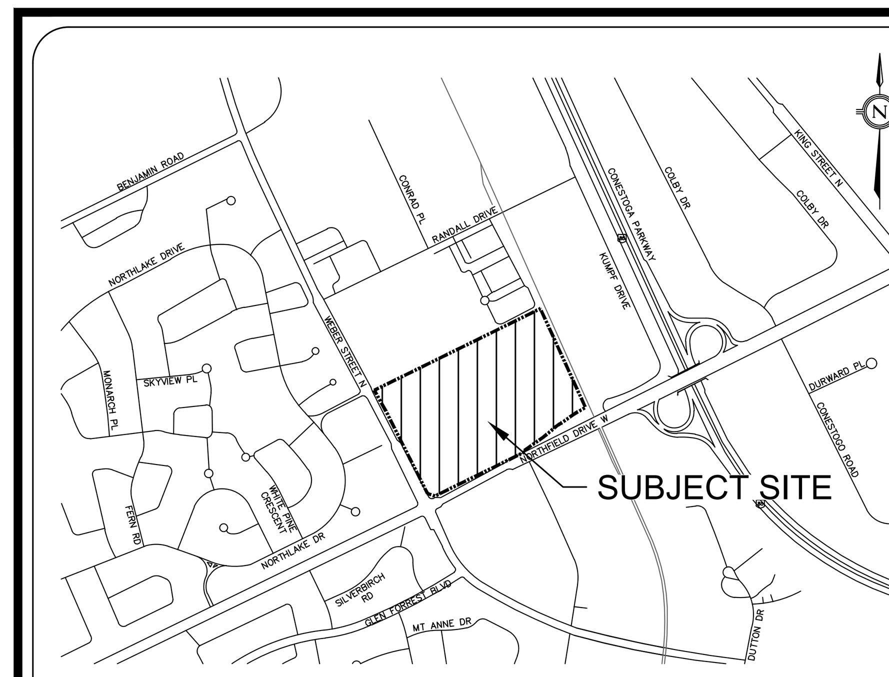
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

WATER BALANCE PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:800 (20 0m 10 20 30 40)		DRAWING NO.	FIG.5

REGION FILE No.:





KEY PLAN

LEGEND

- PROPERTY LINE
- SEVERANCE LINE
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING VALVE BOX/CHAMBER
- EXISTING HYDRANT & VALVE
- M METER CHAMBER

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LOCAL BENCHMARK FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

ELEVATION 346.94m.

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ELEVATION: 350.43m

LEGAL DESCRIPTION:

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1.0	DRAFT – FOR CLIENT REVIEW	2024–02–16	PM	

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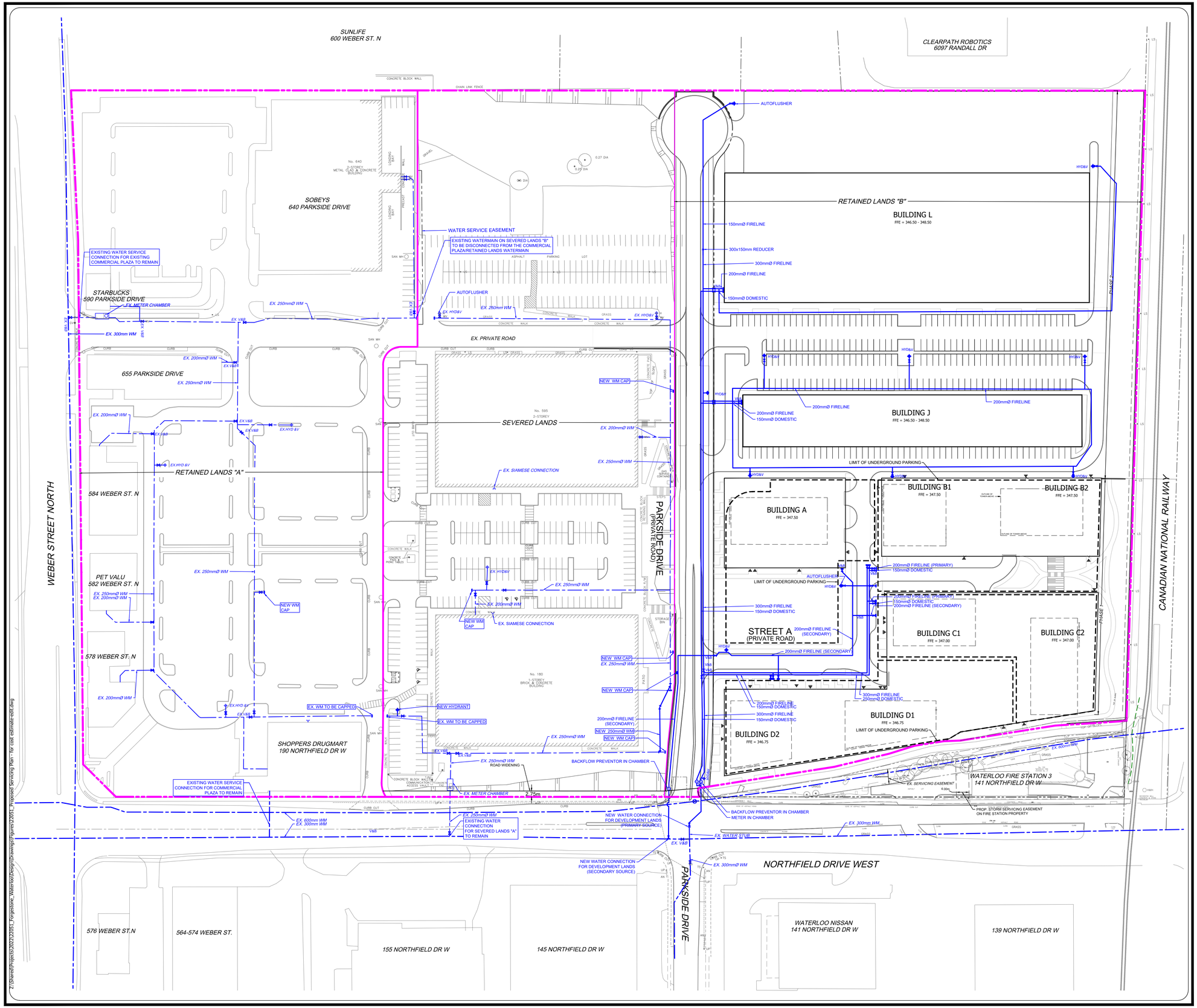
APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

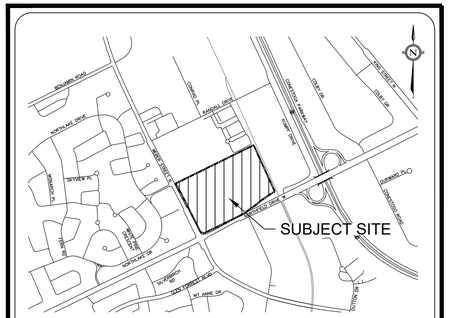
SITE LOCATION:
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

EXISTING SERVICING PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:800 (20 0m 10 20 30 40)		DRAWING NO.	C-100

REGION FILE No.:





KEY PLAN

LEGEND

- PROPERTY LINE
- SEVERANCE LINE
- EXISTING WATERMAIN
- VALVE BOX/CHAMBER
- HYDRANT
- PROPOSED WATERMAIN
- LIMIT OF UNDERGROUND PARKING
- M — METER CHAMBER

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ELEVATION: 350.43m

LEGAL DESCRIPTION:

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APPLICANT:
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100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

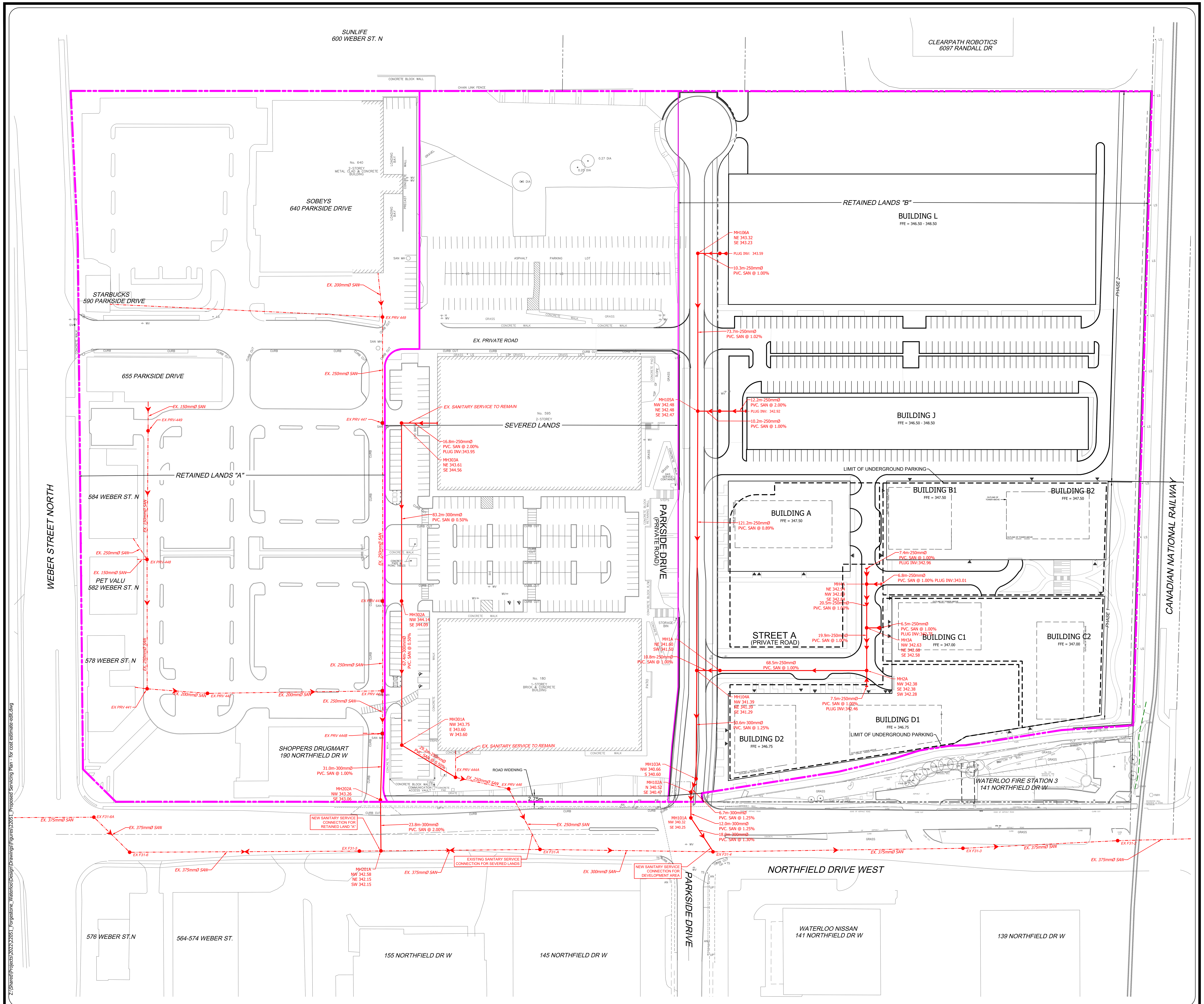
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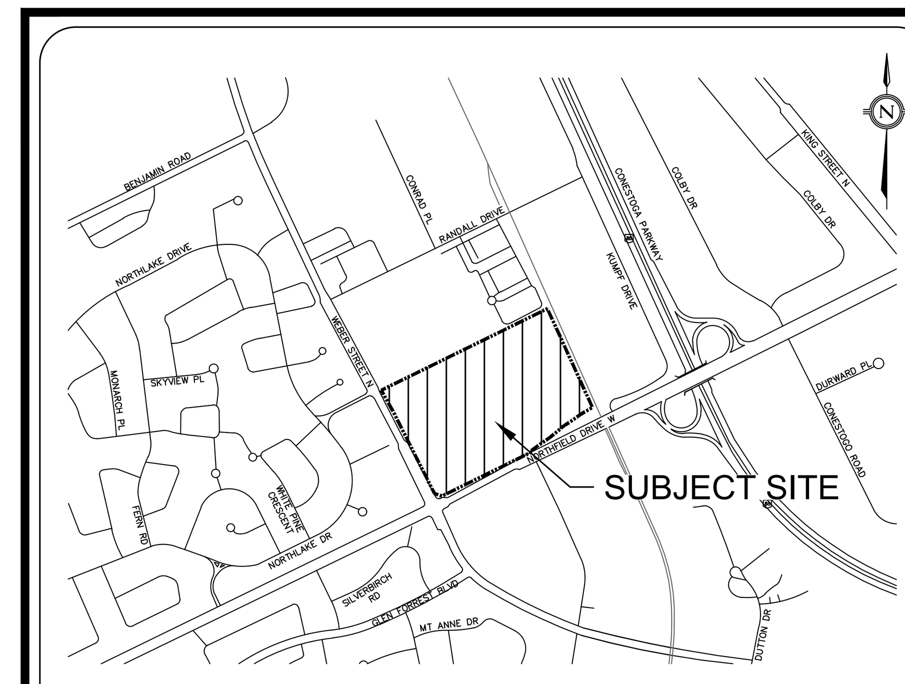
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

WATER SERVICING PLAN

DESIGNED BY:	PM	CHECKED BY:	PW	DATE:	DECEMBER 2023
DRAWING BY:	ML/BB	CHECKED BY:	PM	PROJECT NO.	22051
SWM BY:	PM	CHECKED BY:	PW		
SCALE: 1:800 (20 0m 10 20 30 40)				DRAWING NO.	C-101WA

REGION FILE No.:





KEY PLAN

LEGEND

- PROPERTY LINE
- SEVERANCE LINE
- EXISTING SANITARY SEWER
- EXISTING SANITARY MANHOLE
- PROPOSED SANITARY SEWER
- PROPOSED EASEMENT
- LIMIT OF UNDERGROUND PARKING

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LEGAL DESCRIPTION:

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1.0	DRAFT – FOR CLIENT REVIEW	2024–02–16	PM	

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APPLICANT:
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100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

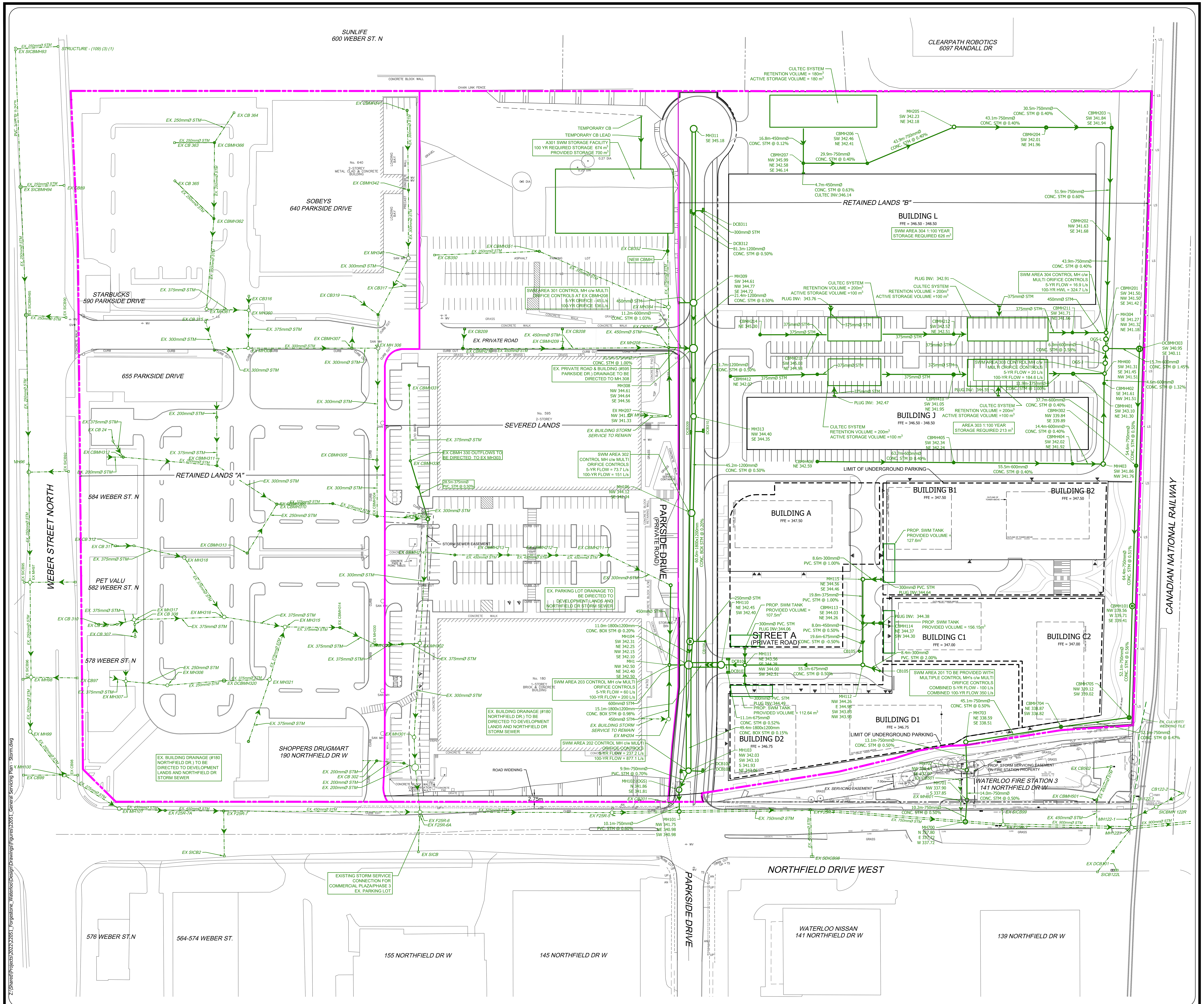
SITE LOCATION:

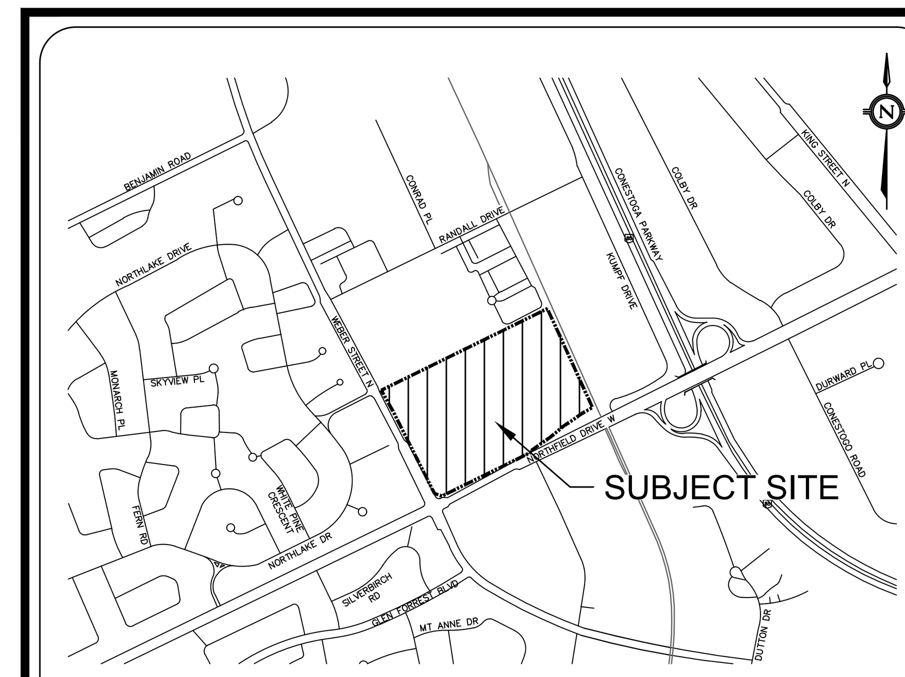
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

SANITARY SERVICING PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO. 22051
SWM BY: PM	CHECKED BY: PW	
SCALE: 1:800 (20 0m 10 20 30 40)		DRAWING NO. C101SA

REGION FILE No.:





KEY PLAN

LEGEND

- PROPERTY LINE
- SEVERANCE LINE
- EXISTING STORM SEWER
- STORM MANHOLE
- PROPOSED STORM SEWER
- CATCH BASIN/ CATCH BASIN MANHOLE
- OVERLAND FLOW ROUTE
- PROPOSED EASEMENT
- LIMIT OF UNDERGROUND PARKING

LEGAL & TOPOGRAPHY

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ELEVATION: 350.43m

LEGAL DESCRIPTION:
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2.0	FIRST SUBMISSION REZONING	2024–03–25	PM	
1.0	DRAFT – FOR CLIENT REVIEW	2024–02–16	PM	

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ENGINEER'S STAMP

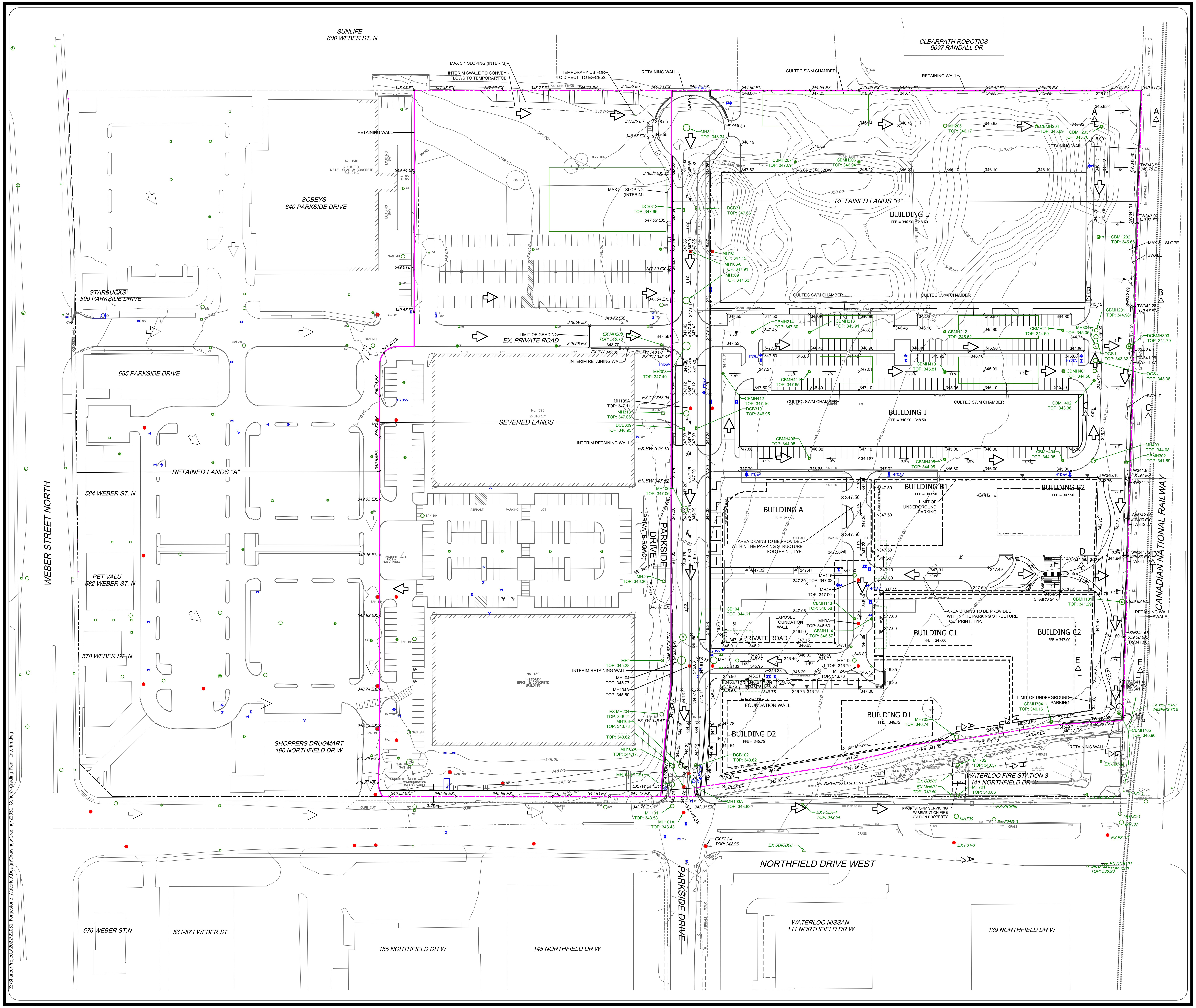
APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

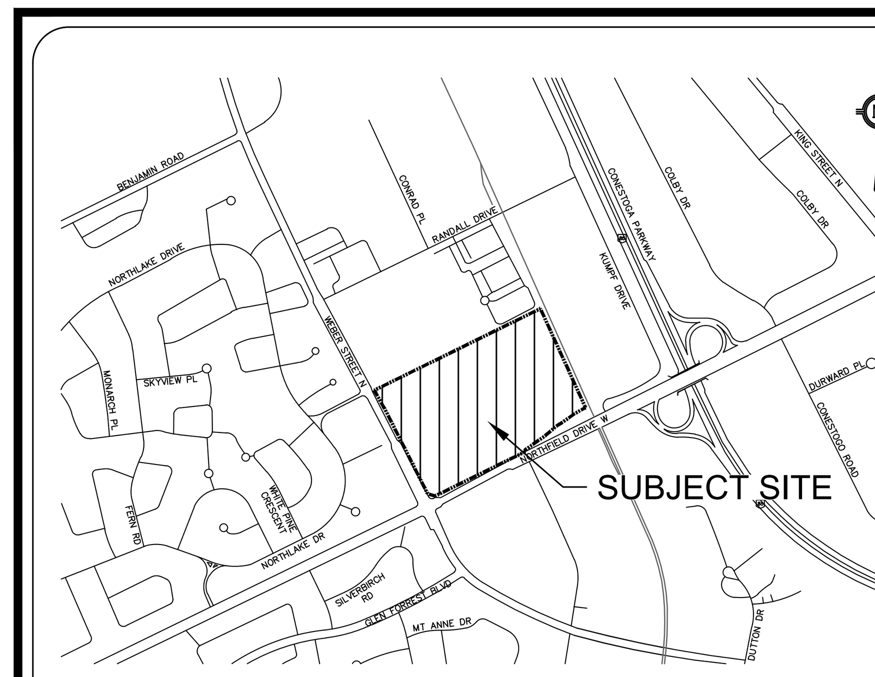
SITE LOCATION:
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

STORM SERVICING PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO. 22051
SWM BY: PM	CHECKED BY: PW	
SCALE: 1:800 (20 0m 10 20 30 40)		DRAWING NO. C101ST

REGION FILE No.:





KEY PLAN

LEGEND

- PROPERTY LINE
- SEVERANCE LINE
- EX.340.01+ EXISTING ELEVATION
- 340.01+ PROPOSED ELEVATION
- 340.00 EXISTING CONTOUR & ELEVATION
- STORM MANHOLE
- SANITARY MANHOLE
- VALVE BOX/CHAMBER
- OVERLAND FLOW ROUTE
- PROPOSED EASEMENT
- LIMIT OF UNDERGROUND PARKING

LEGAL & TOPOGRAPHY

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ENGINEER'S STAMP

APPLICANT:

FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

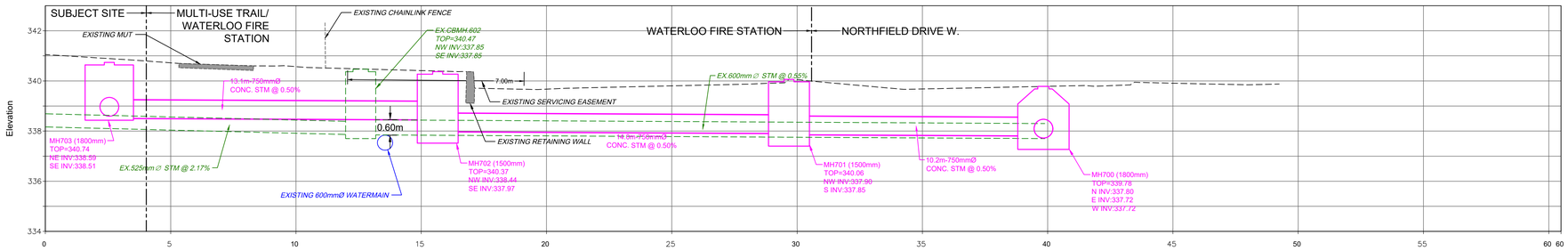
SITE LOCATION:

170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

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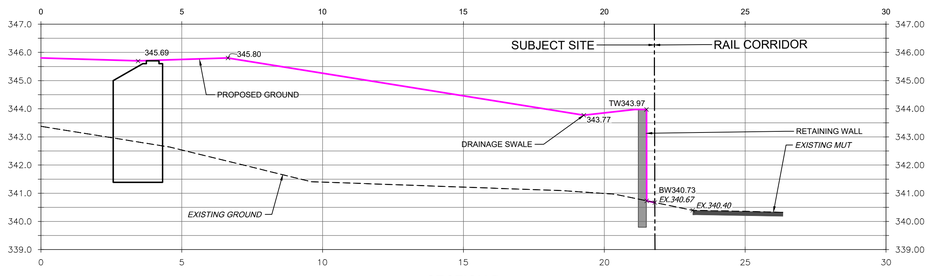
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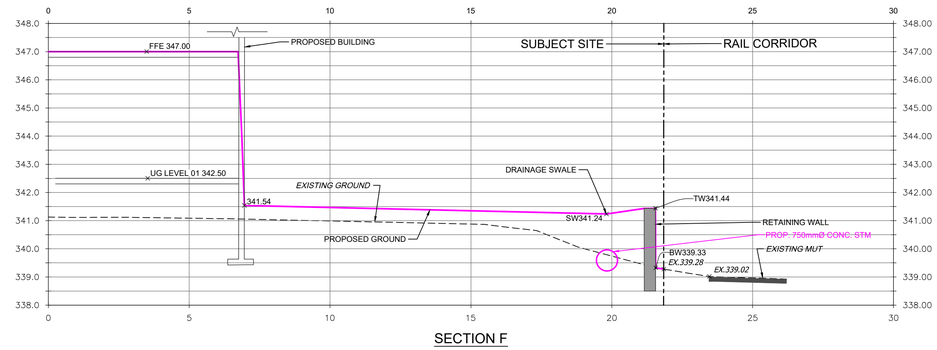
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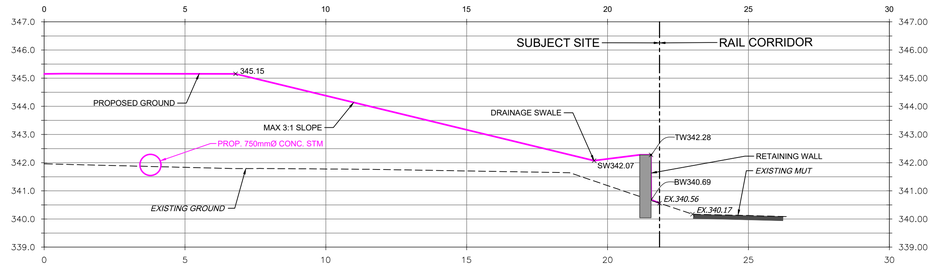
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SCALE 1:100



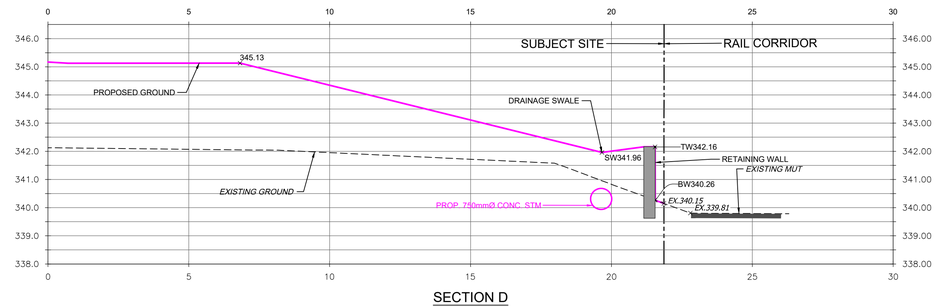
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SCALE 1:100



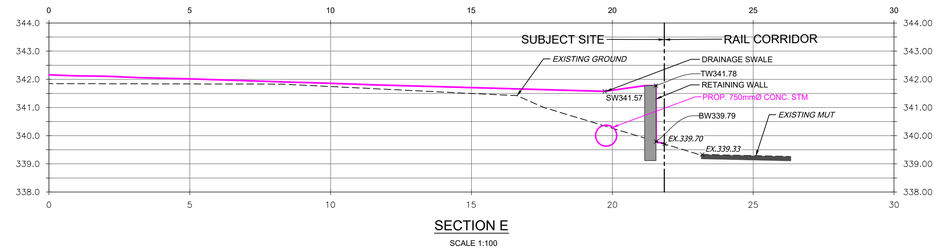
SECTION C

SCALE 1:100



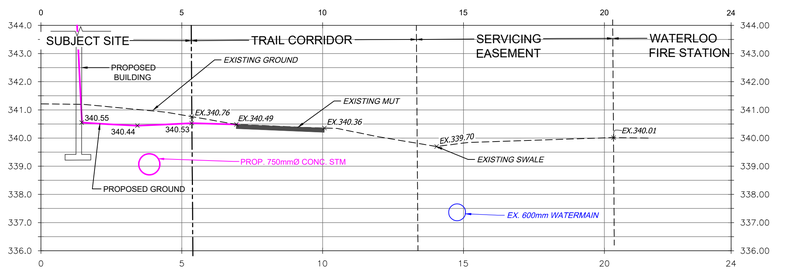
SECTION D

SCALE 1:100



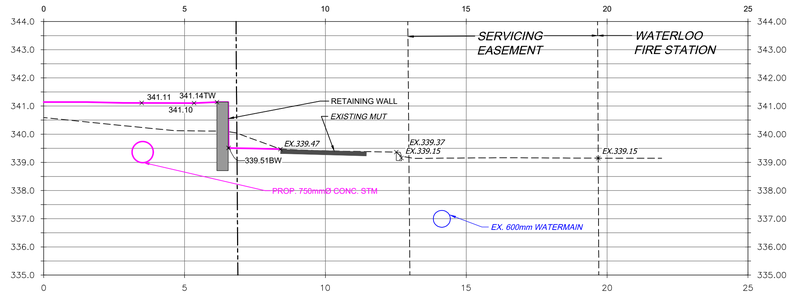
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SCALE 1:100



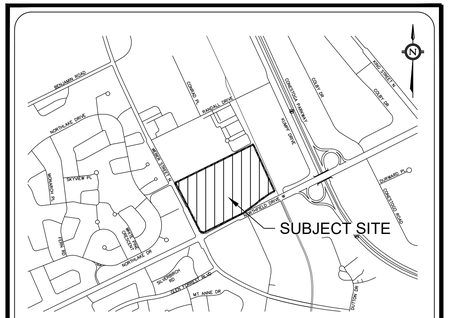
SECTION H

SCALE 1:100



SECTION G

SCALE 1:100



KEY PLAN

LEGEND

LEGAL & TOPOGRAPHY

J.D. BARNES LIMITED
LIMITED INFORMATION SPECIALISTS
4273 KING ST. E., #100, KITCHENER, ON, N2P 2E9
TEL/FAX (519) 578-2220 / (519) 650-5625
www.jdbarnes.com

BENCHMARK:

ELEVATIONS ARE GEODETIC ORIGIN (CGVD-1928: 1978), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0.

LOCAL BENCHMARK FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

ELEVATION 346.94m.

FIRE HYDRANT LOCATED AT THE REAR OF BUILDING No.595, ALONG THE NORTH LIMITS OF PARKSIDE DRIVE AND THE EAST SIDE OF THE PARKING LOT ENTRANCE, AS SHOWN ON THE FACE OF THE PLAN.

ELEVATION: 350.43m

LEGAL DESCRIPTION:

SKETCH SHOWING TOPOGRAPHIC DETAIL 170 & 180 NORTHFIELD DRIVE, 360 & 595 PARKSIDE DRIVE, PARKSIDE DRIVE, AND PART OF NORTHFIELD DRIVE WEST, IN THE CITY OF WATERLOO, REGIONAL MUNICIPALITY OF WATERLOO.

FIELD SURVEY COMPLETED ON THE 27th DAY OF JULY, 2023.

No.	REVISIONS/ISSUED	DATE	BY	CITY
9.0	--	--		
8.0	--	--		
7.0	--	--		
6.0	--	--		
5.0	THIRD SUBMISSION REZONING	2026-08-20	PM	
4.0	SECOND SUBMISSION REZONING	2025-03-26	PM	
3.0	REVISED SEVERANCE PLAN	2024-10-18	PM	
2.0	FIRST SUBMISSION REZONING	2024-03-25	PM	
1.0	DRAFT - FOR CLIENT REVIEW	2024-02-16	PM	

counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

ENGINEER'S STAMP

APPLICANT:

FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

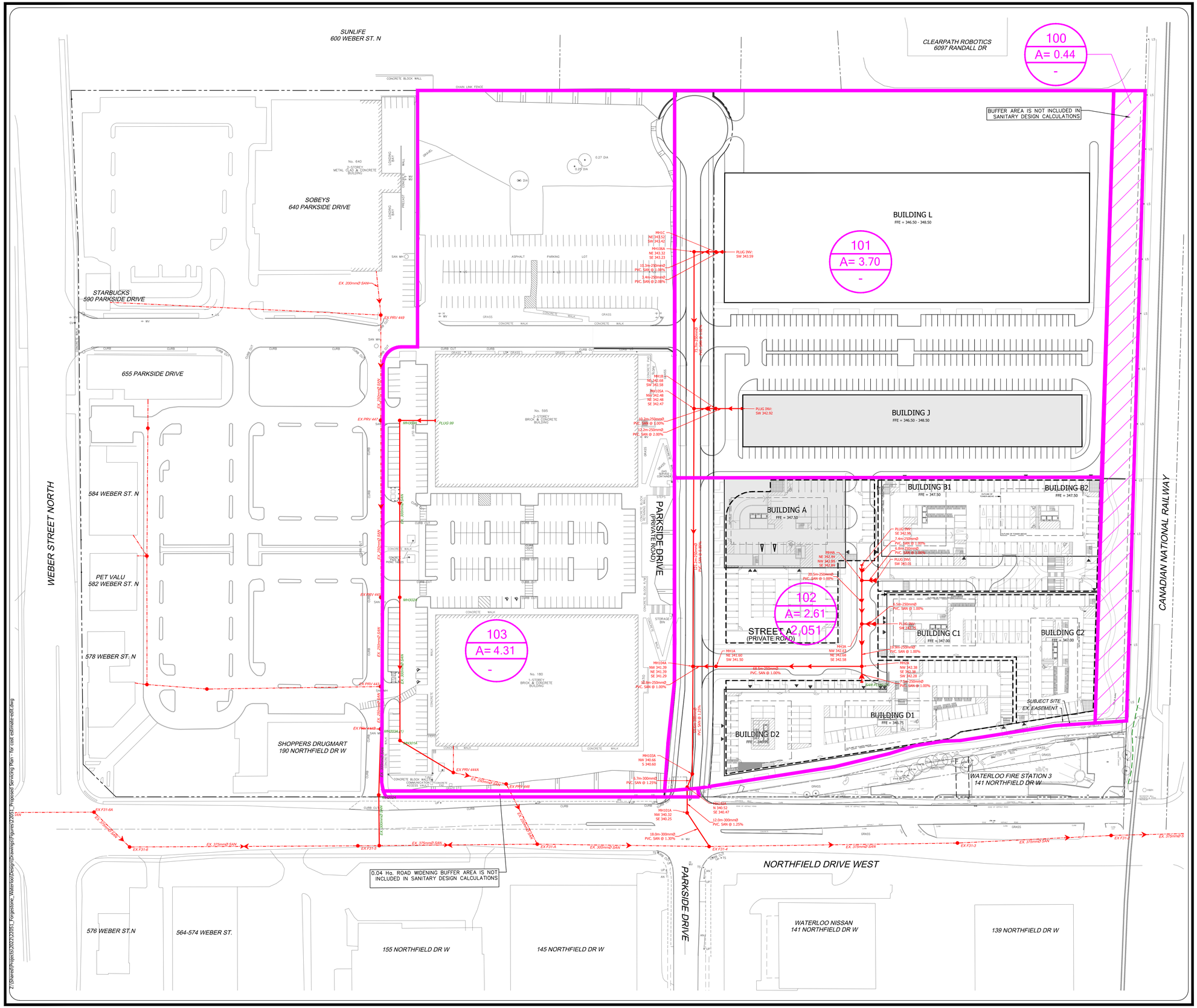
SITE LOCATION:

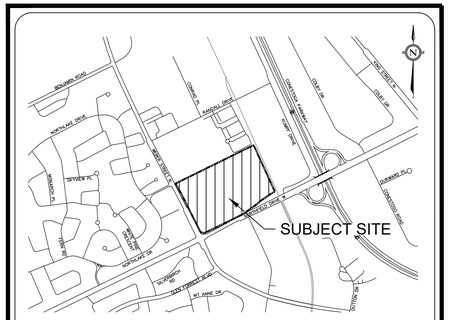
170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

GRADING SECTIONS PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:100		DRAWING NO.	C-202

S:\Shared\Project Delivery\Projects\2022\22051_Forgestone_Waterloo\Design\Drawings\Grading\22051_Grading Sections Plan.dwg





KEY PLAN

LEGEND

- PROPERTY LINE
- EXISTING SANITARY SEWER
- SANITARY MANHOLE
- PROPOSED SANITARY SEWER

201 — AREA ID
A= 1.38 — DRAINAGE AREA (Ha.)
1,973 — RESIDENTIAL UNITS

N

LEGAL & TOPOGRAPHY

J.D. BARNES LIMITED
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TEL/FAX (519) 578-2220 / (519) 650-5625
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LOCAL BENCHMARK FIRE HYDRANT LOCATED ADJACENT TO BUILDING No.180, ALONG THE EAST LIMITS OF PARKSIDE DRIVE AT THE SOUTHERN MOST PARKING LOT ENTRANCE, AS SHOWN ON THE FACE ON THE PLAN.

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SKETCH SHOWING TOPOGRAPHIC DETAIL 170 & 180 NORTHFIELD DRIVE, 360 & 595 PARKSIDE DRIVE, PARKSIDE DRIVE, AND PART OF NORTHFIELD DRIVE WEST, IN THE CITY OF WATERLOO, REGIONAL MUNICIPALITY OF WATERLOO.

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2.0	FIRST SUBMISSION REZONING	2024-03-25	PM	
1.0	DRAFT - FOR CLIENT REVIEW	2024-02-16	PM	

counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

ENGINEER'S STAMP

APPLICANT:
FORGESTONE CAPITAL MANAGEMENT L.P.
100 YONGE STREET, SUITE 1100
TORONTO, ON
M5C 1T4

SITE LOCATION:

170 NORTHFIELD DRIVE
WATERLOO, ONTARIO

SANITARY DRAINAGE PLAN

DESIGNED BY: PM	CHECKED BY: PW	DATE: DECEMBER 2023	
DRAWING BY: ML/BB	CHECKED BY: PM	PROJECT NO.	22051
SWM BY: PM	CHECKED BY: PW		
SCALE: 1:800 (20 0m 10 20 30 40)		DRAWING NO.	C-301

REGION FILE No.:

APPENDIX B

Water Demand Calculations

Project No.: 22051

Counterpoint Engineering Inc.

Domestic Water Demand Design Calculations Phase 1 and 2

Project:	**170 Northfield Drive W**	**Designed By**	LC
Project No:	**22051**	**Checked By**	PM
Client:	**Forgestone Capital Management LP**	**Date**	06-Mar-24
Location:	**Waterloo, ON**	**Revision Date**	26-Mar-25

Development Lands Area: 6.77 ha (Retained Lands "B")

Design Parameters

Average Daily Consumption[1]

Residential	300	(l/c/d)
Light Industrial	0.64	(l/s/ha)

Residential Peaking Factors[2]

Minimum Hour	0.50
Maximum Day	2.00
Peak Hour	3.00

Industrial Peaking Factor[1]

Industrial	4.00

Population Density

Residential - Apartments[3]	2.07	(ppu)

Site Statistics[4]

Residential	2,061	(units)
Commercial/Industrial	3.70	ha

Water Demand

Landuse	Population/ Hectares	Nominal Demand (L/min)	Max. Hour Demand (L/min)	Max Daily Demand (L/min)
Residential	4,266	889	2,666	1,778
Commercial	3.70	141	565	141
Total Peak Demand			3,232	1,919

Required Fire Flow (RFF)

RFF per FUS 2020 Gudelines (L/min)	11,000

Design Flow

Maximum Hour Demand (L/min):	3,232
Maximum Day Demand + Fire Flow (L/min):	12,919

Note 1: As recommened by MECP design guidelines for drinking water systems

Note 2: Peaking factors specificed in MECP design guidelines for drinking water systems Table 3-1

Note 3: Population density specificed in development charges background study (2020)

Note 4: Site Statistics per architectural plans circulated March 6rd, 2024

counterpoint ENGINEERING

REQUIRED FIRE FLOW WORKSHEET - PROPOSED INDUSTRIAL
Fire Underwriters Survey

Project : 170 Northfield Drive W, Waterloo
Project No: 22051
Development Area: **6.77** (Retained Lands "B")

Guide for Determination of Required Fire Flow Copyright I.S.O

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

Type of Construction		Coefficient
Type V	Wood Frame	1.5
Type IV-A	Encapsulated Mass Timber	0.8
Type IV-B	Rated Mass Timber	0.9
Type IV-C	Ordinary Mass Timber	1.0
Type IV-D	Un-Rated Mass Timber	1.5
Type III	Ordinary	1.0
Type II	Noncombustible	0.8
4.87	Fire Resistive	0.6

Contents		Factor
1.04	Non-Combustible	-25%
LC	Limited Combustible	0
C	Combustible	0
FB	Free Burning	0
RB	Rapid Burning	25%

1) Required Fire Flow

Type of Construction:	Type II		
C=	1.0		
A*=	10,469	m^2	**(Building L)**
F=	**22,510**	**L/min**	

2) Occupancy and Contents Adjustment Factor

Type of Occupancy	LC				
Contents Adjustment Factor	-15%		=	-3,376	L/min
F=	**22510L/min +**	**-3376**	**L/min =**	**19,133**	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:	YES	30%			
Standard Water Supply:	YES	10%			
Fully Supervised:	YES	10%			
Total Credit		50%			
Reduction of:	50%	L/min	=	9,567	L/min
F=	**19133L/min -**	**9,567**	**L/min =**	**9,567**	**L/min**

4) Exposure Adjustment Charge

Building Face	Dist(m)	Charge
North	30+	0%
East	30+	0%
South	30+	0%
West	25	10%
Total		10% **of** 19133 **L/min =** 1,913 **L/min**

(max exposure charge can be 75%)

Separation Distance	Maximum Exposure Adjustment Charge
0 m to 3 m	25%
3.1 m to 10 m	20%
10.1 m to 20 m	15%
20.1 m to 30 m	10%
Greater than 30	0%

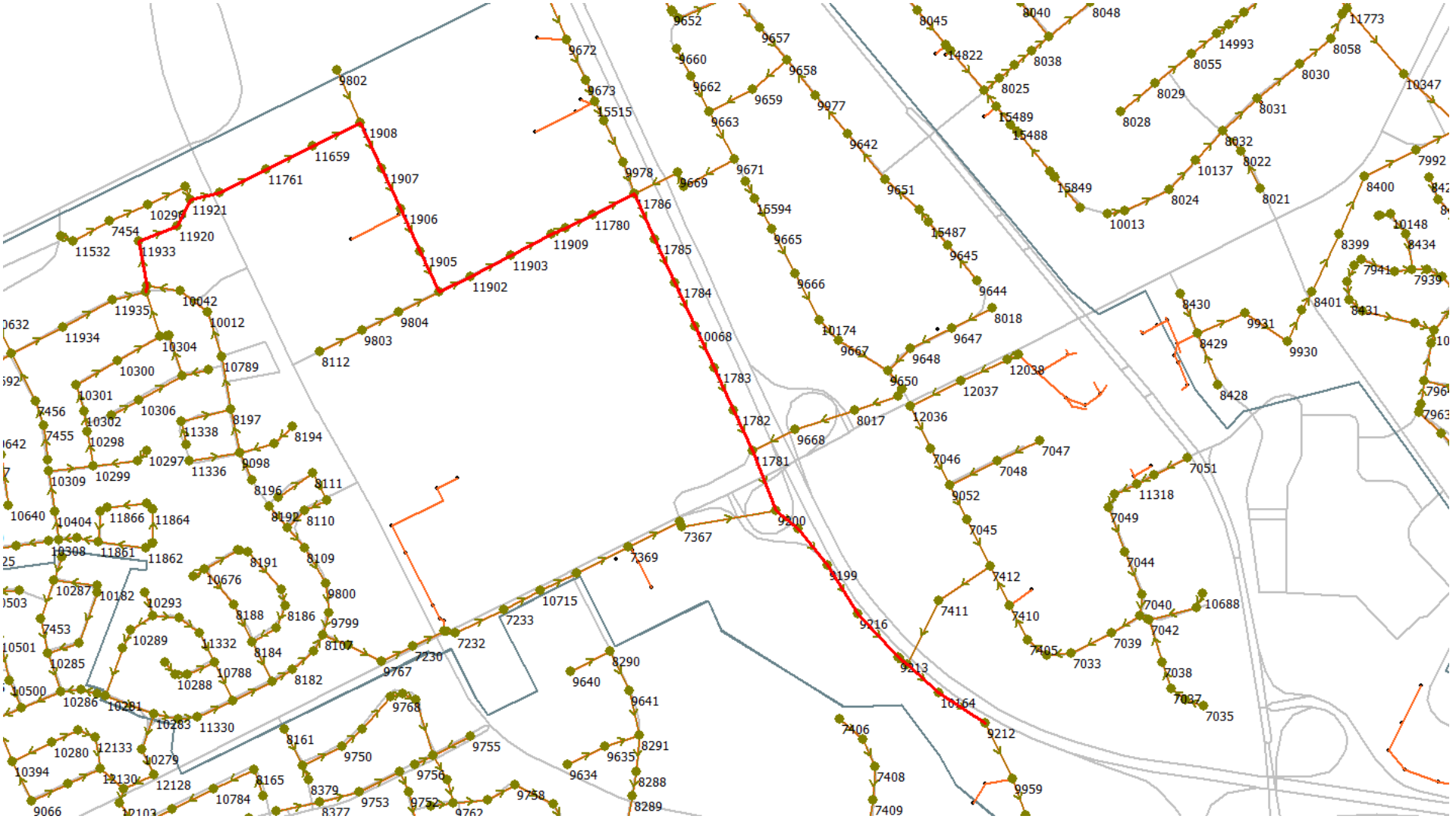
F= **9567L/min +** **1913L/min** **=** 11,480 **L/min**

F=	**11,000**	**L/min**	(round to the nearest 1,000L/min)
F=	**183**	**L/s**	
F=	**2,906**	**gpm**	

APPENDIX C

Sanitary Design Flow Calculations

Project No.: 22051



July 2013

161111191

Stantec

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario, Canada
N2H 6M7
Tel: (519) 579-4410
Fax: (519) 579-6733
www.stantec.comt

Drawing is not to be used for construction

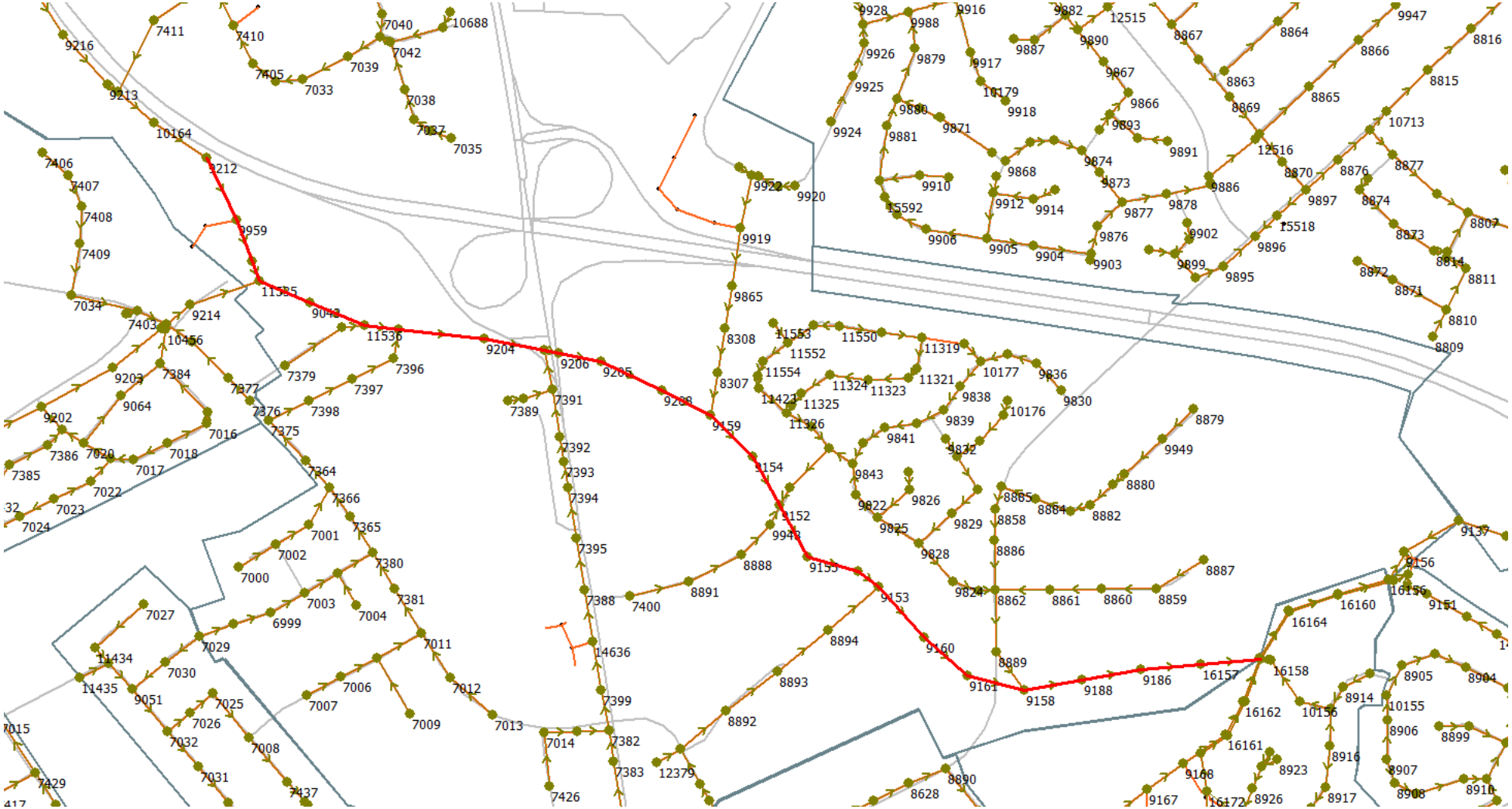
Legend

Figure No. 4

Title **Forwell Trunk Profile 2 Overview**

Client/Project City of Waterloo

Waterloo Sanitary Servicing Master Plan



July 2013
161111191

Stantec

Legend

Figure No. 6

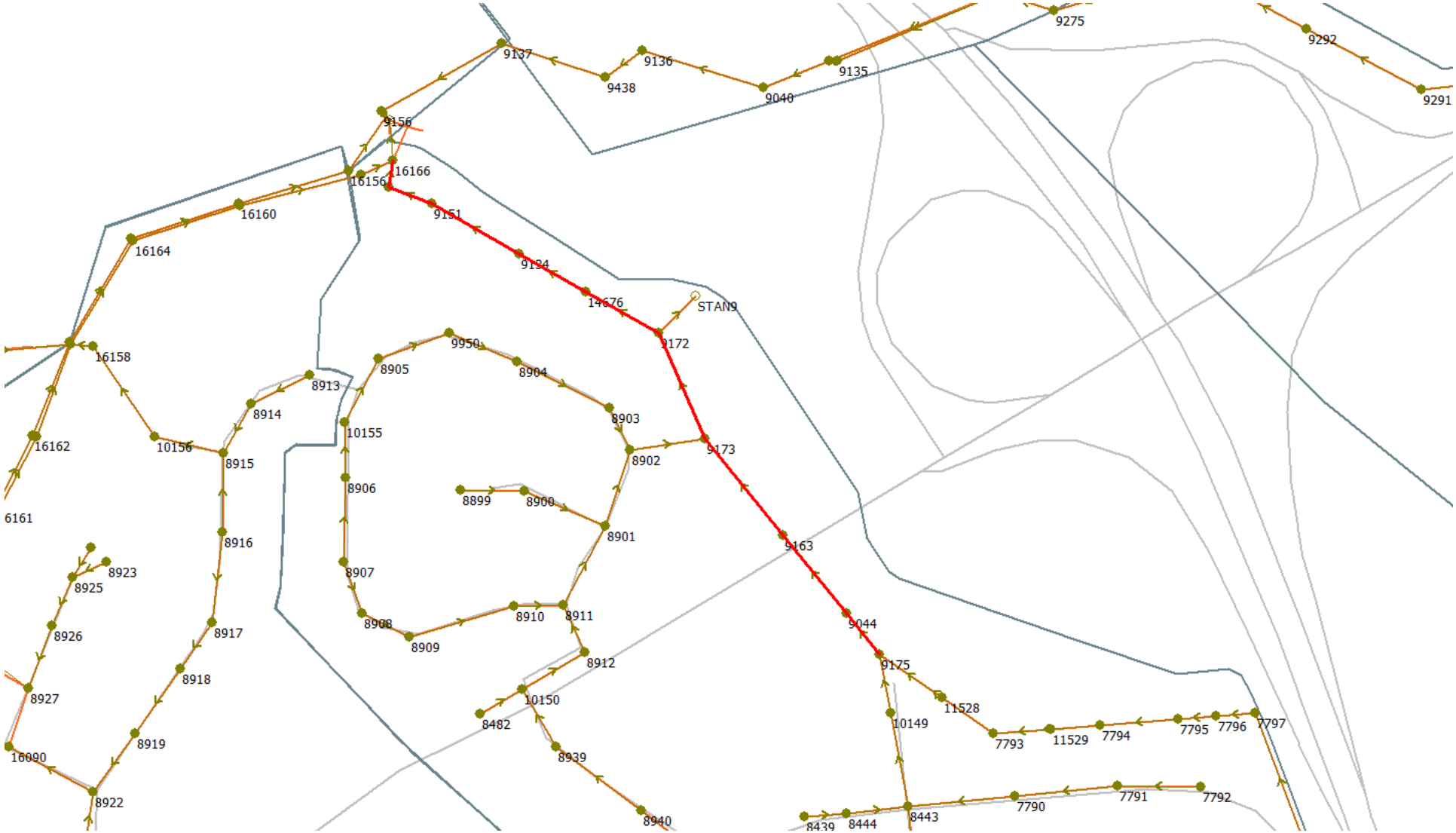
Title **Forwell Trunk Profile 3 Overview**

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario, Canada
N2H 6M7
Tel: (519) 579-4410
Fax: (519) 579-6733
www.stantec.comt

Client/Project City of Waterloo

Waterloo Sanitary Servicing Master Plan

Drawing is not to be used for construction



July 2013
161111191

Stantec

Legend

Figure No. 1

Title **Glenridge Trunk Geoplan Overview**

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario, Canada
N2H 6M7
Tel: (519) 579-4410
Fax: (519) 579-6733
www.stantec.comt

Client/Project City of Waterloo

Waterloo Sanitary Servicing Master Plan

Drawing is not to be used for construction

Counterpoint Engineering Inc.
Existing Sanitary Flows Calculations

Project:	170 Northfield Drive West	**Designed By**	LC
Project No:	22051	**Checked By**	PM
Client:	Forgestone Capital Management LP	**Date**	06-Mar-24
Location:	Waterloo, ON	**Revision Date**	03-Mar-25

Total Site Area: 11.07 ha (excludes 0.04 Ha. Road widening)

Development Area	7.58	ha
Severed Lands	3.05	ha
Buffer	0.44	ha

Region of Waterloo Design Parameters

Population Density

Residential - Apartment	2.07	(ppu)

Infiltration Allowance	0.15	(l/s/ha)

Average Flow

Residential	275	(l/c/d)
Commercial - Core	1.16	(l/s/ha)
Commercial - Shopping Mall	0.3	(l/s/ha)
Commercial - General	0.6	(l/s/ha)

Peaking Factors

Industrial	2
Commercial	2.5

Severed Lands

Commercial - General	3.05	ha

Retained Lands "B"

Commercial - General	7.58	ha

Existing Sanitary Flows

Nominal Demand	1.8	(l/s)
Peak Demand	4.6	(l/s)

Existing Sanitary Flows

Nominal Demand	4.5	(l/s)
Peak Demand	11.4	(l/s)

Existing Sanitary Flows + Infiltration

Infiltration	0.46	(l/s)
Peak Flows	5.0	(l/s)

Existing Sanitary Flows + Infiltration

Infiltration	1.14	(l/s)
Peak Flows	12.5	(l/s)

Counterpoint Engineering Inc.
Sanitary Design Calculations for Development Area

Project:	170 Northfield Drive West	Designed By	LC
Project No:	22051	Checked By	PM
Client:	Forgestone Capital Managenet LP	Date	06-Mar-24
Location:	Waterloo, ON	Revision Date	03-Mar-25

Retained Lands "B" 6.32 ha (excluding CNR buffer)

Region of Waterloo Design Parameters

Population Density

Residential - Apartment	2.07	(ppu)

Infiltration Allow	0.25	(l/s/ha)

Average Flow

Residential	275	(l/c/d)
Commercial - Core	1.16	(l/s/ha)
Commercial - Shopping Mall	0.3	(l/s/ha)
Commercial - General	0.6	(l/s/ha)

Peaking Factors

Commercial	2.5
Residential[2]	3.3

(2) Residential Factor per Harmon Formula

Site Statistics[1]

Residential	2,061	(units)
Residential Area	2.61	ha

[PHASE 1 - BLDG A, B, C, D]

(1) Site Statistics per architectural plans circulated March 6th, 2024

Sanitary Design Flows + Infiltration

Landuse	Population/ Area (ha)	Nominal Flow (l/s)	Peak Flow (l/s)	Infiltration(l/s)	Total Flow (L/s)	
Residential	4,266	13.58	44.92	0.65	45.57	[Phase 1]
Commercial - General	3.70	2.22	5.55	0.93	6.48	[Phase 2]
Total Peak Design Flow - Retained Lands B			52.05			

Counterpoint Engineering Inc.
Sanitary Design Calculations for Future Development Lands

Project:	170 Northfield Drive West	Designed By	LC
Project No:	22051	Checked By	PM
Client:	Forgestone Capital Management LP	Date	06-Mar-24
Location:	Waterloo, ON	Revision Date	03-Mar-25

Severed Lands 4.31 ha

Region of Waterloo Design Parameters

Population Density

Residential - Apartment	2.07	(ppu)

Infiltration Allowance	0.25	(l/s/ha)

Average Flow

Residential	275	(l/c/d)
Commercial - Core	1.16	(l/s/ha)
Commercial - Shopping Mall	0.3	(l/s/ha)
Commercial - General	0.6	(l/s/ha)

Peaking Factors

Commercial	2.5
Residential[2]	3.4

(2) Residential Factor per Harmon Formula

Site Statistics[1]

Residential	1,591	(units)
Commercial - General	2.28	(ha)

(BLDG E, F, G, H)
(BLDG I & K)

(1) Site Statistics per architectural plans circulated March 6th, 2024

Sanitary Design Flows + Infiltration

Landuse	Population /Area (ha)	Nominal Flow (l/s)	Peak Flow (l/s)
Residential	3,293	10.48	35.72
Commercial - General	2.28	1.37	3.42
Infiltration (4.31 ha)			1.08
Total Peak Design Flow			40.22

[PHASE 3)

Counterpoint Engineering Inc.
Sanitary Design Calculations

Project:	170 Northfield Drive West	Designed By	LC
Project No:	22051	Checked By	PM
Client:	Forgestone Capital Management LP	Date	06-Mar-24
Location:	Waterloo, ON	Revision Date	03-Mar-25

Total Development Area:	10.63 ha	(excluding 0.44 Ha. CNR buffer)
Retained Lands "B"	6.32 ha	
Severed Lands	4.31 ha	

Region of Waterloo Design Parameters

Population Density

Residential - Apartment	2.07	(ppu)

Infiltration Allowance	0.25	(l/s/ha)

Average Flow

Residential	275	(l/c/d)
Commercial - Core	1.16	(l/s/ha)
Commercial - Shopping Mall	0.3	(l/s/ha)
Commercial - General	0.5	(l/s/ha)

Peaking Factors

Commercial	2.5
Residential[2]	3.1

(2) Residential Factor per Harmon Formula

$$F = 1 + \frac{14}{4 + \sqrt{P}}$$ (P = Population/1,000)

Site Statistics[1]

Retained Lands B - Phase 1 & 2

Residential	2,061	(units)	(BLDG A, B, C, D)
Commercial - General	3.70	ha	(BLDG J, L)

Future Development (Phase 3)

Residential	1,591	(units)	(BLDG E, F, G, H)
Commercial - General	2.28	ha	(BLDG I & K)

(1) Site Statistics per architectural plans circulated January 17th, 2025

Future Sanitary Design Flows + Infiltration

Landuse	Population /Area	Nominal Flow (l/s)	Peak Flow (l/s)	
Residential	7,560	24.06	73.97	
Commercial - General	5.98	2.99	7.48	
Infiltration (11.07 ha)			2.66	
Total Peak Design Flow			84.10	[PHASES 1, 2 & 3 &]

APPENDIX D

Storm Drainage and Stormwater Management Design Calculations

Project No.: 22051

APPENDIX D

Storm Drainage and Stormwater Management Design Calculations

Project No.: 22051

MUNICIPAL CLASS EA STORMWATER MANAGMENT MASTER PLAN

Figure 3.1.2
SUBWATERSHEDS

- Study Area
- Watercourse
- Subwatershed Boundary

Subwatersheds

- Alder Creek
- Beaver Creek
- Cedar Creek
- Clair Creek
- Colonial Creek
- Conestogo River - Lower
- Forwell Creek
- Grand River Tributaries North
- Grand River Tributaries South
- Laurel Creek Reservoir
- Lower Laurel Creek
- Maple Hill Creek
- Martin Creek East
- Martin Creek West
- Melitzer Creek
- Middle Laurel Creek
- Monastery reek
- Schneider Creek

0 0.5 1 Kilometers

N

Aquafor Beech Limited

Base data provided by The City of Waterloo, 2017 and Grand River Conservation Authority, 2017.

Date: May 2017

- Water balance approach should be be determined in consultation with the City of Waterloo Engineering Services Project Manager prior to preliminary design.
- Stormwater management plans and designs for all development shall strive to match pre-development water balance conditions
- For all sites within ICAs and/or WHPAs with adjusted vulnerability scores equal to or greater than 8, paved surfaces (roads, sidewalks and parking surfaces) should not be treated with stormwater infiltration practices due to salt-based deicers commonly used in the winter
- The Stormwater Management Master Plan: Stormwater Infiltration Policy Recommendations (2021) found on the City of Waterloo Website provides two frameworks for identifying infiltration opportunities.
    - Land Use Infiltration Plan
    - Infiltratoin Plan for Municipal Roads
- If subsurface conditions are suitable, at-source infiltration of roof drainage is encouraged as a method of quantity and quality control
- When infiltration measures are proposed, a qualified Professional must confirm the type of soil, permeability, and depth to water table in a formal Geotechnical or Hydrogeological report
- Monitoring and maintenance ports for all infiltration measures should be included

3.5 Intensity-Duration-Frequency (IDF) Relationship

Observations of rainfall at a particular geographic location can be described statistically by an Intensity-Duration-Frequency (IDF) relationship or curve. For a specific frequency or return period a curve can be defined which predicts the maximum average rainfall intensity which is likely to occur for a range of durations. High rainfall intensity is likely to occur over very short durations such as 5 or 15 minutes whereas for longer durations the average intensity is likely to be more modest.

The reliability of an IDF curve increases with the period of record for which rainfall data is available. For purposes of calculation, the IDF curves can be represented by Equation V5-1 using the values found in Table V6-1.

Equation V5-1: $$i = \frac{a}{(t_d+b)^c}$$

Where i = extreme mean average rainfall intensity in mm/hr
t_d = duration of the storm event in minutes
a,b,c = storm constants for a given return period.

TABLE V6-1 STORM CONSTANTS FOR DIFFERENT RETURN PERIODS

Return period T years	2	5	25	100
a (mm/hour)	1101	1755	3261	4692
b (minutes)	9.258	12.347	16.193	17.437
c	0.882	0.895	0.938	0.956

SWM DESIGN CALCULATIONS
Summary of Storage Provided Calculations

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: '20-Dec-23

Prepared by: LC
Checked by: PM
Last Revised: 20-Aug-26

Rainfall Data

Location:	Waterloo, On	a	4692
Event	100-year	b	17.347
		c	0.956

Northfield Drive Outlet 2 (Storm Sewer Easement)

Area ID	Area (ha)	Runoff Coefficient	TC (min)	Storage Available (m^3)	Storage Required (m^3)	Designed Release Rate (m^3/s)	Description	Orifice Size (mm)	Orifice Release Rate (m^3/s)
Area 304 (Building L)	**2.27**	**0.9**	**15**	**800**	**747**	0.25	Underground and onsite storage.	**N/A**	**N/A**
Area 303 (Building J)	1.08	0.90	15	300	253	0.18	Underground and onsite storage.	**N/A**	**N/A**
Area 305 Uncontrolled	0.48	0.25	15	N/A	N/A	0.08	Underground and onsite storage.	**300**	**0.32**
Total	**3.83**			**1,100**	**1,000**	**0.52**			

Northfield Drive Outlet 1 (Parkside Drive)

Area ID	Area (ha)	Runoff Coefficient	TC (min)	Storage Available (m^3)	Storage Required (m^3)	Designed Release Rate (m^3/s)	Description	Orifice Size (mm)	Orifice Release Rate (m^3/s)
Area 201, 202, 203, 301 & 302	4.02	0.90	15	1200	1095	0.88	Underground and onsite storage	**N/A**	**N/A**
204 Uncontrolled	0.23	0.25	15	N/A	N/A	0.04	Uncontrolled	**N/A**	**N/A**
Total	**4.25**			**1200**	**1095**	**0.92**			

Total site release rate (m^3/s): **1.43** **[100-year storm event]**

Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
TEL: (905) 326-1404 FAX: (905) 326-1405
www.counterpointeng.com

counterpoint ENGINEERING

SWM DESIGN CALCULATIONS
Existing Conditions Release Rate Calculations (Rational Method)
Area 101 (CNR corridor outlet)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: '20-Dec-23

Prepared by: BB
Checked by: PM
Last Revised: 03-Mar-25

Rational Method

Q = KRCIA

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

* Max existing conditions RC of 0.50 used

Area 101

Location	City of Waterloo
Area (ha)	4.24
Runoff Coefficient	0.41

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Event:	2-Year
a	1101.000
b	9.258
c	0.882
Runoff Coefficient	0.41
AC	1.74
Tc (min)	10
Rainfall Intensity (mm/hr)	81
Rational Flow Rate (l/s)	391

Event:	5-Year
a	1755
b	12.347
c	0.895
Runoff Coefficient	0.41
AC	1.74
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	526

Event:	25-Year
a	3261.000
b	16.193
c	0.938
Runoff Coefficient	0.45
AC	1.91
Tc (min)	10
Rainfall Intensity (mm/hr)	152
Rational Flow Rate (l/s)	810

Event:	100-Year
a	4692.000
b	17.347
c	0.956
Runoff Coefficient	0.51
AC	2.17
Tc (min)	10
Rainfall Intensity (mm/hr)	198
Rational Flow Rate (l/s)	1,198

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SWM DESIGN CALCULATIONS
Existing Conditions Release Rate Calculations (Rational Method)
Area 102 (Northfield Dr. storm sewer outlet)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: BB
Checked by: PM
Last Revised: 03-Mar-25

Area 102

Location	City of Waterloo
Area (ha)	3.79
Runoff Coefficient	0.50

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$$Q = KRCIA$$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

* Max existing conditions RC of 0.50 used

Event:	2-Year
a	1101.000
b	9.258
c	0.882
Runoff Coefficient	0.50
AC	1.90
Tc (min)	10
Rainfall Intensity (mm/hr)	81
Rational Flow Rate (l/s)	427

Event:	5-Year
a	1755
b	12.347
c	0.895
Runoff Coefficient	0.50
AC	1.90
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	573

Event:	25-Year
a	3261.000
b	16.193
c	0.938
Runoff Coefficient	0.55
AC	2.08
Tc (min)	10
Rainfall Intensity (mm/hr)	152
Rational Flow Rate (l/s)	883

Event:	100-Year
a	4692.000
b	17.347
c	0.956
Runoff Coefficient	0.63
AC	2.37
Tc (min)	10
Rainfall Intensity (mm/hr)	198
Rational Flow Rate (l/s)	1,306

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SWM DESIGN CALCULATIONS
Existing Conditions Release Rate Calculations (Rational Method)
Areas 103 (Northfield Dr. storm sewer outlet)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: BB
Checked by: PM
Last Revised: 03-Mar-25

Area 102

Location	City of Waterloo
Area (ha)	2.57
Runoff Coefficient	0.64

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$$Q = KRCIA$$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

* Max existing conditions RC of 0.50 used

Event:	2-Year
a	1101.000
b	9.258
c	0.882
Runoff Coefficient	0.50
AC	1.29
Tc (min)	10
Rainfall Intensity (mm/hr)	81
Rational Flow Rate (l/s)	289

Event:	5-Year
a	1755
b	12.347
c	0.895
Runoff Coefficient	0.64
AC	1.64
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	497

Event:	25-Year
a	3261.000
b	16.193
c	0.938
Runoff Coefficient	0.70
AC	1.81
Tc (min)	10
Rainfall Intensity (mm/hr)	152
Rational Flow Rate (l/s)	766

Event:	100-Year
a	4692.000
b	17.347
c	0.956
Runoff Coefficient	0.80
AC	2.06
Tc (min)	10
Rainfall Intensity (mm/hr)	198
Rational Flow Rate (l/s)	1,133

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SWM DESIGN CALCULATIONS
Existing Conditions Release Rate Calculations (Rational Method)
Area 104 (Northfield Dr. storm sewer outlet)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: BB
Checked by: PM
Last Revised: 03-Mar-25

Area 102

Location	City of Waterloo
Area (ha)	5.40
Runoff Coefficient	0.85

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$$Q = KRCIA$$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

* Max existing conditions RC of 0.50 used

Event:	2-Year
a	1101.000
b	9.258
c	0.882
Runoff Coefficient	0.50
AC	2.70
Tc (min)	10
Rainfall Intensity (mm/hr)	81
Rational Flow Rate (l/s)	608

Event:	5-Year
a	1755
b	12.347
c	0.895
Runoff Coefficient	0.85
AC	4.59
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	1,388

Event:	25-Year
a	3261.000
b	16.193
c	0.938
Runoff Coefficient	0.94
AC	5.05
Tc (min)	10
Rainfall Intensity (mm/hr)	152
Rational Flow Rate (l/s)	2,138

Event:	100-Year
a	4692.000
b	17.347
c	0.956
Runoff Coefficient	1.06
AC	5.74
Tc (min)	10
Rainfall Intensity (mm/hr)	198
Rational Flow Rate (l/s)	3,163

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SWM DESIGN CALCULATIONS
Proposed Conditions Release Rate Calculations (Rational Method)
SWM Area 204

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: '20-Dec-23

Prepared by: BB
Checked by: PM
Last Revised: 20-Aug-26

Area 305- Uncontroled Area

Location	City of Waterloo
Area (ha)	0.23
Runoff Coefficient	0.25

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$Q = KRCIA$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

* Max existing conditions RC of 0.50 used

Event:	2-Year
a	1101.000
b	9.258
c	0.882
Runoff Coefficient	0.25
AC	0.06
Tc (min)	10
Rainfall Intensity (mm/hr)	81
Rational Flow Rate (l/s)	13

Event:	5-Year
a	1755
b	12.347
c	0.895
Runoff Coefficient	0.25
AC	0.06
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	17

Event:	25-Year
a	3261.000
b	16.193
c	0.938
Runoff Coefficient	0.28
AC	0.06
Tc (min)	10
Rainfall Intensity (mm/hr)	152
Rational Flow Rate (l/s)	27

Event:	100-Year
a	4692.000
b	17.347
c	0.956
Runoff Coefficient	0.31
AC	0.07
Tc (min)	10
Rainfall Intensity (mm/hr)	198
Rational Flow Rate (l/s)	40

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SWM DESIGN CALCULATIONS
Upstream Required Storage Calculations (Area 201, Buildings A, B, C & D)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 6-Mar-24

Prepared by: LC
Checked by: PM
Last Revised: 20-Aug-26

Rainfall Data

Location:	Waterloo, On	a	4692
Event	100-year	b	17.347
		c	0.956

Site Data

Area (ha)	2.22
Runoff Coefficient	0.80
AC	1.78
Tc (min)	15
Time Increment (min)	5
Release Rate (l/s)	350
Storage Required (m^3)	**453**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	0.83	751	315	436	
20	147	0.73	873	420	453	********
25	131	0.65	968	525	443	
30	117	0.58	1044	630	414	
35	107	0.53	1106	735	371	
40	98	0.48	1159	840	319	
45	90	0.45	1203	945	258	
50	84	0.41	1242	1050	192	
55	78	0.39	1276	1155	121	
60	73	0.36	1306	1260	46	
65	69	0.34	1332	1365	0	
70	65	0.32	1356	1470	0	
75	62	0.31	1378	1575	0	
80	59	0.29	1397	1680	0	
85	56	0.28	1415	1785	0	
90	54	0.27	1432	1890	0	
95	51	0.25	1447	1995	0	
100	49	0.24	1461	2100	0	
105	47	0.23	1474	2205	0	
110	46	0.23	1486	2310	0	
115	44	0.22	1497	2415	0	
120	42	0.21	1508	2520	0	
125	41	0.20	1518	2625	0	

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SWM DESIGN CALCULATIONS
Required Storage Calculations- Area 301

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	2.02
Runoff Coefficient	0.76
AC	1.54
Tc (min)	15
Time Increment (min)	5
Controlled Upstream Flows	0
Release Rate (l/s)	136
Storage Required (m^3)	674

*(Area 301 Only)

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	0.72	0.00	649	123	527	
20	147	0.63	0.00	755	164	591	
25	131	0.56	0.00	836	205	632	
30	117	0.50	0.00	902	245	657	
35	107	0.46	0.00	956	286	670	
40	98	0.42	0.00	1001	327	674	********
45	90	0.39	0.00	1040	368	672	
50	84	0.36	0.00	1074	409	665	
55	78	0.33	0.00	1103	450	653	
60	73	0.31	0.00	1129	491	638	
65	69	0.30	0.00	1152	532	620	
70	65	0.28	0.00	1172	573	600	
75	62	0.26	0.00	1191	614	577	
80	59	0.25	0.00	1208	654	553	
85	56	0.24	0.00	1223	695	528	
90	54	0.23	0.00	1237	736	501	
95	51	0.22	0.00	1251	777	473	

SWM DESIGN CALCULATIONS
Required Storage Calculations- A302 Orifice

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	0.48
Runoff Coefficient	0.77
AC	0.37
Tc (min)	15
Time Increment (min)	5
Controlled Upstream Flows	136
Release Rate (l/s)	151
Storage Required (m^3)	220

*(Area 302)

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	0.17	0.14	279	136	143	
20	147	0.15	0.14	345	181	164	
25	131	0.13	0.14	406	227	179	
30	117	0.12	0.14	463	272	190	
35	107	0.11	0.14	517	318	199	
40	98	0.10	0.14	568	363	205	
45	90	0.09	0.14	619	408	210	
50	84	0.09	0.14	667	454	214	
55	78	0.08	0.14	715	499	216	
60	73	0.08	0.14	763	544	218	
65	69	0.07	0.14	809	590	219	
70	65	0.07	0.14	855	635	220	
75	62	0.06	0.14	900	680	220	********
80	59	0.06	0.14	945	726	219	
85	56	0.06	0.14	990	771	219	
90	54	0.06	0.14	1034	817	218	
95	51	0.05	0.14	1078	862	216	
100	49	0.05	0.14	1122	907	215	
105	47	0.05	0.14	1166	953	213	
110	46	0.05	0.14	1209	998	211	
115	44	0.05	0.14	1252	1043	209	

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 301

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**EX. CBMH**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.80		**[TUBE]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**346.50**	m	**[100-year storm event]**
Orifice Invert Elevation	=	340.820	m	
Orifice Diameter	=	**200**	**mm**	
Orifice Springline Elevation		345.00	m	
Cross section area of orifice (A)	=	0.0314	sq.m.	
Head (H)	=	**1.50**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**136.3**	L/s	**[1:100 year storm event]**

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 301/302

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**MH.106**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.60		**[PLATE]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**347.50**	m	**[100-year storm event]**
Orifice Invert Elevation	=	344.120	m	
Orifice Diameter	=	**200**	**mm**	
Orifice Springline Elevation		344.22	m	
Cross section area of orifice (A)	=	0.0314	sq.m.	
Head (H)	=	**3.28**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**151.2**	L/s	**[1:100 year storm event]**

SWM DESIGN CALCULATIONS
Available Storage Calculations (Downstream Orifice - Area 302)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: PW
Last Revised: 20-Aug-26

Available Storage Underground in Sewer

UPSTREAM OF THE ORIFICE CONTROL AT MH305 (BELOW HWL of 347.50m) :

From	To	Length Below HWL (m)	Diameter (mm)	Volume (m^3)
MH311	MH309	81.2	1200	91.84
MH309	MH308	21.4	1200	24.20
MH308	MH313	21.7	1200	24.54
MH313	MH106	45.2	1200	51.12
Total Storage Underground in Sewers (m^3):				**191.7**

Available Storage Underground in Sewer Catchbasins & Manholes

UPSTREAM OF THE ORIFICE CONTROL AT MH305 (BELOW HWL of 347.50m) :

MH	Manhole/CB Top Elevation or HWL (m)	Low Invert Elevation (m)	Diameter/Dimension (m)	Volume (m^3)
MH311	347.00	345.18	3.00	12.86
MH309	347.00	344.72	3.00	16.12
MH308	347.00	344.56	3.00	17.25
MH313	347.00	344.35	3.00	18.73
Total Storage Underground in CB's & MH's (m^3):				**65.0**

CULTEC SYSTEM STORAGE (m^3)

Total Available Stormwater Storage (m^3): **256.7**

SWM DESIGN CALCULATIONS
Required Storage Calculations - Area 202
1:100 year storm event

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: LC
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	0.58
Runoff Coefficient	0.70
AC	0.41
Tc (min)	15
Time Increment (min)	10
Upstream Controlled Flows	875
Release Rate (l/s)	877
Storage Required (m^3)	343

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)
15	169	0.19	0.87	959	789	169
25	131	0.15	0.87	1533	1316	217
35	107	0.12	0.87	2090	1842	248
45	90	0.10	0.87	2637	2368	268
55	78	0.09	0.87	3178	2895	283
65	69	0.08	0.87	3716	3421	295
75	62	0.07	0.87	4251	3947	304
85	56	0.06	0.87	4784	4473	311
95	51	0.06	0.87	5316	5000	317
105	47	0.05	0.87	5847	5526	321
115	44	0.05	0.87	6377	6052	325
125	41	0.05	0.87	6907	6579	328
135	38	0.04	0.87	7436	7105	331
145	36	0.04	0.87	7965	7631	333
155	34	0.04	0.87	8493	8157	335
165	32	0.04	0.87	9021	8684	337
175	31	0.03	0.87	9548	9210	338
185	29	0.03	0.87	10076	9736	339
195	28	0.03	0.87	10603	10263	340

SWM DESIGN CALCULATIONS
Available Storage Calculations - Area 202 (Private Road)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 6-Mar-24

Prepared by: PM
Checked By: AD
Last Revised: 20-Aug-26

Available Storage Underground in Sewer

UPSTREAM OF THE WEIR/ORIFICE CONTROL AT MH204 (BELOW HWL of 342.75m) :

From	To	Length Below HWL (m)	Diameter (mm)	Volume (m^3)
MH103	MH104	49.4	1800x1200 Box	106.70
MH104	CBMH105	11.0	1800x1200 Box	23.76
CBMH105	MH106	60.0	1800x1200 Box	129.60
MH104	MH110	14.8	1800x1200 Box	31.97
Total Storage Underground in Sewers (m^3):				**292.0**

Available Storage Underground in Sewer Catchbasins & Manholes

UPSTREAM OF THE WEIR/ORIFICE CONTROL AT MH204 (BELOW HWL of 342.75m) :

MH	Manhole/CB Top Elevation or HWL (m)	Low Invert Elevation (m)	Diameter/Dimension (m)	Volume (m^3)
MH103	343.50	341.93	3.60	15.98
MH104	343.50	342.10	3.60	14.25
CBMH105	343.50	342.17	3.60	13.54
MH106	343.50	342.34	3.60	11.81
Total Storage Underground in CB's & MH's (m^3):				**55.6**

Total Available Stormwater Storage (m^3): **350**

SWM DESIGN CALCULATIONS
Available Storage Calculations - Area 202 (Private Road)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 6-Mar-24

Prepared by: PM
Checked By: PW
Last Revised: 26-Mar-25

Available Storage Underground in Sewer

UPSTREAM OF THE WEIR/ORIFICE CONTROL AT MH204 (BELOW HWL of 342.75m) :

From	To	Length Below HWL (m)	Diameter (mm)	Volume (m^3)
MH103	MH104	49.4	1200	55.87
MH104	CBMH105	11.0	1200	12.44
CBMH105	MH106	60.0	1200	67.86
Total Storage Underground in Sewers (m^3):				**136.2**

Available Storage Underground in Sewer Catchbasins & Manholes

UPSTREAM OF THE WEIR/ORIFICE CONTROL AT MH204 (BELOW HWL of 342.75m) :

MH	Manhole/CB Top Elevation or HWL (m)	Low Invert Elevation (m)	Diameter/Dimension (m)	Volume (m^3)
MH103	343.50	341.93	2.40	7.10
MH104	343.50	342.10	2.40	6.33
CBMH105	343.50	342.17	2.40	6.02
MH106	343.50	342.34	2.40	5.25
Total Storage Underground in CB's & MH's (m^3):				**24.7**

Total Available Stormwater Storage (m^3): **160**

SWM DESIGN CALCULATIONS
Required Storage Calculations- Area 203

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	1.22
Runoff Coefficient	0.90
AC	1.10
Tc (min)	15
Time Increment (min)	5
Controlled Roof Flows	0
Release Rate (l/s)	200
Storage Required (m^3)	300

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	0.52	0.00	464	180	284	
20	147	0.45	0.00	540	240	300	********
25	131	0.40	0.00	598	300	298	
30	117	0.36	0.00	645	360	285	
35	107	0.33	0.00	684	420	264	
40	98	0.30	0.00	716	480	236	
45	90	0.28	0.00	744	540	204	
50	84	0.26	0.00	768	600	168	
55	78	0.24	0.00	789	660	129	
60	73	0.22	0.00	807	720	87	
65	69	0.21	0.00	824	780	44	
70	65	0.20	0.00	838	840	0	
75	62	0.19	0.00	852	900	0	
80	59	0.18	0.00	864	960	0	
85	56	0.17	0.00	875	1020	0	
90	54	0.16	0.00	885	1080	0	
95	51	0.16	0.00	894	1140	0	

SWM DESIGN CALCULATIONS
Orifice Calcuation - Area 202

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: PM
Last Revised: 20-Aug-26

Orifice Location	=	**MH103**		**[Parkside Dr. Ext. private road]**
Orifice Coefficient (C)	=	0.80		**[TUBE]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**343.50**	m	**[100-year storm event]**
Orifice Invert Elevation	=	341.930	m	
Orifice Diameter	=	**525**	**mm**	
Orifice Springline Elevation		342.19	m	
Cross section area of orifice (A)	=	0.2165	sq.m.	
Head (H)	=	**1.31**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**877.1**	L/s	**[1:100 year storm event]**

SWM DESIGN CALCULATIONS
Required Storage Calculations - Area 203 (Building J)
1:100 year storm event

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: LC
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	1.08
Runoff Coefficient	0.90
AC	0.97
Tc (min)	15
Time Increment (min)	10
Upstream Controlled Flows	0
Release Rate (l/s)	185
Storage Required (m^3)	**253**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	0.46	0.00	411	166	245	
25	131	0.35	0.00	530	277	253	********
35	107	0.29	0.00	605	388	218	
45	90	0.24	0.00	659	499	160	
55	78	0.21	0.00	698	609	89	
65	69	0.19	0.00	729	720	9	
75	62	0.17	0.00	754	831	0	
85	56	0.15	0.00	774	942	0	
95	51	0.14	0.00	792	1052	0	
105	47	0.13	0.00	807	1163	0	
115	44	0.12	0.00	820	1274	0	
125	41	0.11	0.00	831	1385	0	
135	38	0.10	0.00	841	1496	0	
145	36	0.10	0.00	850	1606	0	
155	34	0.09	0.00	858	1717	0	
165	32	0.09	0.00	866	1828	0	
175	31	0.08	0.00	872	1939	0	
185	29	0.08	0.00	879	2050	0	
195	28	0.08	0.00	884	2160	0	

SWM DESIGN CALCULATIONS
Required Storage Calculations - Area 304(Building L)
1:100 year storm event

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: LC
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	2.27
Runoff Coefficient	0.90
AC	2.04
Tc (min)	15
Time Increment (min)	10
Upstream Controlled Flows	0
Release Rate (l/s)	250
Storage Required (m^3)	747

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	0.96	0.00	864	225	639	
25	131	0.74	0.00	1113	375	738	
35	107	0.61	0.00	1272	525	747	********
45	90	0.51	0.00	1384	675	709	
55	78	0.44	0.00	1468	825	643	
65	69	0.39	0.00	1532	975	557	
75	62	0.35	0.00	1585	1125	460	
85	56	0.32	0.00	1628	1275	353	
95	51	0.29	0.00	1664	1425	239	
105	47	0.27	0.00	1695	1575	120	
115	44	0.25	0.00	1723	1725	0	
125	41	0.23	0.00	1746	1875	0	
135	38	0.22	0.00	1768	2025	0	
145	36	0.21	0.00	1787	2175	0	
155	34	0.19	0.00	1804	2325	0	
165	32	0.18	0.00	1819	2475	0	
175	31	0.17	0.00	1833	2625	0	
185	29	0.17	0.00	1847	2775	0	
195	28	0.16	0.00	1859	2925	0	

SWM DESIGN CALCULATIONS
Required Storage Calculations- Area 301/302 Orifice

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: PW
Last Revised: 26-Mar-25

Rainfall Data

Location:	City of Waterloo	a		4692
Event	100-year	b		17.347
		c		0.956

Site Data

Area (ha)	2.50
Runoff Coefficient	0.90
AC	2.25
Tc (min)	15
Time Increment (min)	5
Controlled Upstream Flows	0
Release Rate (l/s)	564
Storage Required (m^3)	444

*(Area 301 + 302)

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	169	1.06	0.00	952	507	444	********
20	147	0.92	0.00	1106	677	429	
25	131	0.82	0.00	1226	846	380	
30	117	0.73	0.00	1322	1015	307	
35	107	0.67	0.00	1401	1184	217	
40	98	0.61	0.00	1468	1353	115	
45	90	0.56	0.00	1524	1522	2	
50	84	0.52	0.00	1573	1691	0	
55	78	0.49	0.00	1616	1861	0	
60	73	0.46	0.00	1654	2030	0	
65	69	0.43	0.00	1688	2199	0	
70	65	0.41	0.00	1718	2368	0	
75	62	0.39	0.00	1745	2537	0	
80	59	0.37	0.00	1770	2706	0	
85	56	0.35	0.00	1793	2875	0	
90	54	0.34	0.00	1814	3045	0	
95	51	0.32	0.00	1833	3214	0	

SWM DESIGN CALCULATIONS
Available Storage Calculations (Downstream Orifice - Area 302)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: PW
Last Revised: 26-Mar-25

Available Storage Underground in Sewer

UPSTREAM OF THE ORIFICE CONTROL AT MH305 (BELOW HWL of 346.75m) :

From	To	Length Below HWL (m)	Diameter (mm)	Volume (m^3)
MH306	MH305	9.0	1200	10.18
MH307	MH306	21.4	1200	24.20
MH308	MH307	81.3	1200	91.95
MH311	MH308	29.5	450	4.69
CULTEC	MH311	3.0	450	0.48
MH309	MH306	40.0	1200	45.24
Total Storage Underground in Sewers (m^3):				**176.7**

Available Storage Underground in Sewer Catchbasins & Manholes

UPSTREAM OF THE ORIFICE CONTROL AT MH305 (BELOW HWL of 346.75m) :

MH	Manhole/CB Top Elevation or HWL (m)	Low Invert Elevation (m)	Diameter/Dimension (m)	Volume (m^3)
MH305	346.75	344.05	3.00	19.09
MH306	346.75	342.21	3.60	46.21
MH307	346.75	344.25	3.00	17.67
MH308	346.75	345.24	3.00	10.67
MH309	346.75	345.50	2.40	5.65
MH311	346.75	346.14	1.20	0.69
Total Storage Underground in CB's & MH's (m^3):				**100.0**

CULTEC SYSTEM STORAGE (m^3) **180.0**

Total Available Stormwater Storage (m^3): **456.7**

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 304

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**MH400**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.80		**[TUBE]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**343.25**	m	**[100-year storm event]**
Orifice Invert Elevation	=	341.420	m	
Orifice Diameter	=	**225**	**mm**	
Orifice Springline Elevation		341.53	m	
Cross section area of orifice (A)	=	0.0398	sq.m.	
Head (H)	=	**1.72**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**184.6**	L/s	**[1:100 year storm event]**

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 304

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: PM
Last Revised: 20-Aug-26

Orifice Location	=	**CBMH201**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.80		**[TUBE]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**343.25**	m	**[100-year storm event]**
Orifice Invert Elevation	=	341.420	m	
Orifice Diameter	=	**300**	**mm**	
Orifice Springline Elevation		341.57	m	
Cross section area of orifice (A)	=	0.0707	sq.m.	
Head (H)	=	**1.68**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**324.7**	L/s	**[1:100 year storm event]**

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SWM DESIGN CALCULATIONS
Proposed Conditions Release Rate Calculations (Rational Method)
SWM Area 305

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: '20-Dec-23

Prepared by: BB
Checked by: PM
Last Revised: 20-Aug-26

Area 305- Uncontroled Area

Location	City of Waterloo
Area (ha)	0.48
Runoff Coefficient	0.25

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$Q = KRCIA$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

* Max existing conditions RC of 0.50 used

Event:	2-Year
a	1101.000
b	9.258
c	0.882
Runoff Coefficient	0.25
AC	0.12
Tc (min)	10
Rainfall Intensity (mm/hr)	81
Rational Flow Rate (l/s)	27

Event:	5-Year
a	1755
b	12.347
c	0.895
Runoff Coefficient	0.25
AC	0.12
Tc (min)	10
Rainfall Intensity (mm/hr)	109
Rational Flow Rate (l/s)	36

Event:	25-Year
a	3261.000
b	16.193
c	0.938
Runoff Coefficient	0.28
AC	0.13
Tc (min)	10
Rainfall Intensity (mm/hr)	152
Rational Flow Rate (l/s)	56

Event:	100-Year
a	4692.000
b	17.347
c	0.956
Runoff Coefficient	0.31
AC	0.15
Tc (min)	10
Rainfall Intensity (mm/hr)	198
Rational Flow Rate (l/s)	83

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SWM DESIGN CALCULATIONS
Summary of Storage Provided Calculations

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Aug-26

Prepared by: LC
Checked by: PM
Last Revised: 20-Aug-26

Rainfall Data

Location:	Waterloo, On	a	1755
Event	5-year	b	12.347
		c	0.894

Northfield Drive Outlet 2 (Waterloo Fire Station #3)

Area ID	Area (ha)	Runoff Coefficient	TC (min)	Storage Available (m^3)	Storage Required (m^3)	Designed Release Rate (m^3/s)	Description	Orifice Size (mm)	Orifice Release Rate (m^3/s)
Area 304 (Building L)	**2.27**	**0.9**	**15**	**800**	**241**	0.02	Underground and onsite storage.	**N/A**	**N/A**
Area 303 (Building J)	1.08	0.90	15	300	64	0.02	Underground and onsite storage.	**N/A**	**N/A**
Area 305 Uncontrolled	0.48	0.25	15	N/A	N/A	0.08	Underground and onsite storage.	**125**	**0.02**
Total	**3.83**			**1,100**	**305**	**0.12**			

Northfield Drive Outlet 1 (Parkside Drive)

Area ID	Area (ha)	Runoff Coefficient	TC (min)	Storage Available (m^3)	Storage Required (m^3)	Designed Release Rate (m^3/s)	Description	Orifice Size (mm)	Orifice Release Rate (m^3/s)
Area 201, 202, 203 & 301/302	4.02	0.90	15	1200	800	0.24	Underground and onsite storage	**N/A**	**N/A**
204 Uncontrolled	0.23	0.25	15	N/A	N/A	0.02	Uncontrolled	**N/A**	**N/A**
Total	**4.25**			**1200**	**800**	**0.25**			

Total site release rate (m^3/s):	**0.37**	**[5-year storm event]**
Upstream Drainage Area flows (m^3/s):	**0.90**	**[5-year storm event]**
Total Flows to Northfield Dr. sewer	**1.28**	**[5-year storm event]**
Existing Storm Sewer Capacity (m^3/s)	**1.46**	**[750mm dia @ 1.59% slope]**

[Refer to Figure 4C - External Storm Drainage Plan]

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SWM DESIGN CALCULATIONS
Upstream Required Storage Calculations (Area 201, Buildings A, B, C & D)

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 6-Mar-24

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	Waterloo, On	a	1755
Event	5-year	b	12.347
		c	0.894

Site Data

Area (ha)	2.22
Runoff Coefficient	0.84
AC	1.86
Tc (min)	15
Time Increment (min)	5
Release Rate (l/s)	100
Storage Required (m^3)	397

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.47	425	90	335	
20	78	0.41	488	120	368	
25	69	0.36	536	150	386	
30	62	0.32	575	180	395	
35	56	0.29	607	210	397	********
40	51	0.26	635	240	395	
45	47	0.24	658	270	388	
50	44	0.23	678	300	378	
55	41	0.21	697	330	367	
60	38	0.20	713	360	353	
65	36	0.19	727	390	337	
70	34	0.18	741	420	321	
75	32	0.17	753	450	303	
80	31	0.16	764	480	284	
85	29	0.15	774	510	264	
90	28	0.15	784	540	244	
95	27	0.14	793	570	223	
100	26	0.13	801	600	201	
105	25	0.13	809	630	179	
110	24	0.12	817	660	157	
115	23	0.12	824	690	134	
120	22	0.12	831	720	111	
125	22	0.11	837	750	87	

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SWM DESIGN CALCULATIONS
Required Storage Calculations - Area 202

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		1755
Event	5-year	b		12.347
		c		0.894

Site Data

Area (ha)	0.58
Runoff Coefficient	0.75
AC	0.44
Tc (min)	15
Time Increment (min)	10
Upstream Controlled Flows	234
Release Rate (l/s)	237
Storage Required (m^3)	171

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.11	0.23	310	213	96	
25	69	0.08	0.23	476	356	120	
35	56	0.07	0.23	633	498	134	
45	47	0.06	0.23	785	640	144	
55	41	0.05	0.23	934	783	151	
65	36	0.04	0.23	1081	925	156	
75	32	0.04	0.23	1227	1067	160	
85	29	0.04	0.23	1373	1210	163	
95	27	0.03	0.23	1517	1352	165	
105	25	0.03	0.23	1661	1494	167	
115	23	0.03	0.23	1805	1637	168	
125	22	0.03	0.23	1948	1779	169	
135	20	0.02	0.23	2091	1921	170	
145	19	0.02	0.23	2234	2064	170	
155	18	0.02	0.23	2377	2206	171	
165	17	0.02	0.23	2519	2348	171	********
175	16	0.02	0.23	2661	2491	171	
185	16	0.02	0.23	2804	2633	171	
195	15	0.02	0.23	2946	2775	170	

SWM DESIGN CALCULATIONS
Required Storage Calculations- Downstream Orifice Area 201/202

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		1755
Event	5-Year	b		12.347
		c		0.894

Site Data

Area (ha)	1.22
Runoff Coefficient	0.90
AC	1.10
Tc (min)	15
Time Increment (min)	5
Controlled Roof Flows	0
Release Rate (l/s)	60
Storage Required (m^3)	232

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.28	0.00	250	54	196	
20	78	0.24	0.00	287	72	215	
25	69	0.21	0.00	316	90	226	
30	62	0.19	0.00	339	108	231	
35	56	0.17	0.00	358	126	232	********
40	51	0.16	0.00	374	144	230	
45	47	0.14	0.00	387	162	225	
50	44	0.13	0.00	399	180	219	
55	41	0.12	0.00	410	198	212	
60	38	0.12	0.00	420	216	204	
65	36	0.11	0.00	428	234	194	
70	34	0.10	0.00	436	252	184	
75	32	0.10	0.00	443	270	173	
80	31	0.09	0.00	450	288	162	
85	29	0.09	0.00	456	306	150	
90	28	0.09	0.00	462	324	138	
95	27	0.08	0.00	467	342	125	

SWM DESIGN CALCULATIONS
Orifice Calcuation - Area 202

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**MH103**		**[Parkside Dr. Ext. private road]**
Orifice Coefficient (C)	=	0.60		**[PLATE - 5 YEAR]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**344.03**	m	**[5-year storm event]**
Orifice Invert Elevation	=	341.930	m	
Orifice Diameter	=	**285**	**mm**	
Orifice Springline Elevation		342.07	m	
Cross section area of orifice (A)	=	0.0638	sq.m.	
Head (H)	=	**1.96**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**237.2**	L/s	**[5-year storm event]**

SWM DESIGN CALCULATIONS
Required Storage Calculations- Area 301/302 Orifice

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		1755
Event	5-year	b		12.347
		c		0.894

Site Data

Area (ha)	2.02
Runoff Coefficient	0.76
AC	1.54
Tc (min)	15
Time Increment (min)	5
Controlled Upstream Flows	0
Release Rate (l/s)	45
Storage Required (m^3)	424

*(Area 301 Only)

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.39	0.00	350	41	309	
20	78	0.33	0.00	402	54	347	
25	69	0.29	0.00	442	68	374	
30	62	0.26	0.00	474	81	392	
35	56	0.24	0.00	500	95	405	
40	51	0.22	0.00	522	108	414	
45	47	0.20	0.00	542	122	420	
50	44	0.19	0.00	559	136	423	
55	41	0.17	0.00	573	149	424	********
60	38	0.16	0.00	587	163	424	
65	36	0.15	0.00	599	176	423	
70	34	0.15	0.00	610	190	420	
75	32	0.14	0.00	620	203	416	
80	31	0.13	0.00	629	217	412	
85	29	0.13	0.00	638	230	407	
90	28	0.12	0.00	645	244	402	
95	27	0.11	0.00	653	257	395	

SWM DESIGN CALCULATIONS
Required Storage Calculations- A302 Orifice

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		1755
Event	5-year	b		12.347
		c		0.894

Site Data

Area (ha)	0.48
Runoff Coefficient	0.77
AC	0.37
Tc (min)	15
Time Increment (min)	5
Controlled Upstream Flows	45
Release Rate (l/s)	74
Storage Required (m^3)	63

*(Area 302)

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.09	0.05	125	66	59	
20	78	0.08	0.05	151	88	62	
25	69	0.07	0.05	174	111	63	********
30	62	0.06	0.05	195	133	63	
35	56	0.06	0.05	215	155	60	
40	51	0.05	0.05	234	177	57	
45	47	0.05	0.05	252	199	53	
50	44	0.04	0.05	270	221	49	
55	41	0.04	0.05	287	243	44	
60	38	0.04	0.05	304	265	38	
65	36	0.04	0.05	320	288	33	
70	34	0.03	0.05	337	310	27	
75	32	0.03	0.05	352	332	21	
80	31	0.03	0.05	368	354	14	
85	29	0.03	0.05	384	376	8	
90	28	0.03	0.05	399	398	1	
95	27	0.03	0.05	415	420	0	
100	26	0.03	0.05	430	442	0	
105	25	0.03	0.05	445	465	0	
110	24	0.02	0.05	460	487	0	
115	23	0.02	0.05	475	509	0	

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 301/302

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**EX. CBMH**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.60		**[5- YEAR]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**345.75**	m	**[1:5 year storm event]**
Orifice Invert Elevation	=	344.750	m	
Orifice Diameter	=	**150**	**mm**	
Orifice Springline Elevation		344.83	m	
Cross section area of orifice (A)	=	0.0177	sq.m.	
Head (H)	=	**0.93**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**45.2**	L/s	**[1:5 year storm event]**

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 301/302

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**MH.106**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.60		**[PLATE - 5 year]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**345.00**	m	**[1:5 year storm event]**
Orifice Invert Elevation	=	344.120	m	
Orifice Diameter	=	**200**	**mm**	
Orifice Springline Elevation		344.22	m	
Cross section area of orifice (A)	=	0.0314	sq.m.	
Head (H)	=	**0.78**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**73.7**	L/s	**[1:5 year storm event]**

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 304

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**MH304**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.60		**[PLATE - 5 YEAR]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**341.75**	m	**[1:5 year storm event]**
Orifice Invert Elevation	=	341.420	m	
Orifice Diameter	=	**125**	**mm**	
Orifice Springline Elevation		341.48	m	
Cross section area of orifice (A)	=	0.0123	sq.m.	
Head (H)	=	**0.27**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**16.9**	L/s	**[1:5 year storm event]**

SWM DESIGN CALCULATIONS
Orifice Calculation- Downstream Orifice Area 304

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 20-Dec-23

Prepared by: PM
Checked by: AD
Last Revised: 20-Aug-26

Orifice Location	=	**MH400**		**Retained Lands "B"**
Orifice Coefficient (C)	=	0.60		**[PLATE - 5-YEAR]**
Acceleration due to gravity (g)	=	9.81	m/s/s	
High Water Level	=	**341.75**	m	**[1:5 year storm event]**
Orifice Invert Elevation	=	341.310	m	
Orifice Diameter	=	**125**	**mm**	
Orifice Springline Elevation		341.37	m	
Cross section area of orifice (A)	=	0.0123	sq.m.	
Head (H)	=	**0.38**	m	
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**20.0**	L/s	**[1:5 year storm event]**

SWM DESIGN CALCULATIONS
Required Storage Calculations - Area 203 (Building J)
1:5 year storm event

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: LC
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		1755
Event	5-year	b		12.347
		c		0.894

Site Data

Area (ha)	1.08
Runoff Coefficient	0.90
AC	0.97
Tc (min)	15
Time Increment (min)	10
Upstream Controlled Flows	0
Release Rate (l/s)	175
Storage Required (m^3)	64

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.25	0.00	222	158	64	********
25	69	0.19	0.00	280	263	17	
35	56	0.15	0.00	317	368	0	
45	47	0.13	0.00	343	473	0	
55	41	0.11	0.00	363	578	0	
65	36	0.10	0.00	379	683	0	
75	32	0.09	0.00	392	788	0	
85	29	0.08	0.00	404	893	0	
95	27	0.07	0.00	413	998	0	
105	25	0.07	0.00	422	1103	0	
115	23	0.06	0.00	430	1208	0	
125	22	0.06	0.00	436	1313	0	
135	20	0.05	0.00	443	1418	0	
145	19	0.05	0.00	448	1523	0	
155	18	0.05	0.00	453	1628	0	
165	17	0.05	0.00	458	1733	0	
175	16	0.04	0.00	463	1838	0	
185	16	0.04	0.00	467	1943	0	
195	15	0.04	0.00	471	2048	0	

SWM DESIGN CALCULATIONS
Required Storage Calculations - Area 203 (Building L)
1:5 year storm event

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: LC
Last Revised: 20-Aug-26

Rainfall Data

Location:	City of Waterloo	a		1755
Event	5-year	b		12.347
		c		0.894

Site Data

Area (ha)	2.27
Runoff Coefficient	0.90
AC	2.04
Tc (min)	15
Time Increment (min)	10
Upstream Controlled Flows	0
Release Rate (l/s)	250
Storage Required (m^3)	**241**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Controlled Inflows	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	
15	91	0.52	0.00	466	225	241	********
25	69	0.39	0.00	588	375	213	
35	56	0.32	0.00	665	525	140	
45	47	0.27	0.00	721	675	46	
55	41	0.23	0.00	763	825	0	
65	36	0.20	0.00	797	975	0	
75	32	0.18	0.00	825	1125	0	
85	29	0.17	0.00	848	1275	0	
95	27	0.15	0.00	869	1425	0	
105	25	0.14	0.00	887	1575	0	
115	23	0.13	0.00	903	1725	0	
125	22	0.12	0.00	917	1875	0	
135	20	0.11	0.00	930	2025	0	
145	19	0.11	0.00	942	2175	0	
155	18	0.10	0.00	953	2325	0	
165	17	0.10	0.00	963	2475	0	
175	16	0.09	0.00	973	2625	0	
185	16	0.09	0.00	982	2775	0	
195	15	0.08	0.00	990	2925	0	

Hydrodynamic Separation Product Calculator

170 Northfield Drive West

Area 202

CDS 2015-4

Project Information					
Project Name	170 Northfield Drive West			**Option #**	A
Country	Metric	**State**	N/A	**City**	N/A

Contact Information			
First Name		**Last Name**	
Company	Counterpoint Engineering Inc	**Phone #**	905-326-1404
Email	info@counterpointeng.com		

Design Criteria					
Site Designation	Area 202 - Public Road Allowance			**Sizing Method**	Net Annual
Screening Required?	No	**Drainage Area (ac)**	0.58	**Peak Flow (cfs)**	1350.00
Groundwater Depth (ft)	0 - 5	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	0 - 5
Multiple Inlets?	No	**Grate Inlet Required?**	No	**Pipe Size (in)**	750.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	133 - Waterloo/Wellington Airport, ON	**TC (Min)**	15

Treatment Selection					
Treatment Unit	CDS	**System Model**	2015-4		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	82.29%

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

170 Northfield Drive West

Area 202 - Public Road Allowance

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0197	8.13%	8.13%	8.13%	0.0258	0.0258	3.69%	100.00%	8.13%
0.0394	10.27%	18.40%	10.27%	0.0516	0.0516	7.37%	99.94%	10.26%
0.0591	7.86%	26.26%	7.86%	0.0774	0.0774	11.06%	99.20%	7.80%
0.0787	8.10%	34.36%	8.10%	0.1032	0.1032	14.74%	98.46%	7.98%
0.1181	12.28%	46.64%	12.28%	0.1548	0.1548	22.11%	96.99%	11.91%
0.1575	8.43%	55.07%	8.43%	0.2064	0.2064	29.49%	95.51%	8.05%
0.1969	6.44%	61.51%	6.44%	0.2580	0.2580	36.86%	94.03%	6.06%
0.2362	7.76%	69.27%	7.76%	0.3096	0.3096	44.23%	92.56%	7.18%
0.2756	3.87%	73.14%	3.87%	0.3612	0.3612	51.60%	91.08%	3.52%
0.3150	2.79%	75.93%	2.79%	0.4128	0.4128	58.97%	89.61%	2.50%
0.3543	2.85%	78.78%	2.85%	0.4515	0.4515	64.50%	88.50%	2.52%
0.3937	1.24%	80.02%	1.24%	0.5031	0.5031	71.87%	87.03%	1.08%
0.4331	2.75%	82.77%	2.75%	0.5547	0.5547	79.24%	85.55%	2.35%
0.4724	1.92%	84.69%	1.92%	0.6062	0.6062	86.60%	84.08%	1.61%
0.5906	5.44%	90.13%	5.00%	0.7610	0.7000	100.00%	74.88%	4.07%
0.7874	3.23%	93.36%	2.22%	1.0190	0.7000	100.00%	55.92%	1.81%
0.9843	2.93%	96.29%	1.62%	1.2641	0.7000	100.00%	45.08%	1.32%
1.1811	0.55%	96.84%	0.25%	1.5221	0.7000	100.00%	37.44%	0.21%
1.3780	1.19%	98.03%	0.47%	1.7800	0.7000	100.00%	32.01%	0.38%
								88.74%
							Removal Efficiency Adjustment[2] =	6.45%
							Predicted % Annual Rainfall Treated =	87.80%
							Predicted Net Annual Load Removal Efficiency =	82.29%

1 - Based on 10 years of rainfall data from Canadian Station 6149387, Waterloo/Wellington Airport, ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

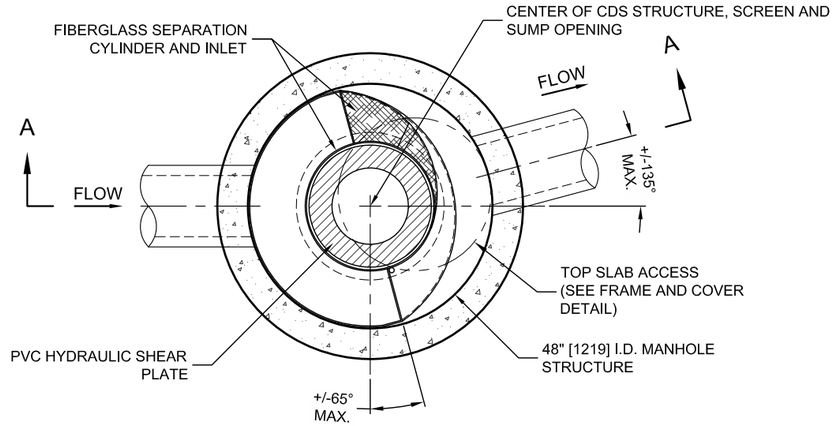
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4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

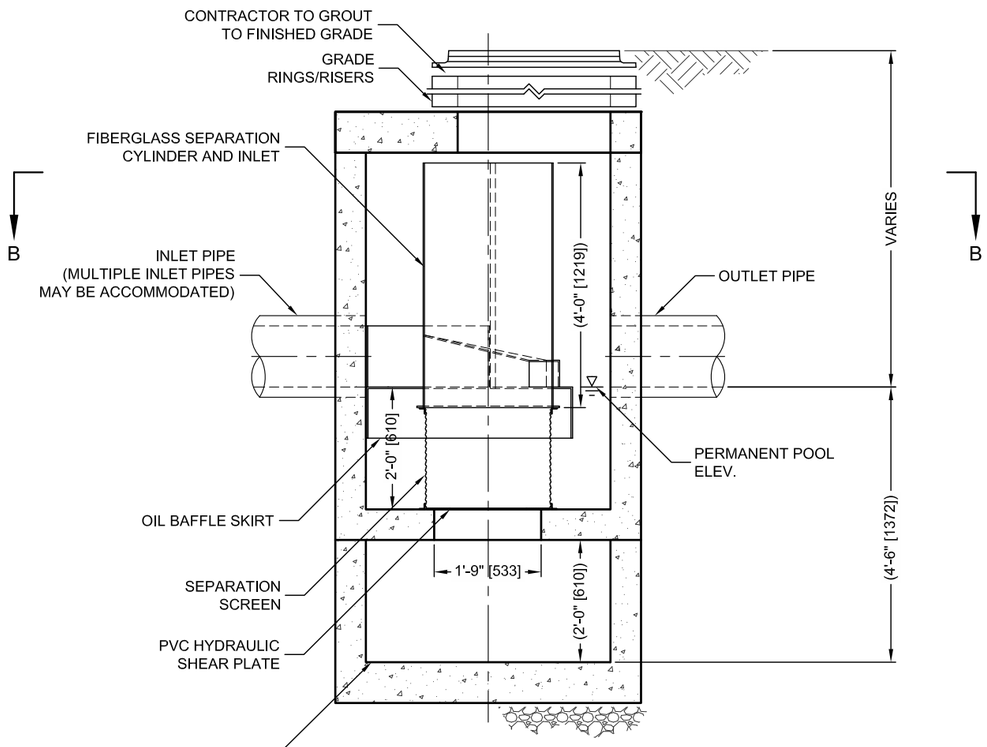
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Storage Capacities

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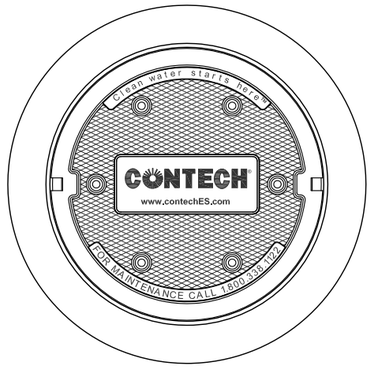
END OF SECTION



PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

CDS2015-4-C DESIGN NOTES

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
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6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

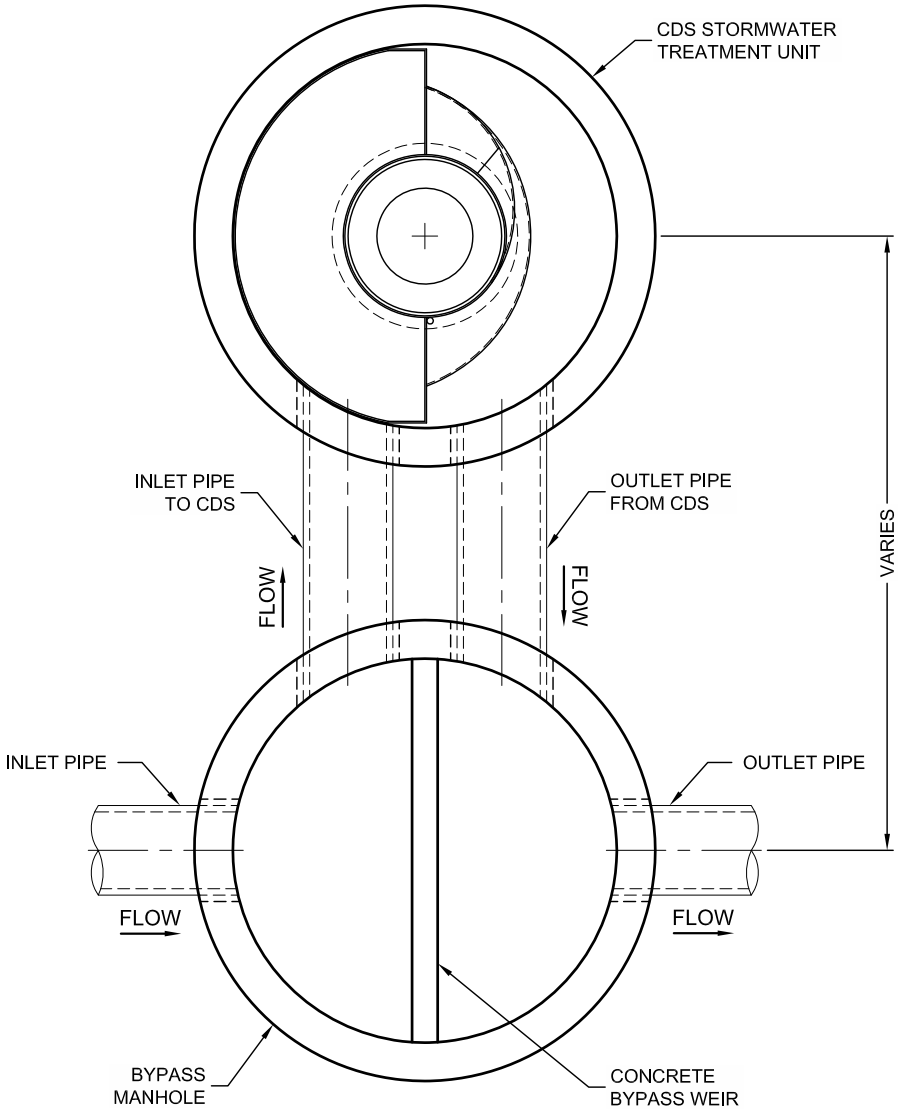
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D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,782; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4-C
INLINE CDS
STANDARD DETAIL

C:\USERS\SCHLACHTERH\DESKTOP\CDS DETAILS 180 MICRON SIZING\ACAD\CDS2015-4-C-DTL.DWG 5/19/2014 5:16 PM



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CDS STORMWATER TREATMENT SYSTEM
TYPICAL OFFLINE LAYOUT
WITH BYPASS MANHOLE STRUCTURE

DATE:03/12/13	SCALE: NONE	PROJECT No.: N/A	SEQ. No.: N/A	DRAWN: N/A	CHECKED: N/A

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Hydrodynamic Separation Product Calculator

170-200 Northfield Drive- Waterloo

Area 303

CDS 2020-5

Project Information					
Project Name	170-200 Northfield Drive- Waterloo			**Option #**	B
Country	Metric	**State**	N/A	**City**	Waterloo

Contact Information			
First Name		**Last Name**	
Company		**Phone #**	
Email			

Design Criteria					
Site Designation	Area 303 - Block J			**Sizing Method**	Net Annual
Screening Required?	No	**Drainage Area (ac)**	1.08	**Peak Flow (cfs)**	220.00
Groundwater Depth (ft)	>15	**Pipe Invert Depth (ft)**	>15	**Bedrock Depth (ft)**	5 - 10
Multiple Inlets?	No	**Grate Inlet Required?**	No	**Pipe Size (in)**	750.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	133 - Waterloo/Wellington Airport, ON	**TC (Min)**	15

Treatment Selection					
Treatment Unit	CDS	**System Model**	2020-5		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	80.15%

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

170-200 Northfield Drive- Waterloo

Area 303 - Block J

CDS 2020-5

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0197	8.13%	8.13%	8.13%	0.0480	0.0480	4.36%	100.00%	8.13%
0.0394	10.27%	18.40%	10.27%	0.0961	0.0961	8.74%	99.66%	10.24%
0.0591	7.86%	26.26%	7.86%	0.1441	0.1441	13.10%	98.79%	7.76%
0.0787	8.10%	34.36%	8.10%	0.1921	0.1921	17.46%	97.92%	7.93%
0.1181	12.28%	46.64%	12.28%	0.2882	0.2882	26.20%	96.17%	11.81%
0.1575	8.43%	55.07%	8.43%	0.3843	0.3843	34.94%	94.42%	7.96%
0.1969	6.44%	61.51%	6.44%	0.4804	0.4804	43.67%	92.67%	5.97%
0.2362	7.76%	69.27%	7.76%	0.5764	0.5764	52.40%	90.92%	7.06%
0.2756	3.87%	73.14%	3.87%	0.6725	0.6725	61.14%	89.18%	3.45%
0.3150	2.79%	75.93%	2.79%	0.7686	0.7686	69.87%	87.43%	2.44%
0.3543	2.85%	78.78%	2.85%	0.8407	0.8407	76.43%	86.12%	2.45%
0.3937	1.24%	80.02%	1.24%	0.9367	0.9367	85.15%	84.37%	1.05%
0.4331	2.75%	82.77%	2.75%	1.0328	1.0328	93.89%	82.62%	2.27%
0.4724	1.92%	84.69%	1.87%	1.1289	1.1000	100.00%	79.32%	1.52%
0.5906	5.44%	90.13%	4.22%	1.4171	1.1000	100.00%	63.19%	3.44%
0.7874	3.23%	93.36%	1.87%	1.8975	1.1000	100.00%	47.19%	1.52%
0.9843	2.93%	96.29%	1.37%	2.3538	1.1000	100.00%	38.04%	1.11%
1.1811	0.55%	96.84%	0.21%	2.8342	1.1000	100.00%	31.59%	0.17%
1.3780	1.19%	98.03%	0.39%	3.3146	1.1000	100.00%	27.01%	0.32%
								86.60%
							Removal Efficiency Adjustment[2] =	6.45%
							Predicted % Annual Rainfall Treated =	86.25%
							Predicted Net Annual Load Removal Efficiency =	80.15%

1 - Based on 10 years of rainfall data from Canadian Station 6149387, Waterloo/Wellington Airport, ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

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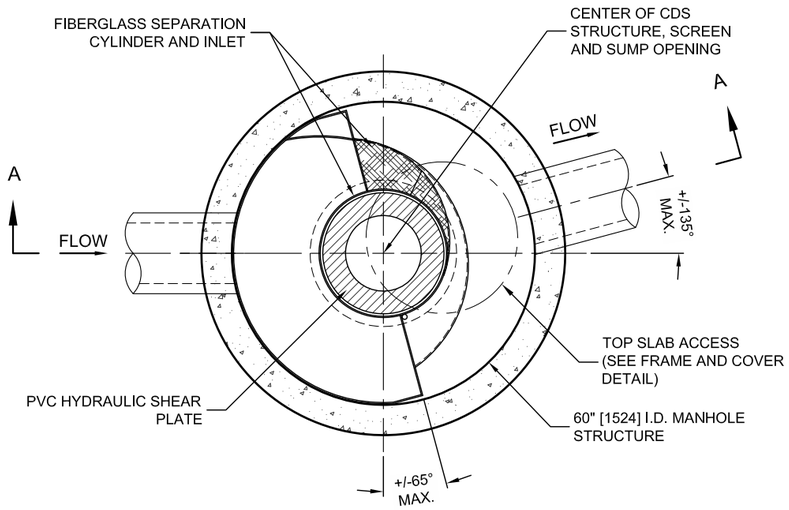
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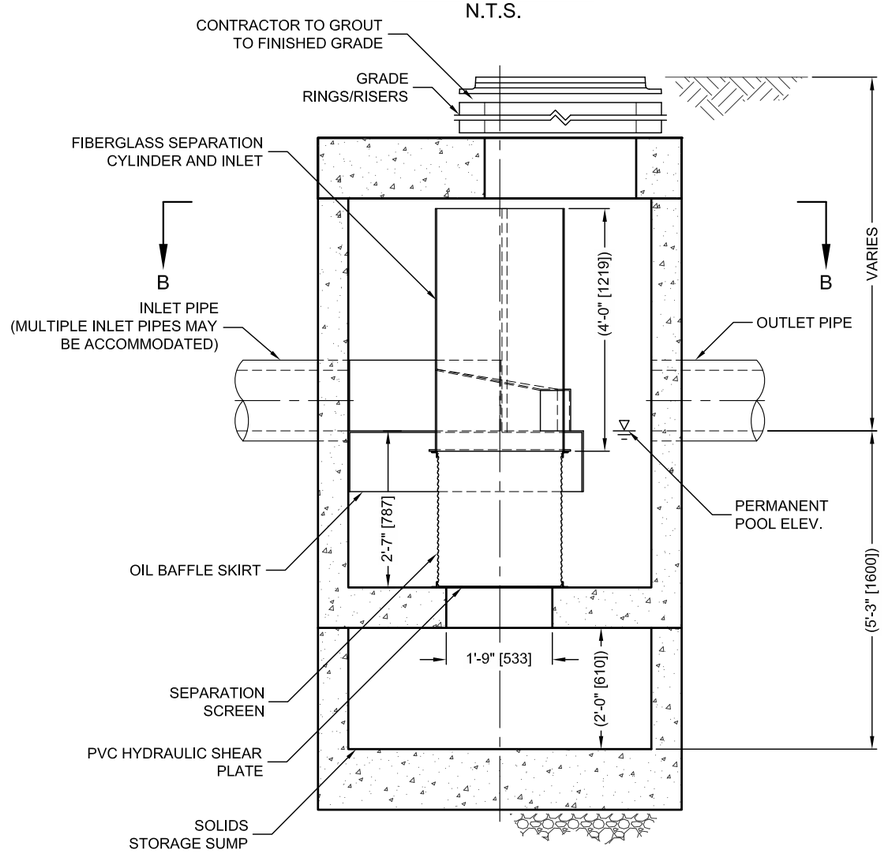
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END OF SECTION



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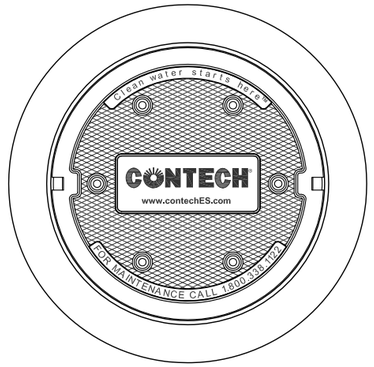
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FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

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ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
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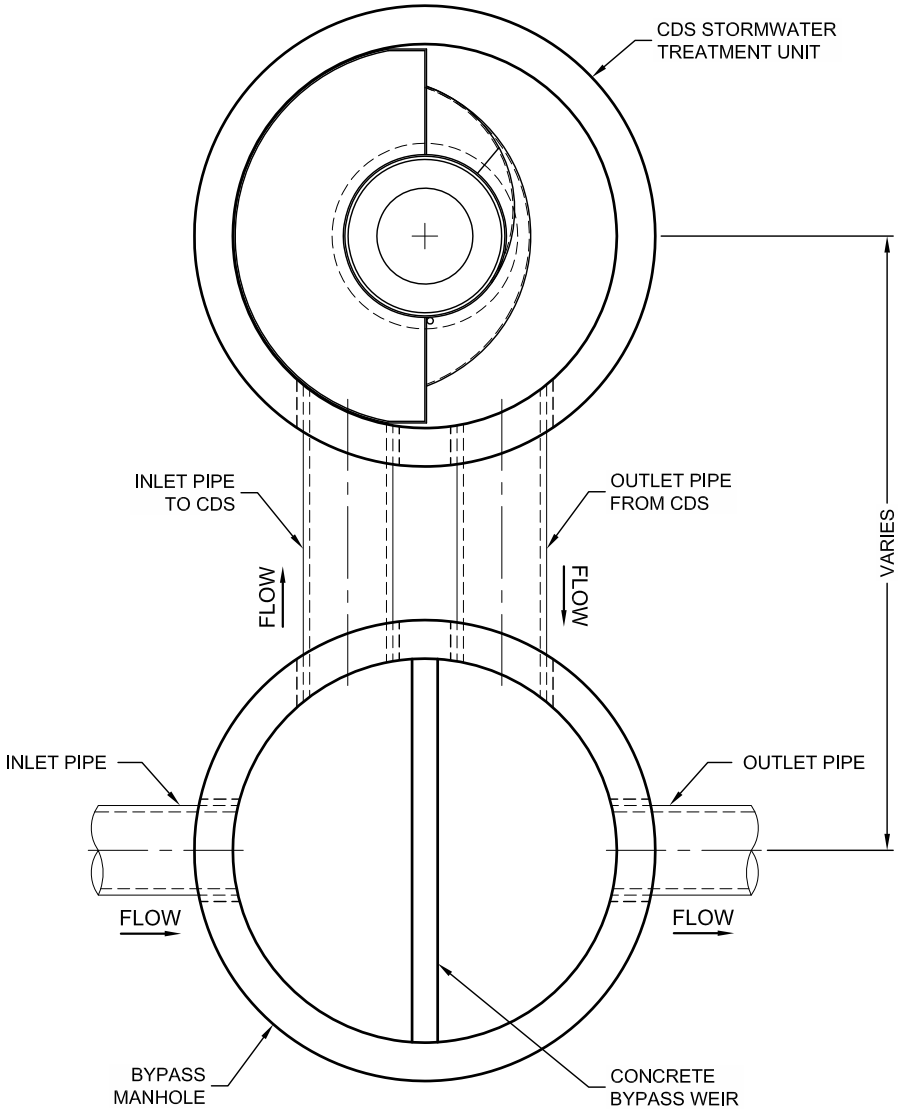
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C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2020-5-C
INLINE CDS
STANDARD DETAIL

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THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

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CDS STORMWATER TREATMENT SYSTEM
TYPICAL OFFLINE LAYOUT
WITH BYPASS MANHOLE STRUCTURE

DATE:03/12/13	SCALE: NONE	PROJECT No.: N/A	SEQ. No.: N/A	DRAWN: N/A	CHECKED: N/A

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Hydrodynamic Separation Product Calculator

170-200 Northfield Drive- Waterloo

Area 304 - Block L

CDS 3025-6

Project Information					
Project Name	170-200 Northfield Drive- Waterloo			**Option #**	B
Country	Metric	**State**	N/A	**City**	Waterloo

Contact Information			
First Name		**Last Name**	
Company		**Phone #**	
Email			

Design Criteria					
Site Designation	Area 304 - Block L			**Sizing Method**	Net Annual
Screening Required?	Yes	**Drainage Area (ac)**	2.27	**Peak Flow (cfs)**	325.00
Groundwater Depth (ft)	0 - 5	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	0 - 5
Multiple Inlets?	Yes	**Grate Inlet Required?**	No	**Pipe Size (in)**	375.00
Required Particle Size Distribution?	No	**90° between two inlets?**	Yes	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	133 - Waterloo/Wellington Airport, ON	**TC (Min)**	15

Treatment Selection					
Treatment Unit	CDS	**System Model**	3025-6		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	80.79%

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

170-200 Northfield Drive- Waterloo

Area 304 - Block L

CDS 3025-6

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0197	8.13%	8.13%	8.13%	0.1010	0.1010	4.16%	100.00%	8.13%
0.0394	10.27%	18.40%	10.27%	0.2019	0.2019	8.31%	99.75%	10.24%
0.0591	7.86%	26.26%	7.86%	0.3029	0.3029	12.47%	98.91%	7.77%
0.0787	8.10%	34.36%	8.10%	0.4039	0.4039	16.62%	98.08%	7.94%
0.1181	12.28%	46.64%	12.28%	0.6058	0.6058	24.93%	96.42%	11.84%
0.1575	8.43%	55.07%	8.43%	0.8077	0.8077	33.24%	94.76%	7.99%
0.1969	6.44%	61.51%	6.44%	1.0097	1.0097	41.55%	93.10%	6.00%
0.2362	7.76%	69.27%	7.76%	1.2116	1.2116	49.86%	91.43%	7.09%
0.2756	3.87%	73.14%	3.87%	1.4135	1.4135	58.17%	89.77%	3.47%
0.3150	2.79%	75.93%	2.79%	1.6155	1.6155	66.48%	88.11%	2.46%
0.3543	2.85%	78.78%	2.85%	1.7669	1.7669	72.71%	86.86%	2.48%
0.3937	1.24%	80.02%	1.24%	1.9689	1.9689	81.02%	85.20%	1.06%
0.4331	2.75%	82.77%	2.75%	2.1708	2.1708	89.33%	83.54%	2.30%
0.4724	1.92%	84.69%	1.92%	2.3727	2.3727	97.64%	81.87%	1.57%
0.5906	5.44%	90.13%	4.44%	2.9785	2.4300	100.00%	66.41%	3.61%
0.7874	3.23%	93.36%	1.97%	3.9882	2.4300	100.00%	49.60%	1.60%
0.9843	2.93%	96.29%	1.44%	4.9474	2.4300	100.00%	39.98%	1.17%
1.1811	0.55%	96.84%	0.22%	5.9571	2.4300	100.00%	33.20%	0.18%
1.3780	1.19%	98.03%	0.42%	6.9667	2.4300	100.00%	28.39%	0.34%
								87.24%
							Removal Efficiency Adjustment[2] =	6.45%
							Predicted % Annual Rainfall Treated =	86.73%
							Predicted Net Annual Load Removal Efficiency =	80.79%

1 - Based on 10 years of rainfall data from Canadian Station 6149387, Waterloo/Wellington Airport, ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

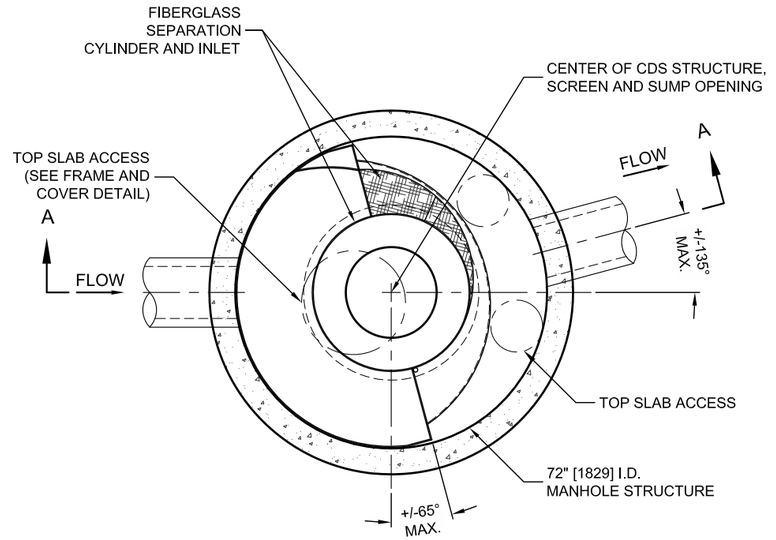
4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

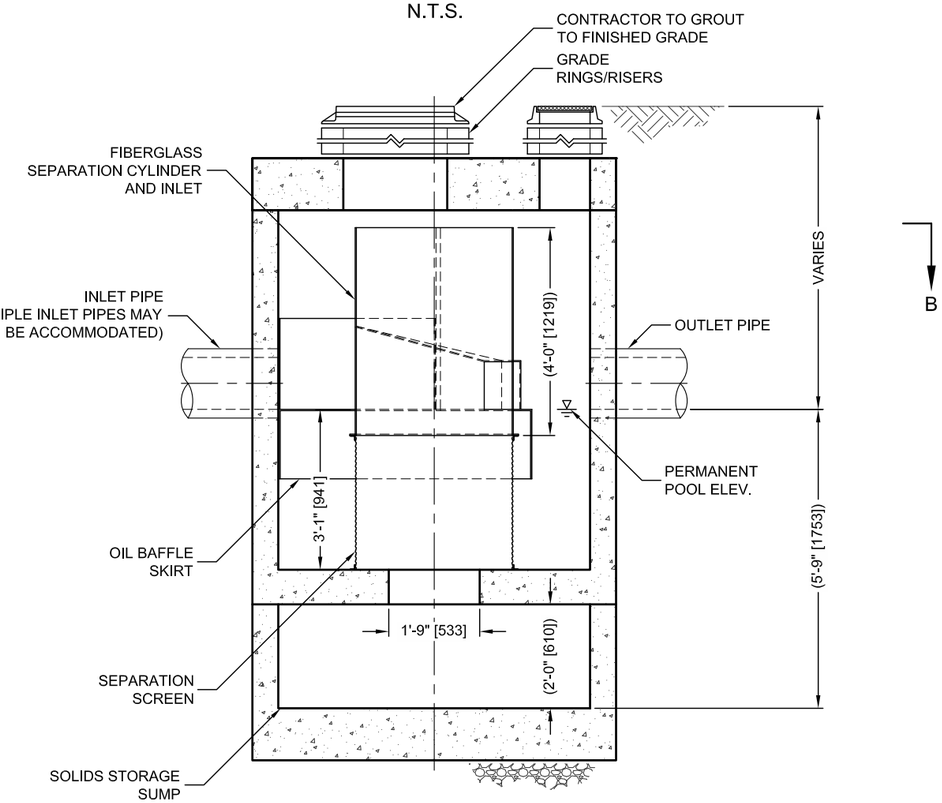
TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
CDS4040-8	5.6 (4.3)	520(1970)
CDS4045-8	5.6 (4.3)	568(2149)
CDS5640-10	8.7(6.7)	758(2869)
CDS5653-10	8.7(6.7)	965(3652)
CDS5668-10	8.7(6.7)	1172(4435)
CDS5678-10	8.7(6.7)	1309(4956)
CDS7070-DV	3.6(2.8)	914 (3459)
CDS10060-DV	5.0 (3.8)	792 (2997)
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

END OF SECTION



PLAN VIEW B-B
N.T.S.



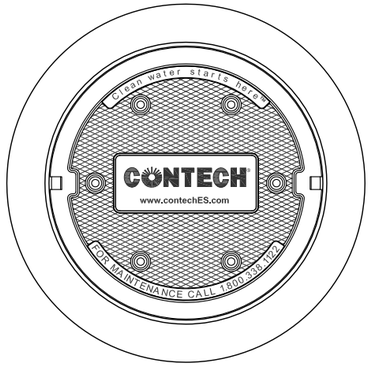
ELEVATION A-A
N.T.S.

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CDS3025-6-C DESIGN NOTES

THE STANDARD CDS3025-6-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

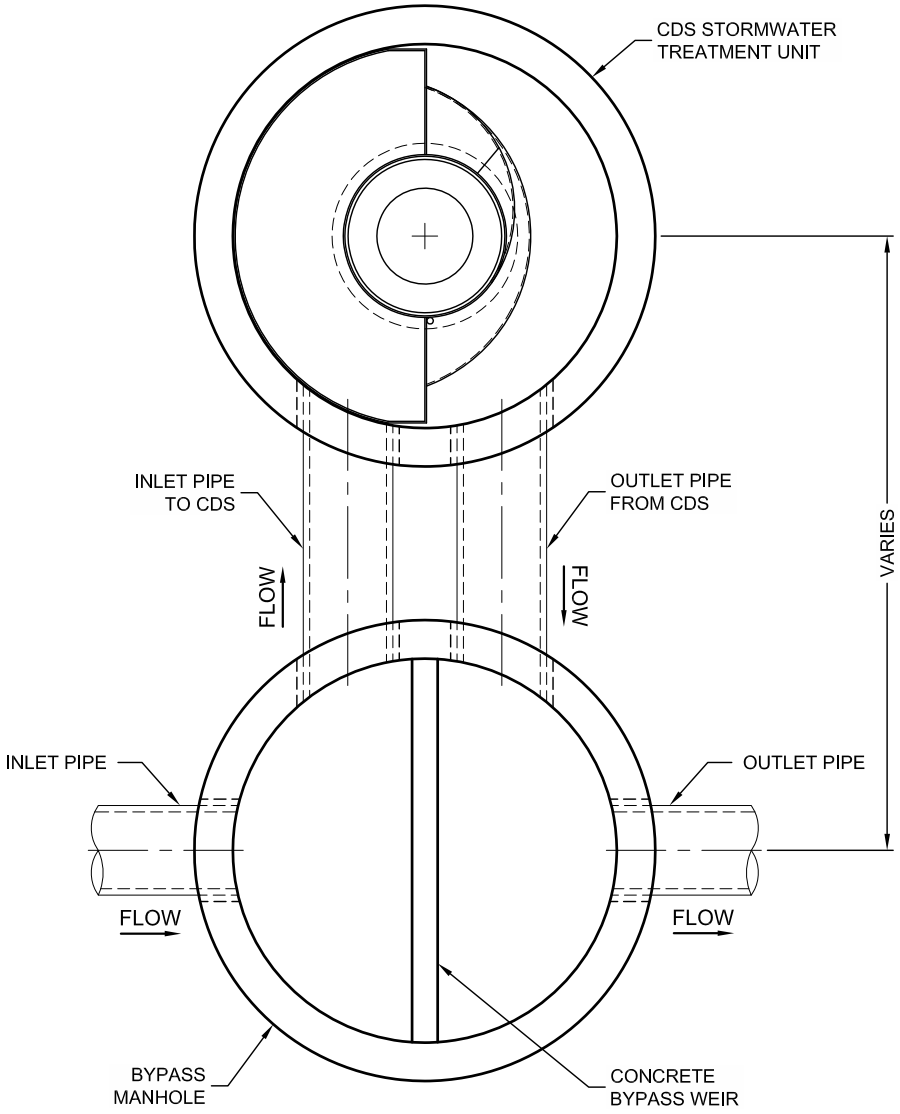
GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
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CDS3025-6-C
INLINE CDS
STANDARD DETAIL

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CDS STORMWATER TREATMENT SYSTEM
TYPICAL OFFLINE LAYOUT
WITH BYPASS MANHOLE STRUCTURE

DATE:03/12/13	SCALE: NONE	PROJECT No.: N/A	SEQ. No.: N/A	DRAWN: N/A	CHECKED: N/A

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counterpoint ENGINEERING

SWM DESIGN CALCULATIONS
Water Balance Calculation

Project Name: 170-200 Northfield Drive West
Municipality: City of Waterloo
Project No.: 22051
Date: 24-Jan-24

Prepared by: PM
Checked by: LC
Last Revised: 20-Aug-26

1. VOLUME TO BE RETAINED

Total Area of Site (A) =	11.08	Ha.
Target Retention Depth (D) =	0.0125	(m)
*site area excluding road widening+ CNR buffer		
Storage Volume Required = V = A x D =	**1,385.0**	(cu.m.)

2. STORAGE VOLUME PROVIDED

Landscape Areas (Park Areas)

Area (A) =	1.25	Ha.
Initial Abstraction (d) =	0.005	(m)
Storage Volume Provided = V = A x d =	**62.5**	(cu.m.)

Infiltration Galleries (Buildings J & L)

Area =	1.92	Ha.
Initial Abstraction =	0.04	m
Storage Volume Provided =	**800.0**	(cu.m.)

Retention Volume for Onsite Reuse (Buildings A-D)

Area =	1.92	Ha.
Initial Abstraction =	0.03	m
Storage Volume Provided =	**574.6**	(cu.m.)

Total

Storage Volume Provided =	**1437.1**	(cu.m.)

Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
TEL: (905) 326-1404 FAX: (905) 326-1405
www.counterpointeng.com