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Functional Servicing & Stormwater Management Report

'Pergola Commons'
Proposed Mixed-Use Re-Development,
1 Clair Road East,
Guelph, Ontario

Prepared for:

FCHT HOLDINGS (ONTARIO) CORPORATION

Rev. No.	*Date*	*Description*
0	December 13th, 2023	Issued for Rezoning Submission
1	July 25th, 2024	Revised as per City Comments; Re-Issued for Rezoning Pre-Submission Review
2	February XX, 2025	Revised as per City Comments; Re-Issued for Rezoning Pre-Submission Review

Project No.: 23-045

Executive Summary

Prospective Development Site

- The subject Site is located in Guelph, Ontario, near the southeast corner of Clair Road East and Gordon Street.
- The Lands which are the subject of this Report are an approx. 2.22 Ha component of a larger 5.38 Ha Site which is owned by FCHT HOLDINGS (ONTARIO) CORPORATION and known as 'Pergola Commons'.
- The larger Site of which the subject Site is part presently comprises various one-storey commercial-retail buildings, principally comprising buildings leased-to Galaxy Cinemas, Beer Store, Dollarama and The Keg, among others.
- The Owner is proposing to re-develop the Site as a mixed-use Development comprising four 14-storey residential buildings, three of which comprise commercial space, as well as a park.

Watermains & Water Servicing

- There are existing watermains within the Rights-of-Way bordering the subject Site, comprising a 400mm-dia. watermain within Clair Rd. E., a 200mm-dia. watermain within Hawkins Dr. and a 150mm-dia. watermain within Poppy Dr. E.
- A Servicing Capacity Check has been completed, confirming that the existing watermains are sufficient to service the proposed development. Connections are proposed for domestic water supply and fire protection.

Sanitary Servicing & Sewers

- There is an existing 250mm-dia. sanitary sewer within Clair Rd. E., adjacent to the Site's frontage. This sewer continues northerly within Farley Drive to the north. There is also an existing 200mm-dia. sanitary sewer within Hawkins Dr. which drains into the above 250mm-dia. sanitary sewer.
- A Servicing Capacity Check has been completed, confirming that the existing downstream sewers have available capacity for the proposed sanitary flows.
- It is proposed to connect the proposed development to the existing sewers.

Storm Servicing, Storm Sewers & Stormwater Management

- Stormwater drainage and stormwater management (comprising stormwater retention, detention and quality control) were provided in the prior development of the subject Site. There is an existing stormwater management pond to the east of the Site, which provides stormwater detention. The Site additionally comprises existing stormwater retention and quality controls.
- There are existing storm sewers within the Rights-of-Way adjacent to the subject Site which provide minor system stormwater conveyance from the subject site, to the existing stormwater management pond.
- It is proposed to utilize the existing stormwater detention and retention facilities in the proposed development, as well as provide additional stormwater retention and quality controls.

Table of Contents

List of Tables

Please refer to the following 'Functional/Conceptual' Engineering Drawings by civilGo Engineering Inc. concurrently with the review of this report:

- *Existing Servicing Plan – Drawing No. CV-100*
- *Functional Servicing Plan – Phase 1 – Drawing No. CV-101*
- *Functional Servicing Plan – Phase 2 – Drawing No. CV-102*
- *Functional Servicing Plan – Phase 3 – Drawing No. CV-103*
- *Existing Grading & Drainage Plan – Drawing No. CV-200*
- *Functional Grading Plan – Phase 1 – Drawing No. CV-201*
- *Functional Grading Plan – Phase 2 – Drawing No. CV-202*
- *Functional Grading Plan – Phase 3 – Drawing No. CV-203*

Appendix A

- Architectural Site Plan by SvN
- Architectural Statistics by SvN

Appendix B

- Existing-Site Site Servicing Plan – Site Servicing Plan Phase 1b by IBI Group

Appendix C

- Domestic Water Demand Calculation Sheet
- Fire Flow Demand (Fire Underwriters' Survey) Fire Flow Demand Calculations Sheets

Appendix D

- Sanitary Flow Calculations – by Land-Use
- Sanitary Flow Calculations – by Unit-Count & Population
- Sanitary Sewer Analysis Sheet – Existing Site Private Sanitary Sewers

Appendix E

- Email Correspondence pertaining-to Stormwater Management Criteria
- Servicing Capacity Check – Excerpt from Memorandum of Feb. 23, 2024

Appendix F

- Jellyfish Filter Catchment Plan
- Jellyfish Filter Sizing Report
- Jellyfish Filter Standard Cut-Sheet
- Canadian Environmental Technology Verification (ETV) Statement for Imbrium Jellyfish Filter

Appendix G

- Existing-Site Water Balance Calculations
- Interim Water Balance Calculations
- Post-Development Water Balance Calculations
- Existing Infiltration Facility Enhanced Infiltration Calculations
- Proposed Infiltration Facility Enhanced Infiltration Calculations

1. Introduction & Background

a. Introduction

civilGo Engineering Inc. was retained by the Owner, FCHT HOLDINGS (ONTARIO) CORPORATION, a subsidiary of First Capital REIT, to prepare a ***Functional Servicing and Stormwater Management Report*** for submission to the City of Guelph in support of an Official Plan Amendment and Rezoning Bylaw Amendment Application Submission. The proposed Development for which the Submission is being made is a mixed-use development comprising four 14-storey residential buildings within the subject lands, 1 Clair Road East in Guelph, Ontario. The following report has accordingly been prepared to provide discussion and engineering analysis pertaining to the site servicing, grading and stormwater management, for the proposed Development.

b. Subject Lands Description

The subject Site has municipal addresses 1 through 105 Clair Road East, Guelph, Ontario and Legal Description *Part of Block 1, Plan 61M-165*. The subject of the Rezoning Application is a 2.22 Ha component of a larger 5.38 Ha Site.

The larger 5.38 Ha Site presently comprises a total of nine commercial-retail buildings. The existing buildings are leased to various tenants including Galaxy Cinemas, The Beer Store, Dollarama and the Keg, among others.

The lands which are the subject of the Rezoning Application are the eastern portion of the site, which is presently occupied by buildings leased-to Galaxy Cinemas as well as The Beer Store and other tenants.

The larger 5.38 Ha site (within which the subject 2.22 Ha Site is located) was initially developed as one Block within a 11.1 Ha Subdivision, in approximately 2008. The subdivision comprised the Subject Site (5.38 Ha Commercial Block), as well as Poppy Drive to the south, Hawkins Drive, residential lots and a stormwater management pond block.

The 2.22 Ha Site which is the subject of this report is bounded by Hawkins Drive to the east, Poppy Drive to the South, Clair Road East to the north and the remainder of the larger 5.38 Ha Site to the west.

A 'line of development' has been established to provide a dividing line between the portion of the existing 5.38 Ha Commercial Block which is being Rezoned and the portion which is not.

Refer-to the 'Existing Site Summary' Figure, below, for an overview of the existing subject site and existing infrastructure.

c. Proposed Development Description

The Owner is proposing to develop the Subject Site as a Mixed-Use Development comprising four proposed buildings as well as a Park.

The proposed Development is to be constructed in three phases:

- Phase 1: Comprises 'Building A' – a 14-storey mid-rise residential tower as well as a park
- Phase 2: Comprises 'Building B' – a 14-storey mid-rise residential tower with commercial space at-grade.

- Phase 3: Comprises 'Building C' and 'Building D' – each 14-storey residential towers with commercial space at-grade.

Refer to the Site Plan and Statistics by SvN Architects, provided here in Appendix A, for the layout of the proposed development and specifics.

There is an east-west private road proposed to extend through the Site, from the western-edge of the development (Line of Development), to Hawkins Drive to the east. This is a result, in part, of existing sewers within the Site which are proposed to remain in the proposed development.

The Proposed Development may be such that each of the three Phases (four proposed Buildings) is under separate respective ownership, or under one common ownership. The site servicing and stormwater management design as outlined herein allows for either configuration; in the event that a singular ownership is proposed, easements should be implemented to facilitate the site services as shown herein.

d. Terms of Reference

The following documents were reviewed in the preparation of this report.

- *Stormwater Management Report: Commercial Development Site Plan, City of Guelph,* by IBI Group (December 7, 2011) – pertaining to the prior development of the Subject Site (Commercial Block '1b'; eastern portion of the 5.38 Ha Commercial Block).
- *Stormwater Management Report: Commercial Development Site Plan, City of Guelph,* by IBI Group (May 20, 2020) – pertaining to the prior development of the Subject Site (Commercial Block '1a'; western portion of the 5.38 Ha Commercial Block).
- *Stormwater Management Report: First Capital Holdings Trust Development, City of Guelph,* by Planning & Engineering Initiatives Ltd. – File: 19569 (Revised April 3, 2008) – pertaining to the prior development of the 11.1 Ha Subdivision in which the subject Site is located.
- City of Guelph *Development Engineering Manual* (October 2023)
- Ontario Ministry of Environment *Stormwater Management Planning & Design Manual* (2003)

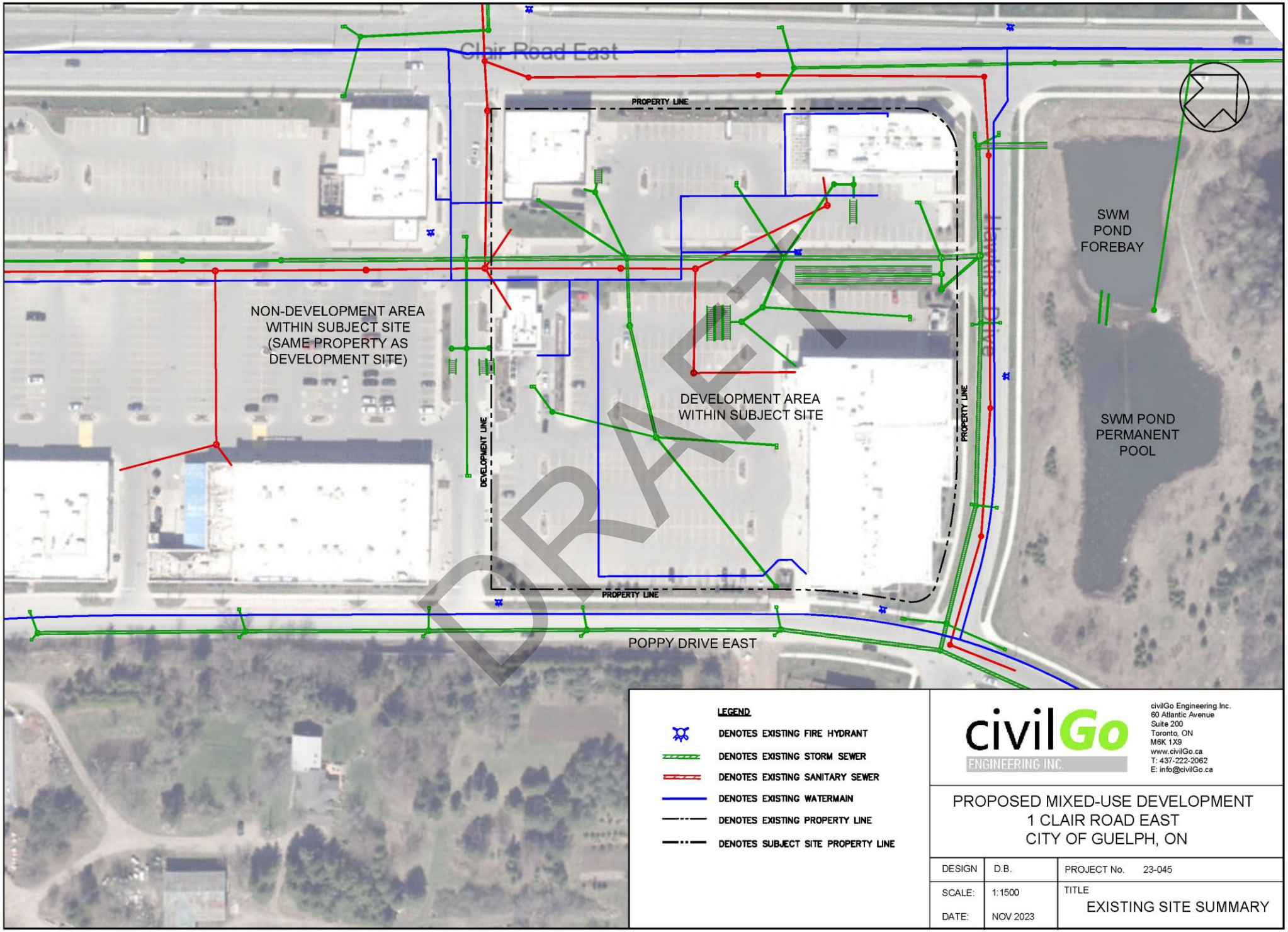
e. Report Scope

The scope of this Report is outlined below. The scope has been reviewed for compliance with the Terms of Reference for both Servicing Reports and Stormwater Management Reports as given in the City of Guelph's *Development Engineering Manual*.

The scope of this report, in general, comprises the following:

- Review municipal and provincial engineering criteria applying to preparation of Functional Servicing & SWM Reports.
- Review prior engineering reports (Servicing & Stormwater Management, as well as Geotechnical and Hydro-Geological) related-to the subject lands.
- Provide calculations, analysis, discussion and conclusions pertaining to site servicing and stormwater management.
- Provide the results of a Servicing Capacity Check undertaken by the City of Guelph to inform capacity of municipal sewers and watermains to accommodate the proposed development.

- Provide stormwater management analysis and design whereby the proposed development of the site complies-with the relevant design criteria and guidelines.
- Provide discussion pertaining-to topography of the subject site and considerations relating-to the proposed grading design.



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PROPOSED MIXED-USE DEVELOPMENT
1 CLAIR ROAD EAST
CITY OF GUELPH, ON

DESIGN	D.B.	PROJECT No.	23-045
SCALE:	1:1500	TITLE	EXISTING SITE SUMMARY
DATE:	NOV 2023		

2. Proposed Development & Phasing

The Owner is proposing to develop the subject Site as a mixed-use development comprising four 14-storey mixed-use/residential towers as well as a Park.

Each of the phases comprises separate respective below-grade parking structures which extend to the Site's boundaries. The only exception to this is within the Park space, which does not comprise a below-grade parking structure.

The proposed Development is to be constructed in three phases, as follows.

- Phase 1: Comprises 'Building A' – a 14-storey mid-rise residential tower as well as the Park
    - This phase is proposed in the present location of the Galaxy Cinemas building at the Site's southeast corner.
    - At the time Phase 1 proceeds, the Cinema would be demolished, however the remaining portions of the Site (three separate commercial buildings) would remain as-existing.
    - The site servicing design reflected herein allows the remaining three buildings external of the Phase 1 area, to be continuously serviced at the time Phase 1 proceeds.
    - There is an existing private road, extending from west-to-east through the Site, connecting-to Hawkins Drive, which will remain in Phase 1 and serve as the northern boundary of Phase 1.
- Phase 2: Comprises 'Building B' – a 14-storey mid-rise residential tower
    - This phase is proposed in the present location of a one-storey 'Harvey's' commercial building at the Site's west side.
    - At the time Phase 2 proceeds, the Harvey's would be demolished, however the remaining northern portions of the Site would remain operational. The existing east-west private road would remain and serve as the northern boundary of Phase 2.
    - The site servicing design reflected herein allows the remaining two buildings (in the area of Phase 3) to remain to be serviced as existing, at the time Phase 2 proceeds.
- Phase 3: Comprises 'Building C' and 'Building D' – each 14-storey residential towers with commercial space at-grade.
    - This phase is proposed in the remainder of the site, on the north half, abutting the entire north property line. There are presently two commercial buildings located in the area of Phase 3, which will be demolished at the time Phase 3 proceeds.

As a result of this phasing, Functional Servicing and Grading Plans have been developed for each of the three proposed Phases, to conceptually illustrate the manner in which the Site will function at the time each phase proceeds. This is necessary to ensure the continued operation of the existing buildings which are proposed to remain on an interim basis in the initial Phases of development.

Refer-to the architectural site plan by SvN, for the proposed development's overall final layout.

3. Grading & Drainage

a. Existing Site Topography & Drainage

The subject Site, for which the development application applies, is 2.22 Ha in area and presently comprises four commercial buildings and associated asphalt surface parking lots. The topography of the Site is sloped down towards the northeast corner of the site.

The lowest elevation on the site's boundary occurs at approximately the northeast corner, where the elevation is approximately 338.70 mASL. The highest elevation at the site's boundary occurs at approximately the southwest corner, where the elevation is approximately 343.10 mASL. There is therefore an approximately 4.4m vertical drop from the highest point on the site, to the lowest.

The existing parking lots within the Site generally slope by 1%-to-5% towards catchbasins therein. There are not any significant retaining walls or grading features within the Site. The vertical grade difference across the site occurs in a gradual manner.

The existing Site's grading/topography is such that the *Major Overland Flow Route* is directed towards the existing stormwater management pond, east of the Site, on the east side of Hawkins Drive.

Minor System Drainage (that is, drainage for storms up-to and including approximately the 1-in-5-year event) is provided by storm sewers internal of the site, which drain into storm sewers within Hawkins Drive, which thereafter drain to the SWM Pond.

Refer to the *Existing Site Grading Plan*, Drawing No. CV-200, for existing topography and elevations, as well as major overland flow routes.

b. Grading Design Criteria & Methodology

The premise of the proposed Grading Design is approximately as follows.

- Match-to existing elevations at the Site's boundaries. It has been assumed that the municipal R.O.W. boulevards adjacent-to the Site shall be re-graded in the development of the site (on account of installation of trees, tree pits, excavation shoring, etc., within the boulevard) therefore it has been assumed that the limit of grading work shall be the existing curbs of the adjacent Rights-of-Way.
- Match-to existing elevations where the site abuts driveways and locations at which vehicles will enter the Site, such as the existing private roads/driveway to the west.
- Ensure that the proposed elevations at the match-line between the different phases matches existing grades at the match-line. For example, where the Phase 1 works abut the portions of the Site which will not be graded until Phases 2 or 3, the Phase 1 grades must match the existing elevations, such that driving access may be maintained via the Phase 2 and 3 areas on an interim basis. A 'Limit of Grading Construction' line has accordingly been shown on each respective Phase's grading plan.
- Satisfy the City of Guelph's criteria for grading design.
- Ensure the continuity of the *Major Overland Flow Route*, which passes through the Site, easterly to Hawkins Drive, thereafter draining towards the stormwater pond to the east.

- It is noted that a two-storey below-grade parking structure is proposed beneath the entire development, therefore the entire site will be excavated, therefore there is little concern for mitigating cut-and-fill volume, because there will be a surplus of soil on account of the excavation for the below-grade parking structures.

Refer to the Functional (Conceptual) Grading Plans, Drawings CV-201, CV-202 and CV-203, for proposed elevations and the manner in which each phase interacts with existing topography.

4. Watermains & Water Servicing

a. Water Servicing Criteria

Design criteria pertaining to water servicing is given in Chapters 5.8 and 6.3.2 of the City of Guelph's *Development Engineering Manual* (October 2023). The criteria that is observed herein is as follows.

- Per-capita average-day domestic water demand (ADD): 225 L/cap/day
- Population (as given in *2023 Development Charges Background Study, City of Guelph,* 2023)
    - Townhouses: 2.449 person/unit
    - Apartments: 1.864 person/unit
- Peaking Factors:
    - Peak Hour: 3.00 x average day demand
    - Maximum Day: 2.00 x average day demand
- Fire Flow Demand: is given by the calculation as per the manual *Water Supply for Public Fire Protection* by the *Fire Underwriters' Survey*.
- Minimum residual pressure in maximum demand scenario (Fire Flow Demand + Max. Day) is 140 kPa.

Each of the four proposed buildings will have a separate respective domestic water and fire pump room, with a separate respective incoming water service lateral.

b. Existing Water Mains

The existing Streets adjacent to the Site are presently understood to comprise the following watermains, adjacent to the Site's frontage.

- Clair Road East: 400mm-dia. watermain
- Hawkins Drive: 200mm-dia. watermain
- Poppy Drive East: 150mm-dia. watermain

The subject site additionally comprises internal private watermains which provide service to the existing buildings within the Site, as well as existing hydrants within the Site. The site's internal private watermain is presently connected-to the Clair Road East 400mm-dia. watermain. The internal private watermain is 200mm-diameter and 250mm-diameter.

c. Proposed Water Servicing

It is proposed to service each of the four buildings with their own respective 150mm-dia. fire and domestic water service lateral connection, to the existing Site's internal watermain (which is 200mm

and 250mm-diameter). The Site's internal watermain connects-to the existing 400mm-dia. watermain within Clair Road East. In the event that the four proposed Buildings are under different ownership in the future, easements should be provided to facilitate the proposed water servicing.

A *Servicing Capacity Check* was completed in support of the preparation of this report. It is concluded, from the memorandum provided by the City of Guelph dated February 23, 2024, page 13, (see excerpt in Appendix E) that the Site's existing internal watermains, and external watermains, provide adequate flow for fire protection and domestic water, based on the flows outlined herein. It follows that no municipal watermain improvements are required to accommodate the proposed Development.

d. Water Demand & Existing System Adequacy

The domestic water demand (using average-day, peak-hour and max.-day peaking factors) as well as fire flow demand, are summarized as follows in Table 1. Detailed calculation sheets for Domestic Water Demand and Fire Flow Demand are provided in Appendix C.

Table 1 - Water Demand Summary

	Average Day Demand (ADD) (@ 225 L/c/d)	Max. Day Demand (MDD) (2.0x ADD)	Peak Hour Demand (PHD) (3.0xADD)	Fire Flow Demand	Max. Water Demand (MDD + Fire Flow)
Proposed Building A	0.93 L/s	1.87 L/s	2.80 L/s	133.3 L/s	135.2L/s
Proposed Building B	1.23 L/s	2.46 L/s	3.69 L/s	200.0 L/s	202.4 L/s
Proposed Building C	0.74 L/s	1.48 L/s	2.22 L/s	216.7 L/s	218.2 L/s
Proposed Building D	0.69 L/s	1.37 L/s	2.06 L/s	200.0 L/s	201.4 L/s
Total	3.59 L/s	7.18 L/s	10.77 L/s	N/A	Max. 218.2 L/s

The fire flow demand calculations are provided in Appendix C. The manual *Water Supply for Public Fire Protection* by *Fire Underwriters Survey* has been utilized to inform fire flow demand. The following assumptions were made in the Fire Flow Demand calculation.

- The proposed buildings will be comprised of non-combustible reinforced concrete construction.
- The proposed buildings will be sprinklered and the sprinklers will be fully monitored according to NFPA 13.
- The proposed buildings' contents (residences and retail) will be limited-combustible in nature.
- Proposed building floor areas are as given in the architectural statistics in Appendix A.

5. Sanitary Sewers & Sewage Disposal

a. Criteria & Terms of Reference

Sanitary servicing criteria is given in Chapters 5.6 and 6.3.2 of the City of Guelph's *Development Engineering Manual* (October 2023). The following sanitary sewage flow-calculation and design criteria are applied in this report as given in the City's manual.

- Peak Sanitary Flows:
  - Apartments – 295 u/Ha = 7 L/s/Ha
  - High-Density Apartments (Re-development Area) = 7 L/s/Ha
- Unit Population (as given in *City of Guelph – Development Engineering Manual,* October 2023)
  - Townhouses: 2.45 person/unit
  - Apartments: 1.86 person/unit
- Unit sanitary flow = 300 L/person/day
- Unit population (Non-residential) Commercial/Retail = 1.1 person/100m^2 GFA
- Inflow & Infiltration Flows (I&I) Originating from Subject Site = 0.25 L/s/Ha
- Peaking Factor – given by Harman Equation

Section 6.3.2. of the City's manual states that *a sanitary maintenance hole is required at the property line*.

b. Existing Sanitary Sewers

The existing Streets adjacent to the Site presently comprise the following sanitary sewers, adjacent to the Site's frontage. Refer to the Functional Servicing Plan (s).

- Within Clair Road East, adjacent-to the Site's north frontage, there is an existing 250mm-diameter sanitary sewer which flows westerly and continues northerly within Farley Drive.
- Within Hawkins Drive, adjacent-to the Site's east frontage, there is an existing 200mm-diameter sanitary sewer which flows northerly and continues as the above-described Clair Road East sewer.

The subject site presently comprises existing 200mm-dia. and 250mm-dia. private sanitary sewers which service the existing buildings within the Site and which discharge into the Farley-Drive sanitary sewer.

There is no municipal sanitary sewer within Poppy Drive, adjacent-to the Site's south frontage.

c. Proposed Sanitary Servicing & Sanitary Flows

It is proposed to service the four proposed buildings in the Development to the existing internal private sanitary sewers, which drain to the existing 250mm-diameter sanitary sewer within Farley Drive.

Connection to the Farley Drive 250mm-dia. sanitary sewer is the only feasible connection-location for sanitary flows from the proposed development. The following alternative outlets for sanitary sewer connections were considered, but ruled-out on the following basis, therefore it was determined that the existing sewer-connection to Farley Drive is the only remaining solution.

- Connection to the Hawkins Drive sanitary sewer: It is not feasible to install sanitary sewer laterals to the existing sanitary sewer within Hawkins Drive due to the pipe-crossing clearance conflict that would arise between the proposed sanitary sewer laterals and the existing 750mm/900mm-dia. storm sewer within Hawkins Drive. It is not possible to install sanitary sewer laterals above the storm sewer, as they would be too-shallow, and it is not possible to install them below the storm sewer, because they would then be beneath the mainline sanitary sewer.
- Connection to Poppy Drive: It is not feasible to install sanitary sewer laterals to Poppy Drive as there is no municipal sanitary sewer within Poppy Drive.

In the event that the four proposed Buildings are under different ownership in the future, easements should be provided to facilitate the proposed sanitary servicing.

A *Servicing Capacity Check* was completed in support of the preparation of this report. It is concluded, from the memorandum provided by the City of Guelph dated February 23, 2024, page 13, (see excerpt in Appendix E) that the Farley Drive 250mm-dia. sanitary sewer has adequate capacity for the Development, based on the flows outlined herein. It follows that no municipal sanitary sewer improvements are required to accommodate the proposed Development.

The site's sanitary servicing has been designed such that sanitary servicing to the existing buildings, which will remain at the time Phase 1 proceeds, will not be interrupted. There is an existing 200mm-dia. east-west sanitary sewer within the private east-west street within the Site, which will remain as-existing in all Phases of the development. A 5.00m-width easement is proposed for this sewer, in accordance with City of Guelph criteria. This sewer will remain such that service to the existing and proposed buildings will not be interrupted by sewer relocations as the different Phases proceed. Refer to the Functional Servicing Plan(s) for the layout of site services.

The existing private sewer is the only suitable outlet for Phase 1, given that the Hawkins Drive sewer is inaccessible and that Phase 1 does not have frontage to Clair Road, therefore Phase 1 must be serviced to existing private sewers within the Site. As the subsequent phases proceed, this sewer will remain in-operation to service the existing buildings and subsequent Phases 2 and 3.

A sanitary sewer analysis sheet has been prepared for the existing private sanitary sewers within the site, provided in Appendix D, to show that the existing private sanitary sewers have adequate capacity for the flows from the proposed development. The existing sanitary sewers will be flowing at no-more than 58% of their respective pipe capacities, with the additional proposed sanitary flows, therefore the existing private sanitary sewers have sufficient capacity to convey the proposed flows.

Proposed sanitary flows are summarized as follows in Table 2. Detailed flow calculations are provided in Appendix D. Sanitary flows are conservatively calculated based on populations as follows, however flow calculations are additionally provided based-on land-use, in Appendix D.

Note that the Total Flows, for the entire Development, reflected as follows, reflect the peaking factor calculated on the basis of the entire Development's population, therefore the Total flows are less than the flows calculated on the basis of each Phase's individual flows.

Table 2 - Proposed Sanitary Flows Summary

	Total Proposed Population	Residential Sanitary Flows	Commercial Sanitary Flows	Inflow & Infiltration (I&I) Flows	Total Proposed Sanitary Flows
Proposed Building A	358	5.0 L/s	0 L/s	0.20 L/s	5.2 L/s
Proposed Building B	468 (res.) + 4 (ICI) = 472	6.5 L/s	0.1 L/s	0.14 L/s	6.7 L/s
Proposed Building C	274 (res.) + 10 (ICI) = 284	3.9 L/s	0.1 L/s	0.11 L/s	4.1 L/s
Proposed Building D	253 (res.) + 10 (ICI) = 265	3.6 L/s	0.1 L/s	0.12 L/s	3.9 L/s
Total	1379	17.4 L/s	0.3 L/s	0.56 L/s	18.3 L/s

6. Storm Drainage & Stormwater Management

a. Criteria & Terms of Reference

The following criteria was addressed in the stormwater management design and calculations herein.

Storm servicing and stormwater management criteria is given in Chapters 5.5 and 6.3.3 of the City of Guelph's *Development Engineering Manual* (DEM) (October 2023). It is also given by the Ministry of Environment's *Stormwater Management Planning and Design Manual* (2003).

In addition to the municipal engineering manuals, stormwater drainage and stormwater management criteria is given by the Reports that were prepared in support-of the prior development of the Site and surrounding subdivision – as outlined in Section 1. d. A meeting was held on October 16th, 2023, between Michelle Thalen (City of Guelph) and Daniel Bancroft (civilGo Engineering Inc.) to confirm the stormwater management criteria that applies to this Site in light of the prior Stormwater Management Reports. Refer to Appendix E for the resulting email correspondence confirming the stormwater criteria that was discussed.

The stormwater management criteria applying to the present development of the Site is summarized as follows, in reference to the above prior SWM Reports and municipal engineering manuals.

- Stormwater Quantity Control/Detention:
    - In accordance with the Stormwater Management Report by Planning & Engineering Initiates Ltd. (PEIL) of 2008, for the 11.1-Ha Subdivision in which the Site is located, the subject site was allocated as a tributary catchment area of the existing stormwater management pond to the east, with a %-imperviousness of 90%. Therefore, so long as the proposed development's %-imperviousness is no-greater than 90%, stormwater detention is addressed by the existing pond.
    - The Site's grading design shall be such that the major overland flow route is directed towards the existing Stormwater Management Pond.
- Minor/'local' system storm drainage:
    - On-site storm sewers are to be designed to convey the 5-year storm event.
- Stormwater Quality Control:
    - Whereas the existing stormwater management pond does comprise a settlement forebay which was sized to provide 80% TSS Removal, and a conventional Oil-Grit-Separator (OGS) was installed on-site previously; the proposed development will be subject-to provision of 80% TSS Removal by-way of an on-site stormwater filter which has been ETV-certified as providing 80% TSS Removal.
- Stormwater Retention/Water Balance:
    - Whereas the subject site presently addresses water balance criteria by provision of existing infiltration tanks; in accordance with the City of Guelph's DEM 5.7.6, the Thornthwaite-Mather method is to be utilized to ascertain water balance targets and to design infiltration measures.

b. Existing Storm Sewers & Stormwater Management Infrastructure

The following storm sewers presently exist within the municipal Rights-of-Way adjacent-to the Site:

1. Within Clair Road East, adjacent to the Site's north frontage, there is an existing 375mm-dia. storm sewer which flows easterly.
2. Within Hawkins Drive, adjacent to the Sites' east frontage, there is a storm sewer which is 750mm-dia., which increases in size to 1350mm-dia. before discharging into the existing stormwater management pond to the east.
3. Within Poppy Drive East, adjacent to the Site's south frontage, there is a 675mm-dia. storm sewer, which discharges into the above-described Hawkins Drive storm sewer.

Adjacent-to the Site, to the east, on the east side of Hawkins Drive, there is an existing stormwater management pond, which was installed in approximately 2008 and provides stormwater detention for the Site and surrounding areas. This pond was installed in accordance with the *Stormwater Management Report* by Planning & Engineering Initiates Ltd. (PEIL) dated June 2007 (Updated April 2008), as part of the initial development of the Subdivision in which the Site is located. This pond provides stormwater detention for storm events up-to the 100-Year storm event. 100-Year stormwater detention is provided in this pond, for the Subject Site, on the basis of the Site having a %-imperviousness of 90%, as per Table 1 of the PEIL SWM Report. This pond additionally provides stormwater quality control, however that quality control was allocated to the residential components of the subdivision, not the subject Site.

Within the subject Site, the following stormwater drainage and stormwater management infrastructure presently exist.

1. There is an 825mm-diameter storm sewer which conveys minor-system storm runoff through the Site, from west-to-east, within the private west-to-east road that connects to Hawkins Drive. This sewer increases to 900mm-diameter before discharging into the 900mm-dia. storm sewer within Hawkins Drive, to the east. This sewer additionally conveys runoff from the western portion of the larger site, easterly, to the same outlet. Given that this sewer conveys runoff from the existing portions of the larger site, it is proposed to remain as-existing.
2. There are various smaller-diameter local storm sewers within the Site's existing parking lots, which convey runoff to the 825mm/900mm-dia. storm sewer, above.
3. There is a conventional Oil-Grit-Separator (OGS) installed at the Site's outlet (via the above 900mm-dia. sewer). This is an *STC 6000* model and was sized (based on the criteria available at the time) for 80% TSS Removal, over a 2.11 Ha catchment area (representing approximately the subject development site area). There is additionally a second *STC 6000* OGS installed at the site's west area (outside and upstream-of the development area), which services the western portion of the larger site.
4. There are existing Infiltration Facilities installed throughout the Site, providing stormwater retention, as follows:
    4.1. Servicing the East Parking Area (Subject Site): there is a 486.0m^3-volume facility providing stormwater retention facility.
        4.1.1. This was designed in accordance with the December 2011 SWM Report by IBI Group.

4.1.2. This is a 'D-RAINTANK' System by EMCO, which comprises a system of stacked storage 'units' and is intended to detain stormwater in the voids of the 'units' and allow it to thereafter percolate into underlying soils.

4.1.3. Stormwater runoff from the parking lot area drains into this facility via the above *STC 6000* OGS.

4.1.4. It is proposed to retain this existing Infiltration Facility in the development due to the significant retention volume it provides and alignment adjacent-to the 900mm-dia. storm sewer which passes-through the Site and which is proposed to remain in the proposed development.

4.2. Servicing the existing 'Galaxy Cinemas' Building (Building 'K') at the southeast corner of the Site, there is a 90.7m^3-volume facility.

4.2.1. This is also a 'D-RAINTANK' System by EMCO.

4.2.2. The roof of the Galaxy Cinemas building drains firstly into this facility and when it is full, then drains out of the Site via the storm sewers.

4.2.3. This facility is in the proposed location of the Phase 1 below-grade parking structure and will therefore be removed.

4.3. Servicing the existing commercial building (Building 'L') at the northeast corner of the Site, there is a 18.7m^3-volume facility.

4.3.1. This is also a 'D-RAINTANK' System by EMCO.

4.3.2. The roof of the building drains firstly into this facility and when it is full, then drains out of the Site via the storm sewers.

4.3.3. This facility is in the proposed location of the Phase 3 below-grade parking structure and will therefore be removed.

c. Proposed Storm Drainage, Servicing & Stormwater Detention

It is proposed to utilize the Site's existing storm drainage outlet in the proposed development, such that existing minor-system and major-system drainage patterns are maintained as-existing.

For minor-system drainage, the Site will continue to drain via the 825mm/900mm-dia. storm sewer which connects-to the 900mm-dia. storm sewer within Hawkins Drive and thereafter drains to the adjacent SWM Pond.

Additional catchbasins have been proposed in the private East-West Road within the Site, connecting-to the 825mm-dia./900mm-dia. storm sewer, to provide drainage from the low-spots in the private road and to ensure that the runoff from the road is channeled-into the proposed stormwater filter, discussed below.

For major-system drainage, the Site will drain via the major overland flow route, easterly towards the adjacent SWM Pond.

Each of the four proposed Buildings will have a separate respective 300mm-dia. storm sewer lateral connection to the existing 825mm-dia./900mm-dia. storm sewer which flows easterly through the Site and is proposed to remain throughout all phases of the development.

All of the proposed Buildings/Phases of the development will comprise respective below-grade parking structures extending, effectively, to the Site's limits. Refer to the Functional Servicing Plan(s) for the

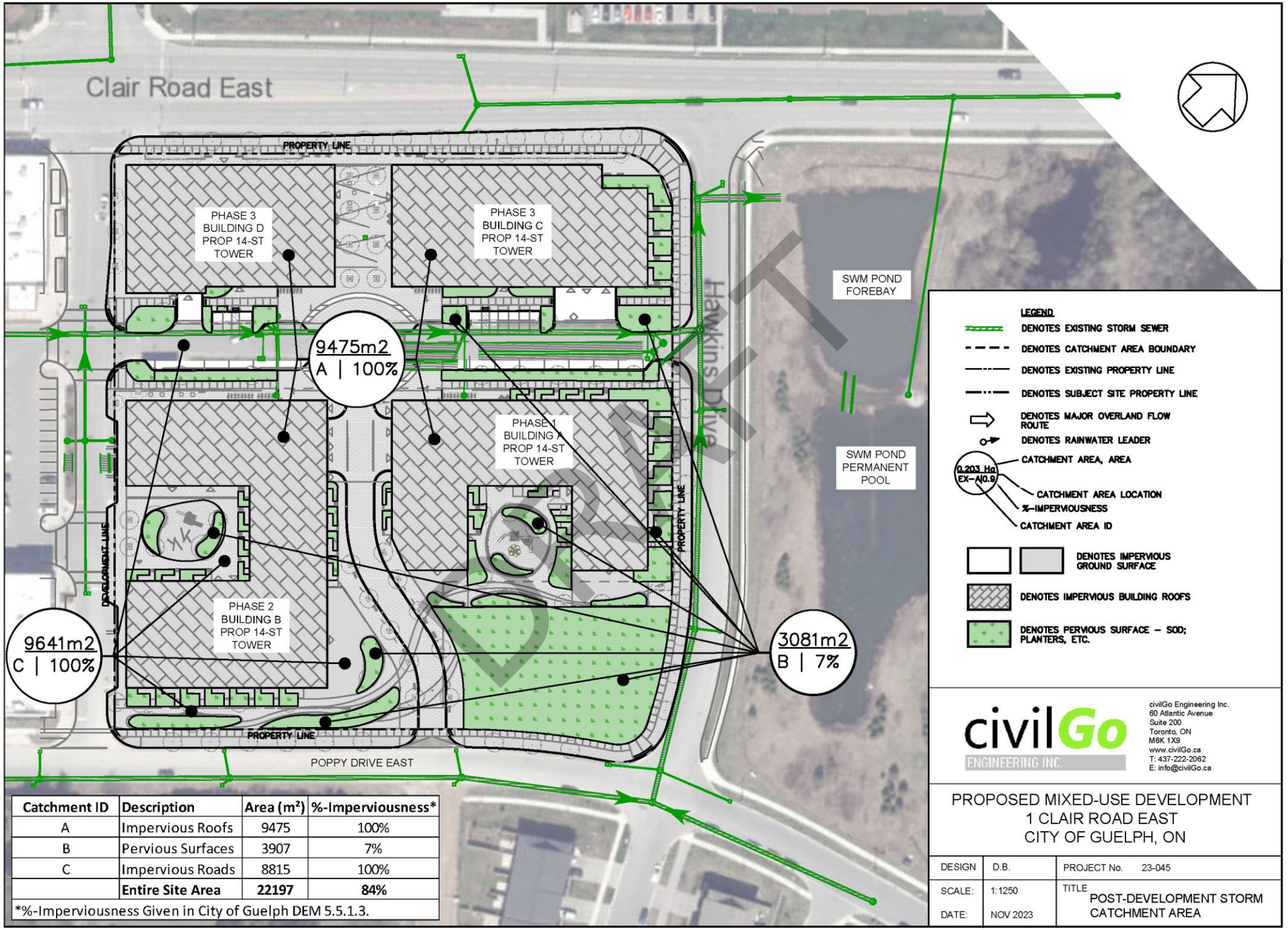
location of the proposed below-grade foundation walls relative-to property lines and stormwater infrastructure, etc. There will therefore be no buried/civil storm sewer pipes within the proposed buildings' extents. Instead, mechanical storm drainage piping systems will be designed in the future, at the Building Permit stage, to convey storm runoff from the buildings' area drains, trench drains and roof drains, to the proposed buildings' respective storm sewer laterals.

The post-development %-imperviousness has been calculated, to ensure that it remains within the allocated 90%-imperviousness which was allocated-to this site in the downstream SWM Pond's design. Post-Development catchment areas are illustrated on the *Post-Development Storm Catchment Area Plan*, on the following page. The area-weighted %-imperviousness is calculated to be 84% therein. This is also summarized in Table 3, as follows. Given that this is less-than the allocated 90%-imperviousness, the site is adequately covered for stormwater detention by the existing adjacent stormwater management pond.

Percent imperviousness, for the specific types of catchment areas (parkland, building roofs, etc.), is as given in the City of Guelph's *Development Engineering Manual*, Section 5.5.1.3.

Table 3 - Post-Development Overall %-Imperviousness

Area ID	Description	Conveyance Method	Catchment Area	%-Imperviousness
A	Impervious Building Roofs	Mechanical Storm Drainage Piping	9475m^2	100%
B	Pervious Ground-Level Surfaces (Planters & Grassed areas)	Overland flow & piped drainage	3907m^2	7%
C	Impervious Roads & Sidewalks, etc.	Overland flow & piped drainage	8815m^2	100%
	Total Area & Composite %-Imperviousness:		22197m^2	84%



Catchment ID	Description	Area (m²)	%-Imperviousness*
A	Impervious Roofs	9475	100%
B	Pervious Surfaces	3907	7%
C	Impervious Roads	8815	100%
	Entire Site Area	**22197**	**84%**

*%-Imperviousness Given in City of Guelph DEM 5.5.1.3.

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PROPOSED MIXED-USE DEVELOPMENT
1 CLAIR ROAD EAST
CITY OF GUELPH, ON

DESIGN	D.B.	PROJECT No. 23-045
SCALE:	1:1250	TITLE POST-DEVELOPMENT STORM CATCHMENT AREA
DATE:	NOV 2023	

d. Stormwater Retention & Water Balance

Criteria for water balance (stormwater retention) is given by the City of Guelph's *Development Engineering Manual*. Section 5.7.6. therein states that Water Balance should be addressed utilizing the *Thornthwaite & Mather Method* (1956) in reference to the MECP *Stormwater Management Planning & Design Manual* (2003).

Section 3.2.3. of the MECP *Stormwater Management Planning & Design Manual* (2003) provides direction for the application of the *Thornthwaite & Mather Method* in Table 3.1 *Hydrologic Cycle Component Values*.

The City of Guelph's manual elaborates that Low-Impact-Development (LID) practices should be implemented to mitigate the impact of developments on the water balance and to mimic pre-development groundwater recharge.

The MECP *Stormwater Management Planning & Design Manual* (2003) provides criteria for the design of LID. It is proposed to utilize LID features comprising below-grade infiltration facilities in the development of the Site, for which the design criteria are generally as follows:

- Groundwater table should be >1.0m below the underside of infiltration facilities
- Bedrock should be >1.0m below the underside of infiltration facilities
- Soils should provide min. infiltration rate of 15 mm/hr
- Buildings should be at least 4.0m horizontally offset from infiltration facilities

Interim (Presently-Existing Commercial Development) Water Balance Scenario

Water balance/stormwater retention was addressed in the initial/prior development of the site, utilizing LID, as per the *Stormwater Management Report* by IBI Group of December 7, 2011. That report identified, as per Section 4.3 therein, the infiltration facilities that were installed in the Site. The infiltration facilities were the 'D-Raintank' system by EMCO. They were installed so as to provide stormwater retention of 30mm-rainfall over their respective catchment areas, based-on providing an annual stormwater retention of 300mm (which equates-to an annual water balance volume of 6,660m^3 retention).

There was a retention volume of 486.0m^3 provided in the existing large D-Raintank system beneath the East-West Driveway, which is proposed to remain. There was additionally a total of 137.4m^3 of stormwater retention volume provided in additional tanks, which are proposed to be removed in the proposed development. These stormwater facilities are summarized as follows:

- Servicing the east parking area (approximately the Subject Development Site): there is a 486.0m^3 D-Raintank system located near the site's east entrance. This is proposed to remain in the Proposed Development.
- Servicing existing Building K (Galaxy Cinemas): there is a 90.7m^3 D-Raintank system, which is in the location of Proposed Building A. This is proposed to be removed as it is in the location of the proposed Building.
- Servicing existing Building L (building at northeast corner): there is a 18.7m^3 D-Raintank system, which is in the location of Proposed Building C. This is proposed to be removed as it is in the location of the proposed Building.

- Servicing existing Building F (Harvey's): there is a 23.0m^3 D-Raintank system, which is the location of Proposed Building B. This is proposed to be removed as it is in the location of the proposed Building.
- Servicing existing Building E (Beer Store): there is a D-Raintank system, which is in the location of Proposed Building D. It is assumed that this D-Raintank provides 5.0m^3 retention. This is proposed to be removed as it is in the location of the proposed Building.

Proposed Development Water Balance Scenario

It is proposed utilize two LID features to address water balance criteria in the presently-proposed re-development of the Site.

- Firstly: the existing 486.0m^3 EMCO D-Raintank near the Site's east entrance is proposed to remain.
    - Note that the MECP criteria for building setback has been addressed in the proposed re-development of the Site. The existing D-raintank system is 6.7m-offset from the proposed adjacent Building A below-grade parking structure, thereby satisfying the minimum offset criteria for infiltration facilities.
- Secondly: a new min. 137.4m^3 stormwater infiltration system, is proposed to be installed within the proposed easement/East-West Driveway area in the middle of the Site.
    - As shown on the Functional Servicing Plans, this can be installed such-that it is min. 5.00m horizontally-offset from the proposed below-grade structures, protecting them from recirculation of infiltrated stormwater.
    - Provision of this new infiltration facility ensures that the infiltration capacity and available storage within the Site is maintained in the Proposed Scenario, as compared to both the 'Interim' (Current development) Scenario, as well as the 'existing' (Greenfield) scenario.

Detailed month-by-month water balance calculations are provided in Appendix G. Calculations are provided in an 'Existing' Scenario, as well as a proposed 'Post-Development' Scenario. The 'Interim' scenario is as given by the existing Stormwater Management Report, discussed above (300mm annual depth, or 6,660m^3 annual volume) (as per initial Stormwater Management Report by IBI Group, Section 4.3, dated December 7, 2011).

It is demonstrated in the calculations provided in Appendix G that, with the provision of proposed active infiltration measures, the pre-development and 'Interim' water balance is maintained in the proposed development.

The 'Existing' scenario is taken as the hydrologic condition that existed on this site prior-to the initial development in approximately 2008-2011. Refer-to Appendix G for the detailed characteristics of the Site which were referenced therein. Existing characteristics of the site, including soil characteristics, were taken as reported in the original Stormwater Management Reports. As shown in Appendix G, there was an annual runoff volume of 4,916m^3 prior to the Site's initial development.

In the post-development condition, without any mitigative measures (enhanced infiltration), there is an annual runoff volume of 7,865m^3; a significant increase as compared to the existing scenario. This is entirely addressed by the existing infiltration facility (discussed above) and supplemented by the

proposed new infiltration gallery. The existing infiltration facility has the capacity to restore the site's hydrology to existing conditions because it has the capacity to infiltrate the average stormwater runoff draining into it in any given month, giving a total annual enhanced infiltration potential of 7,865m^3.

The hydrogeological investigation results, as per the report by WSP, are supportive of the application of infiltration facilities on this site. The groundwater table was typically encountered at a depth of approximately 7-8m – well below the depth of infiltration facilities, thereby providing a min. 1.0m freeboard. The boreholes did not encounter bedrock. The borehole logs show sand in the location of BH23-1, which is the location of the proposed infiltration facility. This is a suitable soil for infiltration facilities. The borehole logs show Silty Sand and Gravel in the location of BH23-4, which is the location of the existing infiltration facility, to remain. This is also suitable soil for infiltration facilities.

The month-by-month Infiltration Results are summarized as follows, in reference to the detailed calculations provided in Appendix G. Note that there would be an increase in runoff volume without the mitigation by the proposed infiltration galleries.

Table 4 - Month-by-Month Water Balance Comparison

Month	Existing-Scenario Infiltration (m^3)	Interim-Scenario Infiltration (via Gallery) (m^3)	Proposed-Scenario Infiltration (via Gallery) (m^3)	Int.-to-Prop. Infiltration Vol.- & %-Change	Existing-Scenario Evaporation (m^3)	Interim-Scenario Evaporation (m^3)	Proposed-Scenario Evaporation (m^3)	Int.-to-Prop. Evaporation Vol. & % Change	Existing-Scenario Runoff (m^3)	Interim-Scenario Runoff *(considering mitigation by infiltration gallery)* (m^3)	Proposed-Scenario Runoff *(considering mitigation by infiltration gallery)* (m^3)	Int.-to-Prop. Runoff Vol. & % Change
January	939.1	1,252.1	1,252.1	0.0m^3; 0.0%	0.0	0.0	0.0	0.0m^3; 0.0%	782.6	1,252.1 *0.0*	1,252.1 *0.0*	0.0m^3; 0.0%
February	845.8	1,127.8	1,127.8	0.0m^3; 0.0%	0.0	0.0	0.0	0.0m^3; 0.0%	704.9	1,127.8 *0.0*	1,127.8 *0.0*	0.0m^3; 0.0%
March	1200.5	1,600.6	1,600.6	0.0m^3; 0.0%	0.0	0.0	0.0	0.0m^3; 0.0%	1,000.4	1,600.6 *0.0*	1,600.6 *0.0*	0.0m^3; 0.0%
April	792.0	1056.0	1056.0	0.0m^3; 0.0%	682.2	508.6	508.6	0.0m^3; 0.0%	660.0	1,233.1 *0.0*	1,233.1 *0.0*	0.0m^3; 0.0%
May	25.4	33.9	33.9	0.0m^3; 0.0%	1,739.9	878.1	878.1	0.0m^3; 0.0%	21.2	909.1 *0.0*	909.1 *0.0*	0.0m^3; 0.0%
June	0.0	0.00	0.00	0.0m^3; 0.0%	2,339.2	997.4	997.4	0.0m^3; 0.0%	0.0	708.9 *0.0*	708.9 *0.0*	0.0m^3; 0.0%
July	0.0	0.00	0.00	0.0m^3; 0.0%	2,832.8	1,113.4	1,113.4	0.0m^3; 0.0%	0.0	874.6 *0.0*	874.6 *0.0*	0.0m^3; 0.0%
August	0.0	0.00	0.00	0.0m^3; 0.0%	2,491.3	1,009.5	1,009.5	0.0m^3; 0.0%	0.0	1,139.9 *0.0*	1,139.9 *0.0*	0.0m^3; 0.0%
September	0.0	493.1	493.1	0.0m^3; 0.0%	1,551.5	728.3	728.3	0.0m^3; 0.0%	0.0	1,328.7 *0.0*	1,328.7 *0.0*	0.0m^3; 0.0%
October	0.0	729.3	729.3	0.0m^3; 0.0%	806.9	515.2	515.2	0.0m^3; 0.0%	0.0	1,026.3 *0.0*	1,026.3 *0.0*	0.0m^3; 0.0%
November	0.0	1,729.7	1,729.7	0.0m^3; 0.0%	186.2	223.8	223.8	0.0m^3; 0.0%	0.0	1,691.2 *0.0*	1,691.2 *0.0*	0.0m^3; 0.0%
December	926.0	1,724.9	1,724.9	0.0m^3; 0.0%	0.0	0.0	0.0	0.0m^3; 0.0%	771.6	1,724.9 *0.0*	1,724.9 *0.0*	0.0m^3; 0.0%
Annual	5,898.8	7,865.1	7,865.1	0.0m^3; 0.0%	12,630.0	5,974.1	5,974.1	0.0m^3; 0.0%	4,915.7	14,617.1 *0.0*	14,617.1 *0.0*	0.0m^3; 0.0%

e. Stormwater Quality

Criteria for stormwater quality is given by the City of Guelph's *Development Engineering Manual*. Section 5.7.2. therein states that all developments shall provide *Enhanced Level of Protection (i.e., 80% Total Suspended Solids Removal)*. It was further clarified in the enclosed correspondence (Appendix E) that this must be satisfied by-way of an OGS which has CETV-certification for 80%-TSS Removal.

A stormwater filter has accordingly been specified which is CETV-certified to provide 80% TSS Removal: a *Jellyfish Filter* by Imbrium Systems. The Jellyfish Filter's sizing report is provided here in Appendix F; the model-number specified is *JF6-4-1*.

The Jellyfish Filter is CETV-certified for 80% TSS Removal. The CETV Verification Statement is provided here in Appendix F. The catchment area on which basis the Jellyfish Filter has been sized is generally all driving/pedestrian surfaces which will be subject to winter maintenance and will drain into the Site's internal 825mm-dia./900mm-dia. storm sewer. The *Jellyfish Catchment Plan* figure in Appendix F illustrates this.

The CETV certification requires that the Jellyfish filter is installed in an *offline* configuration, meaning that there is bypass piping installed to allow high-flow events to bypass the filter. Refer to the Functional Servicing Plans, Drawings CV-101, CV-102 and CV-103, for the proposed installation of the Jellyfish Filter.

Note that the existing *STC6000* conventional OGS will be removed in the proposed development as it does not carry CETV-certification for 80% TSS removal. The Jellyfish filter will be installed approximately in it's place, albeit in an 'offline' configuration, with a bypass.

7. Geotechnical & Hydro-Geological Considerations

a. Geotechnical Engineering

A geotechnical investigation was prepared by WSP Canada Inc., dated December 1, 2023, in a report titled *Preliminary Geotechnical and Hydrogeological Investigations,* Proposed Mixed-Use Development 1 Clair Road East, Guelph, Ontario.

The Report comprises the results of 5 boreholes which were installed, in September, 2023, in the area of the proposed Development. The boreholes were extended to a depth of 14m-18m and piezometers were installed to facilitate hydrogeological investigation (below).

The subsurface conditions were observed to comprise a layer of surficial asphalt, beneath which there was a depth of up-to 2.2m of fill, beneath which were native soils. The native soils consisted of sandy silt, silty sand, sand and gravel, and non-cohesive till materials consisting of silty sand and cohesive till deposits of silty clay. Refer to Section 4.2 of the Geotechnical investigation for further information.

The report notes that the Site, being located in the City of Guelph, is located in a region of Ontario known as the *Guelph Drumlin Field*, which is centered on the City of Guelph.

The report comprises recommendations pertaining to the excavation for the proposed two-level below-grade parking structure as well as pertaining-to excavation and backfill for installation of site services. It is recommended therein that OPSS and Guelph City standards should be observed in the bedding and backfill for proposed site services, the only exception being if wet soils are encountered, in which case sub-excavation may be required.

b. Hydro-Geological Considerations

The above-mentioned report by WSP dated December 2023 comprises hydro-geological conclusions and recommendations.

The report comprises the results of 5 piezometers/wells, which were installed in September, 2023, concurrently with the above-described boreholes. The wells were sampled in three separate events in September/October 2023 in order to provide qualitative and quantitative results pertaining to groundwater conditions.

Groundwater depth measurements were provided in Table 4 of WSP's report, and reflect a depth varying between 5.7m and 9.4m below-grade. As the report notes, these results may be subject to seasonal fluctuation.

The report notes in Section 4.2.9 that the groundwater's quality is such that there are no exceedances for discharge to either the Sanitary Sewers or Storm Sewers, based on the City of Guelph's bylaw criteria.

The report recommends in Section 5.1.3 that the proposed buildings should be constructed with drained foundations consisting of subfloor drainage tiles draining to a central sump. This section also notes that dewatering may be required during the construction stage to facilitate temporary shoring and excavation.

8. Erosion & Sediment Control

Erosion and sediment control (ESC) practices will be employed during the construct phase to mitigate sediment transport, in accordance with GRCA and City of Guelph requirements.

The general intent of erosion & sediment control practices during the construction phase is to mitigate the transport and conveyance of sediment and soil from the site, off-site, into nearby watercourses and storm drainage infrastructure. Sediment transport may occur as a result of grading and earthworks activities; ESC measures are required to mitigate.

The details of the proposed erosion and sediment control measures will be developed at the SPA stage, however they are generally envisioned to comprise the following components:

- At the construction access driveway, a mud mat will be installed, to mitigate egress of sediment on the tires of construction vehicles leaving the site.
- Sediment control traps will be installed at all existing catchbasins in the adjacent streets during the course of construction. Newly-installed catchbasins will additionally have sediment traps installed.
- A silt fence will be installed at the boundary of the Site, in accordance with OPSD standards, to prevent the overland flow of sediment-laden runoff off-site.
- Other measures, such as rock check dams, will be installed within the site, to capture sediment prior-to draining off-site.
- All erosion control measures will be continuously inspected and maintained during the course of construction.
- Areas of grading construction should be re-vegetated and/or sodded as soon as possible following grading construction, in order to prevent washing-away of graded soils.

9. Conclusions

This Functional Servicing and Stormwater Management Report has documented how the proposed development will be serviced by the City's existing municipal infrastructure (for domestic water and fire protection, as well as storm and sanitary sewage), as well as providing the measures by which stormwater quantity and quality criteria are addressed.

In conclusion,

- There is existing storm sewer, sanitary sewer and watermain infrastructure available within and adjacent-to the subject development Site.
- A *Servicing Capacity Check* has been completed so as to verify the capacity of existing municipal sewers and watermains to service the proposed Development of the Site. It was thereby confirmed that existing municipal watermains and sanitary sewers have available capacity to support the proposed development and no offsite sewer or watermain infrastructure improvements are required.
- There are existing private sanitary sewers, storm sewers and watermains within the Site, which are proposed to be in-part retained to service the proposed development.

- There is an existing private storm sewer which passes-through the subject Development Lands and which is proposed to be retained in the proposed development because it presently services, and will remain to service, the adjacent lands which are presently under the same ownership as the development Site.
- There is an existing Stormwater Management Pond adjacent-to the Site, which presently provides stormwater detention/quantity control (up-to the 1-in-100-year event) for the subject site, and will continue to do-so for the proposed Development of the Site. The Site's imperviousness is no-more than that which was allocated-for in the Pond's design, therefore the pond provides adequate quantity control for the proposed development.
- A stormwater filter has been specified to provide stormwater quality control for the proposed development Site; the filter has been sized and specified to provide 80% TSS Removal and has been ETV-certified accordingly.
- Stormwater balance/retention will be addressed by infiltration galleries. The site presently comprises, in the existing condition, four infiltration galleries, however only the largest is proposed to remain in the proposed development. An additional infiltration gallery is proposed within the Park area in Phase 1 to provide additional stormwater retention, thereby satisfying municipal criteria for water balance.
- The site has a significant grade/elevation difference from the highest-point to the lowest-point, of more-than 4m; this occurs gradually over the site's area and preliminarily, no significant grading features or retaining walls are required on account of the grade difference.
- Minor-system storm runoff will drain via piped storm sewers and mechanical storm drainage systems within the buildings (to be designed at the Building Permit stage), to existing municipal storm sewers.
- Major-system storm runoff will drain via overland flows and the major overland flow route, as illustrated on the Functional Grading Plan(s).
- Standard erosion and sediment control measures are to be specified at the SPA stage, pertaining-to the construction stage.

Please contact the undersigned with any questions.

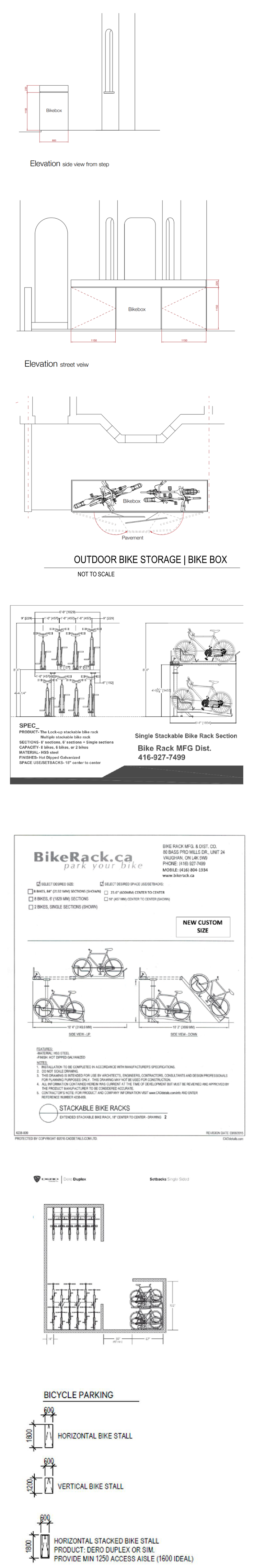
Respectfully submitted,

Feb. XX/2025

Daniel Bancroft, P.Eng.,
civilGo Engineering Inc.

APPENDIX A

- Architectural Site Plan by SvN
- Architectural Statistics by SvN



NO.	DATE	REVISION / ISSUANCE
1	231215	Issued For ZBA Pre-Submission
2	240726	Issued For ZBA Pre-submission

NOTES

GROUND FLOOR PLAN KEY NOTES:

1. LOADING SPACE HAS A LENGTH OF 11.4m, WIDTH OF 6m AND AN UNENCUMBERED VERTICAL CLEARANCE OF 6.5m, IS LEVEL (+/- 2%), AND IS CONSTRUCTED OF A MINIMUM 200mm REINFORCED CONCRETE
2. STAGING AREA HAS AN UNENCUMBERED VERTICAL CLEARANCE OF 6.5m, IS CONSTRUCTED OF 200mm REINFORCED CONCRETE, AND HAS A SLOPE NO GREATER THAN 2%
3. ALL ACCESS DRIVEWAYS USED BY WASTE COLLECTION VEHICLE WILL BE LEVEL (+/- 8%), HAVE A MINIMUM VERTICAL CLEARANCE OF 4.4m THROUGHOUT, A MINIMUM OF 4.5m WIDE THROUGHOUT, AND 6m WIDE AT INGRESS/EGRESS
4. OVERHEAD DOORS THE COLLECTION VEHICLE WILL BE PASSING THROUGH WILL HAVE A MINIMUM WIDTH OF 4m AND A VERTICAL CLEARANCE OF 6.5m

SvN
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Toronto, ON M5C 1K9
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416.593.6499

PERGOLA COMMONS

GROUND LEVEL PLAN

PROJECT		DRAWN	Author
SCALE	1 : 200	CHECKED	Checker
DATE	12/04/23		

A 201

2024-07-23 5:19:29 PM

Autodesk Docs://Pergola Commons_105 Clair Rd E/42404_1 Pergola Commons_R24.rvt

SITE STATS

OVERALL SITE AREA (Approx.)		53,860	sq.m
DEVELOPMENT SITE AREA		22,188	sq.m
PROPOSED PARKLAND DEDICATION	8%	1800	sq.m
NET SITE AREA		20,388	sq.m
DENSITY		3.75	FSI
LANDSCAPE COVERAGE		42%	
BUILDING HEIGHTS			
TOWER A	14 STOREYS	45.74	m*
TOWER B1	14 STOREYS	44.27	m*
TOWER B2	10 STOREYS	32.27	m*
TOWER C	14 STOREYS	45.85	m*
TOWER D	14 STOREYS	45.07	m*

* Measured from average grade

AMENITY

PHASE 1 | BUILDING A	
NO. OF UNITS	187
INDOOR	
GROUND LEVEL	254
LEVEL 7	205
TOTAL	**459**
OUTDOOR	
GROUND LEVEL	1097
LEVEL 7	671
TOTAL	**1768**
INDOOR & OUTDOOR AMENITY COIMBINED	**2227**
TOTAL AMENITY PER UNIT	11.9
BALCONIES	1458.0
TOTAL AMENITY WITH BALCONIES	3226
TOTAL AMENITY PER UNIT WITH BALCONY	17.3
POPS	0

PHASE 2 | BUILDING B	
NO. OF UNITS	246
INDOOR	
GROUND LEVEL	322
LEVEL 7	400
TOTAL	**722**
OUTDOOR	
GROUND LEVEL	990
LEVEL 7	707
TOTAL	**1697**
INDOOR & OUTDOOR AMENITY COIMBINED	**2419**
TOTAL AMENITY PER UNIT	9.8
BALCONIES	1860.0
TOTAL AMENITY WITH BALCONIES	4279.0
TOTAL AMENITY PER UNIT WITH BALCONY	17.4
POPS	660

PHASE 2 | BUILDING C & D	
NO. OF UNITS	282
INDOOR	
GROUND LEVEL	259
LEVEL 7	559
TOTAL	**818**
OUTDOOR	
GROUND LEVEL	0
LEVEL 7	1057
TOTAL	**1057**
INDOOR & OUTDOOR AMENITY COIMBINED	**1875**
TOTAL AMENITY PER UNIT	6.6
BALCONIES	2414.0
TOTAL AMENITY WITH BALCONIES	4288.6
TOTAL AMENITY PER UNIT WITH BALCONY	15.2
POPS	0

ALL PHASES COMBINED	
INDOOR AMENITY	1,999
OUTDOOR AMENITY	4,522
TOTAL	6,521
BALCONIES	5732.0
AREA OF AMENITY/UNIT	9.1
AREA OF AMENITY /UNIT WITH BALCONIES	17.1

UNIT MIX

PHASE 01 – BUILDING A

	1B	1B+D	2B	2B+D	3B	2B TH	3B TH	TOTAL
LEVEL 1						15	2	17
LEVEL 2								
LEVEL 3	8	2	7	4	2			23
LEVEL 4	8	2	7	4	2			23
LEVEL 5	8	2	7	4	2			23
LEVEL 6	8	2	7	4	2			23
LEVEL 7	3	1	2	1	1			8
LEVEL 8	3	1	3	1	2			10
LEVEL 9	3	1	3	1	2			10
LEVEL 10	3	1	3	1	2			10
LEVEL 11	3	1	3	1	2			10
LEVEL 12	3	1	3	1	2			10
LEVEL 13	3	1	3	1	2			10
LEVEL 14	3	1	3	1	2			10
TOTAL	**56**	**16**	**51**	**24**	**23**	**15**	**2**	
GRAND TOTAL	**30%**	**9%**	**27%**	**13%**	**12%**	**8%**	**1%**	187

PHASE 02 – BUILDING B

	1B	1B+D	2B	2B+D	3B	2B TH	3B TH	TOTAL
LEVEL 1						16	2	18
LEVEL 2								
LEVEL 3	11	1	10	4	2			28
LEVEL 4	11	1	10	4	2			28
LEVEL 5	11	1	10	4	2			28
LEVEL 6	11	1	10	4	2			28
LEVEL 7	9	1	5	0	1			16
LEVEL 8	8	2	7	2	1			20
LEVEL 9	8	2	7	2	1			20
LEVEL 10	8	2	7	2	1			20
LEVEL 11	4	1	4	1				10
LEVEL 12	4	1	4	1				10
LEVEL 13	4	1	4	1				10
LEVEL 14	4	1	4	1				10
TOTAL	**93**	**15**	**82**	**26**	**12**	**16**	**2**	
GRAND TOTAL	**38%**	**6%**	**33%**	**11%**	**5%**	**7%**	**1%**	246

PHASE 03 – BUILDING C

	1B	1B+D	2B	2B+D	3B	2B TH	3B TH	TOTAL
LEVEL 1						2	2	4
LEVEL 2								
LEVEL 3	3	3	3	7				16
LEVEL 4	3	3	3	7				16
LEVEL 5	3	3	3	7				16
LEVEL 6	3	3	3	7				16
LEVEL 7	2	2	2	1	1			8
LEVEL 8	3	1	2	2	2			10
LEVEL 9	3	1	2	2	2			10
LEVEL 10	3	1	2	2	2			10
LEVEL 11	3	1	2	2	2			10
LEVEL 12	3	1	2	2	2			10
LEVEL 13	3	1	2	2	2			10
LEVEL 14	3	1	2	2	2			10
TOTAL	**35**	**21**	**28**	**43**	**15**	**2**	**2**	
GRAND TOTAL	**24%**	**14%**	**19%**	**29%**	**10%**	**1%**	**1%**	146

PHASE 03 – BUILDING D

	1B	1B+D	2B	2B+D	3B	2B TH	3B TH	TOTAL
LEVEL 1						0		
LEVEL 2								
LEVEL 3	1	5	5	4				15
LEVEL 4	1	5	5	4				15
LEVEL 5	1	5	5	4				15
LEVEL 6	1	5	5	4				15
LEVEL 7	4		2					6
LEVEL 8	4	1	4	1				10
LEVEL 9	4	1	4	1				10
LEVEL 10	4	1	4	1				10
LEVEL 11	4	1	4	1				10
LEVEL 12	4	1	4	1				10
LEVEL 13	4	1	4	1				10
LEVEL 14	4	1	4	1				10
TOTAL	**36**	**27**	**50**	**23**	**0**	**0**		
GRAND TOTAL	**26%**	**20%**	**37%**	**17%**				136

TOTAL ALL PHASES	715	UNITS	42%	**1B**
			50%	**2B**
			8%	**3B**
INCLUDING PARKLAND	325	UNITS/HA		
EXCLUDING PARKLAND	350.7	UNITS/HA		

GFA / NET FLOOR AREA

PHASE 1 - BUILDING A	GFA (sq.m)	NET FLOOR AREA (sq.m)
LEVEL 1	2238	1581
LEVEL 2	1708	1358
LEVEL 3	2021	1763
LEVEL 4	2021	1763
LEVEL 5	2021	1763
LEVEL 6	2021	1763
LEVEL 7	901	798
LEVEL 8	880	770
LEVEL 9	880	770
LEVEL 10	880	770
LEVEL 11	880	770
LEVEL 12	880	770
LEVEL 13	880	770
LEVEL 14	880	770
MECH PH	420	0
TOTAL	**19510**	**16179**

PHASE 2 - BUILDING B	GFA (sq.m)	NET FLOOR AREA (sq.m)
LEVEL 1	2980	2323
LEVEL 2	2192	1740
LEVEL 3	2433	2117
LEVEL 4	2433	2117
LEVEL 5	2433	2117
LEVEL 6	2433	2117
LEVEL 7	1679	1476
LEVEL 8	1655	1447
LEVEL 9	1655	1447
LEVEL 10	1655	1447
LEVEL 11	827	722
LEVEL 12	827	722
LEVEL 13	827	722
LEVEL 14	827	722
MECH PH	420	0
TOTAL	**25274**	**21234**

PHASE 3 - BUILDING C	GFA (sq.m)	NET FLOOR AREA (sq.m)
LEVEL 1	2045	1571
LEVEL 2	988	753
LEVEL 3	1563	1398
LEVEL 4	1563	1398
LEVEL 5	1563	1398
LEVEL 6	1563	1398
LEVEL 7	925	808
LEVEL 8	882	780
LEVEL 9	882	780
LEVEL 10	882	780
LEVEL 11	882	780
LEVEL 12	882	780
LEVEL 13	882	780
LEVEL 14	882	780
MECH PH	420	0
TOTAL	**16803**	**14178**

PHASE 3 - BUILDING D	GFA (sq.m)	NET FLOOR AREA (sq.m)
LEVEL 1	1773	1428
LEVEL 2	428	292
LEVEL 3	1391	1237
LEVEL 4	1391	1237
LEVEL 5	1391	1237
LEVEL 6	1391	1237
LEVEL 7	869	744
LEVEL 8	830	767
LEVEL 9	830	722
LEVEL 10	830	722
LEVEL 11	830	722
LEVEL 12	830	722
LEVEL 13	830	722
LEVEL 14	830	722
MECH PH	420	0
TOTAL	**14864**	**12509**

TOTAL GFA (sq.m) FOR ALL PHASES **76450** sq.m
TOTAL NFA (sq.m) FOR ALL PHASES **64100** sq.m

New Zoning By-law (2023)-20790 :
Gross floor area (GFA) means the floor area of a building measured from the centre line of partition walls and from the exterior face of outside walls.

Net floor area means the gross floor area of a building measured from the interior walls, excluding stairways, common hallways, elevator shafts and other service and mechanical shafts, service and mechanical rooms, waste and recycling rooms, loading areas, and common washroom facilities.

CAR PARKING

PHASE 1 | BUILDING A		
NO. OF UNITS		187
MIN REQ. VISITOR	.1/unit	19
MIN REQ. RESIDENTIAL	.8/unit	187
REQ. ACCESSIBLE SPACES	1+2%	5
PROPOSED		
LEVEL P1		
NON-RES PARKING		23
RESIDENTIAL PARKING		103
TOTAL		126
LEVEL P2		
NON-RES PARKING		0
RESIDENTIAL PARKING		129
TOTAL		129
TOTAL ACCESSIBLE		10
OVERALL TOTAL		**255**
PROPOSED PARKING RATIO | NON-RES		**0.1**
PROPOSED PARKING RATIO | RES		**1.2**

PHASE 2 | BUILDING B		
NO. OF UNITS		246
MIN REQ. VISITOR	.1/unit	25
MIN REQ. RESIDENTIAL	.8/unit	246
REQ. ACCESSIBLE SPACES	1+2%	6
PROPOSED		
LEVEL P1		
NON-RES PARKING		26
RESIDENTIAL PARKING		97
TOTAL		123
LEVEL P2		
NON-RES PARKING		0
RESIDENTIAL PARKING		129
TOTAL		129
TOTAL ACCESSIBLE		12
OVERALL TOTAL		**252**
PROPOSED PARKING RATIO | NON-RES		**0.1**
PROPOSED PARKING RATIO | RES		**0.9**

PHASE 3 | BUILDINGS C & D		
NO. OF UNITS		282
MIN REQ. VISITOR	.1/unit	28.2
MIN REQ. RESIDENTIAL	.8/unit	282
REQ. ACCESSIBLE SPACES	1+2%	7
PROPOSED		
LEVEL P1		
NON-RES PARKING		36
RESIDENTIAL PARKING		120
TOTAL		156
LEVEL P2		
NON-RES PARKING		0
RESIDENTIAL PARKING		164
TOTAL		164
TOTAL ACCESSIBLE		12
OVERALL TOTAL		**320**
PROPOSED PARKING RATIO | NON-RES		**0.1**
PROPOSED PARKING RATIO | RES		**1.0**

OVERALL ALL PHASES

NON-RES PARKING	**85**
RESIDENTIAL PARKING	**742**
PROPOSED PARKING RATIO | NON-RES	**0.1**
PROPOSED PARKING RATIO | RES	**1.04**

COMMERCIAL PARKING

OVERALL COMMERCIAL AREA (BLDGS A,B,C & D)	2146	
MIN REQUIRED COMMERCIAL PARKING	58	0 spaces for the first 500 m^2 of GFA; 3.5 spaces / 100 m^2 GFA in excess of 500
NON-RES SURFACE PARKING PROPOSED	**24**	
NON-RES PARKING PROPOSED IN BLDGS C & D	**36**	
OVERALL NON-RES PARKING PROPOSED	**60**	

BIKE PARKING

PHASE 1 | BUILDING A | RES		
NO. OF UNITS		189
REQUIRED SHORT-TERM PARKING	.1/unit	19
PROPOSED SHORT-TERM PARKING		**20**
REQUIRED LONG-TERM PARKING	1/unit	189
REQUIRED HORIZONTAL BICYCLE PARKING SPACES	25%	47
PROPOSED HORIZONTAL BICYCLE PARKING SPACES		**49**
PROPOSED STACKED BICYCLE PARKING SPACES		**144**
PROPOSED LONG-TERM PARKING		**193**

PHASE 2 | BUILDING B| RES		
NO. OF UNITS		250
REQUIRED SHORT-TERM PARKING	.1/unit	25
PROPOSED SHORT-TERM PARKING		**26**
REQUIRED LONG-TERM PARKING	1/unit	250
REQUIRED HORIZONTAL BICYCLE PARKING SPACES	25%	63
PROPOSED HORIZONTAL BICYCLE PARKING SPACES		**78**
PROPOSED STACKED BICYCLE PARKING SPACES		**176**
PROPOSED LONG-TERM PARKING		**254**

PHASE 3 | BUILDING C | RES		
NO. OF UNITS		146
REQUIRED SHORT-TERM PARKING	.1/unit	15
PROPOSED SHORT-TERM PARKING		**16**
REQUIRED LONG-TERM PARKING	1/unit	146
REQUIRED HORIZONTAL BICYCLE PARKING SPACES	25%	37
PROPOSED HORIZONTAL BICYCLE PARKING SPACES		**45**
PROPOSED STACKED BICYCLE PARKING SPACES		**104**
PROPOSED LONG-TERM PARKING		**149**

PHASE 3 | BUILDING D | RES		
NO. OF UNITS		136
REQUIRED SHORT-TERM PARKING	.1/unit	14
PROPOSED SHORT-TERM PARKING		**14**
REQUIRED LONG-TERM PARKING	1/unit	136
REQUIRED HORIZONTAL BICYCLE PARKING SPACES	25%	34
PROPOSED HORIZONTAL BICYCLE PARKING SPACES		**41**
PROPOSED STACKED BICYCLE PARKING SPACES		**96**
PROPOSED LONG-TERM PARKING		**137**

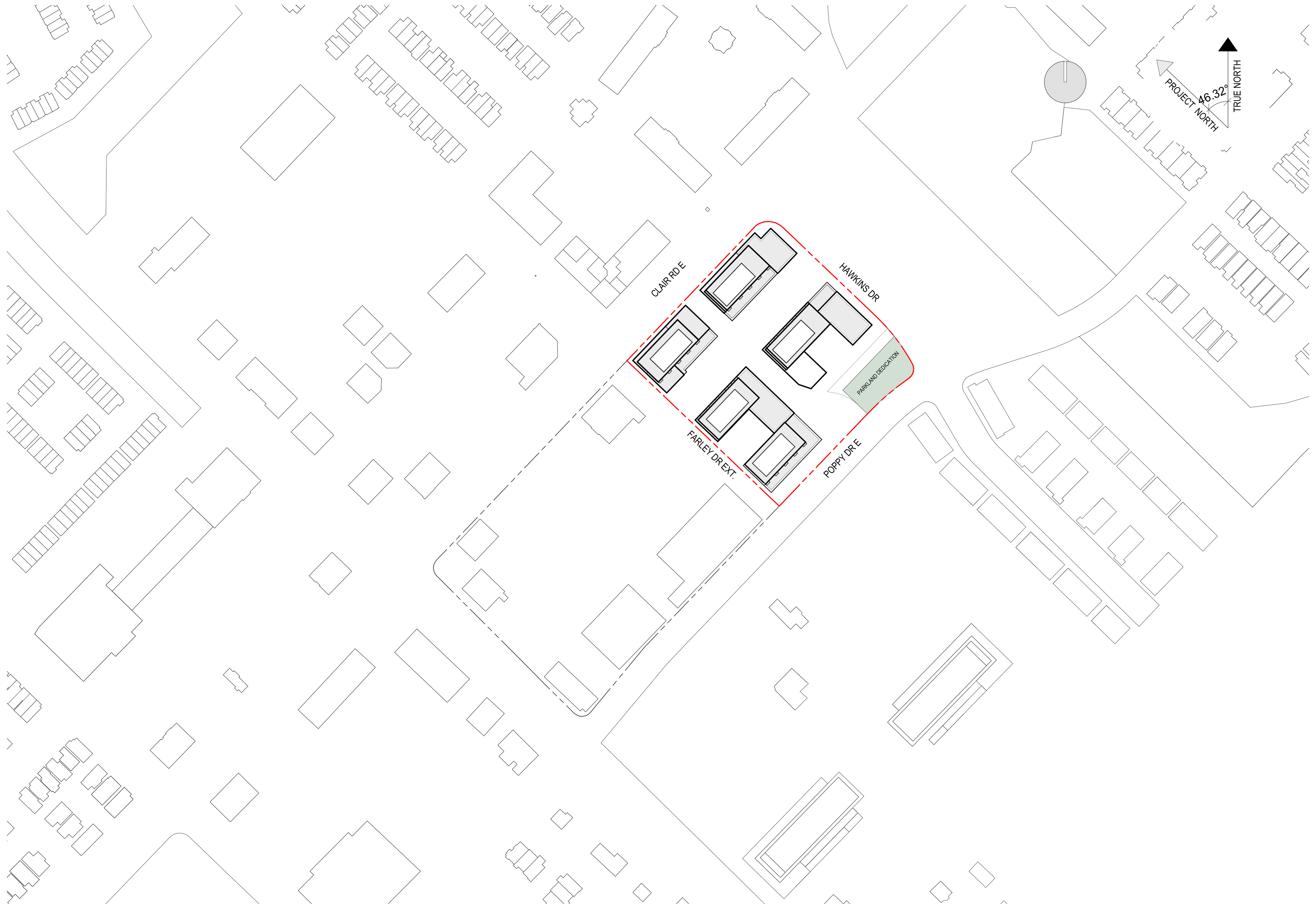
OVERALL COMMERCIAL	
LONG TERM BIKE PARKING	**4**
SHORT TERM BIKE PARKING	**4**

OVERALL RESIDENTIAL- ALL PHASES	
LONG TERM BIKE PARKING	**733**
SHORT TERM BIKE PARKING	**76**

PHASE 2 | BUILDING B| COMMERCIAL		
AREA OF COMMERCIAL SPACE		342
REQUIRED SHORT-TERM PARKING	.2/100 sm	1
REQUIRED LONG-TERM PARKING	.1/100 sm	0
PROPOSED SHORT-TERM PARKING		**2**
PROPOSED LONG-TERM PARKING		**0**

PHASE 3 | BUILDING C | COMMERCIAL		
AREA OF COMMERCIAL SPACE		866
REQUIRED SHORT-TERM PARKING	.2/100 sm	2
REQUIRED LONG-TERM PARKING	.1/100 sm	1
PROPOSED SHORT-TERM PARKING		**2**
PROPOSED LONG-TERM PARKING		**2**

PHASE 3 | BUILDING D | COMMERCIAL		
AREA OF COMMERCIAL SPACE		937
REQUIRED SHORT-TERM PARKING	.2/100 sm	2
REQUIRED LONG-TERM PARKING	.1/100 sm	1
PROPOSED SHORT-TERM PARKING		**2**
PROPOSED LONG-TERM PARKING		**2**



1 A 101 CONTEXT MAP
1 : 2000

NO.	DATE	REVISION / ISSUANCE
1	**231215**	**Issued For ZBA Pre-Submission**
2	**240726**	**Issued For ZBA Pre-submission**

NOTES

SvN

110 Adelaide St. E.
Toronto, ON M5C 1K9
info@svn-ap.com
416.593.6499

PERGOLA COMMONS

PROJECT OVERVIEW

PROJECT		DRAWN	**Author**
SCALE	**1 : 2000**	CHECKED	**Checker**
DATE	**11/10/23**		

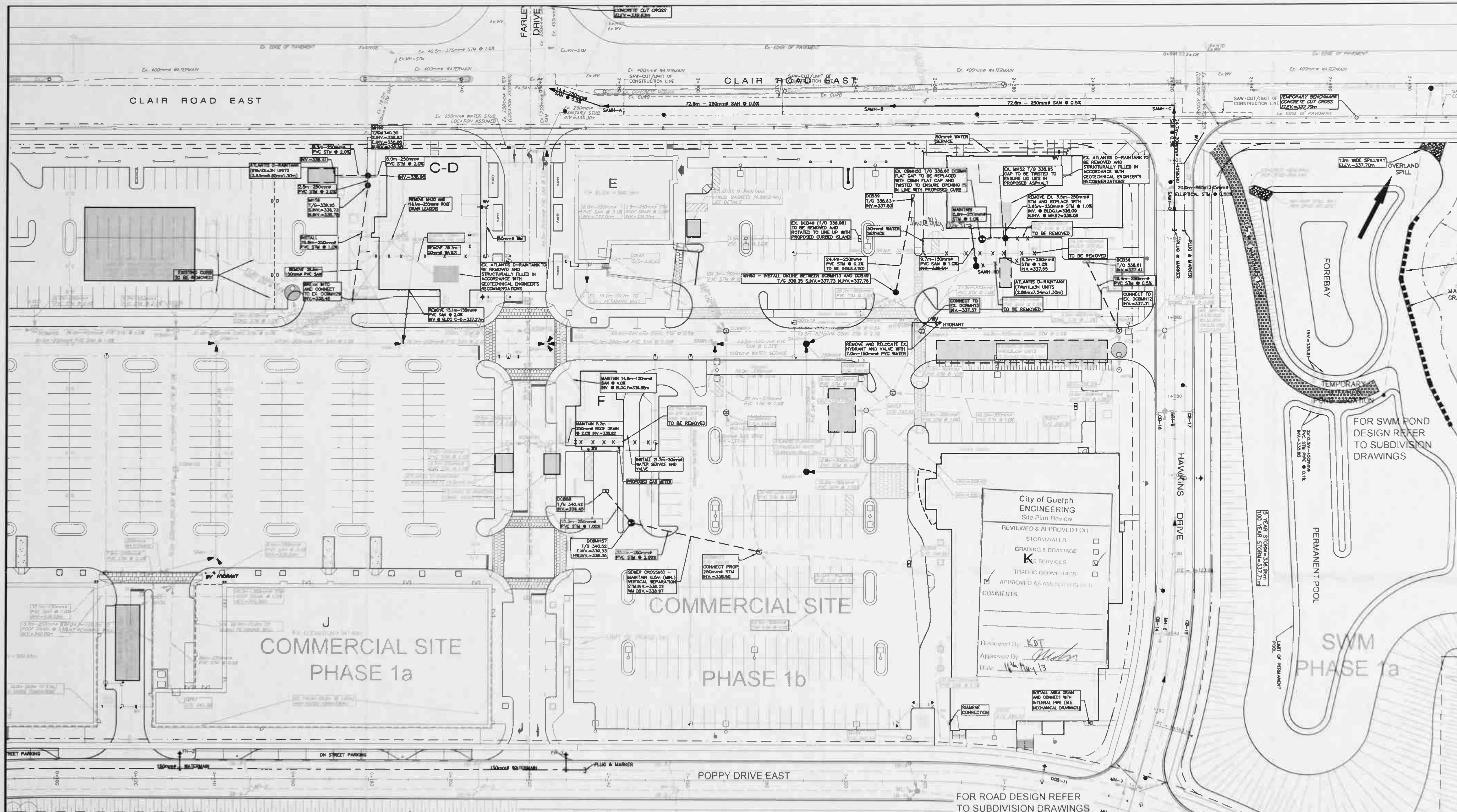
A 101

2024-07-23 5:16:09 PM

Autodesk Docs://Pergola Commons_105 Clair Rd E/42404_1 Pergola Commons_R24.rvt

APPENDIX B

- Existing-Site Site Servicing Plan – Site Servicing Plan Phase 1b by IBI Group



STORM STRUCTURE INVERTS (COMMERCIAL SITE)						
STRUCTURE	T/G	NORTH	EAST	SOUTH	WEST	DESCRIPTION
DCBMH12	338.20	337.20 TO DCB56	336.95	336.70	337.00	DCBMH – 1800mmø, OPSD 701.012
DCBMH13	339.58	NE337.61 NW337.61 N337.37	337.22	337.75	337.26	DCBMH – 1500mmø, OPSD 701.011
DCBMH14	339.56	337.73	337.50	337.80	337.55	DCBMH – 1500mmø, OPSD 701.011 NW INV = 337.85
DCBMH15	339.60	338.00	337.80	338.10	337.90	DCBMH – 1500mmø, OPSD 701.011
DCBMH16	339.80	337.85	338.19	338.45	338.27	DCBMH – 1500mmø OPSD 701.011 NE INV = 338.30
DCBMH17	340.15	338.60	338.45	338.60	338.52	DCBMH – 1500mmø, OPSD 701.011
DCBMH18	340.40	339.00	338.88		338.95	DCBMH – 1500mmø, OPSD 701.011
DCBMH19	340.95	339.35	339.27	339.34		DCBMH – 1500mmø, OPSD 701.011
CBMH20	341.83	340.15		340.20		CBMH – 1200mmø, OPSD 701.010
CBMH21	342.32	341.03			341.08	RELOCATE LID TO ALIGN WITH PROP. EDGE OF PAVEMENT, CBMH – 1200mmø, OPSD 701.010
MH22	343.35	341.15	341.42		341.47	MH 1200mmø – OPSD 701.010
MH23	339.77	337.70		337.97	338.02	MH 1200mmø – OPSD 701.010
DCB24	339.55			338.07		DOUBLE CATCHBASIN – OPSD 705.020
DCBMH25	340.07	338.53	338.60	338.56	338.60	DCBMH – 1500mmø, OPSD 701.011
DCB26	341.05	339.54				DOUBLE CATCHBASIN – OPSD 705.020
MH27	340.34		338.67	337.33	338.70	MH 1200mmø – OPSD 701.010 c/w DROP STRUCTURE
MH28	340.40		338.70	337.33	338.67	MH 1200mmø – OPSD 701.010 c/w DROP STRUCTURE
DCBMH29	339.65	338.43				DCBMH 1500mmø – OPSD 701.011 SW INV = 338.38
MH30	339.87	338.27	338.57	338.52	338.57	MH 1200mmø – OPSD 701.010
STC-31	339.80	337.74		337.76		STORMCEPTOR 6000, SEE DETAIL
DCBMH32	341.03	338.95		339.00		DCBMH – 1500mmø, OPSD 701.011
MH34	341.35	339.15		339.20	340.20	CHANGE CB GRATE TO MH GRATE, MH – 1500mmø, OPSD 701.011
MH35	341.60	NE. 339.75	339.83	SW. 339.45	339.83	MH 1200mmø – OPSD 701.010

STRUCTURE	T/G	NORTH	EAST	SOUTH	WEST	DESCRIPTION
DCB36	339.58			338.71		DOUBLE CATCHBASIN – OPSD 705.020
DCB37	340.44			339.11		DOUBLE CATCHBASIN – OPSD 705.020
MH38	341.03	339.47		339.41	339.47	MH 1200mmø – OPSD 701.010
CB39	340.40	339.34				CATCHBASIN – OPSD 705.010
CB40	338.98		338.00			CATCHBASIN – OPSD 705.010
STC-41	339.35	338.84		338.84		STORMCEPTOR 6000, SEE DETAIL
MH42	339.15	338.59	–		338.54	MH – 1800mmø, OPSD 701.012 FILL 600mmø EAST INV. AND RE-BENCH MH
CB43	340.38	339.33				CATCHBASIN – OPSD 705.010
DCB44	341.58	340.34				CATCHBASIN – OPSD 705.010
DCBMH45	339.58	338.00		338.05		DCBMH – 1500mmø, OPSD 701.011
DCBMH46	339.90	337.87	338.06		338.06	DCBMH – 1500mmø, OPSD 701.011
DCB47	340.38				338.53	DOUBLE CATCHBASIN – OPSD 705.020
DCB48	340.80				338.84	DOUBLE CATCHBASIN – OPSD 705.020
DCB49	338.96			337.89		DOUBLE CATCHBASIN – OPSD 705.020
DCBMH50	338.80		337.94	337.89		CBMH – 1800mmø, OPSD 701.011, ROTATE LID TO LINE UP WITH PROPOSED CURB
DCBMH51	340.51	338.41	338.48	SE338.48	338.86	DCBMH – 1800mmø, OPSD 701.011
MH52	338.85	PLUG 337.70 NEW 338.08	TO BE PLUGGED	337.70	338.00	MH – 1800mmø, OPSD 701.012
MH53	340.10	NE338.14		SE338.19	337.84	MH – 1800mmø, OPSD 701.012
MH54	342.45	NW339.08	339.11			MH – 1800mmø, OPSD 701.012
CB55	340.70				339.48	CATCHBASIN – OPSD 705.010
DCB56	338.81			337.41		DOUBLE CATCHBASIN – OPSD 705.020
DCBMH57	340.52	NW338.36	338.33			DCBMH – 1500mmø, OPSD 701.011
DCB58	338.42			338.48		DOUBLE CATCHBASIN – OPSD 705.020
DCB59	338.83			337.83		DOUBLE CATCHBASIN – OPSD 705.020
MH60	338.36	NW337.76 NE337.76		337.73		

SANITARY STRUCTURE INVERTS (COMMERCIAL SITE)						
STRUCTURE	T/G	NORTH	EAST	SOUTH	WEST	DESCRIPTION
SAMH-1	339.63	Ex. 335.10±		335.35		
SAMH-2	339.88	335.85	335.90		336.20	1500mmø, OPSD 701.011 NE INV = 336.30m SE INV = 336.30m
SAMH-3	340.09	337.00	336.59	337.00	336.65	
SAMH-4	340.42		337.12	337.22	337.16	
SAMH-5	341.07	338.60	338.64	338.60		NW INV = 338.65m
SAMH-6	342.64	340.60			341.00	
SAMH-7	341.27	338.45		338.60	338.60	
SAMH-8	339.65		336.14	337.00	336.17	
SAMH-9	340.00	NE336.19		336.19		
SAMH-10	339.08	336.41	TO BE PLUGGED		SW336.36	
SAMH-11	340.45	336.30	336.35			

PROP. DEVELOPMENT PHASE 2

LEGEND

- 342.00 – PROPOSED GRADE ELEVATION
- 345.51 EXIST – MATCH EXISTING GRADE
- PROP. GRADE ELEVATION
- 2.0% – PROPOSED SLOPE
- DRAINAGE DIVIDE
- ENGINEERING FILL
- ORIGINAL GROUND CONTOUR
- PROPOSED MAJOR OVERLAND FLOW
- EXISTING OVERLAND FLOW
- PROPOSED DITCH INLET
- PROPOSED CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED CB MANHOLE
- PROPOSED DCB MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED STORM SEWER
- EXISTING DITCH INLET
- EXISTING CATCH BASIN
- EXISTING DOUBLE CATCH BASIN
- EXISTING STORM MANHOLE
- EXISTING CB MANHOLE
- EXISTING DCB MANHOLE
- EXISTING STORM FLOW DIRECTION
- PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY SEWER
- LIGHT DUTY SILT FENCE OPSD 219.110
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY FLOW DIRECTION
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED VALVE CHAMBER
- PROPOSED REDUCER
- PROPOSED WATERMAIN TEE
- PROPOSED 90° BEND
- PROPOSED 45° BEND
- PROPOSED WATERMAIN
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING VALVE CHAMBER
- EXISTING CURB STOP
- EXISTING WATERMAIN
- PHASE LANE LIMIT

CITY OF GUELPH
APPROVED FOR DEVELOPMENT
Subject to revisions and conditions indicated hereon in accordance with Section 41 of The Planning Act, R.S.O. 1990 as amended.

for [signature] Jan 5/2013

KEY PLAN Scale : NOT TO SCALE

BENCHMARK:
BM–00819696114 ELEV.=347.063m
TABLET IS SET IN CONCRETE SILO ON SOUTH SIDE OF CLAIR ROAD.
TEMPORARY BENCHMARK ELEV.=337.79m
CUT CROSS ON EXISTING CONC. TOP OF CURB ALONG CLAIR ROAD WEST 37.74m NORTHWEST FROM CORNER 5B (NORTHEAST PROPERTY CORNER).

THE POSITION OF POLES, LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	DATE	DESCRIPTION	BY	CHKD
19	APR.2/13	LOWERED BUILDING L - NE ENTRANCE NOW B.F. PER CITY	PK	JP
18	MAR.20/13	LOWERED BUILDING L PER CITY COMMENTS	PK	JP
17	FEB.13/13	PER REVISED SITE PLAN	PK	JP
16	JAN.25/13	PER REVISED SITE PLAN - BUILDINGS E & L	PK	JP
15	JAN.11/13	PER CITY COMMENTS AND REVISED SITE PLAN	PK	JP
14	SEP.17/12	BUILDING F, L & N ENTRANCE GRADING	PK	JP
13	MAY 31/12	RETAINING WALL ADDED AROUND TRANSFORMER PAD	PK	JP
12	MAY 24/12	REVISED PER SITE PLAN REVISIONS	PK	JP
11	FEB.22/12	WATERMAIN REVISED DUE TO CONFLICT WITH TRANSFORMER	PK	JP
10	FEB.7/12	PER REVISED SITE PLAN AND CITY COMMENTS	PK	JP
9	DEC.8/11	REVISED WATER SERVICE TO AVOID CONFLICTS WITH STORM	PK	JP
8	DEC.7/11	REVISED ATLANTIS D-RAINTANK PER SOIL INFILTRATION RESULTS	PK	JP
7	NOV. 30/11	REVISED ATLANTIS D-RAINTANK	PK	JP
6	NOV. 21/11	REVISED ATLANTIS D-RAINTANK	PK	JP
5	NOV. 16/11	PER SITE PLAN REVISIONS AND ATLANTIS RAINTANK DETAILS	PK	JP
4	NOV. 7/11	PER CITY COMMENTS	PK	JP
3	OCT. 4/11	PER SITE PLAN REVISIONS	PK	JP
2	AUG. 23/11	PER SITE PLAN REVISIONS	PK	JP
1	JUL. 29/11	ISSUED FOR REVIEW	PK	JP

ISSUES/REVISIONS

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PROVINCE OF ONTARIO

SCALE	CONSULTANT DRAWING No
HOR. 1:500	19569
DATE DRAWN	CITY CONTRACT No
JUNE 2011	SP10C028

DESIGN BY	CHECKED BY	CITY REFERENCE No	SHEET
E. CERIĆ	J. PERKS	-	03

SP10C028 APPROVED AS AMENDED IN RED.

APPENDIX C

- Domestic Water Demand Calculation Sheet
- Fire Flow Demand (Fire Underwriters' Survey) Fire Flow Demand Calculations Sheets

Domestic Water Demand Flow Calculation Sheet

civilGo ENGINEERING INC.

Project: 1 Clair Rd. E., Guelph - Pergola Commons
Project No.: 23-045
Date: November 2023 (Rev Jul 2024)
By: DB

	Proposed Residential Population				Proposed Commercial/Retail Population			Total Flows		
Development Component	DT/SDT Houses	TH's, Row-Houses; Duplex	Apartments	Total Residential Population	Commercial/ Retail Floor Area GFA	Non-Residential Population	Total Proposed Population	Average Day Demand (ADD)	Max. Day Demand (MDD) (2.0ADD)	Peak Hour Demand (PHD) (3.0ADD)
	(Units)	(Units)	(Units)	(Persons)	(m^2)	(Persons)		(L/s)	(L/s)	(L/s)
Phase 1-Bldg. A		17	170	359	0.0	0.0	359	0.93	1.87	2.80
Phase 2-Bldg. B		18	228	469	342.0	3.8	473	1.23	2.46	3.69
Phase 3-Bldg. C		4	142	274	866.0	9.5	284	0.74	1.48	2.22
Phase 4-Bldg. D			136	254	937.0	10.3	264	0.69	1.37	2.06
Total		**39**	**676**	**1356**	**2145.0**	**23.6**	**1379**	**3.59**	**7.18**	**10.77**

Residential Unit Population:
Detached & Semi's = 3.401 person/unit
Multiples (TH's, Row Dwellings, Duplex) = 2.449 person/unit
Apartments = 1.864 person/unit
Source: *2023 Development Charges Background Study, City of Guelph, Sept. 27, 2023*

Non-Residential Unit Population:
Commercial/Retail = 1.1 person/100m^2 GFA

ADD Flow = 225 L/cap/day

Fire Flow Demand Calculation

as per *Water Supply for Public Fire Protection, 1999 (Fire Underwriters' Survey)*

Project:	Pergola Commons - Ph.1 - Bldg. A
Project No.:	23-045
Date:	November 2023 (Rev July 2024

Fire Flow is given by the following calculation:

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

where
F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Step 1: $F = 220C\sqrt{A}$ = ***13,040 L/Min*** ***F = 3445 USGPM*** Where:

Type of Construction Factor, 'C' =	**0.6**
Wood Frame Construction:	1.5
Ordinary Construction:	1.0
Non-Combustible Construction:	0.8
Fire Resistive Construction:	0.6

Vertical Openings & Exterior Vertical Connections Adequately Protected?: No

Building Area, 'A' =	
1	2238 m²
2	1708 m²
3	2021 m²
4	2021 m²
5	2021 m²
6	2021 m²
7	901 m²
8	880 m²
9	880 m²
10	880 m²
'A'=	**9758.5 m²**

Step 2: Occupancy Hazard Reduction = -15 %

F reduction = -15% x 13,040 L/min = -1,956 L/min
Therefore, F = 11,084 L/min

Where % Reduction =	
Non-Combustible	-25%
Limited Combusible	-15%
Combustible	0%
Free Burning	+15%
Rapid Burning	+25%

Step 3: Complete Automatic Sprinkler Protection Deduction = 50 %, Where:

Credit for adequately designed system conforming to NFPA 13:	30% Reduction
Credit for Standard Water Supply:	10% Reduction
Credit for Fully Supervised System:	10% Reduction

F reduction = 50% x 11,084 L/min = 5,542 L/min
Therefore, F = 5,542 L/min

Step 4: Exposure Charge:

	Distance:	**Exposure Charge:**
Exposure to North	29.9 m =	10%
Exposure to East	>45 m =	0%
Exposure to South	>45 m =	0%
Exposure to West	17.0 m =	15%
Total Exposure Charge =		**25%**

Exposure Charge:	
0-3m	25%
3.1-10m	20%
10.1-20m	15%
20.1-30m	10%
30.1-45m	5%
>45m	0%

F increase = 25% x 11,084 L/min = 2,771 L/min
Therefore, F = 8,313 L/min

Therefore:

F = 8,313 L/min
F = 8,000 L/min (Rounded to nearest 1,000 L/min)
F = 133.3 L/s
F = 2113 USGPM

Fire Flow Demand Calculation

as per *Water Supply for Public Fire Protection, 1999 (Fire Underwriters' Survey)*

Project:	Pergola Commons - Ph.2 - Bldg. B
Project No.:	23-045
Date:	November 2023 (Rev July 2024

Fire Flow is given by the following calculation:

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

where
F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Step 1: $F = 220C\sqrt{A}$ = ***15,257 L/Min***
F = 4031 USGPM Where:

Type of Construction Factor, 'C' =	**0.6**
Wood Frame Construction:	1.5
Ordinary Construction:	1.0
Non-Combustible Construction:	0.8
Fire Resistive Construction:	0.6

Vertical Openings & Exterior Vertical Connections Adequately Protected?: No

Building Area, 'A' =		
1	2980	m²
2	2192	m²
3	2433	m²
4	2433	m²
5	2433	m²
6	2433	m²
7	1679	m²
8	1655	m²
9	1655	m²
10	1655	m²
'A'=	**13360**	**m²**

Step 2: Occupancy Hazard Reduction = -15 %

F reduction = -15% x 15,257 L/min = -2,289 L/min
Therefore, F = 12,969 L/min

Where % Reduction =	
Non-Combustible	-25%
Limited Combusible	-15%
Combustible	0%
Free Burning	+15%
Rapid Burning	+25%

Step 3: Complete Automatic Sprinkler Protection Deduction = 50 %, Where:

Credit for adequately designed system conforming to NFPA 13: 30% Reduction
Credit for Standard Water Supply: 10% Reduction
Credit for Fully Supervised System: 10% Reduction

F reduction = 50% x 12,969 L/min = 6,484 L/min
Therefore, F = 6,484 L/min

Step 4: Exposure Charge:

	Distance:	**Exposure Charge:**
Exposure to North	28.1 m =	10%
Exposure to East	17.0 m =	15%
Exposure to South	>45 m =	0%
Exposure to West	19.7 m =	15%
Total Exposure Charge =		**40%**

F increase = 40% x 12,969 L/min = 5,187 L/min
Therefore, F = 11,672 L/min

Exposure Charge:	
0-3m	25%
3.1-10m	20%
10.1-20m	15%
20.1-30m	10%
30.1-45m	5%
>45m	0%

Therefore:
F = 11,672 L/min
F = 12,000 L/min (Rounded to nearest 1,000 L/min)
F = 200.0 L/s
F = 3170 USGPM

Fire Flow Demand Calculation

as per *Water Supply for Public Fire Protection, 1999 (Fire Underwriters' Survey)*

Project:	Pergola Commons - Ph.3 - Bldg. C
Project No.:	23-045
Date:	November 2023 (Rev July 2024

Fire Flow is given by the following calculation:

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

where
F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Step 1: $F = 220C\sqrt{A}$ = ***11,765 L/Min***
F = 3108 USGPM Where:

Type of Construction Factor, 'C' =	**0.6**
Wood Frame Construction:	1.5
Ordinary Construction:	1.0
Non-Combustible Construction:	0.8
Fire Resistive Construction:	0.6

Vertical Openings & Exterior Vertical Connections Adequately Protected?: No

Building Area, 'A' =		
1	2045	m²
2	988	m²
3	1563	m²
4	1563	m²
5	1563	m²
6	1563	m²
7	925	m²
8	882	m²
9	882	m²
10	882	m²
'A'=	**7944.5**	**m²**

Step 2: Occupancy Hazard Reduction = -15 %

F reduction = -15% x 11,765 L/min = -1,765 L/min
Therefore, F = 10,001 L/min

Where % Reduction =	
Non-Combustible	-25%
Limited Combusible	-15%
Combustible	0%
Free Burning	+15%
Rapid Burning	+25%

Step 3: Complete Automatic Sprinkler Protection Deduction = 50 %, Where:

Credit for adequately designed system conforming to NFPA 13: 30% Reduction
Credit for Standard Water Supply: 10% Reduction
Credit for Fully Supervised System: 10% Reduction

F reduction = 50% x 10,001 L/min = 5,000 L/min
Therefore, F = 5,000 L/min

Step 4: Exposure Charge:

	Distance:		**Exposure Charge:**
Exposure to North	37.5	m =	50%
Exposure to East	>45	m =	0%
Exposure to South	29.9	m =	10%
Exposure to West	15.0	m =	15%
Total Exposure Charge =			**75%**

F increase = 75% x 10,001 L/min = 7,500 L/min
Therefore, F = 12,501 L/min

Exposure Charge:	
0-3m	25%
3.1-10m	20%
10.1-20m	15%
20.1-30m	10%
30.1-45m	5%
>45m	0%

Therefore:

F = 12,501 L/min
F = 13,000 L/min (Rounded to nearest 1,000 L/min)
F = 216.7 L/s
F = 3434 USGPM

Fire Flow Demand Calculation

as per *Water Supply for Public Fire Protection, 1999 (Fire Underwriters' Survey)*

Project:	Pergola Commons - Ph.3 - Bldg. D
Project No.:	23-045
Date:	November 2023 (Rev July 2024

Fire Flow is given by the following calculation:

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

where
F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Step 1:

$F = 220C\sqrt{A}$ = ***10,774 L/Min***
F = 2846 USGPM

Where:

Type of Construction Factor, 'C' =	**0.6**
Wood Frame Construction:	1.5
Ordinary Construction:	1.0
Non-Combustible Construction:	0.8
Fire Resistive Construction:	0.6

Vertical Openings & Exterior Vertical Connections Adequately Protected?: No

Building Area, 'A' =		
1	1773	m²
2	428	m²
3	1391	m²
4	1391	m²
5	1391	m²
6	1391	m²
7	869	m²
8	830	m²
9	830	m²
10	830	m²
'A'=	**6662.5**	**m²**

Step 2:

Occupancy Hazard Reduction = -15 %

F reduction = -15% x 10,774 L/min = -1,616 L/min
Therefore, F = 9,158 L/min

Where % Reduction =	
Non-Combustible	-25%
Limited Combusible	-15%
Combustible	0%
Free Burning	+15%
Rapid Burning	+25%

Step 3:

Complete Automatic Sprinkler Protection Deduction = 50 %, Where:

Credit for adequately designed system conforming to NFPA 13: 30% Reduction
Credit for Standard Water Supply: 10% Reduction
Credit for Fully Supervised System: 10% Reduction

F reduction = 50% x 9,158 L/min = 4,579 L/min
Therefore, F = 4,579 L/min

Step 4:

Exposure Charge:

	Distance:	**Exposure Charge:**
Exposure to North	37.5 m =	50%
Exposure to East	15.0 m =	15%
Exposure to South	28.1 m =	10%
Exposure to West	21.3 m =	10%
Total Exposure Charge =		**85%**

Exposure Charge:	
0-3m	25%
3.1-10m	20%
10.1-20m	15%
20.1-30m	10%
30.1-45m	5%
>45m	0%

F increase = 85% x 9,158 L/min = 7,784 L/min
Therefore, F = 12,364 L/min

Therefore:

F = 12,364 L/min
F = 12,000 L/min (Rounded to nearest 1,000 L/min)
F = 200.0 L/s
F = 3170 USGPM

APPENDIX D

- Sanitary Flow Calculations – by Land-Use
- Sanitary Flow Calculations – by Unit-Count & Population
- Sanitary Sewer Analysis Sheet – Existing Site Private Sanitary Sewers

Proposed Sanitary Flows Calculation Sheet (by-Lot-Area)

civilGo ENGINEERING INC.

Project: 1 Clair Rd. E. - Pergola Commons
Project No.: 23-045
Date: November, 2023
By: DB

	Proposed Sanitary Flows		
Development Component	Component Land Area	High-Density Apartments Sanitary Flows	**Peak Sanitary Flows**
	(Ha)	(L/s)	**(L/s)**
Phase 1 Bldg. A	0.780	5.46	**5.46**
Phase 2 Bldg. B	0.540	3.78	**3.78**
Phase 3 Bldg. C	0.420	2.94	**2.94**
Phase 3 Bldg. D	0.480	3.36	**3.36**
Total	**2.220**	**15.54**	**15.54**

Residential Unit Population:

Residential (Singles & Semi's)	1.0 L/s/Ha
Townhomes and Schools	2.5 L/s/Ha
Apartments - up-to 150 units/Ha	6.0 L/s/Ha
Apartments - High-Density, or >=295 Units per Ha	7.0 L/s/Ha (Applies here)

Non-Residential Unit Population:

Commercial and Industrial	1.7 L/s/Ha

Source: City of Guelph *Development Engineering Manual Version 2.0 (January 2019)*

Proposed Sanitary Flows Calculation Sheet (by-Unit-Count)

civilGo ENGINEERING INC.

Project: 1 Clair Rd. E. - Pergola Commons
Project No.: 23-045
Date: December, 2023 (Rev July 2024)
By: DB

	Proposed Residential Sanitary Flows						Proposed Non-Res'l Sanitary Flows				Proposed I&I Flows		
Development Component	DT/SDT Houses	TH's, Row-Houses; Duplex	Apartments	Residential Population	Peaking Factor	Peak Residential Sanitary Flow	Commercial / Retail Floor Area GFA	Non-Residential Population	Peaking Factor	Peak Non-Residential Sanitary Flow	Inflow & Infiltration Area	Segment I&I Flow	**Peak Sanitary Flows**
	(Units)	(Units)	(Units)	(Persons)	M	(L/s)	(m^2)	(Persons)	M	(L/s)	(Ha)	(L/s)	**(L/s)**
Phase 1 Bldg. A		17	170	358	4.0	5.03		0.0	4.5	0.00	0.780	0.20	**5.22**
Phase 2 Bldg. B		18	228	468	4.0	6.48	342.0	3.8	4.4	0.05	0.540	0.14	**6.67**
Phase 3 Bldg. C		4	142	274	4.1	3.89	866.0	9.5	4.4	0.13	0.420	0.11	**4.13**
Phase 3 Bldg. D			136	253	4.1	3.61	937.0	10.3	4.4	0.14	0.480	0.12	**3.87**
Total	**0**	**39**	**676**	**1353**	**3.7**	**17.44**	**2145.0**	**23.6**	**4.4**	**0.33**	**2.220**	**0.56**	**18.32**

Residential Unit Population:
Detached & Semi's = 3.401 person/unit
Multiples (TH's, Row Dwellings, Duplex) = 2.45 person/unit
Apartments = 1.86 person/unit
Source: *Guelph Development Engineering Manual (October 2023 Revision)*

Non-Residential Unit Population:
Commercial/Retail = 1.1 person/100m^2 GFA

Unit Sanitary Flow = 300 L/person/d

Harmon's Peaking Factor, $M = 1 + 14/(4 + P/1000)^2$

Peak Sanitary Flow, Q(D) (L/s) = P * Q * M / 86,400

Inflow & Infiltration Allowance = 0.25 L/s/Ha

Existing Private Sanitary Sewer Analysis Sheet

Project: 1 Clair Rd. E. - Pergola Commons
Project No.: 23-045
Date: December, 2023 (Rev July 2024)
By: DB

civilGo ENGINEERING INC.

Location Info				Proposed Residential Sanitary Flows						Proposed Non-Res'l Sanitary Flows				Proposed I&I Flows			Pipe Information & Results						
Street Name	Catchment Area	Upstream MH	Downstream MH	DT/SDT Houses	TH's, Row-Houses; Duplex	Apartments	Residential Population	Peaking Factor	Peak Residential Sanitary Flow	Commercial / Retail Floor Area GFA	Non-Residential Population	Peaking Factor	Peak Non-Residential Sanitary Flow	Inflow & Infiltration Area	Segment I&I Flow	**Peak Cumulative Sanitary Flows**	Length (m)	Diameter (mm)	Slope (%)	Shape	Full-Flow Capacity (L/s)	Full-Flow Velocity (m/s)	% Full (%)
				(Units)	(Units)	(Units)	(Persons)	M	(L/s)	(m^2)	(Persons)	M	(L/s)	(Ha)	(L/s)	**(L/s)**					Q(cap)	V(ff)	Q(D)/Q(cap)
Private E-W Road	Bldg A & B	EX SAN MH9	EX SAN MH8		35	398	826	3.9	11.05	342.0	3.8	4.4	0.05	0.780	0.20	**11.30**	23.58	200	0.35	Circle	19	0.62	58.2%
Private E-W Road		EX SAN MH8	EX SAN MH2				0	4.5	0.00		0.0	4.5	0.00	0.540	0.14	**11.43**	42.82	200	0.51	Circle	23	0.75	48.8%
Private N-S Road	Bldg C + Ex Bldgs	EX SAN MH2	EX SAN MH1		4	142	274	4.1	3.89	7798.0	85.8	4.3	1.16	0.420	0.11	**16.59**	49.64	250	1.01	Circle	60	1.22	27.8%
Private N/s Road	Bldg D	EX SAN MH1	EX SAN MH0			136	253	4.1	3.61	937.0	10.3	4.4	0.14	0.480	0.12	**20.47**	15.67	250	1.00	Circle	59	1.21	34.4%
			Total:	**0**	**39**	**676**	**1353**	**3.7**	**17.44**	**9077.0**	**99.8**	**4.2**	**1.35**	**2.220**	**0.56**								

Residential Unit Population:
Detached & Semi's = 3.401 person/unit
Multiples (TH's, Row Dwellings, Duplex) = 2.45 person/unit
Apartments = 1.86 person/unit
Source: *Guelph Development Engineering Manual (October 2023 Revision)*

Non-Residential Unit Population:
Commercial/Retail = 1.1 person/100m^2 GFA

Unit Sanitary Flow = 300 L/person/d

Harmon's Peaking Factor, M = 1 + 14/(4 + P/1000)^2

Peak Sanitary Flow, Q(D) (L/s) = P * Q * M / 86,400

Inflow & Infiltration Allowance = 0.25 L/s/Ha

APPENDIX E

- Email Correspondence pertaining-to Stormwater Management Criteria
- Servicing Capacity Check – Excerpt from Memorandum of Feb. 23, 2024

From: Daniel Bancroft
Sent: October 16, 2023 11:51 AM
To: Michelle Thalen <Michelle.Thalen@guelph.ca>
Cc: Mary Angelo <Mary.Angelo@guelph.ca>; Kara Green <Kara.Green@fcr.ca>; Joshua Butcher <Joshua.Butcher@fcr.ca>
Subject: RE: Pergola Commons - Modelling Capacity Analysis

Hi Michelle,

Likewise, a pleasure to meet this morning. Thanks for the info re: Capacity Check.

My notes from our meeting as follows:

1) SWM Quantity Control/Detention
    a. As per 2008 PEIL SWM Report:
        i. The subject site is part of a catchment area (Commercial Block) which was allocated 90% imperviousness in the SWM Pond's design
    b. The proposed development will almost certainly be <90% impervious (will review + quantify in SWM Report) – if so, no further SWM analysis or on-site SWM detention required
    c. Minor/local storm system: on-site storm sewers to be designed for 5-year storm
    d. Major system: overland flow path towards SWM Pond
2) Noted aside: SWM pond is being maintained this fall/presently (sediment removal etc.; nothing else)
3) SWM Quality Control
    a. As per 2008 PEIL SWM Report:
        i. The prior development of the subject site was to provide enhanced/80% TSS Removal via on-site treatment (OGS) – however:
    b. Current Guelph DEM manual requires 80% TSS Removal per ETV certification whereas a conventional OGS provides 50% per ETV
    c. We inquired whether an area-weighted approach may be used to justify retention of the existing OGS given that it will service a significantly reduced 'dirty' catchment area in the proposed development compared to existing however we understand that this is not acceptable per Guelph DEM.
    d. New 80%-TSSR-ETV-certified SWM Filter therefore to be provided & sized per proposed reduced driving area
4) SWM Retention/Water Balance
    a. Existing site presently utilizes an infiltration gallery at East Side to provide 30mm retention over the area of the subject site + external-to-west
    b. It was acknowledged that Guelph DEM 5.7.6. has more advanced WB criteria (Thornthwaite-M.) to be reviewed in reference to subject site and existing infiltration gallery

c. If we retain the existing infiltration gallery, we understand that a 2.5m horizontal easement offset is acceptable (if there is no risk of water recirculation in building foundation drains by clay liner or other 'watertight' construction'). If not, would need to provide min. 5.0m horizontal offset.

5) Easements: 5.0m-width is acceptable. We will provide 2.50m-horizontal offset from existing sewer/water infrastructure which is proposed to be retained either temporarily or permanently.
6) We will get back to you with application for servicing capacity check per your email below

Regards,

Daniel

Daniel Bancroft, P.Eng.

Civil Engineer & Owner,

civilGo ENGINEERING INC.

Email: daniel@civilGo.ca

Main: 437-222-2062

Cell: 647-466-3765

civilGo Engineering Inc.

60 Atlantic Avenue, Suite 200

Toronto, ON M6K 1X9

www.civilGo.ca

From: Michelle Thalen <Michelle.Thalen@guelph.ca>
Sent: October 16, 2023 11:39 AM
To: Daniel Bancroft <daniel@civilgo.ca>
Cc: Mary Angelo <Mary.Angelo@guelph.ca>; Kara Green <Kara.Green@fcr.ca>
Subject: Pergola Commons - Modelling Capacity Analysis

Hi Daniel,

It was a pleasure to meet with you and Kara this morning and dig deeper into the technical requirements for your exciting project here in Guelph. As we had discussed at out meeting, you can find

the "Application for Servicing Capacity Check" on the City's website here: https://guelph.ca/city-hall/planning-and-development/how-to-develop-property/development-applications-guidelines-fees/. The current fee in accordance with the User Fee Bylaw is $750 for this analysis to be completed. Please submit the form, fee as well as all pertinent information (projected flow rates, population etc.) for the project and send to Mary Angelo, whom I've copied on this email.

Best regards,

Michelle Thalen, C.Tech, Engineering Technologist III

Engineering and Transportation Services
City of Guelph

T 519-822-1260 x 2333 | F 519-822-6194
E michelle.thalen@guelph.ca

guelph.ca

Engineering Comments – Michelle Thalen, Engineering Technologist III Municipal Services:

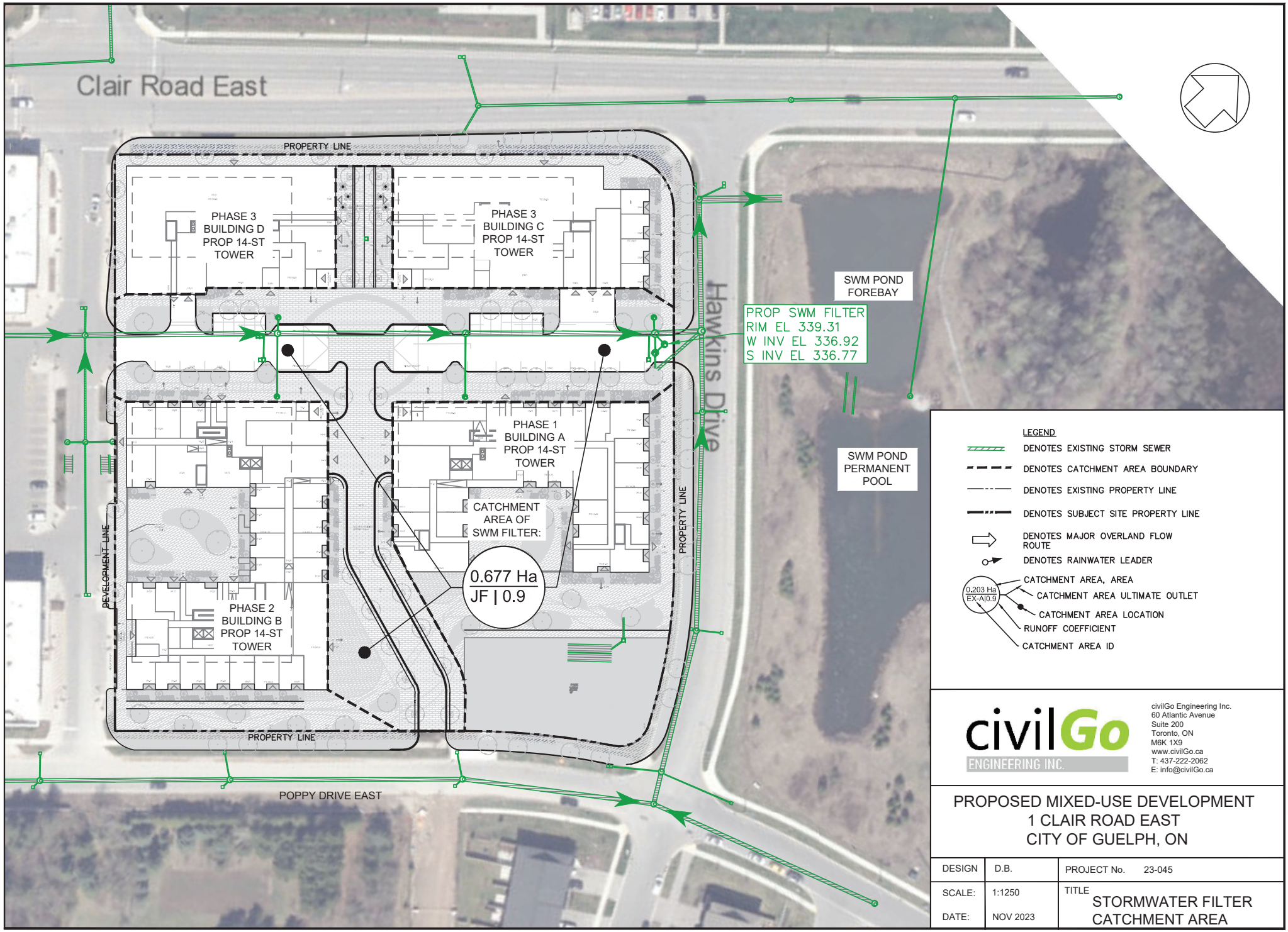
Servicing Capacity:
The servicing capacity analysis was completed using the City's water and wastewater model and the results were as follows:

Water
The existing pre-development pressures around the development ranged from 41.7-52.2 psi. The calculated development demands as provided by the consultant firm, CivilGO, were added to the model at each proposed building service connection on Poppy Drive East, Hawkins Drive and Clair Road East. Within the water model, the development pressure fell below the preferred operating range of 50 - 80 psi specified by the MECP but above the minimum allowable pressure of 40 psi for each building under all four (4) phases. The new development water demand was not found to significantly impact pressures in the development area.
A fire flow analysis was conducted with the City's hydraulic model at the existing hydrants on Poppy Drive East, Hawkins Drive, Clair Road West and Farley Drive. The fire flow results predicted by the model are representative of the amount of water available in a watermain and not the extent of flow available from a hydrant. Hydrants on Poppy Drive East do not meet the specified fire flows criteria due to the capacity limitation of the 150 mm watermain. However, the hydrants on Hawkins Drive, Clair Road East and Farley Drive do meet the specified fire flow criteria under all development phases.

Wastewater
City staff evaluated the influence of increased flows from the development for all phases of the proposed development – Buildings A, B, C and D. The calculated wastewater flows (18.45 L/s) as provided by the consulting engineer, CivilGO was added to the model for the entire development and the model results suggested that the existing collection system has sufficient residual capacity to manage the flows from the proposed development.

APPENDIX F

- Jellyfish Filter Catchment Plan
- Jellyfish Filter Sizing Report
- Jellyfish Filter Standard Cut-Sheet
- Canadian Environmental Technology Verification (ETV) Statement for Imbrium Jellyfish Filter



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PROPOSED MIXED-USE DEVELOPMENT
1 CLAIR ROAD EAST
CITY OF GUELPH, ON

DESIGN	D.B.	PROJECT No.	23-045
SCALE:	1:1250	TITLE	STORMWATER FILTER CATCHMENT AREA
DATE:	NOV 2023		

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Wednesday, November 22, 2023
Project Name	1 Clair Road East
Project Number	PN: 23-045
Location	Guelph

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF6-4-1 is recommended to meet the water quality objective by treating a flow of 22.7 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 33 years of WATERLOO WELLINGTON A rainfall data for this site. This model has a sediment capacity of 256 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF6-4-1	4	1	1.8	22.7	256

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

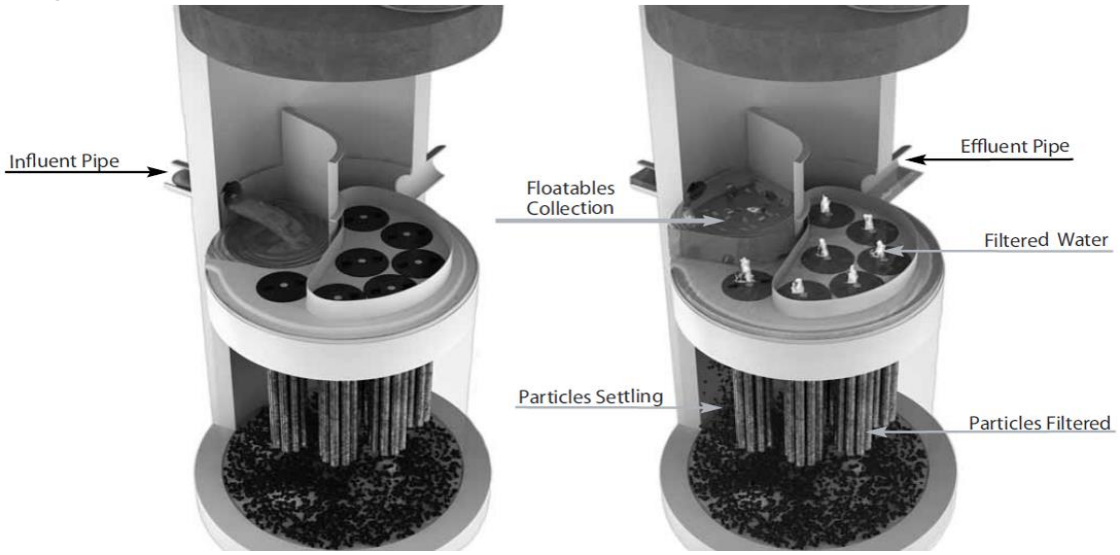
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TAPE qualifying rain events and field monitored according to the TAPE field test protocol, demonstrating:

- A median TSS removal efficiency of 90%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Wednesday, November 22, 2023
Project Name:	1 Clair Road East
Project Number:	PN: 23-045
Location:	Guelph

Designer Information

Company:	CivilGo
Contact:	Daniel Bancroft
Phone #:	

Notes

Rainfall

Name:	WATERLOO WELLINGTON A
State:	ON
ID:	9387
Record:	1970 to 2003
Co-ords:	43°27'N, 80°23'W

Drainage Area

Total Area:	0.677 ha
Runoff Coefficient:	0.9

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 33 years of WATERLOO WELLINGTON A rainfall data:	**20.5 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 2721 m³, with a suspended sediment concentration of 60 mg/L.	**163 kg**

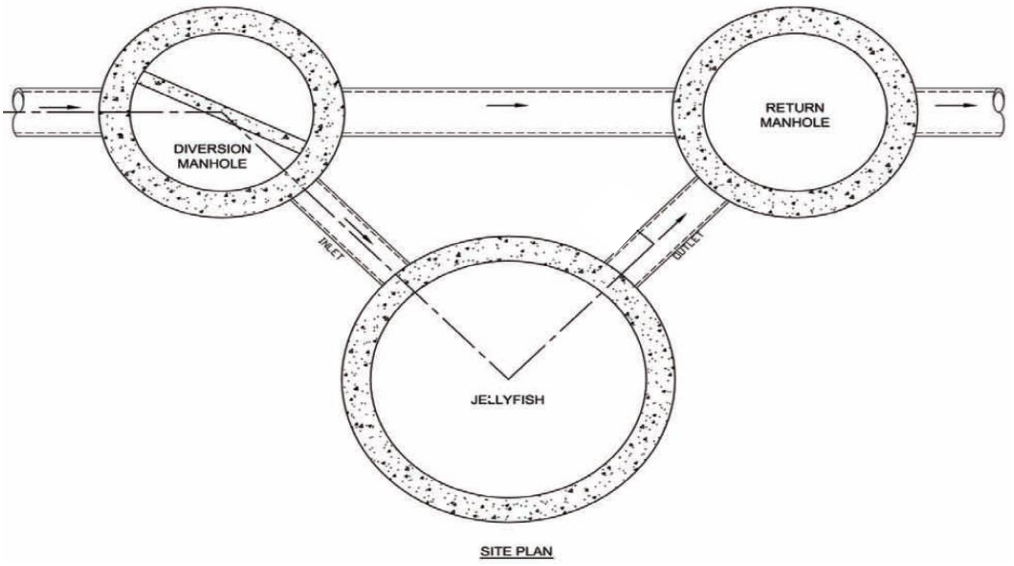
Recommendation

The Jellyfish Filter model JF6-4-1 is recommended to meet the water quality objective by treating a flow of 22.7 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 33 years of WATERLOO WELLINGTON A rainfall data for this site. This model has a sediment capacity of 256 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	**4**	**1**	**1.8**	**5205**	**0.79**	**848**	**22.7**	**256**
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	62º	150	200
1.8	**59º**	**200**	**250**
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

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.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:
1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:
1. 457 MM Ø (18") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

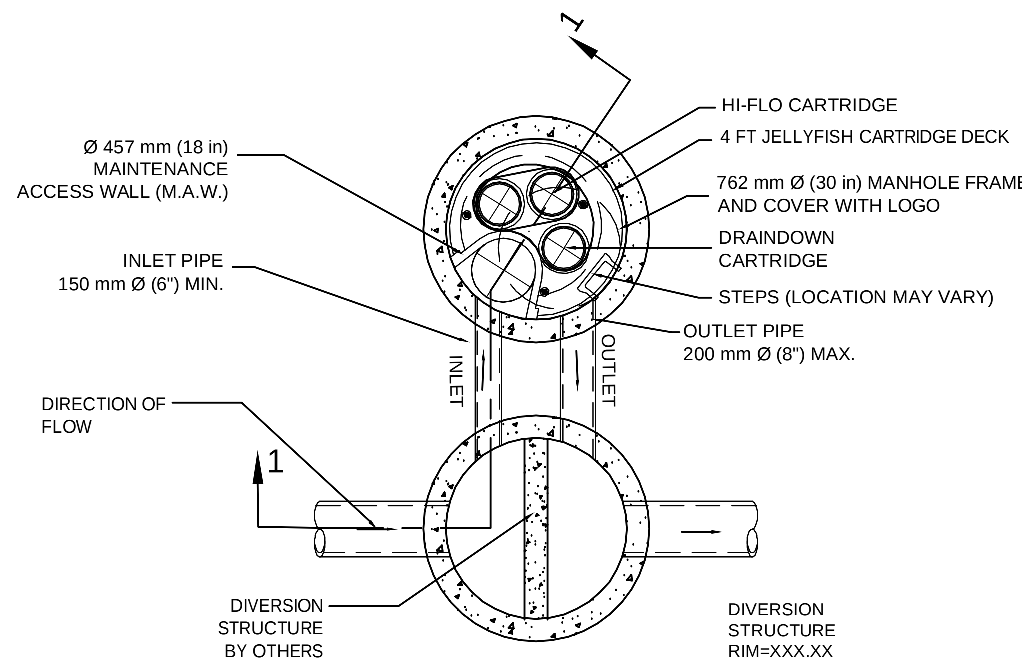
INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

STANDARD OFFLINE JELLYFISH RECOMMENDED PIPE DIAMETERS

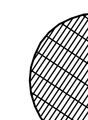
MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MINIMUM OULTET PIPE DIAMETER (mm)
1.2	62	150	200
1.8	59	200	250
2.4	52	250	300
3.0	48	300	450
3.6	40	300	450

CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS

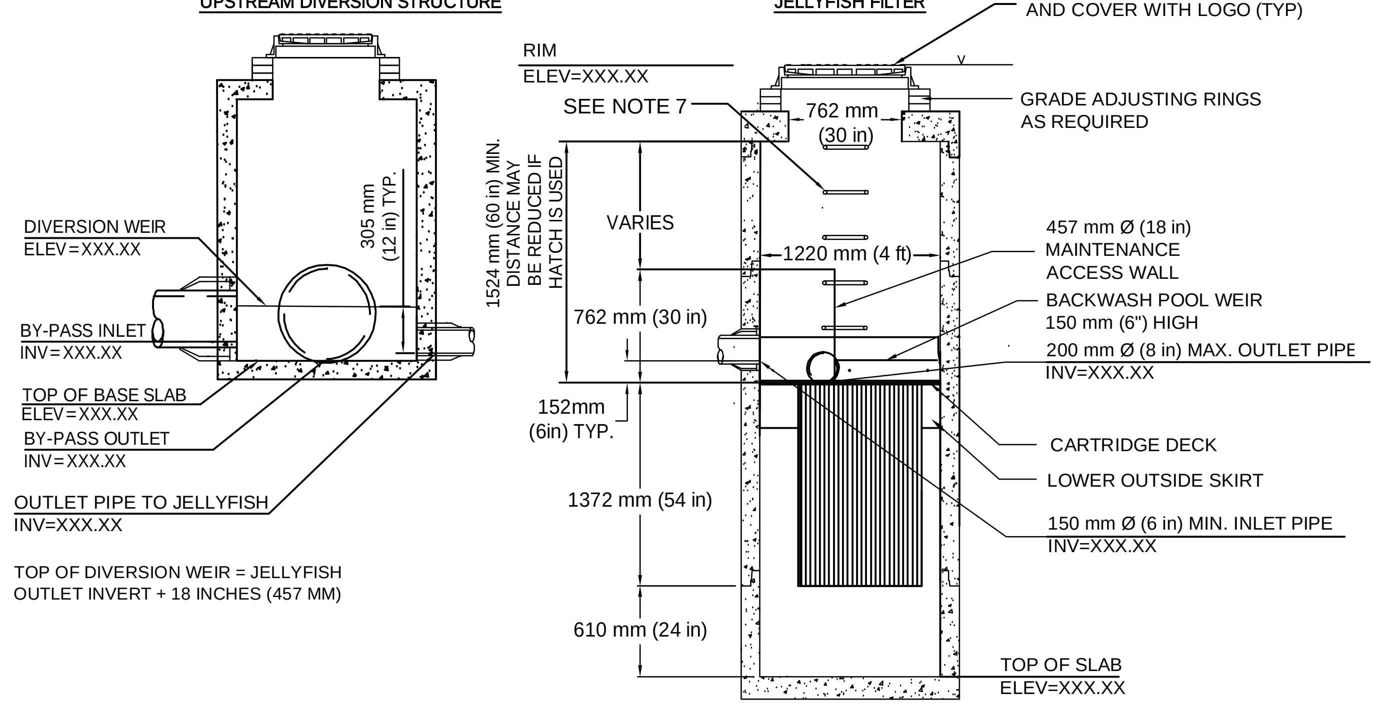
FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.



OFFLINE LAYOUT



XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



TOP OF DIVERSION WEIR = JELLYFISH OUTLET INVERT + 18 INCHES (457 MM)

CROSS SECTION 1-1

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1220 mm (48") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 12.7 L/s (0.54 CFS). TREATMENT FLOW RATE IS BASED ON 457 mm (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION				
CARTRIDGE DEPTH	54"	40"	27"	15"
OUTLET INVERT TO STRUCTURE BASE SLAB	90"	76"	63"	51"
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
MAX. CARTS HIGH-FLO/DRAINDOWN	2 / 1			
MAX. SEDIMENT CAPACITY (kg)	142	105	70	40
MAX. TREATMENT (L/s)	12.7	9.3	6.2	3.4

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
# OF CARTRIDGES REQUIRED (HF / DD)					*
CARTRIDGE SIZE (inches)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
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1	08/01/2015	NOTES	BSF
0	10/01/2014	INITIAL RELEASE	BSF

Jellyfish®
JF4 STANDARD
Scale = 1:50

www.imbriumsystems.com
info@imbriumsystems.com

imbrium® Jellyfish® Filter
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9

DATE: #####
DESIGNED: BSF
DRAWN: BSF
CHECKED: BSF
APPROVED: SP
PROJECT #: #####
PROJECT NAME: #####
SHEET: 1 OF 2

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF4 - OFFLINE DIVERSION MANHOLE.DWG 4/15/2019 9:18 AM

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:

ASTM C 891:	SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478:	SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990:	SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101:	SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: 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.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

MARK	DATE	REVISION DESCRIPTION	BY
0	10/01/2014	INITIAL RELEASE	BSF
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JELLYFISH FILTER SPECIFICATIONS

Jellyfish®

JF4 STANDARD

Scale = 1:50

www.imbriumsystems.com info@imbriumsystems.com

imbrium®

407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9

TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

Jellyfish® Filter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING AUS NO. 2008/285748, U.S.A. NO. US 8,287,726, US 8,221,618, US 8,123,935, CA 2,988,482, CA 2,634,542, CA 2,686,482, KR 10-1287539, NZ 583461, NZ 604227, ZA 2010/01088; OTHER INTERNATIONAL PATENTS PENDING

DATE: #####	
DESIGNED:	DRAWN:
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 2 OF 2	

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◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Jellyfish® Filter

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

Registration: GPS-ETV_V2022-03-01

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 1, 2022
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Jellyfish® Filter is an engineered stormwater quality treatment technology designed to remove a variety of stormwater pollutants including floatable trash and debris, oil, coarse and fine suspended sediments, and particulate-bound pollutants such as nutrients, heavy metals, and hydrocarbons. The Jellyfish Filter combines gravitational pre-treatment (sedimentation and floatation) and membrane filtration in a single compact structure. The system utilizes membrane filtration cartridges comprised of multiple detachable pleated filter elements ('filtration tentacles") that provide high filtration surface area with the associated advantages of high flow rate, high sediment capacity, and low filtration flux rate.

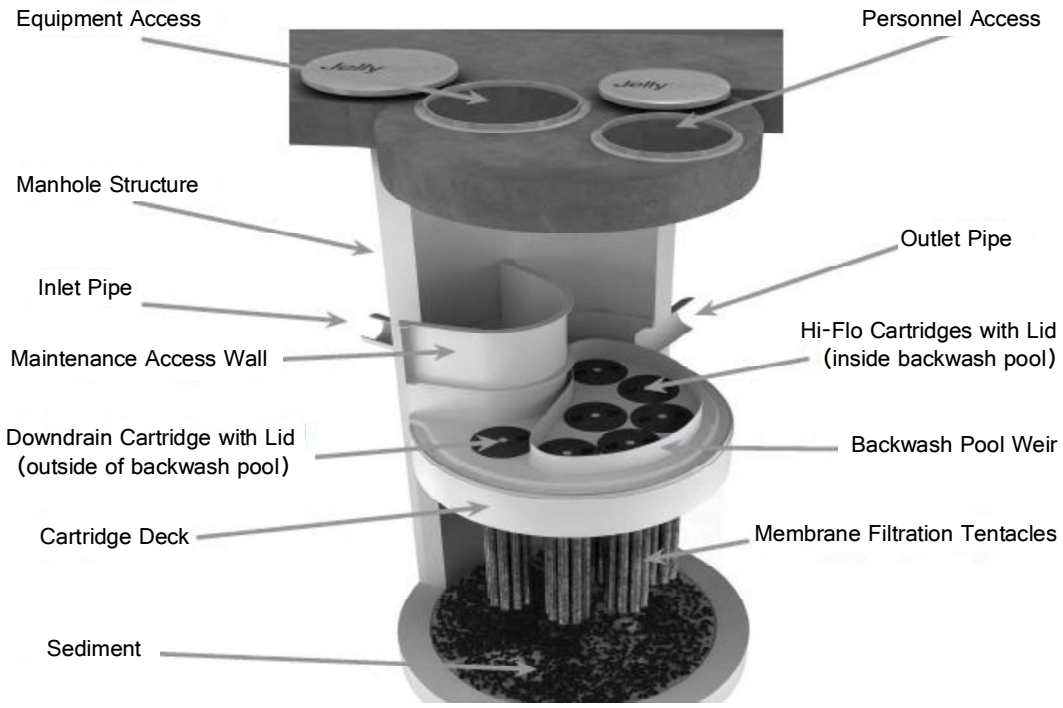

Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

Figure 1 depicts a cut-away graphic of a typical 6-ft diameter Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge (JF6-6-1). Stormwater influent enters the system through the inlet pipe and builds a pond behind the maintenance access wall, with the pond elevation providing driving head. Flow is channeled downward into the lower chamber beneath the cartridge deck. A flexible separator skirt surrounds the filtration zone where the filtration tentacles of each cartridge are suspended, and the volume between the vessel wall and the outside surface of the separator skirt comprises a pre-treatment channel. As flow spreads throughout the pre-treatment channel, floatable pollutants accumulate at the surface of the pond behind the maintenance access wall and also beneath the cartridge deck in the pre-treatment channel, while coarse sediments settle to the sump. Flow proceeds under the separator skirt and upward into the filtration zone, entering each filtration tentacle and depositing fine suspended sediment and associated particulate-bound pollutants on the outside surface of the membranes. Filtered water proceeds up the center tube of each tentacle, with the flow from each tentacle combining under the cartridge lid, and discharging to the top of the cartridge deck through the cartridge lid orifice. Filtered effluent from the hi-flo cartridges enters a pool enclosed by a 15-cm high weir, and if storm intensity and resultant driving head is sufficient, filtered water overflows the weir and proceeds across the cartridge deck to the outlet pipe. Filtered effluent discharging from the draindown cartridge(s) passes directly to the outlet pipe, and requires only a minimal amount of driving head (2.5 cm) to provide forward flow. As

storm intensity subsides and driving head drops below 15 cm, filtered water within the backwash pool reverses direction and passes backward through the hi-flo cartridges, and thereby dislodges sediment from the membrane which subsequently settles to the sump below the filtration zone. During this passive backwashing process, water in the lower chamber is displaced only through the draindown cartridge(s). Additional self-cleaning processes include gravity, as well as vibrational pulses emitted when flow exits the orifice of each cartridge lid, and these combined processes significantly extend the cartridge service life and maintenance cleaning interval. Sediment removal from the sump by vacuum is required when sediment depths reach 30 cm, and cartridges are typically removed, externally rinsed, and recommissioned on an annual basis, or as site-specific maintenance conditions require. Filtration tentacle replacement is typically required every 3 – 5 years.

Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on a Jellyfish Filter JF6-6-1 (6-ft diameter manhole with 6 hi-flo cartridges and 1 draindown cartridge), in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). The drainage area providing stormwater runoff to the test unit was 86 acres and was 32% impervious. Throughout the monitoring period (March 2017 – April 2020), a total of 25 individual storm events were sampled. The Basic Treatment standard outlined in the TAPE requires ≥ 80% total suspended solids (TSS) removal at influent TSS concentrations ranging from 100 to 200 mg/L. In addition, the Phosphorus Treatment standard outlined in the TAPE requires ≥ 50% removal of total phosphorus (TP) at influent concentrations ranging from 0.10 to 0.5 mg/L. For this verification, the performance claim for TSS removal is for influent TSS concentration ≥ 100 mg/L, and the performance claim for TP removal is for influent TP concentration ≥ 0.1 mg/L. Based on these requirements, 15 and 18 sample pairs deemed qualified for evaluating the removal performance of TSS and TP, respectively. Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

Table 1 shows the specified and achieved TAPE criteria for storm selection and sampling.

Table 1. Specified and achieved TAPE criteria for storm selection and sampling

Description	TAPE criteria value	Achieved value
Total rainfall	> 3.8 mm (0.15 in)	> 3.8 mm (0.15 in)[1]
Minimum inter-event period	6 hours	6 hours
Minimum flow-weighted composite sample storm coverage	Minimum 70% including as much of the first 20% of the storm	> 70%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	10, except for two events that had 9 aliquots
Total sampled rainfall	N/A	8.29 in
Number of storms	Minimum 15 (preferably 20)	25

[1]N.B. Storm event depth was greater than the TAPE rainfall depth guideline of 0.15 inches for all events sampled, except for the 3/21/2017, 3/22/2019, 3/26/2019, and 04/13/2019 events. Given the size of the drainage basin, storm events below this threshold produced adequate runoff volume for sampling. Only two of these events were used to evaluate performance, and all had rainfall depths of 0.11 inches or greater. These events were included as their runoff volumes, precipitation durations, and influent TSS concentrations were all within range of the total data set.

The 6-ft diameter test unit has sedimentation surface area of 2.62 m^2 (28.26 ft^2). Each of the seven filter cartridges employed in the test unit uses filtration tentacles of 137 cm (54 in) length, with filter surface area of 35.4 m^2 (381 ft^2) per cartridge, and total filter surface area of 247.8 m^2 (2667 ft^2) for the seven cartridges combined. The design treatment flow rate is 5 L/s (80 gal/min) for each of the six hi-flo

cartridges and 2.5 L/s (40 gal/min) for the single draindown cartridge, for a total design treatment flow rate of 32.5 L/s (520 gal/min) at design driving head of 457 mm (18 in). This translates to a filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) for the draindown cartridge. The design flow rate for each cartridge is controlled by the sizing of the orifice in the cartridge lid. The distance from the bottom of the filtration tentacles to the sump is 61 cm (24 in).

Performance claim(s)

The Jellyfish® Filter demonstrated the removal efficiencies indicated in **Table 2** for TSS and TP during field monitoring conducted in accordance with the Washington State Department of Ecology's Technology Assessment Protocol – Ecology (TAPE), and using the following design parameters:

- System hydraulic loading rate (system treatment flow rate per unit of sedimentation surface area) of 12.5 L/s/m^2 (18.4 gal/min/ft^2) or lower
- Filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) or lower for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) or lower for each draindown cartridge
- Distance from the bottom of the filtration tentacles to the sump of 61 cm (24 in) or greater
- Driving head of 457 mm (18 in) or greater

Table 2. Bootstrapped mean, median, and 95% confidence interval (median) for removal efficiencies of Total Suspended Solids (TSS) and Total Phosphorus (TP)

Parameter	Mean (%)	Median (%)	Median – 95% Lower Limit	Median – 95% Upper Limit
TSS [1]	87.6	90.1	85.1	91.6
TP [2]	77.3	77.5	70.8	85.6

[1] TSS influent concentration ≥ 100 mg/L
[2] TP influent concentration ≥ 0.1 mg/L

N.B. As with any field test of stormwater treatment devices, removal efficiencies will vary based on pollutant influent concentrations and other site-specific conditions.
The performance claims can be applied to other Jellyfish® Filter models smaller or larger than the tested model as long as the untested models are designed in accordance with the design parameters specified in the performance claims.

Performance results

Performance Claims – Removal Efficiency for Total Suspended Solids

Raw data summarizing the percent removal of total suspended solids (TSS) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 15 sample pairs deemed qualified are presented in **Table 3**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 3. Raw data summarizing the percent removal of total suspended solids (TSS)

Event ID	TSS Influent (mg/L)	TSS Effluent (mg/L)	TSS Removal (%) (Inf ≥ 100 mg/L)
3/21/2017	102.0	22.0	78.4
4/7/2017	201.0	30.8	84.7
4/12/2017	108.0	24.4	77.4
4/19/2017	452.0	44.6	90.1
4/26/2017	257.0	10.0	96.1

6/15/2017	134.0	10.4	92.2
3/8/2018	755.0	47.2	93.8
3/14/2018	181.0	27.0	85.1
3/22/2018	224.0	20.0	91.1
4/5/2019	171.0	23.0	86.6
4/13/2019	117.0	25.0	78.6
5/18/2019	254.0	20.0	92.1
12/7/2019	200.0	17.0	91.5
3/30/2020	605.0	51.0	91.6
4/20/2020	210.0	29.0	86.2
n	15	15	15
Min	102.0	10.0	77.4
Max	755.0	51.0	96.1
Median	201.0	24.4	90.1
Mean	264.7	26.8	87.7
SD	190.9	12.3	5.9

Performance Claims – Removal Efficiency for Total Phosphorus

Raw data summarizing the percent removal of total phosphorus (TP) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 18 sample pairs deemed qualified are presented in **Table 4**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 4. Raw data summarizing the percent removal of total phosphorus (TP)

Event ID	TP Influent (mg/L)	TP Effluent (mg/L)	TP Removal (%) (Inf ≥ 0.1 mg/L)
4/7/2017	0.706	0.092	87.0
4/12/2017	0.338	0.076	77.5
4/19/2017	0.500	0.036	92.8
4/26/2017	0.504	0.042	91.7
5/13/2017	0.256	0.110	57.0
6/8/2017	0.256	0.104	59.4
6/15/2017	0.362	0.052	85.6
3/8/2018	1.75	0.130	92.6
3/14/2018	0.652	0.094	85.6
3/22/2018	0.364	0.072	80.2
3/27/2019	0.226	0.070	69.1
4/5/2019	0.337	0.092	72.9
4/13/2019	0.249	0.087	65.1
5/18/2019	1.09	0.173	84.1
12/7/2019	0.335	0.105	68.7
12/19/2019	0.211	0.093	56.2
3/30/2020	1.05	0.092	91.2
4/20/2020	0.451	0.112	75.2
n	18	18	18
Min	0.211	0.036	56.2
Max	1.75	0.173	92.8
Median	0.363	0.092	78.9
Mean	0.535	0.091	77.3
SD	0.400	0.032	12.5

Verification

The verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems to support the performance claim included the performance monitoring report "General Use Level Designation Technical Evaluation Report" prepared by CONTECH Engineered Solutions, Portland, OR, USA, and dated December 28, 2020. This report is based on a field testing completed by CONTECH personnel at a site in Dundee, Oregon between March 2017 and April 2020 in accordance with the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology (WADOE, 2011).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Jellyfish® Filter please contact:

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For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
404 – 999 Canada Place
Vancouver, BC
V6C 3E2, Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

APPENDIX G

- Existing-Site Water Balance Calculations
- Interim Water Balance Calculations
- Post-Development Water Balance Calculations
- Existing Infiltration Facility Enhanced Infiltration Calculations
- Proposed Infiltration Facility Enhanced Infiltration Calculations

Water Balance Calculations - Month-by-Month Thornthwaite-Mather Method

Project: 1 Clair Rd. E. - Pergola Commons
Project No.: 23-045
Date: November, 2023
By: DB

Scenario: Pre-Development (prior to current existing development)
Soil Type: Sand & Gravel
Vegetation: Shallow rooted crops
Climate data: Canadian Climate Normals 1971-2000 Station Data - Guelph Arboretum

Site Area: 2.22 Ha

Potential Evapotranspiration:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Temperature, t (°c)	-7.60	-6.90	-1.30	5.90	12.30	16.90	19.70	18.60	14.10	7.90	2.40	-4.00	6.50
Heat index, i = (t/5)^1.514	0.00	0.00	0.00	1.28	3.91	6.32	7.97	7.31	4.80	2.00	0.33	0.00	33.93
a	1.03												
Unadjusted Daily Potential Evapotranspiration, PETu (mm)	0.00	0.00	0.00	28.37	60.68	84.30	98.79	93.09	69.89	38.37	11.18	0.00	484.66
Adjusting Factor for PETu	0.78	0.78	1.03	1.08	1.29	1.25	1.29	1.21	1.00	0.95	0.75	0.78	
Adjusted Daily Potential Evapotranspiration, PET (mm)	0.00	0.00	0.00	30.73	78.37	105.37	127.60	112.22	69.89	36.35	8.39	0.00	568.92
Daily Potential Evapotranspiration (m3)	0.00	0.00	0.00	682.24	1739.86	2339.21	2832.78	2491.30	1551.48	806.91	186.19	0.00	12629.98

as per Canadian Climate Normals - Guelph Arboretum
Annual i = I
$$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$$

Pre-Development Water Balance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation, P (mm)	56.40	50.80	72.10	78.30	79.90	76.00	88.50	95.90	92.10	69.20	86.30	77.70	923.20
Potential Evapotranspiration, PET (mm)	0.00	0.00	0.00	30.73	78.37	105.37	127.60	112.22	69.89	36.35	8.39	0.00	568.92
P-PET (mm)	56.40	50.80	72.10	47.57	1.53	-29.37	-39.10	-16.32	22.21	32.85	77.91	77.70	354.28
Change in Soil Moisture Storage (mm)	0.00	0.00	0.00	0.00	0.00	-29.37	-39.10	-16.32	22.21	32.85	77.91	22.09	0.00
Soil Moisture Storage (mm)	100.00	100.00	100.00	100.00	100.00	70.63	31.53	15.21	37.42	70.27	100.00	100.00	100
Actual Evapotranspiration, AET (mm)	0.00	0.00	0.00	30.73	78.37	105.37	127.60	112.22	69.89	36.35	8.39	0.00	568.92
Soil Moisture Deficit (mm)	0.00	0.00	0.00	0.00	0.00	29.37	68.47	84.79	62.58	29.73	0.00	0.00	0.00
Water Surplus, available for infiltration or runoff	56.40	50.80	72.10	47.57	1.53	0.00	0.00	0.00	0.00	0.00	0.00	55.61	354.28
Potential Infiltration, I (MOE Methodology) (mm)	42.30	38.10	54.08	35.68	1.15	0.00	0.00	0.00	0.00	0.00	0.00	41.71	265.71
Potential Infiltration Volume (m3)	939.06	845.82	1200.47	792.01	25.44	0.00	0.00	0.00	0.00	0.00	0.00	925.95	5898.80
Potential Direct Surface Water Runoff (mm)	14.10	12.70	18.03	11.89	0.38	0.00	0.00	0.00	0.00	0.00	0.00	13.90	88.57
Recharge (deep infiltration-50% of I) (mm)	21.15	19.05	27.04	17.84	0.57	0.00	0.00	0.00	0.00	0.00	0.00	20.85	132.86
Interflow (indirect runoff-50% of I) (mm)	21.15	19.05	27.04	17.84	0.57	0.00	0.00	0.00	0.00	0.00	0.00	20.85	132.86
Total Runoff (direct and indirect components) (mm)	35.25	31.75	45.06	29.73	0.96	0.00	0.00	0.00	0.00	0.00	0.00	34.76	221.43
Runoff Volume (m3)	782.55	704.85	1000.39	660.01	21.20	0.00	0.00	0.00	0.00	0.00	0.00	771.63	4915.66

as per Canadian Climate Normals - Guelph Arboretum

MECP Stormwater Planning & Design Manual - Table 3.1

MECP SWM Infiltration Factor:
(As given in Stormwater Management Planning & Design Manual Table 3.1)
topo graphy - flat/rolling land = 0.25
soils - open sandy loam = 0.4
cover = cultivated land = 0.1
Therefore, Infiltration Factor = 0.75

Water Balance Calculations - Month-by-Month Thornthwaite-Mather Method

Project: 1 Clair Rd. E. - Pergola Commons
Project No.: 23-045
Date: February, 2025
By: DB

Scenario: Interim
Soil Type: Sand and Gravel
Vegetation: Mostly unvegetated
Climate data: Canadian Climate Normals 1971-2000 Station Data - Guelph Arboretum

Site Area: 2.22 Ha

Potential Evapotranspiration:	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Average Temperature, t (°c)	-7.60	-6.90	-1.30	5.90	12.30	16.90	19.70	18.60	14.10	7.90	2.40	-4.00	6.50
Heat index, i = (t/5)^1.514	0.00	0.00	0.00	1.28	3.91	6.32	7.97	7.31	4.80	2.00	0.33	0.00	33.93
a	0.50												
Unadjusted Daily Potential Evapotranspiration, PETu (mm)	0.00	0.00	0.00	21.15	30.62	35.94	38.83	37.72	32.81	24.50	13.44	0.00	235.00
Adjusting Factor for PETu	0.78	0.78	1.03	1.08	1.29	1.25	1.29	1.21	1.00	0.95	0.75	0.78	
Adjusted Daily Potential Evapotranspiration, PET (mm)	0.00	0.00	0.00	22.91	39.55	44.93	50.15	45.47	32.81	23.21	10.08	0.00	269.11
Daily Potential Evapotranspiration (m3)	0.00	0.00	0.00	508.58	878.11	997.36	1113.40	1009.51	728.27	515.16	223.75	0.00	5974.14

as per Canadian Climate Normals - Guelph Arboretum
Annual i = I
$$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$$

Pre-Development Water Balance	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Precipitation, P (mm)	56.40	50.80	72.10	78.30	79.90	76.00	88.50	95.90	92.10	69.20	86.30	77.70	923.20
Potential Evapotranspiration, PET (mm)	0.00	0.00	0.00	22.91	39.55	44.93	50.15	45.47	32.81	23.21	10.08	0.00	269.11
P-PET (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Change in Soil Moisture Storage (mm)	0.00	0.00	0.00	0.00	0.00	31.07	38.35	50.43	59.29	45.99	76.22	-76.22	0.00
Soil Moisture Storage (mm)	0.00	0.00	0.00	0.00	0.00	31.07	69.42	119.85	179.14	225.14	0.00	0.00	100
Actual Evapotranspiration, AET (mm)	0.00	0.00	0.00	22.91	39.55	44.93	50.15	45.47	32.81	23.21	10.08	0.00	269.11
Soil Moisture Deficit (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Surplus, available for infiltration or runoff	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Potential Infiltration, I (MOE Methodology) (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potential Infiltration Volume (m3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potential Direct Surface Water Runoff (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Recharge (deep infiltration-50% of I) (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interflow (indirect runoff-50% of I) (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runoff (direct and indirect components) (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Runoff Volume (m3)	1252.08	1127.76	1600.62	1229.68	895.67	689.84	851.30	1119.47	1316.35	1021.08	1692.11	1724.94	14520.90
Infiltration Gallery Infiltration Capacity (monthly) (m3)	11517.12	10402.56	11517.12	11145.60	11517.12	11145.60	11517.12	11517.12	11145.60	11517.12	11145.60	11517.12	135604.80
Runoff Volume less Infiltration Gallery Infiltration Capacity (m3) ('0' if neg've)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

as per Canadian Climate Normals - Guelph Arboretum

Soil Moisture Storage is effectively 0 for paved surfaces

Infiltration is effectively 0 for paved surfaces

MECP SWM Infiltration Factor:
(As given in Stormwater Management Planning & Design Manual Table 3.1)
topo graphy - Flat/Rolling at ~2% = 0.25
soils - sandy Loam = 0.4
cover = ~95% impervious = 0
Therefore, Infiltration Factor = 0.65

Water Balance Calculations - Month-by-Month Thornthwaite-Mather Method

Project: 1 Clair Rd. E. - Pergola Commons
Project No.: 23-045
Date: November, 2023
By: DB

Scenario: Post-Development
Soil Type: Impervious (below-grade parking structures)
Vegetation: Mostly unvegetated, except-for Park Area
Climate data: Canadian Climate Normals 1971-2000 Station Data - Guelph Arboretum

Site Area: 2.22 Ha

Potential Evapotranspiration:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Temperature, t (°c)	-7.60	-6.90	-1.30	5.90	12.30	16.90	19.70	18.60	14.10	7.90	2.40	-4.00	6.50
Heat index, i = (t/5)^1.514	0.00	0.00	0.00	1.28	3.91	6.32	7.97	7.31	4.80	2.00	0.33	0.00	33.93
a	0.50												
Unadjusted Daily Potential Evapotranspiration, PETu (mm)	0.00	0.00	0.00	21.15	30.62	35.94	38.83	37.72	32.81	24.50	13.44	0.00	235.00
Adjusting Factor for PETu	0.78	0.78	1.03	1.08	1.29	1.25	1.29	1.21	1.00	0.95	0.75	0.78	
Adjusted Daily Potential Evapotranspiration, PET (mm)	0.00	0.00	0.00	22.91	39.55	44.93	50.15	45.47	32.81	23.21	10.08	0.00	269.11
Daily Potential Evapotranspiration (m3)	0.00	0.00	0.00	508.58	878.11	997.36	1113.40	1009.51	728.27	515.16	223.75	0.00	5974.14

as per Canadian Climate Normals - Guelph Arboretum
Annual i = I
$$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$$

Pre-Development Water Balance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation, P (mm)	56.40	50.80	72.10	78.30	79.90	76.00	88.50	95.90	92.10	69.20	86.30	77.70	923.20
Potential Evapotranspiration, PET (mm)	0.00	0.00	0.00	22.91	39.55	44.93	50.15	45.47	32.81	23.21	10.08	0.00	269.11
P-PET (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Change in Soil Moisture Storage (mm)	0.00	0.00	0.00	0.00	0.00	31.07	38.35	50.43	59.29	45.99	76.22	-76.22	0.00
Soil Moisture Storage (mm)	0.00	0.00	0.00	0.00	0.00	31.07	69.42	119.85	179.14	225.14	0.00	0.00	100
Actual Evapotranspiration, AET (mm)	0.00	0.00	0.00	22.91	39.55	44.93	50.15	45.47	32.81	23.21	10.08	0.00	269.11
Soil Moisture Deficit (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Surplus, available for infiltration or runoff	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Potential Infiltration, I (MOE Methodology) (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potential Infiltration Volume (m3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potential Direct Surface Water Runoff (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Recharge (deep infiltration-50% of I) (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interflow (indirect runoff-50% of I) (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runoff (direct and indirect components) (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
Runoff Volume (m3)	1252.08	1127.76	1600.62	1229.68	895.67	689.84	851.30	1119.47	1316.35	1021.08	1692.11	1724.94	14520.90
Infiltration Gallery Infiltration Capacity (monthly) (m3)	11517.12	10402.56	11517.12	11145.60	11517.12	11145.60	11517.12	11517.12	11145.60	11517.12	11145.60	11517.12	135604.80
Runoff Volume less Infiltration Gallery Infiltration Capacity (m3) ('0' if neg've)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

as per Canadian Climate Normals - Guelph Arboretum

Soil Moisture Storage is effectively 0 for paved surfaces

Infiltration is effectively 0 for paved surfaces

MECP SWM Infiltration Factor:
(As given in Stormwater Management Planning & Design Manual Table 3.1)
topo graphy - Flat/Rolling at ~2% = 0.25
soils - impervious (below-grade parking) = 0.1
cover = 84% impervious (Except-for Park) = 0.3
Therefore, Infiltration Factor = 0.65

Existing Infiltration Facility - Enhanced Infiltration Calculations

civilGo ENGINEERING INC.

Project:	1 Clair Rd. E. - Pergola Commons
Project No.:	23-045
Date:	November, 2023
By:	DB

Infiltration Facility Details:

Make:	EMCO	
Model:	D-Raintank	
Length:	43.00	m
Width:	6.00	m
Depth:	2.17	m
Void Ratio, Vr:	0.87	(plastic chamber system)
infiltration rate, i:	60.00	mm/hr (MECP Stormwater Management Manual Table 4.4)
Provided Tank Storage:	487.08	m3

$$d_{max} = i * t_s / V_r$$

Rearrange to:

$$t_s = d_{max} * \frac{V_r}{i}$$

Therefore,
Drawdown time, ts:

ts = 31.47 Hour or 1.31 days

Tributary Area to Existing Infiltration Facility:

Contributing Area =	2.22	Ha	(Entire Site drains towards this facility)
Recharge time =	31.47	Hours	
Recharge Volume Potential =	487.08	m3	

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Total Runoff (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
No. of Days	31	28	31	30	31	30	31	31	30	31	30	31	365
Max Potential Recharge (m3):	11517.1	10402.6	11517.1	11145.6	11517.1	11145.6	11517.1	11517.1	11145.6	11517.1	11145.6	11517.1	135604.8
Available Recharge (m3):	1252.1	1127.8	1600.6	1229.7	895.7	0.0	0.0	0.0	1316.3	1021.1	1692.1	1724.9	14520.9
Enhanced Recharge (m3):	1252.1	1127.8	1600.6	1229.7	895.7	0.0	0.0	0.0	1316.3	1021.1	1692.1	1724.9	14520.9

Proposed Infiltration Facility - Enhanced Infiltration Calculations

civilGo ENGINEERING INC.

Project:	1 Clair Rd. E. - Pergola Commons
Project No.:	23-045
Date:	November, 2023
By:	DB

Infiltration Facility Details:

Make:	TBD	
Model:	TBD	
Length:	43.00	m
Width:	6.00	m
Depth:	2.17	m
Void Ratio, Vr:	0.87	(plastic chamber system)
infiltration rate, i:	60.00	mm/hr (MECP Stormwater Management Manual Table 4.4)
Provided Tank Storage:	487.08	m3

$$d_{max} = i * t_s / V_r$$

Rearrange to:

$$t_s = d_{max} * \frac{V_r}{i}$$

Therefore,
Drawdown time, ts:

ts = 31.47 Hour or 1.31 days

Tributary Area to Existing Infiltration Facility:

Contributing Area =	2.22	Ha	(Entire Site drains towards this facility)
Recharge time =	31.47	Hours	
Recharge Volume Potential =	487.08	m3	

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Total Runoff (mm)	56.40	50.80	72.10	55.39	40.35	31.07	38.35	50.43	59.29	45.99	76.22	77.70	654.09
No. of Days	31	28	31	30	31	30	31	31	30	31	30	31	365
Max Potential Recharge (m3):	11517.1	10402.6	11517.1	11145.6	11517.1	11145.6	11517.1	11517.1	11145.6	11517.1	11145.6	11517.1	135604.8
Available Recharge (m3):	1252.1	1127.8	1600.6	1229.7	895.7	0.0	0.0	0.0	1316.3	1021.1	1692.1	1724.9	14520.9
Enhanced Recharge (m3):	1252.1	1127.8	1600.6	1229.7	895.7	0.0	0.0	0.0	1316.3	1021.1	1692.1	1724.9	14520.9