
FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

AUBURN DEVELOPMENTS

SHERGAR DEVELOPMENTS – 825 RIVERSIDE DRIVE WEST,
WINDSOR, ONTARIO
Project No.: 2019-0561-11

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WALTERFEDY

AUBURN DEVELOPMENTS

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Shergar Developments – 825 Riverside Drive West, Windsor, Ontario

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1.0 INTRODUCTION

WalterFedy was retained by the Auburn Developments to complete this Functional Servicing and Stormwater Management Report in support of a Master Plan design and its associated Zoning By-law/Official Plan amendment for a mixed-use development at 825 Riverside Drive West in Windsor, Ontario (“the site”).

The purpose of this functional servicing and stormwater management report is to identify how the proposed development will be serviced, including water, sanitary, and storm connections to existing municipal infrastructure. The report will discuss the existing boundary servicing conditions and the availability in the municipal system to accommodate the development. Preliminary stormwater management design has been presented, demonstrating consistency with the City of Windsor’s design criteria. Given the size of the development, it is anticipated that the construction will be completed in multiple phases.

1.1 Background

The 2.70-hectare site is located just northwest of Windsor’s downtown core, and is bounded by Riverside Drive West to the north, Crawford Avenue to the west, existing residential and commercial buildings to the south, and an existing protected snake corridor to the east. The Detroit River is located approximately 50m north of Riverside Drive. University Avenue West and Slater Avenue also exist to the south of the site. The site’s current zoning is CD1.4 (Commercial Districts – Neighbourhoods) at the western side, which allows for the use of offices and CD3.6 (Commercial Districts - Major), allowing for general commercial use. The site will be undergoing a zone change process to allow for residential use throughout the site.

The southern part of the site is currently developed, housing a CBC Radio broadcast centre and its associated parking. The northernmost area of the site is currently undeveloped, consisting of a grass area, a sign, and a flowerbed with flag poles. The eastern part of the site slopes down to a valley approximately 6m deep before raising back up. This area acts as a snake corridor, providing passage from the Detroit River to a railyard to the south. It is expected that any disturbance to this area will be restored to prevent any potential habitat loss.

At the time of this functional servicing and stormwater management report, a total of 1,602 units are proposed, comprised of 1,558 apartment units and 44 townhouse units. The proposed development is to consist of five buildings ranging from 17-stories to 25 stories, and 1 townhouse block consisting of 24 units, from 12 back-to-back townhomes. The buildings are currently referred to as Building 1, 2A, 2B, 2C, and 3. Building 2 has a shared podium between the three towers. Some townhouse units are also proposed on the lower levels of Building 1 and 2A. The site is to have two full levels of underground parking, underneath the majority of the site area, as well as a third level of underground parking below the eastern portion of the site.

Salter Avenue to the east currently comes to a dead-end prior to reaching the existing parking lot for the site. It is currently proposed that this roadway will continue through the site as a private road, and connect to Crawford Avenue west of the site. Given the size of the development, it is expected that the full build out will be completed in multiple phases. At the time of writing the development phasing and ownership strategy is not confirmed; the development could proceed as a single phased condominium or could be separated into multiple condominium corporations. The impact of the proposed development strategy on the servicing is further discussed within this report.

1.2 Reference Reports and Drawings

The following were referenced in the preparation of this Functional Servicing and Stormwater Management Report.

1. Windsor/Essex Region Stormwater Management Standards Manual by Stantec, dated December 8, 2018
2. Design Guidelines and Specifications for Water Main and Water Service Installation by Windsor Utilities Commission, Water Division, City of Windsor, dated November 2022.

3. City of Windsor Development Manual, dated May 2015.
4. 825 Riverside Drive – Environmental Impact Assessment by MTE Consultants Inc, dated December 5, 2019.

2.0 EXISTING INFORMATION

2.1 Existing Topography, Soils, and Hydrogeology

The site currently exists with a CBC Radio building and its associated parking, as well as a grassed area to the north, and a protected snake corridor to the east. Existing topographic information was obtained by Dillon Consulting (dated October 5, 2017). Legal boundary information was obtained from a survey by Callon Deitz Incorporated.

The elevation on the site ranges from approximately 185m near the middle of the site and around the building, to a low of 183m at the western limits along Crawford Avenue, and a low of 184m at the eastern limits along Salter Avenue. The site then drops down an embankment to an elevation of 177.5m, before raising back up to 184m at the eastern property line. This valley currently acts as a snake corridor and is to be restored to natural habitat as much as possible after construction to allow animal passage from the Detroit River to a railyard to the south. Overall, drainage from the site is split between Crawford Avenue and Salter Avenue. The northern half of the site drains towards Crawford Avenue/Riverside Drive, and the southern portion of the site drains to catchbasins in the parking area, which are assumed to be connected to municipal infrastructure on Salter Avenue. The eastern area of the site drains to the valley, which appears to be relatively flat along the bottom, and is assumed to remain within the rail corridor.

The Ministry of Environment, Conservation and Parks maintains a record of all monitoring wells in the province and four records were available to review for the subject site. Based on a review of these records, it is noted that the site has a cover of approximately 150mm-230mm of topsoil underlain with silt. None of the 4 wells, constructed to a depth of 6.1m and completed in July 2014, recorded any observed groundwater. However, groundwater may be a concern for the underground parking levels due to proximity to the Detroit River. An extensive geotechnical assessment should be conducted on the site to document the existing soil and groundwater conditions.

2.2 Existing Servicing and Utilities

Existing services on and around the site were documented by Dillon Consulting using the findings of their topographic survey, as well as online documents from the City of Windsor's Open Data Sewers and Manhole drawing files, and *MappMyCity – MyWindsorSewerSystem*. Prior to detailed design, this information will be field verified and incorporated into the design.

A 375-mm-diameter vitrified clay combined sewer exists along Salter Avenue. It is unknown at the time of this report if the existing catchbasins in the parking area connect to this sewer. A 450-mm-diameter brick combined sewer exists along Crawford Avenue and is expected that this sewer collects the sanitary flows from the existing site, as well as stormwater runoff from the northern and western portions of the site.

The sewer on Salter Avenue drains to a 375-mm-diameter pipe along University Avenue, which conveys flows to the 450-mm-diameter sewer on Crawford Avenue. As a result, all sanitary flows and stormwater runoff from the site are ultimately conveyed to the combined sewer on Crawford Avenue. This combined sewer then drains towards the Detroit River, where flows are directed to a 1650-mm-diameter concrete trunk sewer that conveys the flows to a waste water treatment facility. Overflow from this sewer as a result of surcharging is conveyed directly to the Detroit River.

The size of the watermain and service on and around the site are currently unknown. The size and material will be determined prior to detailed design. Based on the review of surrounding developments, watermain capacity is not expected to be an issue, however further investigation may be required during detailed design. There is also a municipal hydrant along Crawford Avenue fronting the site.

The site also has hydro and gas services, and the source of these services will be determined prior to detailed design. Utility service infrastructure appears to be present within all the surrounding roadways.

2.3 Environmental Impact Assessment

The Environmental Impact Assessment (EIA) completed by MTE Consultants Inc. was warranted due to the existence of habitat for two endangered snake species (Butler's Gartersnake and Eastern Foxsnake) which are protected under the provincial Endangered Species Act (ESA, 2007). The site is also within 120m of the Detroit River, which is identified as a fish habitat. Additionally, species at risk (SAR) Bats could potentially be found within the site, however, it has been determined that the site is not a Significant Wildlife Habitat (SWH) for these bats.

It has been determined that there is Eastern Foxsnake regulated habitat within the site, which should be protected. Mitigation measures will be required for the Butler's Gartersnakes habitat on site and the fish habitat in the Detroit River during construction.

The recommendations of the EIA are reiterated and further discussed as appropriate within this report.

3.0 PROPOSED PHASING OF SERVICING AND DEVELOPMENT STRATEGY

Given the size and scale of development, the project will likely be carried out in multiple phases. The exact methodology of the development is not known at this time. In general, the development could proceed as a single, phased condominium, multiple condominiums for each phase or a combination thereof. The advantages and disadvantages of each type of condominium is beyond the scope of this report, however the selected strategy may impact the proposed servicing.

Should there be multiple condominium corporations formed as a result of the development, each of the condominium corporations could be construed to be a separate legal entity with distinct property lines. In such an event, each condominium corporation is therefore entitled to a separate connection to municipal services, and at minimum, separate water services to each condominium corporation will be required to comply with the Safe Drinking Water Act.

Should a water service leave the bounds of the plan of condominium it is servicing, except to connect to the municipal main in the street, or if a water service is connected in any way between condominium plans, such a system may be deemed to be a non-municipal drinking water system. The owner/operator of such a system is subject to the same stringent testing and reporting standards as the water utility itself, and shall be required to complete the testing regardless of the fact that the supply of the water is through the utility which already complies with the regulations. A non-municipal water supply system is generally prohibited unless under extenuating circumstances.

Additionally, it is generally understood that the sanitary servicing follows a similar strategy. When multiple, separate legal entities are formed, a single private sewer providing service to multiple owners is generally not permitted. Such restrictions are generally not applied to storm services, although if possible, each entity should be able to function independently of one another as far as storm servicing and stormwater management is concerned.

For the purposes of this report, it is assumed that a multiple condominium approach will be undertaken and that each condominium corporation will be provided with individual sets of services. Should this not be the case, the total demands of the municipal servicing do not change, simply the size of the single individual service required for the development.

4.0 SANITARY SERVICING

According to the *City of Windsor Development Manual (2015)*, the sanitary flows from the proposed development are to be sized based off a design flow rate of 0.0042 L/s/capita. The design population is to be determined using the Population Density Code identified in Section 9.1.2.c. For residential land use, the Population Density Code is 50 persons/ha.

The overall site area is approximately 2.7ha, which would result in a very small design population. Since the site is to consist of high-density residential buildings, the design population may be based off of the total floor space provided for each use of each individual building, which will provide a much more reasonable design population. Using these criteria, the design population for the proposed development is 790. For an expected population near or below 1000, an Ultimate Flow Factor of 6.0 is to be multiplied with the calculated flow rate. This flow is to be coupled with an infiltration flow rate of 0.1560 L/s/ha. Table I below summarizes the sanitary demand for the proposed development.

Table I: Proposed Sanitary Flow from Overall Development (persons/ha approach)

	Floor Space (ha)	Population Density Code (persons/ha)	Design Population (persons)	Flow Rate (L/s/capita)	Ultimate Flow Factor	Ultimate Flow (l/s)
Building 1	3.29	50	165	0.0042	6.0	4.16
Building 2	9.80	50	490	0.0042	6.0	12.35
Building 3	2.46	50	123	0.0042	6.0	3.10
Townhouse Block 1	0.23	50	12	0.0042	6.0	0.30
Total Domestic Flow	15.78	-	790	0.0042	6.0	19.91
Extraneous Flow	2.70	-	-	0.1560	-	0.42
Total Sanitary Flow	-	-	-	-	-	20.33

^[1] Commercial Floor Space includes amenity areas

Based on Table I, a total population of 790 persons is noted for 1,558 apartment units and 44 townhome units. While the methodology is consistent with City of Windsor design requirements, the resulting population is not in line with the expected density on the site. According to 2021 Census Data obtained from Statistics Canada, Windsor has an average household size of 2.5 persons. The number of units within the apartment buildings are based on a unit size of approximately 800ft². Such a unit size is typically associated with 1-2 occupants and therefore a population density of 1.75 persons/unit was utilized. For the townhouses, a population density of 2.5 persons was utilized in accordance with the statistical household size. This results in a design population of 2,835 people, and an Ultimate Flow Factor of 5.35. Table II summarizes the sanitary demand using a persons per unit approach.

Table II: Proposed Sanitary Flow from Overall Development (persons/unit approach)

	Unit (#)	Population Density Code (persons/unit)	Design Population (persons)	Flow Rate (L/s/capita)	Ultimate Flow Factor	Ultimate Flow (l/s)
Building 1 - Apartments	342	1.75	599	0.0042	5.35	13.46
Building 1 - Townhouse	10	2.5	25	0.0042	5.35	0.56
Building 2 - Apartments	950	1.75	1663	0.0042	5.35	37.37
Building 2 - Townhouse	10	2.5	25	0.0042	5.35	0.56
Building 3	266	1.75	466	0.0042	5.35	10.47
Townhouse Block 1	24	2.5	60	0.0042	5.35	1.35
Total Domestic Flow	1602	-	2838	0.0042	5.35	63.77
Extraneous Flow	2.70	-	-	0.1560	-	0.42
Total Sanitary Flow	-	-	-	-	-	64.19

Based on the above, a sanitary flow of 64.19 L/s is anticipated for the overall development. This flow can be accommodated by a 300-mm-diameter sewer, sloped at 1.0%. In a multiple condominium approach, each of the condominiums (4 anticipated in total) will have a separate connection. Two connections will be to the combined sewer on Crawford Avenue, and the other two connections will be to the combined sewer on Salter Avenue. A sanitary design calculation sheet is provided in Appendix A.

As the site is currently operational and generating sanitary flows in the current condition, it is important to understand the change in sanitary sewage generation anticipated. The existing building can be considered as a commercial building, resulting in a Population Density Code of 74 persons/ha. Using the overall site area, this results in an existing design population of 200. Applying the City of Windsor sanitary design standards, the redevelopment of the entire site results in the removal of the existing 5.0446 L/s of sanitary generation with the demolition of the current building.

The development results in an increased sanitary demand of 59.15 L/s for the site.

5.0 WATER SERVICING

5.1 Design Criteria

The *Design Guidelines and Specifications for Water Main and Water Service Installation* (November 2022) by the Windsor Utilities Commission – Water Division states that a minimum operating pressure of 40 psi (275 kPa) and a maximum operating pressure of 80 psi (550 kPa) is optimal in all watermain systems. The minimal residual pressure at any location in the water distribution system shall never be less than 140 kPa (20 psi).

Watermain within the right-of-way are to be designed for a 1000 kPa (150 psi) test pressure. Any services installed that have a diameter of 100 mm or greater are subject to pressure and bacteriological testing. Fire service line systems are to be tested to 1380 kPa (200 psi), and must hold the pressure for one hour.

5.2 Domestic Water Demand

Calculations of the water demand for the proposed development have been determined using the guidelines outlined within the Ministry of the Environment, Conservation and Parks (MECP) *Design Guidelines for Drinking-Water Systems* (published in 2016 and updated in May 2023).

In accordance with MECP, the average residential demand for the proposed development was estimated using a per capita demand of 360 L/day, which is the average of the historical domestic demand indicated in the

guidelines. The design population determined for the sanitary design flow was utilized for residential domestic water demand calculations as well. In order to convert the average daily demands into maximum daily and peak hourly flows, a peaking factor was applied. The peak factor was in accordance with Table 3-1 of the MECP design guidelines, resulting in a peak factor of 2.25 for maximum daily demand and a peak factor between 3.38 for peak hourly demand for populations between 2000 and 3000 persons. Domestic water demand calculations for the proposed development are presented in Table III.

Table III: Domestic Water Demand

	Population	Domestic Demand	Max Day Peak Factor	Max Hourly Peak Factor	Max Hourly Demand (l/s)	Max Hourly Demand (l/s)
Building 1	624	360 (L/c/day)	2.25	3.38	5.85	8.79
Building 2	1688	360 (L/c/day)	2.25	3.38	15.83	23.77
Building 3	466	360 (L/c/day)	2.25	3.38	4.37	6.56
Townhouse Block 1	60	360 (L/c/day)	2.25	3.38	0.56	0.85
Total Domestic Demand	2838		-	-	26.61	39.97

A maximum day domestic demand of 26.61 L/s and a peak hourly demand of 39.97 L/s are anticipated for the development. Refer to Appendix B for a detailed calculation of domestic flow demand for the site.

5.3 Fire Flow Demand

In addition to the daily demand from the proposed development, fire flow demand calculations are required to assess the adequacy of any proposed watermain system. The Windsor Utilities Commission specifies that all fire flow requirements shall be determined in accordance with the current issue of Water Supply for Public Fire Protection published by the Fire Underwriters Survey (FUS), and the Ontario Building Code. To facilitate calculations, it is necessary to determine whether the buildings are to be protected by a sprinkler system, as the resulting requirement for fire flow is calculated differently for buildings with or without sprinkler systems. As such, the fire flow for the site will need to be designed per NFPA 13 Standard for Installation of Sprinkler Systems (2013), which stipulates the criteria used for determining fire flow for buildings with sprinklers.

The fire flow demands according to the FUS methodology are presented in Appendix B and summarized in Table IV.

Table IV: Fire Flow Demand

Type of Construction	Modified Fire-Resistive Construction (C=0.6)
Occupancy Charge	Non-Combustible Construction (-15%)
Automated Sprinkler Protection	Yes
Designed to NFPA 13 Standard	Yes (-30%)
Standard Water Supply to Sprinklers and Standpipes	Yes (-10%)
Fully Supervised System	Yes (-10%)
Fire Flow Demands ^[1]	
Building 1	133 L/s (2113 usgpm)
Building 2A	117 L/s (1849 usgpm)
Building 2B	100 L/s (1585 usgpm)
Building 2C	117 L/s (1849 usgpm)
Building 3	133 L/s (2113 usgpm)
Townhouse Block 1 ^[2]	117 L/s (1849 usgpm)
Maximum Fire Demand	133 L/s (2113 usgpm)

^[1]The fire flow demands are inclusive of exposure charges to other buildings.

^[2]Townhouse Block 1 Construction type is Non-Combustible Construction. Also assumed to not have automatic sprinkler protection.

In accordance with FUS 2020, the maximum fire flow demand is expected to be 133 L/s.

5.4 Service Design

According to the MECP Design Guidelines for Drinking Water Systems, the water service shall be able to convey the maximum of the Maximum Day Demand plus the Fire Demand, or the Peak Hourly Demand, within the pressure and velocity ranges as specified. As such, the servicing to the site must be able to convey a maximum day demand and fire flow of a total 159.61 L/s if a single service was provided, or a maximum of 138.85 L/s for Building 1 should individual services to each condominium be provided.

It is anticipated that the development will be provided with four 150-mm to 200-mm-diameter water services if separate condominium corporations are created. Available capacity is not expected to be a concern for the proposed development, since there are multiple high-density residential buildings around the site which would have similar fire demands.

Additionally, hydrants along University Avenue are accompanied with blue tops and rings. Based on NFPA 291, hydrants with blue color codes are noted to have very good flow of water with a rated capacity of greater than 1500 usgpm at 20 psi.

Noting the above, capacity in the municipal system is not anticipated to be of concern. A hydrant flow test will be conducted during the detailed design phase for this project to confirm available pressures and flows in the system.

The Windsor Utilities Commission also requires that each water service be accompanied with a meter pit at or near the property line.

6.0 STORM SERVICING AND STORMWATER MANAGEMENT

6.1 Stormwater Management Objectives and Design Criteria

Stormwater from the site should be controlled to pre-development rates if possible. If this cannot be met, the Essex Region Conservation Authority (ERCA) requires that sites retain the difference of post-development and pre-development flow from the site for 1:100-year storm event.

Runoff from the site is expected to be conveyed towards the Detroit River. As a result, a stormwater quality study may be required for the site. Primarily, stormwater quality on the site should reduce the amount of suspended solids in the runoff, and secondly, it should treat phosphorus, oil and grease, salt, bacteria and other contaminants.

According to the *Windsor/Essex Region Stormwater Management Standards Manual* (2018) by Stantec, the required storage on site is dependent on the soil classification. This will be determined once a geotechnical study is conducted on the existing soil and groundwater conditions. Minimum freeboard from the 1:100-yr storm event is allowed to pond up to a depth of 30 cm, measured to the lowest building opening. It is expected that 90% of the Runoff Volume Control Target (RVCT) be treated and remove 70% of suspended solids for normal level protection. For enhanced level protection, at least 80% of the suspended solids should be removed. Storm sewers for proposed developments are to be designed to convey the 5-year storm event to the municipal infrastructure.

The eastern snake corridor will be restored to natural snake habitat upon completion of construction. It appears that the snake corridor, although extremely flat, does have a major overland flow route from north to south in existing conditions. In proposed conditions, a culvert system will ensure this drainage path is maintained.

Although the site is expected to potentially comprise of four legal entities, the stormwater management measures can be shared by all parcels.

6.2 Quantity/Peak Flow Control

Approximately 1.5 ha of the site drains towards the municipal infrastructure. The remaining 1.2 ha is the snake corridor. Approximately 0.78 ha of the 1.5 ha portion is impervious. This results in an expected existing stormwater runoff rate of approximately 432 L/s for the 1:100-year storm event, and 269 L/s for the 1:5-year storm event, assuming a runoff coefficient of 0.60 and using the Rational Method.

It is assumed that the 1:5-year storm event is conveyed in the combined sewer on the street. As such, the site currently contributes 269 L/s in storm water and 5.04 L/s in sanitary sewage to the municipal system. Given the increase in sanitary flows to 64.19 L/s, the storm discharge in the 1:5-year event must be limited to 209.85 L/s. Additionally, the total storm discharge in the 100-year event must be limited to a flow rate of 372.89 L/s.

The proposed development is expected to be more impervious than the existing site, and this increase can be estimated by increasing the runoff coefficient to 0.75. Additionally, the site area in proposed conditions that will be conveyed to the municipal system is approximately 2.3 ha. This results in a peak runoff rate of 828.1 L/s for the 1:100-year storm event, requiring further controls to limit the rates.

6.3 On-Site Retention and Quality Control

At the time of this functional servicing and stormwater management report, it is expected that an underground storage tank will be provided within the underground parking footprint to provide on-site retention. An oil-grit separator unit will also be installed to provide at least normal level protection from the site.

The Modified Rational Method was used to estimate the amount of storage required to control the proposed development peak flow rates to the pre-development levels. This resulted in a maximum storage volume of 341.76 m³. Detailed calculations are presented in Appendix C.

The maximum storage was calculated by controlling the 1:100-year storm event to pre-development levels, while subtracting the proposed sanitary demand increase. The allowable release rate for the 1:100-year storm event is 372.89 L/s.

7.0 SITE GRADING

The grading of the site will respect the existing grades at the boundary conditions. This includes Riverside Drive to the north, Crawford Avenue to the west, and Salter Avenue and the existing residential and commercial buildings to the south. It is also expected that retaining walls will be proposed near the northeast portion of the site along the snake corridor to maintain the existing grade and discourage snakes from entering the site, as the corridor is approximately 7 m lower than the finished floor elevations.

The site will be graded to comply with slopes outlined as part of the Accessibility for Ontarians with Disabilities Act (AODA) and City of Windsor Development Manual. The grading will also allow for the stormwater management objectives of directing minor flows towards the existing surrounding infrastructure, and the major flows towards the municipal roadways.

7.1 Compliance with On-Site and Excess Soil Management Provincial Regulations

The MECP regulation O.Reg. 406/19 "On-Site and Excess Soil Management" under the Environmental Protection Act states that the excavation of excess material, and subsequent off-site disposal of excess soils from this site, will require testing and reporting in the MECP's Environmental Activity and Sector Registry (EASR). The Owner and Contractor will be responsible for complying with all of the noted requirements.

8.0 EROSION AND SEDIMENT CONTROL

Sediment tracked onto the roadway during the course of construction will be cleaned by the Contractor. To help minimize the amount of mud being tracked onto the roadway, a mud mat will be installed at the primary construction exit. Additionally, silt fence will be installed around the development area to eliminate sediment from leaving the site and will remain in place and be maintained until landscaping has been completed and soil has been vegetated. Silt fence will also be installed around stockpiles on site, with the stockpiles kept a minimum 2.5 m from the property boundary.

Filter fabric will be wrapped around storm and sanitary structures to prevent silt or sediment-laden water from entering inlets. These will be inspected periodically to ensure that they have been properly installed and function as designed throughout construction.

It is assumed that the Contractor will keep in mind weather conditions when scheduling work to minimize dust to the neighboring residential properties due to construction activities.

The controls will be maintained and accumulated sediments removed once their capture capacity has been decreased by one third. It is proposed that, during construction activities, visual monitoring will be conducted bi-weekly and within 24 hours of any rainfall event of 25 mm or greater. During the construction period, monitoring will consist of visual observation for the effectiveness of the sediment and erosion controls and sediment migration off site. Construction inspections will be conducted until such time as the construction activities are complete and vegetation has established itself to a density equivalent to 70% of the background native vegetation density.

The erosion control measures on the site will be coordinated with the recommendations of the EIA to mitigate any indirect impacts to fish habitat in the Detroit River.

9.0 CONCLUSIONS

Based on the analysis presented in this report, it is concluded that:

- Mitigation measures will be required to protect two snake species that are thought to live within the protected snake corridor, as well as fish species in the Detroit River.
- The development strategy will ultimately dictate the number of individual sets of services that are to be provided to the overall development.
- The 450-mm-diameter combined sewer on Crawford Avenue will ultimately collect stormwater runoff and sanitary flows from the proposed development. Buildings 2 and 3 may connect to the combined sewer on Salter Avenue, which is conveyed to the sewer on Crawford.
- The proposed development is expected to generate a Total Ultimate Sanitary Flow of 64.12 L/s, which can be accommodated by one 300-mm-diameter sewers sloped at 1.0% or individual, smaller sanitary services for the condominium corporations. The proposed increase in sanitary sewage generation from the site is 59.15L/s.
- Four 150-mm to 200-mm-diameter water services will be provided to service the proposed development, each accompanied with a water meter pit, if there are separate condominium corporations.
- Runoff from the proposed development will be controlled to this pre-development flow rate for the 1:5year and 1:100 year storm event.

- The proposed development must provide at least 341.76 m³ of storage to meet the 1:100-year pre-development flow rate. It is assumed that this will be achieved by using an underground stormwater holding tank.
- An oil-grit separator unit will be installed to provide at least normal level protection from the site.
- Perimeter silt fence, silt fence at the base of all stock piles, silt sacs in storm structures, and construction entrance mud mats can provide erosion and sediment control. These will be designed during detailed design.

All of which is respectfully submitted,

WALTERFEDY

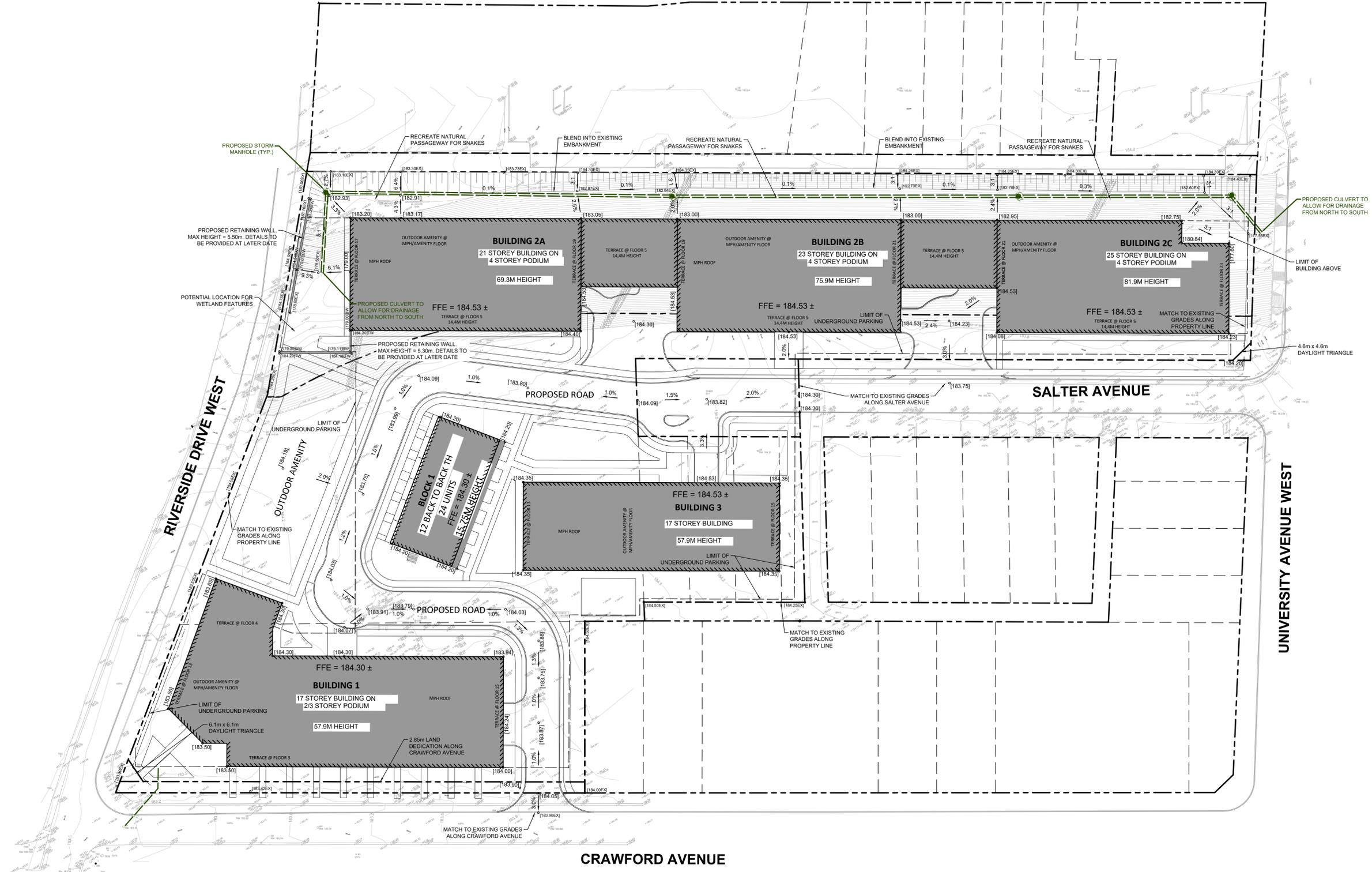


Tyler Keller, P.Eng.
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Associate

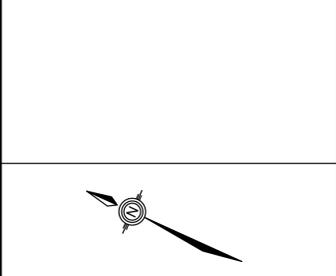
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DRAWINGS

C201 Functional Grading Plan
C301 Functional Servicing Plan



KEY PLAN



DATE	ISSUANCE	NO.
2025.09.02	ISSUED FOR OPA/ZBA	



CLIENT
AUBURN DEVELOPMENTS

PROJECT
825 RIVERSIDE DRIVE WEST
WINDSOR, ON

TITLE
FUNCTIONAL GRADING PLAN

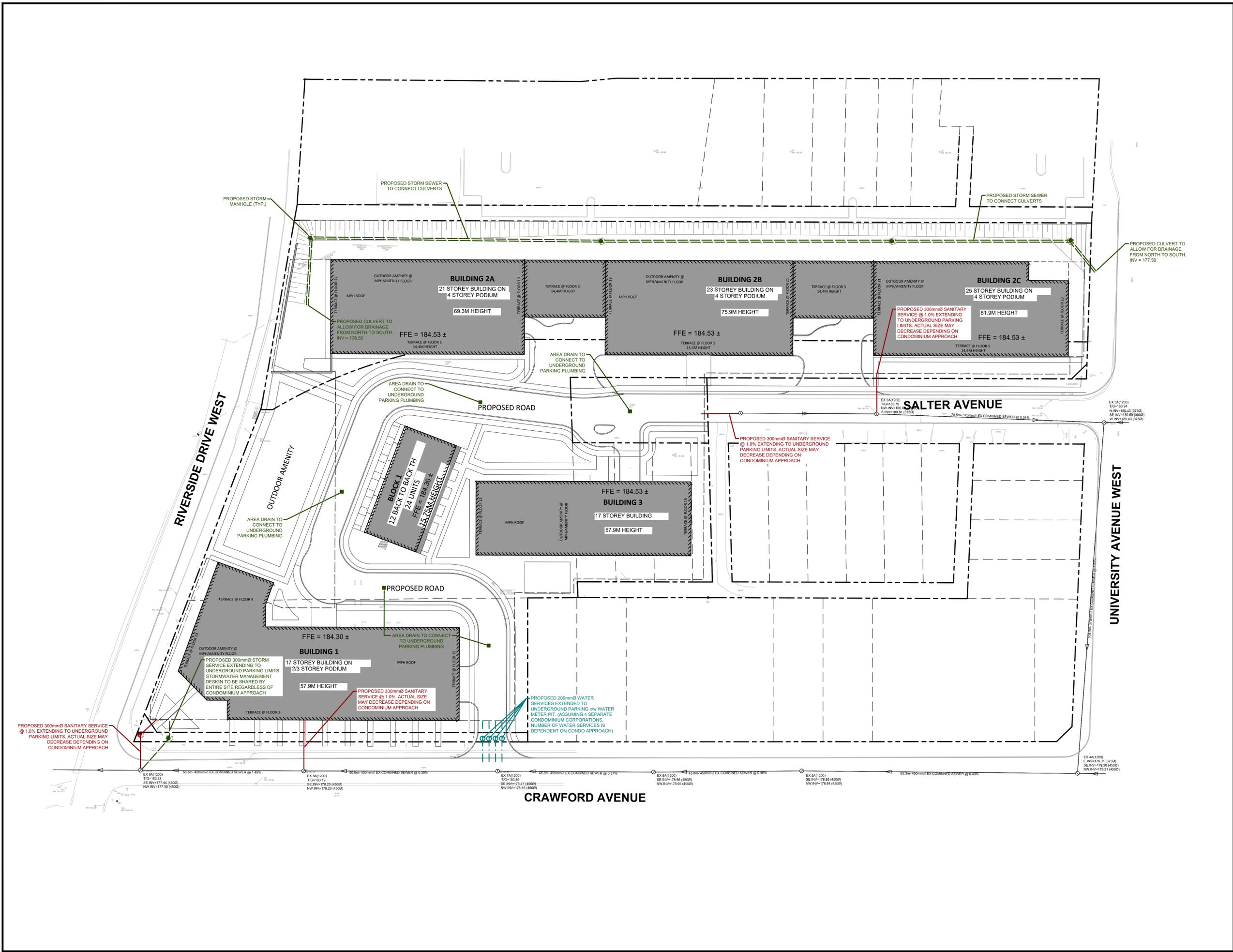
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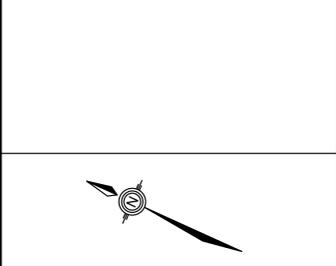
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DATE	2025-08-29	C201
PROJECT NO.	2019-0561-11	
DRAWN BY	TK	
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KEY PLAN



DATE	ISSUANCE	NO.
2025.09.02	ISSUED FOR OPA/ZBA	

CLIENT
AUBURN DEVELOPMENTS

PROJECT
825 RIVERSIDE DRIVE WEST WINDSOR, ON

TITLE
FUNCTIONAL SERVICING PLAN

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LICENSED PROFESSIONAL ENGINEER
 T. B. KELLER
 100529626
 2025.09.02
 PROVINCE OF ONTARIO

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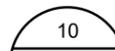
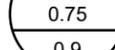
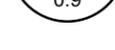
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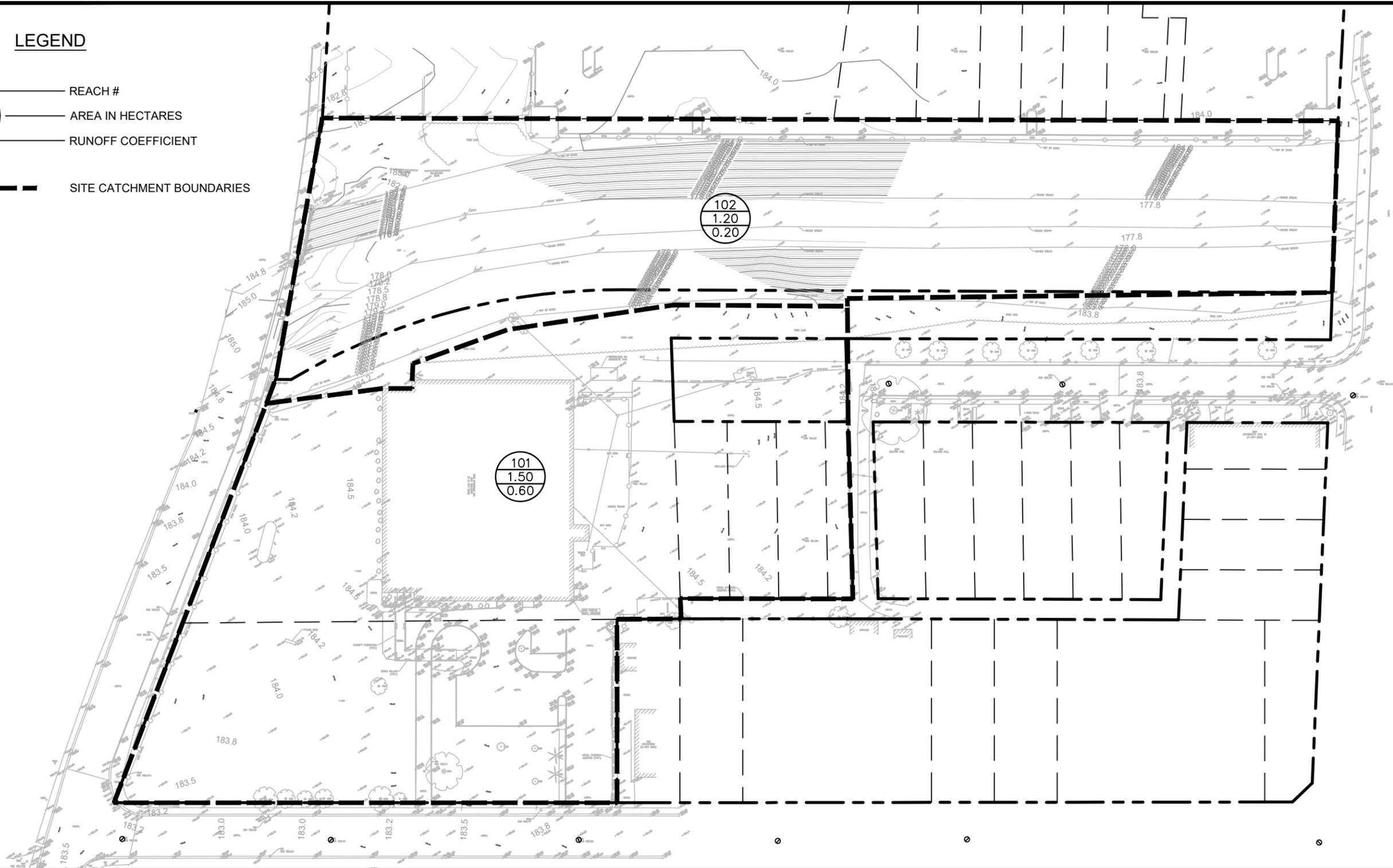
FIGURES

- FIG-1 Existing Catchment Areas
- FIG-2 Proposed Catchment Areas

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LEGEND

-  REACH #
-  AREA IN HECTARES
-  RUNOFF COEFFICIENT
-  SITE CATCHMENT BOUNDARIES



PROJECT:
825 RIVERSIDE DRIVE WEST

TITLE:
EXISTING CATCHMENT AREAS

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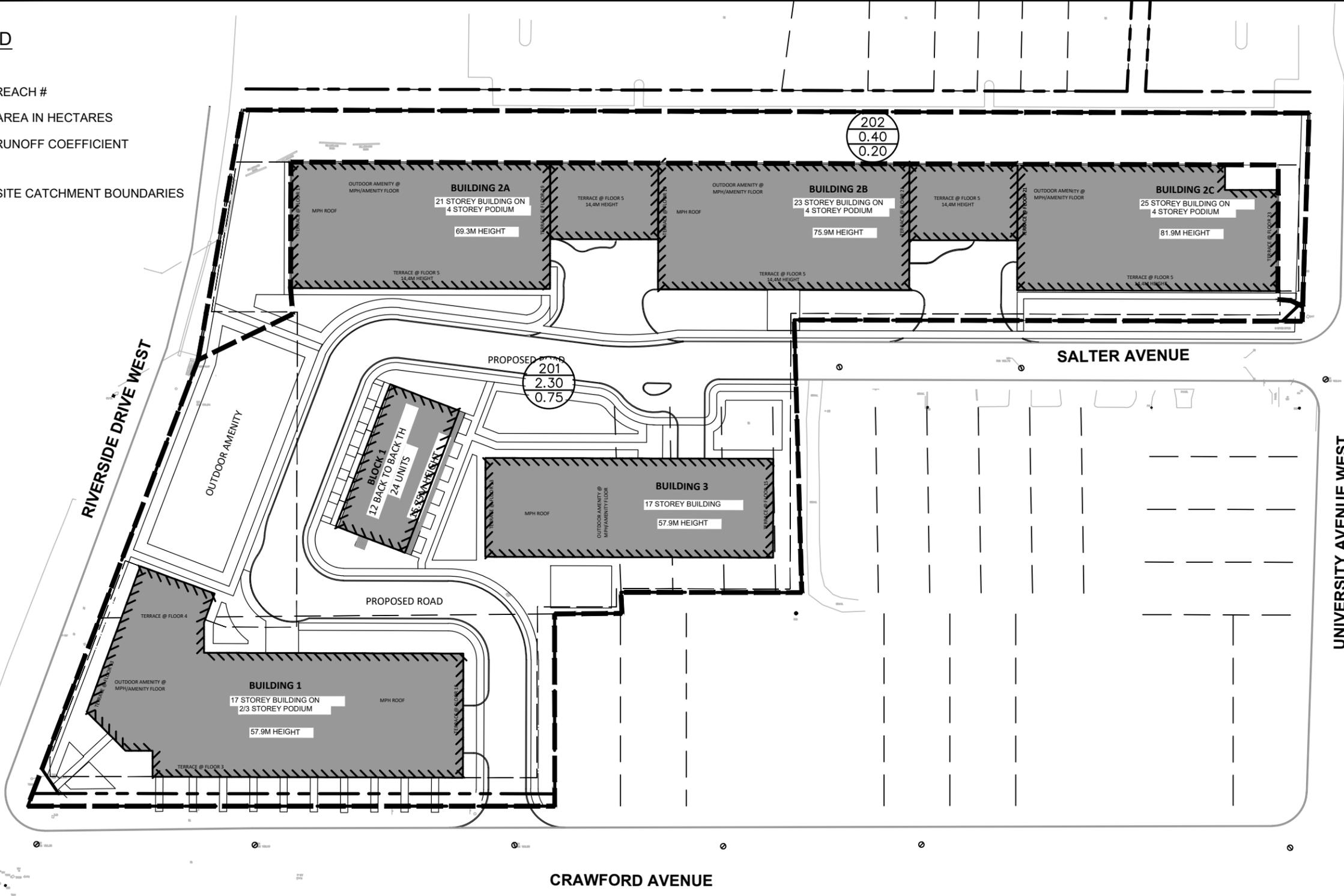
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FIG-1

LEGEND

- 10 — REACH #
- 0.75 — AREA IN HECTARES
- 0.9 — RUNOFF COEFFICIENT
- SITE CATCHMENT BOUNDARIES



PROJECT:
825 RIVERSIDE DRIVE WEST

TITLE:
PROPOSED CATCHMENT AREAS

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SHEET NO.:

FIG-2

APPENDIX A

Sanitary Sewer Design Spreadsheet

Project: Shergar Developments		Design Data		SANITARY SEWER DESIGN CALCULATIONS						WALTERFEDY							
Project No: 2019-0561-11		Min. Velocity	0.75 m/s	Residential		Commercial		Peaking Factor							Converted to Population		
Date: 2024-09-17		Max. Velocity	3.0 m/s	Ultimate Flow Factor		Peaking Factor		Avg. Daily Flow		0.0042 L/s/ha		Infiltration		Design Data			
Designed By: TK Checked By: RK		Manning's 'n'	0.013	0.0042		0.0042		0.0042		0.0042		Total Site Area		Total Flow			
		Infiltration	0.156 l/s/ha	Avg. Daily Flow		Avg. Daily Flow		Avg. Daily Flow		Avg. Daily Flow		Total Site Area		Total Flow			
				Residential		Commercial		Cumulative		Ultimate Flow		Infiltration		Design Data			
		Floor Space	Density	Population	Floor Space	Density	Population	Floor Space	Population	Ultimate Flow	Total Site Area		Total Flow	Diameter	Slope	Q _{FULL}	V _{FULL}
		(ha)	(ppha)	(people)	(ha)	(ppha)	(people)	(ha)	(people)	Factor	Total Site Area		(L/s)	(mm)	(%)	(L/s)	(m/s)
Building 1		3.29	50	165				3.29	165	6.00			4.158				
Building 2		9.80	50	490				9.80	490	6.00			12.348				
Building 3		2.46	50	123				2.46	123	6.00			3.100				
Townhouse Block 1		0.23	50	12				0.23	12	6.00			0.302				
TOTAL		15.78	50	790				15.78	790	6.00	2.70		20.329	250	0.53	43.29	0.88
		Units	Density	Population	Floor Space	Density	Population	Units	Population	Ultimate Flow	Infiltration		Total Flow	Diameter	Slope	Q _{FULL}	V _{FULL}
		(#)	(p/unit)	(people)	(ha)	(ppha)	(people)			Factor	Total Site Area		(L/s)	(mm)	(%)	(L/s)	(m/s)
Building 1 - Apartment		342	1.75	599				342	599	5.35			13.460				
Building 1 - Townhouse		10	2.5	25				10	25	5.35			0.562				
Building 2 - Aptment		950	1.75	1663				950	1663	5.35			37.368				
Building 2 - Townhouse		10	2.5	25				10	25	5.35			0.562				
Building 3		266	1.75	466				266	466	5.35			10.471				
Townhouse Block 1		24	2.5	60				24	60	5.35			1.348				
TOTAL		1602		2838				1602	2838	5.35	2.70		64.19	300	1.00	96.70	1.37

APPENDIX B

**Domestic Water Demand Calculations
Fire Demand Calculations**

REQUIRED DOMESTIC FLOW

MECP

WALTERFEDY

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Domestic Water Demand

Building Description	Units	Population	Demand	Max Daily Peak Factor	Max Hourly Peak Factor	Max Daily Demand (L/s)	Max Hourly Demand (L/s)
Building 1	352	624	360 L/cap/day	2.25	3.38	5.85	8.79
Building 2	960	1688	360 L/cap/day	2.25	3.38	15.83	23.77
Building 3	266	466	360 L/cap/day	2.25	3.38	4.37	6.56
Townhouse Block 1	24	60	360 L/cap/day	2.25	3.38	0.56	0.85
Total	1,602	2838				26.61	39.97

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 2020)

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Fire Flows - Building 1

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

F = Required fire flow (LPM)
 C = Coefficient related to type of construction
 A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	C =	0.6
Description	Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel		

Total Floor Area	32937	m ²
# Storeys	1	
Fire Resistant Building?	YES	
Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating?	NO	

Area	12290	m ²
Description	Area of two largest floors + 50% of each of the floors above it (maximum 8) 1-2 = 2665, 3 = 2234, 4-12 = 1898	
Required Fire Flow	15000	L/min

Occupancy Charge	Limited-Combustible Contents
Fire Flow Reduction	-15% OR -2250 L/min
Required Fire Flow	12750 L/min

Automated Sprinkler Protection	YES	
Designed to NFPA 13 Standard	YES	-30%
Standard Water Supply to Sprinklers and Standpipes	YES	-10%
Fully Supervised System	YES	-10%
Fire Flow Adjustment	-6375	L/min

Exposure 1 (North)	Distance	23.25	m	Charge	10%
Description	Townhouse Block 1				

Exposure 2 (South)	Distance	>30	m	Charge	0%
Description	Existing Residential				

Exposure 3 (East)	Distance	0	m	Charge	0%
Description					

Exposure 4 (West)	Distance	0	m	Charge	0%
Description					

Total Exposure Charge	10%	
Fire Flow Adjustment	1275	L/min

Total Required Fire Flow	8000	L/min
Total Required Fire Flow	2113	U.S. GPM
Total Required Fire Flow	133	L/s

REQUIRED FIRE FLOW**WALTERFEDY**

Water Supply for Public Fire Protection (FUS 2020)

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Fire Flows - Building 2A

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

F = Required fire flow (LPM)
 C = Coefficient related to type of construction
 A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	C =	0.6
Description	Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel		

Total Floor Area	45817	m ²
# Storeys	1	
Fire Resistant Building?	YES	
Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating?	NO	
Area	9518	m ²
Description	Area of two largest floors + 50% of each of the floors above it (maximum 8)	
	3-4=2023 ,5-17 = 1368	
Required Fire Flow	13000	L/min

Occupancy Charge	Limited-Combustible Contents
Fire Flow Reduction	-15% OR -1950 L/min
Required Fire Flow	11050 L/min

Automated Sprinkler Protection	YES	
Designed to NFPA 13 Standard	YES	-30%
Standard Water Supply to Sprinklers and Standpipes	YES	-10%
Fully Supervised System	YES	-10%
Fire Flow Adjustment	-5525	L/min

Exposure 1 (North)	Distance	0	m	Charge	0%
Description					
Exposure 2 (South)	Distance	22.3	m	Charge	10%
Description	Townhouse Block 1				
Exposure 3 (East)	Distance	0	m	Charge	0%
Description	Building 2B - Also Fully Protected				
Exposure 4 (West)	Distance	0	m	Charge	0%
Description					

Total Exposure Charge	10%
Fire Flow Adjustment	1105 L/min

Total Required Fire Flow	7000	L/min
Total Required Fire Flow	1849	U.S. GPM
Total Required Fire Flow	117	L/s

REQUIRED FIRE FLOW**WALTERFEDY**

Water Supply for Public Fire Protection (FUS 2020)

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Fire Flows - Building 2B

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

F = Required fire flow (LPM)
 C = Coefficient related to type of construction
 A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	C =	0.6
Description	Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel		

Total Floor Area	24117	m ²
# Storeys	1	
Fire Resistant Building?	YES	
Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating?	NO	
Area	9346	m ²
Description	Area of two largest floors + 50% of each of the floors above it (maximum 8)	
	3-4=2023 ,5-18 = 1325	
Required Fire Flow	13000	L/min

Occupancy Charge	Limited-Combustible Contents
Fire Flow Reduction	-15% OR -1950 L/min
Required Fire Flow	11050 L/min

Automated Sprinkler Protection	YES	
Designed to NFPA 13 Standard	YES	-30%
Standard Water Supply to Sprinklers and Standpipes	YES	-10%
Fully Supervised System	YES	-10%
Fire Flow Adjustment	-5525	L/min

Exposure 1 (North)	Distance	0	m	Charge	0%
Description					
Exposure 2 (South)	Distance	>30	m	Charge	0%
Description	Townhouse Block 1				
Exposure 3 (East)	Distance	0	m	Charge	0%
Description	Building 2C - Also Fully Protected				
Exposure 4 (West)	Distance	0	m	Charge	0%
Description	Building 2A - Also fully protected				

Total Exposure Charge	0%
Fire Flow Adjustment	0 L/min

Total Required Fire Flow	6000	L/min
Total Required Fire Flow	1585	U.S. GPM
Total Required Fire Flow	100	L/s

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 2020)

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Fire Flows - Building 2C

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

F = Required fire flow (LPM)
 C = Coefficient related to type of construction
 A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	C =	0.6
Description	Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel		

Total Floor Area	28011	m ²
# Storeys	1	
Fire Resistant Building?	YES	
Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating?	NO	
Area	9542	m ²
Description	Area of two largest floors + 50% of each of the floors above it (maximum 8)	
	3-4=2023 ,5-20 = 1374	
Required Fire Flow	13000	L/min

Occupancy Charge	Limited-Combustible Contents
Fire Flow Reduction	-15% OR -1950 L/min
Required Fire Flow	11050 L/min

Automated Sprinkler Protection	YES	
Designed to NFPA 13 Standard	YES	-30%
Standard Water Supply to Sprinklers and Standpipes	YES	-10%
Fully Supervised System	YES	-10%
Fire Flow Adjustment	-5525	L/min

Exposure 1 (North)	Distance	0	m	Charge	0%
Description					
Exposure 2 (South)	Distance	23	m	Charge	10%
Description	Existing Commercial				
Exposure 3 (East)	Distance	0	m	Charge	0%
Description					
Exposure 4 (West)	Distance	0	m	Charge	0%
Description	Building 2B - Also Fully Protected				

Total Exposure Charge	10%
Fire Flow Adjustment	1105 L/min

Total Required Fire Flow	7000	L/min
Total Required Fire Flow	1849	U.S. GPM
Total Required Fire Flow	117	L/s

REQUIRED FIRE FLOW**WALTERFEDY**

Water Supply for Public Fire Protection (FUS 2020)

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Fire Flows - Building 3

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

F = Required fire flow (LPM)
 C = Coefficient related to type of construction
 A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	C =	0.6
Description	Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel		

Total Floor Area	24584	m ²
# Storeys	1	
Fire Resistant Building?	YES	
Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating?	NO	
Area	9109	m ²
Description	Area of two largest floors + 50% of each of the floors above it (maximum 8)	
	1 = 1519, 2-12 = 1518	
Required Fire Flow	13000	L/min

Occupancy Charge	Limited-Combustible Contents
Fire Flow Reduction	-15% OR -1950 L/min
Required Fire Flow	11050 L/min

Automated Sprinkler Protection	YES	
Designed to NFPA 13 Standard	YES	-30%
Standard Water Supply to Sprinklers and Standpipes	YES	-10%
Fully Supervised System	YES	-10%
Fire Flow Adjustment		-5525 L/min

Exposure 1 (North)	Distance	>30	m	Charge	0%
Description	Townhouse Blocks				
Exposure 2 (South)	Distance	0	m	Charge	0%
Description	Building 1 - Also Fully Protected				
Exposure 3 (East)	Distance	0	m	Charge	0%
Description					
Exposure 4 (West)	Distance	9.6	m	Charge	20%
Description	Townhouse Block 1				

Total Exposure Charge	20%
Fire Flow Adjustment	2210 L/min

Total Required Fire Flow	8000	L/min
Total Required Fire Flow	2113	U.S. GPM
Total Required Fire Flow	133	L/s

REQUIRED FIRE FLOW**WALTERFEDY**

Water Supply for Public Fire Protection (FUS 2020)

Project	Shergar Developments
Project #	2019-0561-10
Designer	TK
Address	825 Riverside Drive West, Windsor, ON
Description	Fire Flows - Townhouse Block 1

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

F = Required fire flow (LPM)
 C = Coefficient related to type of construction
 A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Non-Combustible Construction	C =	0.8
Description	Unprotected Metal Structural Components, Masonry or Metal Walls. All Structural Members are Non-Combustible but does not qualify as Fire-Resistive		

Total Floor Area	2332	m ²
# Storeys	1	
Fire Resistant Building?	NO	
Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating?	NO	

Area	1749	m ²
Description	Area of two largest floors + 50% of each of the floors above it (maximum 8)	
	1-4 = 583	
Required Fire Flow	7000	L/min

Occupancy Charge	Limited-Combustible Contents
Fire Flow Reduction	-15% OR -1050 L/min
Required Fire Flow	5950 L/min

Automated Sprinkler Protection	NO
Designed to NFPA 13 Standard	YES 0%
Standard Water Supply to Sprinklers and Standpipes	YES 0%
Fully Supervised System	YES 0%
Fire Flow Adjustment	0 L/min

Exposure 1 (North)	Distance	22.3	m	Charge	5%
Description	Building 2A - Fully Protected				

Exposure 2 (South)	Distance	23.25	m	Charge	5%
Description	Building 1 - Fully Protected				

Exposure 3 (East)	Distance	9.6	m	Charge	10%
Description	Building 3 - Fully Protected				

Exposure 4 (West)	Distance	0	m	Charge	0%
Description					

Total Exposure Charge	20%
Fire Flow Adjustment	1190 L/min

Total Required Fire Flow	7000	L/min
Total Required Fire Flow	1849	U.S. GPM
Total Required Fire Flow	117	L/s

APPENDIX C

Modified Rational Method Calculations

Auburn - Shergar Developments - 825 Riverside Avenue West, Windsor, ON

Modified Rational Method Worksheet

Project: 2019-0561-10

City of Windsor - 100 Year Storm

$$I = A/(T+b)^c \text{ (mm/hr)}$$

$$a = 2375$$

$$b = 11$$

$$c = 0.861$$

Area of site being investigated (ha) =

1.5000

Composite Runoff Coeff. (C) =

0.60

Release Rate (m³/s) =

0.437076

Sanitary Flow Rate (L/s)

5.04

(Control 100 Year post-development flows to 100 Year pre-development levels)

Duration (T)		City of Windsor 100-Year intensity (i)		Q _{POST}	Storm Volume	Release Volume	Storage Volume
(min)	(sec)	(mm/hr)	(m/s)	(m ³ /s)	(m ³)	(m ³)	(m ³)
5	300	218.231	0.0000606	0.551	165.3112	131.123	34.188
10	600	172.676	0.0000480	0.437	262.2905	262.246	0.045
15	900	143.672	0.0000399	0.365	328.1756	393.369	-65.193
20	1200	123.481	0.0000343	0.314	376.9959	524.491	-147.496
25	1500	108.564	0.0000302	0.277	415.3062	655.614	-240.308
30	1800	97.064	0.0000270	0.248	446.6145	786.737	-340.123
35	2100	87.908	0.0000244	0.225	472.9838	917.860	-444.876
40	2400	80.435	0.0000223	0.207	495.7147	1048.983	-553.268
45	2700	74.212	0.0000206	0.191	515.6725	1180.106	-664.433
50	3000	68.944	0.0000192	0.178	533.4578	1311.229	-777.771
55	3300	64.422	0.0000179	0.167	549.502	1442.351	-892.849
60	3600	60.496	0.0000168	0.157	564.1244	1573.474	-1009.350
65	3900	57.054	0.0000158	0.148	577.5667	1704.597	-1127.030
70	4200	54.008	0.0000150	0.140	590.0159	1835.720	-1245.704
75	4500	51.293	0.0000142	0.134	601.6194	1966.843	-1365.223
80	4800	48.857	0.0000136	0.128	612.4949	2097.966	-1485.471
85	5100	46.658	0.0000130	0.122	622.7382	2229.088	-1606.350
90	5400	44.662	0.0000124	0.117	632.4276	2360.211	-1727.784
95	5700	42.843	0.0000119	0.113	641.6283	2491.334	-1849.706
100	6000	41.176	0.0000114	0.108	650.3948	2622.457	-1972.062

Max. required storage volume = 34.19 m³

$$Q_{POST} = (C i A) \times 10000 \text{ m}^2/\text{ha}$$

$$\text{Storm Volume} = Q_{POST} \times T$$

$$\text{Release Volume} = \text{Release Rate} \times T$$

$$\text{Storage Volume} = \text{Storm Volume} - \text{Release Volume}$$

Auburn - Shergar Developments - 825 Riverside Avenue West, Windsor, ON

Modified Rational Method Worksheet

Project: 2019-0561-10

City of Windsor - 100 Year Storm

$$I = AT^c \text{ (mm/hr)}$$

$$a = 2375$$

$$b = 11$$

$$c = 0.861$$

Area of site being investigated (ha) =

2.3000

Composite Runoff Coeff. (C) =

0.75

Release Rate (m³/s) =

0.372886

Sanitary Flow Rate (L/s)

64.19

(Control 100 Year post-development flows to 100 Year pre-development levels)

Duration (T)		City of Windsor 100.-Year intensity (i)		Q _{POST} (m ³ /s)	Storm Volume (m ³)	Release Volume (m ³)	Storage Volume (m ³)
(min)	(sec)	(mm/hr)	(m/s)				
5	300	218.231	0.0000606	1.110	332.964	111.866	221.098
10	600	172.676	0.0000480	0.892	534.9584	223.732	311.227
15	900	143.672	0.0000399	0.753	677.3557	335.598	341.758
20	1200	123.481	0.0000343	0.656	787.0455	447.463	339.582
25	1500	108.564	0.0000302	0.584	876.5911	559.329	317.262
30	1800	97.064	0.0000270	0.529	952.7162	671.195	281.521
35	2100	87.908	0.0000244	0.485	1019.375	783.061	236.314
40	2400	80.435	0.0000223	0.450	1079.06	894.927	184.133
45	2700	74.212	0.0000206	0.420	1133.43	1006.793	126.637
50	3000	68.944	0.0000192	0.395	1183.636	1118.659	64.977
55	3300	64.422	0.0000179	0.373	1230.505	1230.524	-0.020
60	3600	60.496	0.0000168	0.354	1274.648	1342.390	-67.742
65	3900	57.054	0.0000158	0.338	1316.53	1454.256	-137.726
70	4200	54.008	0.0000150	0.323	1356.509	1566.122	-209.613
75	4500	51.293	0.0000142	0.310	1394.866	1677.988	-283.121
80	4800	48.857	0.0000136	0.298	1431.829	1789.854	-358.025
85	5100	46.658	0.0000130	0.288	1467.579	1901.719	-434.140
90	5400	44.662	0.0000124	0.278	1502.268	2013.585	-511.317
95	5700	42.843	0.0000119	0.269	1536.02	2125.451	-589.431
100	6000	41.176	0.0000114	0.261	1568.94	2237.317	-668.377

Max. required storage volume =	341.76 m³
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$$Q_{POST} = (C i A) \times 10000 \text{ m}^2/\text{ha}$$

$$\text{Storm Volume} = Q_{POST} \times T$$

$$\text{Release Volume} = \text{Release Rate} \times T$$

$$\text{Storage Volume} = \text{Storm Volume} - \text{Release Rate}$$

Modified Rational Method							
Project Auburn - Shergar Developments							
Project #: 2019-0561-10							
Designed By: TK							
Date: 2024-12-02							
Storm Parameters		Catchment Parameters		Modelling Parameters			
Return Period	100 Years	Area (ha)	2.3	First Time Step (min)	5		
A	2375.000	Runoff Coefficient, C	0.75	Time Increments (min)	5		
B	11	Release Rate (m ³ /s)	0.373				
C	0.861	Sanitary Flow Rate(L/s)	64.19				
$i \text{ (mm/hr)} = \frac{a}{(t_{min} + b)^c} = AT_{hr}^{\frac{c}{a}}$				Converting $i = AT_{hr}^C$ to $i = \frac{a}{(t+b)^c}$ $c = -C; b = 0; a = A \times 60^c$			
						Modelling Results	
						Storage Required (m ³)	341.758
						Peak Outflow (m ³ /s)	0.373
Time (min)	Intensity (mm/hr)	Peak Flow (m ³ /s)	Uncontrolled Flow (m ³ /s)	Total Flow (m ³ /s)	Runoff Volume (m ³)	Discharge Volume (m ³)	Storage Volume (m ³)
5	218.231	1.110	0.000	1.110	332.964	111.866	221.098
10	172.676	0.892	0.000	0.892	534.958	223.732	311.227
15	143.672	0.753	0.000	0.753	677.356	335.598	341.758
20	123.481	0.656	0.000	0.656	787.045	447.463	339.582
25	108.564	0.584	0.000	0.584	876.591	559.329	317.262
30	97.064	0.529	0.000	0.529	952.716	671.195	281.521
35	87.908	0.485	0.000	0.485	1019.375	783.061	236.314
40	80.435	0.450	0.000	0.450	1079.060	894.927	184.133
45	74.212	0.420	0.000	0.420	1133.430	1006.793	126.637
50	68.944	0.395	0.000	0.395	1183.636	1118.659	64.977
55	64.422	0.373	0.000	0.373	1230.505	1230.524	0.000
60	60.496	0.354	0.000	0.354	1274.648	1342.390	0.000
65	57.054	0.338	0.000	0.338	1316.530	1454.256	0.000
70	54.008	0.323	0.000	0.323	1356.509	1566.122	0.000
75	51.293	0.310	0.000	0.310	1394.866	1677.988	0.000
80	48.857	0.298	0.000	0.298	1431.829	1789.854	0.000
85	46.658	0.288	0.000	0.288	1467.579	1901.719	0.000
90	44.662	0.278	0.000	0.278	1502.268	2013.585	0.000
95	42.843	0.269	0.000	0.269	1536.020	2125.451	0.000
100	41.176	0.261	0.000	0.261	1568.940	2237.317	0.000
105	39.643	0.254	0.000	0.254	1601.117	2349.183	0.000
110	38.228	0.247	0.000	0.247	1632.625	2461.049	0.000
115	36.919	0.241	0.000	0.241	1663.530	2572.915	0.000
120	35.702	0.235	0.000	0.235	1693.888	2684.780	0.000
125	34.569	0.230	0.000	0.230	1723.748	2796.646	0.000
130	33.511	0.225	0.000	0.225	1753.152	2908.512	0.000
135	32.520	0.220	0.000	0.220	1782.137	3020.378	0.000
140	31.591	0.216	0.000	0.216	1810.737	3132.244	0.000
145	30.717	0.211	0.000	0.211	1838.981	3244.110	0.000
150	29.894	0.207	0.000	0.207	1866.896	3355.976	0.000
155	29.117	0.204	0.000	0.204	1894.505	3467.841	0.000
160	28.383	0.200	0.000	0.200	1921.829	3579.707	0.000
165	27.687	0.197	0.000	0.197	1948.887	3691.573	0.000
170	27.027	0.194	0.000	0.194	1975.696	3803.439	0.000
175	26.401	0.191	0.000	0.191	2002.273	3915.305	0.000
180	25.804	0.188	0.000	0.188	2028.630	4027.171	0.000

WALTERFEDY

Project: Shergar Developments				Storm Parameters		STORM SEWER DESIGN CALCULATIONS												
Project No: 2019-0561-10				A	1259	Design Frequency	5-year	Maximum Permitted Full Flow Velocity (m/s)			6							
Date: 17-Sep-24				B	8.8			Manning's 'n'			0.013							
Designed By: TK		Checked By: RK		C	0.838	Minimum Permitted Full Flow Velocity (m/s)			0.8									
Pipe Data			Drainage Area			Time		Design Flow		Pipe Flow							Remarks	
From	To	Length (m)	Area (ha)	C	AC	ΣAC	Inlet (min)	System (min)	I (mm/hr)	Q (L/s)	Diameter (mm)	Slope (%)	Q _{FULL} (L/s)	Q/Q _{FULL}	V _{FULL} (m/s)	V (m/s)		Flow Time (min)
Impervious			0.7787	0.95	0.740	0.740	10	10.00	107.72	221.35	450	1.00%	285.11	0.78	1.79	1.98	0.00	No Surcharge
Pervious			0.7213	0.2	0.144	0.144	10	10.00	107.72	43.16	450	1.00%	285.11	0.15	1.79	1.29	0.00	No Surcharge
Average			1.5	0.6	0.900	0.900	10	10.00	107.72	269.29	450	1.00%	285.11	0.94	1.79	2.04	0.00	No Surcharge

WALTERFEDY

Project: Shergar Developments				Storm Parameters		STORM SEWER DESIGN CALCULATIONS												
Project No: 2019-0561-10				A	2375							Maximum Permitted Full Flow Velocity (m/s)			6			
Date: 17-Sep-24				B	11	Design Frequency			100-yr									
Designed By: TK		Checked By: RK		C	0.861	Manning's 'n'			0.013			Minimum Permitted Full Flow Velocity (m/s)			0.8			
Pipe Data			Drainage Area				Time		Design Flow		Pipe Flow							Remarks
From	To	Length (m)	Area (ha)	C	AC	ΣAC	Inlet (min)	System (min)	I (mm/hr)	Q (L/s)	Diameter (mm)	Slope (%)	Q _{FULL} (L/s)	Q/Q _{FULL}	V _{FULL} (m/s)	V (m/s)	Flow Time (min)	
	Impervious		0.7787	0.95	0.740	0.740	10	10.00	172.68	354.83	450	1.00%	285.11	1.24	1.79	1.79	0.00	SURCHARGED
	Pervious		0.7213	0.2	0.144	0.144	10	10.00	172.68	69.20	450	1.00%	285.11	0.24	1.79	1.48	0.00	No Surcharge
	Average		1.5	0.6	0.900	0.900	10	10.00	172.68	431.69	450	1.00%	285.11	1.51	1.79	1.79	0.00	SURCHARGED