2668867 Ontario Inc.

155 Dun Skipper Drive

Design Brief

February 18th, 2025

November 2024
Revised February 2025

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Design Brief
City of Ottawa
Development Application File: D07-12-24-0169

February 18th, 2025

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1 Introduction

1.1 Scope

Arcadis Professional Services (Canada) Inc. (Arcadis, formerly IBI Group) has been retained by 2668867 Ontario Inc. to prepare the necessary engineering plans, specifications and documents to support the proposed amended Site Plan Application for the subject property in accordance with the policies set out by the Planning and Development Branch of the City of Ottawa. This Brief will present a detailed grading and servicing scheme to support the Phase 2 site plan adjustment and will include sections on-site grading, water supply, wastewater management, minor and major stormwater management, and erosion and sediment control.

1.2 Subject Site

The proposed development is part of the previously approved Leitrim Home Hardware site, which is located at the southwest corner of the Bank Street and Dun Skipper Drive intersection. The approved site plan is approximately 2.5 hectares in size and is also bounded by the Idone subdivision to the south and east. Please refer to **Figure 1.1** below for more information regarding the site location.

Figure 1.1 Subject Site Location

The subject property consists of a Home Hardware building (Building A) and three other proposed buildings (Building B-D) with two vehicular accesses. The approved site plan is included in **Appendix A.** Although the subject site will eventually include four buildings, the property owner plans to phase the site development. The first phase includes only Building A, associated parking, and vehicular connection to both Bank Street and Dun Skipper Drive. Please refer to 119351-001 Site Servicing Plan for Phase 1 limits, included in **Appendix A**. Phase 1 was fully constructed in 2022. The previous site plan identified Building B as a 500-bed hotel, while the new site plan changed it to a mixed use apartment building (2-bed: 87 units; 1-bed: 54 units) with commercial area on the ground floor.

A site plan of the proposed development is included in **Appendix A**.

1.3 Previous Studies

Design of this project has been undertaken in accordance with the following reports:

- Design Brief – Bank Street Development, 4836 Bank Street prepared by IBI Group, April 2019, Revised April 2020

An engineering pre-consultation with the City of Ottawa was held in October 2023 regarding the proposed development. Notes from this meeting is included in **Appendix A**.

1.4 Geotechnical Considerations

Paterson Group Inc. was retained to prepare a geotechnical investigation for the site. The objectives of the investigation were to prepare a report to:

- Determine the subsoil and groundwater conditions at the site by means of test pits and boreholes
- To provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations

The geotechnical investigation report PG2934-1 Dated October 4, 2024 confirmed that the site consists of fill underlain by glacial till. The fill generally consists of silty sand with some gravel. The glacial till underlying the fill consists of compact to very dense, brown to grey silty sand with gravel, cobbles and boulders.

The report contains recommendations which include but are not limited to the following:

- Fill used for grading beneath the proposed development to meet OPSS Granular ‘A’ or Granular ‘B’ Type II placed in lifts no greater than 300 mm compacted to 98% SPMDD
- Pavement Structures as identified below

Table 1-1 Pavement Structure – Car Only Parking Areas on Podium Deck

Local Road – Parking Areas	Thickness
12.5 Asphaltic Concrete	50 mm
OPSS Granular A Base	200 mm
Thermal Break	Depends on grade of insulation

Table 1-2 Pavement Structure – Access Lanes, Fire Routes and Heavy Truck Parking Areas on Podium Deck

Local Road	Thickness
12.5 Asphaltic Concrete	40 mm
19.0 Asphaltic Concrete	50 mm
OPSS Granular A Base	300 mm
Thermal Break	Depends on grade of insulation

Table 1-3 Pavement Structure – Car Only Parking Areas on Overburden

Local Road – Parking Areas	Thickness
12.5 Asphaltic Concrete	50 mm
OPSS Granular A Base	150 mm
OPSS Granular B Type II Subbase	300 mm

Table 1-4 Pavement Structure – Access Lanes, Fire Routes and Heavy Truck Parking Areas on Overburden

Local Road	Thickness
12.5 Asphaltic Concrete	40 mm
19.0 Asphaltic Concrete	50 mm
OPSS Granular A Base	150 mm
OPSS Granular B Type II Subbase	450 mm

The report contains recommendations which include but are not limited to the following:

- Pipe bedding and cover: The pipe bedding for water and pipes placed on a relatively dry, undisturbed subgrade surface should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located upon silty clay the thickness of the bedding material should be increased to a minimum of 300 mm of OPSS Granular A. The bedding layer should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A. The bedding and cover materials should be placed in maximum 300 mm thick lifts compacted to a minimum of 99% of the material's SPMDD.
- The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level.

2 Water Supply

2.1 Existing Conditions

As previously noted, the proposed development is located west of Bank Street and south of Dun Skipper Drive. The subject site is flanked on both the north and east sides by existing watermains. Existing 400mm diameter watermains are included in both Bank Street and Dun Skipper Drive. Both watermains fall within the City of Ottawa's pressure district Zone 4C which will provide the water supply to the site. As part of Phase 1, a 200mm watermain has been built to connect to the existing 400mm watermain in Bank Street and Dun Skipper Drive, to create a looped system to service the site.

2.2 Design Criteria

2.2.1 Water Demands

Water demands have been calculated for the development using consumption rates from Table 4.2 of the Ottawa Design Guidelines – Water Distribution. Buildings A, C and D are one or two-storey retail buildings. Building B was identified as a 4-storey hotel with an estimated 500 beds, while the proposed site plan changed to an apartment building (2-bed: 87 units; 1-bed: 54 units) with commercial area on the ground floor. The proposed Building B will include 87 of 2-bedroom and 54 units of 1-bedroom units. A summary of the water consumption rates is as follows:

- Commercial Shopping Center — 2500 l/1000m^2/day
- Other Commercial — 28,000 l/gross ha/day
- Residential — 280 l/cap/day
- 2 Bedroom Apartment — 2.1 persons/unit
- 1 Bedroom Apartment — 1.4 persons/unit
- ICI Average Day Demand — 28,000 l/gross ha/day
- ICI peak Daily Demand — 42,000 l/gross ha/day
- ICI Peak Hour Demand — 75,600 l/gross ha/day

A watermain demand calculation sheet is included in **Appendix B** and the total water demands are summarized as follows:

- Average Day — 0.97 l/s
- Maximum Day — 2.30 l/s
- Peak Hour — 4.98 l/s

2.2.2 System Pressure

The Ottawa Design Guidelines – Water Distribution (WDG001), July 2010, City of Ottawa, Clause 4.2.2 states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 480 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in Clause 4.2.2 of the guidelines and Fire Underwriters Survey (FUS) 2020 are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 150 kPa (22 psi) during a fire flow event.
Maximum Pressure	In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls will be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.2.3 Fire Flow Rates

The subject site plan contains 3 storage buildings (Building A, C & D) and an apartment building with partial commercial ground floor (Building B). Calculations using the Fire Underwriter Survey (FUS) method were conducted to determine the fire flow requirement for Building ‘A’ in the approved Home Hardware site plan. Results of the calculations show a fire demand of 11,000 l/min (183.3 l/s) for Building ‘A’. A copy of the FUS calculations is included in **Appendix B**.

The proposed Building B will fall under Group C and D, residential and commercial shops/Stores occupancy and combustibility. The sprinkler system will be designed and installed in accordance with NFPA-13 requirements. The sprinkler system will be supplied from the city water connection and the demand will be calculated using the hazard classification plus the appropriate inside/outside hose allowances.

Calculations using the Fire Underwriting Survey (FUS version 2020) were conducted to determine the fire flow requirement for the site. Results of the analysis provides a maximum fire flow rate of 10,000 l/min (166.7 l/s) for Building B. Therefore, 11,000 l/min (183.3 l/s) is used for fire flow in the hydraulic analysis. A copy of the FUS calculations is included in **Appendix B**.

2.2.4 Boundary Conditions

The City of Ottawa has provided hydraulic boundary conditions at two locations, one at the existing main on Dun Skipper Drive at the entrance to the site and the other is on the existing Bank Street main at the Bank Street entrance. Boundary conditions have been supplied for the 2019 existing conditions and for the future SUC zone reconfiguration. HGL under basic day scenario is higher in pre-SUC condition while peak hour and max day is lower. Therefore, the existing condition Max HGL is used for the basic day analysis to determine the maximum pressure as it represents the highest HGL elevation. For the peak hour and max day plus fire analysis the existing condition is used in the analysis as these represent the lowest HGL elevations. A copy of the boundary conditions is included in **Appendix B** and summarized as follows:

Table 2-1 Hydraulic Boundary Conditions – Dun Skipper Dr. (Pre-SUC Pressure Zone Reconfiguration)

Criteria	Hydraulic Head (m)	Pressure (psi)
Max HGL (Basic Day)	154.6	78.3
Peak Hour	143.9	63.1
Max Day + Fire Flow (11,000 L/m)	125.1	36.3

Ground elevation: 99.5 m

Table 2-2 Hydraulic Boundary Conditions – Bank Street (Pre-SUC Pressure Zone Reconfiguration)

Criteria	Hydraulic Head (m)	Pressure (psi)
Max HGL (Basic Day)	154.6	79.1
Peak Hour	143.9	63.9
Max Day + Fire Flow (11,000 L/m)	124.6	36.4

Ground elevation: 99.0 m

Table 2-3 Hydraulic Boundary Conditions – Dun Skipper Dr. (Post-SUC Pressure Zone Reconfiguration)

Criteria	Hydraulic Head (m)	Pressure (psi)
Max HGL (Basic Day)	147.3	67.9
Peak Hour	144.6	64.1
Max Day + Fire Flow (11,000 L/m)	140.2	57.8

Ground elevation: 99.5 m

Table 2-4 Hydraulic Boundary Conditions – Bank Street (Post-SUC Pressure Zone Reconfiguration)

Criteria	Hydraulic Head (m)	Pressure (psi)
Max HGL (Basic Day)	147.3	68.7
Peak Hour	144.3	64.5
Max Day + Fire Flow (11,000 L/m)	139.2	57.2

Ground elevation: 99.0 m

2.2.5 Hydraulic Model

A computer model for the subject site has been developed using the InfoWater Pro program by Autodesk. The model includes the existing watermain and boundary condition at Dun Skipper Drive and Bank Street.

2.3 Proposed Water Plan

2.3.1 Proposed Water Plan

In order to provide additional reliability to the system in case of a watermain break, two connections to the City's watermain system were proposed and constructed in Phase 1. One proposed connection is to the existing 400 mm watermain within the Dun Skipper Drive right of way and the other proposed connection is to the 400 mm watermain in Bank Street. The approved water plan, Drawing 119351-001 Site Servicing Plan, is included in **Appendix B**. The proposed fire hydrant layout also includes an unobstructed path of no more than 45m between the hydrant and

Siamese connections as required by the Ontario Building Code. Refer to the general plan of services **Drawing C-001** for detailed watermain layout for the proposed development.

2.3.2 Hydraulic Analysis

The hydraulic model was run under basic day conditions to determine the maximum pressure for the site. The minimum pressure for the site is determined in the peak hour analysis using the provided boundary condition. The site are serviced by two connections to the existing 400 mm watermains on Dun Skipper Drive and Bank Street. All watermains are 200 mm diameter except for the 150 mm diameter stubs which services Buildings ‘A’, ‘B’ and ‘D”. There are three fire hydrants, represented by nodes TH-010, TH-030 and T-150 in the model. Nodes TH-010 and TH-030 are adjacent to Buildings ‘A’ and ‘D’ with a fire demand of 11,000 l/min, which have been built in Phase 1. Node T-150 is adjacent to Buildings ‘B’ with a fire demand of 10,000 l/min. An existing hydrant on Dun Skipper Drive also provides fire protection to Building ‘B’ and is represented by Node S15-300 in the water model. Results of the analysis for the site are summarized in Section 2.3.2. Water model schematic and detailed model results are included in **Appendix B**.

The main level finished floor elevation for Building B will be approximately 100.85m. Under peak hour condition, the hydraulic head is 143.89m. The head difference to the main level is 43.04m which converts to a water pressure inside the building is 422 kPa, which exceeds the minimum requirement of 276 kPa per the City guidelines.

The minimum pressures of 276kPa are not achieved when the floor levels are higher than 14.90m under the peak hour conditions. Therefore, the pressures are not achieved at elevation 115.75m. The 5th floor elevation is approximately 114.95m and the 6th floor elevation is approximately 118.25m. The minimum pressures are not provided for levels higher than 5th floor. Therefore, booster pumps are required and shall be designed by a qualified mechanical engineer at building permit stage.

2.3.3 Modeling Results

The hydraulic model was run under basic day, maximum day with fire flows and under peak hour conditions. Results of the hydraulic model are included in **Appendix B** and summarized as follows:

- Basic Day (Max HGL) Pressure Range (kPa) 510.54 – 542.39
- Peak Hour (Min HGL) Pressure Range (kPa) 405.64 – 437.53
- Fire Flow @ 11,000 L/min Residual Pressure (kPa) 168.21 – 199.61
- Residual Pressure @ 150 kPa Available Fire Flow (l/s) 209.22 – 330.22

A comparison of the results and design criteria is summarized as follows:

Maximum Pressure	No nodes in basic day scenario exceed 552 kPa (80 psi), therefore no pressure reducing control is required for the buildings in this development.
Minimum Pressure	All nodes in the model exceed the minimum value of 276 kPa (40 psi). Considering this is a 9-storey apartment building, the water pressure at the 6th to 9th levels drop below the minimum pressure. Therefore, booster pumps are required for the proposed building.
Fire Flow	The minimum design fire flow under maximum day conditions with minimum system pressure of 150 kPa is 209.22 l/s for retail which exceeds the requirement of 183.3 l/s (11,000 l/min) from Section 2.3.3.

3 Wastewater Disposal

3.1 Existing Conditions

The subject site is located within the Leitrim Development Area where sanitary flows ultimately outlet to the Leitrim Sanitary Pumping Station. As part of the adjacent downstream developments, the outlet sanitary sewer system for the subject site was completed. A 200mm diameter sanitary sewer in Dun Skipper Drive was constructed as part of the Pathways Phase 1 project. That sewer (at MH1A) was also sized for the upstream Idone commercial lands. To service Building A (Home Hardware) in Phase 1, a 200mm diameter sanitary sewer has been built within the site. A copy of the sanitary sewer design sheet and drainage area plan for the approved overall site 119351-400 can be found in **Appendix C.**

3.2 Design Criteria

The sanitary sewers for the subject site will be based on the City of Ottawa design criteria. It should be noted that the sanitary sewer design for this study incorporates the latest City of Ottawa design parameters identified in Technical Bulletin ISTB-2018-01. Some of the key criteria will include the following:

- Average commercial flow = 28,000 l/s/ha
- Peak ICI flow factor = 1.5 if ICI area is > 20% total area
  1.0 if ICI area is ≤ 20% total area
- Inflow and Infiltration Rate = 0.33 l/s/ha
- Minimum Full Flow Velocity = 0.60 m/s
- Maximum Full Flow Velocity = 3.0 m/s
- Minimum Pipe Size = 250 mm diameter (for ICI lands per OSDG)

3.3 Recommended Wastewater Plan

The on-site sanitary system will consist of a network of 200mm PVC sewers installed at normal depth and slope and will provide a single service connection to each commercial building. The sewers have been designed using the criteria noted above in Section 3.2 and outlet via a connection to the sanitary sewer (*EXMH6138A*) within the Dun Skipper Drive right of way. The Dun Skipper sanitary sewer was designed assuming 4.07 Ha of commercial lands from the subject site, includes upstream Idone commercial property, with a total flow of 4.67 l/s. As noted previously, Building B was originally approved as a 500-bed hotel. The proposed new building will include less units (141 units in total) and less building area. This site generates approximately 6.24 l/s. The minor (1.57 l/s) increase in flow to MH 6138A has negligible impact on the system as it has over 76% spare capacity up to MH 6136A.

A copy of the sanitary sewer design sheet can be found in **Appendix C.** Please refer to the General Plan of Services **Drawing C-001** for further details.

4 Site Stormwater Management

4.1 Existing Conditions

The 2016 Updated Serviceability Report recommended that the subject site and the upstream Idone commercial site be serviced with a 1350 mm diameter minor storm sewer. That sewer was constructed in 2017 as part of the downstream Pathway Phase 1 development and is presently terminated near the north-east corner on the subject site.

As noted previously, the subject development will be sub phased. The first phase has been fully constructed, which include Building A, associated parking, and vehicular connection to both Bank Street and Dun Skipper Drive. A 750 mm diameter storm sewer was built near the Dun Skipper Drive driveway access, and extended throughout the site to the upstream Idone commercial site. Phase 2 will only include Building B and associated parking.

4.2 Design Criteria

IBI Group completed the municipal infrastructure design for the Pathways Phase 1 development. That design included a review of the allowable flow from the subject site including the adjacent Idone commercial property. The "Pathways" design assumed that the allowable minor storm release rate for the two commercial sites was 760 l/s and that the 1:100 year storm event would be self-contained with no overflow to adjacent properties. The emergency overflow for events greater than the 1:100 year event would be directed to Bank Street.

The stormwater system was designed following the principles of dual drainage, making accommodations for both major and minor flow.

Some of the key criteria include the following:

• Design Storm	1:2 year return (Ottawa)
• Rational Method Sewer Sizing	1:2 year return (Ottawa)
• Initial Time of Concentration	10 minutes
• Runoff Coefficients	
- Landscaped Areas	C = 0.20
- Asphalt/Concrete	C = 0.90
- Roof	C = 0.90
• Pipe Velocities	0.80 m/s to 6.0 m/s
• Minimum Pipe Size	250 mm diameter (200 mm CB Leads)

4.3 Proposed Minor System

Using the criteria identified in Section 4.2, the proposed on-site storm sewers were sized accordingly. A detailed storm sewer design sheet and the associated Storm Sewer Drainage Area plan (drawing 119351-500) for the overall site are both included in **Appendix D**. The overall Site Servicing Plan (drawing 119351-001), depicting all on-site storm sewers can be found in **Appendix A**.

The proposed minor storm sewers will range in size between 250 mm diameter and 450 mm diameter in Phase 2. The minor storm sewer outlet will be via the 750 mm diameter pipe which ultimately connects to the existing 1350 mm diameter storm sewer in Dun Skipper Drive.

The 1350 mm diameter storm sewer in Dun Skipper Drive ultimately outlets to the Findlay Creek Village SWMF. This facility provides 80% TSS removal, as such no additional on-site stormwater quality control is required within the subject lands.

A detailed storm sewer design sheet and the associated storm sewer drainage area plan is included in **Appendix D**. The General Plan of Services, depicting all on-site storm sewers can be found in **Appendix A**.

4.4 Stormwater Management

The subject site will be limited to a release rate established using the criteria described in section 4.2. This will be achieved through a combination of inlet control devices (ICD's) at inlet locations and surface storage.

Flows generated that are in excess of the site's allowable release rate will be stored on site in strategic surface storage areas or by the use of roof top storage and gradually released into the minor system so as not to exceed the site's allocation.

The maximum surface retention depth located within the developed areas will be limited to 300mm during a 1:100 year event as shown on the ponding and grading plans located in **Appendix D.**

Overland flow routes will be provided in the grading to permit emergency overland flow, in excess of the 100-year event, from the site.

At certain locations within the site, the opportunity to store runoff is limited due to grading constraints and building geometry. These locations are generally located at the perimeter of the site where it is necessary to tie into public boulevards and adjacent properties or in areas where ponding stormwater is undesirable. The area west of building D (Drainage Area MH6136), will flow uncontrolled to the Dun Skipper right-of-way. This uncontrolled area – 0.01 hectares in total, have an average C value of 0.5 (x1.25 as per City Comment). Based on 1:100 year storm uncontrolled flows, the uncontrolled areas generate 3.10 l/s runoff (refer to Section 4.5 for the calculation). Another uncontrolled area along north and east property side, adjacent to Building B (Drainage Area UNRES) – 0.05 hectares in total, have an average C value of 0.9 (x1.25, maximum 1.0 as per City Comment). Based on 1:100 year storm uncontrolled flows, the uncontrolled areas generate 24.82 l/s runoff (refer to Section 4.5 for the calculation).

The site grading and ponding has been designed to control water generated during the 1:100-year event, with no overflow leaving the site. Please refer to the SWM calculations in **Appendix D**.

4.5 Inlet Control

The allowable 2-year post-development release rate for the 2.49 Ha site can be calculated as follows:

$\mathbf{Q_{allowable}}$	= 760 L/s as per IBI Pathways Phase 1 Report – EXT 4 drainage area
Total Area EXT 4	= 4.04 Ha
Subject Land share	= 62% of EXT4 release rate (2.5 Ha / 4.04 Ha = 0.62)
$\mathbf{Q_{allowable\ subject\ land}}$	= 468.42 **L/s**

As noted in Section 4.4, the landscaped area along the west property line will drain offsite uncontrolled.

Based on a 100-year event, the flow from the 0.01 Ha uncontrolled area MH6136 can be determined as:

$\mathbf{Q_{uncontrolled}}$ = $\mathbf{2.78} \times \mathbf{C} \times \mathbf{i_{100yr}} \times \mathbf{A}$ where:

C = Average runoff coefficient of uncontrolled area = 0.50

$\mathbf{i_{100yr}}$ = Intensity of 100-year storm event (mm/hr)

= $1735.688 \times (T_c + 6.014)^{0.820}$ = 178.56 mm/hr; where T_c = 10 minutes

A = Uncontrolled Area = 0.01 Ha

Therefore, the uncontrolled release rate can be determined as:

$\mathbf{Q_{uncontrolled}}$ = $\mathbf{2.78} \times \mathbf{1.25C} \times \mathbf{i_{100yr}} \times \mathbf{A}$

= 2.78 x 1.25 x 0.50 x 178.56 x 0.01

= **3.10 L/s**

The flow from the uncontrolled area UNRES to the north and east side of Building B can be determined as:

$\mathbf{Q_{uncontrolled}}$ = $\mathbf{2.78} \times \mathbf{C} \times \mathbf{i_{100yr}} \times \mathbf{A}$

= 2.78 x 1.0 x 178.56 x 0.05

= **24.82 L/s**

The maximum allowable release rate from the remainder of the site can then be determined as:

$\mathbf{Q_{max\ allowable}}$ = $\mathbf{Q_{restricted} - Q_{uncontrolled}}$

= 468.42 L/s – 3.10 L/s – 24.82 L/s

= **440.49 L/s**

Based on the flow allowance at the various inlet locations, a combination of various sizes of inlet control devices (ICDs) were chosen for the design. The design of the inlet control devices is unique to each drainage area and is determined based on several factors, including hydraulic head and allowable release rate. The inlet control devices were sized according to the manufacturer's design charts. The restrictions will cause the on-site catch basins and manholes to surcharge, generating surface ponding in the parking and landscaped areas. Ponding locations and elevations are summarized on the Ponding Plan **Drawing C-600**, and included in **Appendix D**.

4.6 On-Site Detention

Any excess storm water up to the 100-year event is to be stored on-site to avoid surcharging the downstream municipal storm sewer system. Detention will be provided in parking and landscape areas and building rooftops, where feasible. As previously noted, the volume of storage is dependent on the characteristics of each individual drainage area and the ICDs were chosen accordingly. It should be noted that 0.30m of vertical separation has been provided from all maximum ponding elevations to lowest building openings. Stormwater management and on-site underground storage volume calculations, and manufacturers spec sheets are included in **Appendix D**.

Arcadis Response: Interim Storm Drainage Area Plan C-501 and Interim Ponding Plan C-601 have been included. Interim summary tables are also included in Section 4.8.

Provide a table like this for both interim and ultimate condition. There needs to be a different Storm Drainage Area Plan and Ponding Plan provided for each condition as well. Each table should correspond to the respective build-out scenario.

The tables must provide enough information to determine that the overall peak release rate and storage requirements are satisfied for each scenario.

4.6.1 Site Inlet Control

The following Table summarizes the on-site storage requirements during 1:100-year events.

Table 4-1 Post-Development Storage Summary Table

Drainage Area	ICD Structure Location	Tributary Area (Ha)	Restricted Flow (L/s)	Storage Required (m^3)	Storage Provided (m^3)		
			100-year	100-year	Surface	Underground	Total
MH9/MH9B	*MH8*	*0.14*	*10*	*44.84*	*20.64*	*10.07*	30.71
MH8	*CB1*	*0.17*	*16*	*43.02*	*50.59*	*5.58*	56.17
MH5B	*CB16*	*0.01*	*6*	*1.56*	*0.31*	*0.00*	0.31
MH5A	*CB17*	*0.09*	*9*	*25.47*	*0.84*	*5.10*	5.94
CB20	**CB20**	**0.12**	**15**	**30.02**	**12.51**	**0.00**	**12.51**
MH22	**MH22**	**0.06**	**6**	**4.00**	**2.87**	**46.61**	**49.48**
CB24	**CB24**	**0.10**	**15**	**22.31**	**0.00**	**0.22**	**0.22**
CB25	**CB25**	**0.02**	**6**	**2.36**	**0.27**	**0.00**	**0.27**
MH21	**MH21**	**0.24**	**33**	**81.05**	**11.79**	**96.68**	**108.47**
MH1D	**CB10**	**0.11**	**45**	**8.77**	**6.81**	**0.00**	**6.81**
CBMH2	*CBMH2*	*0.08*	*20*	*11.83*	*6.21*	*0.00*	6.21
CBMH1C	*CB7*	*0.08*	*30*	*7.30*	*6.97*	*0.00*	6.97
CBMH1B	*CB6*	*0.07*	*20*	*9.01*	*13.66*	*0.00*	13.66
CBMH1A	*CB5*	*0.06*	*15*	*8.87*	*3.41*	*0.00*	3.41
MH1B	**CB8**	**0.17**	**47**	**22.66**	**24.90**	**1.60**	**26.5**
MH10A	*CB4*	*0.03*	*6*	*5.42*	*10.62*	*0.00*	10.62
MH10B	*CBMH1*	*0.08*	*20*	*11.83*	*0.00*	*0.00*	0
MH1A	**CB9**	**0.15**	**43**	**19.23**	**10.83**	**0.00**	**10.83**
CBMH20	**CBMH20**	**0.10**	**15**	**32.84**	**109.61**	**0.00**	**109.61**
TOTAL		**1.88**	**377**	**392.39**	**292.84**	**165.86**	**458.70**

** Existing(italic) and future (bold) drainage areas are grey hatched.*

4.6.2 Roof Inlet Controls

The proposed buildings will have roof inlet controls that help to control the amount of stormwater being released into the system. The restricted flow rate for the proposed building is shown below.

Arcadis Response: Interim Storm Drainage Area Plan C-501 and Interim Ponding Plan C-601 have been included. Interim summary tables are also included in Section 4.8.

Provide a table like this for both interim and ultimate condition. There needs to be a different Storm Drainage Area Plan & Ponding Plan provided for each condition as well. Each table should correspond to the respective build-out scenario.

The tables must provide enough information to determine that the overall peak release rate and storage requirements are satisfied for each scenario.

Table 4-2 Post-Development Roof Storage Summary Table

Roof Area	Tributary Area	100-Year Storm		
		Restricted Flow (L/s)	Required Storage (m^3)	Storage Provided (m^3)
Building A	*0.30*	*27.0*	*89.56*	*90.00*
Building B	**0.19**	**20.0**	**52.35**	**57.00**
Building C	**0.05**	**8.0**	**10.68**	**13.50**
Building D	**0.05**	**8.0**	**10.68**	**11.25**
TOTAL	**0.62**	**63.0**	**163.27**	**171.75**

** Existing(italic) and future (bold) drainage areas are grey hatched.*

4.6.3 Overall Release Rate

Provide a conclusive statement for both interim and ultimate build-out scenarios.

As noted above, the site uses new inlet control devices to restrict the 100 year storm event to the criteria approved by the City of Ottawa. Restricted stormwater will be contained onsite by utilizing surface ponding, in structure/pipe and rooftop storage. In the 100 year event, there will be no off-site overflow.

The sum of restrictions on the site, rooftops and uncontrolled flows is 467.92 l/s (377 l/s + 63.00 l/s + 3.10 L/s +24.82 l/s), which is less than the allowable release of 468.42 l/s noted in section 4.6.

Arcadis Response: Added discussion for interim conditions in Section 4.8.

4.7 Underground Storage

Due to the site's constraints and the stormwater management plan, underground storage was deemed the best option to contain the 100-year storm event on site. The table below summarizes underground storage, and additional information about the underground storage structures is found in **Appendix D.**

Table 4-3 Underground Storage Summary Table

Storage Name	Structure Type	Storage Provided (m^3)
MH22	Clear Stone Gallery	43.01
MH21	Stormtech SC-310 or approved equivalent Plus the storage pipe and structures	88.64

The overall site plan was approved in 2022, and 100+20% stressed test analysis was not provided. Building B follows the overall site plan design standards, and 0.3m free board are provided throughout the site. The site grading and ponding has been designed to control water generated during the 1:100-year event, with no overflow leaving the site.

As noted in Section 4.4, the 1350 mm diameter storm sewer in Dun Skipper Drive ultimately outlets to the Findlay Creek Village SWMF. This facility provides 80% TSS removal, as such no additional on-site stormwater quality control is required within the subject lands.

4.8 Interim conditions

During interim conditions, flows from future development lands will be directed into the dry pond, including the areas from phase 1 & 2 that drains towards the future lands. The total area is calculated to be 0.58 ha, with an average C of 0.56. Refer to Storm Drainage Area Plan C-500 for Detailed C calculations.

The ICD will be installed for CBMH20, with a release rate of 15 L/s. Table 4-4 below provides the detailed calculation for the storage required during interim conditions for a 100 year event.

Table 4-4 100-Year Storage Calculation for Interim Conditions

Drainage Area	**CBMH20**	*Previously Drainage Area Plan - CB18*			
Area (Ha)	0.580				
C =	0.56	Restricted Flow Q_r (L/s) =		15.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi_{100yr}A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
49	64.91	58.61	15.00	43.61	128.20
50	63.95	57.75	15.00	42.75	128.24
51	63.03	56.92	15.00	41.92	**128.26**
52	62.14	56.11	15.00	41.11	128.26
53	61.28	55.33	15.00	40.33	128.24
	Storage (m^3)				
	Overflow	**Required**	**Surface**	**Sub-surface**	**Balance**
	29.75	158.01	163.49	0.00	0.00

The ponding plan shows that the ponding elevation is 9 cm above the T/G of CBMH20 during the 100 year event. Review and revise accordingly.

Arcadis Response: The table on Ponding Plan 600 shows the ultimate condition. A total of 32.84m3 of storage is required for this drainage area, thus end up with only 0.09m of ponding depth.

Interim ponding plan C-601 is added, to illustrate the pondings during interim conditions.

Table 4-1 Post-Development Storage Summary Table

Drainage Area	ICD Structure Location	Tributary Area (Ha)	Restricted Flow (L/s)	Storage Required (m^3)	Storage Provided (m^3)		
			100-year	100-year	Surface	Underground	Total
MH9/MH9B	*MH8*	*0.14*	*10*	*44.84*	*20.64*	*10.07*	30.71
MH8	*CB1*	*0.17*	*16*	*43.02*	*50.59*	*5.58*	56.17
MH5B	*CB16*	*0.01*	*6*	*1.56*	*0.31*	*0.00*	0.31
MH5A	*CB17*	*0.09*	*9*	*25.47*	*0.84*	*5.10*	5.94
CB20	**CB20**	**0.12**	**15**	**30.02**	**12.51**	**0.00**	**12.51**
MH22	**MH22**	**0.06**	**6**	**4.00**	**2.87**	**46.61**	**49.48**
CB24	**CB24**	**0.10**	**15**	**22.31**	**0.00**	**0.00**	**0.00**
CB25	**CB25**	**0.02**	**6**	**2.36**	**0.27**	**0.00**	**0.27**
MH21	**MH21**	**0.24**	**33**	**81.05**	**11.79**	**96.68**	**108.47**
MH1D	**CB10**	**0.11**	**45**	**8.77**	**6.81**	**0.00**	**6.81**
CBMH2	*CBMH2*	*0.08*	*20*	*11.83*	*6.21*	*0.00*	6.21
CBMH1C	*CB7*	*0.08*	*30*	*7.30*	*6.97*	*0.00*	6.97
CBMH1B	*CB6*	*0.07*	*20*	*9.01*	*13.66*	*0.00*	13.66
CBMH1A	*CB5*	*0.06*	*15*	*8.87*	*3.41*	*0.00*	3.41
MH1B	**CB8**	**0.17**	**47**	**22.66**	**24.90**	**1.60**	**26.5**
MH10A	*CB4*	*0.03*	*6*	*5.42*	*10.62*	*0.00*	10.62
MH10B	*CBMH1*	*0.08*	*20*	*11.83*	*0.00*	*0.00*	0
MH1A	**CB9**	**0.15**	**43**	**19.23**	**10.83**	**0.00**	**10.83**
CBMH20	**CBMH20**	**0.10**	**15**	**32.84**	**131.62**	**0.00**	**131.62**
TOTAL		**1.88**	**377**	**392.39**	**314.85**	**165.64**	**480.49**

** Existing (italic) and future (bold) drainage areas are grey hatched.*

5 Grading and Roads

5.1 Site Grading

The existing grades within portions of the proposed development lands vary significantly due to the existing topography of the site. The grading plan will require the balancing of various requirements including but not limited to geotechnical constraints, minimum/maximum slopes, overland routing of stormwater, all to ensure the site is graded in accordance with municipal and accessibility standards.

Refer to the grading plan provided in **Appendix E**.

In order to meet the stringent stormwater management criteria, every effort was made to reduce uncontrolled discharge from the site. In landscape areas where typical 2-7% grading cannot be met, 3:1 maximum terracing has been utilized to tie the proposed grading into existing.

5.2 Road Network

No public roads are proposed through the site. A minimum 9.0m wide drive aisle has been provided, as shown on the Site Plan in **Appendix A.** An internal Fire route has been shown where fire truck access is required, as determined by the site architect.

There are a total of 387 parking stalls provided, including 160 parking stalls for Building A & D, 171 for Building B and 56 for Building C. A total of 6 barrier-free parking stalls are provided for the proposed Building B.

Pedestrian access facilities are provided in the unsecured area of the site nearest to Bank Street and Dun Skipper Drive, which provide access to the building.

A bicycle parking facility has been proposed adjacent to each building entrance where feasible.

Earthbin (or similar approved type) garbage facilities have been provided throughout.

Noise attenuation features and indoor noise clause provisions will not be required for commercial use lands for road noise generated by the adjacent roads.

6 Source Controls

6.1 General

Since an end of pipe treatment facility is already provided for the development lands, stormwater site management for the subject lands will focus on site level or source control management of runoff. Such controls or mitigative measures are proposed for this development not only for final development but also during construction and build out. Some of these measures are:

- Flat site grading where possible
- Vegetation planting
- Groundwater recharge in landscaped areas

6.2 Lot Grading

Where possible, all of the proposed blocks within the development will make use of gentle surface slopes on hard surfaces such as asphalt and concrete. In accordance with local municipal standards, all grading will be between 0.5 and 5.0 percent for hard surfaces and 2.0 and 7.0 percent for all landscaped areas. Significant grade changes will be accomplished through the use of terracing (3:1 max slope), ramps and/or retaining walls. All street and parking lot catch basins shall be equipped with 3.0m subdrains on opposite sides of a curbside catch basin running parallel to the curb, and with 3.0m subdrains extending out from all 4 sides of parking lot catch basins.

6.3 Vegetation

As with most site plans, the developer will be required to complete a vegetation and planting program. Vegetation throughout the development including planting along roadsides and within the individual blocks provides opportunities to re-create lost vegetation.

6.4 Groundwater Recharge

Groundwater recharge targets have not been identified for this site. Perforated sub-drain systems will be implemented at capture locations in all vegetated areas. This will promote increased infiltration during low flow events before water is collected by the storm sewer system.

7 Conveyance Controls

7.1 Generals

Besides source controls, the development also proposes to use several conveyance control measures to improve runoff quality. These will include:

- Vegetated swales
- Catch basin sumps and manhole sumps

7.2 Catch basins and Maintenance Hole Sumps

All catch basins within the development, either rear yard or street, will be constructed with minimum 600 mm deep sumps. These sumps trap pollutants, sand, grit and debris which can be mechanically removed prior to being flushed into the minor pipe system. Both rear yard and street catch basins will be to OPSD 705.02. All storm sewer maintenance holes serving local sewers less than 900 mm diameter shall be constructed with a 300 mm sump as per City standards.

8 Sediment and Erosion Control Plan

8.1 General

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. Although construction is only a temporary situation, it is proposed to possibly introduce a number of mitigative construction techniques to reduce unnecessary construction sediment loadings. These may include:

- Until the local storm sewer is constructed, groundwater in construction trenches shall be pumped into a filter mechanism prior to release to the environment
- Vegetated swale sediment capture filter socks will remain on open surface structures such as maintenance holes and catch basins until these structures are commissioned and put into use
- Silt fence on the site perimeter will be installed

8.2 Trench Dewatering

Any trench dewatering using pumps will be discharged into a filter trap made up of geotextile filters and straw bales similar in design to the OPSD 219.240 Dewatering Trap. These will be constructed in a bowl shape with the fabric forming the bottom and the straw bales forming the sides. Any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filters as needed, including sediment removal and disposal and material replacement as needed. It should be noted that that the contractor will be responsible for the design and management of the trap(s).

8.3 Seepage Barriers

In order to further reduce sediment loading to the stormwater management facility, seepage barriers will be installed on any surface water courses at appropriate locations that may become evident during construction. These barriers will be Light Duty Straw Bale Barriers per OPSD 219.100 and Heavy-Duty Silt Fence Barriers per OPSD 219.130; locations are shown on the Sediment and Erosion Control Plan included in **Appendix E**. They are typically made of layers of straw bales or geotextile fabric staked in place. All seepage barriers will be inspected and maintained as needed.

8.4 Surface Structure Filters

All catch basins, and to a lesser degree, manholes, convey surface water to sewers. Until streets are asphalted and curbed, all catch basins and manholes will be constructed with sediment capture inserts or equivalent located between the structure frame and cover. These will stay in place and be maintained during construction and build until it is appropriate to remove same.

9 Conclusion

This report and the accompanying working drawings clearly indicate that the proposed development meets the requirements of the stakeholder regulators, including the City of Ottawa, provincial MECP and SNC. The proposed development is in general conformance with the recommendations of both the 2016 Updated Serviceability Report and the Pathways Phase 1 design.

There is a reliable water supply available adjacent to the proposed development; a wastewater outlet is available adjacent to the site, local storm sewers have been installed adjacent to the site and an expansion to the existing Findlay Creek Village Stormwater Facility has been constructed to collect and treat runoff from the subject site.

Based on the information provided within this report, the plans prepared for the subject development can be serviced to meet City of Ottawa requirements.

Appendix A

Site Plan

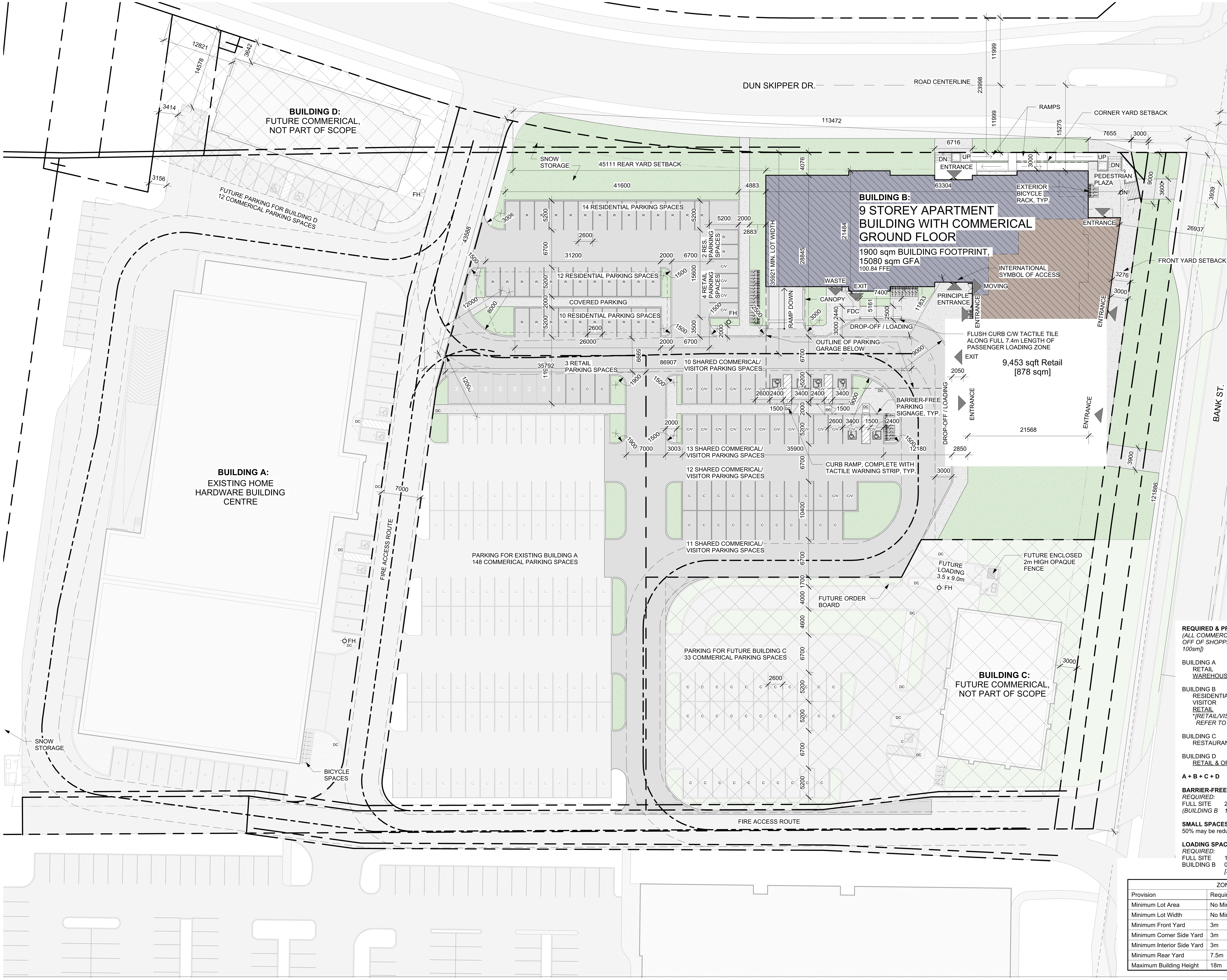
Site Servicing Plan 148290-C-001

AOV Legal Plan

Site Servicing Plan 119351-C-001

Pre-Consultation City Comments

Study and Plan Identification List



DO NOT SCALE DRAWINGS

CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH THE WORK.

DRAWINGS NOT TO BE USED FOR CONSTRUCTION UNLESS STAMPED AND SIGNED BY THE CONSULTANT.

THESE DRAWINGS HAVE BEEN DESIGNED IN COMFORMANCE WITH THE ONTARIO BUILDING CODE.

Revisions

Revision Number	Revision Date	Revision Description
1	2024-02-20	MINOR VARIANCE
2	2024-12-09	MINOR VARIANCE r1

BICYCLE SCHEDULE

Type	Count
GARAGE P2	
Bicycle Space, Horizontal	16
GARAGE P1	
Bicycle Space, Horizontal	20
GROUND FLOOR	
Bicycle Space, Horizontal	40
	76

UNITS PER FLOOR

Level	Count
SECOND FLOOR	18
THIRD FLOOR	18
FOURTH FLOOR	18
FIFTH FLOOR	18
SIXTH FLOOR	18
SEVENTH FLOOR	18
EIGHTH FLOOR	18
NINTH FLOOR	15
	141

UNIT MIX

Name	Area	Count
1 BEDROOM A3	670 ft²	16
1 BEDROOM A1	690 ft²	16
1 BEDROOM A5	710 ft²	8
1 BEDROOM A2	750 ft²	16
1 BEDROOM A4	750 ft²	16
1 BEDROOM A6	750 ft²	2
1 BEDROOM A6	760 ft²	2
1 BEDROOM A4	790 ft²	8
1 BEDROOM A4	840 ft²	3
2 BEDROOM B3	990 ft²	4
2 BEDROOM B2	1050 ft²	8
2 BEDROOM B1	1080 ft²	7
2 BEDROOM B4	1080 ft²	3
2 BEDROOM B1	1090 ft²	7
2 BEDROOM + DEN C2	1100 ft²	4
2 BEDROOM B1	1100 ft²	7
2 BEDROOM B1	1110 ft²	7
2 BEDROOM +DEN C1	1410 ft²	7
		141

87 [62%] 1 BEDROOM
54 [38%] 2 BEDROOM

PARKING SCHEDULE

Type	Mark	Count
BUILDING B		
GARAGE P2		
Std Space 2600x5200	R	43
Small Space 2400x4600	Rs	2
Small Space 2400x5200	Rs	1
Small Space 2600x4600	Rs	6
GARAGE P1		
Std Space 2600x5200	R	42
Small Space 2400x4600	Rs	2
Small Space 2400x5200	Rs	1
Small Space 2600x4600	Rs	6
GROUND FLOOR		
Std Space 2600x5200	C	24
BF Space Type A 3400x5200	C/V	3
BF Space Type B 2400x5200	C/V	3
Std Space 2600x5200	C/V	23
Std Space 2600x5200	R	38
		194
EXISTING A&D		
GROUND FLOOR		
BF Space Type A 3400x5200	C	3
BF Space Type B 2400x5200	C	3
Std Space 2600x5200	C	154
		160
FUTURE C		
GROUND FLOOR		
BF Space Type A 3400x5200	C	1
Std Space 2600x5200	C	32
		33
		387

AMENITY AREA

	REQ'D	PROPOSED
TOTAL	6sqm/UNIT (870sqm)	1510
COMMUNAL	>50% TOTAL	560
BALCONIES	N/A	950

Interior of Building contains enough Amenity Area that no exterior Amenity Area is needed

BICYCLES

	REQ'D	PROPOSED
RESIDENTIAL 0.5 PER UNIT	71	71
RETAIL 1/250sqm GFA	4	4

TOTAL 75 (40 EXTERIOR, 35 UNDERGROUND WITHIN THE 92 TENANT STORAGE LOCKERS)

REQUIRED & PROPOSED PARKING RATES
(ALL COMMERCIAL SPACES HAVE BEEN CALCULATED BASED OFF OF SHOPPING CENTRE REQUIREMENTS [3.6 SPACES / 100sm])

			REQ'D	PROV.
BUILDING A				
RETAIL	1,944.6 sqm / 100 x 3.6	=	70	
WAREHOUSE	1,108.5 sqm / 100 x 3.6	=	40	
			110	148
BUILDING B				
RESIDENTIAL	1 / UNIT	=	141	141
VISITOR	0.2 / UNIT	=	29	
RETAIL	878 sqm / 100 x 3.6	=	32	53
*[RETAIL/VISITOR TO BE SHARED REFER TO TDM DD & INF. 6.1.3]			202	194
BUILDING C				
RESTAURANT	502.2 sqm / 100 x 3.6	=	18	33
BUILDING D				
RETAIL & OFFICE	987 sqm / 100 x 3.6	=	36	12
A + B + C + D		=	366	387

BARRIER-FREE PARKING

REQUIRED:			PROVIDED:
FULL SITE	201-1000	2 + 2% = 10	13
(BUILDING B	101-200	1 + 3% = 6	6)

SMALL SPACES
50% may be reduced if signed and >300mm from obstruction.

LOADING SPACES

REQUIRED:			PROVIDED:
FULL SITE	1 MIN. FOR 2000-4999sqm	[4928sqm]	2
BUILDING B	0 FOR 1000-1999sqm	[878sqm]	0

[3m wide Loading & Drop-off Area Provided]

ZONING TABLE

Provision	Required	Provided
Minimum Lot Area	No Minimum	7398 sqm
Minimum Lot Width	No Minimum	35.9m
Minimum Front Yard	3m	3.2m
Minimum Corner Side Yard	3m	3.2m
Minimum Interior Side Yard	3m	3.2m
Minimum Rear Yard	7.5m	45.1m
Maximum Building Height	18m	34.2m

Alexander Wilson Architect Inc
Admiralty Place
103-20 Gore Street
Kingston Ontario, K7L 2L1
t: 613.545.3744 ext 213
f: 613.545.1411

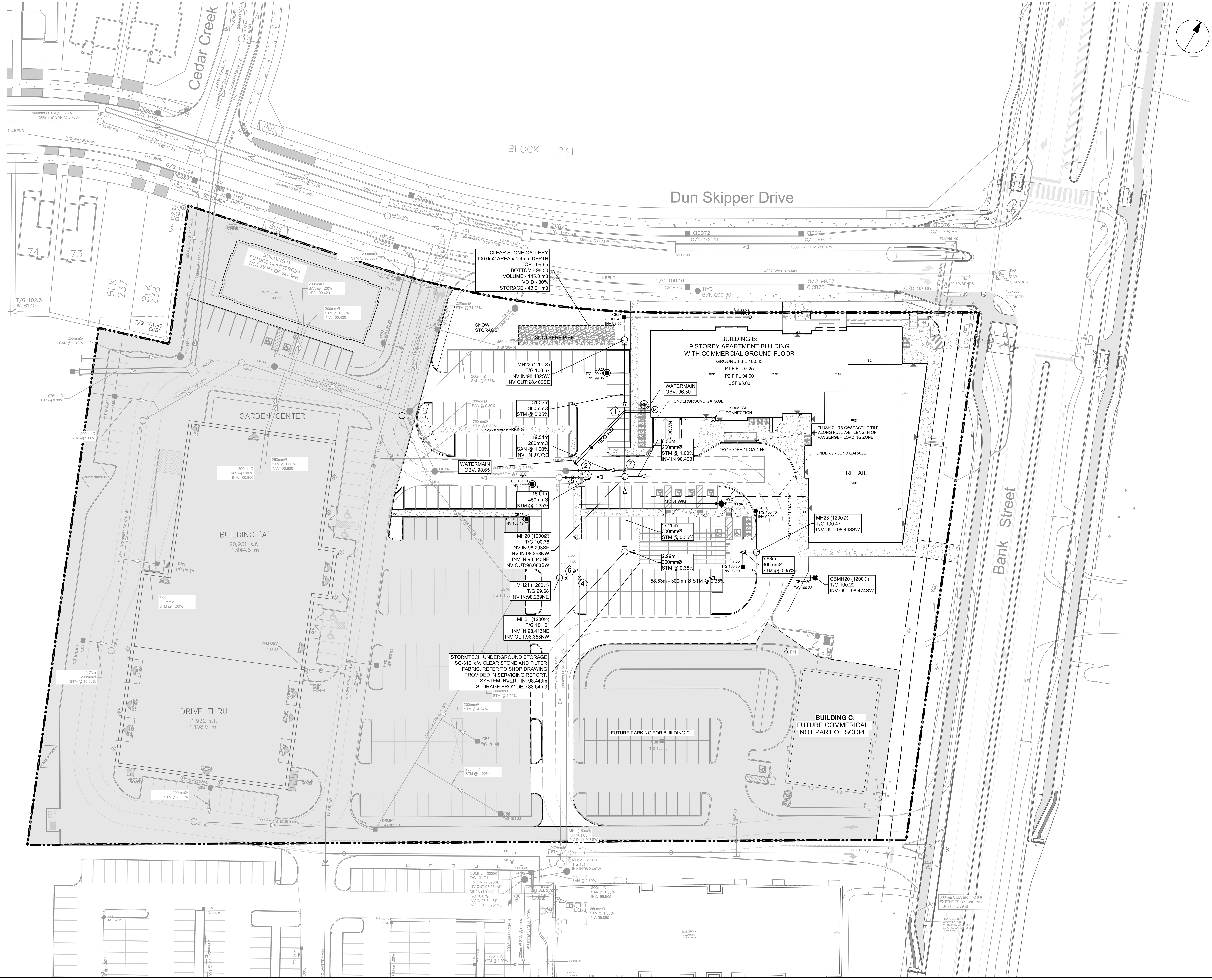
Stamp

Project
4836 Bank Street Seniors Apartments

Drawing
SITE PLAN

Drawn By		Checked By	-
Scale	As indicated	Date	2025-02-08 9:59:00 PM
Project No.	2330	Revision	2
Drawing No.	A010		

1 : 1



CLIENT

2668867 Ontario Inc.

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ISSUES

No.	DESCRIPTION	DATE
1	SUBMISSION NO.1 FOR CITY REVIEW	2024-11-26
2	SUBMISSION NO.2 FOR CITY REVIEW	2025-02-18
3		
4		

SEE 010 FOR NOTES, LEGEND AND DETAILS

KEY PLAN

SUBJECT SITE

CONSULTANTS

SEAL

LICENSED PROFESSIONAL ENGINEER
W. ZHUANG
100231427
2025/02/18
PROVINCE OF ONTARIO

PRIME CONSULTANT

ARCADIS

333 Preston Street - Suite 500
Ottawa ON K1S 5N4 Canada
tel 613 225 1311
www.arcadis.com

PROJECT

SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO: 148290	
DRAWN BY: M.M.	CHECKED BY: D.G.Y.
PROJECT MGR: R.M.	APPROVED BY: A.Z.

SHEET TITLE

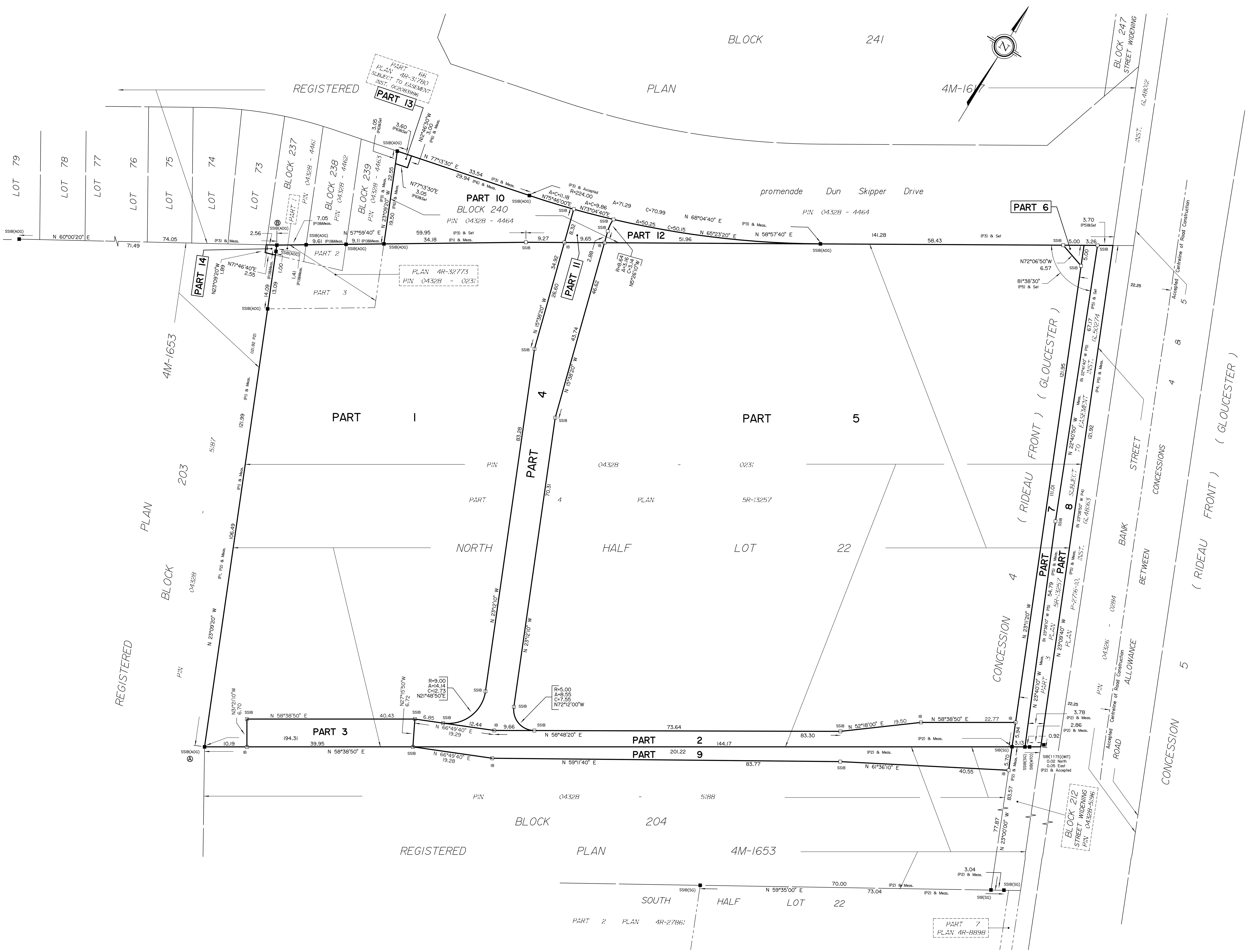
GENERAL PLAN OF SERVICES

SHEET NUMBER C-001

ISSUE 2

D07-12-24-0169

19213



I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.

DATE:_ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

T. HARTWICK
ONTARIO LAND SURVEYOR

PLAN 4R-

RECEIVED AND DEPOSITED

DATE: _ _ _ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

REPRESENTATIVE FOR LAND REGISTRAR FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4.

SCHEDULE

AREA (sqm)	PART	LOT / BLOCK	CONCESSION / PLAN	PIN
7621.5	1	PART OF 22	4 (RIDEAU FRONT)	ALL OF 04328-0231
647.5	2			
269.4	3			
967.7	4			
14006.8	5			
12.4	6			
353.7	7			
483.2	8			
477.6	9	PART OF 204	4M-1653	PART OF 04328-5188
653.4	10	ALL OF 240	4M-1617	ALL OF 04328-4464
66.6	11			
99.8	12			
10.0	13			
5.4	14	PART OF 203	4M-1653	PART OF 04328-5187

Part 8: Subject to easement, Inst. GL50274.
Part 13: Subject to easement, Inst. OC2083996.

PLAN OF SURVEY OF
PART OF 22
CONCESSION 4 (RIDEAU FRONT)
Geographic Townsgip of Gloucester
and
BLOCK 240
REGISTERED PLAN 4M-1617
and
PART OF BLOCKS 203 and **204**
REGISTERED PLAN 4M-1653
CITY OF OTTAWA
Surveyed by Annis, O'Sullivan, Vollebekk Ltd.

Scale 1 : 400

16 12 8 4 0 8 16 Metres

Metric

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

Surveyor's Certificate

I CERTIFY THAT :

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Land Titles Act and the regulations made under them.
2. The survey was completed on the _ _ day of _ _ _ _ _ _ _ _ _, 2020.

_ _ _ _ _ _ _ _ _ _ _ _ Date

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ T. Hartwick
Ontario Land Surveyor

Notes & Legend

—□—	Denotes	Survey Monument Planted
—■—	"	Survey Monument Found
SIB	"	Standard Iron Bar
SSIB	"	Short Standard Iron Bar
IB	"	Iron Bar
(WIT)	"	Witness
(AOG)	"	Annis, O'Sullivan, Vollebekk Ltd.
Meas.	"	Measured
(P1)	"	Plan 4R-32773
(P2)	"	Registered Plan 4M-1653
(P3)	"	Registered Plan 4M-1617
(P4)	"	Plan 4R-29630
(P5)	"	Plan 5R-13257
(P6)	"	Plan 4R-31780

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.99996.

Bearings are grid, derived from Can-Net 2016 Real Time Network GPS observations on reference points A and B, shown hereon, having a bearing of N 23°09'20" W and are referenced to Specified Control Points 01919760735 and 01919871649, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

For bearing comparisons, a rotation of 0°40'40" counter-clockwise was applied to bearings on plan (P5).

Coordinates are derived from Can-Net 2016 Real Time Network GPS observations referenced to Specified Control Points 01919760735 and 01919871649, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinate values are to urban accuracy in accordance with O. Reg. 216/10.

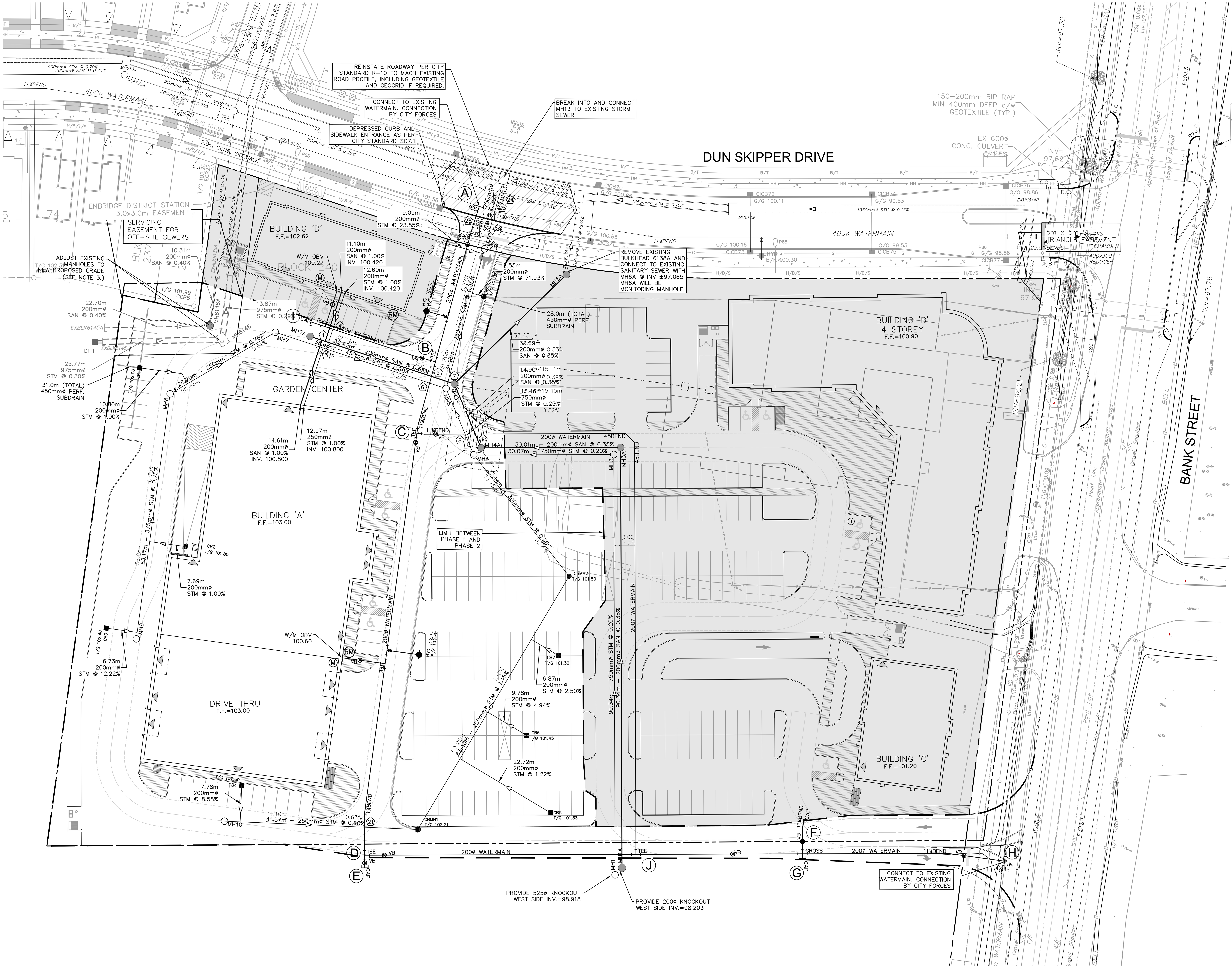
. 01919760735	Northing	5026903.34	Easting	376968.72
. 01919871649	Northing	5007189.87	Easting	372435.05
. Point A	Northing	5019079.47	Easting	376200.08
. Point B	Northing	5019191.65	Easting	376152.10

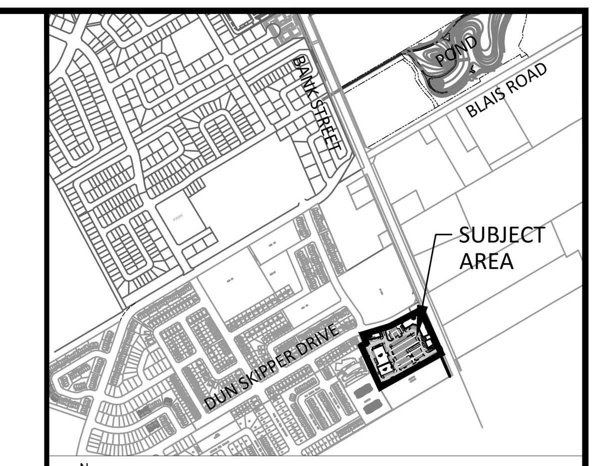
Caution: Coordinates cannot, in themselves, be used to re-establish corners or boundaries shown on this plan.

11

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No. 18835-20 Atwal Pt Lt 22 C4 RF GL R D7 | N





KEY PLAN
(NTS)

NOTES:
1. SEE DRAWING C-010 FOR ADDITIONAL DETAILS AND NOTES.

2. SITE BENCHMARK TO BE OBTAINED FROM LEGAL SURVEYOR H.A. KEN SHIPMAN SURVEYING LTD.

3.0 EXISTING SANITARY MANHOLE - MH6146A AS-BUILT F/C = 102.019 TO BE ADJUSTED TO ±102.160
EXISTING STORM MANHOLE - MH61646 AS-BUILT F/C = 102.018 TO BE ADJUSTED TO ±102.24.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10	RELOCATED SEWERS AND WM IN PHASE 2	JIM	2023:03:24
9	RECORD DRAWINGS (PHASE 1)	JIM	2022:08:19
8	ADD PHASING	JIM	2020:06:23
7	REVISED AS PER CITY COMMENTS	JIM	2020:04:20
6	REVISED AS PER CITY COMMENTS	JIM	2020:04:02
5	ISSUED FOR TENDER	JIM	2020:03:18
4	REVISED AS PER CITY COMMENTS	JIM	2020:03:13
3	REVISED AS PER CITY COMMENTS	JIM	2019:12:09
2	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	JIM	2019:10:11
1	ISSUED FOR SPA	JIM	2019:04:15

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

BANK STREET DEVELOPMENT
4836 BANK STREET

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2023/03/24
PROVINCE OF ONTARIO

Drawing Title

SITE SERVICING PLAN

Scale
1 : 400

Design	Date
SEL	FEB. 2019
Drawn	Checked
DPS	JIM
Project No.	Drawing No.
119351	001

D07-12-19-0092

#17977

File No.: PC2023-0272

Alison Clarke
The Stirling Group
Via email: alison@tsgdi.ca

Subject: **Pre-Consultation: Meeting Feedback – Phase 1**
Proposed Complex Site Plan Application
155 Dun Skipper Drive (formerly 4836 Bank Street)

Please find below information regarding next steps as well as consolidated comments from the above-noted pre-consultation meeting held on October 26, 2023.

Pre-Consultation Preliminary Assessment

1 ☐	2 ☐	3 ☐	4 ☒	5 ☐

One (1) indicates that considerable major revisions are required while five (5) suggests that the proposal appears to meet the City's key land use policies and guidelines. This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.

Next Steps

1. A review of the proposal and materials submitted for the above-noted pre-consultation has been undertaken. Please proceed to complete a Phase 2 Pre-consultation Application Form and submit it together with the necessary studies and/or plans to planningcirculations@ottawa.ca.

2. In your subsequent pre-consultation submission, please ensure that all comments or issues detailed herein are addressed. A detailed cover letter stating how each issue has been addressed must be included with the submission materials. Please coordinate the numbering of your responses within the cover letter with the comment number(s) herein.

3. Please note, if your development proposal changes significantly in scope, design, or density before the Phase 3 pre-consultation, you may be required to complete or repeat the Phase 2 pre-consultation process.

Supporting Information and Material Requirements

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified, during this phase of pre-consultation, as either required (R) or advised (A) as part of a future complete application submission.

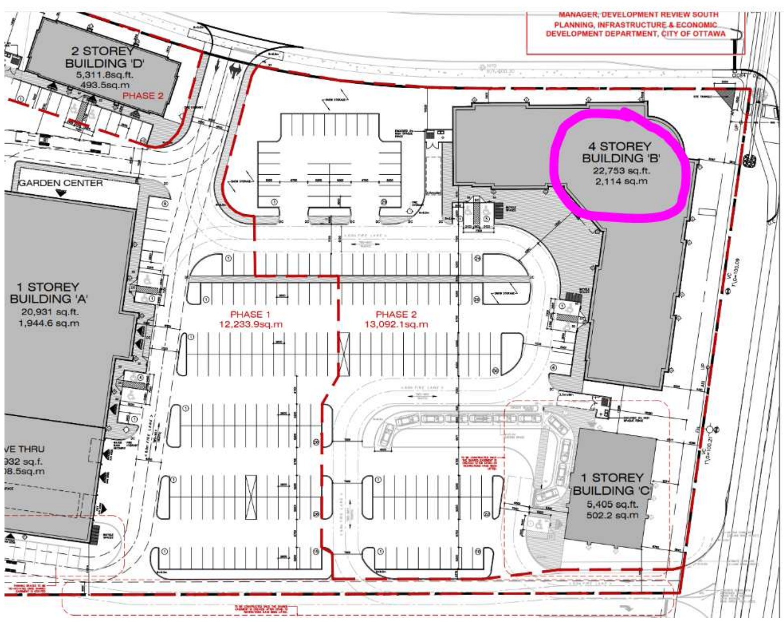
   a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.

Consultation with Technical Agencies

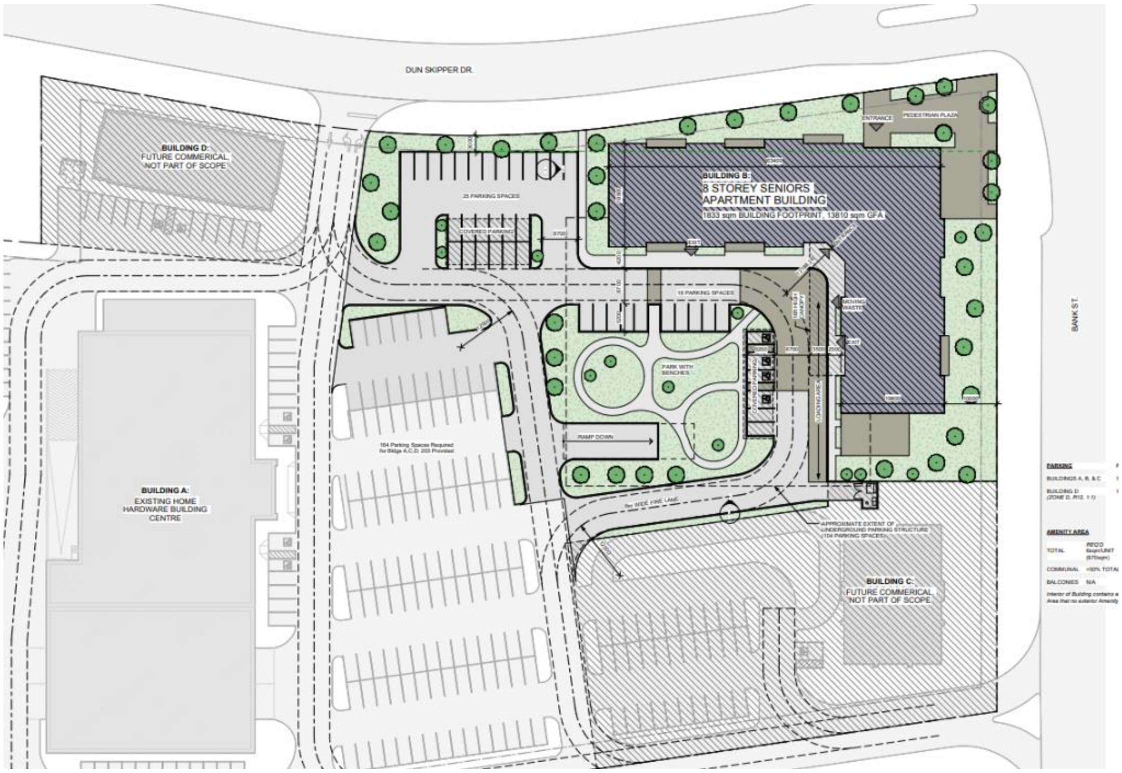
1. You are encouraged to consult with technical agencies early in the development process and throughout the development of your project concept. A list of technical agencies and their contact information is enclosed (Appendix A).

Overview Discussion

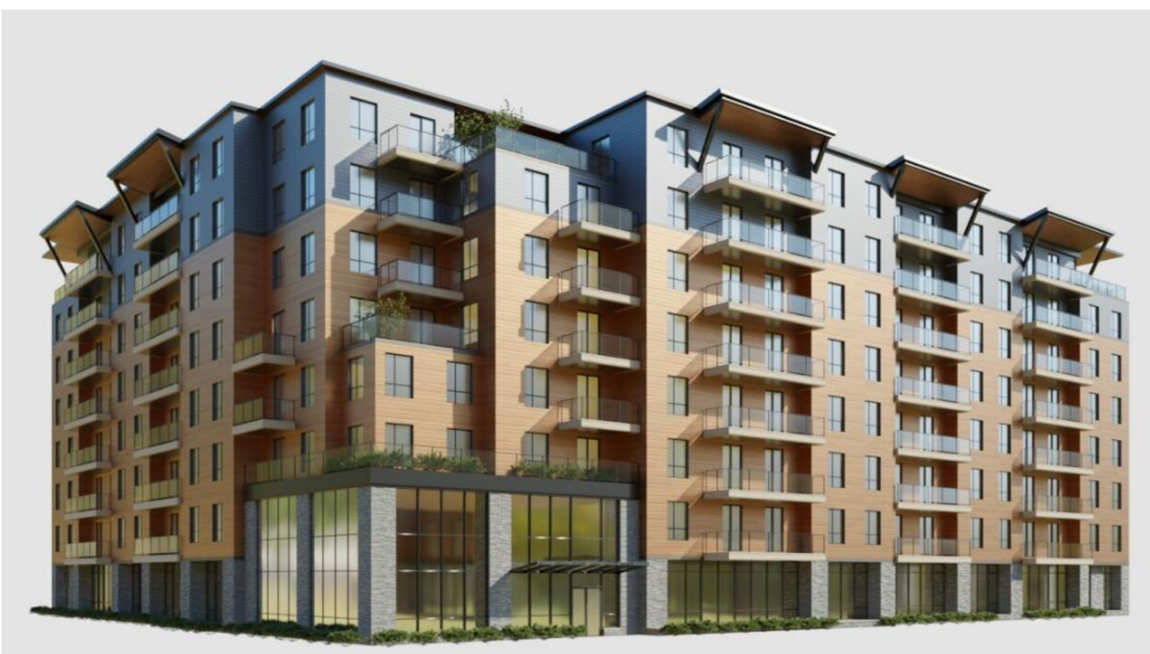
1. Previous Site Plan Approval for the site (D07-12-19-0092) from 2019 for the entire site of 4836 Bank Street. Building A (Home Hardware) has been constructed and is in operation.
2. The proposal is for Building B – which was previously shown as a 4-storey hotel, and is now being shown as an apartment building, geared to seniors (8-storeys, 145 units, surface and u/g parking)
3. Applicant has indicated that they will require a MV for an increase in height (GM [2615]



Previously approved 4-storey hotel proposal.



Oct 25, 2023 – current proposal for 8-storey apartment building



Updated Rendering, Oct 25, 2023

Planning (Katie O'Callaghan, Tracey Scaramozzino)

Policies and provisions:

1. In the Official Plan, the subject property is in the Suburban Transect, which has a planned pattern to enhance mobility options, street connections and evolve towards the 15-minute neighbourhood. Within the Suburban Transect, diverse housing forms are encouraged to meet evolving demographics.

2. The subject property is also located within the Mainstreet Corridor land use designation. Mainstreet Corridors can accommodate higher density development, a greater degree of mixed-use and residential uses that integrate with a dense, mixed-use urban environment. The maximum height along Mainstreet Corridors, within the Suburban Transect, is 9 storeys.

3. There is no CDP for this site; however, the Leitrim CDP, 2005, pertains to the lands to the north of Dun Skipper. The proposed development is in keeping with, and complimentary, to the policies laid out under the Leitrim CDP.

4. The subject property is zoned as General Mixed-Use (GM), with exception (2615) that permits a hotel use on the property. Residential uses, including mid-rise buildings with a maximum height of 18m (@ 6-storeys), are permitted in the GM zone.

5. To seek relief from maximum permitted height, the Applicant will need a minor variance application. The Committee of Adjustment is a City of Ottawa quasi-judicial tribunal which reviews *Planning Act* applications that are independent from development review. Please see the City's website for more information.

6. Bicycle parking is required. Please indicate bicycle parking on the site plan.

7. Please see information on Section 37 requirements / Community Benefits Charge

    a. The former Section 37 regime has been replaced with a "Community Benefits Charge", By-law No. 2022-307, of 4% of the land value. This charge will be required for ALL buildings that are 5 or more storeys and 10 or more units and will be required at the time of building permit unless the development is subject to an existing registered Section 37 agreement. Questions regarding this change can be directed to Ranbir.Singh@ottawa.ca.

8. Landscape requirements

    b. Use local, native species where possible

    c. Provide as much greenery, trees, soft surfaces as possible to mitigate urban heat island and help with SWM

9. Update zoning table as required based on changes made.

10. It is recommended that a courtesy heads-up be provided to the local ward Councillor Steve Desroches – Riverside South – Findlay Creek (steve.desroches@ottawa.ca).

Urban Design (Randolph Wang)

11. Submission Requirements

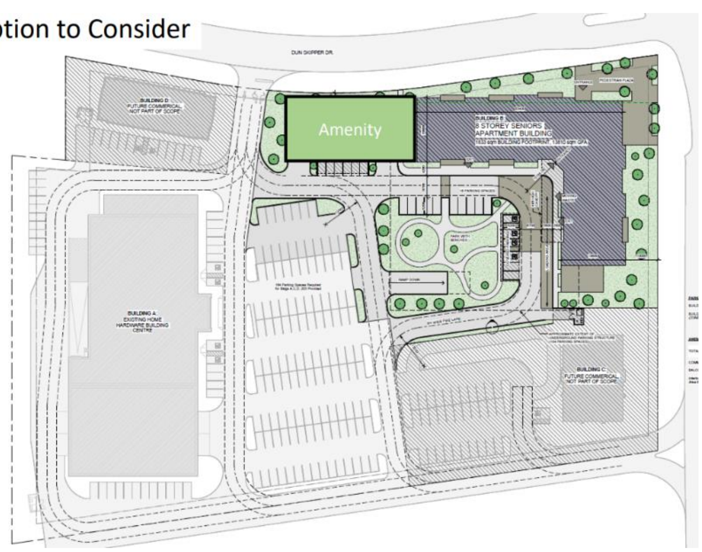
1. Urban Design Brief is required for a ZBLA. Please see attached customized Terms of Reference to guide the preparation. Here are a few highlights:
    a. The Urban Design Brief should be structured by generally following the headings highlighted under Section 3 – Contents of these Terms of Reference.
    b. Please explore alternative site plan and massing options and include diagrams and images to show and document options explored.
2. Please refer to relevant Terms of Reference available on the City's website (Planning application submission information and materials | City of Ottawa) to prepare additional drawings and studies required. **Please note that both shadow and wind studies are required**.

Comments on the Design Concept

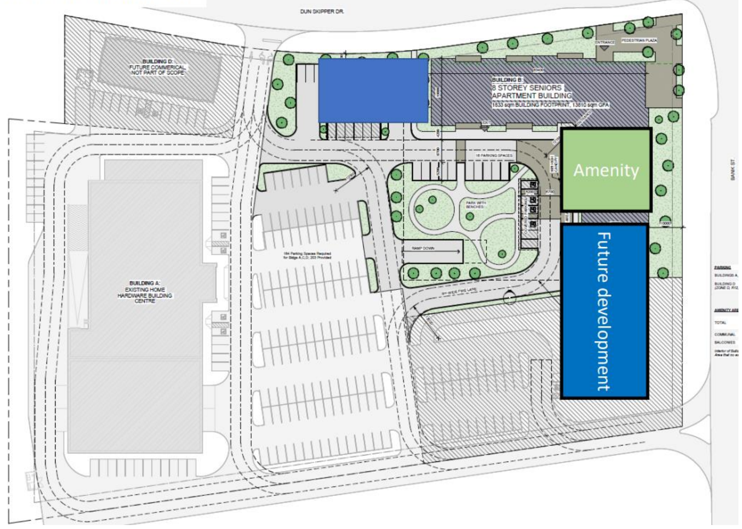
1. Urban design supports the proposed ground floor programs, particularly the communal and amenity uses along Bank Street and their potential to animate the Mainstreet Corridor.
2. The site plan requires further study. The amenity space is situated in the middle of the parking lot, detached from the building, surrounded by driveways, and broken up by a ramp. It is not the most desirable place to be in.
3. With respect to built form and building design, urban design appreciates the attention to the street corner through building form design.
    a. The massing articulation (the stepping) at the corner is interesting. However, it seems contradictory to the overall "classical" approach to built form design.
    b. Urban design cautions the coplanar effects.
    c. The canopies on the top appear to be heavy.

Suggestions for Design

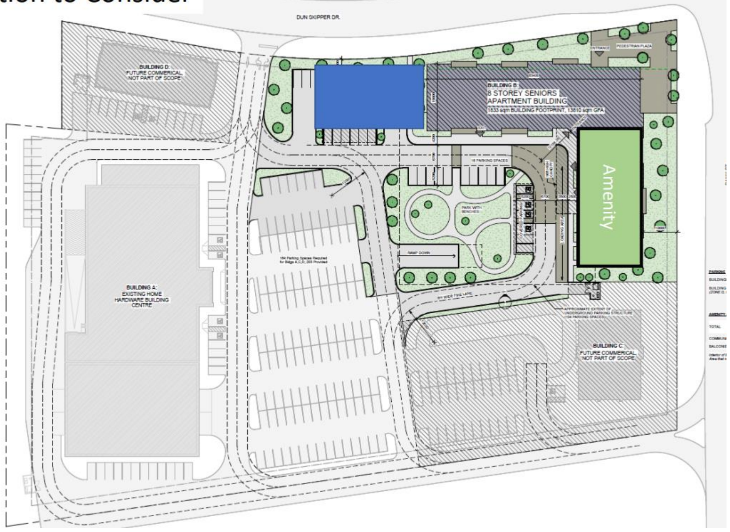
Site Plan Option to Consider



Site Plan Option to Consider



Site Plan Option to Consider



Explore site plan options, for example:

   1. Without changing the built form design, consider locating the amenity area to the west of the proposed building, along Dun Skipper. Elements such as decorative fencing around the amenity area can be suitable for the street.
   2. Design a simple bar building along Dun Skipper and locate the amenity area on Bank Street. Depending on the size and shape of the amenity space, this may allow for future intensification along Bank Street.

2. Simplify vehicular circulations so that they function well and won't interfere with pedestrian circulations.
3. Incorporate the parking ramp into the building rather than being a standalone structure. If the ramp has to be located outside of the building, it should be convenient for way finding, and properly landscaped.
4. With respect to built form and building design, consider the following:

1. Simplify the massing at the corner to create a stronger vertical presence. Given the overall built form approach being pursued, stepping may be most suitable at the two ends of the building.
2. Create a stronger base. A 2-storey base with stone cladding may be appropriate.
3. Create a lighter top. Step back the top two floors. Remove and/or reduce the size of the balcony canopies.
4. Avoid coplanar on facades. Wherever there is change of materials, include a building step back and/or introduce a strong datum line that separates the two materials.

Engineering (Tyler Cassidy)

Comments:

12. The Stormwater Management Criteria, for the subject site, is to be based on the following existing reports:

    i. Design Brief, Pathways at Findlay Creek, 4800 Bank Street, Phase 1, prepared by IBI, revised August 2017.

    ii. Design Brief, Bank Street Development, 4836 Bank Street, prepared by IBI Group, revised April 2020.

    a. Stormwater management criteria has been determined for this site through the two (2) studies listed above. The site's overall release rate (Phase 1 + future phases) shall be respected. There shall be a sufficient allocation of capacity remaining for future phases to be developed.

    b. Emergency overflow for events greater than the 1:100 year storm shall be directed to the Bank Street right-of-way.

    c. All flows exceeding the allowable release rate for design storms up to and including the 1:100 year event are to be detained on-site.

    d. Quality controls (80% TSS removal) are being provided by the existing downstream Findlay Creek Stormwater Management Facility.

    e. A calculated time of concentration (Cannot be less than 10 minutes).

13. Deep Services (Storm, Sanitary & Water Supply)

    a. Deep services are available on site as part of the Phase 1 site plan works. See the existing report(s) for proposed connection locations. New connections to the municipal right-of-way will not be accepted.

    b. It is the responsibility of the applicant/consultant to confirm sufficient capacity in the sanitary sewer system for any flows that exceed the allocation allotted in the subdivision level and phase one site plan control servicing reports.

    c. Sewer connections to be made above the springline of the sewermain as per:

i. Std Dwg S11.1 for flexible main sewers – connections made using approved tee or wye fittings.

ii. Std Dwg S11 (For rigid main sewers) – lateral must be less that 50% the diameter of the sewermain,

iii. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – for larger diameter laterals where manufactured inserts are not available; lateral must be less that 50% the diameter of the sewermain,

iv. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.

v. No submerged outlet connections.

14. Water Boundary condition requests must include the location of the service (map or plan with connection location(s) indicated) and the expected loads required by the proposed development, including calculations. Please provide the following information:

    a. Location of service

    b. Type of development and the amount of fire flow required (as per FUS).

    c. Average daily demand: ___ l/s.

    d. Maximum daily demand: ___l/s.

    e. Maximum hourly daily demand: ___ l/s.

15. It is the applicant/consultant's responsibility to confirm if the existing MECP Environmental Compliance Approval needs to be amended to accommodate the proposed development. If required, please contact the Ministry of the Environment, Conservation and Parks, Ottawa District Office to arrange a pre-submission consultation:

    a. Charlie Primeau at (613) 521-3450, ext. 251 or Charlie.Primeau@ontario.ca

16. The Geotechnical Investigation Report for this development shall be scoped specially for the proposal. The report can make use of existing geotechnical data obtained during the phase 1 investigation, however if the data is more than 1 year old, a professional will be required to certify the data is still reflective of existing site conditions and applicable to this phase of development.

Feel free to contact Tyler Cassidy, P.Eng., Infrastructure Project Manager, for follow-up questions.

Noise (Neeti Paudel)

Comments:

17. Noise Impact Studies required:

i. Road (site is within 100m of an arterial road- fronting Bank Street)

Feel free to contact Neeti Paudel, Transportation Project Manager, for follow-up questions.

Transportation (Neeti Paudel)

Comments:
18. TIA is not required.

19. On site plan:

i. Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
ii. Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements (loading space) and at all access (entering and exiting and going in both directions).
iii. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible
iv. Show lane/aisle widths
v. Note the maximum access width is 9m.

20. As the site proposed is residential, AODA legislation applies for all areas accessible to the public (i.e. outdoor pathways, parking, etc.).

- Clearly define accessible parking stalls and ensure they meet AODA standards (include an access aisle next to the parking stall and **a pedestrian curb ramp** at the end of the access aisle, as required).

- Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements. https://ottawa.ca/en/city-hall/creating-equal-inclusive-and-diverse-city/accessibility-services/accessibility-design-standards-features#accessibility-design-standards

21. The design for Bank Street Widening and Construction from south of Leitrim Road to south of Blais is complete. Construction time is to be confirmed.

22. Right-of-way protection.

a. Overlay the Bank Street design (attached) on the site plan to ensure sufficient ROW is protected.

b. Any requests for exceptions to ROW protection requirements must be discussed with Transportation Planning and concurrence provided by Transportation Planning management.

Feel free to contact Neeti Paudel, Transportation Project Manager, for follow-up questions.

Planning Forestry – Hayley Murray

23. If there are City owned trees of any size and/or privately owned trees 10 cm in diameter or greater on the subject property, a Tree Conservation Report would be required. The required information could be combined with the Landscape Plan if relevant.

24. The Landscape Plan terms of reference must be adhered to: https://documents.ottawa.ca/sites/documents/files/landscape_tor_en.pdf

25. TCR requirements

    - The TCR must list all trees on site, as well as off-site trees if the CRZ extends into the developed area, by species, diameter and health condition
    - Please identify trees by ownership – private onsite, private on adjoining site, city owned, boundary (trees on a property line)
    - If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained
    - All retained trees must be shown, and all retained trees within the area impacted by the development process must be protected as per City guidelines available at Tree Protection Specification or by searching Ottawa.ca
    - The location of tree protection fencing must be shown on the plan
    - The City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.
    - For more information on the process or help with tree retention options, contact Hayley Murray hayley.murray@ottawa.ca or on City of Ottawa

26. LP tree planting requirements

    Minimum Setbacks

    - Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
    - Maintain 2.5m from curb
    - Coniferous species require a minimum 4.5m setback from curb, sidewalk or MUP/cycle track/pathway.
    - Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when **planting around overhead primary conductors.**

    Tree specifications

    - Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
    - Maximize the use of large deciduous species wherever possible to maximize future canopy coverage
    - Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and include watering and warranty as described in the specification (can be provided by Forestry Services).
    - Plant native trees whenever possible
    - No root barriers, dead-man anchor systems, or planters are permitted.

- No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)

Hard surface planting

- Curb style planter is highly recommended
- No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
- Trees are to be planted at grade

Soil Volume

- Please document on the LP that adequate soil volumes can be met:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

- ** Please note that these soil volumes are not applicable in cases with Sensitive Marine Clay **
- Please follow the City's 2017 Tree Planting in Sensitive Marine Clay guidelines for trees in the Right of Way

Tree Canopy

- The landscape plan shall show how the proposed tree planting will replace and increase canopy cover on the site over time, to support the City's 40% urban forest canopy cover target.
- At a site level, efforts shall be made to provide as much canopy cover as possible, through tree planting and tree retention, with an aim of 40% canopy cover at 40 years, as appropriate. Indicate on the plan the projected future canopy cover at 40 years for the site.

Feel free to contact Hayley Murray, Planning Forester, for follow-up questions.

Environment and Trees (Matthew Hayley)

Comments:

27. Significant environmental features – The nearest natural feature is east of Bank Street and over 30 m from the proposed development and accordingly an Environmental Impact Study (EIS) is not triggered.

28. Species at risk – Site is cleared and there is no natural habitat present.

29. Environmental impact Study – No EIS is triggered.

30. Bird-Safe Design Guidelines - Please review and incorporate bird safe design elements. Some of the risk factors include glass and related design traps such as corner glass, balcony glass and fly-through conditions, ventilation grates and open pipes, landscaping, light pollution. More guidance and solutions are available in the guidelines which can be found here:
https://documents.ottawa.ca/sites/documents/files/birdsafedesign_guidelines_en.pdf

31. Urban Heat Island - Please add features that reduce the urban heat island effect (see OP 10.3.3) produced by the parking lot and a building footprint. For example, this impact can be reduced by adding large canopy trees, green roofs or vegetation walls, or constructing the parking lot or building differently.

Feel free to contact Matthew Hayley or Mark Elliot, Environmental Planner, for follow-up questions.

Parkland (Burl Walker):

Comments:

32. Cash-in-lieu of parkland will be required as a condition of site plan approval. The parkland dedication requirement will be determined in accordance with the provisions of Parkland Dedication By-law No. 2022-280 and the *Planning Act.* The Owner will also be required to pay for the cost of a land value appraisal.

33. Parkland Dedication By-law No. 2022-280 is in force. However, multiple appeals to the By-law are currently before the Ontario Land Tribunal. The final parkland dedication requirement for the proposed site plan application will be determined in accordance with any By-law amendments made by the OLT or an order made by the OLT.

34. The cash-in-lieu of parkland dedication requirement for a mid-rise apartment building is 1 ha per 1,000 net residential units up to a maximum of 15% of the gross land area. For a mixed-use development where land is developed for a mix of land uses that are located on discrete parts of a site, the parkland dedication requirement is the cumulative sum for each use, as calculated using the applicable rate and based upon the portion of the site allocated to each use, including, but not limited to, required and provided parking spaces, amenity space, landscape buffers, and drive aisles. In addition, subsection 42 (3.3) of the *Planning Act* indicates that in the case of land proposed for development or redevelopment that is 5 ha or less in area, a Parkland Dedication By-law shall not require a conveyance that is greater than 10% of the value of the land.

35. For the Phase 2 pre-consultation submission, please provide the area of the site that is allocated to Building B including the parking area, amenity space, landscaping, etc. The area allocation may be based on the limits of construction for the Building B site development or a parcel line from a lease agreement, if applicable. Staff will defer providing an estimate of the land area for the cash-in-lieu of parkland dedication requirement until the parcel area for Building B has been provided.

Feel free to contact Burl Walker, Parks Planner, for follow-up questions.

Conservation Authority (South Nation, James Holland)

SNC's review considers the impacts of the development on natural hazards, including flooding and erosion upstream and downstream of the property. The review identifies areas and features regulated under the *Conservation Authorities Act* and the permit requirements of SNC's Regulation Policies. These policies can be obtained from SNC's website at [Regulations | South Nation Conservation Authority]

Comments:

36. Natural Hazards

- There are no mapped natural hazards on the property.
- Increased stormwater must not negatively impact flooding and erosion following development. If the stormwater outlets to approved municipal infrastructure, SNC does not complete a technical review and relies on the City's engineering review to confirm capacity of the infrastructure. If flows outlet to Findlay Creek, SNC will complete a technical review of the quantity control component of the design.

37. Conservation Authority Regulation

- Please note that any interference with a watercourse may require a permit under O.Reg. 170/06 and restrictions may apply. A watercourse includes any feature with a defined bed and bank that conveys water permanently or intermittently during a year.

Other

38. The High Performance Development Standard (HPDS) is a collection of voluntary and required standards that raise the performance of new building projects to achieve sustainable and resilient design. The HPDS was passed by Council on April 13, 2022.

    a. At this time, the HPDS is not in effect and Council has referred the 2023 HPDS Update Report back to staff with direction to bring forward an updated report to Committee with recommendations for revised phasing timelines, resource requirements and associated amendments to the Site Plan Control By-law by no later than Q1 2024.

    b. Please refer to the HPDS information attached and ottawa.ca/HPDS for more information.

Should there be any questions, please do not hesitate to contact myself or the contact identified for the above areas / disciplines.

Yours Truly,
Katie O'Callaghan
Planner I

cc.

Tracey Scaramozzino, Senior Planner
Tyler Cassidy, Infrastructure Approvals
Neeti Paudel, Transportation
Hayley Murray, Forester
Matthew Hayley, Environmental Planner
Burl Walker, Park Planner
James Holland, South Nation Conversation Authority
Randolph Wang, Senior Urban Designer

Omkar, Atwal, Owner, omkar.atwal@homehardware.ca

Appendix A. List of Technical Agencies

List of Technical Agencies to Consult

☒	Zayo	Utility.Circulations@Zayo.com
☒	Bell Canada	circulations@wsp.com
☒	Telus Communications	telusutilitymarkups@Telecon.ca / jovica.stojanovski@telus.com
☒	Rogers Communications	OPE.Ottawa@rci.rogers.com
☒	Enbridge Gas Distribution	municipalplanning@enbridge.com
☒	O.C. District School Board	planningcirculations@ocdsb.ca
☒	O.C. Catholic School Board	planningcirculations@ocsb.ca
☒	Conseil des écoles publiques	planification@cepeo.on.ca
☒	Conseil des écoles catholiques du Centre-Est	planification@ecolecatholique.ca
☒	Hydro Ottawa (Local Distribution)	ExternalCirculations@HydroOttawa.com
☐	Hydro One Networks (Transmission)	landuseplanning@hydroone.com
☐	Ontario Power Generation	Executivevp.lawanddevelopment@opg.com
☐	Trans Canada Pipeline c/o Lehman & Associates	dpresley@mhbcplan.com
☐	Trans Northern Pipeline Inc.	wwatt@tnpi.com
☐	Railways	Choose an item
☐	National Capital Commission	Ted.Horton@ncc-ccn.ca
☐	Parks Canada	susan.millar@pc.gc.ca
☐	Airport Authority	Choose an item
☐	Ministry of Transportation	corridoreast@ontario.ca
☐	Infrastructure Ontario	NoticeReview@infrastructureontario.ca
☐	Propane Operator	Mailing Addresses Only
☐	NAV Canada	landuse@navcanada.ca
☒	Conservation Authority	SNCA – jholland@nation.on.ca

APPLICANT'S STUDY AND PLAN IDENTIFICATION LIST

Proposed Site Plan Control Application – 155 Dun Skipper Road – PC2024-0127

Legend: **R** = Required, the study or plan is required with application submission
A = Advised, the study or plan is advised to evaluate the application or satisfy a condition of approval/draft approval
1 - OPA, **2** - ZBA, **3** - Plan of Subdivision, **4** - Plan of Condominium, **5** - SPC

Core studies required for certain applications all the time (Remaining studies are site specific)

For information and guidance on preparing required studies and plans refer here:

ENGINEERING										
R	**A**	**Study/ Plan Name**	**Description**	**When Required**						**Applicable Study Components & Other Comments**
				1	**2**	**3**	**4**	**5**		
☒	☐	1. Environmental Site Assessment (Phase 1 & Phase 2)	Ensures development only takes place on sites where the environmental conditions are suitable for the proposed use	☒	☒	☒	☒	☒	Study Trigger Details: All cases	Record of Site Condition Yes ☐ No ☐
☒	☐	2. Geotechnical Study	Geotechnical design requirements for the subsurface conditions	☒	☒	☒	☒	☒	Study Trigger Details: All cases	
☒	☐	3. Grading and Drainage Plan	Grading relationships between connecting (or abutting) properties and surface runoff control	☐	☐	☒	☐	☒	Study Trigger Details: All cases	
☐	☐	4. Hydrogeological and Terrain Analysis	A scientific study or evaluation that includes a description of the ground and surface hydrology, geology, terrain, affected landform and its susceptibility	☐	☐	☒	☒	☒	Study Trigger Details: When developing on private services or when urban development is in close proximity to existing private serviced development	Reasonable Use Study Yes ☐ No ☐ Groundwater Impact Study Yes ☐ No ☐
☒	☐	5. Noise Control Study	Potential impacts of noise on a development	☒	☒	☒	☒	☒	Study Trigger Details: See Terms of Reference for full details.	Vibration Study Yes ☐ No ☐

☐	☐	6. Rail Proximity Study	Development on land adjacent to all Protected Transportation Corridors and facilities shown on Schedule C2 of the Official Plan, to follow rail safety and risk mitigation best practices	☐	☒	☒	☒	☒	Rail Safety Report Yes ☐ No ☐ O-Train Network Proximity Study Yes ☐ No ☐
				Study Trigger Details: Within the Development Zone of Influence for existing and future rapid transit stations and corridors, as shown on Annex 2 of the OP OR on land adjacent to all Protected Transportation Corridors and facilities shown on Schedule C2 of the Official Plan					
☒	☐	7. Site Servicing Study	Provides servicing details based on proposed scale of development with an engineering overview taking into consideration surrounding developments and connections.	☐	☒	☒	☒	☒	Fluvial Geomorphological Report Yes ☐ No ☐ Assessment of Adequacy of Public Services Yes ☐ No ☐ Servicing Options Report Yes ☐ No ☐ Erosion and Sediment Control Plan / Brief Yes ☐ No ☐ Hydraulic Water Main Analysis Yes ☐ No ☐ Stormwater Management Report and Detailed Design Brief Yes ☐ No ☐
				Study Trigger Details: All cases					
☐	☐	8. Slope Stability Study	Assessment of slope stability and measures to provide safe set-back.	☐	☒	☒	☒	☒	Retrogressive Landslide Analysis Yes ☐ No ☐
				Study Trigger Details: Where the potential for Hazard Lands exists on a site.					
☒	☐	9. Transportation Impact Assessment	Identify on and off-site measures to align a development with City transportation objectives.	☐	☒	☒	☒	☒	Roadway Modification Functional Design Yes ☐ No ☐
				Study Trigger Details: If the development generates 60 person-trips or more; or if the development is located in a Location Trigger; or if the development has a Safety Trigger.					

☐	☐	10. Water Budget Assessment	Identify impact of land use changes on the hydrologic cycle and post-development mitigation targets.	☐	☒	☒	☒	☒	
				Study Trigger Details: May be required for site plan control applications for sites with private servicing and / or proximity to hydrogeologically-sensitive areas. Draft plans of subdivision are required to integrate water budget assessments into supporting stormwater management plans and analysis for the study area.					
☐	☐	11. Wellhead Protection Study	Delineate a Wellhead Protection Area (WHPA) and characterize vulnerability for new communal residential drinking water well systems, in accordance with Technical Rules under *Clean Water Act.*	☐	☒	☒	☒	☒	
				Study Trigger Details: Required for all new communal residential drinking water well systems; including new municipal wells, new private communal wells (small water works) that require a Municipal Responsibility Agreement (MRA), expansions or increased water takings from an existing municipal well or existing private communal well and new private communal wells.					

PLANNING									
R	A	Study/Plan Name	Description	When Required					Applicable Study Components & Other Comments
				1	2	3	4	5	
☐	☐	12. Agrology and Soil Capability Study	Confirm or recommend alterations to mapping of agricultural lands in the City.	☒	☐	☐	☐	☐	
				Study Trigger Details: For the expansion of a settlement area or identification of a new settlement area through a comprehensive review; or where it is demonstrated that the land does not meet the requirements for an Agricultural Resource Area.					
☒	☐	13. Archaeological Assessment	Discover any archaeological resources on site, evaluate cultural heritage value and conservation strategies	☒	☒	☒	☒	☒	
				Study Trigger Details: When the land has either: a known archaeological site; or the potential to have archaeological sites; or where the City's Archaeological Resource Potential Mapping Study indicates archaeological potential, outside of the historic core; or upon discovery of any archaeological resource during construction in the City's historic core area.					
☒	☐	14. Building Elevations	Visual of proposed development to understand facing of building including direction of sunlight, height, doors, and windows.	☒	☒	☐	☐	☒	
				Study Trigger Details: Site Plan: for residential buildings with 25 or more residential units; or for residential buildings with less than 25 residential units, if the units are within the Urban area or the High-performance Development Standard threshold in the rural area. Official Plan or Zoning By-law: if staff deem it necessary to determine compliance with OP policies, the Zoning By-law or City of Ottawa Urban Design Guidelines.					

☐	☐	15. Heritage Impact Assessment	Determine impacts of proposed development on cultural heritage resources.	☒	☒	☒	☒	☒	Conservation Plan Yes ☐ No ☐
				Study Trigger Details: Where development or an application under the Ontario Heritage Act is proposed on, adjacent to, across the street from or within 30 metres of a protected heritage property; or for any development adjacent to the Rideau Canal UNESCO World Heritage Site and its landscaped buffer.					
☐	☐	16. Heritage Act Acknowledgement Report	A submission requirement to demonstrate that the *Ontario Heritage Act* requirements have been satisfied, to ensure that multiple applications are considered currently.	☐	☒	☒	☒	☒	Heritage Permit Application Yes ☐ No ☐ Notice of Intent to Demolish Yes ☐ No ☐
				Study Trigger Details: Where the subject property is listed on the Heritage Register and the applicant must submit a Heritage Permit Application (designated heritage property listed on the Heritage Register) or provide notice of intent to demolish or remove a building (non-designated property listed on the Heritage Register).					
☐	☐	17. Impact Assessment Study – Mineral Aggregate	Mineral aggregate extraction activities; and to protect known high quality mineral aggregate resources from development and activities that would preclude or hinder their existence (ability to be extracted) or expansion.	☒	☒	☒	☒	☒	
				Study Trigger Details: New Development within 500 metres of lands within the Bedrock Overlay , or within 300 metres of lands within the Sand and Gravel Resource Area Overlay.					
☐	☐	18. Impact Assessment Study – Mining Hazards	To identify or confirm known mineral deposits or petroleum resources and significant areas of mineral potential. To protect mineral and petroleum resources from development and activities which would preclude or hinder the establishment of new operations or access to the resources.	☒	☒	☒	☒	☒	
				Study Trigger Details: For all applications in proximity to mining operations.					

☐	☐	19. Impact Assessment Study – Waste Disposal Sites / Former Landfill Sites	To identify or confirm known proximity of existing or former waste disposal sites. To ensure issues of public health, public safety and environmental impact are addressed.	☒	☒	☒	☒	☒	
				Study Trigger Details: For the establishment of any new Solid Waste Disposal Site or for a footprint expansion of an operating Solid Waste Disposal Site; or development within three kilometers of an operating or non-operating Waste Disposal Site.					
☒	☐	20. Landscape Plan	A plan to demonstrate how the canopy cover, urban design, health, and climate change objectives of Official Plan will be met through tree planting and other site design elements.	☒	☒	☒	☒	☒	
				Study Trigger Details: Site Plan, Plan of Subdivision, and Plan of Condominium: always required, except where it is demonstrated that the landscape component of a project is not relevant to the review of the application. A high-level conceptual Landscape Plan may be required to support Zoning By-law and Official Plan Amendment applications.					
☐	☐	21. Mature Neighbourhood Streetscape Character Analysis	In the Mature Neighbourhoods a Streetscape Character Analysis is required to determine the applicable zoning requirements.	☐	☒	☐	☐	☐	
				Study Trigger Details: Zoning By-law amendment application in areas covered by the Mature Neighbourhoods zoning overlay for applications of residential development of four storeys or less located in a R1, R2, R3, or R4 zone.					
☐	☐	22. Minimum Distance Separation	Provincial land use planning tool that determines setback distances between livestock barns, manure storages or anaerobic digesters and surrounding land uses, with the objective of minimizing land use conflicts and nuisance complaints related to odour.	☒	☒	☒	☒	☒	
				Study Trigger Details: Applications in the Rural Area, outside of a village.					

☐	☐	23. Parking Plan	A tool to assess the sufficiency of on-street parking in plans of subdivision.	☐	☐	☒	☒	☐	
				Study Trigger Details: For new or revised plans of subdivision with public streets.					
☒	☐	24. Plan of Survey	A Plan of Survey depicts legal boundaries and is a specialized map of a parcel of land and it delineates boundary locations, building locations, physical features and other items of spatial importance.	☒	☒	☒	☒	☒	
				Study Trigger Details: Required for all *Planning Act* applications.					
☐	☐	25. Plan of Subdivision	Proposed subdivision layout to be used for application approval	☐	☒	☒	☐	☐	
				Study Trigger Details: Always required with the submission of plan of subdivision application. Only required with a Zoning By-law Amendment application, where such ZBLA is in response to enable a subdivision.					
☒	☐	26. Plan of Condominium *If Needed	Proposed condominium layout to be used for application approval	☐	☐	☐	☒	☐	
				Study Trigger Details: With the submission of plan of condominium application.					
☐	☐	27. Planning Rationale	Provides the planning justification in support of the *Planning Act* application and to assist staff and the public in the review of the proposal.	☒	☒	☒	☐	☐	Integrated Environmental Review Summary Yes ☐ No ☐
				Study Trigger Details: For all Official Plan amendment, Zoning By-law amendment, or plan of subdivision applications.					
☒	☐	28. Preliminary Construction Management Plan	A checklist that shows a development proposal's anticipated impacts to all modes of transportation and all elements in the right of way during construction.	☐	☐	☒	☐	☒	
				Study Trigger Details: For all Site Plan and plan of subdivision applications.					

☐	☐	29. Public Consultation Strategy	Proposal to reach and collect public input as part of development application.	☒	☒	☒	☒	☒	
				Study Trigger Details: Official Plan Amendment, Zoning By-law Amendment and Subdivision: Always required. Condominium: Vacant Land only Site Plan: At the discretion of the City's file lead in consultation with the Business and Technical Support Services Manager.					
☒	☐	30. Shadow Analysis	A visual model of how the proposed development will cast its shadow.	☐	☒	☐	☐	☐	
				Study Trigger Details: When there is an increase in height or massing proposed for a residential, commercial or office use. Two triggers: 1. Inside the Greenbelt: proposed development is over 5 storeys in height (≤15 meters). If a development proposal is 5 storeys or less, but is proposing an increase in height and/or massing and is in close proximity to a shadow sensitive area, a shadow analysis may be requested. 2. Outside the Greenbelt: proposed development is over 3 storeys in height (≤9 meters) and is in close proximity to a shadow sensitive area. Where a proposed development is not in close proximity to a shadow sensitive area (e.g. industrial development) the trigger for a shadow analysis is over 5 storeys in height (≤15 meters).					
☒	☐	31. Site Plan	A Site Plan is a visual drawing that illustrates the proposed development of a site in two dimensions.	☒	☒	☒	☒	☒	Site Plan Yes ☐ No ☐ Concept Plan Yes ☐ No ☐
				Study Trigger Details: Site Plan: All Other applications: where a layout of the					

				public realm, building massing, heights, densities or massing of the proposal provides changes to the planned context; sites proposing multiple land uses; sites with multiple landowners; sites with two or more buildings, on-site park dedication, and/or a new public or private street(s); sites with proposed changes to connectivity (such as active transportation networks, vehicular circulation or access to transit); sites where the development potential on adjacent properties may be impacted by or could be integrated into the proposed site.	Facility Fit Plan Yes ☐ No ☐
☒	☐	32. Urban Design Brief	Illustrate how a development proposal represents high-quality and context sensitive design that implements policies of the Official Plan, relevant secondary plans, and Council approved plans and guidelines.	☒ ☒ ☒ ☐ ☒ <u>Study Trigger Details</u>: For all Official Plan amendment, Zoning By-law amendment, and plan of subdivision applications. For SPC applications: proposals for residential buildings with 25 or more residential units, or for proposals for residential buildings with less than 25 residential units, if the units are within the Urban area or the High-performance Development Standard threshold in the rural area where OP Policy 11.3 (3) is relevant; for non-residential and mixed-use proposals.	
☐	☐	33. Urban Design Review Panel Report	Demonstrates that a development proposal has attended an Urban Design Review Panel formal review meeting, received, and responded to the associated recommendations, if applicable	☒ ☒ ☒ ☒ ☒ <u>Study Trigger Details</u>: Required for all planning act applications subject to UDRP review, in accordance with the UDRP Panel Terms of Reference.	
☒	☐	34. Wind Analysis	A visual model and a written evaluation of how a proposed development will impact pedestrian-level wind conditions.	☐ ☒ ☐ ☐ ☒ <u>Study Trigger Details</u>: Applications seeking an increase in height and/or massing which is either: a tall building(s), 10 storeys or more or a proposed building that is more than twice the height of	

				adjacent existing buildings and is greater than five storeys in height and is adjacent to existing or planned low rise development, open spaces, water bodies and large public amenity areas.					
☒	☐	35. Zoning Confirmation Report	The purpose of the Zoning Confirmation Report (ZCR) is to identify all zoning compliance issues, if any, at the outset of a planning application.	☐	☒	☐	☐	☒	
				Study Trigger Details: Required for all SPC and ZBLA applications.					

ENVIRONMENTAL

R	A	Study / Plan Name	Description	When Required 1	2	3	4	5	Applicable Study Components & Other Comments
☐	☐	36. Community Energy Plan	Includes a community energy analysis, alongside mitigation measures, and other associated information. The community energy analysis refers to the overall assessment process to identify on and off-site measures to align the design of the development with City climate objectives.	☐	☐	☐	☐	☐	
				NOT IMPLEMENTED & NOT REQUIRED					
☐	☐	37. Energy Modelling Report	The Energy Modeling Report is a Site Plan Control application submission requirement to show how climate change mitigation, and energy objectives will be met through exterior building design elements.	☐	☐	☐	☐	☐	
				NOT IMPLEMENTED & NOT REQUIRED					
☐	☐	38. Environmental Impact Study	Assessment of environmental impacts of a project and documents the existing natural features, identifies the potential environmental impacts,	☒	☒	☒	☐	☒	Assessment of Landform Features Yes ☐ No ☐ Integrated Environmental Review Yes ☐ No ☐
				Study Trigger Details: Is required when development or site alteration is proposed in or within a					

			recommends ways to avoid and reduce the negative impacts, and proposes ways to enhance natural features and functions.	specified distance of environmentally designated lands, natural heritage features, the City's Natural Heritage System, or hazardous forest types for wildland fire. The EIS Decision Tool (Appendix 2 of the Environmental Impact Study Guidelines) provides a checklist of the natural heritage features and adjacent areas within which an EIS is required to support development applications under the *Planning Act.*					Protocol for Wildlife Protection during Construction Yes ☐ No ☐ Significant Woodlands Guidelines for Identification, Evaluation, and Impact Assessment Yes ☐ No ☐
☐	☐	39. Environmental Management Plan	A comprehensive environmental planning document that identifies, evaluates, and mitigates the potential impacts of proposed development on the natural environment and its ecological functions at local planning stage.	☒	☐	☐	☐	☐	
				Study Trigger Details: Official Plan amendments for local plans (area-specific policy or secondary plan, where: there is significant change in the conditions upon which the original study was based; there are proposed changes to planned infrastructure needed to service a subdivision that would have a significant impact on the infrastructure needs of another subdivision within the EMP study area, or the applicable Class Environmental Assessment approval has expired.					
☐	☐	40. High-performance Development Standard	A collection of voluntary and required standards that raise performance of new building projects to achieve sustainable and resilient design	☐	☐	☐	☐	☐	
				NOT IMPLEMENTED & NOT REQUIRED					
☐	☐	41. Tree Conservation Report	Demonstrates how tree cover will be retained and protected on the site, including mature trees, stands of trees, and hedgerows.	☐	☐	☒	☒	☒	
				Study Trigger Details: Where there is a tree of 10 centimeters in diameter or greater on the site and/or if there is a tree on an adjacent site that has a Critical Root Zone (CRZ) extending onto the development site.					

Appendix B

Watermain Boundary Conditions

Water Demand Calculations

FUS Calculations

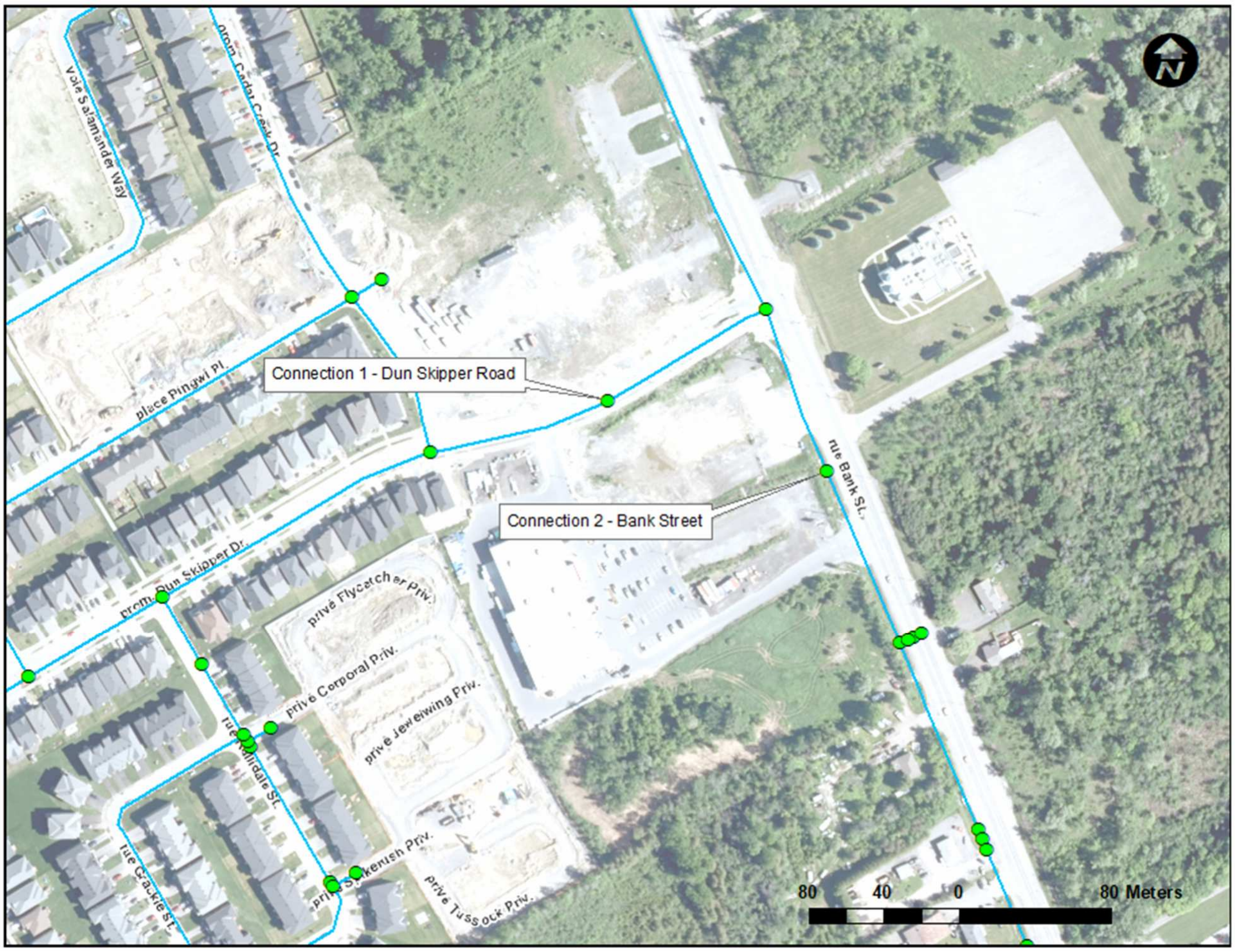
Water Model Results

Boundary Conditions
155 Dun Skipper Drive

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	58	0.97
Maximum Daily Demand	138	2.30
Peak Hour	299	4.98
Fire Flow Demand #1	11,000	183.33

Location



Results

Existing Condition (Pre- SUC Pressure Zone Reconfiguration)

Connection 1 – Dun Skipper Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	154.6	78.3
Peak Hour	143.9	63.1
Max Day plus Fire Flow 1	125.1	36.3
Ground Elevation =	99.5	m

Connection 1 – Bank Street

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	154.6	79.1
Peak Hour	143.9	63.9
Max Day plus Fire Flow 1	124.6	36.4
Ground Elevation =	99.0	m

Future Condition (Post- SUC Pressure Zone Reconfiguration)

Connection 1 – Dun Skipper Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	147.3	67.9
Peak Hour	144.6	64.1
Max Day plus Fire Flow 1	140.2	57.8
Ground Elevation =	99.5	m

Connection 1 – Bank Street

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	147.3	68.7
Peak Hour	144.3	64.5
Max Day plus Fire Flow 1	139.2	57.2
Ground Elevation =	99.0	m

Notes

1. Any connection to a watermain 400 mm or larger should be approved by DWS as per the Water Design Guidelines Section 2.4 Review by Drinking Water Services.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : 4836 Bank Street
LOCATION : Leitrim Development Area - City of Ottawa
DEVELOPER : Leitrim Home Hardware

FILE: 119351.5.7.3
DATE PRINTED: 17-Oct-24
DESIGN: LME

NODE	RESIDENTIAL UNITS SF	RESIDENTIAL UNITS 2-BED	RESIDENTIAL UNITS 1-BED	RESIDENTIAL HOTEL BEDS	NON-RESIDENTIAL INDTRL (ha.)	NON-RESIDENTIAL INST. (ha.)	NON-RESIDENTIAL RETAIL (m^2)	AVERAGE DAILY DEMAND (l/s) Res.	AVERAGE DAILY DEMAND (l/s) Non-res.	AVERAGE DAILY DEMAND (l/s) Total	MAXIMUM DAILY DEMAND (l/s) Res.	MAXIMUM DAILY DEMAND (l/s) Non-res.	MAXIMUM DAILY DEMAND (l/s) Total	MAXIMUM HOURLY Res.	MAXIMUM HOURLY Non-res.	MAXIMUM HOURLY Total	FIRE DEMAND (l/min)
T-120																	
(Building A and D)							3,490	0.00	0.10	0.10	0.00	0.15	0.15	0.00	0.27	0.27	
T-150																	
(Building B Revised)		87	54				878	0.837	0.025	0.86	2.09	0.04	2.13	4.60	0.07	4.67	10,000
T-160																	
(Building C)							502	0.00	0.01	0.01	0.00	0.02	0.02	0.00	0.04	0.04	
Fire Nodes																	
TH-110, TH-030																	11,000
TH-020, TH-040																	10,000
TOTAL										**0.97**			**2.30**			**4.98**	

ASSUMPTIONS

RESIDENTIAL DENSITIES
- Single Family (SF) 3.4 p / p / u
- Hotel Beds average 1.8 p / p / u
- Stacked Townhouse (ST) 2.3 p / p / u

AVG. DAILY DEMAND
- Hotel (Table 4.2) 225 l / cap / day
- Retail (Shopping Centre) 2,500 l / 1000m^2 / day

MAX. DAILY DEMAND
- Hotel (Table 4.2) 338 l / cap / day
- Retail (Shopping Centre) 3,750 l / 1000m^2 / day

MAX. HOURLY DEMAND
- Hotel (Table 4.2) 608 l / cap / day
- Retail (Shopping Centre) 6,750 l / 1000m^2 / day

FIRE FLOW
- Hotel 10,000 l / min
- Retail 11,000 l / min

ARCADIS IBI GROUP
500-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
ibigroup.com

WATERMAIN DEMAND CALCULATION SHEET
155 Dun Skipper Dr, Seniors Departments | 2668867 Ontario Inc.
148290-6.0 | Rev #1 | 2024-11-26
Prepared By: WZ | Checked By: RM

NODE	RESIDENTIAL				NON-RESIDENTIAL (ICI)			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND (l/min)
	SINGLE FAMILY UNITS	2 bedroom UNITS	1 bedroom UNITS	POPULATION	INDUST. (ha)	COMM. (ha)	INSTIT. (ha)	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	
Building B		87	54	258.30		0.0878		0.837	0.025	0.86	2.09	0.04	2.13	4.60	0.07	4.67	10,000
TOTAL		**87**	**54**	**258.30**		**0.09**				**0.86**			**2.13**			**4.67**	

ASSUMPTIONS

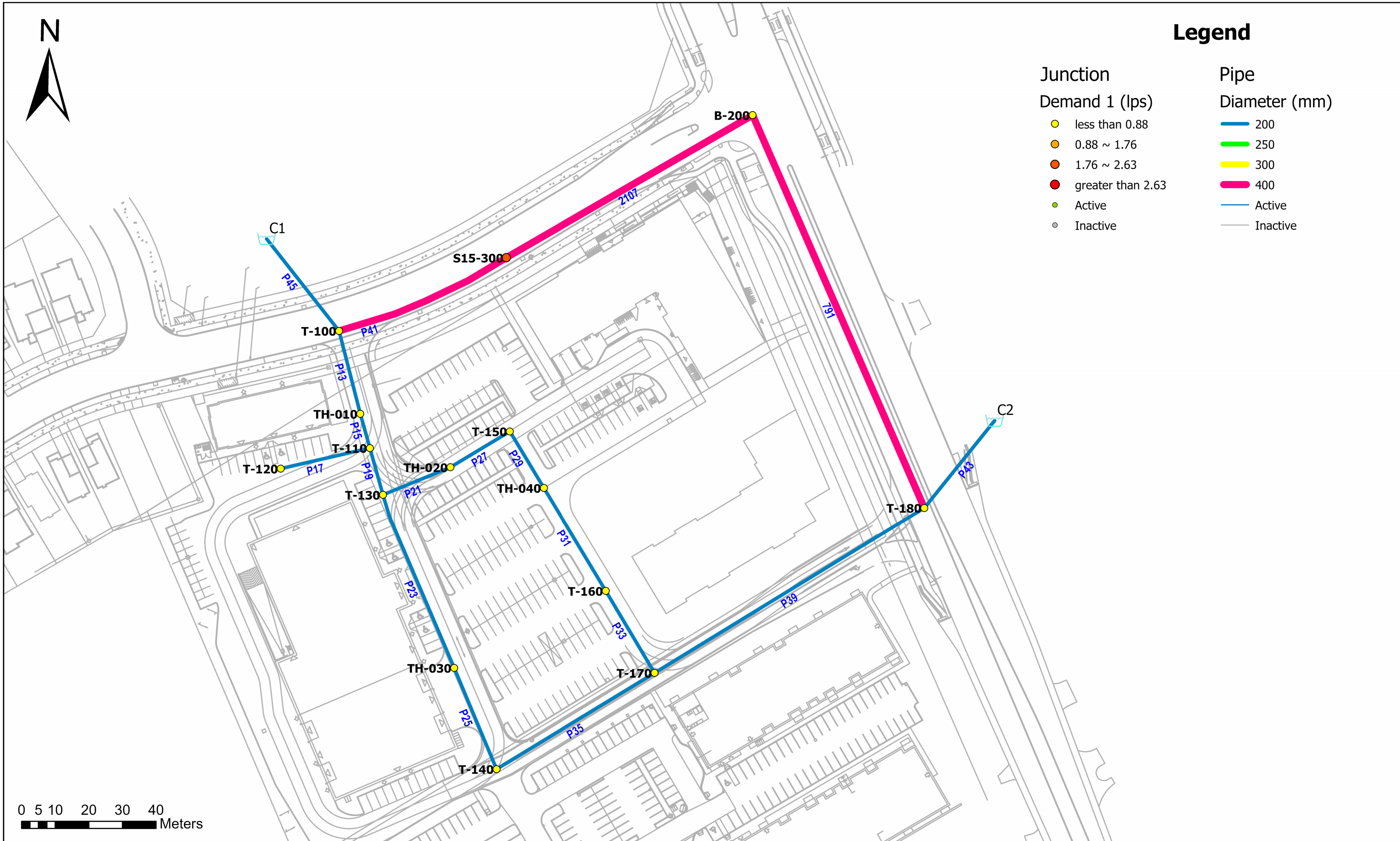
POPULATION DENSITY		WATER DEMAND RATES		PEAKING FACTORS			FIRE DEMANDS	
Single Family	3.4 persons/unit	Residential	280 l/cap/day	Maximum Daily			Single Family	10,000 l/min (166.7 l/s)
					Residential	2.5 x avg. day		
2 Bedroom Units	2.1 persons/unit				Commercial	1.5 x avg. day	Semi Detached &	
		Commercial Shopping Center	2,500 L/(1000m2)/day	Maximum Hourly			Townhouse	10,000 l/min (166.7 l/s)
1 Bedroom Units	1.4 persons/unit				Residential	2.2 x max. day		
					Commercial	1.8 x max. day	Medium Density	15,000 l/min (250 l/s)

STEP	Contents	Description		Adjustment Factor		Result	
1	**Building A (9-storey)**	1st Floor Area	1900	Height 2.8m	1	1900	m2
		2nd Floor Area	1900	Height 2.8m	1	1900	m2
		3rd Floor Area	1680	Height 2.8m	0.5	840	m2
		4th Floor Area	1680	Height 2.8m	0.5	840	m2
		5th Floor Area	1680	Height 2.8m	0.5	840	m2
		6th Floor Area	1665	Height 2.8m	0.5	833	m2
		7th Floor Area	1665	Height 2.8m	0.5	833	m2
		8th Floor Area	1665	Height 2.8m	0.5	833	m2
		9th Floor Area	1672	Height 2.8m	0.5	836	m2
	Total Effective Floor Area	(Storage space exceeding 3m in height, floor area X 3)				**6726.8**	m2
2	**Type of Construction**	**Type V** Wood Frame	1.5	Type II Noncombustible Construction	0.8		
		Type III Ordinary Construction	1.0				
		Type II Noncombustible Construction	0.8				
		Type I Fire Resistive Construction	0.6				
3	**Required Fire Flow**	RFF = 220C√A, rounded to nearest 1000 L/min				**14000**	L/min
4	**Occupancy and Contents**	Noncombustible Contents	-25%	Combustible - Residential/Commercial	0%	0	L/min
		Limited Conbustible Contents	-15%				
		Combustible Contents	0%				
		Free Burning Contents	15%				
		Rapid Burning Contents	25%				
	Fire Flow					**14000**	L/min
5	**Automatic Sprinkler Protection**	Automatic Sprinkler Conforming to NFPA 13	-30%	Yes	-30%	-4200	L/min
		Standard Water Supply for both the system and Fire Department Hose Lines	-10%	Yes	-10%	-1400	L/min
		Fully Supervised System	0%	No			
	Total Sprinkler Adjustment					**-5600**	L/min
6	**Exposure Adjustment**	Based on **Table 6** Exposure Adjustement Charges for Subject Building					
	North	Separation (m)	>30	With unprotected opening	0%	0	L/min
		Length X Height Factor (m.storeys)	0				
		Construction Type	Type II				
	South	Separation (m)	21.9	With unprotected opening	10%	1400	L/min
		Length X Height Factor (m.storeys)	108				
		Construction Type	Type II				
	East	Separation (m)	>30	With unprotected opening	0%	0	L/min
		Length X Height Factor (m.storeys)	0				
		Construction Type	Type II				
	West	Separation (m)	>30	With unprotected opening	0%	0	L/min
		Length X Height Factor (m.storeys)	0				
		Construction Type	Type II				
	Total Exposure Adjustment					**1400**	L/min
7	**Total Required Fire Flow**					**9800**	L/min
		Rounded to Nearest 1000 L/min				**10000**	L/min
						167	L/s

Notes 1. Fire flow calculation are based on Fire Underwriters Survey version 2020.

2. If any vertical opening in the building are unprotected (e.g. interconnected floor spaces, elevators etc.), consider the two largest adjoining floor area plus 50% of all floors immediately above them up to a maximum of eight.

Junctions and Pipes Layouts



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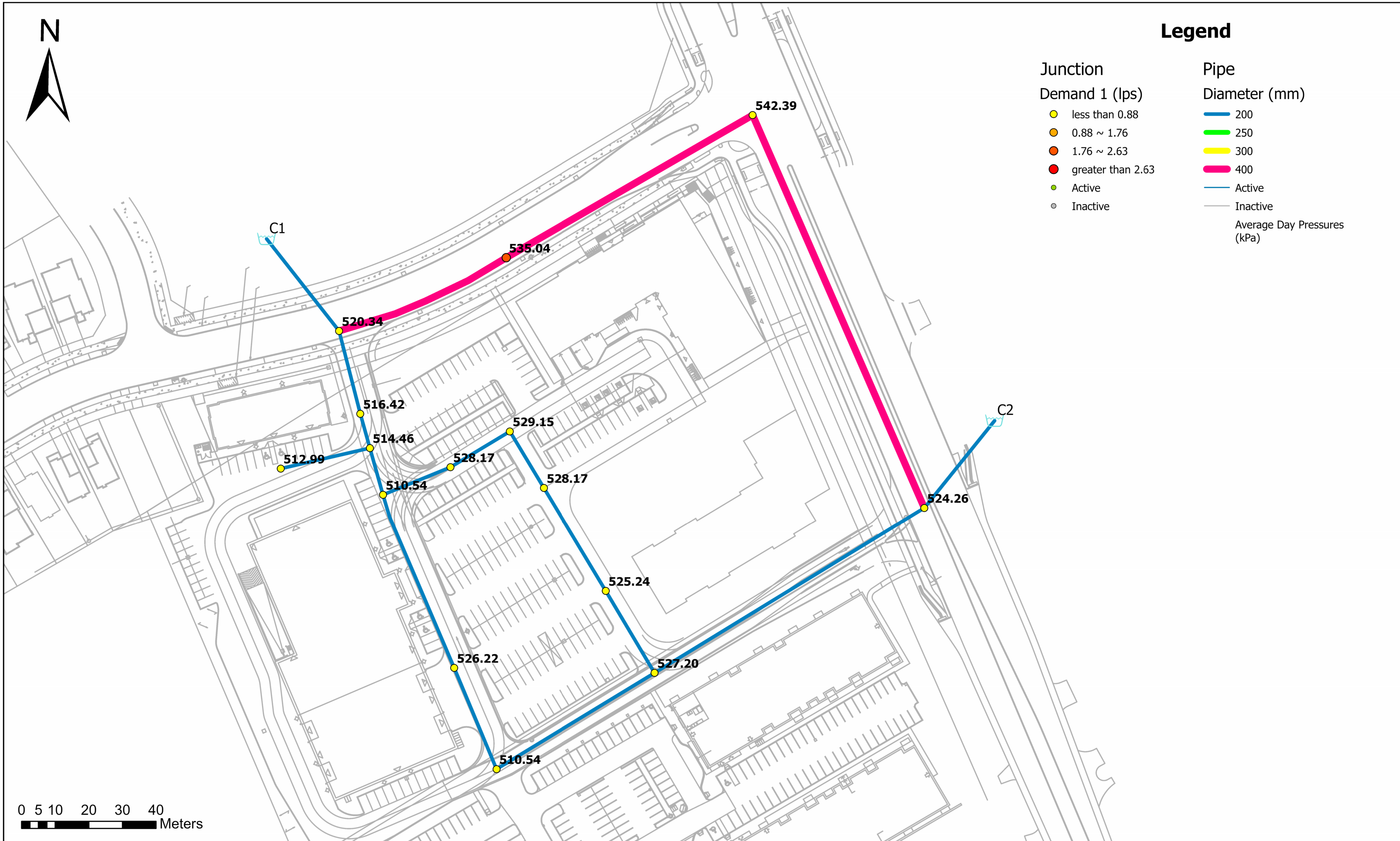
Average Day Pressure (kPa)



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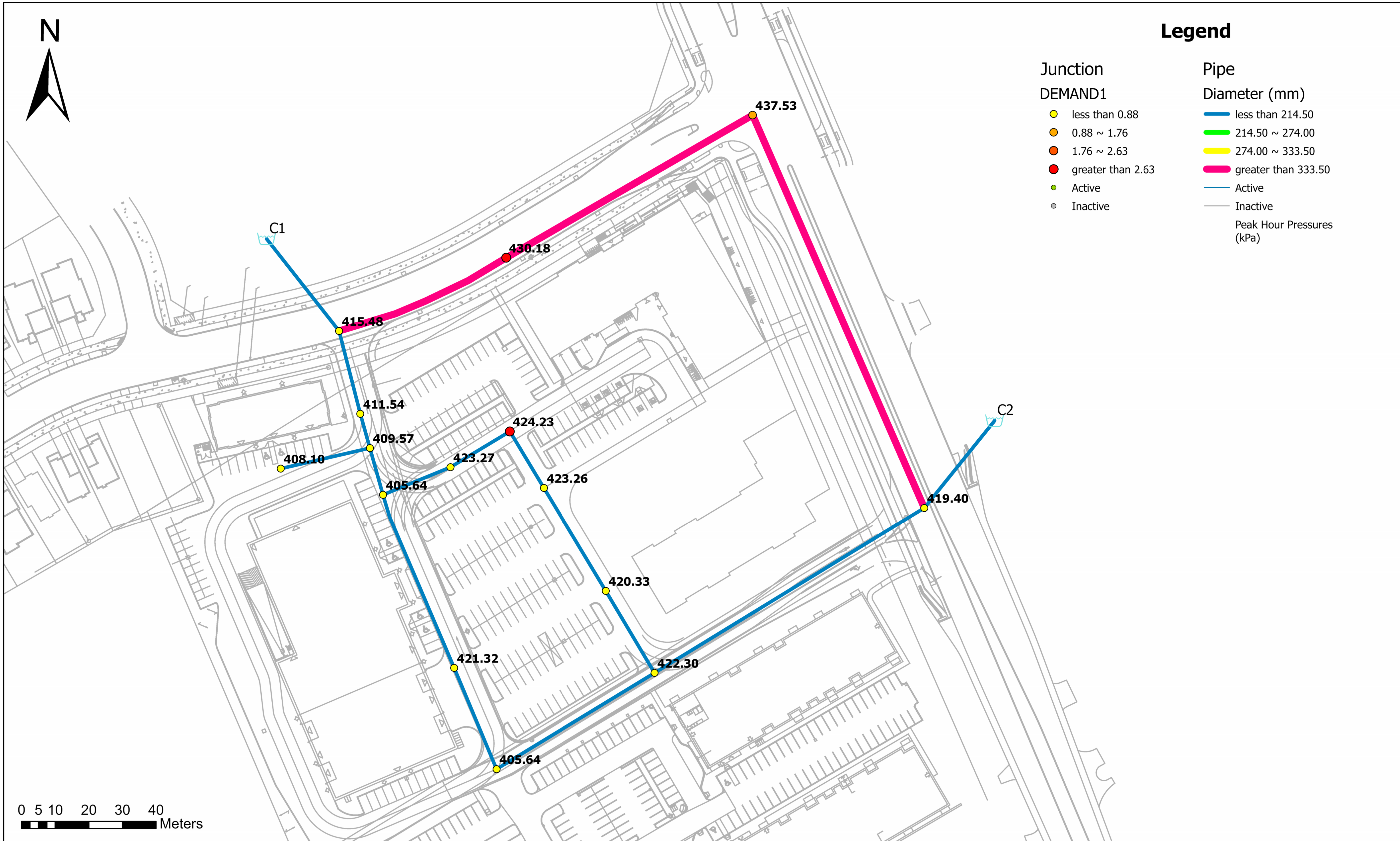
Average Day Results

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)	Water Age (hrs)
1	☐	B-200	0.68	99.25	154.60	542.39	3.45
2	☐	S15-300	2.34	100.00	154.60	535.04	2.85
3	☐	T-100	0.00	101.50	154.60	520.34	0.00
4	☐	T-110	0.00	102.10	154.60	514.46	0.58
5	☐	T-120	0.10	102.25	154.60	512.99	2.01
6	☐	T-130	0.00	102.50	154.60	510.54	2.83
7	☐	T-140	0.00	102.50	154.60	510.54	13.73
8	☐	T-150	0.86	100.60	154.60	529.15	3.82
9	☐	T-160	0.01	101.00	154.60	525.24	2.82
10	☐	T-170	0.00	100.80	154.60	527.20	2.11
11	☐	T-180	0.00	101.10	154.60	524.26	0.01
12	☐	TH-010	0.00	101.90	154.60	516.42	0.41
13	☐	TH-020	0.00	100.70	154.60	528.17	3.19
14	☐	TH-030	0.00	100.90	154.60	526.22	20.62
15	☐	TH-040	0.00	100.70	154.60	528.17	3.74

Peak Hour Pressure (kPa)

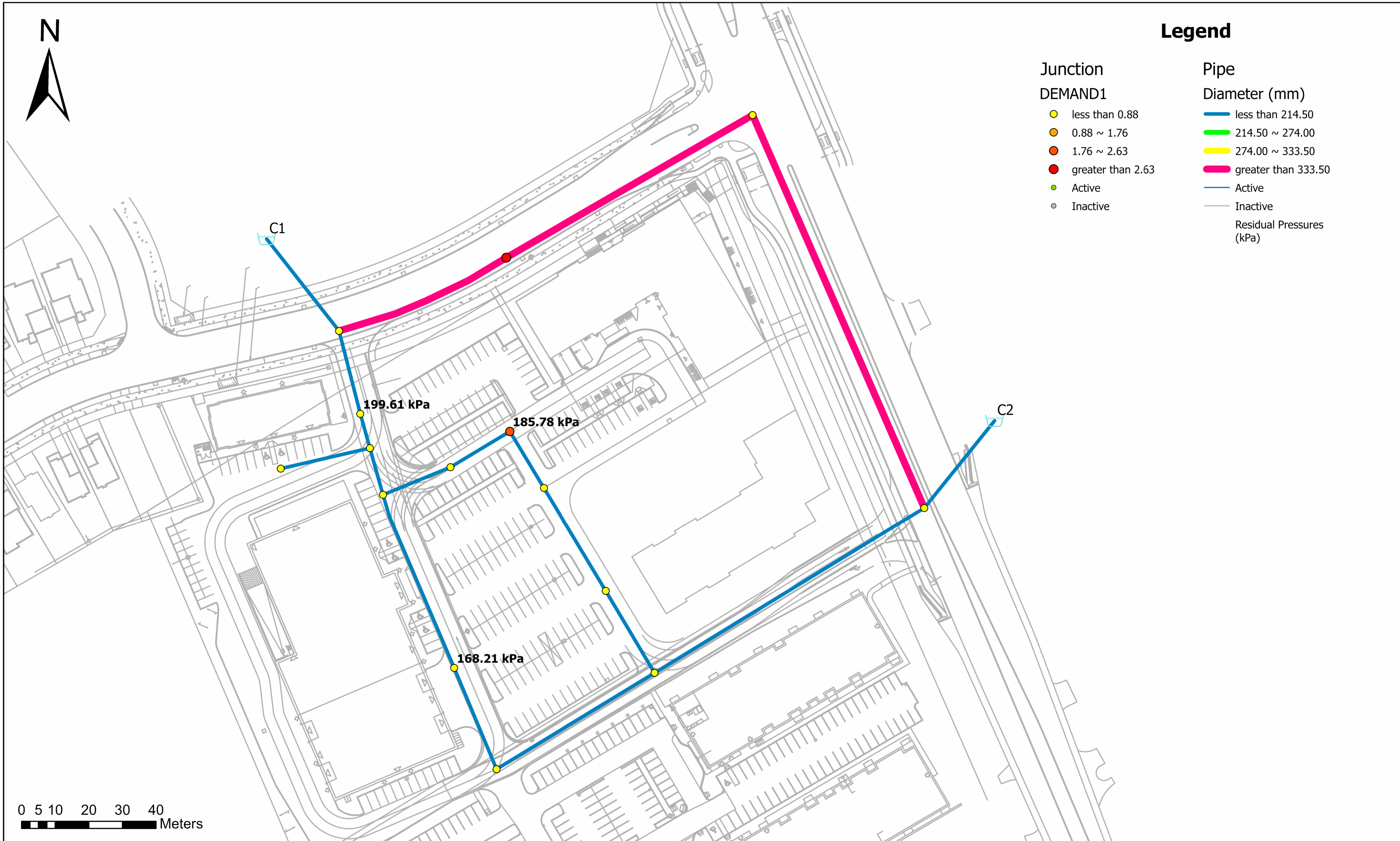


Date Printed: 2024-10-28 11:37 AM

Peak Hour Results

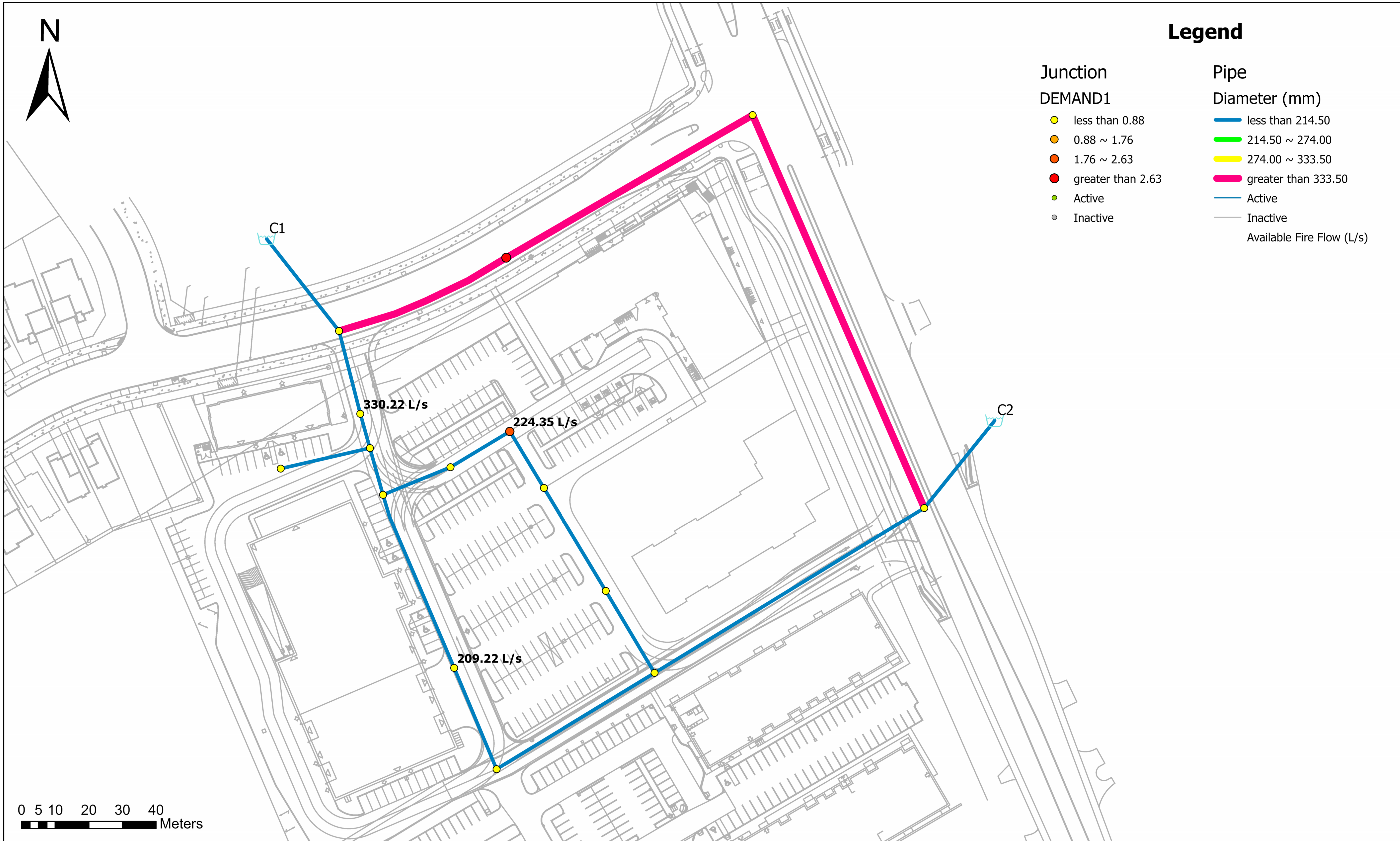
		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)	Water Age (hrs)
1	☐	B-200	1.02	99.25	143.90	437.53	1.41
2	☐	S15-300	6.31	100.00	143.90	430.18	1.20
3	☐	T-100	0.00	101.50	143.90	415.48	0.00
4	☐	T-110	0.00	102.10	143.90	409.57	0.11
5	☐	T-120	0.27	102.25	143.90	408.10	0.64
6	☐	T-130	0.00	102.50	143.90	405.64	0.65
7	☐	T-140	0.00	102.50	143.90	405.64	4.47
8	☐	T-150	4.67	100.60	143.89	424.23	0.80
9	☐	T-160	0.04	101.00	143.89	420.33	0.55
10	☐	T-170	0.00	100.80	143.90	422.30	0.41
11	☐	T-180	0.00	101.10	143.90	419.40	0.00
12	☐	TH-010	0.00	101.90	143.90	411.54	0.08
13	☐	TH-020	0.00	100.70	143.89	423.27	0.72
14	☐	TH-030	0.00	100.90	143.90	421.32	6.87
15	☐	TH-040	0.00	100.70	143.89	423.26	0.72

Max day + Fire Flow



Date Printed: 2024-10-30 11:05 AM

Max day + Fire Flow



Date Printed: 2024-10-28 11:55 AM

Max Day + Fire Flow Results

		ID	Static Demand (L/s)	Static Pressure (kPa)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Hydrant Available Flow (L/s)	Hydrant Pressure at Available Flow (kPa)
1	☐	T-150	2.13	237.92	124.88	166.67	185.78	224.35	150.0
2	☐	TH-010	0.00	226.12	124.97	183.33	199.61	330.22	150.0
3	☐	TH-030	0.00	235.02	124.88	183.33	168.21	209.22	150.0

Max Day + Fire Flow - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	Flow Reversal	Water Age (hrs)
1	☐	2107	S15-300	B-200	84.75	393.00	120.00	83.06	0.68	0.12	0	0.02
2	☐	791	B-200	T-180	127.53	393.00	120.00	82.38	0.68	0.18	0	0.06
3	☐	P13	T-100	TH-010	25.45	204.00	110.00	18.27	0.56	0.06	0	0.00
4	☐	P15	TH-010	T-110	10.56	204.00	110.00	18.27	0.56	0.03	0	0.01
5	☐	P17	T-110	T-120	27.22	155.00	100.00	0.15	0.01	0.00	0	0.02
6	☐	P19	T-130	T-110	14.44	204.00	110.00	-18.12	0.55	0.03	0	0.02
7	☐	P21	T-130	TH-020	21.69	204.00	110.00	10.03	0.31	0.02	0	0.03
8	☐	P23	T-130	TH-030	55.80	204.00	110.00	8.08	0.25	0.03	0	0.03
9	☐	P25	TH-030	T-140	32.64	204.00	110.00	8.08	0.25	0.02	0	0.09
10	☐	P27	T-150	TH-020	20.64	204.00	110.00	-10.03	0.31	0.02	0	0.04
11	☐	P29	TH-040	T-150	19.63	204.00	110.00	-7.90	0.24	0.01	0	0.06
12	☐	P31	TH-040	T-160	35.83	204.00	110.00	7.90	0.24	0.02	0	0.09
13	☐	P33	T-160	T-170	28.39	204.00	110.00	7.88	0.24	0.01	0	0.13
14	☐	P35	T-140	T-170	55.09	204.00	110.00	8.08	0.25	0.03	0	0.12
15	☐	P39	T-170	T-180	94.13	204.00	110.00	15.97	0.49	0.18	0	0.17
16	☐	P41	T-100	S15-300	54.54	393.00	120.00	86.57	0.71	0.08	0	0.00
17	☐	P43	C2	T-180	1.00	204.00	110.00	-98.34	3.01	0.06	0	0.13
18	☐	P45	C1	T-100	1.00	204.00	110.00	104.83	3.21	0.06	0	0.00

Appendix C

Sanitary Sewer Design Sheet

Sanitary Drainage Area Plan 148290-C-400

Sanitary Sewer Design Sheet 119351

Sanitary Drainage Area Plan 119351-C-400

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

SANITARY SEWER DESIGN SHEET

155 Dun Skipper Drive
City of Ottawa
2668867 Ontario Inc.

LOCATION: STREET	LOCATION: AREA ID	LOCATION: FROM MH	LOCATION: TO MH	RESIDENTIAL: AREA w/ Units (Ha)	RESIDENTIAL: UNIT TYPES SF	RESIDENTIAL: UNIT TYPES APT	RESIDENTIAL: UNIT TYPES 2-BED	RESIDENTIAL: UNIT TYPES 1-BED	RESIDENTIAL: AREA w/o Units (Ha)	RESIDENTIAL: POPULATION IND	RESIDENTIAL: POPULATION CUM	RESIDENTIAL: RES PEAK FACTOR	RESIDENTIAL: PEAK FLOW (L/s)	ICI AREAS: AREA (Ha) INSTITUTIONAL IND	ICI AREAS: AREA (Ha) INSTITUTIONAL CUM	ICI AREAS: AREA (Ha) COMMERCIAL IND	ICI AREAS: AREA (Ha) COMMERCIAL CUM	ICI AREAS: AREA (Ha) INDUSTRIAL IND	ICI AREAS: AREA (Ha) INDUSTRIAL CUM	ICI AREAS: ICI PEAK FACTOR	ICI AREAS: PEAK FLOW (L/s)	INFILTRATION ALLOWANCE: AREA (Ha) IND	INFILTRATION ALLOWANCE: AREA (Ha) CUM	INFILTRATION ALLOWANCE: FLOW (L/s)	FIXED FLOW (L/s): IND	FIXED FLOW (L/s): CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN: CAPACITY (L/s)	PROPOSED SEWER DESIGN: LENGTH (m)	PROPOSED SEWER DESIGN: DIA (mm)	PROPOSED SEWER DESIGN: SLOPE (%)	PROPOSED SEWER DESIGN: VELOCITY (full) (m/s)	PROPOSED SEWER DESIGN: AVAILABLE CAPACITY L/s	PROPOSED SEWER DESIGN: AVAILABLE CAPACITY (%)
EXISTING PHASE 1		*BLDG D*	*MH7A-MH5A*							*0.0*	*0.0*	*3.80*	*0.00*			*0.05*	*0.05*			*1.50*	*0.02*	*0.05*	*0.05*	*0.02*	*0.00*	*0.00*	*0.04*	*34.22*	*11.10*	*200*	*1.00*	*1.055*	*34.18*	*99.88%*
		BLDG A	*MH7A-MH5A*							*0.0*	*0.0*	*3.80*	*0.00*			*0.30*	*0.30*			*1.50*	*0.15*	*0.30*	*0.30*	*0.10*	*0.00*	*0.00*	*0.24*	*34.22*	*14.61*	*200*	*1.00*	*1.055*	*33.97*	*99.28%*
		MH7A	*MH5A*							*0.0*	*0.0*	*3.80*	*0.00*			*1.01*	*1.01*			*1.50*	*0.49*	*1.01*	*1.01*	*0.33*	*0.00*	*0.00*	*0.82*	*28.05*	*32.74*	*200*	*0.67*	*0.865*	*27.22*	*97.06%*
Future		BLDG C	MH1A-MH3A							0.0	0.0	3.80	0.00			0.05	0.05			1.50	0.02	0.05	0.05	0.02	0.00	0.00	0.04	34.22	50.00	200	1.00	1.055	34.18	99.88%
Phase 2		BLDG B	MH3A				87	54		258.3	258.3	3.48	2.92			0.19	0.19			1.50	0.09	0.19	0.19	0.06	0.00	0.00	3.07	34.22	19.54	200	1.00	1.055	31.14	91.02%
External		*MH1A*	*MH3A*	*1.54*		*180*				*324.0*	*582.3*	*3.35*	*6.32*			*0.86*	*0.86*			*1.50*	*0.42*	*0.86*	*0.86*	*0.29*	*0.00*	*0.00*	*7.03*	*19.66*	*92.55*	*200*	*0.33*	*0.606*	*12.63*	*64.24%*
		MH3A	*MH4A*							*0.0*	*582.3*	*3.35*	*6.32*			*0.42*	*1.29*			*1.50*	*0.63*	*0.42*	*1.29*	*0.43*	*0.00*	*0.00*	*7.38*	*21.37*	*30.45*	*200*	*0.39*	*0.659*	*13.99*	*65.48%*
		MH4A	*MH5A*							*0.0*	*582.3*	*3.35*	*6.32*			*0.02*	*1.31*			*1.50*	*0.64*	*0.02*	*1.31*	*0.43*	*0.00*	*0.00*	*7.39*	*21.49*	*15.21*	*200*	*0.39*	*0.663*	*14.10*	*65.60%*
		MH5A	*MH6A*							*0.0*	*582.3*	*3.35*	*6.32*			*0.17*	*2.49*			*1.50*	*1.21*	*0.17*	*2.49*	*0.82*	*0.00*	*0.00*	*8.35*	*19.56*	*33.65*	*200*	*0.33*	*0.603*	*11.21*	*57.29%*

Design Parameters:

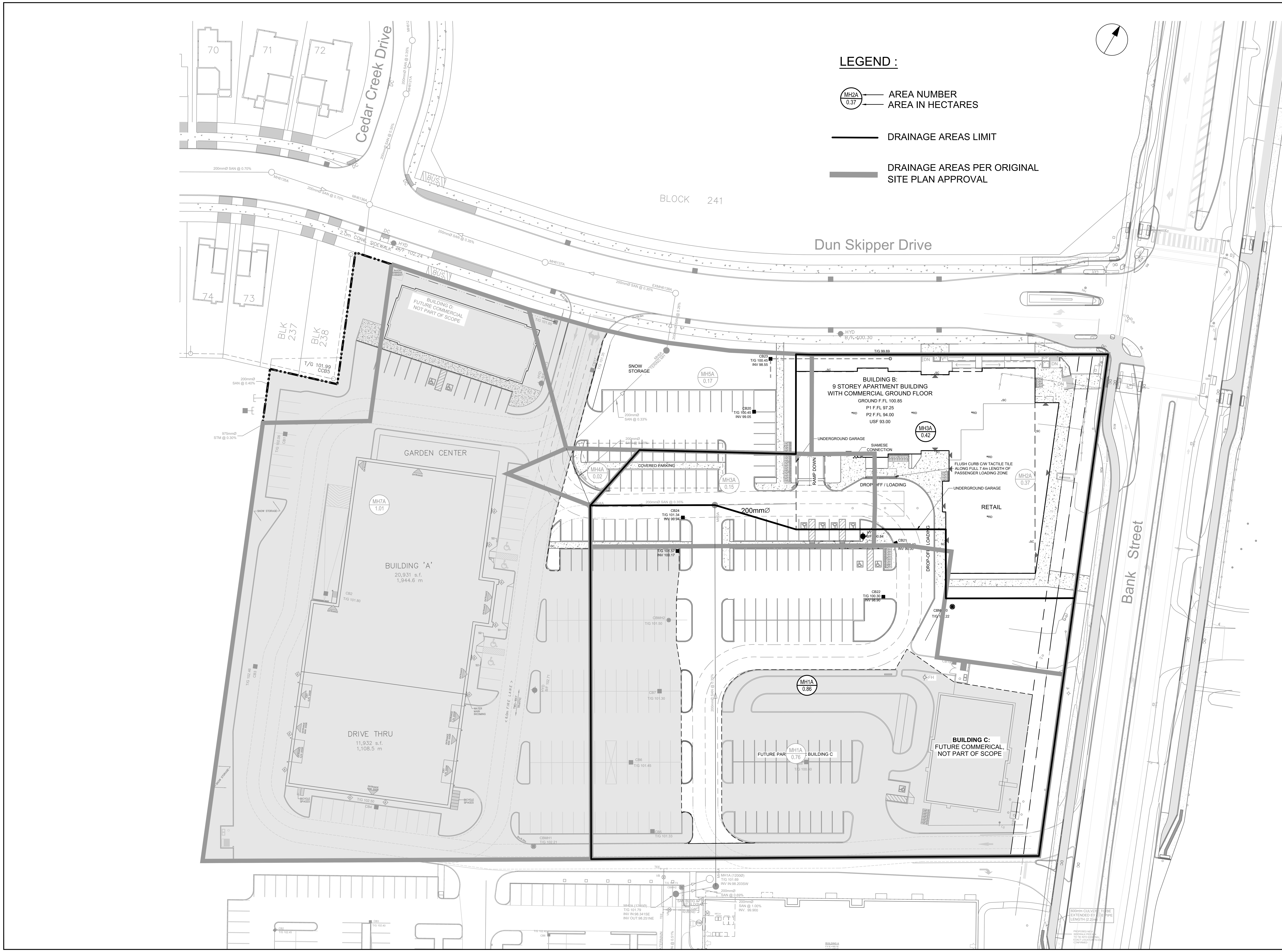
Residential			ICI Areas			
SF	3.4	p/p/u				
APT	1.8	p/p/u	INST	28,000	L/Ha/day	
2-BED	2.1	p/p/u	COM	28,000	L/Ha/day	
1-BED	1.4	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

Designed: WZ
Checked: RM
Dwg. Reference: 148590-400

No.	Revision	Date
1	Submission No. 1	2024-11-26
2	Submission No. 2	2025-02-18

File Reference:	Date:	Sheet No:
148590-6.04.04	2024-11-26	1 of 1



CLIENT

2668867 Ontario Inc.

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Arcadis Professional Services (Canada) Inc.
formerly IBI Group Professional Services (Canada) Inc.

ISSUES

No.	DESCRIPTION	DATE
1	SUBMISSION NO.1 FOR CITY REVIEW	2024-11-26
2	SUBMISSION NO.2 FOR CITY REVIEW	2025-02-18
3		
4		

SEE 010 FOR NOTES, LEGEND AND DETAILS

KEY PLAN

SUBJECT SITE

CONSULTANTS

1:400 0 4 12 20m

SEAL

LICENSED PROFESSIONAL ENGINEER
W. ZHUANG
100231427
2025/02/18
PROVINCE OF ONTARIO

PRIME CONSULTANT

ARCADIS

333 Preston Street - Suite 500
Ottawa ON K1S 5N4 Canada
tel 613 225 1311
www.arcadis.com

PROJECT

SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO: 148290	
DRAWN BY: M.M.	CHECKED BY: R.M.
PROJECT MGR: R.M.	APPROVED BY: A.Z.

SHEET TITLE

SANITARY DRAINAGE AREA PLAN

SHEET NUMBER	ISSUE
C-400	1

D07-12-24-0169

19213

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

SANITARY SEWER DESIGN SHEET

4836 Bank Street
CITY OF OTTAWA
Home Hardware

LOCATION: STREET	LOCATION: AREA ID	LOCATION: FROM MH	LOCATION: TO MH	RESIDENTIAL: AREA w/ Units (Ha)	RESIDENTIAL: UNIT TYPES SF	UNIT TYPES SD	UNIT TYPES TH	UNIT TYPES APT	RESIDENTIAL: AREA w/o Units (Ha)	POPULATION IND	POPULATION CUM	RES PEAK FACTOR	PEAK FLOW (L/s)	ICI AREAS: AREA (Ha) INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	ICI PEAK FACTOR	PEAK FLOW (L/s)	INFILTRATION ALLOWANCE: AREA (Ha) IND	AREA (Ha) CUM	FLOW (L/s)	FIXED FLOW (L/s) IND	FIXED FLOW (L/s) CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN: CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	AVAILABLE CAPACITY (%)
		BLDG D	MH7A-MH5A							0.0	0.0	3.80	0.00			0.05	0.05			1.50	0.02	0.05	0.05	0.02	0.00	0.00	0.04	34.22	11.10	200	1.00	1.055	34.18	99.88%
		BLDG A	MH7A-MH5A							0.0	0.0	3.80	0.00			0.30	0.30			1.50	0.15	0.30	0.30	0.10	0.00	0.00	0.24	34.22	14.61	200	1.00	1.055	33.97	99.28%
		MH7A	MH5A							0.0	0.0	3.80	0.00			1.01	1.01			1.50	0.49	1.01	1.01	0.33	0.00	0.00	0.82	27.59	32.62	200	0.65	0.851	26.76	97.01%
		BLDG C	MH1A-MH2A							0.0	0.0	3.80	0.00			0.06	0.06			1.50	0.03	0.06	0.06	0.02	0.00	0.00	0.05	34.22	12.70	200	1.00	1.055	34.17	99.86%
Idone Commercial		MH1A	MH2A							0.0	0.0	3.80	0.00			2.35	2.35			1.50	1.14	2.35	2.35	0.78	0.00	0.00	1.92	20.24	83.16	200	0.35	0.624	18.32	90.53%
		BLDG B	MH2A-MH3A							0.0	0.0	3.80	0.00			0.22	0.22			1.50	0.11	0.22	0.22	0.07	0.00	0.00	0.18	34.22	17.46	200	1.00	1.055	34.04	99.48%
		MH2A	MH3A							0.0	0.0	3.80	0.00			0.37	2.72			1.50	1.32	0.37	2.72	0.90	0.00	0.00	2.22	20.24	12.25	200	0.35	0.624	18.02	89.03%
		MH3A	MH4A							0.0	0.0	3.80	0.00			0.15	2.87			1.50	1.40	0.15	2.87	0.95	0.00	0.00	2.34	20.24	68.50	200	0.35	0.624	17.90	88.43%
		MH4A	MH5A							0.0	0.0	3.80	0.00			0.02	2.89			1.50	1.40	0.02	2.89	0.95	0.00	0.00	2.36	20.24	14.90	200	0.35	0.624	17.88	88.35%
		MH5A	MH6A							0.0	0.0	3.80	0.00			0.17	4.07			1.50	1.98	0.17	4.07	1.34	0.00	0.00	3.32	20.24	33.69	200	0.35	0.624	16.92	83.59%

Design Parameters:

Residential			ICI Areas			
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	28,000	L/Ha/day	
APT	1.8	p/p/u	COM	28,000	L/Ha/day	
Other	60	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart
				17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

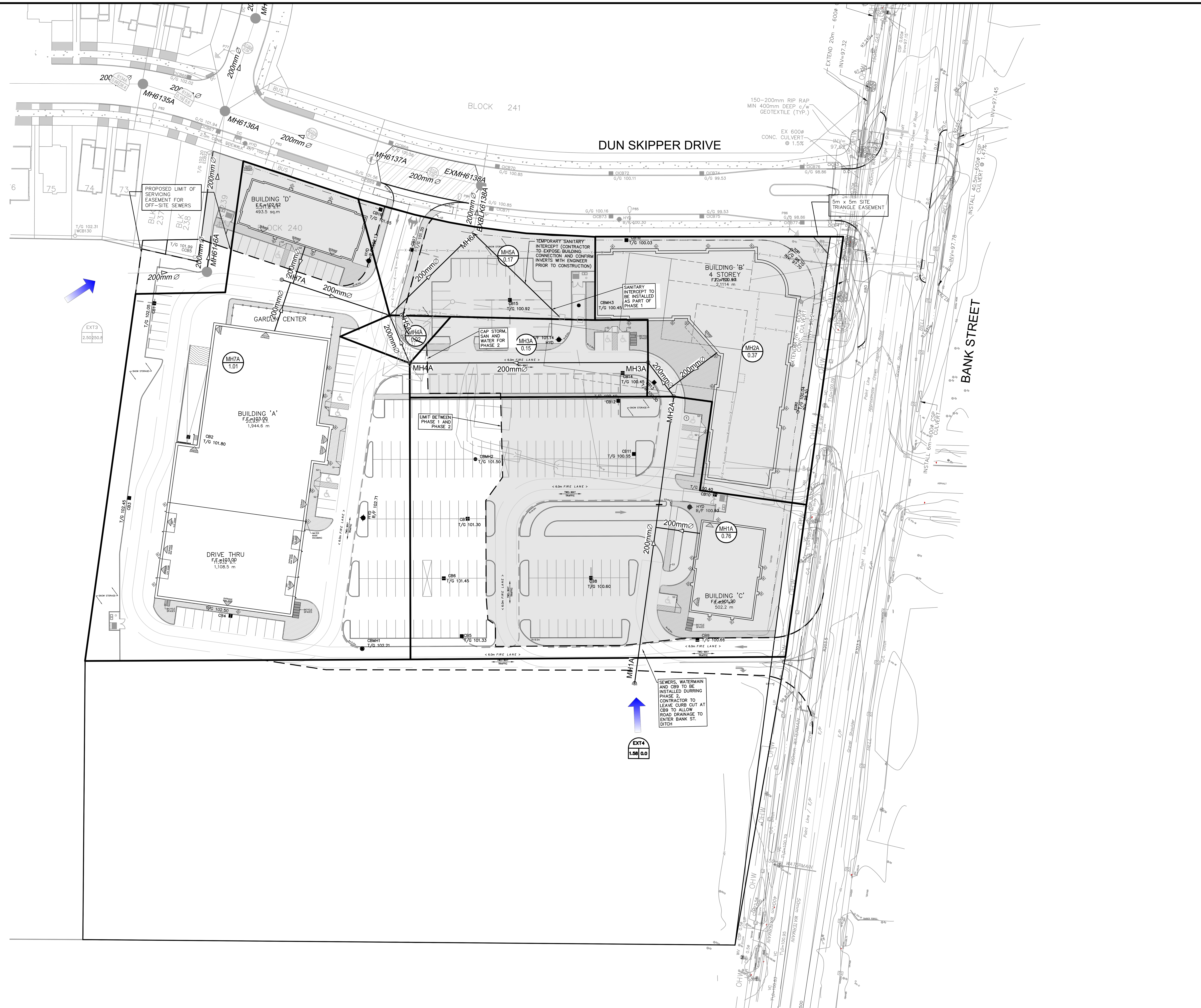
Designed: SEL

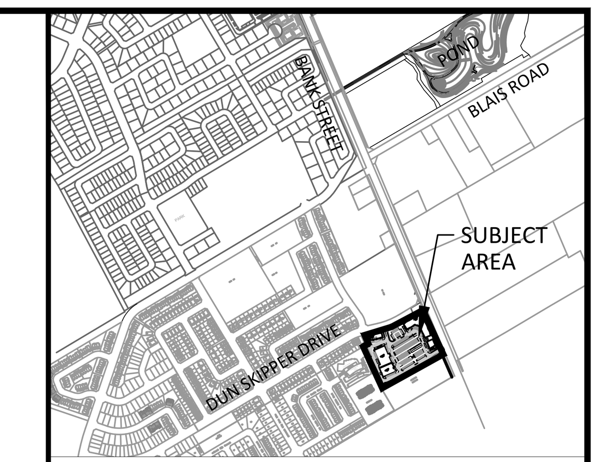
Checked: JIM

Dwg. Reference: 119351-501

No.	Revision	Date
1.	Report Name (Master Servicing Study, Adequacy of Public Services, Servicing Brief, ect) - Submission No. 1	2019-03-30

File Reference:	Date:	Sheet No:
119351.5.7.1	2019-03-30	1 of 1





KEY PLAN
(NTS)

NOTES:
1. SEE DRAWING C-010 FOR ADDITIONAL DETAILS AND NOTES.

2. SITE BENCHMARK TO BE OBTAINED FROM LEGAL SURVEYOR H.A. KEN SHIPMAN SURVEYING LTD.

LEGEND :
6115A — EXISTING AREA NUMBER
0.81 | 43.2 — EXISTING POPULATION; EXISTING AREA IN HECTARES
FUTURE FLOW DIRECTION
MH2A 0.37 (existing) — EXISTING AREA NUMBER; EXISTING AREA IN HECTARES
MH2A 0.37 — AREA NUMBER; AREA IN HECTARES

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	ADD PHASING	JIM	2020:06:23
4	REVISED AS PER CITY COMMENTS	JIM	2020:04:20
3	REVISED AS PER CITY COMMENTS	JIM	2019:12:09
2	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	JIM	2019:10:11
1	ISSUED FOR SPA	JIM	2019:04:15

IBI

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400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
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ibigroup.com

Project Title

BANK STREET DEVELOPMENT
4836 BANK STREET

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2020/06/23
PROVINCE OF ONTARIO

N

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale
1 : 500

Design	Date
SEL	FEB. 2019
Drawn	Checked
DPS	JIM
Project No.	Drawing No.
119351	400

D07-12-19-0092

#17977

Appendix D

Storm Sewer Design Sheet

Storm Water Management Sheet

Storm Drainage Area Plan 148290-C-500

Ponding Plan 148290-C-600

Stormtech Underground Chamber Specifications

Orifice Sizing Calculations

Storm Sewer Design Sheet 119351

Storm Water Management Sheet 119351

Storm Drainage Area Plan 119351-C-500

Ponding Plan 119351-C-600

A Storm Sewer Design Sheet is required for both Interim and Ultimate build-out scenarios.

Arcadis Response: Provide storm design sheet for interim conditions.

IBI GROUP
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Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

STORM SEWER DESIGN SHEET

155 Dun Skipper Drive
City of Ottawa
2668867 Ontario Inc.

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW															SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.25	C= 0.30	C= 0.40	C= 0.50	C= 0.55	C= 0.65	C= 0.81	C= 0.75	C= 0.90	C= 1.00	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	(%)
EXISTING PHASE 1		CB3	MH9-MH8								0.12			0.25	0.25	10.00	0.11	10.11	76.81	104.19	122.14	178.56	19.22	26.07	30.56	44.68		19.22	34.22	6.73	200			1.00	1.055	15.00	43.84%
		CB2	MH9-MH8									0.02		0.05	0.05	10.00	0.12	10.12	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	34.22	7.69	200			1.00	1.055	30.37	88.77%
		MH9	MH8											0.00	0.30	10.12	0.64	10.76	76.34	103.56	121.39	177.46	22.92	31.09	36.45	53.28		22.92	158.48	53.17	375			0.75	1.390	135.56	85.54%
		CB1	MH8-MH7								0.17			0.35	0.35	10.00	0.17	10.17	76.81	104.19	122.14	178.56	27.22	36.93	43.29	63.29		27.22	34.22	10.80	200			1.00	1.055	6.99	20.44%
		MH8	MH7											0.00	0.65	10.76	0.45	11.21	74.01	100.35	117.61	171.91	48.45	65.70	77.00	112.55		48.45	48.63	26.20	250			0.61	0.960	0.18	0.36%
		BLDG D	MH7-MH5									0.05		0.13	0.13	10.00	0.20	10.20	76.81	104.19	122.14	178.56	9.61	13.03	15.28	22.34		9.61	34.22	12.60	200			1.00	1.055	24.61	71.92%
		BLDG A	MH7-MH5									0.30		0.75	0.75	10.00	0.18	10.18	76.81	104.19	122.14	178.56	57.65	78.21	91.68	134.03		57.65	62.04	12.97	250			1.00	1.224	4.39	7.07%
		MH7	MH5											0.00	1.53	11.21	0.47	11.68	72.44	98.19	115.07	168.17	110.86	150.27	176.11	257.37		110.86	225.20	38.55	450			0.57	1.372	114.34	50.77%
		CB4	MH10-CBMH1									0.03		0.08	0.08	10.00	0.12	10.12	76.81	104.19	122.14	178.56	5.76	7.82	9.17	13.40		5.76	34.22	7.78	200			1.00	1.055	28.45	83.15%
		MH10	CBMH1											0.00	0.08	10.12	0.71	10.83	76.34	103.55	121.38	177.44	5.73	7.77	9.11	13.32		5.73	49.16	41.40	250			0.63	0.970	43.43	88.35%
		CB5	CBMH1-CBMH2									0.06		0.15	0.15	10.00	0.36	10.36	76.81	104.19	122.14	178.56	11.53	15.64	18.34	26.81		11.53	34.22	22.72	200			1.00	1.055	22.69	66.30%
		CB6	CBMH1-CBMH2									0.07		0.18	0.18	10.00	0.15	10.15	76.81	104.19	122.14	178.56	13.45	18.25	21.39	31.27		13.45	34.22	9.78	200			1.00	1.055	20.76	60.69%
		CB7	CBMH1-CBMH2									0.08		0.20	0.20	10.00	0.15	10.15	76.81	104.19	122.14	178.56	15.37	20.86	24.45	35.74		15.37	34.22	9.59	200			1.00	1.055	18.84	55.07%
		CBMH1	CBMH2											0.00	0.60	10.83	0.81	11.64	73.74	99.98	117.18	171.28	44.28	60.04	70.37	102.85		44.28	65.96	63.25	250			1.13	1.302	21.68	32.87%
		CBMH2	MH4									0.08		0.20	0.80	11.64	0.70	12.34	71.02	96.24	112.78	164.81	56.86	77.06	90.30	131.95		56.86	58.89	33.75	300			0.34	0.807	2.03	3.44%
PHASE 2		CB23	MH22	0.06										0.04	0.04	10.00	0.08	10.08	76.81	104.19	122.14	178.56	3.20	4.34	5.09	7.45		3.20	34.22	5.20	200			1.00	1.055	31.01	90.64%
		CB20	MH22-MH20									0.12		0.30	0.30	10.00	0.06	10.06	76.81	104.19	122.14	178.56	23.06	31.28	36.67	53.61		23.06	34.22	3.93	200			1.00	1.055	11.16	32.61%
		MH22	MH20											0.00	0.34	10.08	0.64	10.72	76.49	103.76	121.63	177.81	26.16	35.48	41.59	60.80		26.16	59.68	31.32	300			0.35	0.818	33.53	56.18%
		BLDG B	MH20									0.19		0.48	0.48	10.00	0.08	10.08	76.81	104.19	122.14	178.56	36.51	49.53	58.06	84.88		36.51	62.04	6.06	250			1.00	1.224	25.53	41.15%
		CB21	MH23									0.12		0.30	0.30	10.00	0.14	10.14	76.81	104.19	122.14	178.56	23.06	31.28	36.67	53.61		23.06	34.22	9.04	200			1.00	1.055	11.16	32.61%
		CB22	MH23-MH21									0.12		0.30	0.30	10.00	0.05	10.05	76.81	104.19	122.14	178.56	23.06	31.28	36.67	53.61		23.06	34.22	3.16	200			1.00	1.055	11.16	32.61%
		MH23	U/G Chamber											0.00	0.60	10.14	0.11	10.26	76.26	103.44	121.26	177.26	45.79	62.12	72.81	106.44		45.79	59.68	5.63	300			0.35	0.818	13.89	23.27%
		U/G Chamber	MH21											0.00	0.60	10.26	0.06	10.32	75.83	102.85	120.56	176.24	45.53	61.76	72.40	105.83		45.53	59.68	2.99	300			0.35	0.818	14.15	23.71%
		MH21	MH20											0.00	0.60	10.26	0.35	10.61	75.83	102.85	120.56	176.24	45.53	61.76	72.40	105.83		45.53	59.68	17.25	300			0.35	0.818	14.15	23.71%
		MH20	MH3											0.00	1.42	10.72	0.23	10.95	74.15	100.54	117.83	172.23	105.12	142.54	167.06	244.19		105.12	175.96	15.01	450			0.35	1.072	70.84	40.26%
		CB24	MH3-MH4									0.10		0.25	0.25	10.00	0.02	10.02	76.81	104.19	122.14	178.56	19.22	26.07	30.56	44.68		19.22	34.22	1.08	200			1.00	1.055	15.00	43.84%
		CBMH20	MH1-MH3		0.10									0.08	0.08	10.00	1.19	11.19	76.81	104.19	122.14	178.56	6.41	8.69	10.19	14.89		6.41	59.68	58.53	300			0.35	0.818	53.28	89.27%
		BLDG C	MH1-MH3									0.05		0.13	0.13	10.00	0.68	10.68	76.81	104.19	122.14	178.56	9.61	13.03	15.28	22.34		9.61	62.04	50.00	250			1.00	1.224	52.43	84.51%
		CB25	MH1-MH3									0.02		0.05	0.05	10.00	0.11	10.11	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	34.22	7.07	200			1.00	1.055	30.37	88.77%
EXISTING	External 2.78AC=3.03	MH1	MH3							1.34		0.11		3.31	3.56	11.19	1.34	12.53	72.51	98.29	115.19	168.34	258.41	350.28	410.51	599.95		258.41	506.25	89.13	750			0.19	1.110	247.83	48.96%
		MH3	MH4									0.12		0.30	5.53	12.53	0.39	12.92	68.28	92.49	108.36	158.32	377.76	511.65	599.45	875.82		377.76	592.21	30.43	750			0.26	1.299	214.45	36.21%
		MH4	MH5											0.00	6.33	12.92	0.18	13.10	67.15	90.94	106.53	155.64	425.26	575.87	674.64	985.59		425.26	660.70	15.45	750			0.32	1.449	235.44	35.64%
		CB17	MH5-MH12									0.09		0.23	0.23	10.00	0.04	10.04	76.81	104.19	122.14	178.56	17.29	23.46	27.50	40.21		17.29	34.22	2.55	200			1.00	1.055	16.92	49.45%
		CB16	MH5-MH12		0.01									0.01	0.01	10.00	0.14	10.14	76.81	104.19	122.14	178.56	0.64	0.87	1.02	1.49		0.64	34.22	9.09	200			1.00	1.055	33.58	98.13%
		MH5	MH12											0.00	8.10	13.10	0.34	13.44	66.65	90.25	105.72	154.45	539.65	730.71	856.00	1,250.50		539.65	705.11	31.20	750			0.37	1.546	165.46	23.47%
		MH12	EX 1350 SEWER											0.00	8.10	13.44	0.16	13.59	65.73	88.98	104.23	152.25	532.15	720.42	843.90	1,232.75		532.15	747.54	15.69	750			0.41	1.639	215.38	28.81%
													TOTAL	8.10	TRUE																						

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: WZ
Checked: RM
Dwg. Reference: 148590-500

No.	Revision	Date
1	Submission No. 1	2024-11-26
2	Submission No. 2	2025-02-18

File Reference:	Date:	Sheet No:
148590-6.04.04	2024-11-26	1 of 1

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

PROJECT: 155 Dun Skipper
DATE: 2025-02-18
FILE: 148590-6.04.04
REV #: 2
DESIGNED BY: WZ
CHECKED BY: RM

STORMWATER MANAGEMENT

Formulas and Descriptions

i_{2yr} = 1:2 year Intensity = 732.951 / $(T_c+6.199)^{0.810}$
i_{5yr} = 1:5 year Intensity = 998.071 / $(T_c+6.053)^{0.814}$
i_{100yr} = 1:100 year Intensity = 1735.688 / $(T_c+6.014)^{0.820}$
T_c = Time of Concentration (min)
C = Average Runoff Coefficient
A = Area (Ha)
Q = Flow = 2.78CiA (L/s)

Maximum Allowable Release Rate

Restricted Flowrate
Taken from City of Ottawa approved Design Brief "Pathways at Findlay Creek" (D07-16-13-0023) drainage area EXT 4

EXT 4 Release Rate	760.00 L/s
Area EXT 4 $_{TOTAL}$ =	4.04 Ha
Area Subject Lands	2.49
Perscentage Share of release rate	62%

Q_{TOTAL} =	468.42 L/s

Uncontrolled Release ($Q_{uncontrolled}$ = 2.78*C*i_{100yr}*$A_{uncontrolled}$)
For Drainage Area <u>MH6136</u>

C =	0.625
T_c =	10 min
i_{100yr} =	178.56 mm/hr
$A_{uncontrolled}$ =	0.01 Ha
$Q_{uncontrolled}$ =	3.10 L/s

Uncontrolled Release ($Q_{uncontrolled}$ = 2.78*C*i_{100yr}*$A_{uncontrolled}$)
For Drainage Area <u>UNRES</u>

C =	1.00
T_c =	10 min
i_{100yr} =	178.56 mm/hr
$A_{uncontrolled}$ =	0.05 Ha
$Q_{uncontrolled}$ =	24.82 L/s

Maximum Allowable Release Rate ($Q_{max\ allowable}$ = $Q_{restricted}$ - $Q_{uncontrolled}$)

$Q_{max\ allowable}$ =	440.49 L/s

MODIFIED RATIONAL METHOD (100-Year & 5-Year Ponding & 2-Year Ponding)

Drainage Area MH9/MH9B — *Drainage Area Plan - MH9/MH9B*

Drainage Area	MH9/MH9B
Area (Ha)	0.14
C =	0.98

Restricted Flow Q_r (L/s)= 10.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
30	91.87	34.86	10.00	24.86	44.75
32	87.89	33.35	10.00	23.35	44.83
33	86.03	32.65	10.00	22.65	**44.84**
34	84.27	31.98	10.00	21.98	44.83
36	80.96	30.72	10.00	20.72	44.76

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	44.84	20.64	10.07	14.13

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
54.91	0.375	0.110	6.06
6.73	0.200	0.031	0.21
7.69	0.200	0.031	0.24
			6.51

overflows to: CB1

Drainage Area	MH9/MH9B
Area (Ha)	0.14
C =	0.78

Restricted Flow Q_r (L/s)= 10.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
13	90.63	27.51	10.00	17.51	13.66
15	83.56	25.37	10.00	15.37	13.83
16	80.46	24.43	10.00	14.43	**13.85**
17	77.61	23.56	10.00	13.56	13.83
19	72.53	22.02	10.00	12.02	13.70

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	13.85	20.64	10.07	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
CB2 (600mm x 600mm)	1.80	0.36	0.65
CBMH10 (1200mm round)	2.00	1.13	2.26
			3.56

overflows to: CB1

Drainage Area	MH9/MH9B
Area (Ha)	0.140
C =	0.78

Restricted Flow Q_r (L/s)= 10.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
10	76.81	23.32	10.00	13.32	7.99
11	73.17	22.21	10.00	12.21	8.06
12	69.89	21.22	10.00	11.22	**8.08**
13	66.93	20.32	10.00	10.32	8.05
15	61.77	18.75	10.00	8.75	7.88

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	8.08	20.64	10.07	0.00

overflows to: CB1

Drainage Area CB1 — *Drainage Area Plan - MH8*

Drainage Area	CB1
Area (Ha)	0.17
C =	0.94

Restricted Flow Q_r (L/s)= 16.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
21	116.30	50.01	16.00	34.01	42.85
23	109.68	47.17	16.00	31.17	43.01
24	106.68	45.87	16.00	29.87	**43.02**
25	103.85	44.66	16.00	28.66	42.99
27	98.66	42.43	16.00	26.43	42.81

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
14.13	57.15	50.59	5.58	0.98

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
31.00	0.450	0.159	4.93
			4.93

overflows to: CB17

Drainage Area	CB1
Area (Ha)	0.17
C =	0.75

Restricted Flow Q_r (L/s)= 16.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
7	123.30	42.42	16.00	26.42	11.10
9	109.79	37.77	16.00	21.77	11.76
10	104.19	35.85	16.00	19.85	**11.91**
11	99.19	34.12	16.00	18.12	11.96
13	90.63	31.18	16.00	15.18	11.84

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	11.91	50.59	5.58	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
			0.65

overflows to: CB17

Drainage Area	CB1
Area (Ha)	0.165
C =	0.75

Restricted Flow Q_r (L/s)= 16.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	31.19	16.00	15.19	6.38
9	80.87	27.82	16.00	11.82	6.38
10	76.81	26.42	16.00	10.42	**6.25**
11	73.17	25.17	16.00	9.17	6.05
13	66.93	23.03	16.00	7.03	5.48

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	6.25	50.59	5.58	0.00

overflows to: CB17

Drainage Area CB16 — *Drainage Area Plan - MH5B*

Drainage Area	CB16
Area (Ha)	0.010
C =	0.38

Restricted Flow Q_r (L/s)= 6.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
-6	57497.20	599.41	16.00	583.41	-210.03
-4	977.56	10.19	16.00	-5.81	1.39
-3	702.38	7.32	16.00	-8.68	**1.56**
-2	555.31	5.79	16.00	-10.21	1.23
0	398.62	4.16	16.00	-11.84	0.00

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.56	0.31	0.00	1.25

overflows to: CB17

Drainage Area	CB16
Area (Ha)	0.010
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
7	123.30	1.03	6.00	-4.97	-2.09
9	109.79	0.92	6.00	-5.08	-2.75
10	104.19	0.87	6.00	-5.13	**-3.08**
11	99.19	0.83	6.00	-5.17	-3.41
13	90.63	0.76	6.00	-5.24	-4.09

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	-3.08	0.31	0.00	0.00

overflows to: CB17

Drainage Area	CB16
Area (Ha)	0.010
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	0.76	6.00	-5.24	-2.20
9	80.87	0.67	6.00	-5.33	-2.88
10	76.81	0.64	6.00	-5.36	**-3.22**
11	73.17	0.61	6.00	-5.39	-3.56
13	66.93	0.56	6.00	-5.44	-4.24

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	0.31	0.00	0.00

overflows to: CB17

Drainage Area CB17 — *Drainage Area Plan - MH5A*

Drainage Area	CB17
Area (Ha)	0.090
C =	1.00

Restricted Flow Q_r (L/s)= 9.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
22	112.88	28.24	9.00	19.24	25.40
24	106.68	26.69	9.00	17.69	25.47
25	103.85	25.98	9.00	16.98	**25.47**
26	101.18	25.32	9.00	16.32	25.45
28	96.27	24.09	9.00	15.09	25.35

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
2.24	27.71	0.84	5.10	21.77

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
28.00	0.450	0.159	4.45
			4.45

overflows to: MH22

Drainage Area	CB17
Area (Ha)	0.090
C =	0.90

Restricted Flow Q_r (L/s)= 9.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
10	104.19	23.46	9.00	14.46	8.68
12	94.70	21.32	9.00	12.32	8.87
13	90.63	20.41	9.00	11.41	**8.90**
14	86.93	19.58	9.00	10.58	8.88
16	80.46	18.12	9.00	9.12	8.75

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	8.90	0.84	5.10	2.96

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
			0.65

overflows to: MH22

Drainage Area	CB17
Area (Ha)	0.090
C =	0.90

Restricted Flow Q_r (L/s)= 9.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	20.42	9.00	11.42	4.79
9	80.87	18.21	9.00	9.21	4.97
10	76.81	17.29	9.00	8.29	**4.98**
11	73.17	16.48	9.00	7.48	4.93
13	66.93	15.07	9.00	6.07	4.74

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	4.98	0.84	5.10	0.00

overflows to: MH22

Drainage Area	CB20		
Area (Ha)	0.120		
C =	1.00	Restricted Flow Q_r (L/s)=	15.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
17	132.63	44.24	15.00	29.24	29.83
19	123.87	41.32	15.00	26.32	30.01
20	119.95	40.02	15.00	25.02	**30.02**
21	116.30	38.80	15.00	23.80	29.98
23	109.68	36.59	15.00	21.59	29.79

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	30.02	12.51	0.00	17.51

overflows to: MH22

Drainage Area	CB20		
Area (Ha)	0.120		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
7	123.30	37.02	15.00	22.02	9.25
9	109.79	32.96	15.00	17.96	9.70
10	104.19	31.28	15.00	16.28	**9.77**
11	99.19	29.78	15.00	14.78	9.76
13	90.63	27.21	15.00	12.21	9.52

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	9.77	12.51	0.00	0.00

overflows to: MH22

Drainage Area	CB20		
Area (Ha)	0.120		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	27.22	15.00	12.22	5.13
9	80.87	24.28	15.00	9.28	5.01
10	76.81	23.06	15.00	8.06	**4.84**
11	73.17	21.97	15.00	6.97	4.60
13	66.93	20.09	15.00	5.09	3.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	4.84	12.51	0.00	0.00

overflows to: MH22

Drainage Area	MH22			
Area (Ha)	0.060	Restricted Flow ICD $_{Actual}$ (L/s)=	6.00	50% reduction for sub-surface storage
C =	0.31	Restricted Flow $Q_{r\ for\ swm\ calc}$ (L/s)=	3.00	

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
13	155.11	8.08	3.00	5.08	3.97
14	148.72	7.75	3.00	4.75	3.99
15	142.89	7.45	3.00	4.45	**4.00**
16	137.55	7.17	3.00	4.17	4.00
18	128.08	6.68	3.00	3.68	3.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
39.28	43.28	2.87	46.61	0.00

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
33.40	0.250	0.049	1.64
23.23	0.300	0.071	1.64
		TOTAL	3.28

overflows to: Dun Skipper Drive

Drainage Area	MH22		
Area (Ha)	0.060		
C =	0.25	Restricted Flow Q_r (L/s)=	3.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
7	123.30	5.14	3.00	2.14	0.90
9	109.79	4.58	3.00	1.58	0.85
10	104.19	4.34	3.00	1.34	**0.81**
11	99.19	4.14	3.00	1.14	0.75
13	90.63	3.78	3.00	0.78	0.61

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
2.96	3.77	2.87	46.61	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB23 (600mm x 600mm)	0.89	0.36	0.32
Clear Stone Gallery	1.45	100	43.01
		TOTAL	43.33

overflows to: Dun Skipper Drive

Drainage Area	MH22		
Area (Ha)	0.060		
C =	0.25	Restricted Flow Q_r (L/s)=	3.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	3.78	3.00	0.78	0.33
9	80.87	3.37	3.00	0.37	0.20
10	76.81	3.20	3.00	0.20	**0.12**
11	73.17	3.05	3.00	0.05	0.03
13	66.93	2.79	3.00	-0.21	-0.16

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.12	2.87	46.61	0.00

overflows to: Dun Skipper Drive

Drainage Area	CB24		
Area (Ha)	0.100		
C =	1.00	Restricted Flow Q_r (L/s)=	15.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
13	155.11	43.12	15.00	28.12	21.93
15	142.89	39.72	15.00	24.72	22.25
16	137.55	38.24	15.00	23.24	**22.31**
17	132.63	36.87	15.00	21.87	22.31
19	123.87	34.44	15.00	19.44	22.16

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	22.31	0.00	0	22.31

overflows to: MH21

Drainage Area	CB24		
Area (Ha)	0.100		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
7	123.30	30.85	15.00	15.85	6.66
9	109.79	27.47	15.00	12.47	6.73
10	104.19	26.07	15.00	11.07	**6.64**
11	99.19	24.82	15.00	9.82	6.48
13	90.63	22.68	15.00	7.68	5.99

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	6.64	0.00	0.00	6.64

overflows to: MH21

Drainage Area	CB24		
Area (Ha)	0.100		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	22.68	15.00	7.68	3.23
9	80.87	20.23	15.00	5.23	2.83
10	76.81	19.22	15.00	4.22	**2.53**
11	73.17	18.31	15.00	3.31	2.18
13	66.93	16.75	15.00	1.75	1.36

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.53	0.00	0.00	2.53

overflows to: MH21

Drainage Area	CB25		
Area (Ha)	0.020		
C =	1.00	Restricted Flow Q_r (L/s)=	6.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
8	199.20	11.08	6.00	5.08	2.44
9	188.25	10.47	6.00	4.47	2.41
10	178.56	9.93	6.00	3.93	**2.36**
11	169.91	9.45	6.00	3.45	2.27
13	155.11	8.62	6.00	2.62	2.05

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.36	0.27	0.00	2.09

overflows to: MH21

Drainage Area	CB25		
Area (Ha)	0.020		
C =	0.90	Restricted Flow Q_r (L/s)=	6.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
8	116.11	5.81	6.00	-0.19	-0.09
9	109.79	5.49	6.00	-0.51	-0.27
10	104.19	5.21	6.00	-0.79	**-0.47**
11	99.19	4.96	6.00	-1.04	-0.68
12	94.70	4.74	6.00	-1.26	-0.91

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	0.27	0.00	0.00

overflows to: MH21

Drainage Area	CB25		
Area (Ha)	0.020		
C =	0.90	Restricted Flow Q_r (L/s)=	6.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
8	85.46	4.28	6.00	-1.72	-0.83
9	80.87	4.05	6.00	-1.95	-1.05
10	76.81	3.84	6.00	-2.16	**-1.29**
11	73.17	3.66	6.00	-2.34	-1.54
12	69.89	3.50	6.00	-2.50	-1.80

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	0.27	0.00	0.00

overflows to: MH21

Drainage Area	MH21				
Area (Ha)	0.240	Restricted Flow ICD Actual (L/s)=			33.00
C =	1.00	Restricted Flow Q_r for swm calc (L/s)=			16.50

50% reduction for sub-surface storage

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
33	86.03	57.40	16.50	40.90	80.99
34	84.27	56.22	16.50	39.72	81.03
35	82.58	55.10	16.50	38.60	**81.05**
36	80.96	54.02	16.50	37.52	81.04
38	77.93	52.00	16.50	35.50	80.93

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
24.40	105.45	11.79	96.68	0.00

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
8.30	0.200	0.031	0.26
3.10	0.200	0.031	0.10
8.62	0.300	0.071	0.61
		TOTAL	0.97

overflows to: CBMH20

Drainage Area	MH21		
Area (Ha)	0.240		
C =	0.90	Restricted Flow Q_r (L/s)=	16.50

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
16	80.46	48.31	16.50	31.81	30.54
18	74.97	45.02	16.50	28.52	30.80
19	72.53	43.55	16.50	27.05	**30.84**
20	70.25	42.18	16.50	25.68	30.82
22	66.15	39.72	16.50	23.22	30.65

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	30.84	11.79	96.68	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB21 (600mm x 600mm)	1.40	0.36	0.50
CB22 (600mm x 600mm)	1.40	0.36	0.50
MH21 (1200mm)	3.40	1.13	3.84
MH23 (1200mm)	1.97	1.13	2.23
Underground Chamber			88.64
		TOTAL	95.72

overflows to: CBMH20

Drainage Area	MH21		
Area (Ha)	0.240		
C =	0.90	Restricted Flow Q_r (L/s)=	16.50

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
11	73.17	43.94	16.50	27.44	18.11
13	66.93	40.19	16.50	23.69	18.48
14	64.23	38.57	16.50	22.07	**18.54**
15	61.77	37.09	16.50	20.59	18.53
17	57.42	34.48	16.50	17.98	18.34

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	18.54	11.79	96.68	0.00

overflows to: CBMH20

Drainage Area	CBMH2	Drainage Area Plan - CBMH2	
Area (Ha)	0.080		
C =	1.00	Restricted Flow Q_r (L/s)=	20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
7	211.67	47.07	20.00	27.07	11.37
9	188.25	41.87	20.00	21.87	11.81
10	178.56	39.71	20.00	19.71	**11.83**
11	169.91	37.79	20.00	17.79	11.74
13	155.11	34.50	20.00	14.50	11.31

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	11.83	6.21	0.00	5.62

overflows to: CB10

Drainage Area	CBMH2		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	40.73	20.00	20.73	1.24
3	166.09	33.24	20.00	13.24	2.38
4	152.51	30.53	20.00	10.53	**2.53**
5	141.18	28.26	20.00	8.26	2.48
7	123.30	24.68	20.00	4.68	1.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.53	6.21	0.00	0.00

Drainage Area	CBMH2		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	18.15	20.00	-1.85	-0.78
9	80.87	16.19	20.00	-3.81	-2.06
10	76.81	15.37	20.00	-4.63	**-2.78**
11	73.17	14.65	20.00	-5.35	-3.53
13	66.93	13.40	20.00	-6.60	-5.15

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	6.21	0.00	0.00

Drainage Area	CB10	Drainage Area Plan - MH1D	
Area (Ha)	0.110		
C =	1.00	Restricted Flow Q_r (L/s)=	45.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
3	286.05	87.47	45.00	42.47	7.65
4	262.41	80.24	45.00	35.24	8.46
5	242.70	74.22	45.00	29.22	**8.77**
6	226.01	69.11	45.00	24.11	8.68
8	199.20	60.92	45.00	15.92	7.64

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
5.62	14.38	6.81	0.00	7.57

overflows to: CBMH20

Drainage Area	CB10		
Area (Ha)	0.110		
C =	0.90	Restricted Flow Q_r (L/s)=	45.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
0	230.48	63.43	45.00	18.43	0.00
2	182.69	50.28	45.00	5.28	0.63
3	166.09	45.71	45.00	0.71	**0.13**
4	152.51	41.97	45.00	-3.03	-0.73
6	131.57	36.21	45.00	-8.79	-3.16

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.13	6.81	0.00	0.00

overflows to: CBMH20

Drainage Area	CB10		
Area (Ha)	0.110		
C =	0.90	Restricted Flow Q_r (L/s)=	45.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	24.95	45.00	-20.05	-8.42
9	80.87	22.26	45.00	-22.74	-12.28
10	76.81	21.14	45.00	-23.86	**-14.32**
11	73.17	20.14	45.00	-24.86	-16.41
13	66.93	18.42	45.00	-26.58	-20.73

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	6.81	0.00	0.00

overflows to: CBMH20

Drainage Area	CB7	Drainage Area Plan - CBMH1C	
Area (Ha)	0.080		
C =	1.00	Restricted Flow Q_r (L/s)=	30.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
3	286.05	63.62	30.00	33.62	6.05
5	242.70	53.98	30.00	23.98	7.19
6	226.01	50.26	30.00	20.26	**7.30**
7	211.67	47.07	30.00	17.07	7.17
9	188.25	41.87	30.00	11.87	6.41

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	7.30	6.97	0.00	0.33

overflows to: CB8

Drainage Area	CB7		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	30.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
-1	266.98	53.44	30.00	23.44	-1.41
1	203.51	40.73	30.00	10.73	0.64
2	182.69	36.57	30.00	6.57	**0.79**
3	166.09	33.24	30.00	3.24	0.58
5	141.18	28.26	30.00	-1.74	-0.52

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
6.64	7.43	6.97	0.00	0.46

overflows to: CB8

Drainage Area	CB7		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	30.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	18.15	30.00	-11.85	-4.98
9	80.87	16.19	30.00	-13.81	-7.46
10	76.81	15.37	30.00	-14.63	**-8.78**
11	73.17	14.65	30.00	-15.35	-10.13
13	66.93	13.40	30.00	-16.60	-12.95

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	6.97	0.00	0.00

overflows to: CB8

Drainage Area CB6 — Drainage Area Plan - CBMH1B

Drainage Area	CB6
Area (Ha)	0.070
C =	1.00

Restricted Flow Q_r (L/s)= 20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
5	242.70	47.23	20.00	27.23	8.17
7	211.67	41.19	20.00	21.19	8.90
8	199.20	38.76	20.00	18.76	**9.01**
9	188.25	36.63	20.00	16.63	8.98
11	169.91	33.06	20.00	13.06	8.62

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	9.01	13.66	0.00	0.00

overflows to: CB8

Drainage Area	CB6
Area (Ha)	0.070
C =	0.90

Restricted Flow Q_r (L/s)= 20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
0	230.48	40.37	20.00	20.37	0.00
2	182.69	32.00	20.00	12.00	1.44
3	166.09	29.09	20.00	9.09	**1.64**
4	152.51	26.71	20.00	6.71	1.61
6	131.57	23.04	20.00	3.04	1.10

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.64	13.66	0.00	0.00

overflows to: CB8

Drainage Area	CB6
Area (Ha)	0.070
C =	0.90

Restricted Flow Q_r (L/s)= 20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	15.88	20.00	-4.12	-1.73
9	80.87	14.16	20.00	-5.84	-3.15
10	76.81	13.45	20.00	-6.55	**-3.93**
11	73.17	12.81	20.00	-7.19	-4.74
13	66.93	11.72	20.00	-8.28	-6.46

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	13.66	0.00	0.00

overflows to: CB8

Drainage Area CB5 — Drainage Area Plan - CBMH1A

Drainage Area	CB5
Area (Ha)	0.060
C =	1.00

Restricted Flow Q_r (L/s)= 15.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
7	211.67	35.31	15.00	20.31	8.53
9	188.25	31.40	15.00	16.40	8.86
10	178.56	29.78	15.00	14.78	**8.87**
11	169.91	28.34	15.00	13.34	8.80
13	155.11	25.87	15.00	10.87	8.48

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	8.87	3.41	0.00	5.46

overflows to: CB8

Drainage Area	CB5
Area (Ha)	0.060
C =	0.90

Restricted Flow Q_r (L/s)= 15.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	30.55	15.00	15.55	0.93
3	166.09	24.93	15.00	9.93	1.79
4	152.51	22.89	15.00	7.89	**1.89**
5	141.18	21.19	15.00	6.19	1.86
7	123.30	18.51	15.00	3.51	1.47

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.89	3.41	0.00	0.00

overflows to: CB8

Drainage Area	CB5
Area (Ha)	0.060
C =	0.90

Restricted Flow Q_r (L/s)= 15.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	13.61	15.00	-1.39	-0.58
9	80.87	12.14	15.00	-2.86	-1.54
10	76.81	11.53	15.00	-3.47	**-2.08**
11	73.17	10.98	15.00	-4.02	-2.65
13	66.93	10.05	15.00	-4.95	-3.86

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	3.41	0.00	0.00

overflows to: CB8

Drainage Area CB8 — Drainage Area Plan - MH1B

Drainage Area	CB8
Area (Ha)	0.170
C =	1.00

Restricted Flow Q_r (L/s)= 47.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
6	226.01	106.81	47.00	59.81	21.53
8	199.20	94.14	47.00	47.14	22.63
9	188.25	88.97	47.00	41.97	**22.66**
10	178.56	84.39	47.00	37.39	22.43
12	162.13	76.62	47.00	29.62	21.33

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
5.79	28.45	24.90	1.60	1.95

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
6.00	0.450	0.159	0.95
			0.95

overflows to: MH1A

Drainage Area	CB8
Area (Ha)	0.170
C =	0.90

Restricted Flow Q_r (L/s)= 47.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	86.56	47.00	39.56	2.37
3	166.09	70.64	47.00	23.64	4.26
4	152.51	64.87	47.00	17.87	**4.29**
5	141.18	60.05	47.00	13.05	3.91
7	123.30	52.45	47.00	5.45	2.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	4.29	24.90	1.60	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB8 (600mm x 600mm)	1.80	0.36	0.65
			0.65

Drainage Area	CB8
Area (Ha)	0.170
C =	0.90

Restricted Flow Q_r (L/s)= 47.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	38.56	47.00	-8.44	-3.54
9	80.87	34.40	47.00	-12.60	-6.80
10	76.81	32.67	47.00	-14.33	**-8.60**
11	73.17	31.12	47.00	-15.88	-10.48
13	66.93	28.47	47.00	-18.53	-14.46

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	24.90	1.60	0.00

Drainage Area CB4 — Drainage Area Plan - MH10A

Drainage Area	CB4
Area (Ha)	0.030
C =	1.00

Restricted Flow Q_r (L/s)= 6.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
9	188.25	15.70	6.00	9.70	5.24
11	169.91	14.17	6.00	8.17	5.39
12	162.13	13.52	6.00	7.52	**5.42**
13	155.11	12.94	6.00	6.94	5.41
15	142.89	11.92	6.00	5.92	5.33

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	5.42	10.62	0.00	0.00

overflows to: CBMH1

Drainage Area	CB4
Area (Ha)	0.030
C =	0.90

Restricted Flow Q_r (L/s)= 6.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
3	166.09	12.47	6.00	6.47	1.16
5	141.18	10.60	6.00	4.60	1.38
6	131.57	9.88	6.00	3.88	**1.40**
7	123.30	9.26	6.00	3.26	1.37
9	109.79	8.24	6.00	2.24	1.21

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.40	10.62	0.00	0.00

overflows to: CBMH1

Drainage Area	CB4
Area (Ha)	0.030
C =	0.90

Restricted Flow Q_r (L/s)= 6.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	6.81	6.00	0.81	0.34
9	80.87	6.07	6.00	0.07	0.04
10	76.81	5.76	6.00	-0.24	**-0.14**
11	73.17	5.49	6.00	-0.51	-0.34
13	66.93	5.02	6.00	-0.98	-0.76

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	10.62	0.00	0.00

overflows to: CBMH1

Drainage Area	***CBMH1***	***Drainage Area MH10B***			
Area (Ha)	0.080				
C =	1.00	Restricted Flow Q_r (L/s)=		20.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
7	211.67	47.07	20.00	27.07	11.37
9	188.25	41.87	20.00	21.87	11.81
10	178.56	39.71	20.00	19.71	**11.83**
11	169.91	37.79	20.00	17.79	11.74
13	155.11	34.50	20.00	14.50	11.31

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	11.83	0.00	0.00	11.83

overflows to: MH1A

Drainage Area	***CBMH1***				
Area (Ha)	0.080				
C =	0.90	Restricted Flow Q_r (L/s)=		20.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
1	203.51	40.73	20.00	20.73	1.24
3	166.09	33.24	20.00	13.24	2.38
4	152.51	30.53	20.00	10.53	**2.53**
5	141.18	28.26	20.00	8.26	2.48
7	123.30	24.68	20.00	4.68	1.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.53	0.00	0.00	2.53

overflows to: MH1A

Drainage Area	***CBMH1***				
Area (Ha)	0.080				
C =	0.90	Restricted Flow Q_r (L/s)=		20.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
7	90.66	18.15	20.00	-1.85	-0.78
9	80.87	16.19	20.00	-3.81	-2.06
10	76.81	15.37	20.00	-4.63	**-2.78**
11	73.17	14.65	20.00	-5.35	-3.53
13	66.93	13.40	20.00	-6.60	-5.15

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	0.00	0.00	0.00

overflows to: MH1A

Drainage Area	***MH1A***				
Area (Ha)	0.150				
C =	1.00	Restricted Flow Q_r (L/s)=		43.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
5	242.70	101.21	43.00	58.21	17.46
7	211.67	88.27	43.00	45.27	19.01
8	199.20	83.07	43.00	40.07	**19.23**
9	188.25	78.50	43.00	35.50	19.17
11	169.91	70.85	43.00	27.85	18.38

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
13.78	33.01	10.83	0.00	22.18

overflows to: CBMH20

Drainage Area	***MH1A***				
Area (Ha)	0.160				
C =	0.90	Restricted Flow Q_r (L/s)=		43.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
2	182.69	73.13	43.00	30.13	3.62
4	152.51	61.05	43.00	18.05	4.33
5	141.18	56.52	43.00	13.52	**4.05**
6	131.57	52.67	43.00	9.67	3.48
8	116.11	46.48	43.00	3.48	1.67

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
2.53	6.58	10.83	0.00	0.00

overflows to: CBMH20

Drainage Area	***MH1A***				
Area (Ha)	0.150				
C =	0.90	Restricted Flow Q_r (L/s)=		43.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
7	90.66	34.03	43.00	-8.97	-3.77
9	80.87	30.35	43.00	-12.65	-6.83
10	76.81	28.82	43.00	-14.18	**-8.51**
11	73.17	27.46	43.00	-15.54	-10.26
13	66.93	25.12	43.00	-17.88	-13.95

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	10.83	0.00	0.00

overflows to: CBMH20

Drainage Area	***CBMH20***	***Previously CB18, Drainage Area Plan - MH11***			
Area (Ha)	0.100				
C =	0.38	Restricted Flow Q_r (L/s)=		15.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
3	286.05	29.82	15.00	14.82	2.67
4	262.41	27.36	15.00	12.36	2.97
5	242.70	25.30	15.00	10.30	**3.09**
6	226.01	23.56	15.00	8.56	3.08
7	211.67	22.07	15.00	7.07	2.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
29.75	32.84	109.61	0.00	0.00

overflows to: offsite

Drainage Area	***CBMH20***				
Area (Ha)	0.160				
C =	0.30	Restricted Flow Q_r (L/s)=		15.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
1	203.51	27.16	15.00	12.16	0.73
2	182.69	24.38	15.00	9.38	1.13
3	166.09	22.16	15.00	7.16	**1.29**
4	152.51	20.35	15.00	5.35	1.28
5	141.18	18.84	15.00	3.84	1.15

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.29	109.61	0.00	0.00

overflows to: offsite

Drainage Area	***CBMH20***				
Area (Ha)	0.100				
C =	0.30	Restricted Flow Q_r (L/s)=		15.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
0	167.22	13.95	15.00	-1.05	0.00
1	148.14	12.36	15.00	-2.64	-0.16
2	133.33	11.12	15.00	-3.88	**-0.47**
3	121.46	10.13	15.00	-4.87	-0.88
4	111.72	9.32	15.00	-5.68	-1.36

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	109.61	0.00	0.00

Drainage Area	***RA***	***Drainage Area Plan - MH7A***			
Area (Ha)	0.300				
C =	1.00	Restricted Flow Q_r (L/s)=		27.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
25	103.85	86.61	27.00	59.61	89.41
26	101.18	84.38	27.00	57.38	89.52
27	98.66	82.28	27.00	55.28	**89.56**
28	96.27	80.29	27.00	53.29	89.53
29	94.01	78.41	27.00	51.41	89.45

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	89.56	90.00	0.00	0.00

Drainage Area	***RA***				
Area (Ha)	0.300				
C =	0.90	Restricted Flow Q_r (L/s)=		27.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
13	90.63	68.03	27.00	41.03	32.00
14	86.93	65.25	27.00	38.25	32.13
15	83.56	62.72	27.00	35.72	**32.15**
16	80.46	60.39	27.00	33.39	32.06
17	77.61	58.25	27.00	31.25	31.88

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	32.15	90.00	0.00	0.00

Drainage Area	***RA***				
Area (Ha)	0.300				
C =	0.90	Restricted Flow Q_r (L/s)=		27.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
8	85.46	64.14	27.00	37.14	17.83
10	76.81	57.65	27.00	30.65	18.39
11	73.17	54.92	27.00	27.92	**18.43**
12	69.89	52.46	27.00	25.46	18.33
14	64.23	48.21	27.00	21.21	17.82

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	18.43	90.00	0.00	0.00

Drainage Area RB — Drainage Area Plan - MH2A

Drainage Area	RB
Area (Ha)	0.190
C =	1.00

Restricted Flow Q_r (L/s)= 20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
20	119.95	63.36	20.00	43.36	52.03
22	112.88	59.62	20.00	39.62	52.30
23	109.68	57.93	20.00	37.93	**52.35**
24	106.68	56.35	20.00	36.35	52.34
26	101.18	53.44	20.00	33.44	52.17

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	52.35	57.00	0.00	0.00

Drainage Area	RB
Area (Ha)	0.190
C =	0.90

Restricted Flow Q_r (L/s)= 20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
11	99.19	47.15	20.00	27.15	17.92
13	90.63	43.08	20.00	23.08	18.01
14	86.93	41.33	20.00	21.33	**17.91**
15	83.56	39.72	20.00	19.72	17.75
17	77.61	36.89	20.00	16.89	17.23

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	17.91	57.00	0.00	0.00

Drainage Area	RB
Area (Ha)	0.190
C =	0.90

Restricted Flow Q_r (L/s)= 20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
6	96.64	45.94	20.00	25.94	9.34
8	85.46	40.62	20.00	20.62	9.90
9	80.87	38.45	20.00	18.45	**9.96**
10	76.81	36.51	20.00	16.51	9.91
12	69.89	33.23	20.00	13.23	9.52

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	9.96	57.00	0.00	0.00

Drainage Area RC — Drainage Area Plan - MH7

Drainage Area	RC
Area (Ha)	0.050
C =	1.00

Restricted Flow Q_r (L/s)= 8.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
12	162.13	22.54	8.00	14.54	10.47
14	148.72	20.67	8.00	12.67	10.64
15	142.89	19.86	8.00	11.86	**10.68**
16	137.55	19.12	8.00	11.12	10.67
18	128.08	17.80	8.00	9.80	10.59

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	10.68	13.50	1.00	0.00

Drainage Area	RC
Area (Ha)	0.050
C =	0.90

Restricted Flow Q_r (L/s)= 8.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
5	141.18	17.66	8.00	9.66	2.90
7	123.30	15.43	8.00	7.43	3.12
8	116.11	14.53	8.00	6.53	**3.13**
9	109.79	13.74	8.00	5.74	3.10
11	99.19	12.41	8.00	4.41	2.91

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	3.13	13.50	0.00	0.00

Drainage Area	RC
Area (Ha)	0.050
C =	0.90

Restricted Flow Q_r (L/s)= 8.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
2	133.33	16.68	8.00	8.68	1.04
4	111.72	13.98	8.00	5.98	1.43
5	103.57	12.96	8.00	4.96	**1.49**
6	96.64	12.09	8.00	4.09	1.47
8	85.46	10.69	8.00	2.69	1.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.49	13.50	0.00	0.00

Drainage Area RD — Drainage Area Plan - MH1C

Drainage Area	RD
Area (Ha)	0.050
C =	1.00

Restricted Flow Q_r (L/s)= 8.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
12	162.13	22.54	8.00	14.54	10.47
14	148.72	20.67	8.00	12.67	10.64
15	142.89	19.86	8.00	11.86	**10.68**
16	137.55	19.12	8.00	11.12	10.67
18	128.08	17.80	8.00	9.80	10.59

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	10.68	11.25	1.00	0.00

Drainage Area	RD
Area (Ha)	0.050
C =	0.90

Restricted Flow Q_r (L/s)= 8.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
5	141.18	17.66	8.00	9.66	2.90
7	123.30	15.43	8.00	7.43	3.12
8	116.11	14.53	8.00	6.53	**3.13**
9	109.79	13.74	8.00	5.74	3.10
11	99.19	12.41	8.00	4.41	2.91

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	3.13	11.25	0.00	0.00

Drainage Area	RD
Area (Ha)	0.050
C =	0.90

Restricted Flow Q_r (L/s)= 8.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
2	133.33	16.68	8.00	8.68	1.04
4	111.72	13.98	8.00	5.98	1.43
5	103.57	12.96	8.00	4.96	**1.49**
6	96.64	12.09	8.00	4.09	1.47
8	85.46	10.69	8.00	2.69	1.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.49	11.25	0.00	0.00

Drainage Area EXTERNAL

Drainage Area	EXTERNAL
Area (Ha)	1.550
C =	1.00

Restricted Flow Q_r (L/s)= 291.58

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
10	178.56	769.41	291.58	477.83	286.70
12	162.13	698.63	291.58	407.05	293.08
13	155.11	668.36	291.58	376.78	**293.89**
14	148.72	640.85	291.58	349.27	293.38
16	137.55	592.70	291.58	301.12	289.08

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	293.89	270.00	0.00	23.89

Drainage Area	EXTERNAL
Area (Ha)	1.550
C =	0.80

Restricted Flow Q_r (L/s)= 291.58

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
2	182.69	629.76	291.58	338.18	40.58
4	152.51	525.73	291.58	234.15	56.19
5	141.18	486.67	291.58	195.09	**58.53**
6	131.57	453.54	291.58	161.96	58.31
8	116.11	400.26	291.58	108.68	52.17

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	58.53	270.00	0.00	0.00

Drainage Area	EXTERNAL
Area (Ha)	1.550
C =	0.80

Restricted Flow Q_r (L/s)= 291.58

2-Year Ponding

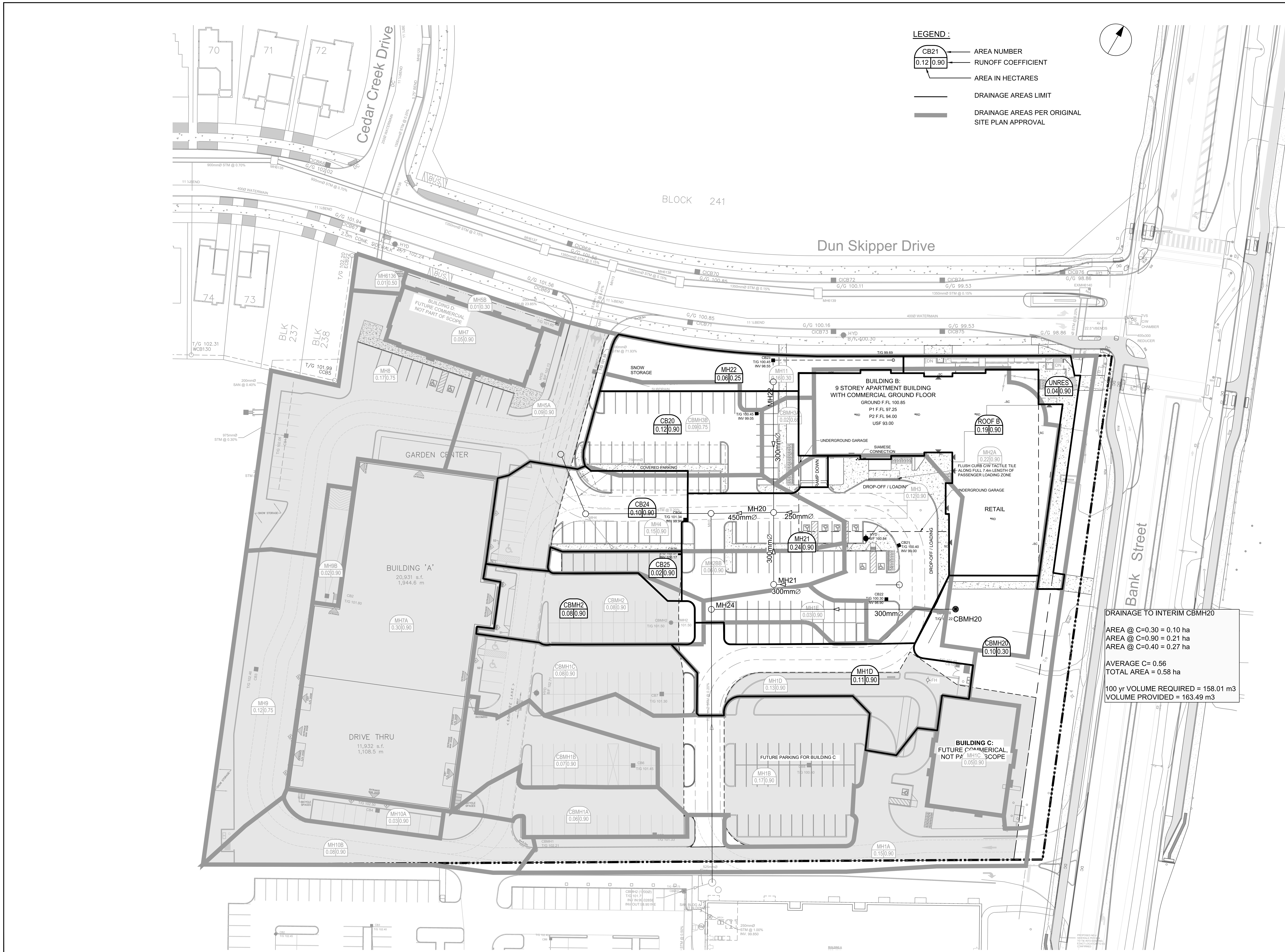
T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
0	167.22	576.45	291.58	284.87	0.00
2	133.33	459.62	291.58	168.04	20.16
3	121.46	418.71	291.58	127.13	**22.88**
4	111.72	385.13	291.58	93.55	22.45
6	96.64	333.13	291.58	41.55	14.96

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	22.88	270.00	0.00	0.00

Summary

	Area	Flow
Buildings		63.00
Site		377.00
Uncontrolled	0.06	27.92
External		291.58
	0.060	**759.50**
Allowable		**760.00**
		TRUE



CLIENT

2668867 Ontario Inc.

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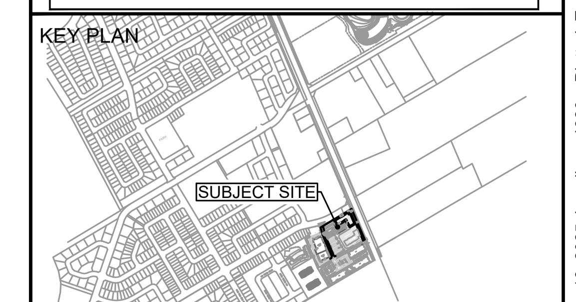
ISSUES

No.	DESCRIPTION	DATE
1	SUBMISSION NO.1 FOR CITY REVIEW	2024-11-26
2	SUBMISSION NO.2 FOR CITY REVIEW	2025-02-18
3		
4		

SEE 010 FOR NOTES, LEGEND AND DETAILS

KEY PLAN



CONSULTANTS

1:400 0 4 12 20m

SEAL

LICENSED PROFESSIONAL ENGINEER
W. ZHUANG
100231427
2025/02/18
PROVINCE OF ONTARIO

PRIME CONSULTANT

ARCADIS

333 Preston Street - Suite 500
Ottawa ON K1S 5N4 Canada
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PROJECT

SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO: 148290

DRAWN BY: **M.M.** CHECKED BY: **R.M.**

PROJECT MGR: **R.M.** APPROVED BY: **A.Z.**

SHEET TITLE

STORM DRAINAGE AREA PLAN

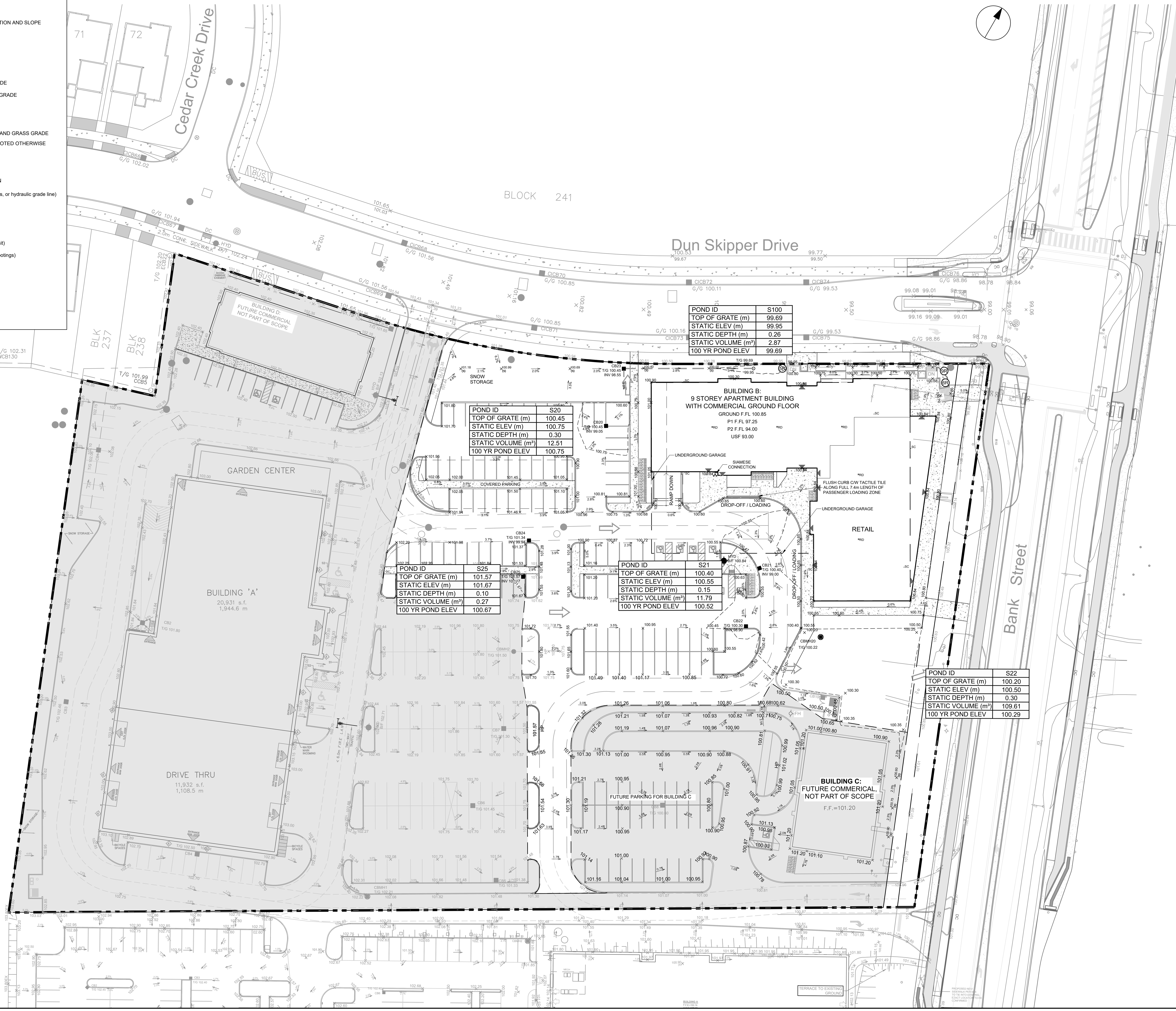
SHEET NUMBER C-500 ISSUE 1

File Location: C:\DARoot\Jobs\341ca65197ba4c62a0f37de13e50dfb0\adskfiles\b.7bf90247-15a4-4e64-8244-beb3a59b671e\Project Files\7.03_Design\04_Civil\Sheets\C-500 STORM DRAINAGE AREA PLAN.dwg Last Saved: February 18, 2025, by milnem4626 Plotted: Tuesday, February 18, 2025 9:20:09 PM by acesuser

D07-12-24-0169

SCALE CHECK 1 in 10mm

19213



GRADING LEGEND

- PROPOSED DITCH C/W FLOW DIRECTION AND SLOPE
- SLOPE C/W FLOW DIRECTION
- MAJOR OVERLAND FLOW ROUTE
- PROPOSED SPOT GRADE
- PROPOSED SWALE GRADE
- PROPOSED SWALE HIGH POINT GRADE
- LOT CORNER GRADE C/W EXISTING GRADE
- FULL STATIC PONDING GRADE
- RETAINING WALL C/W TOP OF WALL AND GRASS GRADE
- TERRACING 3:1 MAXIMUM UNLESS NOTED OTHERWISE
- PRESSURE REDUCING VALVE
- FINISHED FLOOR ELEVATION
- TOP OF FOUNDATION ELEVATION
- UNDERSIDE OF FOOTING ELEVATION
- MINIMUM UNDERSIDE OF FOOTING (Based on the higher of the sewer obverts, or hydraulic grade line)
- MINIMUM GARAGE GRADE
- WALKUP UNIT
- WALKOUT UNIT
- NON-STANDARD FOUNDATION (Frost cover not provided for standard unit)
- HIGHBACK UNIT (1.5m frost cover on footings)
- NOISE BARRIER LOCATION
- NOISE BARRIER GATE
- RIP-RAP
- TOWN HOUSE SPLITS
- 2 hr FIREWALL

POND ID	S100
TOP OF GRATE (m)	99.69
STATIC ELEV (m)	99.95
STATIC DEPTH (m)	0.26
STATIC VOLUME (m³)	2.87
100 YR POND ELEV	99.69

POND ID	S20
TOP OF GRATE (m)	100.45
STATIC ELEV (m)	100.75
STATIC DEPTH (m)	0.30
STATIC VOLUME (m³)	12.51
100 YR POND ELEV	100.75

POND ID	S25
TOP OF GRATE (m)	101.57
STATIC ELEV (m)	101.67
STATIC DEPTH (m)	0.10
STATIC VOLUME (m³)	0.27
100 YR POND ELEV	100.67

POND ID	S21
TOP OF GRATE (m)	100.40
STATIC ELEV (m)	100.55
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	11.79
100 YR POND ELEV	100.52

POND ID	S22
TOP OF GRATE (m)	100.20
STATIC ELEV (m)	100.50
STATIC DEPTH (m)	0.30
STATIC VOLUME (m³)	109.61
100 YR POND ELEV	100.29

CLIENT
2668867 Ontario Inc.

ISSUES

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3		
4		

SEE 010 FOR NOTES, LEGEND AND DETAILS

KEY PLAN
SUBJECT SITE

CONSULTANTS

1:400 0 4 12 20m

SEAL
LICENSED PROFESSIONAL ENGINEER
W. ZHUANG
100231427
2025/02/18
PROVINCE OF ONTARIO

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PROJECT
SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO: 148290	
DRAWN BY: M.M.	CHECKED BY: R.M.
PROJECT MGR: R.M.	APPROVED BY: A.Z.

SHEET TITLE
PONDING PLAN

SHEET NUMBER	ISSUE
C-600	1

D07-12-24-0169

19213

User Inputs

Chamber Model:	SC-310
Outlet Control Structure:	Yes
Project Name:	148290 Dun Skipper
Engineer:	Amy Zhuang
Project Location:	Ontario
Measurement Type:	Metric
Required Storage Volume:	88.00 cubic meters.
Stone Porosity:	30%
Stone Foundation Depth:	200 mm.
Stone Above Chambers:	600 mm.
Design Constraint Dimensions:	(9.01 m. x 22.01 m.)

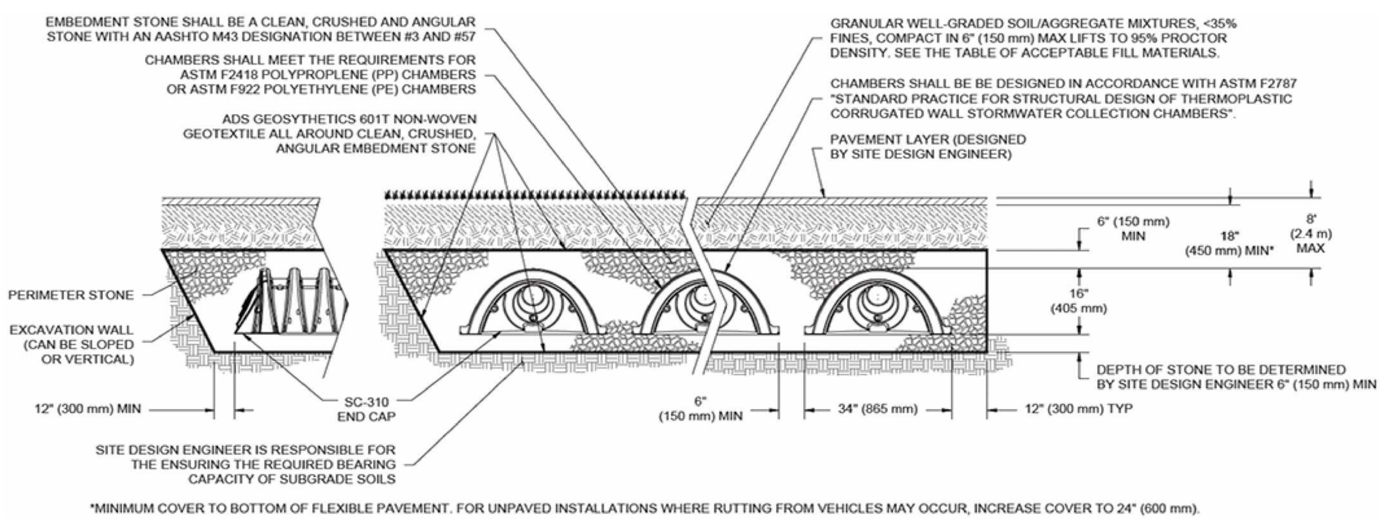
Results

System Volume and Bed Size

Installed Storage Volume:	88.64 cubic meters.
Storage Volume Per Chamber:	0.42 cubic meters.
Number Of Chambers Required:	72
Number Of End Caps Required:	16
Chamber Rows:	8
Maximum Length:	21.51 m.
Maximum Width:	8.77 m.
Approx. Bed Size Required:	186.96 square meters.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required:	196 cubic meters
Volume Of Excavation (Not Including Fill):	226 cubic meters
Total Non-woven Geotextile Required:	537 square meters
Woven Geotextile Required (excluding Isolator Row):	27 square meters
Woven Geotextile Required (Isolator Row):	30 square meters
Total Woven Geotextile Required:	56 square meters
Impervious Liner Required:	0 square meters



ORIFICE SIZING

155 Dun Skipper Drive
148290-6.0 | Rev #2 | 2025-02-18
Prepared By: WZ | Checked By: RM

Orifice coefficients	
Cv =	0.60

	Invert	Diameter	Centre ICD	Max. Pond Elevation	Hydraulic Slope	Target Flow	Theoretical		Recommended	
							Orifice	Actual Flow	Orifice	Actual Flow
	(m)	(mm)	(m)	(m)	(m)	(l/s)	(m)	(l/s)	(m)	(l/s)
CB20	99.050	200	99.150	100.750	1.600	15.00	0.067	15.00	0.067	15.00
CB24	99.940	200	100.040	101.340	1.300	15.00	0.070	15.00	0.070	15.00
CB25	100.170	200	100.270	101.670	1.400	6.00	0.044	6.00	0.044	6.00
CBMH20	98.474	300	98.624	100.500	1.876	15.00	0.064	15.00	0.064	15.00
MH21	98.373	300	98.523	100.550	2.027	33.00	0.093	33.00	0.093	33.00
MH22	98.422	300	98.572	100.750	2.178	6.00	0.039	6.00	0.039	6.00
						90.00				**89.99**

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
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ibigroup.com

STORM SEWER DESIGN SHEET

4836 Bank Street
City of Ottawa
Home Hardware

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW				
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.30	C= 0.40	C= 0.50	C= 0.55	C= 0.65	C= 0.70	C= 0.75	C= 0.90	C= 1.00	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)
		CB3	MH9-MH8								0.12			0.25	0.25	10.00	0.11	10.11
		CB2	MH9-MH8									0.02		0.05	0.05	10.00	0.12	10.12
		MH9	MH8											0.00	0.30	10.12	0.64	10.76
		CB1	MH8-MH7								0.17			0.35	0.35	10.00	0.17	10.17
		MH8	MH7											0.00	0.65	10.76	0.41	11.17
		BLDG D	MH7-MH5									0.05		0.13	0.13	10.00	0.20	10.20
		BLDG A	MH7-MH5									0.30		0.75	0.75	10.00	0.18	10.18
		MH7	MH5											0.00	1.53	11.17	0.46	11.63
		CB4	MH10-CBMH1									0.03		0.08	0.08	10.00	0.12	10.12
		MH10	CBMH1											0.00	0.08	10.12	0.73	10.85
		CB5	CBMH1-CBMH2									0.06		0.15	0.15	10.00	0.36	10.36
		CB6	CBMH1-CBMH2									0.07		0.18	0.18	10.00	0.15	10.15
		CB7	CBMH1-CBMH2									0.08		0.20	0.20	10.00	0.15	10.15
		CBMH1	CBMH2									0.08		0.20	0.80	10.85	0.80	11.66
		CBMH2	MH4											0.00	0.80	11.66	0.68	12.33
		CB9	MH1-MH2									0.15		0.38	0.38	10.00	0.28	10.28
		CB8	MH1-MH2									0.17		0.43	0.43	10.00	0.24	10.24
		BLDG C	MH1-MH2									0.05		0.13	0.13	10.00	0.22	10.22
		CB10	MH1-MH2									0.13		0.33	0.33	10.00	0.27	10.27
		CB11	MH1-MH2									0.03		0.08	0.08	10.00	0.11	10.11
		CB12	CB13									0.06		0.15	0.15	10.00	0.18	10.18
Idone Commercial		MH1	MH2								1.58			3.29	4.77	10.28	0.87	11.15
		CB13	MH2-MH3									0.18		0.45	0.45	10.00	0.01	10.01
		BLDG B	MH2-MH3									0.22		0.55	0.55	10.00	0.26	10.26
		MH2	MH3											0.00	5.77	11.15	0.14	11.29
		CB14	MH3-MH4									0.15		0.38	0.38	10.00	0.03	10.03
		CB15	CBMH3								0.09			0.19	0.19	10.00	0.31	10.31
		CB18	MH11		0.16									0.13	0.13	10.00	0.27	10.27
		MH11	CBMH3											0.00	0.13	10.27	0.34	10.61
		CBMH3	MH3-MH4						0.02					0.04	0.36	10.31	0.35	10.67
		MH3	MH4											0.00	6.50	11.29	1.01	12.30
		MH4	MH5											0.00	7.30	12.30	0.20	12.51
		CB17	MH5-MH12									0.09		0.23	0.23	10.00	0.04	10.04
		CB16	MH5-MH12		0.01									0.01	0.01	10.00	0.14	10.14
		MH5	MH12											0.00	9.07	12.51	0.34	12.85
		MH12	EX 1350 SEWER											0.00	9.07	12.85	0.17	13.02

FROM	TO	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	SEWER DATA: CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	AVAIL CAP (2yr) (%)
CB3	MH9-MH8	76.81	104.19	122.14	178.56	19.22	26.07	30.56	44.68		19.22	34.22	6.73	200			1.00	1.055	15.00	43.84%
CB2	MH9-MH8	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	34.22	7.69	200			1.00	1.055	30.37	88.77%
MH9	MH8	76.34	103.56	121.39	177.46	22.92	31.09	36.45	53.28		22.92	158.41	53.17	375			0.75	1.389	135.48	85.53%
CB1	MH8-MH7	76.81	104.19	122.14	178.56	27.22	36.93	43.29	63.29		27.22	34.22	10.80	200			1.00	1.055	6.99	20.44%
MH8	MH7	74.01	100.35	117.61	171.90	48.45	65.70	77.00	112.54		48.45	53.73	26.20	250			0.75	1.060	5.28	9.82%
BLDG D	MH7-MH5	76.81	104.19	122.14	178.56	9.61	13.03	15.28	22.34		9.61	34.22	12.60	200			1.00	1.055	24.61	71.92%
BLDG A	MH7-MH5	76.81	104.19	122.14	178.56	57.65	78.21	91.68	134.03		57.65	62.04	12.97	250			1.00	1.224	4.39	7.07%
MH7	MH5	72.58	98.39	115.31	168.52	111.08	150.57	176.46	257.90		111.08	230.39	38.63	450			0.60	1.403	119.31	51.79%
CB4	MH10-CBMH1	76.81	104.19	122.14	178.56	5.76	7.82	9.17	13.40		5.76	34.22	7.78	200			1.00	1.055	28.45	83.15%
MH10	CBMH1	76.34	103.55	121.38	177.44	5.73	7.77	9.11	13.32		5.73	48.06	41.57	250			0.60	0.948	42.33	88.08%
CB5	CBMH1-CBMH2	76.81	104.19	122.14	178.56	11.53	15.64	18.34	26.81		11.53	34.22	22.72	200			1.00	1.055	22.69	66.30%
CB6	CBMH1-CBMH2	76.81	104.19	122.14	178.56	13.45	18.25	21.39	31.27		13.45	34.22	9.78	200			1.00	1.055	20.76	60.69%
CB7	CBMH1-CBMH2	76.81	104.19	122.14	178.56	15.37	20.86	24.45	35.74		15.37	34.22	9.59	200			1.00	1.055	18.84	55.07%
CBMH1	CBMH2	73.68	99.89	117.07	171.12	58.99	79.98	93.73	137.00		58.99	66.53	63.40	250			1.15	1.313	7.54	11.33%
CBMH2	MH4	70.98	96.18	112.71	164.70	56.83	77.01	90.24	131.87		56.83	59.68	33.14	300			0.35	0.818	2.86	4.79%
CB9	MH1-MH2	76.81	104.19	122.14	178.56	28.82	39.10	45.84	67.01		28.82	34.22	17.68	200			1.00	1.055	5.39	15.76%
CB8	MH1-MH2	76.81	104.19	122.14	178.56	32.67	44.32	51.95	75.95		32.67	34.22	14.99	200			1.00	1.055	1.55	4.53%
BLDG C	MH1-MH2	76.81	104.19	122.14	178.56	9.61	13.03	15.28	22.34		9.61	34.22	14.20	200			1.00	1.055	24.61	71.92%
CB10	MH1-MH2	76.81	104.19	122.14	178.56	24.98	33.89	39.73	58.08		24.98	34.22	17.04	200			1.00	1.055	9.23	26.99%
CB11	MH1-MH2	76.81	104.19	122.14	178.56	5.76	7.82	9.17	13.40		5.76	34.22	6.75	200			1.00	1.055	28.45	83.15%
CB12	CB13	76.81	104.19	122.14	178.56	11.53	15.64	18.34	26.81		11.53	34.22	11.50	200			1.00	1.055	22.69	66.30%
MH1	MH2	75.75	102.74	120.43	176.05	361.36	490.12	574.51	839.82		361.36	452.94	81.04	600			0.50	1.552	91.59	20.22%
CB13	MH2-MH3	76.81	104.19	122.14	178.56	34.59	46.92	55.01	80.42		34.59	40.49	1.00	200			1.40	1.248	5.90	14.56%
BLDG B	MH2-MH3	76.81	104.19	122.14	178.56	42.28	57.35	67.23	98.29		42.28	62.04	19.00	250			1.00	1.224	19.76	31.85%
MH2	MH3	72.66	98.49	115.42	168.69	419.32	568.41	666.14	973.56		419.32	480.32	10.88	675			0.30	1.300	61.00	12.70%
CB14	MH3-MH4	76.81	104.19	122.14	178.56	28.82	39.10	45.84	67.01		28.82	34.22	1.63	200			1.00	1.055	5.39	15.76%
CB15	CBMH3	76.81	104.19	122.14	178.56	14.41	19.55	22.92	33.51		14.41	34.22	19.85	200			1.00	1.055	19.80	57.88%
CB18	MH11	76.81	104.19	122.14	178.56	10.25	13.90	16.30	23.83		10.25	27.59	13.80	200			0.65	0.851	17.34	62.85%
MH11	CBMH3	75.78	102.79	120.48	176.12	10.11	13.72	16.08	23.50		10.11	27.59	17.50	200			0.65	0.851	17.47	63.34%
CBMH3	MH3-MH4	75.62	102.57	120.22	175.74	27.01	36.64	42.95	62.78		27.01	27.59	17.94	200			0.65	0.851	0.57	2.07%
MH3	MH4	72.19	97.84	114.66	167.58	469.49	636.36	745.75	1,089.88		469.49	519.40	69.31	750			0.20	1.139	49.91	9.61%
MH4	MH5	68.96	93.42	109.46	159.93	503.74	682.38	799.52	1,168.19		503.74	580.71	15.46	750			0.25	1.273	76.96	13.25%
CB17	MH5-MH12	76.81	104.19	122.14	178.56	17.29	23.46	27.50	40.21		17.29	34.22	2.55	200			1.00	1.055	16.92	49.45%
CB16	MH5-MH12	76.81	104.19	122.14	178.56	0.64	0.87	1.02	1.49		0.64	34.22	9.09	200			1.00	1.055	33.58	98.13%
MH5	MH12	68.36	92.59	108.48	158.49	619.90	839.64	983.73	1,437.28		619.90	687.10	31.13	750			0.35	1.507	67.20	9.78%
MH12	EX 1350 SEWER	67.36	91.21	106.86	156.12	610.81	827.17	969.05	1,415.73		610.81	687.10	15.71	750			0.35	1.507	76.29	11.10%

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: JEB
Checked: JIM
Dwg. Reference: 119351-500

No.	Revision	Date
1.	- Submission No. 1	2019-03-30
2.	Revised per City Comments	2020-04-20

File Reference:	Date:	Sheet No:
119351.5.7.1	2019-03-30	1 of 1

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

PROJECT: 4836 Bank St
DATE: 2019-10-08
FILE: 119351.5.7
REV #:
DESIGNED BY: JEB
CHECKED BY: JM

STORMWATER MANAGEMENT

Formulas and Descriptions

i_{2yr} = 1:2 year Intensity = 732.951 / $(T_c+6.199)^{0.810}$
i_{5yr} = 1:5 year Intensity = 998.071 / $(T_c+6.053)^{0.814}$
i_{100yr} = 1:100 year Intensity = 1735.688 / $(T_c+6.014)^{0.820}$
T_c = Time of Concentration (min)
C = Average Runoff Coefficient
A = Area (Ha)
Q = Flow = 2.78CiA (L/s)

Maximum Allowable Release Rate

Restricted Flowrate
Taken from City of Ottawa approved Design Brief "Pathways at Findlay Creek" (D07-16-13-0023) drainage area EXT 4

EXT 4 Release Rate	760.00	L/s
Area EXT 4 $_{TOTAL}$ =	4.04	Ha
Area Subject Lands	2.49	
Perscentage Share of release rate	62%	

Q_{TOTAL} =	468.42	L/s

Uncontrolled Release ($Q_{uncontrolled}$ = 2.78*C*i_{100yr}*$A_{uncontrolled}$)

C =	0.625	
T_c =	10	min
i_{100yr} =	178.56	mm/hr
$A_{uncontrolled}$ =	0.01	Ha

$Q_{uncontrolled}$ =	3.10	L/s

Maximum Allowable Release Rate ($Q_{max\ allowable}$ = $Q_{restricted}$ - $Q_{uncontrolled}$)

$Q_{max\ allowable}$ =	465.31	L/s

MODIFIED RATIONAL METHOD (100-Year & 5-Year Ponding)

Drainage Area	***MH9/MH9B***				
Area (Ha)	0.14				
C =	0.98	Restricted Flow Q_r (L/s)=			10.00
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi_{100yr}A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
30	91.87	34.86	10.00	24.86	44.75
32	87.89	33.35	10.00	23.35	44.83
33	86.03	32.65	10.00	22.65	**44.84**
34	84.27	31.98	10.00	21.98	44.83
36	80.96	30.72	10.00	20.72	44.76

Storage (m^3)

Overflow	**Required**	**Surface**	**Sub-surface**	**Balance**
0.00	44.84	20.64	10.07	14.13

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
54.91	0.375	0.110	6.06
6.73	0.200	0.031	0.21
7.69	0.200	0.031	0.24
			6.51

overflows to: CB1

Drainage Area	***MH9/MH9B***				
Area (Ha)	0.14				
C =	0.78	Restricted Flow Q_r (L/s)=			10.00
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi_{5yr}A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
13	90.63	27.51	10.00	17.51	13.66
15	83.56	25.37	10.00	15.37	13.83
16	80.46	24.43	10.00	14.43	**13.85**
17	77.61	23.56	10.00	13.56	13.83
19	72.53	22.02	10.00	12.02	13.70

Storage (m^3)

Overflow	**Required**	**Surface**	**Sub-surface**	**Balance**
0.00	13.85	20.64	10.07	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
CB2 (600mm x 600mm)	1.80	0.36	0.65
CBMH10 (1200mm round)	2.00	1.13	2.26
			3.56

overflows to: CB1

Drainage Area	***MH9/MH9B***				
Area (Ha)	0.140				
C =	0.78	Restricted Flow Q_r (L/s)=			10.00
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi_{2yr}A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
10	76.81	23.32	10.00	13.32	7.99
11	73.17	22.21	10.00	12.21	8.06
12	69.89	21.22	10.00	11.22	**8.08**
13	66.93	20.32	10.00	10.32	8.05
15	61.77	18.75	10.00	8.75	7.88

Storage (m^3)

Overflow	**Required**	**Surface**	**Sub-surface**	**Balance**
0.00	8.08	20.64	10.07	0.00

overflows to: CB1

Drainage Area	*CB1*		
Area (Ha)	0.17		
C =	0.88	Restricted Flow Q_r (L/s)=	16.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
19	123.87	49.72	16.00	33.72	38.44
21	116.30	46.68	16.00	30.68	38.65
22	112.88	45.31	16.00	29.31	**38.68**
23	109.68	44.02	16.00	28.02	38.67
25	103.85	41.68	16.00	25.68	38.52

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
14.13	52.82	50.59	5.58	0.00

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
31.00	0.450	0.159	4.93
			4.93

overflows to: CB17

Drainage Area	*CB1*		
Area (Ha)	0.17		
C =	0.70	Restricted Flow Q_r (L/s)=	16.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
7	123.30	39.59	16.00	23.59	9.91
9	109.79	35.25	16.00	19.25	10.40
10	104.19	33.46	16.00	17.46	**10.47**
11	99.19	31.85	16.00	15.85	10.46
13	90.63	29.10	16.00	13.10	10.22

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	10.47	50.59	5.58	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
			0.65

overflows to: CB17

Drainage Area	*CB1*		
Area (Ha)	0.165		
C =	0.70	Restricted Flow Q_r (L/s)=	16.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
4	111.72	35.87	16.00	19.87	4.77
6	96.64	31.03	16.00	15.03	5.41
7	90.66	29.11	16.00	13.11	**5.51**
8	85.46	27.44	16.00	11.44	5.49
10	76.81	24.66	16.00	8.66	5.20

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	5.51	50.59	5.58	0.00

overflows to: CB17

Drainage Area	*CB16*		
Area (Ha)	0.010		
C =	0.38	Restricted Flow Q_r (L/s)=	6.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
-6	57497.20	599.41	16.00	583.41	-210.03
-4	977.56	10.19	16.00	-5.81	1.39
-3	702.38	7.32	16.00	-8.68	**1.56**
-2	555.31	5.79	16.00	-10.21	1.23
0	398.62	4.16	16.00	-11.84	0.00

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.56	0.31	0.00	1.25

overflows to: CB17

Drainage Area	*CB16*		
Area (Ha)	0.010		
C =	0.30	Restricted Flow Q_r (L/s)=	6.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
-6	10904.38	90.94	6.00	84.94	-30.58
-4	555.75	4.63	6.00	-1.37	0.33
-3	402.34	3.36	6.00	-2.64	**0.48**
-2	319.47	2.66	6.00	-3.34	0.40
0	230.48	1.92	6.00	-4.08	0.00

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.48	0.31	0.00	0.17

overflows to: CB17

Drainage Area	*CB16*		
Area (Ha)	0.010		
C =	0.30	Restricted Flow Q_r (L/s)=	6.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-7	#NUM!	#NUM!	6.00	#NUM!	#NUM!
-5	632.75	5.28	6.00	-0.72	0.22
-4	387.14	3.23	6.00	-2.77	**0.67**
-3	285.77	2.38	6.00	-3.62	0.65
-1	192.83	1.61	6.00	-4.39	0.26

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.67	0.31	0.00	0.36

overflows to: CB17

Drainage Area	*CB17*		
Area (Ha)	0.090		
C =	1.00	Restricted Flow Q_r (L/s)=	9.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
22	112.88	28.24	9.00	19.24	25.40
24	106.68	26.69	9.00	17.69	25.47
25	103.85	25.98	9.00	16.98	**25.47**
26	101.18	25.32	9.00	16.32	25.45
28	96.27	24.09	9.00	15.09	25.35

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
1.25	26.73	0.84	5.10	20.79

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
28.00	0.450	0.159	4.45
			4.45

overflows to: CB15

Drainage Area	*CB17*		
Area (Ha)	0.090		
C =	0.90	Restricted Flow Q_r (L/s)=	9.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
10	104.19	23.46	9.00	14.46	8.68
12	94.70	21.32	9.00	12.32	8.87
13	90.63	20.41	9.00	11.41	**8.90**
14	86.93	19.58	9.00	10.58	8.88
16	80.46	18.12	9.00	9.12	8.75

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.17	9.06	0.84	5.10	3.13

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
			0.65

overflows to: CB15

Drainage Area	*CB17*		
Area (Ha)	0.090		
C =	0.90	Restricted Flow Q_r (L/s)=	9.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	20.42	9.00	11.42	4.79
9	80.87	18.21	9.00	9.21	4.97
10	76.81	17.29	9.00	8.29	**4.98**
11	73.17	16.48	9.00	7.48	4.93
13	66.93	15.07	9.00	6.07	4.74

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	4.98	0.84	5.10	0.00

overflows to: CB15

Drainage Area	CB15		
Area (Ha)	0.090		
C =	0.94	Restricted Flow Q_r (L/s)=	6.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
33	86.03	20.18	6.00	14.18	28.08
35	82.58	19.37	6.00	13.37	28.08
36	80.96	18.99	6.00	12.99	**28.06**
37	79.42	18.63	6.00	12.63	28.03
39	76.51	17.95	6.00	11.95	27.96

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
20.79	48.85	66.27	5.10	0.00

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
28.00	0.450	0.159	4.45
			4.45

overflows to: out

Drainage Area	CB15		
Area (Ha)	0.090		
C =	0.75	Restricted Flow Q_r (L/s)=	6.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
13	90.63	17.01	6.00	11.01	8.59
15	83.56	15.68	6.00	9.68	8.71
16	80.46	15.10	6.00	9.10	**8.73**
17	77.61	14.56	6.00	8.56	8.73
19	72.53	13.61	6.00	7.61	8.67

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
3.13	11.86	66.27	5.10	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB3 (600mm x 600mm)	1.80	0.36	0.65
			0.65

overflows to: out

Drainage Area	CB15		
Area (Ha)	0.090		
C =	0.75	Restricted Flow Q_r (L/s)=	6.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
9	80.87	15.18	6.00	9.18	4.95
11	73.17	13.73	6.00	7.73	5.10
12	69.89	13.12	6.00	7.12	**5.12**
13	66.93	12.56	6.00	6.56	5.12
15	61.77	11.59	6.00	5.59	5.03

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	5.12	66.27	5.10	0.00

overflows to: out

Drainage Area	CBMH3		
Area (Ha)	0.020		
C =	0.81	Restricted Flow Q_r (L/s)=	6.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
3	286.05	12.92	6.00	6.92	1.25
5	242.70	10.96	6.00	4.96	1.49
6	226.01	10.21	6.00	4.21	**1.52**
7	211.67	9.56	6.00	3.56	1.50
9	188.25	8.50	6.00	2.50	1.35

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.52	4.17	0	0.00

overflows to: CB12/13/14

Drainage Area	CBMH3		
Area (Ha)	0.020		
C =	0.90	Restricted Flow Q_r (L/s)=	6.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
0	230.48	11.53	6.00	5.53	0.00
2	182.69	9.14	6.00	3.14	0.38
3	166.09	8.31	6.00	2.31	**0.42**
4	152.51	7.63	6.00	1.63	0.39
6	131.57	6.58	6.00	0.58	0.21

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.42	4.17	0.00	0.00

overflows to: CB12/13/14

Drainage Area	CBMH3		
Area (Ha)	0.020		
C =	0.90	Restricted Flow Q_r (L/s)=	6.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
-2	229.26	11.47	6.00	5.47	-0.66
0	167.22	8.37	6.00	2.37	0.00
1	148.14	7.41	6.00	1.41	**0.08**
2	133.33	6.67	6.00	0.67	0.08
4	111.72	5.59	6.00	-0.41	-0.10

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.08	4.17	0.00	0.00

overflows to: CB12/13/14

Drainage Area	CB11		
Area (Ha)	0.030		
C =	1.00	Restricted Flow Q_r (L/s)=	15.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
1	351.38	29.31	15.00	14.31	0.86
3	286.05	23.86	15.00	8.86	1.59
4	262.41	21.88	15.00	6.88	**1.65**
5	242.70	20.24	15.00	5.24	1.57
7	211.67	17.65	15.00	2.65	1.11

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
5.62	7.27	0.93	0	6.34

overflows to: CB12/CB13/CB14

Drainage Area	CB11		
Area (Ha)	0.030		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
-2	319.47	23.98	15.00	8.98	-1.08
0	230.48	17.30	15.00	2.30	0.00
1	203.51	15.28	15.00	0.28	**0.02**
2	182.69	13.71	15.00	-1.29	-0.15
4	152.51	11.45	15.00	-3.55	-0.85

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.02	0.93	0.00	0.00

overflows to: CB12/CB13/CB14

Drainage Area	CB11		
Area (Ha)	0.030		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
-4	387.14	29.06	15.00	14.06	-3.37
-2	229.26	17.21	15.00	2.21	-0.26
-1	192.83	14.47	15.00	-0.53	**0.03**
0	167.22	12.55	15.00	-2.45	0.00
2	133.33	10.01	15.00	-4.99	-0.60

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.03	0.93	0.00	0.00

overflows to: CB12/CB13/CB14

Drainage Area	**CB12/CB13/CB14**				
Area (Ha)	0.330				
C =	1.00	Restricted Flow Q_r (L/s)=		73.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
9	188.25	172.70	73.00	99.70	53.84
10	178.56	163.81	73.00	90.81	54.49
11	169.91	155.87	73.00	82.87	**54.70**
12	162.13	148.74	73.00	75.74	54.53
14	148.72	136.44	73.00	63.44	53.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
6.34	61.03	54.36	5.07	1.60

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
11.07	0.375	0.110	1.22
12.00	0.450	0.159	1.91
			3.13

overflows to: CB10

Drainage Area	**CB12/CB13/CB14**				
Area (Ha)	0.330				
C =	0.90	Restricted Flow Q_r (L/s)=		73.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
2	182.69	150.84	73.00	77.84	9.34
4	152.51	125.92	73.00	52.92	12.70
5	141.18	116.57	73.00	43.57	**13.07**
6	131.57	108.63	73.00	35.63	12.83
8	116.11	95.87	73.00	22.87	10.98

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	13.07	54.36	5.07	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB12 (600mm x 600mm)	1.80	0.36	0.65
CB13 (600mm x 600mm)	1.80	0.36	0.65
CB14 (600mm x 600mm)	1.80	0.36	0.65
			1.94

overflows to: CB10

Drainage Area	**2/CB13/CB14**				
Area (Ha)	0.330				
C =	0.90	Restricted Flow Q_r (L/s)=		73.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
0	167.22	138.07	73.00	65.07	0.00
2	133.33	110.09	73.00	37.09	4.45
3	121.46	100.29	73.00	27.29	**4.91**
4	111.72	92.25	73.00	19.25	4.62
6	96.64	79.79	73.00	6.79	2.44

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	4.91	54.36	5.07	0.00

overflows to: CB10

Drainage Area	**CB10**				
Area (Ha)	0.130				
C =	1.00	Restricted Flow Q_r (L/s)=		45.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
5	242.70	87.71	45.00	42.71	12.81
6	226.01	81.68	45.00	36.68	13.20
7	211.67	76.50	45.00	31.50	**13.23**
8	199.20	71.99	45.00	26.99	12.96
10	178.56	64.53	45.00	19.53	11.72

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
5.62	18.85	6.81	0.00	12.04

overflows to: CB18

Drainage Area	**CB10**				
Area (Ha)	0.130				
C =	0.90	Restricted Flow Q_r (L/s)=		45.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
-1	266.98	86.84	45.00	41.84	-2.51
1	203.51	66.19	45.00	21.19	1.27
2	182.69	59.42	45.00	14.42	**1.73**
3	166.09	54.02	45.00	9.02	1.62
5	141.18	45.92	45.00	0.92	0.28

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.73	6.81	0.00	0.00

overflows to: CB18

Drainage Area	**CB10**				
Area (Ha)	0.130				
C =	0.90	Restricted Flow Q_r (L/s)=		45.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
-2	229.26	74.57	45.00	29.57	-3.55
0	167.22	54.39	45.00	9.39	0.00
1	148.14	48.19	45.00	3.19	**0.19**
2	133.33	43.37	45.00	-1.63	-0.20
4	111.72	36.34	45.00	-8.66	-2.08

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
Balance	#VALUE!	6.81	0.00	#VALUE!

overflows to: CB18

Drainage Area	CBMH2		
Area (Ha)	0.080		
C =	1.00	Restricted Flow Q_r (L/s)=	20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
7	211.67	47.07	20.00	27.07	11.37
9	188.25	41.87	20.00	21.87	11.81
10	178.56	39.71	20.00	19.71	**11.83**
11	169.91	37.79	20.00	17.79	11.74
13	155.11	34.50	20.00	14.50	11.31

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	11.83	6.21	0.00	5.62

overflows to: CB11

Drainage Area	CBMH2		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	40.73	20.00	20.73	1.24
3	166.09	33.24	20.00	13.24	2.38
4	152.51	30.53	20.00	10.53	**2.53**
5	141.18	28.26	20.00	8.26	2.48
7	123.30	24.68	20.00	4.68	1.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.53	6.21	0.00	0.00

Drainage Area	CBMH2		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-1	192.83	38.60	20.00	18.60	-1.12
1	148.14	29.65	20.00	9.65	0.58
2	133.33	26.69	20.00	6.69	**0.80**
3	121.46	24.31	20.00	4.31	0.78
5	103.57	20.73	20.00	0.73	0.22

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.80	6.21	0.00	0.00

Drainage Area	CB7		
Area (Ha)	0.080		
C =	1.00	Restricted Flow Q_r (L/s)=	30.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
3	286.05	63.62	30.00	33.62	6.05
5	242.70	53.98	30.00	23.98	7.19
6	226.01	50.26	30.00	20.26	**7.30**
7	211.67	47.07	30.00	17.07	7.17
9	188.25	41.87	30.00	11.87	6.41

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
5.62	12.91	6.97	0.00	5.94

overflows to: CB8

Drainage Area	CB7		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	30.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
-1	266.98	53.44	30.00	23.44	-1.41
1	203.51	40.73	30.00	10.73	0.64
2	182.69	36.57	30.00	6.57	**0.79**
3	166.09	33.24	30.00	3.24	0.58
5	141.18	28.26	30.00	-1.74	-0.52

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.79	6.97	0.00	0.00

overflows to: CB8

Drainage Area	CB7		
Area (Ha)	0.080		
C =	0.90	Restricted Flow Q_r (L/s)=	30.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-3	285.77	57.20	30.00	27.20	-4.90
-1	192.83	38.60	30.00	8.60	-0.52
0	167.22	33.47	30.00	3.47	**0.00**
1	148.14	29.65	30.00	-0.35	-0.02
3	121.46	24.31	30.00	-5.69	-1.02

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	6.97	0.00	0.00

overflows to: CB8

Drainage Area	CB6		
Area (Ha)	0.070		
C =	1.00	Restricted Flow Q_r (L/s)=	20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
5	242.70	47.23	20.00	27.23	8.17
7	211.67	41.19	20.00	21.19	8.90
8	199.20	38.76	20.00	18.76	**9.01**
9	188.25	36.63	20.00	16.63	8.98
11	169.91	33.06	20.00	13.06	8.62

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	9.01	13.66	0.00	0.00

overflows to: CB8

Drainage Area	P3/L3		
Area (Ha)	0.160		
C =	0.45	Restricted Flow Q_r (L/s)=	20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	40.73	20.00	20.73	1.24
3	166.09	33.24	20.00	13.24	2.38
4	152.51	30.53	20.00	10.53	**2.53**
5	141.18	28.26	20.00	8.26	2.48
7	123.30	24.68	20.00	4.68	1.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.53	13.66	0.00	0.00

overflows to: CB8

Drainage Area	CB6		
Area (Ha)	0.070		
C =	0.45	Restricted Flow Q_r (L/s)=	20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-4	387.14	33.90	20.00	13.90	-3.34
-2	229.26	20.08	20.00	0.08	-0.01
-1	192.83	16.89	20.00	-3.11	**0.19**
0	167.22	14.64	20.00	-5.36	0.00
2	133.33	11.68	20.00	-8.32	-1.00

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.19	13.66	0.00	0.00

overflows to: CB8

Drainage Area	CB5		
Area (Ha)	0.060		
C =	1.00	Restricted Flow Q_r (L/s)=	15.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
7	211.67	35.31	15.00	20.31	8.53
9	188.25	31.40	15.00	16.40	8.86
10	178.56	29.78	15.00	14.78	**8.87**
11	169.91	28.34	15.00	13.34	8.80
13	155.11	25.87	15.00	10.87	8.48

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	8.87	3.41	0.00	5.46

overflows to: CB8

Drainage Area	CB5		
Area (Ha)	0.060		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	30.55	15.00	15.55	0.93
3	166.09	24.93	15.00	9.93	1.79
4	152.51	22.89	15.00	7.89	**1.89**
5	141.18	21.19	15.00	6.19	1.86
7	123.30	18.51	15.00	3.51	1.47

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.89	3.41	0.00	0.00

overflows to: CB8

Drainage Area	CB5		
Area (Ha)	0.060		
C =	0.90	Restricted Flow Q_r (L/s)=	15.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-1	192.83	28.95	15.00	13.95	-0.84
1	148.14	22.24	15.00	7.24	0.43
2	133.33	20.02	15.00	5.02	**0.60**
3	121.46	18.23	15.00	3.23	0.58
5	103.57	15.55	15.00	0.55	0.16

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
#VALUE!	#VALUE!	3.41	0.00	#VALUE!

overflows to: CB8

Drainage Area	CB8				
Area (Ha)	0.170				
C =	1.00	Restricted Flow Q_r (L/s)=		47.00	
100-Year Ponding					
T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
6	226.01	106.81	47.00	59.81	21.53
8	199.20	94.14	47.00	47.14	22.63
9	188.25	88.97	47.00	41.97	**22.66**
10	178.56	84.39	47.00	37.39	22.43
12	162.13	76.62	47.00	29.62	21.33

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
11.40	34.07	24.90	1.60	7.57

Length (m)	Dia (m)	Area (m^2)	Volume (m^3)
6.00	0.450	0.159	0.95
			0.95

overflows to: CB9

Drainage Area	CB8				
Area (Ha)	0.170				
C =	0.90	Restricted Flow Q_r (L/s)=		47.00	
5-Year Ponding					
T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	86.56	47.00	39.56	2.37
3	166.09	70.64	47.00	23.64	4.26
4	152.51	64.87	47.00	17.87	**4.29**
5	141.18	60.05	47.00	13.05	3.91
7	123.30	52.45	47.00	5.45	2.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	4.29	24.90	1.60	0.00

Structure	Depth	Area (m^2)	Volume (m^3)
CB8 (600mm x 600mm)	1.80	0.36	0.65
			0.65

Drainage Area	CB8				
Area (Ha)	0.170				
C =	0.90	Restricted Flow Q_r (L/s)=		47.00	
2-Year Ponding					
T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-1	192.83	82.02	47.00	35.02	-2.10
1	148.14	63.01	47.00	16.01	0.96
2	133.33	56.71	47.00	9.71	**1.17**
3	121.46	51.66	47.00	4.66	0.84
5	103.57	44.05	47.00	-2.95	-0.88

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.17	24.90	1.60	0.00

Drainage Area	CB4				
Area (Ha)	0.030				
C =	1.00	Restricted Flow Q_r (L/s)=		6.00	
100-Year Ponding					
T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
9	188.25	15.70	6.00	9.70	5.24
11	169.91	14.17	6.00	8.17	5.39
12	162.13	13.52	6.00	7.52	**5.42**
13	155.11	12.94	6.00	6.94	5.41
15	142.89	11.92	6.00	5.92	5.33

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
7.57	12.98	10.62	0.00	2.36

overflows to: CBMH1

Drainage Area	CB4				
Area (Ha)	0.030				
C =	0.90	Restricted Flow Q_r (L/s)=		6.00	
5-Year Ponding					
T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
3	166.09	12.47	6.00	6.47	1.16
5	141.18	10.60	6.00	4.60	1.38
6	131.57	9.88	6.00	3.88	**1.40**
7	123.30	9.26	6.00	3.26	1.37
9	109.79	8.24	6.00	2.24	1.21

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.40	10.62	0.00	0.00

overflows to: CBMH1

Drainage Area	CB4				
Area (Ha)	0.030				
C =	0.90	Restricted Flow Q_r (L/s)=		6.00	
2-Year Ponding					
T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
1	148.14	11.12	6.00	5.12	0.31
3	121.46	9.12	6.00	3.12	0.56
4	111.72	8.39	6.00	2.39	**0.57**
5	103.57	7.77	6.00	1.77	0.53
7	90.66	6.81	6.00	0.81	0.34

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.57	10.62	0.00	0.00

overflows to: CBMH1

Drainage Area	CBMH1				
Area (Ha)	0.080				
C =	1.00	Restricted Flow Q_r (L/s)=		20.00	
100-Year Ponding					
T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
7	211.67	47.07	20.00	27.07	11.37
9	188.25	41.87	20.00	21.87	11.81
10	178.56	39.71	20.00	19.71	**11.83**
11	169.91	37.79	20.00	17.79	11.74
13	155.11	34.50	20.00	14.50	11.31

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
2.36	14.19	0.00	0.00	14.19

overflows to: CB9

Drainage Area	CBMH1				
Area (Ha)	0.080				
C =	0.90	Restricted Flow Q_r (L/s)=		20.00	
5-Year Ponding					
T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
1	203.51	40.73	20.00	20.73	1.24
3	166.09	33.24	20.00	13.24	2.38
4	152.51	30.53	20.00	10.53	**2.53**
5	141.18	28.26	20.00	8.26	2.48
7	123.30	24.68	20.00	4.68	1.97

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	2.53	0.00	0.00	2.53

overflows to: CB9

Drainage Area	CBMH1				
Area (Ha)	0.080				
C =	0.90	Restricted Flow Q_r (L/s)=		20.00	
2-Year Ponding					
T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-1	192.83	38.60	20.00	18.60	-1.12
1	148.14	29.65	20.00	9.65	0.58
2	133.33	26.69	20.00	6.69	**0.80**
3	121.46	24.31	20.00	4.31	0.78
5	103.57	20.73	20.00	0.73	0.22

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.80	0.00	0.00	0.80

overflows to: CB9

Drainage Area	CB9				
Area (Ha)	0.150				
C =	1.00	Restricted Flow Q_r (L/s)=		43.00	
100-Year Ponding					
T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{100yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
5	242.70	101.21	43.00	58.21	17.46
7	211.67	88.27	43.00	45.27	19.01
8	199.20	83.07	43.00	40.07	**19.23**
9	188.25	78.50	43.00	35.50	19.17
11	169.91	70.85	43.00	27.85	18.38

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
21.75	40.99	10.83	0.00	30.16

overflows to: CB18

Drainage Area	CB9				
Area (Ha)	0.160				
C =	0.45	Restricted Flow Q_r (L/s)=		43.00	
5-Year Ponding					
T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{5yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
-3	402.34	80.53	43.00	37.53	-6.76
-1	266.98	53.44	43.00	10.44	-0.63
0	230.48	46.13	43.00	3.13	**0.00**
1	203.51	40.73	43.00	-2.27	-0.14
3	166.09	33.24	43.00	-9.76	-1.76

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
2.53	2.53	10.83	0.00	0.00

overflows to: CB18

Drainage Area	CB9				
Area (Ha)	0.150				
C =	0.45	Restricted Flow Q_r (L/s)=		43.00	
2-Year Ponding					
T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow Q_p=2.78xCi_{2yr}A (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
-3	285.77	53.62	43.00	10.62	-1.91
-1	192.83	36.18	43.00	-6.82	0.41
0	167.22	31.38	43.00	-11.62	**0.00**
1	148.14	27.80	43.00	-15.20	-0.91
3	121.46	22.79	43.00	-20.21	-3.64

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	10.83	0.00	0.00

overflows to: CB18

Drainage Area	***CB18***				
Area (Ha)	0.160				
C =	0.25	Restricted Flow Q_r (L/s)=		15.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$ A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
3	286.05	31.81	15.00	16.81	3.03
5	242.70	26.99	15.00	11.99	3.60
6	226.01	25.13	15.00	10.13	**3.65**
7	211.67	23.54	15.00	8.54	3.59
9	188.25	20.93	15.00	5.93	3.20

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
42.19	45.84	13.76	46.33	0.00

Drainage Area	***CB18***				
Area (Ha)	0.160				
C =	0.20	Restricted Flow Q_r (L/s)=		15.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$ A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
-2	319.47	28.42	15.00	13.42	-1.61
0	230.48	20.50	15.00	5.50	0.00
1	203.51	18.10	15.00	3.10	**0.19**
2	182.69	16.25	15.00	1.25	0.15
4	152.51	13.57	15.00	-1.43	-0.34

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.19	13.76	46.33	0.00

Drainage Area	***CB18***				
Area (Ha)	0.160				
C =	0.20	Restricted Flow Q_r (L/s)=		15.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$ A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
-3	285.77	25.42	15.00	10.42	-1.88
-1	192.83	17.15	15.00	2.15	-0.13
0	167.22	14.88	15.00	-0.12	**0.00**
1	148.14	13.18	15.00	-1.82	-0.11
3	121.46	10.81	15.00	-4.19	-0.76

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.00	13.76	46.33	0.00

Subsurface storage calculation

450mm subdrain @ 96m	15.30	m^3
Bottom of storage medium ave. grade	98.00	m
width of S29 trench	1.00	m
depth of S29 trench (below spill elev.)	1.01	m
Volume of S29 trench	96.96	m^3
Volume of clear stone	81.66	m^3
25mm clear stone per S29	0.38	void ratio
Stoage within clear stone	31.03	m^3

C

overflows to: offsite

overflows to: offsite

overflows to: offsite

Drainage Area	***RA***				
Area (Ha)	0.300				
C =	1.00	Restricted Flow Q_r (L/s)=		27.00	
100-Year Ponding					
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$ A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***
25	103.85	86.61	27.00	59.61	89.41
26	101.18	84.38	27.00	57.38	89.52
27	98.66	82.28	27.00	55.28	**89.56**
28	96.27	80.29	27.00	53.29	89.53
29	94.01	78.41	27.00	51.41	89.45

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	89.56	90.00	0.00	0.00

Drainage Area	***RA***				
Area (Ha)	0.300				
C =	0.90	Restricted Flow Q_r (L/s)=		27.00	
5-Year Ponding					
T_c Variable (min)	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$ A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
13	90.63	68.03	27.00	41.03	32.00
14	86.93	65.25	27.00	38.25	32.13
15	83.56	62.72	27.00	35.72	**32.15**
16	80.46	60.39	27.00	33.39	32.06
17	77.61	58.25	27.00	31.25	31.88

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	32.15	90.00	0.00	0.00

Drainage Area	***RA***				
Area (Ha)	0.300				
C =	0.90	Restricted Flow Q_r (L/s)=		27.00	
2-Year Ponding					
T_c Variable (min)	***i_{2yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{2yr}$ A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 2yr (m^3)***
8	85.46	64.14	27.00	37.14	17.83
10	76.81	57.65	27.00	30.65	18.39
11	73.17	54.92	27.00	27.92	**18.43**
12	69.89	52.46	27.00	25.46	18.33
14	64.23	48.21	27.00	21.21	17.82

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	18.43	90.00	0.00	0.00

Drainage Area	RB
Area (Ha)	0.220
C =	1.00
Restricted Flow Q_r (L/s)=	20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
24	106.68	65.24	20.00	45.24	65.15
26	101.18	61.88	20.00	41.88	65.34
27	98.66	60.34	20.00	40.34	**65.35**
28	96.27	58.88	20.00	38.88	65.32
30	91.87	56.19	20.00	36.19	65.14

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	65.35	66.00	0.00	0.00

Drainage Area	RB
Area (Ha)	0.220
C =	0.90
Restricted Flow Q_r (L/s)=	20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
11	99.19	54.60	20.00	34.60	22.84
13	90.63	49.89	20.00	29.89	23.31
14	86.93	47.85	20.00	27.85	**23.40**
15	83.56	45.99	20.00	25.99	23.39
17	77.61	42.72	20.00	22.72	23.17

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	23.40	66.00	0.00	0.00

Drainage Area	RB
Area (Ha)	0.220
C =	0.90
Restricted Flow Q_r (L/s)=	20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
8	85.46	47.04	20.00	27.04	12.98
10	76.81	42.28	20.00	22.28	13.37
11	73.17	40.27	20.00	20.27	**13.38**
12	69.89	38.47	20.00	18.47	13.30
14	64.23	35.36	20.00	15.36	12.90

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	13.38	66.00	0.00	0.00

Drainage Area	RC
Area (Ha)	0.050
C =	1.00
Restricted Flow Q_r (L/s)=	8.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
12	162.13	22.54	8.00	14.54	10.47
14	148.72	20.67	8.00	12.67	10.64
15	142.89	19.86	8.00	11.86	**10.68**
16	137.55	19.12	8.00	11.12	10.67
18	128.08	17.80	8.00	9.80	10.59

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	10.68	13.50	1.00	0.00

Drainage Area	RC
Area (Ha)	0.050
C =	0.90
Restricted Flow Q_r (L/s)=	8.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
5	141.18	17.66	8.00	9.66	2.90
7	123.30	15.43	8.00	7.43	3.12
8	116.11	14.53	8.00	6.53	**3.13**
9	109.79	13.74	8.00	5.74	3.10
11	99.19	12.41	8.00	4.41	2.91

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	3.13	13.50	0.00	0.00

Drainage Area	RC
Area (Ha)	0.050
C =	0.90
Restricted Flow Q_r (L/s)=	8.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
2	133.33	16.68	8.00	8.68	1.04
4	111.72	13.98	8.00	5.98	1.43
5	103.57	12.96	8.00	4.96	**1.49**
6	96.64	12.09	8.00	4.09	1.47
8	85.46	10.69	8.00	2.69	1.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.49	13.50	0.00	0.00

Drainage Area	RD
Area (Ha)	0.050
C =	1.00
Restricted Flow Q_r (L/s)=	8.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
12	162.13	22.54	8.00	14.54	10.47
14	148.72	20.67	8.00	12.67	10.64
15	142.89	19.86	8.00	11.86	**10.68**
16	137.55	19.12	8.00	11.12	10.67
18	128.08	17.80	8.00	9.80	10.59

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	10.68	11.25	1.00	0.00

Drainage Area	RD
Area (Ha)	0.050
C =	0.90
Restricted Flow Q_r (L/s)=	8.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
5	141.18	17.66	8.00	9.66	2.90
7	123.30	15.43	8.00	7.43	3.12
8	116.11	14.53	8.00	6.53	**3.13**
9	109.79	13.74	8.00	5.74	3.10
11	99.19	12.41	8.00	4.41	2.91

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	3.13	11.25	0.00	0.00

Drainage Area	RD
Area (Ha)	0.050
C =	0.90
Restricted Flow Q_r (L/s)=	8.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
2	133.33	16.68	8.00	8.68	1.04
4	111.72	13.98	8.00	5.98	1.43
5	103.57	12.96	8.00	4.96	**1.49**
6	96.64	12.09	8.00	4.09	1.47
8	85.46	10.69	8.00	2.69	1.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.49	11.25	0.00	0.00

Drainage Area	EXTERNAL
Area (Ha)	1.550
C =	1.00
Restricted Flow Q_r (L/s)=	291.58

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
9	188.25	811.19	291.58	519.61	280.59
11	169.91	732.13	291.58	440.55	290.76
12	162.13	698.63	291.58	407.05	**293.08**
13	155.11	668.36	291.58	376.78	293.89
15	142.89	615.73	291.58	324.15	291.74

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	293.08	270.00	0.00	23.08

Drainage Area	EXTERNAL
Area (Ha)	1.550
C =	0.80
Restricted Flow Q_r (L/s)=	291.58

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
2	182.69	629.76	291.58	338.18	40.58
4	152.51	525.73	291.58	234.15	56.19
5	141.18	486.67	291.58	195.09	**58.53**
6	131.57	453.54	291.58	161.96	58.31
8	116.11	400.26	291.58	108.68	52.17

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	58.53	270.00	0.00	0.00

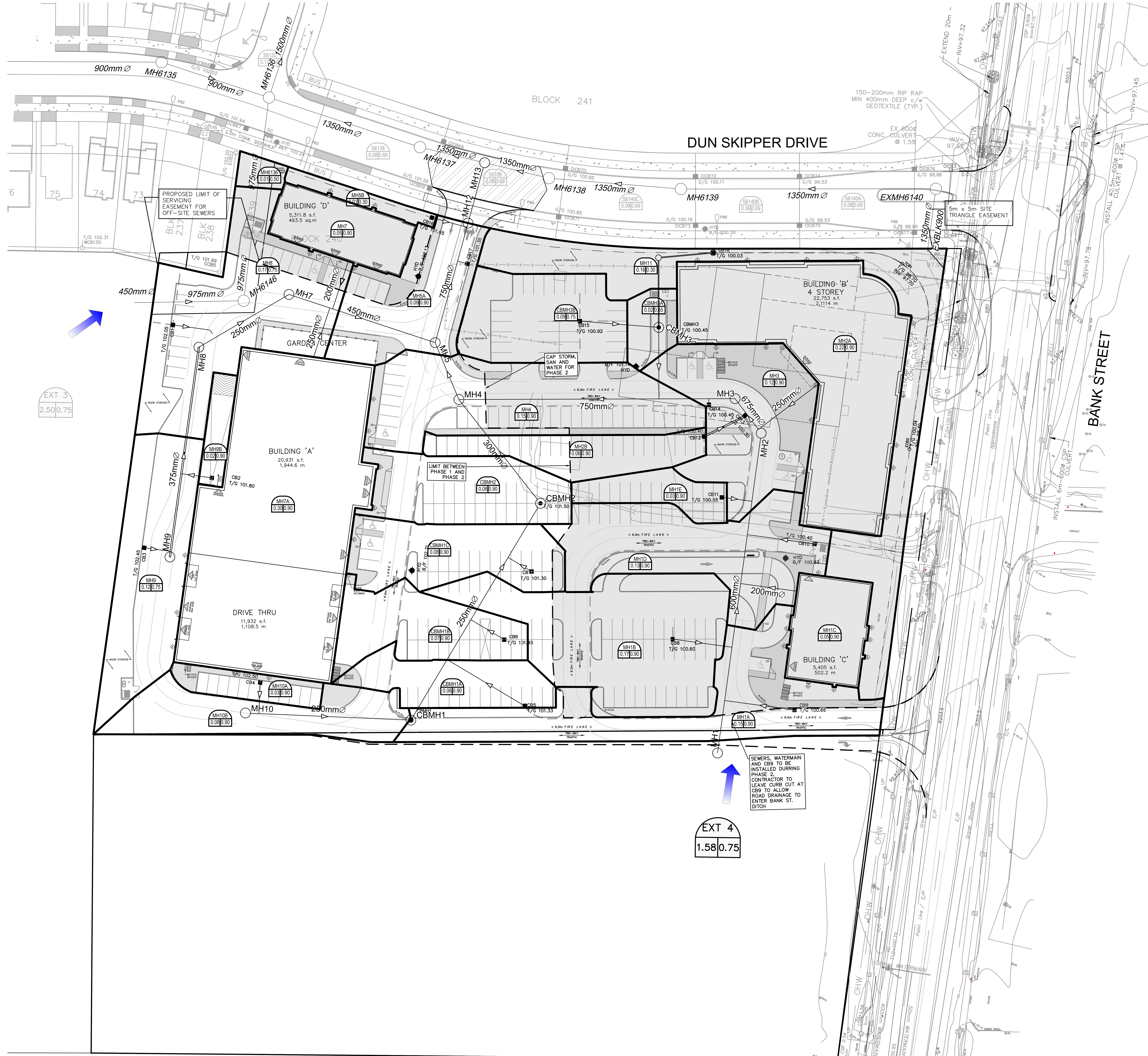
Drainage Area	EXTERNAL
Area (Ha)	1.550
C =	0.80
Restricted Flow Q_r (L/s)=	291.58

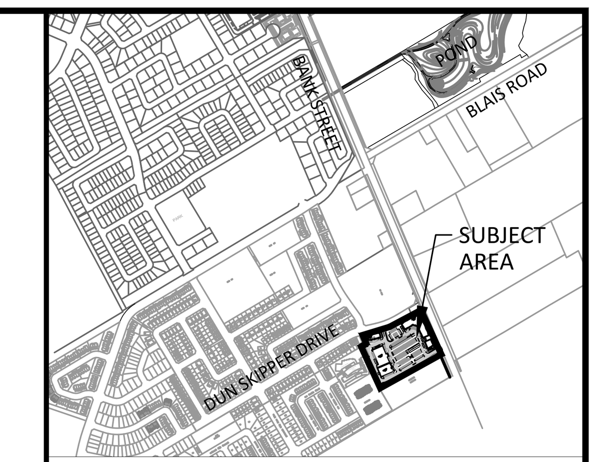
2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
0	167.22	576.45	291.58	284.87	0.00
2	133.33	459.62	291.58	168.04	20.16
3	121.46	418.71	291.58	127.13	**22.88**
4	111.72	385.13	291.58	93.55	22.45
6	96.64	333.13	291.58	41.55	14.96

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	22.88	270.00	0.00	0.00





KEY PLAN
(NTS)

NOTES:
1. SEE DRAWING C-010 FOR ADDITIONAL DETAILS AND NOTES.

2. SITE BENCHMARK TO BE OBTAINED FROM LEGAL SURVEYOR H.A. KEN SHIPMAN SURVEYING LTD.

LEGEND:
DRAINAGE AREA LIMITS

XX
0.01 0.30
AREA ID
RUNOFF COEFFICIENT
AREA IN HECTARES

XX
0.01 0.30
EXISTING AREA ID
EXISTING RUNOFF COEFFICIENT
EXISTING AREA IN HECTARES

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4	ADD PHASING	JIM	2020:06:23
3	REVISED AS PER CITY COMMENTS	JIM	2019:12:09
2	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	JIM	2019:10:11
1	ISSUED FOR SPA	JIM	2019:04:15

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

BANK STREET DEVELOPMENT
4836 BANK STREET

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2020/06/23
PROVINCE OF ONTARIO

Drawing Title

STORM DRAINAGE AREA PLAN

Scale
1 : 500

Design	SEL	Date	FEB. 2019
Drawn	DPS	Checked	JIM
Project No.	119351	Drawing No.	500

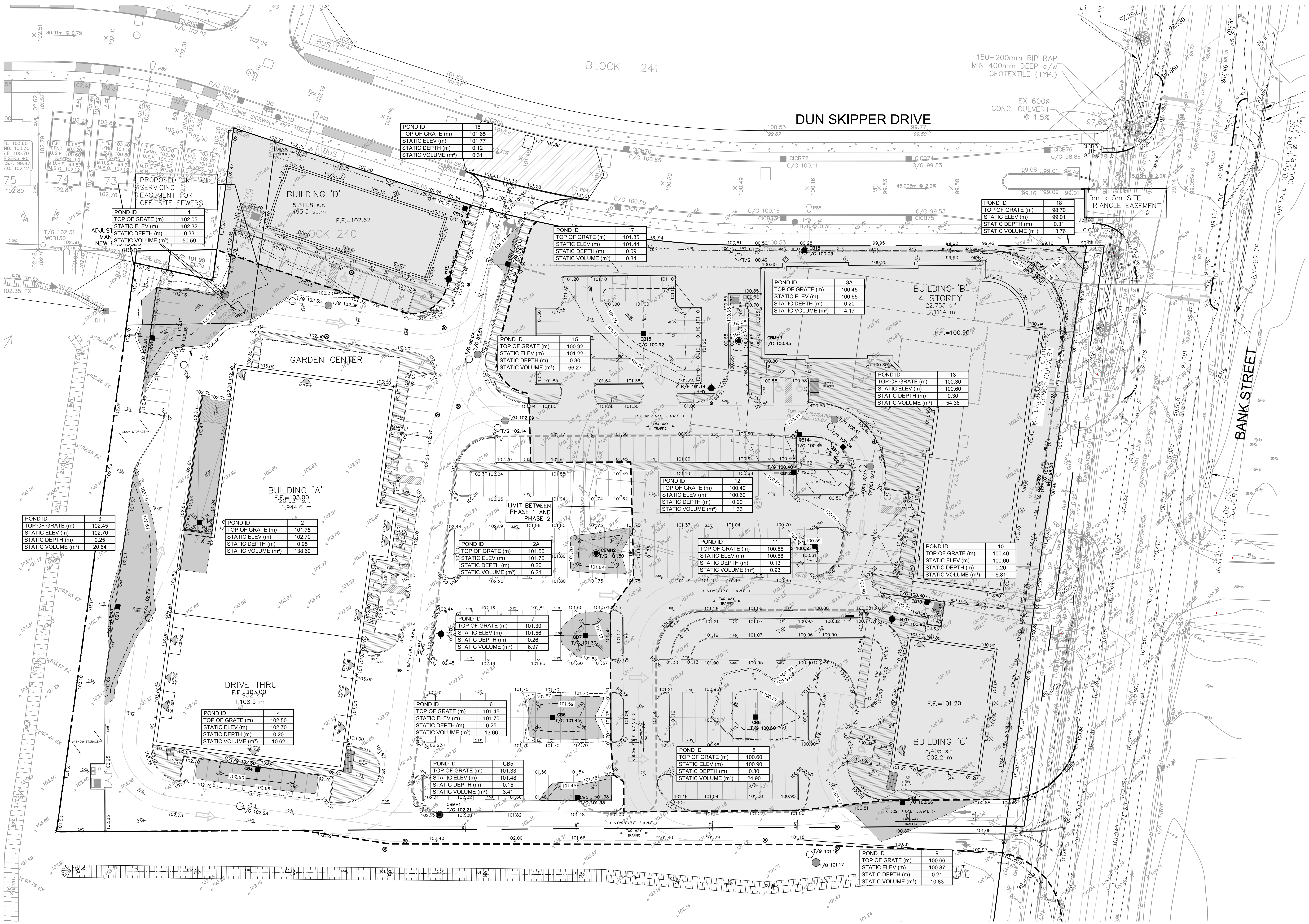
APPROVED ☐ REFUSED ☐

THIS____DAY OF ____________ , 20______

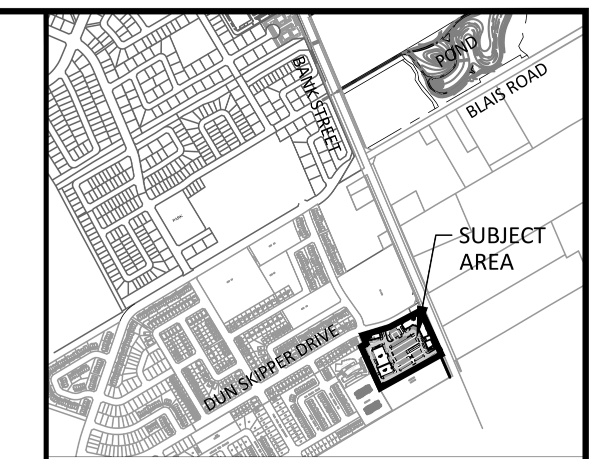
DON HERWEYER, MCIP, RPP
MANAGER, DEVELOPMENT REVIEW - SOUTH
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

D07-12-19-0092

#17977



POND ID	TOP OF GRATE (m)	STATIC ELEV (m)	STATIC DEPTH (m)	STATIC VOLUME (m³)
16	101.65	101.77	0.12	0.31
1	102.05	102.32	0.33	50.59
17	101.35	101.44	0.09	0.84
18	98.70	99.01	0.31	13.76
3A	100.45	100.65	0.20	4.17
15	100.92	101.22	0.30	66.27
13	100.30	100.60	0.30	54.36
12	100.40	100.60	0.20	1.33
	102.45	102.70	0.25	20.64
2	101.75	102.70	0.95	138.60
2A	101.50	101.70	0.20	6.21
11	100.55	100.68	0.13	0.93
10	100.40	100.60	0.20	6.81
7	101.30	101.56	0.26	6.97
4	102.50	102.70	0.20	10.62
6	101.45	101.70	0.25	13.66
CB5	101.33	101.48	0.15	3.41
8	100.60	100.90	0.30	24.90
9	100.66	100.87	0.21	10.83



KEY PLAN
(NTS)

NOTES:
1. SEE DRAWING C-010 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK TO BE OBTAINED FROM LEGAL SURVEYOR H.A. KEN SHIPMAN SURVEYING LTD.

LEGEND :
100 YEAR PONDING VOLUME LIMIT
5 YEAR PONDING ELEVATION
SPILL OVER ELEVATION
MAJOR OVERLAND FLOW ROUTE

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4	ADD PHASING	JIM	2020:06:23
3	REVISED AS PER CITY COMMENTS	JIM	2020:04:20
2	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	JIM	2019:10:11
1	ISSUED FOR SPA	JIM	2019:04:15

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ibigroup.com

Project Title
BANK STREET DEVELOPMENT
4836 BANK STREET

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2020/06/23
PROVINCE OF ONTARIO

Drawing Title
PONDING PLAN

Scale
1 : 400

Design	SEL	Date	FEB. 2019
Drawn	DPS	Checked	JIM
Project No.	119351	Drawing No.	600

D07-12-19-0092

#17977

Appendix E

Grading Plan 148290-C-200

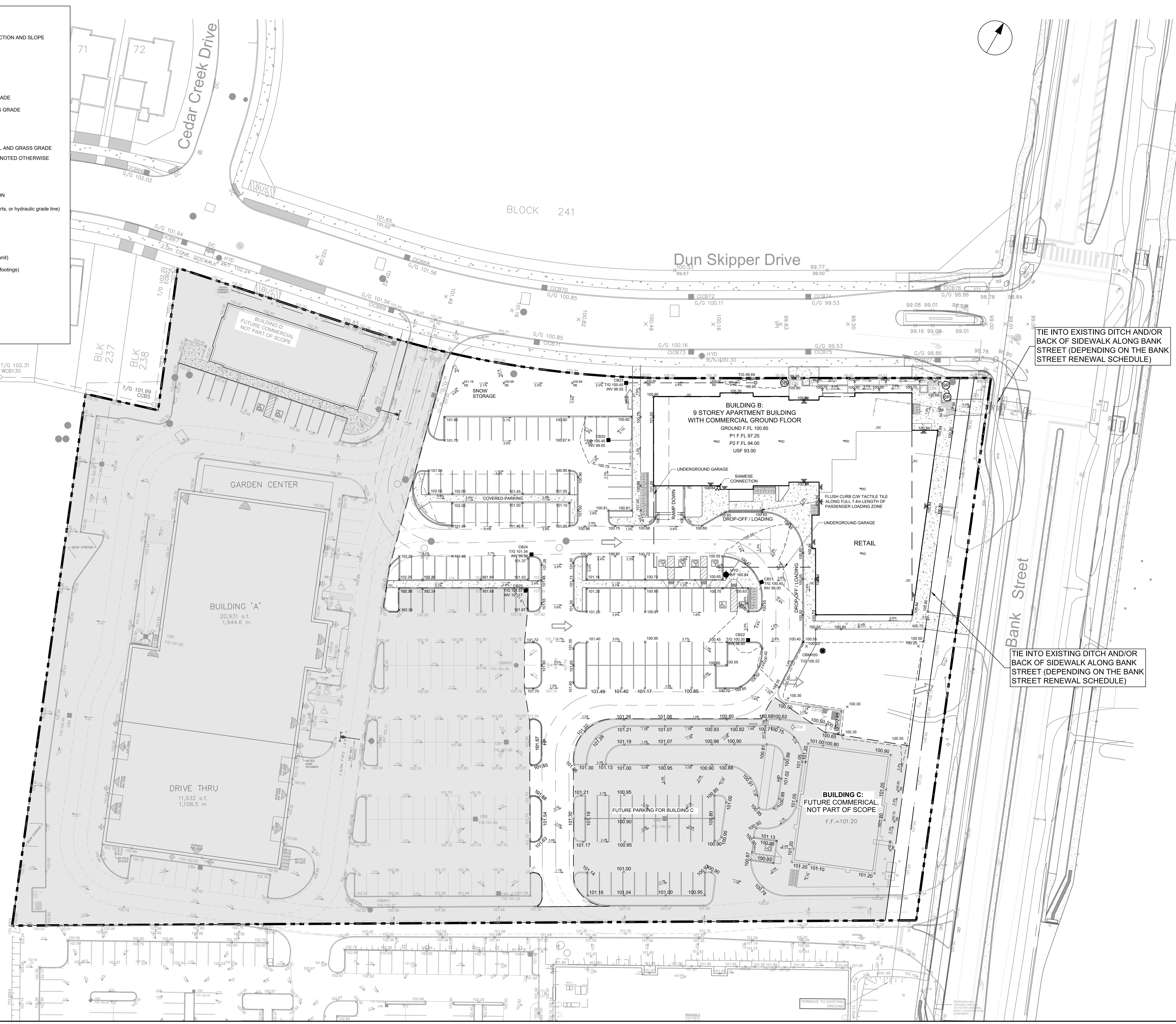
Interim Grading Plan 148290-C-201

Erosion and Sediment Control Plan 148290-C-900

Grading Plan 119351-C-200

GRADING LEGEND

- PROPOSED DITCH C/W FLOW DIRECTION AND SLOPE
- SLOPE C/W FLOW DIRECTION
- MAJOR OVERLAND FLOW ROUTE
- PROPOSED SPOT GRADE
- PROPOSED SWALE GRADE
- PROPOSED SWALE HIGH POINT GRADE
- LOT CORNER GRADE C/W EXISTING GRADE
- FULL STATIC PONDING GRADE
- RETAINING WALL C/W TOP OF WALL AND GRASS GRADE
- TERRACING 3:1 MAXIMUM UNLESS NOTED OTHERWISE
- PRESSURE REDUCING VALVE
- FINISHED FLOOR ELEVATION
- TOP OF FOUNDATION ELEVATION
- UNDERSIDE OF FOOTING ELEVATION
- MINIMUM UNDERSIDE OF FOOTING (Based on the higher of the sewer obverts, or hydraulic grade line)
- MINIMUM GARAGE GRADE
- WALKUP UNIT
- WALKOUT UNIT
- NON-STANDARD FOUNDATION (Frost cover not provided for standard unit)
- HIGHBACK UNIT (1.5m frost cover on footings)
- NOISE BARRIER LOCATION
- NOISE BARRIER GATE
- RIP-RAP
- TOWN HOUSE SPLITS
- 2 hr FIREWALL



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ISSUES

No.	DESCRIPTION	DATE
1	SUBMISSION NO.1 FOR CITY REVIEW	2024-11-26
2	SUBMISSION NO.2 FOR CITY REVIEW	2025-02-18
3		
4		

SEE 010 FOR NOTES, LEGEND AND DETAILS

KEY PLAN

SUBJECT SITE

CONSULTANTS

1:400 0 4 12 20m

SEAL

LICENSED PROFESSIONAL ENGINEER
W. ZHUANG
100231427
2025/02/18
PROVINCE OF ONTARIO

PRIME CONSULTANT

ARCADIS

333 Preston Street - Suite 500
Ottawa ON K1S 5N4 Canada
tel 613 225 1311
www.arcadis.com

PROJECT
SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO: 148290	
DRAWN BY: M.M.	CHECKED BY: D.G.Y.
PROJECT MGR: R.M.	APPROVED BY: A.Z.

SHEET TITLE
GRADING PLAN

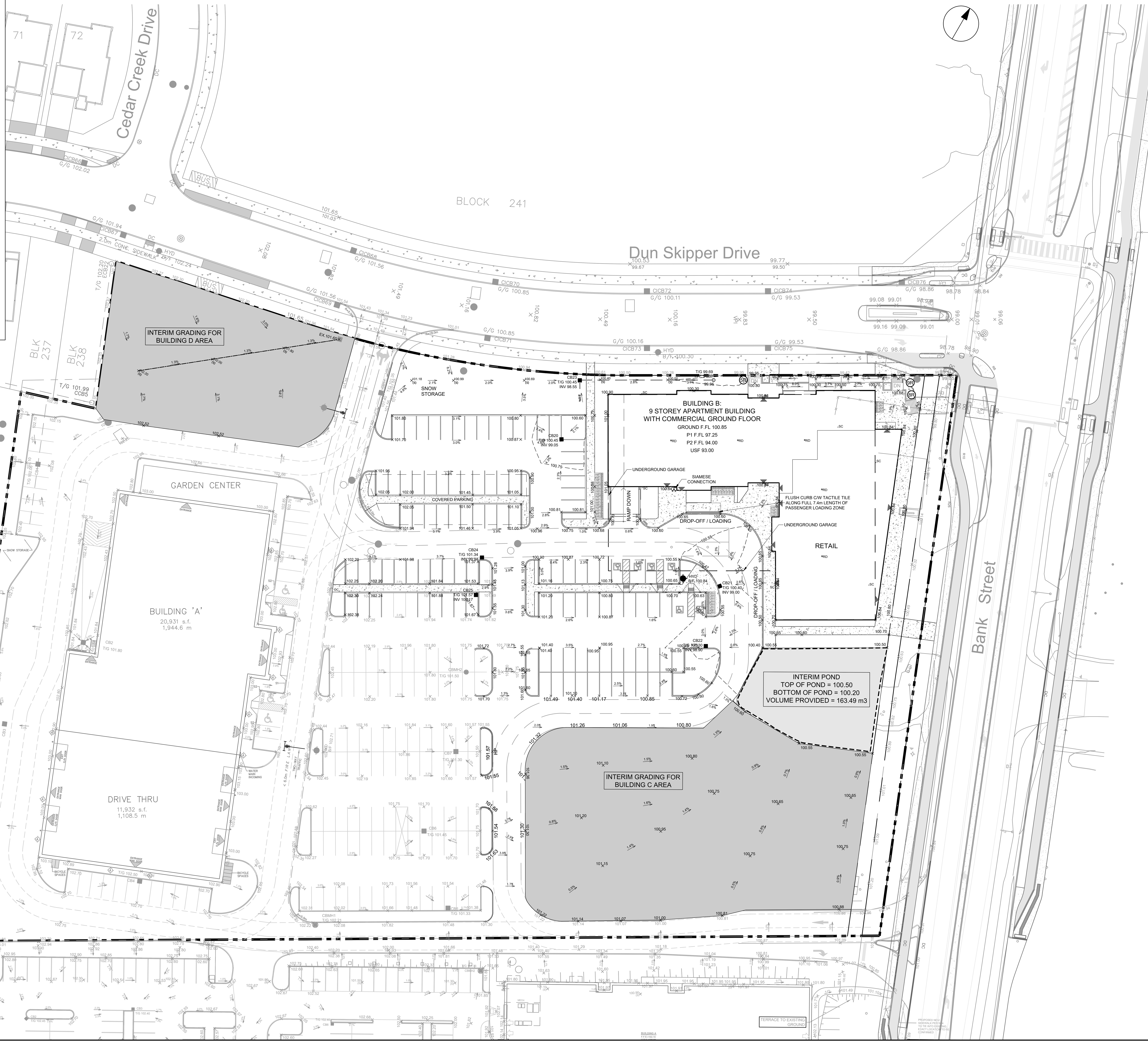
SHEET NUMBER	ISSUE
C-200	1

D07-12-24-0169

19213

GRADING LEGEND

- PROPOSED DITCH C/W FLOW DIRECTION AND SLOPE
- SLOPE C/W FLOW DIRECTION
- MAJOR OVERLAND FLOW ROUTE
- PROPOSED SPOT GRADE
- PROPOSED SWALE GRADE
- PROPOSED SWALE HIGH POINT GRADE
- LOT CORNER GRADE C/W EXISTING GRADE
- FULL STATIC PONDING GRADE
- RETAINING WALL C/W TOP OF WALL AND GRASS GRADE
- TERRACING 3:1 MAXIMUM UNLESS NOTED OTHERWISE
- PRESSURE REDUCING VALVE
- FINISHED FLOOR ELEVATION
- TOP OF FOUNDATION ELEVATION
- UNDERSIDE OF FOOTING ELEVATION
- MINIMUM UNDERSIDE OF FOOTING (Based on the higher of the sewer obverts, or hydraulic grade line)
- MINIMUM GARAGE GRADE
- WALKUP UNIT
- WALKOUT UNIT
- NON-STANDARD FOUNDATION (Frost cover not provided for standard unit)
- HIGHBACK UNIT (1.5m frost cover on footings)
- NOISE BARRIER LOCATION
- NOISE BARRIER GATE
- RIP-RAP
- TOWN HOUSE SPLITS
- 2 hr FIREWALL



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ISSUES

No.	DESCRIPTION	DATE
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3		
4		

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KEY PLAN

SUBJECT SITE

CONSULTANTS

1:400 0 4 12 20m

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100231427
2025/02/18
PROVINCE OF ONTARIO

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PROJECT

SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO: 148290	
DRAWN BY: M.M.	CHECKED BY: R.M.
PROJECT MGR: R.M.	APPROVED BY: A.Z.

SHEET TITLE

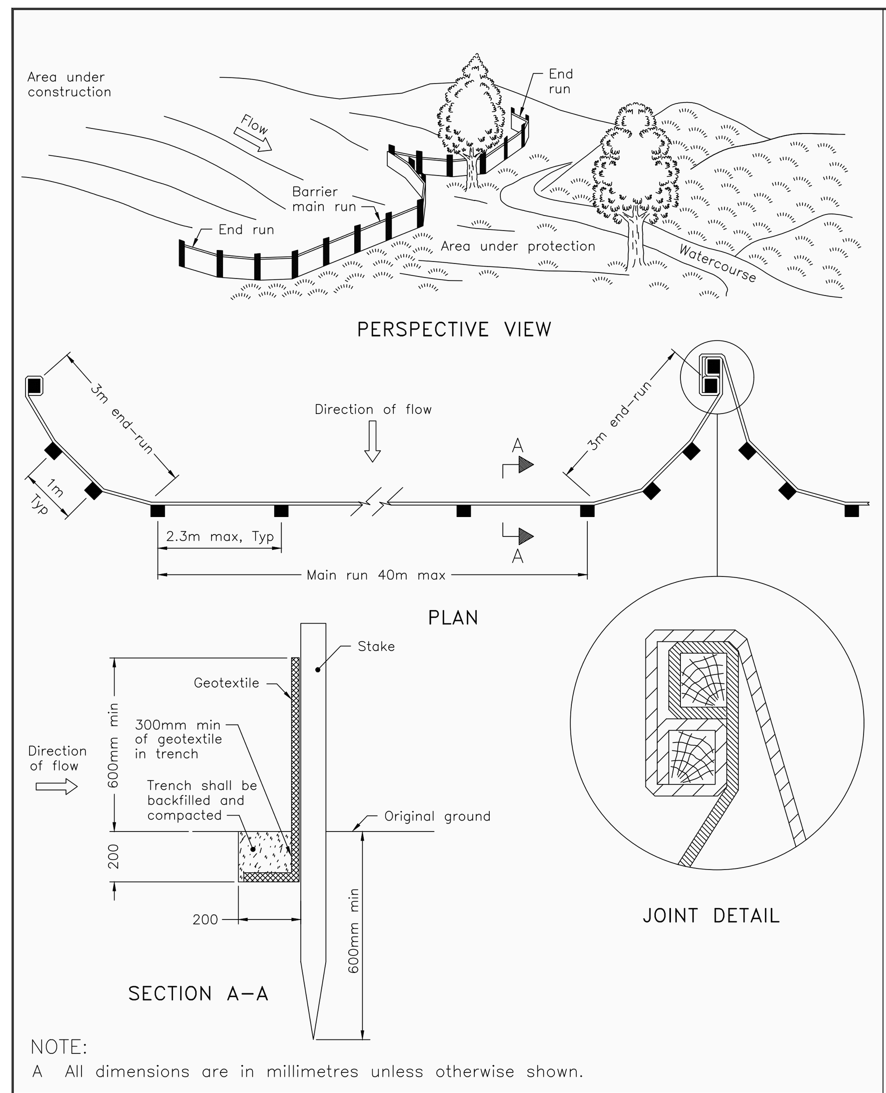
INTERIM GRADING PLAN

SHEET NUMBER	ISSUE
C-201	1

File Location: C:\Users\zhuanja7667\DC\ACCDocs\Arcadis ACC US\ACA-00148290-155 Dun Skipper\Project Files\7.03_Design\04_Civil\Sheets\C-201 INTERIM GRADING PLAN.dwg Last Saved: February 18, 2025, by mlmem4626 Plotted: February 18, 2025 4:58:09 PM by Zhuang, Amy

D07-12-24-0169

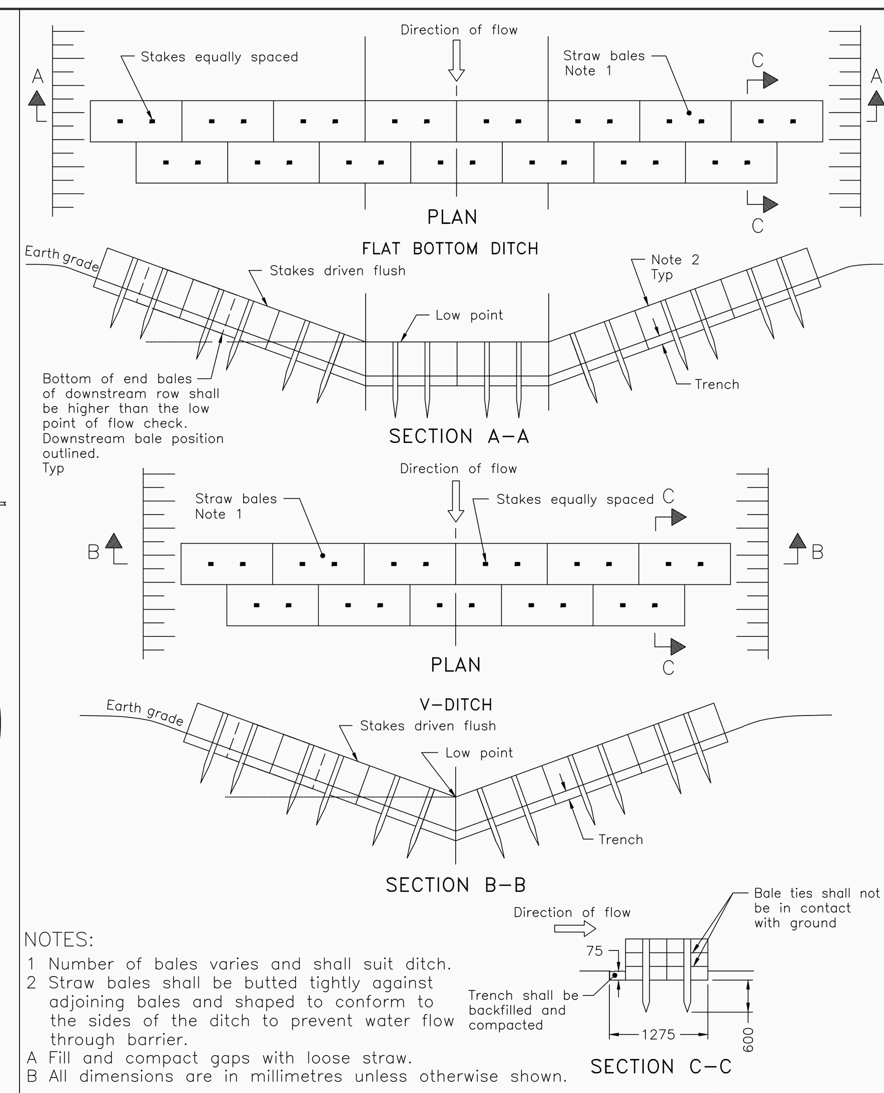
19213



ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2021 | Rev 3

LIGHT-DUTY SILT FENCE BARRIER

OPSD 219.110



ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2021 | Rev 3

STRAW BALE FLOW CHECK DAM

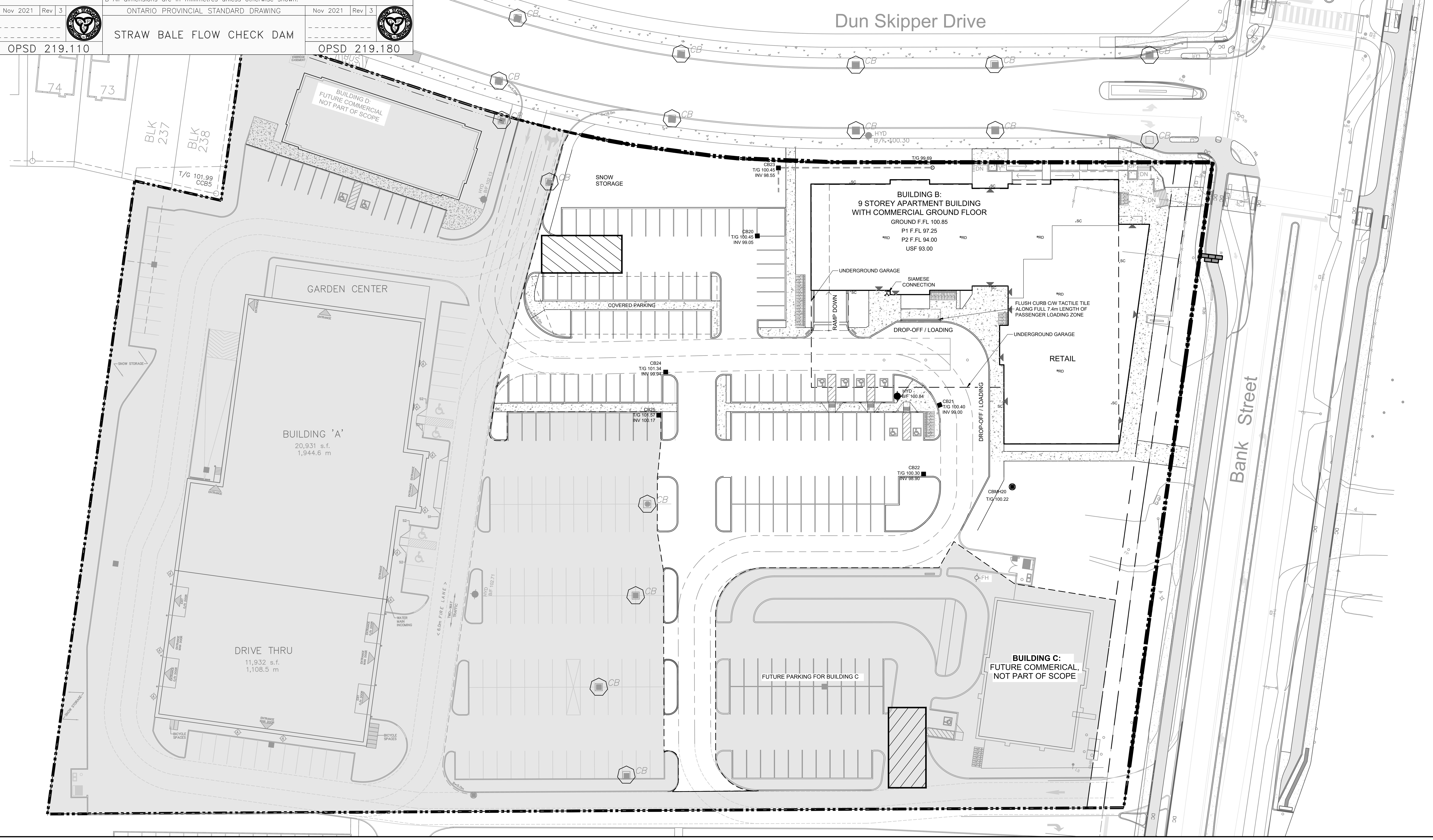
OPSD 219.180

NOTES:

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
2. SILT FENCE TO BE ERECTED PRIOR TO EARTH WORKS BEING COMMENCED. SILT FENCE TO BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED OR UNTIL START OF SUBSEQUENT PHASE.
3. STRAW BALE SEDIMENT TRAPS TO BE CONSTRUCTED IN EXISTING ROAD SIDE DITCHES. TRAPS TO REMAIN AND BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED.
4. SILT SACK TO BE PLACED AND MAINTAINED UNDER COVER OF ALL CATCHBASINS. GEOTEXTILE SILT SACK IN STREET CBs TO REMAIN UNTIL ALL CURBS ARE CONSTRUCTED. GEOTEXTILE FABRIC IN RYCBs TO REMAIN UNTIL VEGETATION IS ESTABLISHED. ALL CATCHBASINS TO BE REGULARLY INSPECTED AND CLEANED, AS NECESSARY, UNTIL SOD AND CURBS ARE CONSTRUCTED.
5. CONTRACTOR TO PROVIDE DETAILS ON LOCATION(S) AND DESIGN OF DEWATERING TRAP(S) PRIOR TO COMMENCING WORK. CONTRACTOR ALSO RESPONSIBLE FOR MAINTAINING TRAP(S) AND ADJUSTING SIZE(S) IF DEEMED REQUIRED BY THE ENGINEER DURING CONSTRUCTION.
6. CONTRACTOR TO PROTECT EXISTING CATCHBASINS WITH FILTER CLOTH UNDER THE COVERS TO TRAP SEDIMENTATION. REFER TO IDENTIFIED STRUCTURES.
7. WORKS NOTED ABOVE ARE TO BE INSTALLED, INSPECTED, MAINTAINED AND ULTIMATELY REMOVED BY SERVICING CONTRACTOR.
8. THIS IS A "LIVING DOCUMENT" AND MAY BE MODIFIED IN THE EVENT THE PROPOSED CONTROL MEASURES ARE INSUFFICIENT.

LEGEND:

- LIGHT DUTY SILT FENCE AS PER OPSD-219.110
- SNOW FENCE
- STRAW BALE CHECK DAM AS PER OPSD-219.180
- ROCK CHECK DAM AS PER OPSD-219.210
- SILT SACK PLACED UNDER EXISTING CB COVER
- TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOTH



CLIENT
2668867 Ontario Inc.

Arcadis Professional Services (Canada) Inc.
formerly IBI Group Professional Services (Canada) Inc.

ISSUES

No.	DESCRIPTION	DATE
1	SUBMISSION NO.1 FOR CITY REVIEW	2024-11-26
2	SUBMISSION NO.2 FOR CITY REVIEW	2025-02-18
3		
4		

SEE 010 FOR NOTES, LEGEND AND DETAILS

KEY PLAN

SUBJECT SITE

CONSULTANTS

1:400 0 4 12 20m

SEAL

LICENSED PROFESSIONAL ENGINEER
W. ZHUANG
100231427
2025/02/18
PROVINCE OF ONTARIO

PRIME CONSULTANT

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www.arcadis.com

PROJECT
SENIORS APARTMENTS

BANK STREET AT DUN SKIPPER DRIVE

PROJECT NO:
148290

DRAWN BY:	CHECKED BY:
M.M.	R.M.
PROJECT MGR:	APPROVED BY:
R.M.	A.Z.

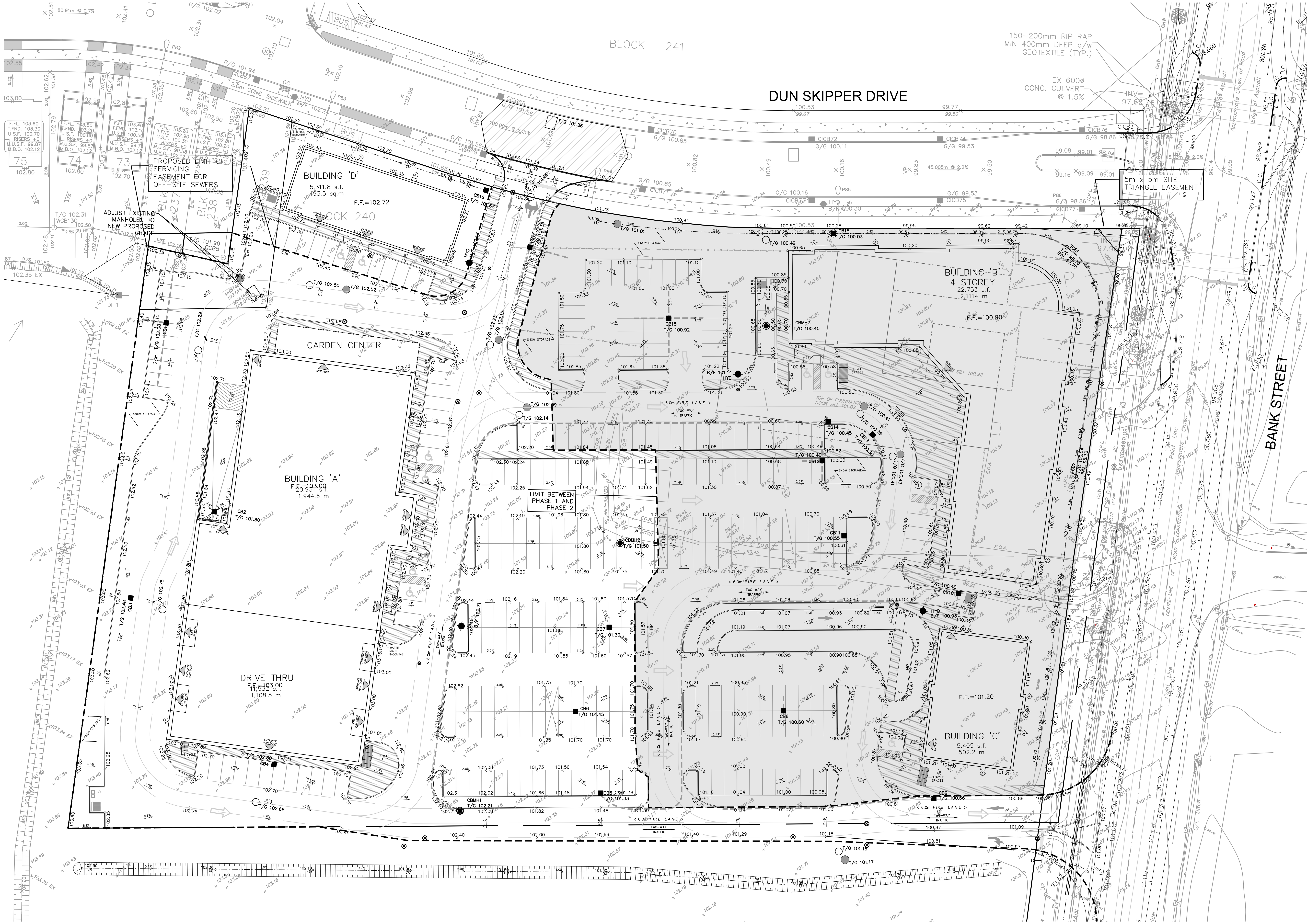
SHEET TITLE
SEDIMENT AND EROSION CONTROL PLAN

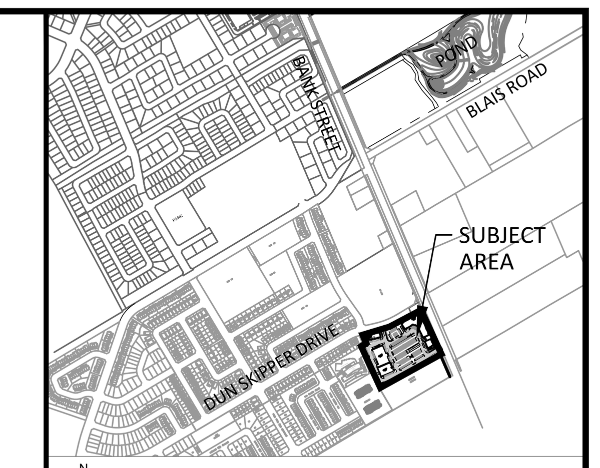
SHEET NUMBER
C-900

ISSUE
1

D07-12-24-0169

19213





KEY PLAN
(NTS)

NOTES:

1. SEE DRAWING C-010 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK TO BE OBTAINED FROM LEGAL SURVEYOR H.A. KEN SHIPMAN SURVEYING LTD.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10	REVISED GRADING AT GARDEN CENTER	JIM	2020:12:09
9	ADD PHASING	JIM	2020:06:22
8	REVISED AS PER CITY COMMENTS	JIM	2020:04:20
7	REVISED AS PER CITY COMMENTS	JIM	2020:04:02
6	ISSUED FOR TENDER	JIM	2020:03:13
5	REVISED AS PER CITY COMMENTS	JIM	2020:03:13
4	REVISED AS PER CITY COMMENTS	JIM	2019:12:09
3	ADD EXISTING AND PROPOSED DITCHES ON WEST AND SOUTH SIDE OF PROPERTY	JIM	2019:11:26
2	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	JIM	2019:10:11
1	ISSUED FOR SPA	JIM	2019:04:15

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Project Title

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4836 BANK STREET

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2020/12/09
PROVINCE OF ONTARIO

Drawing Title

SITE GRADING PLAN

Scale
1 : 400

Design	Date
SEL	FEB. 2019
Drawn	Checked
DPS	JIM
Project No.	Drawing No.
119351	200

D07-12-19-0092

#17977

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Canada
Phone: 613 241 3300
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