Barrhaven Conservancy East Water Distribution System Analysis

Final Report

March 11, 2025

Prepared for:
Barrhaven Conservancy Development Corporation

Prepared by:
Stantec Consulting Ltd.

Project/File:
163401964

Revision	Description	Author		Quality Check		Independent Review	
1	Final	HM	20250310	AMG	20250310	AP	20250311
0	Draft	HM	20250116	AMG	20250116	AP	20250121

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Prepared by: 

Signature

Hamidreza Mohabbat, MASC.

Reviewed by: 

Signature

Alexandre Mineault-Guitard M.Sc., ing. P.Eng.

Approved by: 

Signature

Ana Paerez P.Eng.

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1 Introduction

To support David Schaeffer Engineering Ltd (DSEL) with their detailed design submission of the Barrhaven Conservancy East Development Lands (encompassing Phases 2, 3.1, 3.2, 4 and Jock River), Stantec Consulting Ltd (Stantec) was retained to perform a water distribution system analysis for the development lands within the City of Ottawa's (City) boundaries. **Figure 1-1** shows the proposed phasing plan for the Barrhaven Conservancy East Development Lands.

The purpose of this hydraulic analysis is to assess the system performance based on the proposed watermain sizing and redundancy needs throughout the proposed development while meeting the demands of the projected serviceable population. This study focuses on Phases 3.1, 3.2, and 4 of the development.

For this assignment, Stantec's scope of work includes the following tasks:

1) Reviewing background information and establishing updated water demands for the Conservancy East development area based on the latest draft plan;

2) Preparing and submitting a boundary condition request to the City of Ottawa;

3) Updating the previously developed stand-alone hydraulic model of the distribution system within the Conservancy East development lands using boundary conditions provided by the City;

4) Assessing fire flow requirements for the proposed phases, based on the latest City's Water Distribution Guidelines;

5) Setting up and running model simulations for average day (AVDY), peak hour (PKHR), and maximum day (MXDY) plus fire flow demands to assess the performance of the water system within the development lands to meet design criteria;

6) Analyzing the implications of watermain breaks along the connections to the development lands under average day and fire flow demands (AVDY+FF); and

7) Documenting the approach used, findings and recommendations from the analysis.

1.1 Study Area

The study area, referred to as the Conservancy East development lands, is located in the City's southwestern suburban neighbourhood of Barrhaven. The lands are situated between Strandherd Dr to the north, the Jock River to the south, Fraser-Clark Drain to the east, and Borrisokane Rd to the west. The Barrhaven Conservancy West development lands project, located west of Borrisokane Rd, is expected to proceed once all phases within the East development lands have been built out.

Based on a series of previously completed serviceability studies for these lands (Stantec, 2021, Stantec, 2022, Stantec, 2023, and Stantec, 2024), these development lands are currently situated in Pressure Zone

3SW (previously known as Zone BARR). In 2015, the City embarked on a large initiative to reconfigure the pressure zones servicing Barrhaven and the southern reaches of Ottawa (i.e., 3SW). The 3SW pressure zone is ultimately planned to be serviced by the future Zone South Urban Community (SUC). Based on the projected timeline, the City expressed that the reconfiguration efforts are expected to start as early as 2026.

The distribution network within the Conservancy East development lands is to be serviced, ultimately, by three (3) connections to the City's existing distribution network. Two (2) of these connections, as described below, are currently in service (Stantec Consulting Ltd., 2023). The connections include the following locations as shown in **Figure 1-1**:

1) The existing 305 mm stub extending from Chapman Mills Dr (east of Kennedy-Burnett Pond);
2) The T-junction on the existing 203 mm watermain at Danson Gardens Grv and Darjeeling Ave; and,
3) Ultimately, a future 305 mm stub at the intersection of Flagstaff Drive and Borrisokane Rd, which requires crossing the Jock River.

Given the anticipated timeline for the ultimate build-out of the Conservancy East development lands (expected to be completed in late 2025), it is assumed that full build-out will occur prior to the construction of the watermain along Borrisokane Rd, crossing the Jock River. As a result, this study assesses scenarios where only two (2) connections are operational, under existing servicing conditions (Pressure Zone 3SW).

1.2 Phasing of Conservancy East Development Lands

The most current phasing plan for the Conservancy East development lands includes a total of seven (7) phases. The design and construction status for each phase is summarized in **Table 1-1.** The unit configuration has been continuously updated through stages of design submissions, with a focus of the current report on Phases 3.1, 3.2, and 4. **Figure 1-1** depicts the most current phasing plan, **Figure 1-2** illustrates the most current site plans provided by the DSEL as of December 2024.

Table 1-1. Phasing Summary for Conservancy East Development Lands

Phasing (December 2024)	Design/Construction Status
Conservancy East Phase 2 (PH 2)	Under Construction
Conservancy East Phase 3.1 (PH 3-1)	Undergoing Detailed Design
Conservancy East Phase 3.2 (PH 3-2)	Undergoing Detailed Design
Conservancy East Phase 4 (PH 4 / Site Plan)	Undergoing Detailed Design
Jock River Phase 1 (JR 1)	Under Construction
Jock River Phase 2 (JR 2)	Designed and Approved
Jock River Phase 3 (JR 3)	Designed and Approved

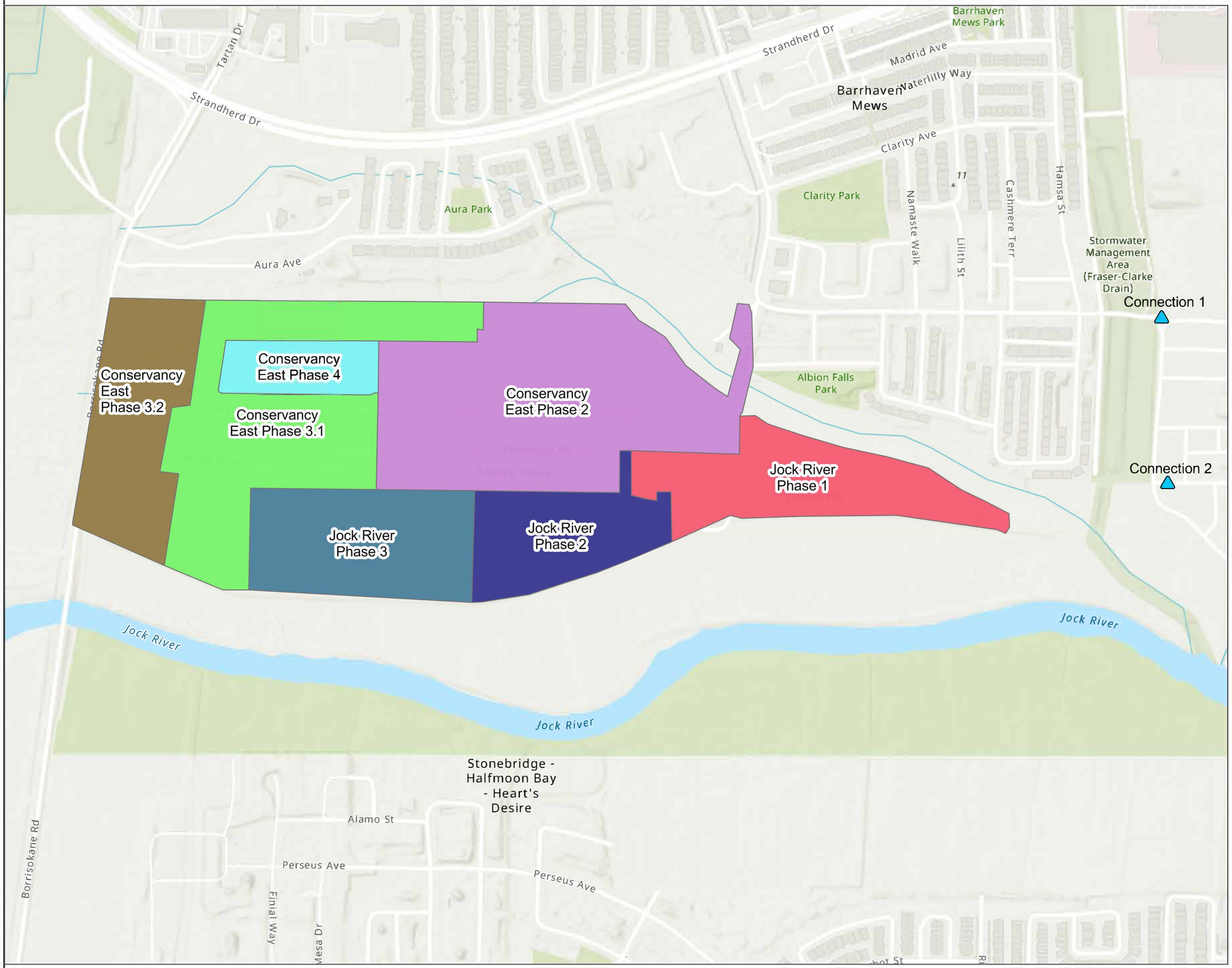


Figure No.
1-1

Title
Phasing Setup for Barrhaven Conservancy East Lands Development Project

Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

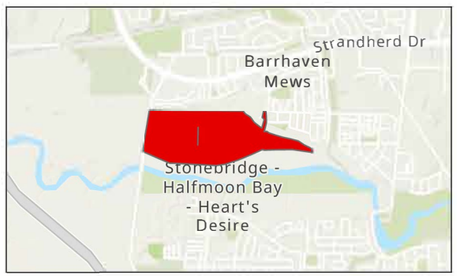
Project Location
Barrhaven, ON, CA

N

0 50 100
Meters
(At original document size of 11x17)
1:6,000

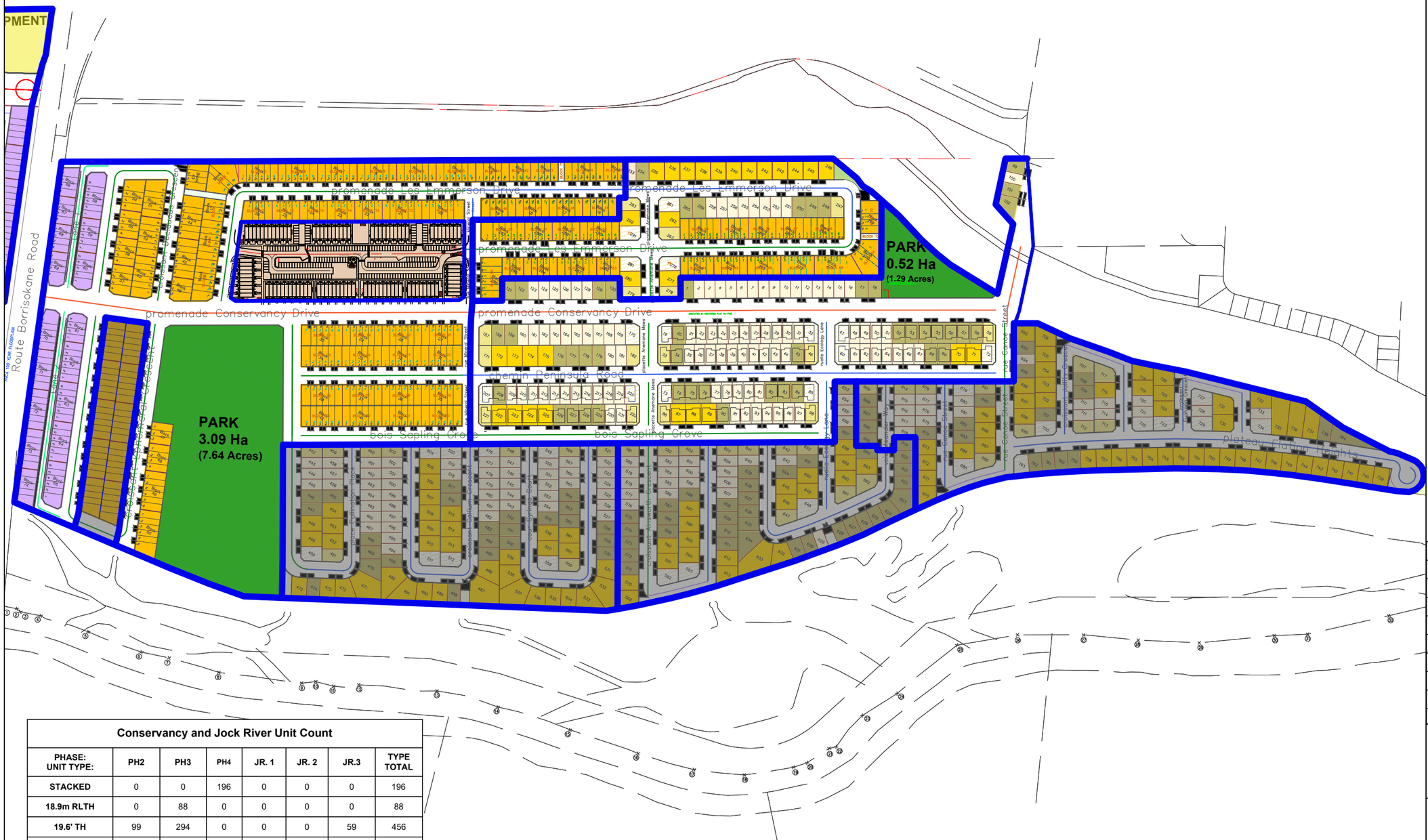
Legend
- Connection Location

Barrhaven Conservancy East Lands
- Conservancy East Phase 2
- Conservancy East Phase 3.1
- Conservancy East Phase 3.2
- Conservancy East Phase 4
- Jock River Phase 1
- Jock River Phase 2
- Jock River Phase 3



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

Stantec



CAIVAN

LEGEND:

- RLTH (18.9m DEPTH)
- 19.6' STANDARD TOWNHOUSE
- 35' DETACHED HOME
- 41' DETACHED HOME (REGULAR)
- 41' DETACHED HOME (OVERSIZED)
- 42' DETACHED HOME
- 50' DETACHED HOME
- STACKED CONDO BLOCK
- PARKS
- WALKWAY/SERVICING BLOCK
- PHASE BOUNDARY

Conservancy and Jock River Unit Count

PHASE: UNIT TYPE:	PH2	PH3	PH4	JR. 1	JR. 2	JR.3	TYPE TOTAL
STACKED	0	0	196	0	0	0	196
18.9m RLTH	0	88	0	0	0	0	88
19.6' TH	99	294	0	0	0	59	456
35' SINGLE	100	0	0	18	22	49	189
41' REGULAR	15	0	0	10	11	9	45
41' OVERSIZED	14	0	0	9	3	8	34
42' SINGLE	46	0	0	19	35	24	124
50' SINGLE	29	0	0	49	20	37	135
Sub-Total	**303**	**382**	**196**	**105**	**91**	**186**	**1263**
Phase Total	685		196	382			
Total	**1263**						

REV#	DESCRIPTION	DATE
23	Lot optimization	241127
22	Numbered lots	241009
21	Optimized lots for updated driveways	241004
20	New draft plan area (24/10/02), shift to window streets ph.3	241003
19	unit count updated per new phase lines	240918
18	Updated phase lines	240822
17	Added stacked condo block SP-1_0816	240816
16	Updated to reflect changes in mplan.	24-05-06

DATE: 2024-09-18

DRAWN BY: LV

PROJECT NO.: OTL400.2_OTL402_OTL400.4

PROJECT NAME: BCDC EAST

DRAWING #: SK-9.0

2 Hydraulic Assessment

The City of Ottawa Water Design Guidelines (City of Ottawa, 2010) and criteria outlined in the 2013 Water Master Plan (WMP) were used to establish water demands, level of service and pressure objectives during normal and emergency conditions. As per the City's design guidelines and recently issued Technical Bulletin IWSTB-2024-05, since this is a new development involving the design of new watermains, the design shall consider a required fire flow established using the calculation method published by the Fire Underwriters Survey (FUS). However, the proposed Phase 4 encompasses a private block, and as such fire flow requirements for this block will be established based on Section A-3.2.5.7 of the Ontario Building Code (OBC) as per the latest City of Ottawa Technical Bulletin (IWSTB-2024-05, Appendix J) .

2.1 Serviceability

As per the City's Water Design Guidelines, the desired range of pressure under average day (AVDY), maximum day (MXDY) and peak hour (PKHR) demands is 345 to 552 kPa (50 to 80 psi) and no less than 276 kPa (40 psi) at ground elevation (i.e., at street level). The maximum pressure at any point in the water distribution system should not exceed 552 kPa (80 psi); pressure reducing measures are required to service areas where pressures greater than 552 kPa (80 psi) are anticipated. Under emergency fire conditions, the system must be able to supply appropriate fire flow while maintaining a residual pressure of 138 kPa (20 psi).

2.1.1 System Pressures

As per the City's Water Design Guidelines, the desired range of pressure under average day (AVDY), maximum day (MXDY) and peak hour (PKHR) demands is 345 to 552 kPa (50 to 80 psi) and no less than 276 kPa (40 psi) at ground elevation (i.e., at street level). The maximum pressure at any point in the water distribution system should not exceed 552 kPa (80 psi). Pressure reducing measures are required to service areas where pressures greater than 552 kPa (80 psi) are anticipated. Under emergency fire conditions, the system must be able to supply appropriate fire flow while maintaining a residual pressure of 138 kPa (20 psi).

Figure 2-1 shows the ground elevation at each model junction within the Conservancy East lands. Proposed grades range from 92.4 m to 93.5 m, based on the grading plan provided by DSEL.

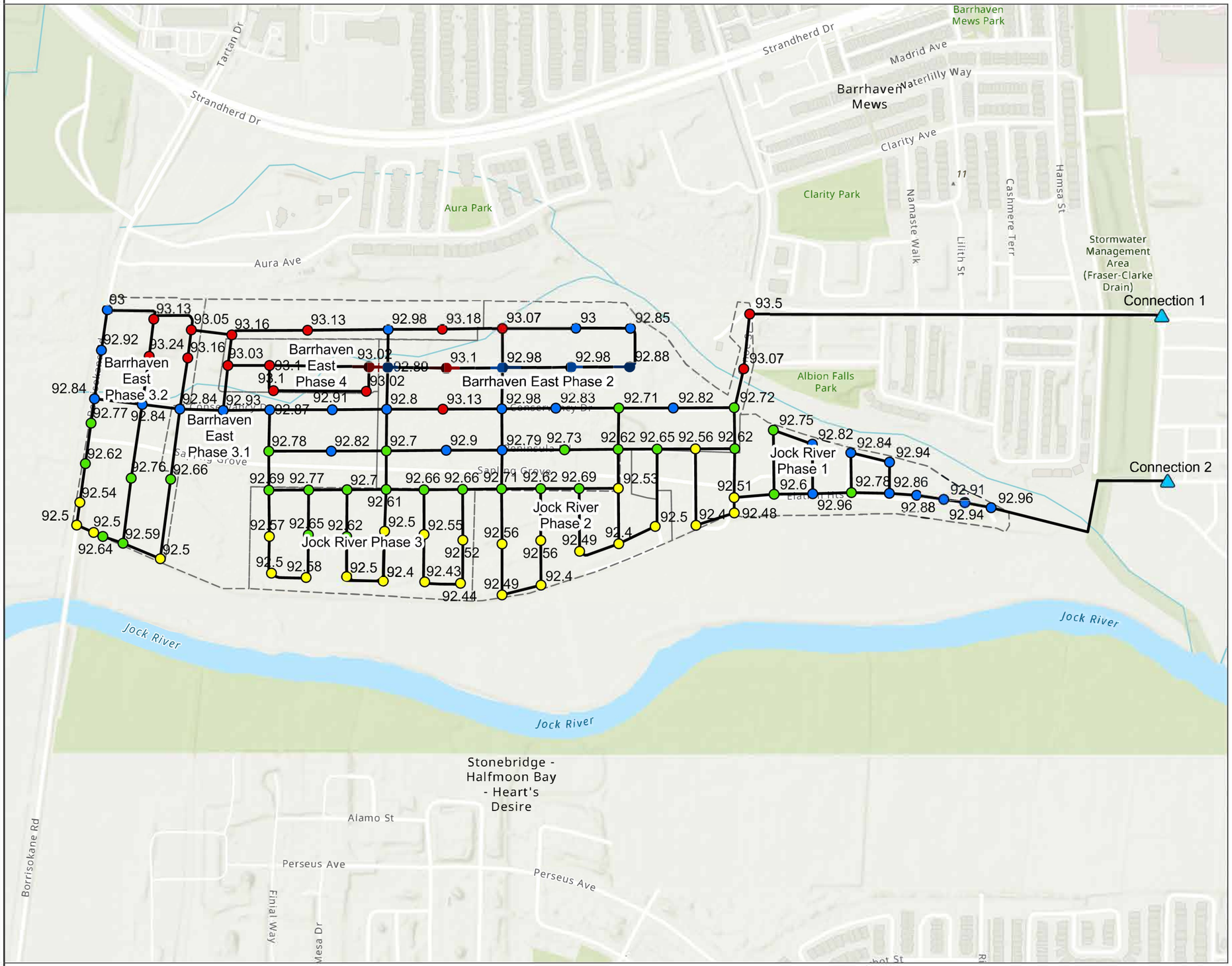


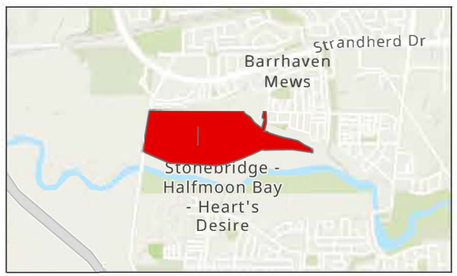
Figure No.
2-1

Title

Ground Elevations of the Barrhaven Conservancy East Lands Development Project

Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

Project Location
Barrhaven, ON, CA



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

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2.1.2 Fire Flows

It is important to note that the overall watermain network recommendations are governed by fire flow requirements. As part of the 2022 Study (Stantec), a maximum required fire flow (RFF) of 216.67 L/s (13,000 L/min) was identified. This RFF was linked to the governing unit design at the time, which consisted of rear-lane townhome blocks. Given the change in proposed unit configurations throughout the proposed phases of the Conservancy East Lands, updated fire flow calculations are required for the development area. Note that this study only focuses on Phases 3.1, 3.2 and 4, as other phases were assessed under separate covers.

Additionally, from the provisions listed in the City of Ottawa's Technical Bulletin ISDTB-2014-02, if specific conditions listed below are met, the RFF can be capped at 10,000 L/min.

1) The building footprint is less than 600 m2.
2) The rear unit exposure is at least 10 m.
3) The total number of residential units in a block is less than or equal to 6.

Some residential blocks in Phases 3.1 and 3.2 will meet the conditions outlined above, and as such, the RFF may be capped at 10,000 L/min for such blocks. However, the rear exposure distance is less than 10 m in some instances, and as such, detailed FUS calculations are required to identify the governing fire flow for these phases.

Based on the information provided to Stantec, Phase 4 of the development would be serviced by two watermains equipped with check valves. Based on this assumption, the proposed Phase 4 units are considered to be on private property. Accordingly, the fire flow requirement for Phase 4 is governed by the OBC.

It is important to note that to calculate the fire flow requirements for all phases, the units are assumed to be built using "Wood Frame" construction and their occupancy content will classify as "Limited Combustible". Additionally, it is assumed that neither the subject building nor the neighbouring buildings are equipped with a sprinkler system. **Table 2-1** summarizes the worst-case scenarios for fire flow calculations based on the most current information. Detailed calculations are provided in **Appendix A**.

Table 2-1. Fire Flow Requirements

Phase		Fire Flow (L/min)
PH2		13,000 (1)
PH 3	**PH 3-1**	15,000
	PH 3-2	14,000
PH 4		6,300
JR 1		13,000 (1)
JR 2		13,000 (1)
JR3		13,000 (1)
Notes: 1- Identified and carried over from previous studies.		

2.1.3 Water Age

As per the City of Ottawa Design Guidelines, watermains should not be oversized as this may pose water quality degradation, assessed in terms of water age. The Design Guidelines recommend the following:

- A total travel time of 5 days or less during average day demand would be ideal; and
- A maximum residence time of 8 days.

2.2 Growth Projections

The residential population was estimated based on household sizes as per population densities (or persons per unit, PPU) specified in the City's Water Design Guidelines, namely 3.4 and 2.7 PPU for Single Family Homes (SFMH) and Townhomes (TH), respectively. Based on the latest plans, the Conservancy East lands comprises 1,263 total units (527 SFH and 736 TH), with a total residential population of 3,779. **Table 2-2** summarizes the unit counts and estimated population throughout different phases of the development project based on the unit type.

Table 2-2. Estimated Unit Counts and Populations Based on Updated Concept Plan

Phase	Sub-phase	Unit Type	Units	PPU	Population
Phase 2 (PH 2)		Singles	204	3.4	694
		Towns	99	2.7	267
		Phase 2 Sub-total	***303***	***-***	***961***
Phase 3 (PH 3)	PH 3.1	Singles	0	3.4	0
		Towns	182	2.7	491
		Phase 3.1 Sub-total	***182***	***-***	***491***
	PH 3.2	Singles	0	3.4	0
		Towns	200	2.7	551
		Phase 3.2 Sub-total	***200***	***-***	***540***
		Phase 3 Sub-total	***382***	***-***	***1,031***
Phase 4 (PH 4)		Singles	0	3.4	0
		Towns	196	2.7	529
		Phase 4 Sub-total	***196***	***-***	***529***
Jock River (JR)	JR1	Singles	105	3.4	357
		Towns	0	2.7	0
		Jock River 1 Sub-total	***105***	***-***	***357***
	JR2	Singles	91	3.4	309
		Towns	0	2.7	0
		Jock River 2 Sub-total	***91***	***-***	***309***
	JR3	Singles	127	3.4	432
		Towns	59	2.7	159
		Jock River 3 Sub-total	***186***	***-***	***591***
		Jock River Phases Sub-total	***382***	***-***	***1,258***
East Development Grand Total			***1,263***	***-***	***3,779***

2.3 Demand Projections

As part of the 2022 Study (Stantec) that analyzed the serviceability of the Conservancy East development lands, the City requested that the criteria outlined in the City's Water Design Guidelines and Technical Bulletin ISTB-2021-03 were followed to establish water demands. This was considered a conservative approach, as the criteria in the City's Water Design Guidelines are more restrictive in comparison to the ones outlined in the 2013 City's Water Master Plan (WMP).

As such, the demand rates and peaking factors from the Water Design Guidelines and Technical Bulletin ISTB-2021-03 were applied to the population projections presented in **Table 2-2** based on unit type. For residential land-use, SFH and TH units were assigned an average day (AVDY) consumption rate of 280 L/cap/d. To determine maximum day (MXDY) demands, the AVDY demands were multiplied by a residential

peaking factor of 2.5. Peak hour (PKHR) demands were established by multiplying MXDY demands by a residential peaking factor of 2.2. Estimated AVDY, MXDY and PKHR demand projections are summarized in **Table 2-3.**

Table 2-3: Estimated Demand Projects Based on the Most Current Concept Plans

Phase	Sub-phase	Unit Types	Units	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Phase 2 (PH 2)		Singles	204	694	2.25	5.62	12.36
		Towns	99	267	0.87	2.17	4.76
		Phase 2 Sub-total	***303***	***961***	***3.11***	***7.79***	***17.13***
Phase 3 (PH 3)	PH 3.1	Singles	0	0	0.00	0.00	0.00
		Towns	182	491	1.59	3.98	8.76
		Phase 3 .1 Sub-total	***182***	***491***	***1.59***	***3.98***	***8.76***
	PH 3.2	Singles	0	0	0.00	0.00	0.00
		Towns	200	551	1.75	4.38	9.63
		Phase 3.2 Sub-total	***200***	***540***	***1.75***	***4.38***	***9.63***
		Phase 3 Sub-total	***382***	***1,031***	***3.34***	***8.36***	***18.38***
Phase 4 (PH 4)		Singles	0	0	0.00	0.00	0.00
		Towns	196	529	1.72	4.29	9.43
		Phase 4 Sub-total	***196***	***529***	***1.72***	***4.29***	***9.43***
Jock River (JR)	JR1	Singles	105	357	1.16	2.89	6.36
		Towns	0	0	0.00	0.00	0.00
		Jock River 1 Sub-total	***105***	***357***	***1.16***	***2.89***	***6.36***
	JR2	Singles	91	309	1.00	2.51	5.51
		Towns	0	0	0.00	0.00	0.00
		Jock River 2 Sub-total	***91***	***309***	***1.00***	***2.51***	***5.51***
	JR3	Singles	127	432	1.40	3.50	7.70
		Towns	59	159	0.52	1.29	2.84
		Jock River 3 Sub-total	***186***	***591***	***1.92***	***4.79***	***10.54***
		Jock River Phase Sub-total	***382***	***1,258***	***4.08***	***10.19***	***22.41***
East Development Total			***1,263***	***3,779***	***12.25***	***30.62***	***67.36***

2.4 Model Development

Innovyze's InfoWater Pro (v. 2024) was used to update the stand-alone hydraulic model of the water distribution system within the proposed development area for this analysis. The model was updated to reflect the most current site plan, including proposed watermain layout (based on proposed road alignment) and water demands for East Lands developments. Watermains included in the model were assigned Hazen-Williams coefficients ("C-Factors") in accordance with the City's Water Design Guidelines, based on diameter.

2.4.1 Boundary Conditions

As introduced in **Section 1**, the proposed subdivision has two (2) connections to the City's existing water distribution system. The boundary conditions provided by the City include hydraulic gradeline (HGL) values under existing and post-reconfiguration (SUC) conditions. Boundary conditions are provided in **Appendix B** and summarized in **Table 2-4**, and have been simulated in the hydraulic model using fixed head reservoirs to which HGLs have been applied for the respective demand scenarios.

Differences in HGL between connections 1 and 2 under existing conditions are observed under higher demand scenarios. While under AVDY and PKHR conditions these differences are minimal, under MXDY+FF and AVDY+FF conditions, these differences increase to approximately 4 m. This is likely due to the fact that the Connection 1 is connected to a 305 mm diameter along Chapman Mills Dr, whereas Connection 2 is connected to a 203 mm diameter along Darjeeling Ave.

As shown in **Table 2-4**, the available HGLs at the at the connection locations under existing conditions (i.e., 3SW) are greater than under post-reconfiguration (SUC) conditions. For instance, under AVDY conditions, the HGL at the connections under existing conditions is approximately 10 m (14 psi) greater than under post-reconfiguration (SUC) conditions.

As introduced in **Section 1.1**, this study assumes two (2) connections to the City's distribution network are operational under existing servicing conditions (Pressure Zone 3SW). These conditions were evaluated at DSEL's request, considering the anticipated timeline for the ultimate build-out of the Conservancy East development lands (expected to be completed in late 2025), and that the construction of the third connection (Jock River crossing) will occur before the SUC pressure zone reconfiguration.

Table 2-4. HGL Boundary Conditions

Demand Scenario	Fire Flow (L/min)	Existing Conditions (Zone 3SW)	
		Connection 1 (1)	Connection 2 (2)
AVDY	N/A	156.4	156.4
PKHR		141.0	141.0
AVDY+FF (3)	13,000	-	137.9
	15,000	-	133.5
MXDY+FF	13,000	141.2	139.3
	15,000	138.1	135.5
Demand Scenario	**Fire Flow (L/min)**	**Zone SUC Conditions**	
		Connection 1 (1)	**Connection 2 (2)**
AVDY	N/A	146.8	146.8
PKHR		142.7	142.7
AVDY+FF (3)	13,000	-	132.4
	15,000	-	128.7
MXDY+FF	13,000	136.3	134.3
	15,000	133.9	131.3

Notes:

1- Ground Elevation @ Connection 1 (Chapman Mills Dr) = 93.1 m.
2- Ground Elevation @ Connection 2 (Danson Gardens Grv / Darjeeling Ave) = 91.8 m.
3- For the reliability analysis, it is assumed that the connection 1 would be offline and connection 2 would service the AVDY+FF demand scenario.

2.4.2 Proposed Watermain Sizing & Layout

The network is proposed to consist of 152 mm, 203 mm, and 305 mm diameter watermains, with the 305 mm watermains functioning as the hydraulic backbone throughout the development lands. The 305 mm diameter watermains run west from connections 1 and 2, and continue westward to Borrisokane Rd. **Figure 2-2** captures the proposed watermain sizing throughout the Conservancy East lands.

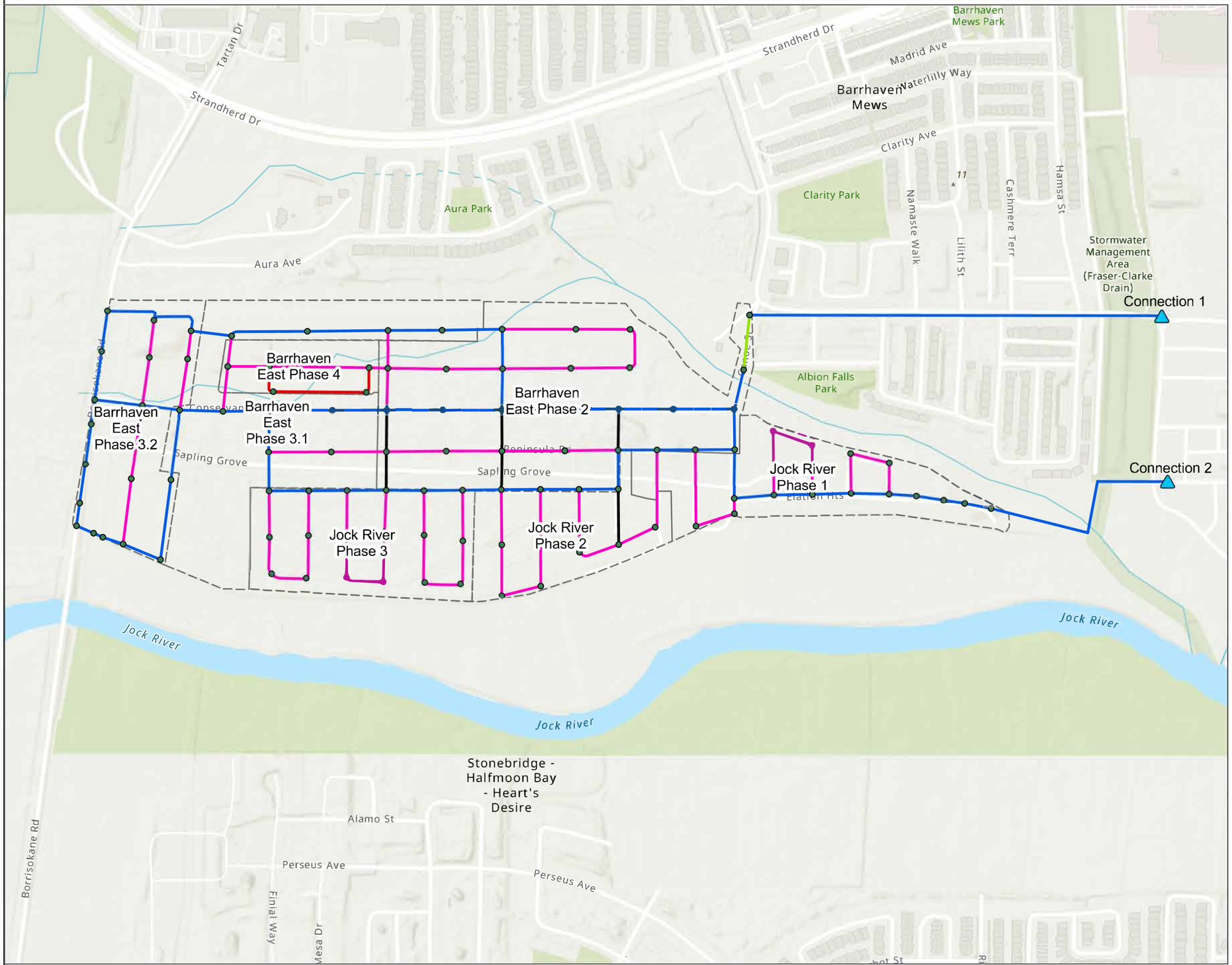


Figure No.
2-2

Title
Watermain Sizing and Layouts

Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

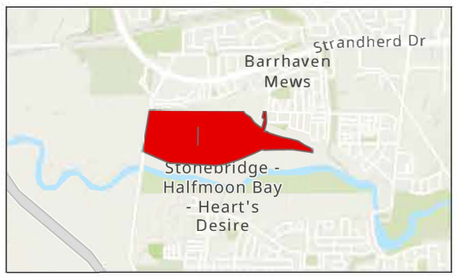
Project Location
Barrhaven, ON, CA

N

0 50 100 Meters
(At original document size of 11x17)
1:6,000

Legend
- Connection Location
- Barrhaven Conservancy East Lands
- Junctions

DIAMETER
- 100
- 152
- 203
- 274
- 305



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

Stantec

3 Hydraulic Modelling Results

Hydraulic modelling was completed for buildout conditions of the Conservancy East Development lands, under the existing servicing conditions (Zone 3SW) to assess how the network would respond. The following sub-sections present the modelling results under AVDY, PKHR, and MXDY+FF demands, as well as under emergency conditions in the event of a watermain break at a key point (feedermain along the Chapman Mills Dr or Connection 1) within the proposed network. Detailed modelling results for all scenarios are also provided in **Appendix D**.

3.1 Average Day and Peak Hour Demands

Under AVDY demands with two connections to the water distribution system, the maximum modelled head for buildout conditions is equal to 156.4 m. Given the difference in ground elevation across the site, the available maximum pressures range from 89.4 psi and 90.9 psi. These maximum pressures exceed the City's maximum pressure objective of 80 psi. As per the OBC, in areas that may be occupied, the static pressure at any fixture shall not exceed 80 psi. Where pressures do exceed 80 psi, pressure control measures such as pressure reducing valves (PRVs) shall be considered. However, given that the development area will ultimately be serviced under SUC conditions, which will be operate at lower HGL of approximately 10 m (14 psi), such maximum pressures are considered acceptable under ultimate (SUC) servicing conditions.

Table 3-1. System Pressure under AVDY for Existing Conditions

Parameter	Existing Condition / Zone 3SW (psi)
Maximum Pressure (under AVDY)	90.9
Minimum Pressure (under PKHR)	66.3

Under PKHR demands with two connections to the water distribution system, minimum modelled pressures for buildout conditions range between 66.3 psi and 67.9 psi under existing conditions. These minimum pressures fall within the desired pressure range of 50 to 80 psi outlined by the City's Guidelines.

Following the SUC pressure zone reconfiguration, the maximum pressure under AVDY is expected to be approximately 77.3 psi, while the minimum pressure under PKHR demands is expected to be approximately 68.9 psi. Thus, both pressures are expected to fall within the desired range of pressures recommended by the City's Guidelines.

3.2 Maximum Day Plus Fire Flow

With two connections to the water distribution system, available fire flows throughout each phase were assessed based on the fire flow requirements outlined under **Section 2.1.2** (refer to **Table 2-1**). The results under MXDY+FF showed that the system would be able to provide the required fire flows (calculated based

on FUS, and OBC guidelines) throughout the Conservancy East Development lands. To conclude, these results show that the proposed watermain sizing and layout meet serviceability requirements with two connections under existing conditions.

3.3 Reliability

As per the City of Ottawa Design Guidelines, the system must be able to provide average day demand plus fire flow (AVDY+FF) while meeting serviceability requirements during a major failure (i.e., watermain break). To assess reliability and resiliency against major failures, a reliability scenario was developed to confirm sufficient pressure and flow can be achieved during a major failure. The break was considered to happen along the feedermain along Chapman Mills Dr (Connection 1).

The boundary conditions corresponding to the AVDY+FF scenario were provided by the City and are presented in **Table 2-4**. The results of the reliability analysis, included in **Appendix D**, showed that the distribution system would face difficulties in providing the required fire flow requirements (refer to **Appendix D2**) under a scenario where only one connection is operational. It should be noted that the third connection to the City's network (305 mm diameter across Jock River) will be implemented in the near future to accommodate future development west of Borrisokane Rd (i.e., Conservancy West lands). Results from Stantec's 2023 hydraulic analysis for the Barrhaven Conservancy Lands (East and West) demonstrate that appropriate fire flow conditions would be achieved within the Conservancy East development lands under a reliability scenario with the Jock River crossing in operation (i.e., two of the three connections to the City's network in operation).

The reliability analysis represents a conservative condition in which a fire would occur simultaneously to a watermain break during the interim conditions, where the East Conservancy lands are serviced from only two (2) connections to the existing distribution network. The construction of the future Jock River crossing will add a third connection to the City's network, providing the required resiliency to meet the City's Design Guidelines. Nonetheless, the performance of the distribution network will need to be revisited following the construction of third connection, or under following the SUC pressure zone reconfiguration, whichever comes first.

3.4 Water Age

Water age trends were assessed using the hydraulic model under AVDY conditions. The water age was determined by allowing the model to run for a long period of time (10 days), until convergence of water age across the network. The water age amongst the system was estimated from 1.2 to 48 hours (2 days), with detailed results presented in **Appendix D**.

It should be noted that no water age boundary conditions at the connection points were available, therefore the total water age from the source or last point of rechlorination cannot be assessed. Nonetheless, this analysis shows that the residence time of water within the development lands does not exceed the limits per the City's Design Guidelines, and as such water age issues within the development are not anticipated.

4 Conclusion and Recommendations

A water distribution system hydraulic analysis was completed for the Barrhaven Conservancy East development lands. The purpose of this analysis was to confirm associated watermain sizing and redundancy needs. Based on the hydraulic analysis, the following conclusions and recommendations were made:

- Based on the most current draft plan layout, the estimated AVDY, MXDY and PKHR demand projections for the development lands are 12.25 L/s, 30.62 L/s, and 67.36 L/s, respectively.
- The required fire flow for the governing unit design was calculated to be 13,000 L/min (217 L/s) for Phase 2, and Jock River 1 to 3, 15,000 L/min (250 L/s) for Phases 3.1 and 3.2, and 6,300 L/min (105 L/s) for Phase 4.
- The serviceability of the Conservancy East development lands was analyzed, considering that the East Lands would be serviced by the existing pressure zone, with two (2) connections to the City's existing distribution network. With the future expansion of the development west of Borrisokane Rd (i.e., Conservancy West lands), a third connection across the Jock river will be implemented. The performance of the distribution network will need to be revisited following the construction of third connection, or under following the SUC pressure zone reconfiguration, whichever comes first.
- Under AVDY demand conditions, model results using boundary conditions provided by the City exceed the allowable maximum pressure of 80 psi in accordance with the City of Ottawa Design Guidelines. As per the OBC, the static pressure at any fixture shall not exceed 80 psi, in areas that may be occupied. Where pressures do exceed 80 psi, pressure control measures such as PRVs installed immediately downstream of the isolation valve to the home/building shall be considered. However, under ultimate (SUC servicing) conditions, the maximum pressure under AVDY is expected to be approximately 77.3 psi, meeting the City's requirements.
- Under PKHR demand conditions, the minimum pressures are in accordance with the City's system pressure requirements.
- Under MXDY+FF demand conditions, the target fire flows of 6,300 L/min (Phase 4), 13,000 L/min (Phases 2 and JR 1 to 3), 14,000 L/min (Phase 3.2) and 15,000 L/min (Phase 3.1) can be achieved through the proposed network for all phases.
- Under a reliability analysis, where Connection 1 (Chapman Mills Dr) to the existing water system would not be operational, results showed that the fire flow requirements (13,000 L/min and 15,000 L/min) would not be achievable throughout the network under AVDY+FF conditions. However, the future watermain connection along Borrisokane Rd, crossing the Jock River, would help providing appropriate fire flows under a watermain break scenario (two of the three connections to the City's network in operation). As such, adequate resiliency will be provided to the development lands upon construction of the Jock River crossing.

- A water age analysis shows that the residence time of water within the development lands does not exceed the limits per the City's Design Guidelines. No water age boundary conditions at the connection points were available, therefore the total water age from the source or last point of re-chlorination cannot be assessed. As such, water age issues within the development are not anticipated.

5 References

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Appendix

Appendix A Fire Flow Requirements

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 163401964
Project Name: Barrhaven Conservancy Development Project
Date: 1/20/2025
Fire Flow Calculation #: 18
Description: Phase 3.1; Block #12

Data inputted by: Alexandre Mineault-G, P.Eng.
Data reviewed by: Alexandre Mineault-G, P.Eng.

Notes: *Block #12 comprises a total of 6 townhouse units of 2 storeys units, with a basement (more than 50% below ground). It is also assumed that the average floor area is 775 sq. ft. Wood Frame Construction, no sprinklers.*

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										YES	-
		432	432									864	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	10,000
4	Determine Occupancy Charge	Limited Combustible										-15%	8,500
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
5A	Determine Bylaw Requirement	Community bylaw requiring all building that may be built within 30m of subject building to be fully sprinkler protected										NO	-
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		Front	20.1 to 30	72	2	> 100	Type V	NO				10%	6,120
		Right	0 to 3	14	2	21-41	Type V	NO				21%	
		Rear	3.1 to 10	38	3	> 100	Type V	NO				20%	
		Left	0 to 3	14	2	21-41	Type V	NO				21%	
7	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**											**15,000**
		Total Required Fire Flow in L/s											**250**
		Required Duration of Fire Flow (hrs)											**3.00**
		Required Volume of Fire Flow (m^3)											**2,700**

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 163401964
Project Name: Barrhaven Conservancy Development Project
Date: 1/20/2025
Fire Flow Calculation #: 4
Description: Phase 3-2; Block #57

Data inputted by: Hamidreza Mohabbat MASc.
Data reviewed by: Alexandre Mineault-G, P.Eng.

Notes: *Block #57 is assumed to comprise a total of 6 townhouse units. For FUS calculations, each unit was considered with a basement (more than 50% below ground) and an average floor area of 775 sq. ft. Wood Frame Construction, Limited Combustible Occupancy Content, and no sprinklers.*

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type V - Wood Frame / Type IV-D - Mass Timber Construction										1.5	-
2	Determine Effective Floor Area	Sum of All Floor Areas										YES	-
		453	411									863	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	10,000
4	Determine Occupancy Charge	Limited Combustible										-15%	8,500
5	Determine Sprinkler Reduction	None										0%	0
		Non-Standard Water Supply or N/A										0%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										0%	
5A	Determine Bylaw Requirement	Community bylaw requiring all building that may be built within 30m of subject building to be fully sprinkler protected										NO	-
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		Front	20.1 to 30	72	2	> 100	Type V	NO				10%	5,100
		Right	3.1 to 10	12	2	21-41	Type V	NO				16%	
		Rear	3.1 to 10	36	2	61-80	Type V	NO				18%	
		Left	3.1 to 10	12	2	21-41	Type V	NO				16%	
7	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**											**14,000**
		Total Required Fire Flow in L/s											**233**
		Required Duration of Fire Flow (hrs)											**3.00**
		Required Volume of Fire Flow (m^3)											**2,520**

Fire Flow Calculations as per the Ontario Building Code (OBC)

Stantec

OFM Fire Flow Calculation

Calculations based on *Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code* by the Office of the Fire Marshal (OFM 1999)

Stantec Projec: 163401964
Project Name: Barrhaven Conservancy Development Project
Date: 1/21/2025
Fire Flow Calc: 1
Description: Residential

Data inputted b: Hamidreza Mohabbat MASc.
Data reviewed b: Alexandre Mineault-G, P.Eng.

Notes: *Block #10 comprises a total of 24 stacked townhouse units. For FUS calculations, the block was considered as 12 - 3 storeys units, with a basement (more than 50% below ground). It is also assumed that the block consists of 10 inside units, 1 corner unit, and 1 end unit configuration with an average floor area of 509 sq. ft. Wood Frame Construction, no sprinklers.*

Office of the Fire Marshal Determination of Required Fire Protection Water Supply							
Step	**Task**	**Notes**		**Multiplier Associated with Option**		**Value Used**	
1	**General Building Details**						
1.1	**Enter Number of Storeys**	Number of Floors/Storeys in the Unit (incl. basement):			4	4	Storeys
1.2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	Type of Housing	Single Family	0	Townhouse - indicate # of units	12	Units
			Townhouse - indicate # of units	12			
			Other (Comm, Ind, Apt etc.)	0			
1.3	**Choose Presence of Sprinklers**	Sprinklers?			None	None	N/A
1.4	**Choose Presence of Firewalls**	Firewall separations?			None	None	N/A
1.5	**Choose Presence of Stand-Pipe System**	Stand-pipe system?			None	None	N/A
2	**Determining Water Supply Coefficient K**						
2.1	**Choose Type of Construction**	**Type of Construction**					
		Type of Construction	Non-combustible construction + fire separations + fire-resistance ratings in accordance with Section 3.2.2 of OBC	Type I	Type III	N/A	N/A
			Non-combustible construction + fire separations + no fire-resistance rating	Type II			
			Combustible construction + fire separations + fire-resistance ratings in accordance with Section 3.2.2 of OBC	Type III			
			Combustible construction + fire separations + no fire-resistance rating	Type IV			
2.2	**Choose Classification**	**Building Classification**					
		Occupancy Classification (OBC)	A-2, B-1, B-2, B-3, C, D	18	C	A-2, B-1, B-2, B-3, C, D	N/A
			A-4, F-3	22			
			A-1, A-3	25			
			E, F-2	31			
			F-1	41			
2.3	**Water Supply Coefficient (K)**	Water Supply Coefficient K				18	N/A
3	**Determining Building Volume V**						
3.1	**Enter Ground Floor Area of One Unit**	**Floor Space Area**					
		Average Floor Area (A) :			559 Square Metres (m2)	559	Area in Square Meters (m^2)
3.2	**Building Height (h)**	**Building Height**					
		Bottom Elevation :			0.0 Meters (m)	11.6	Height in Meters (m)
		Top Elevation :			11.6 Meters (m)		
3.3	**Building Volume (V)**	Building Volume V = A * h				6,470	Volume in Meters Cube (m^3)
4	**Determining Spatial Coefficient S**						
4.1	**Choose Exposure Distances from Building to Property Line**	Exposure Distance from Building to Property Line in Meters (m)	**North Side**	3.3	0.00	1.00	Distance in Meters (m)
			Property Line to Street Centreline (Street Facing)	10.0			
			Total Exposure Distance	**13.3**			
			East Side	2.5	0.50		
			Property Line to Street Centreline (Street Facing)	0			
			Total Exposure Distance	**2.5**			
			South Side	3.7	0.00		
			Property Line to Street Centreline (Street Facing)	12.0			
			Total Exposure Distance	**15.7**			
			West Side	1.7	0.50		
			Property Line to Street Centreline (Street Facing)	0			
			Total Exposure Distance	**1.7**			
4.2	**Total Spatial Coefficient (S_{tot})**	Total Spatial Coefficient $S_{tot} = 1 + \Sigma S_x$				2.00	N/A
5	**Determining Required Minimum Supply of Water Q and Fire Flow**						
5.1	**Obtain Required Fire Volume, Flow & Duration**	**Minimum Supply of Water, rounded to nearest 1,000 L; $Q = K*V*S_{tot}$**				**233,000 L**	
		Required Minimum Water Supply Flow Rate (L/min)				**6,300 L/min**	
		Required Minimum Water Supply Flow Rate (L/s)				**105 L/s**	
		Required Minimum Duration of Fire Flow (min)				**40 min**	

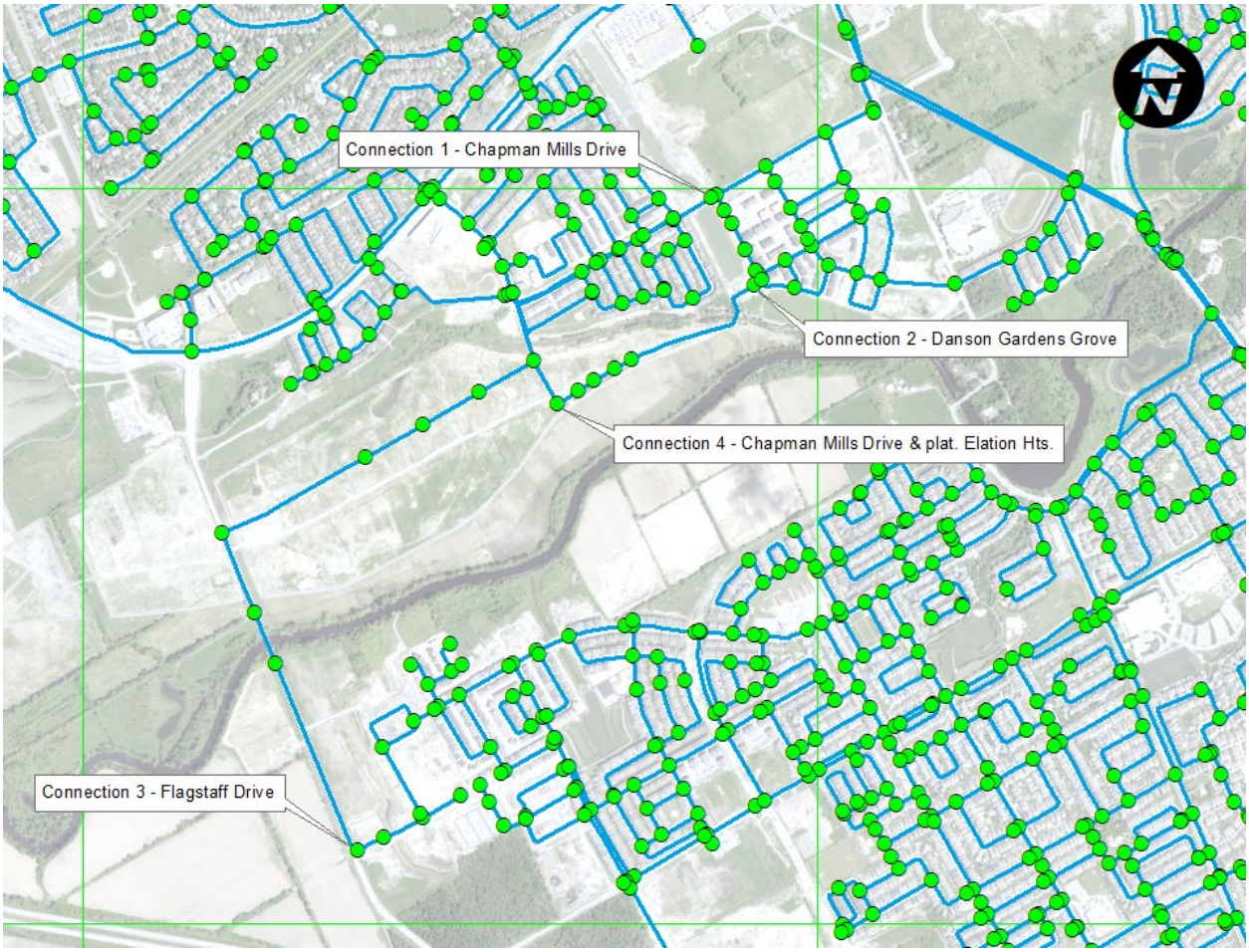
Appendix B Boundary Conditions

Boundary Conditions
Ultimate Scenario – Barrhaven Conservancy – East

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	737	12.28
Maximum Daily Demand	1,842	30.70
Peak Hour	4,053	67.55
Fire Flow Demand #1	13,000	216.67
Fire Flow Demand #2	15,000	250.00
Fire Flow Demand #3	16,000	266.67

Location



Results

Scenario 1 : Connection 1 & 2 at Chapman Mills Drive & Danson Gardens Grove

Existing Condition (Pre- SUC Pressure Zone Reconfiguration, 3SW)

Connection 1 - Chapman Mills Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	90.1
Peak Hour	141.0	68.2
Max Day plus Fire Flow #1	141.2	68.5
Max Day plus Fire Flow #2	138.1	64.1
Max Day plus Fire Flow #3	136.4	61.6
[1] Ground Elevation =	93.1	m

Connection 2 - Danson Gardens Grove & DarJeeling Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	91.9
Peak Hour	141.0	70.0
Basic Day Demands plus Fire Flow1*	137.9	65.5
Basic Day Demands plus Fire Flow2*	133.5	59.2
Basic Day Demands plus Fire Flow3*	131.1	55.8
Max Day plus Fire Flow #1	139.3	67.4
Max Day plus Fire Flow #2	135.5	62.2
Max Day plus Fire Flow #3	133.5	59.3
[1] Ground Elevation =	91.8	m

Future Condition (Post- SUC Pressure Zone Reconfiguration)

Connection 1 - Chapman Mills Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.8	76.4
Peak Hour	142.7	70.6
Max Day plus Fire Flow #1	136.3	61.5
Max Day plus Fire Flow #2	133.9	58.0
Max Day plus Fire Flow #3	132.6	56.1
[1] Ground Elevation =	93.1	m

Connection 2 - Danson Gardens Grove & DarJeeling Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.8	78.2
Peak Hour	142.7	72.3
Basic Day Demands plus Fire Flow1*	132.4	57.7
Basic Day Demands plus Fire Flow2*	128.7	52.5
Basic Day Demands plus Fire Flow3*	126.7	49.7
Max Day plus Fire Flow #1	134.3	60.4
Max Day plus Fire Flow #2	131.3	56.1
Max Day plus Fire Flow #3	129.7	53.8
[1] Ground Elevation =	91.8	m

Note:
* Basic day demands plus fire flow scenario shows boundary condition result with only one connection at #2 due to watermain break (failure scenario) at connection #1.

Scenario 2 : Connection 1 & 2 & 3 at Chapman Mills Drive, Danson Gardens Grove & Flagstaff Drive

Existing Condition (Pre- SUC Pressure Zone Reconfiguration, 3SW)

Connection 1 - Chapman Mills Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	90.1
Peak Hour	141.0	68.1
Max Day plus Fire Flow #1	141.2	68.4
Max Day plus Fire Flow #2	140.6	67.5
Max Day plus Fire Flow #3	139.2	65.5
[1] Ground Elevation =	93.1	m

Connection 2 - Danson Gardens Grove & DarJeeling Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.4	91.9
Peak Hour	141.0	69.9
Max Day plus Fire Flow #1	138.1	65.8
Max Day plus Fire Flow #2	133.9	59.9
Max Day plus Fire Flow #3	131.7	56.7
[1] Ground Elevation =	91.8	m

Connection 3 - Flagstaff Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.3	90.9
Peak Hour	140.6	68.7
Max Day plus Fire Flow #1	136.4	62.7
Max Day plus Fire Flow #2	132.0	56.4
Max Day plus Fire Flow #3	129.6	53.0
Basic Day Demands plus Fire Flow1*	136.9	63.3
Basic Day Demands plus Fire Flow2*	132.5	57.1
Basic Day Demands plus Fire Flow3*	130.1	53.7
[1] Ground Elevation =	92.3	m

Future Condition (Post- SUC Pressure Zone Reconfiguration)

Connection 1 - Chapman Mills Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.8	76.4
Peak Hour	142.8	70.7
Max Day plus Fire Flow #1	138.4	64.4
Max Day plus Fire Flow #2	136.5	61.8
Max Day plus Fire Flow #3	135.5	60.3
[1] Ground Elevation =	93.1	m

Connection 2 - Danson Gardens Grove & DarJeeling Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.8	78.2
Peak Hour	142.9	72.6
Max Day plus Fire Flow #1	133.2	58.9
Max Day plus Fire Flow #2	129.8	54.0
Max Day plus Fire Flow #3	128.0	51.4
[1] Ground Elevation =	91.8	m

Connection 3 - Flagstaff Drive

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.7	77.3
Peak Hour	142.1	70.8
Max Day plus Fire Flow #1	132.4	56.9
Max Day plus Fire Flow #2	128.8	51.8
Max Day plus Fire Flow #3	126.8	49.1
Basic Day Demands plus Fire Flow1*	132.3	56.9
Basic Day Demands plus Fire Flow2*	128.7	51.8
Basic Day Demands plus Fire Flow3*	126.8	49.0
[1] Ground Elevation =	92.3	m

Scenario 3 : Connection 4 at Chapman Mills Drive & plat. Elation Hts.

Existing Condition (Pre- SUC Pressure Zone Reconfiguration, 3SW)

Connection 4 - Chapman Mills Dr. & plat. Elation Hts.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.3	92.3
Peak Hour	138.1	66.5
Max Day plus Fire Flow #1	106.4	21.4
Max Day plus Fire Flow #2	93.9	3.6
Max Day plus Fire Flow #3	87.1	-6.0
Basic Day Demands plus Fire Flow1*	111.5	28.6
Basic Day Demands plus Fire Flow2*	99.5	11.6
Basic Day Demands plus Fire Flow3*	93.0	2.4
[1] Ground Elevation =	91.4	m

Future Condition (Post- SUC Pressure Zone Reconfiguration)

Connection 4 - Chapman Mills Dr. & plat. Elation Hts.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.7	78.7
Peak Hour	138.5	67.0
Max Day plus Fire Flow #1	101.5	14.4
Max Day plus Fire Flow #2	89.7	-2.4
Max Day plus Fire Flow #3	83.3	-11.5
Basic Day Demands plus Fire Flow1*	106.0	20.8
Basic Day Demands plus Fire Flow2*	94.8	4.8
Basic Day Demands plus Fire Flow3*	88.6	-3.9
[1] Ground Elevation =	91.4	m

Notes

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.
2. Per the OWDG Section 4.2.2:
    a. During periods of maximum day and fire flow demand, the residual pressure at any point in the distribution system shall not be less than 20 psi.

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.

Appendix C Junction IDs

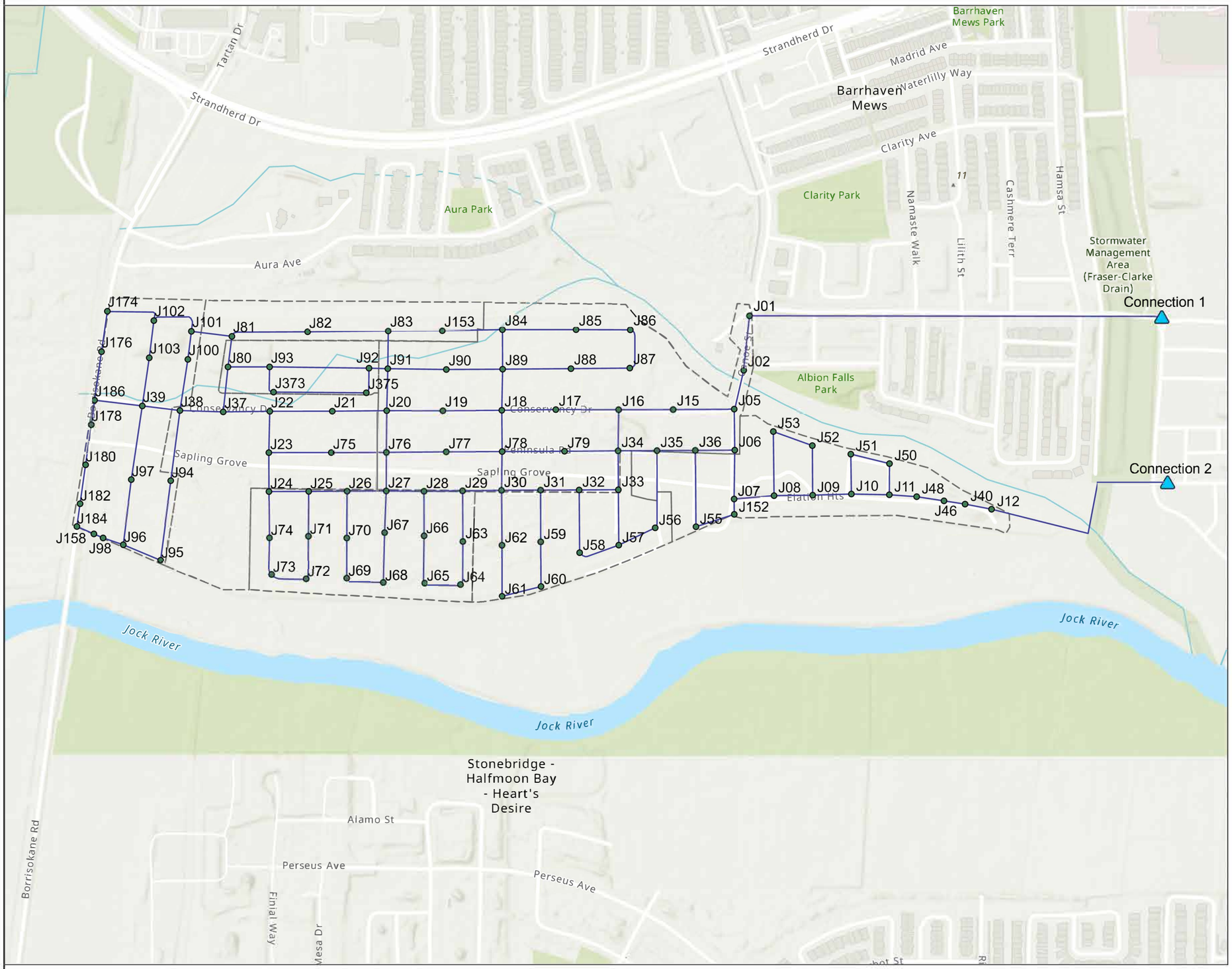


Figure No.
Appendix C

DRAFT

Title
Junction IDs

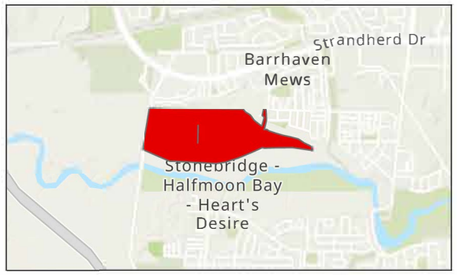
Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

Project Location
Barrhaven, ON, CA

N

0 50 100
Meters
(At original document size of 11x17)
1:6,000

Legend
- Connection Location
- Barrhaven Conservancy East Lands
- Junctions
- Watermain



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

Stantec

Appendix D Model Results

Stantec

163401964- Barrhaven Conservancy East Lands Development Project Water System Analysis
Modeling Results

Junction	Maximum Pressure under AVDY	Minimum Pressure under PKHR	Available Fire Flow under MXDY @ 20psi Residual Pressure		Water Age	Available Fire Flow under Reliability Scenario	
			13,000 L/min Boundary Condition	15,000 L/min Boundary Condition		13,000 Boundary Condition	15,000 Boundary Condition
ID	(psi)	(psi)	(L/min)	(L/min)	(hrs)	(L/min)	(L/min)
J01	89.4	66.7	30,500	28,500	2	12,500	11,500
J02	90	67.1	29,500	27,500	2.5	14,000	13,000
J05	90.5	67.5	29,500	27,500	2.5	14,500	13,500
J06	90.6	67.6	29,500	28,000	3.5	15,000	14,000
J07	90.8	67.8	30,000	28,000	3	15,500	14,500
J08	90.7	67.8	30,500	28,500	2.5	16,500	15,000
J09	90.1	67.3	30,500	28,500	2	17,000	15,500
J10	90.4	67.7	31,500	29,500	2	18,000	16,500
J11	90.3	67.6	32,000	30,000	1.5	19,000	17,500
J12	90.2	67.7	36,000	33,500	1	23,500	21,500
J15	90.3	67.2	27,000	25,000	3	14,500	13,000
J16	90.5	67.3	25,500	24,000	3.5	14,000	13,000
J17	90.3	67	24,500	23,000	4	14,000	13,000
J18	90.1	66.8	24,000	22,500	4.5	14,000	12,500
J19	89.9	66.5	23,000	21,500	5	13,500	12,500
J20	90.3	67	23,000	21,500	6.5	13,500	12,500
J21	90.2	66.8	22,500	21,500	7.5	13,500	12,500
J22	90.2	66.9	23,000	21,500	11	13,500	12,500
J23	90.4	67	23,000	21,500	13.5	13,500	12,500
J24	90.5	67.1	22,500	21,000	11.5	13,500	12,500
J25	90.4	67	22,500	21,000	10	13,500	12,500
J26	90.5	67.1	22,500	21,500	9.5	13,500	12,500
J27	90.6	67.3	23,000	21,500	9	13,500	12,500
J28	90.5	67.2	23,000	21,500	8.5	14,000	12,500
J29	90.5	67.2	23,500	22,000	7.5	14,000	12,500
J30	90.5	67.2	24,000	22,500	7	14,000	13,000
J31	90.6	67.3	24,000	22,500	6	14,000	13,000
J32	90.5	67.3	24,500	23,000	5.5	14,000	13,000
J33	90.7	67.5	25,000	23,500	5	14,500	13,000
J34	90.6	67.4	26,000	24,500	4.5	14,500	13,000
J35	90.6	67.4	26,500	25,000	4	14,500	13,500
J36	90.7	67.6	28,000	26,500	4	15,000	13,500
J37	90.2	66.8	22,000	20,500	11.5	13,500	12,500
J38	90.3	66.9	21,500	20,000	13.5	13,500	12,000
J50	90.2	67.5	23,500	22,000	2	16,500	15,000
J51	90.3	67.6	22,500	21,500	2.5	16,000	14,500
J52	90.3	67.5	20,500	19,500	3	14,500	13,000
J53	90.4	67.6	20,000	19,000	3.5	14,000	13,000
J55	90.9	67.9	21,000	19,500	3.5	13,500	12,500
J56	90.8	67.6	18,500	17,500	5	12,500	11,500
J57	90.9	67.7	19,000	18,000	5.5	12,500	11,500
J58	90.8	67.6	18,500	17,500	6.5	12,500	11,500
J59	90.7	67.4	17,000	16,000	7	12,000	11,000
J60	90.9	67.6	16,000	15,000	8.5	11,500	10,500
J61	90.8	67.5	15,500	15,000	10	11,500	10,500
J62	90.7	67.4	17,000	16,000	12	12,000	11,000
J63	90.7	67.4	17,000	16,000	8.5	12,000	11,000
J64	90.9	67.5	16,000	15,000	10	11,500	10,500
J65	90.9	67.5	16,000	15,000	12	11,500	10,500
J66	90.7	67.4	17,500	16,000	15	12,000	11,000
J67	90.8	67.4	17,500	16,500	10	12,000	11,000
J68	90.9	67.5	16,000	15,000	11.5	11,500	10,500
J69	90.8	67.4	16,000	15,000	16	11,500	10,500
J70	90.6	67.2	17,000	16,000	11.5	12,000	11,000
J71	90.6	67.2	17,000	16,000	11.5	12,000	11,000
J72	90.7	67.3	16,000	15,000	13.5	11,500	10,500
J73	90.8	67.4	16,000	15,000	17.5	11,500	10,500
J74	90.7	67.3	17,000	16,000	13	12,000	11,000
J75	90.3	66.9	18,000	17,000	9	12,000	11,000
J76	90.5	67.1	20,000	19,000	8	13,000	12,000
J77	90.2	66.9	18,000	17,000	6.5	12,000	11,000
J78	90.4	67.1	21,000	19,500	6	13,000	12,000

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163401964- Barrhaven Conservancy East Lands Development Project Water System Analysis
Modeling Results

Junction	Maximum Pressure under AVDY	Minimum Pressure under PKHR	Available Fire Flow under MXDY @ 20psi Residual Pressure		Water Age	Available Fire Flow under Reliability Scenario	
			13,000 L/min Boundary Condition	15,000 L/min Boundary Condition		13,000 Boundary Condition	15,000 Boundary Condition
ID	(psi)	(psi)	(L/min)	(L/min)	(hrs)	(L/min)	(L/min)
J79	90.5	67.2	19,000	18,000	5	12,500	11,500
J80	90	66.6	19,000	18,000	16	12,500	11,500
J81	89.8	66.4	21,500	20,000	12.5	13,000	12,000
J82	89.9	66.5	21,500	20,000	10.5	13,000	12,000
J83	90.1	66.7	22,000	20,500	8.5	13,500	12,500
J84	90	66.6	22,500	21,000	5.5	13,500	12,500
J85	90.1	66.7	15,000	14,500	25	11,000	10,000
J86	90.3	66.9	14,500	13,500	15.5	10,500	10,000
J87	90.2	66.9	14,500	13,500	11	10,500	10,000
J88	90.1	66.7	15,500	14,500	7.5	11,000	10,500
J89	90.1	66.7	23,000	21,500	5	13,500	12,500
J90	89.9	66.6	18,000	17,000	6	12,000	11,000
J91	90.2	66.8	21,000	19,500	7.5	13,000	12,000
J92	90	66.7	19,000	17,500	8	12,500	11,500
J93	89.9	66.5	17,500	16,500	13	12,000	11,000
J94	90.5	67.1	20,500	19,000	16.5	13,000	12,000
J95	90.8	67.4	20,000	19,000	29	13,000	12,000
J100	89.8	66.4	18,500	17,500	15	12,500	11,500
J101	90	66.6	21,000	20,000	13.5	13,000	12,000
J152	90.8	67.8	24,500	23,000	3	14,500	13,500
J153	89.8	66.4	22,000	20,500	7	13,500	12,000
J40	90.2	67.7	34,500	32,500	1	22,000	20,500
J46	90.2	67.7	33,500	31,500	1.5	21,000	19,500
J48	90.3	67.7	33,000	31,000	1.5	20,000	18,500
J373	89.9	66.5	4,500	4,500	13	4,500	4,000
J375	90	66.7	5,000	4,500	8.5	4,500	4,000
J176	90.2	66.8	20,500	19,000	24	13,000	12,000
J174	90.1	66.7	20,500	19,000	20	13,000	12,000
J178	90.4	67	20,500	19,000	26.5	13,000	12,000
J180	90.6	67.2	20,000	19,000	30	13,000	12,000
J186	90.3	66.9	21,000	19,500	25	13,000	12,000
J39	90.3	66.9	21,000	20,000	17	13,000	12,000
J96	90.6	67.2	20,000	19,000	38	13,000	12,000
J97	90.4	67	16,500	15,500	23	11,500	10,500
J102	89.9	66.5	21,000	19,500	16	13,000	12,000
J103	89.7	66.3	18,000	17,000	19	12,000	11,000
J158	90.8	67.4	20,000	19,000	44	13,000	12,000
J182	90.7	67.3	20,000	19,000	34.5	13,000	12,000
J184	90.8	67.4	20,000	19,000	38	13,000	12,000
J98	90.6	67.2	20,000	19,000	48.5	13,000	12,000

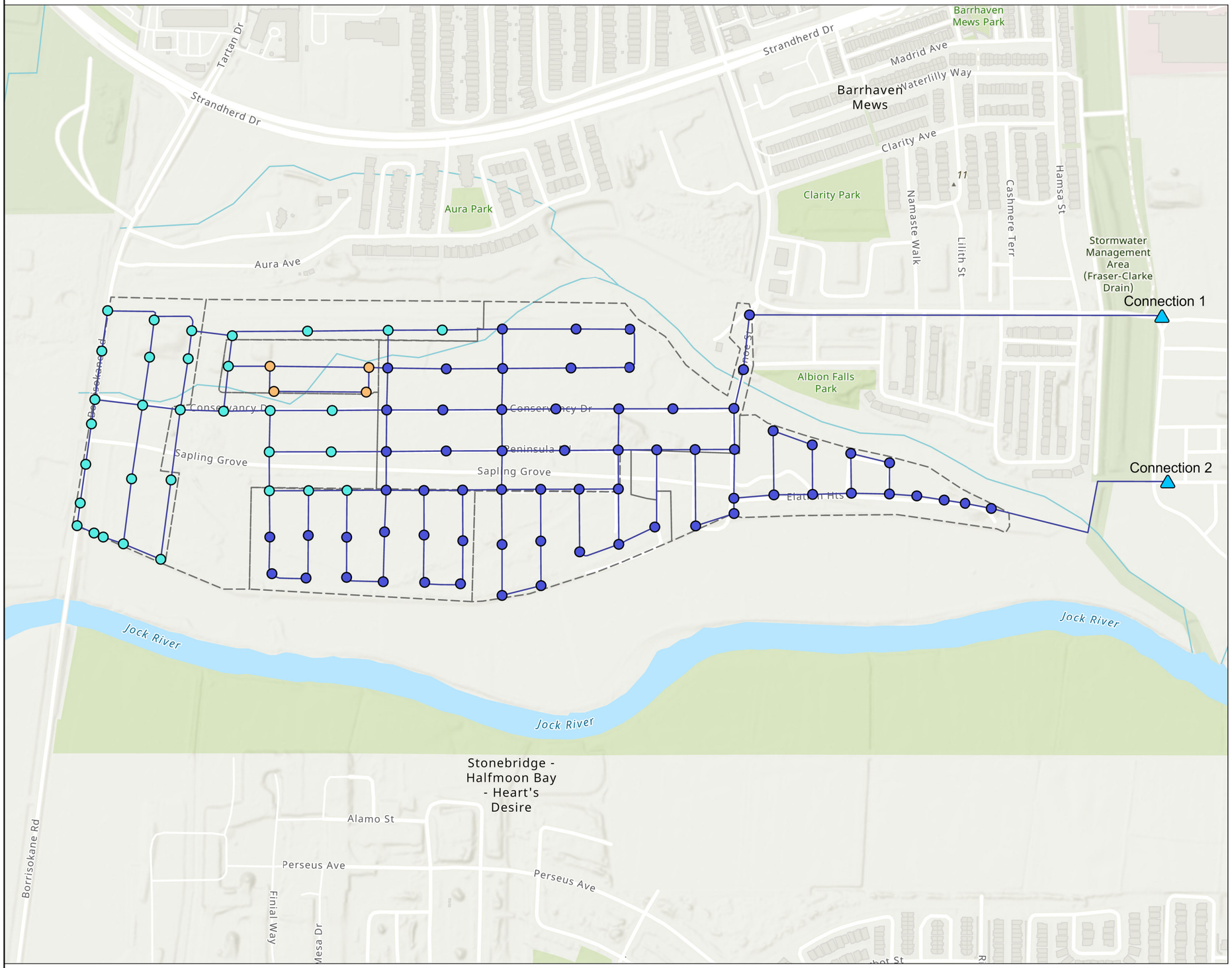


Figure No.
Appendix D-1

DRAFT

Title
Target Fire Flow Values Based on FUS and OBC guidelines

Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

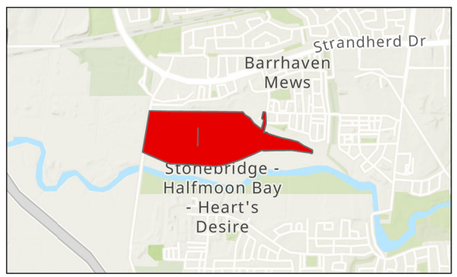
Project Location
Barrhaven, ON, CA

N

0 50 100 Meters
(At original document size of 11x17)
1:6,000

Legend
- Connection Location
- Barrhaven Conservancy East Lands

Target Fire Flow (L/min)
- 6,300
- 13,000
- 15,000
- Watermain



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

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Figure No.

Appendix D-2

DRAFT

Title

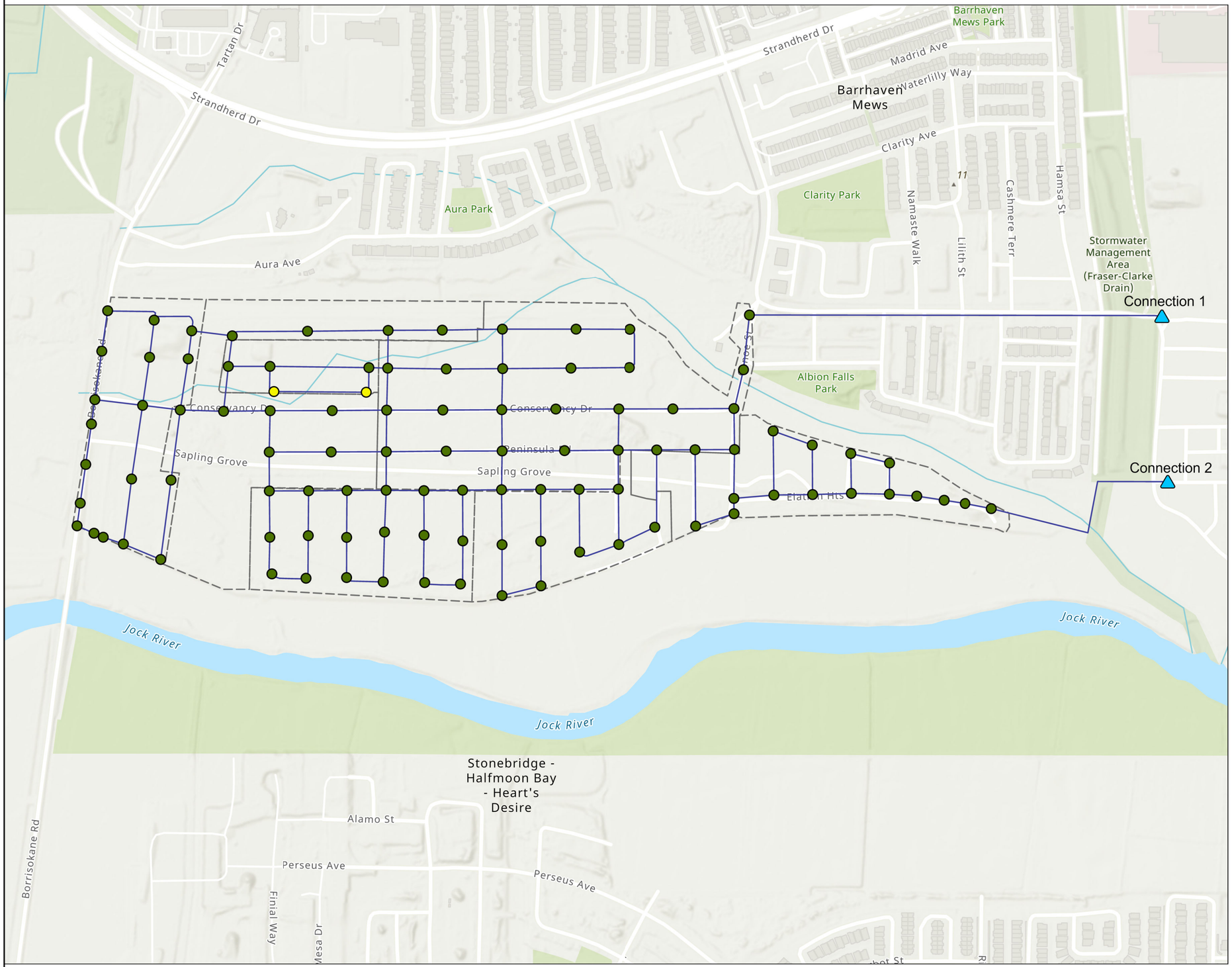
Available Fire Flow under MXDY+FF conditions (FF of 13,000 L/min)

Client/Project 163401964

David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

Project Location

Barrhaven, ON, CA



N

0 50 100 Meters

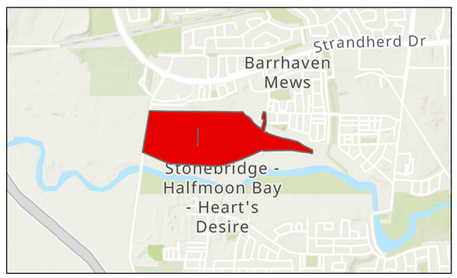
(At original document size of 11x17)
1:6,000

Legend

- Connection Location
- Barrhaven Conservancy East Lands

Available Fire Flow (L/min)

- Less than 11,000
- 11,000 - 13,000
- Greater than 13,000
- Watermain



Notes

1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

Stantec

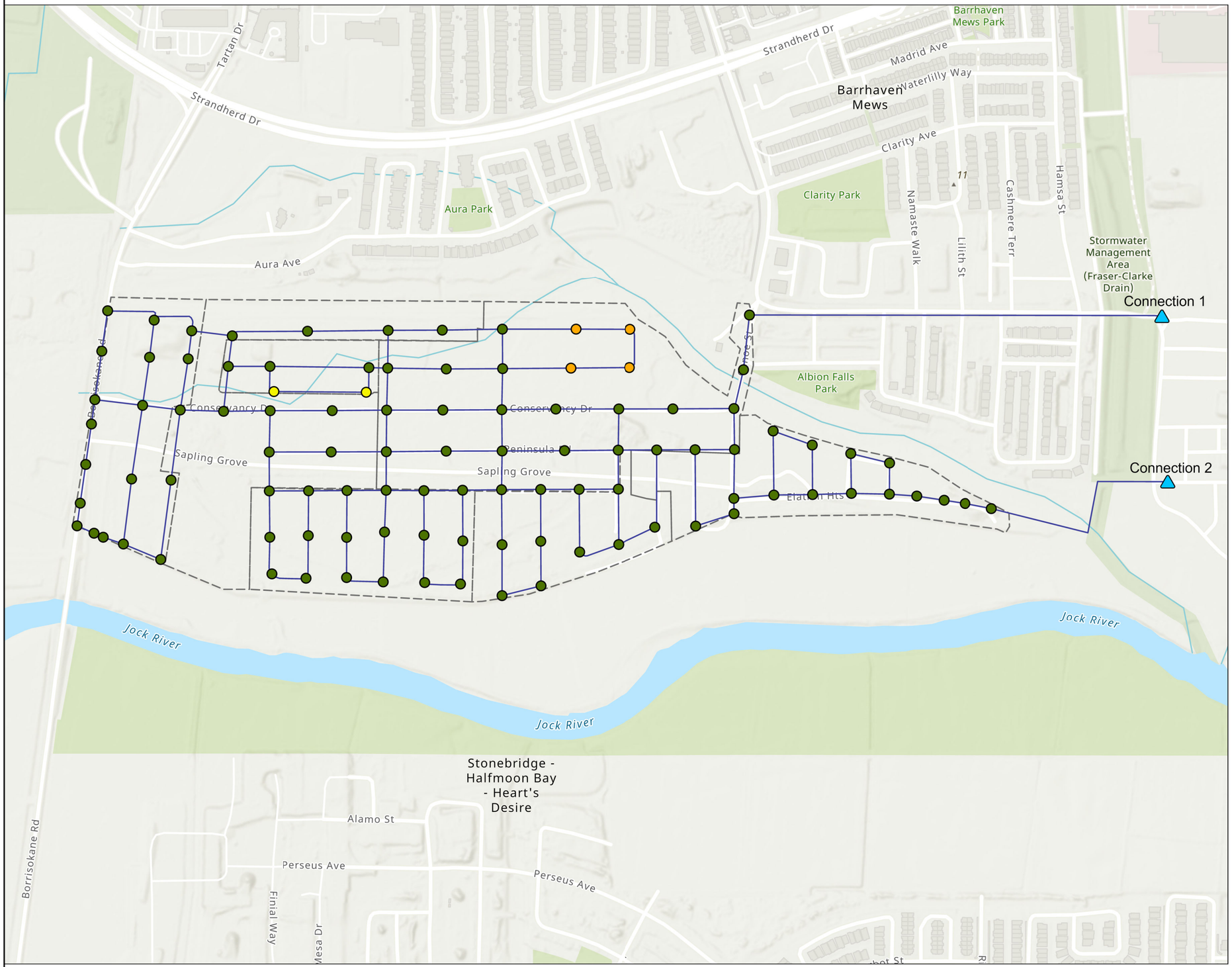


Figure No.
Appendix D-3

DRAFT

Title
Available Fire Flow under MXDY+FF conditions (FF of 15,000 L/min)

Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

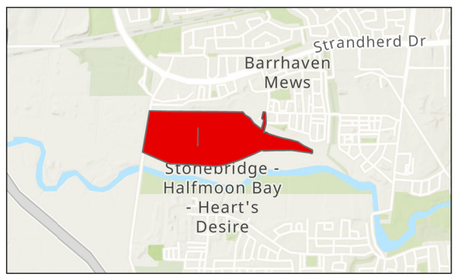
Project Location
Barrhaven, ON, CA

N

0 50 100 Meters
(At original document size of 11x17)
1:6,000

Legend
- Connection Location
- Barrhaven Conservancy East Lands

Available Fire Flow (L/min)
- Less than 11,000
- 11,000 - 13,000
- 13,000 - 15,000
- Greater than 15,000
- Watermain



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

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Figure No.
Appendix D-4

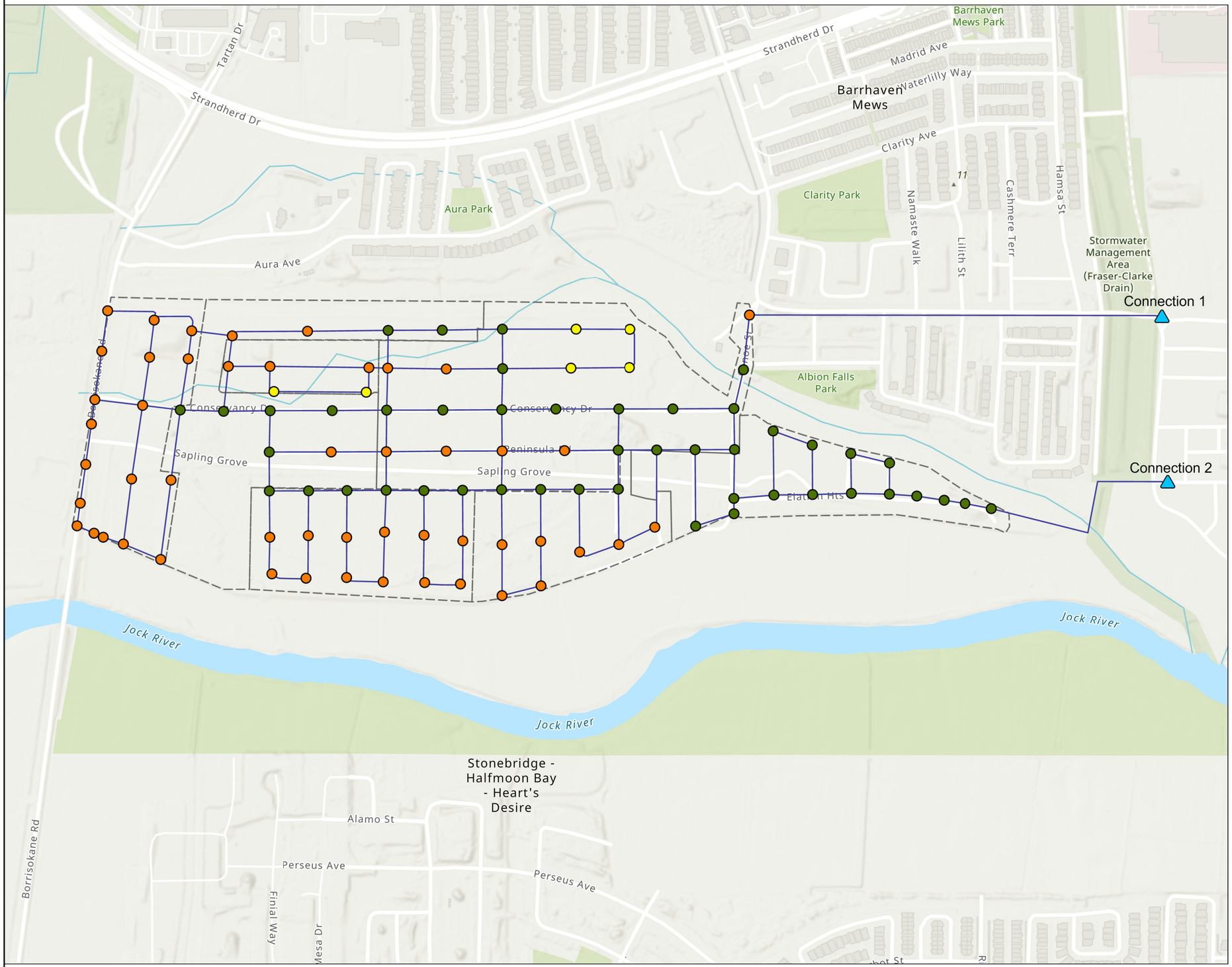
DRAFT

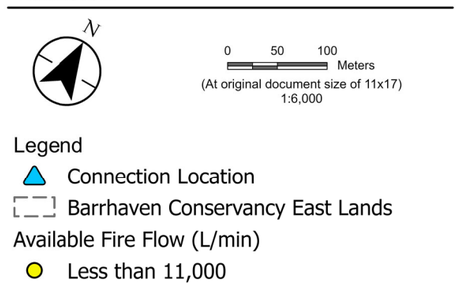
Title
Available Fire Flow under Reliability Analysis Conditions (AVDY+FF of 13,000 L/min)

Client/Project
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

163401964

Project Location
Barrhaven, ON, CA





Legend
- Connection Location
- Barrhaven Conservancy East Lands

Available Fire Flow (L/min)
- Less than 11,000
- 11,000 – 13,000
- Greater than 13,000
- Watermain

0 50 100 Meters
(At original document size of 11x17)
1:6,000

Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

Stantec

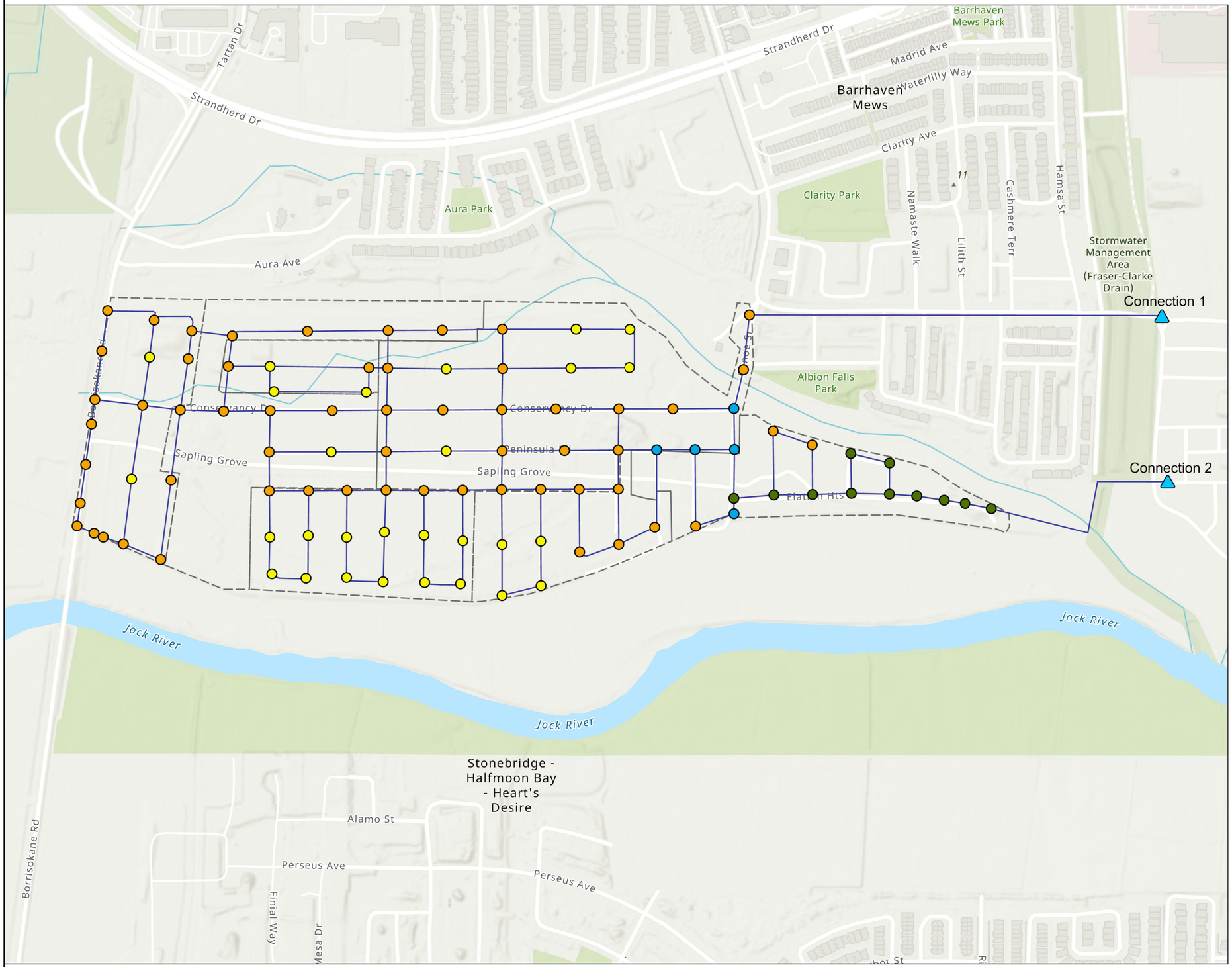


Figure No.
Appendix D-5

DRAFT

Title
Available Fire Flow under Reliability Analysis conditions (AVDY+FF of 15,000 L/min)

Client/Project 163401964
David Schaeffer Engineering Ltd
Barrhaven Conservancy East Lands

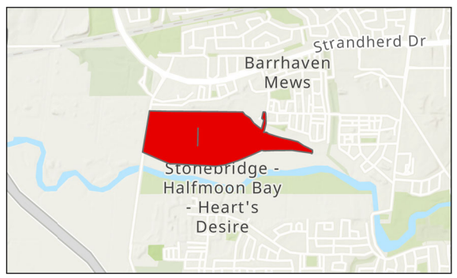
Project Location
Barrhaven, ON, CA

N

0 50 100
Meters
(At original document size of 11x17)
1:6,000

Legend
- Connection Location
- Barrhaven Conservancy East Lands

Available Fire Flow (L/min)
- Less than 11,000
- 11,000 – 13,000
- 13,000 – 15,000
- Greater than 15,000
- Watermain



Notes
1. Coordinate System: NAD 1983 CSRS MTM 9
2. Data Sources: David Schaeffer Engineering Ltd

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