JLR No.: 26610-300
Revision: 1

April 10, 2026

Prepared for:

MINTO COMMUNITIES CANADA INC.
180 Kent Street, Suite 200
Ottawa, ON
K1P 0B6

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED
343 Preston Street, Tower II, Suite 1000
Ottawa, ON
K1S 1N4
TEL: 613-728-3571

Addendum to Extend the Master Servicing Study (2018)

Barrhaven South Phase 3 (S1 Area)

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

Value through **service** and **commitment**

Table of Contents

List of Figures

List of Tables

List of Drawings

Refer to Appendix K – Drawings.

List of Appendices

Executive Summary

Minto Communities Inc. (Minto) retained a multi-disciplinary Consultant Team to prepare a suite of comprehensive technical studies in support of the Community Design Plan (CDP) for the Barrhaven South Phase 3 – S1 Area (the S1 Area). The CDP will be implemented through an amendment to the City of Ottawa Official Plan (OP).

J.L. Richards & Associates Limited (JLR) was retained to complete an Existing Conditions Study and subsequently undertake a Master Servicing Study (MSS). The MSS demonstrates that the subject lands can be adequately serviced with municipal water, sanitary sewer, storm sewer, and stormwater management infrastructure in accordance with City of Ottawa standards and applicable provincial requirements. The recommended servicing approach confirms that sufficient capacity exists, or can be provided through planned infrastructure upgrades, to support the proposed development without adverse impacts to existing municipal systems.

The S1 Area is located immediately adjacent to the existing Barrhaven South Urban Expansion Area (BSUEA) and the Ridge Subdivision. Owing to this proximity, the MSS for the S1 Area was undertaken as an extension to the 2018 BSUEA Master Servicing Study, which was completed under the Municipal Class Environmental Assessment (EA) process as a Master Plan. As part of this EA, a comprehensive range of servicing alternatives was developed and evaluated. Accordingly, the MSS for the S1 Area was completed as an addendum to the 2018 study and is hereafter referred to as the “MSS Addendum” or “Addendum.”

This Addendum documents the technical reviews, analyses, and findings that define the preferred infrastructure servicing strategies for the S1 Area Concept Plan. The objectives of the study, as outlined in the approved Terms of Reference (Appendix A), include:

- Reviewing and inventorying existing infrastructure in the vicinity of the proposed development.
- Assessing the residual capacity of the existing water, wastewater, and stormwater infrastructure. infrastructure.
- Identifying recommended stormwater, sanitary, and water servicing solutions for the proposed development, together with design criteria to guide future detailed design.

This Addendum to Extend the Master Servicing Study has been prepared to support the Concept Plan for the S1 Area and provides a functional design solution for on-site storm drainage, wastewater collection and water distribution servicing within the S1 Area. Future draft plan of subdivision and site plan applications submitted under the Planning Act will build upon and refine the conceptual servicing solutions presented herein.

The S1 Area encompasses approximately ≈71 hectares and is bounded to the east by the Quinn’s Pointe Subdivision, to the north by the Cavain’s Greenbank Development (Ridge Subdivision), to the south by Barnsdale Road, and to the west by Borrisokane Road and Highway 416. The lands are also located adjacent to the current City of Ottawa Urban Boundary.

The Study Area consists of undeveloped lands formerly used for agricultural purposes, together with two woodlots that have been identified as ecologically significant by the project biologist. The site also includes a man-excavated pond at the intersection of Borrisokane Road and Barnsdale Road, as well as an existing spill-over dry pond located in the southeast portion of the Study Area.

As part of the original BSUEA Master Servicing Study, opportunities were identified and multiple servicing alternatives were developed and evaluated to extend municipal infrastructure into the expansion area while minimizing potential impacts to the social and natural environment. The servicing strategies established through the 2018 BSUEA MSS have been extended to the S1 Area through this Addendum. The recommended servicing approach includes the following key elements:

- A conceptual storm drainage system based on a dual-drainage design approach.
- Consistent with the 2018 BSUEA MSS, the incorporation of an Etobicoke Exfiltration System (EES) along local roads, to the maximum extent practicable, where adequate separation from seasonally high groundwater levels can be achieved, while recognizing site-specific constraints under the Consolidated Linear Infrastructure Environmental Compliance Approval (CLI-ECA).
- Extension of rooftop stormwater infiltration via subsurface systems, which had previously been proposed for site plans within the BSUEA, to the industrial lands within the S1 Area.
- In areas where infiltration-based Low Impact Development (LID) measures are not feasible, implementation of a treatment train approach incorporating a filtration dry pond in Block 61 with appropriate pre-treatment measures.
- Proposed filtration dry pond adjacent to an existing spill over dry pond associated with the Quinn's Pointe Subdivision. The existing spill-over pond, originally intended to convey major overland drainage flows, will be expanded within Block 61 while maintaining the existing outlet sewer and respecting allowable flows within the downstream Quinn's Pointe storm sewer system.
- Provision of conventional storm sewers within public rights-of-way serving both residential and industrial lands. Storm sewers will be conceptually sized in accordance with the City of Ottawa Sewer Design Guidelines to convey the 1:2-year event on local roads and the 1:5-year event on collector roads.
- Assessment of residual capacity within surrounding wastewater infrastructure to identify suitable servicing outlets for sewage generated within the S1 Area. Wastewater servicing is proposed via extension of the existing sanitary sewer capped along Barnsdale Road near Bundoran Place.
- Provision of potable water servicing through watermain extensions from existing distribution systems within the Quinn's Pointe and Ridge Subdivisions.
- Confirmation that water servicing can be provided without additional interim or post-construction measures in advance of, or following, the planned municipal pressure zone reconfiguration.

This Addendum to extend the 2018 BSUEA MSS demonstrates that the development envisioned in the S1 Area Concept Plan can be serviced through strategic extensions of existing municipal water and wastewater infrastructure, together with the construction of an expanded stormwater management facility. These works will support the City of Ottawa in lifting the land-use overlay associated with the proposed Community Design Plan. The Addendum also establishes design criteria to inform future draft plan of subdivision and site plan applications within the S1 Area. All proposed servicing works are consistent with current municipal and provincial design standards and satisfy the pre-established conditions of the CLI-ECA, thereby qualifying as pre-approved projects.

1.0 Introduction

1.1 Background

In 2016, Minto Communities Inc. (Minto) and Mattamy Homes (Mattamy) had retained a Consultant Team to prepare a series of comprehensive documents to support the Barrhaven South Urban Expansion Area (BSUEA) Community Design Plan (CDP), which was subsequently implemented as an Amendment to the City of Ottawa Official Plan (OP). As part of this undertaking, J.L. Richards & Associates Limited (JLR) had been retained to prepare a Master Servicing Study (MSS) which outlined water, wastewater, storm, and stormwater management servicing strategies for the BSUEA as well as an Existing Conditions Report that evaluated and documented existing water resources as well as the identification of servicing infrastructure in and around the BSUEA, and identified constraints and opportunities which provided the baseline conditions of an Environmental Management Plan (EMP).

The BSUEA MSS was subsequently approved by council, and a Notice of Completion of the Class Environmental Assessments (EA) was issued on August 31, 2018. Subsequently, the city was able to lift the overlay of the proposed Community Design Plan for the BSUEA. In parallel to the preparation of the 2018 MSS, parts of the BSUEA were disconnected from existing Municipal Drains, namely the Hawley and Thomas Baxter Municipal Drains, in accordance with the Ontario Drainage Act.

JLR was subsequently retained by Minto to proceed with detailed design of the various phases of the Quinn's Pointe Subdivision, which forms part of the BSUEA. To date, Stages 2 to 4 exist while the last stage of Quinn's Pointe Subdivision, namely Stage 5, is in the review process with the city's Development Review (DR).

In 2019, JLR was retained by Minto to prepare a Serviceability Study for the inclusion of several parcels located adjacent to the BSUEA. These parcels, previously referred to as the Barnsdale Expansion Lands, are located either adjacent to the current Official Plan Urban Area or in very close proximity to the Quinn's Pointe Subdivision (Stages 1-4). The 2019 Serviceability Study demonstrated that extensions from existing, and proposed infrastructure could support the urbanization of these parcels. Given their location next to the Quinn's Pointe Subdivisions (existing and future), their urbanization was deemed to be a logical urban expansion in the Barrhaven South - Barnsdale Expansion Lands.

The high-level servicing solutions presented in JLR's Serviceability Study (2019) for water, wastewater, storm and stormwater management were developed for the sole purpose of demonstrating the serviceability of each parcel. The Serviceability Study was prepared to support an application to amend the Official Plan (OP) during the City of Ottawa (City) 5-year review of the OP.

Following a review of the Serviceability Study (2019) by the City of Ottawa, two (2) of the four (4) expansion parcels that were analyzed by JLR were approved to be included in the Official Plan (OP) Urban Area; the parcels are those located north of Barnsdale Road, east and west of Greenbank Road. Specifically, this Master Servicing Study (MSS), herein as the Addendum was only prepared for one of the two (2) approved parcels, namely for the Barrhaven South Phase 3 – S1 Area.

1.2 Study and Public Participation

New urban areas added to the City's Official Plan require the preparation of Environmental Assessment (EA) Master Plans, integrated and approved under the Planning Act, to ensure coordinated land use and infrastructure planning. From a servicing perspective, the EA Master Plan should identify recommended water, sanitary, and stormwater management infrastructure, as well as transportation infrastructure (prepared by others), to support the new community.

The S1 Area is located immediately adjacent to existing Quinn's Pointe and the Ridge Subdivisions, which were part of the Barrhaven South Urban Expansion Area (BSUEA). Given this proximity, the MSS for the S1 Area was completed as an extension to the 2018 BSUEA Master Servicing Study, which was undertaken as a Municipal Class Environmental Assessment (EA) Master Plan that evaluated a range of servicing alternatives. Accordingly, this undertaking has been prepared as an Addendum to Extend the 2018 Master Servicing Study and is herein referred to as the "Addendum" or "MSS Addendum".

Under this framework, this Addendum fulfills Phase 1 (Problem and Opportunity) and Phase 2 (Alternative Solutions). Although Approach 2 typically includes a review of several servicing alternatives, these are limited, apart from those developed and evaluated under storm servicing, given that the Study Area is the last future community located in the southeast quadrant of the Barnsdale Road / Highway 416 / Borrisokane Road intersection.

As part of this Addendum, the following public consultation events have been completed to date:

- Notice of Commencement and Public Open House
- Public Open House 1 – Combined S1 & S2 (March 7, 2024)
- Public Open House 2 (May 20, 2025).

1.3 Addendum Objectives

Minto retained a Consultant Team to prepare a series of comprehensive documents that would support the Barrhaven South Phase 3 - S1 Area (herein referred to as the S1 Area). Once approved, this growth area will be implemented as an Amendment to the City of Ottawa (City) Official Plan (OP).

J.L. Richards & Associates Limited (JLR) was retained to undertake the MSS Addendum, which outlines water, wastewater, storm and stormwater management servicing strategies for the S1 Area. The Addendum demonstrates that the subject lands are serviceable with municipal water, sanitary sewer, and stormwater management infrastructure in accordance with City of Ottawa Sewer Design Guidelines and standards as well as applicable provincial requirements. The recommended servicing approach confirms that adequate capacity exists, or can be provided, to support the proposed development without adverse impacts to existing systems.

For reporting purposes, this Addendum which extends the servicing strategies identified in the 2018 BSUEA MSS will outline the preferred infrastructure servicing strategies for the S1 Area, including water, sanitary, storm sewer systems, and stormwater management.

The specific objectives of this Addendum are as follows:

- Review and prepare an inventory of the existing infrastructure surrounding the proposed development.
- Estimate residual capacity of the existing infrastructure.
- Develop conceptual site servicing for storm, stormwater management, sanitary and water services for the proposed development based on the approved Concept Plan.
- Evaluate the feasibility of conceptual servicing based on constraints and opportunities while recognizing that the proposed infrastructure will connect to existing infrastructure which had been identified as the preferred servicing solutions (per 2018 BSUEA MSS) as per the Class Environmental (Class EA) screening process.
- Select the optimal conceptual service solution for storm and stormwater management, as well as sanitary and water infrastructure.

1.4 General

Prior in preparing this Addendum that would support this new community, Terms of Reference (TOR) was prepared in accordance with the latest Ottawa Infrastructure Master Plan (IMP). The IMP provides guidance for preparing TORs for Master Servicing Studies (MSS), as outlined in “Appendix C: Guideline for Preparing Terms of Reference for a Master Servicing Study, June 2023.”

JLR subsequently prepared a TOR for the S1 Area, which was accepted by the City of Ottawa. A copy of the TOR is included in Addendum for reference (Appendix A).

An Existing Conditions Report (ECR) was also prepared, with the latest version dated March 14, 2025 (sealed March 24, 2025), which is included in this Addendum (Appendix B). The ECR documented existing conditions and identified constraints and opportunities that serve as the baseline for an Environmental Impact Statement (EIS) prepared by Fotenn.

This Addendum has been prepared in support of the Concept Plan submission to confirm the servicing feasibility of the proposed development at a conceptual level. The study evaluates the proposed water, sanitary, and stormwater servicing approach associated with the Concept Plan and demonstrates that the development framework can be accommodated within the City of Ottawa’s servicing standards and policies. The servicing concepts presented herein are intended to support the Concept Plan approval and to inform subsequent planning and detailed engineering design submissions, which will be subject to further review and approval by the City.

Since the proposed infrastructure within the S1 Area will connect to existing linear infrastructure in the adjacent subdivisions, as identified in the 2018 BSUEA MSS, a copy of that report is included in Appendix C for reference. This document as well as the ECR (2025) documents the servicing strategies investigated and the decision-making process that led to the selection of the recommended site servicing solutions.

Accordingly, this Addendum has been prepared in accordance with the City-approved Terms of Reference to support the Concept Plan approval process and to facilitate removal of the growth management overlay applicable to the subject lands.

1.5 Study Area

The Study Area of this Addendum encompasses ≈71 ha of an undeveloped mix of former agricultural fields and woodlots and a man-made excavated pond. The Study Area is adjacent to Barnsdale Road and Borrisokane Road to the south and west and by two (2) existing subdivisions to the east and north. It is adjacent to the Urban Boundary to the west and south (refer to Section 2.0 for more details).

1.6 Zoning and Proposed Land Use

The S1 Area is a logical development pattern, with improved phasing opportunities and more efficient connection to surrounding developments and infrastructure particularly to the Quinn's Pointe Subdivision. The S1 Area also supports the broader objectives of the city's Official Plan and will form part of the creation of a 15-minute neighbourhood with adjacent developments although not a specific requirement for this future growth area.

The Study Area includes the following three (3) types of zoning:

- Rural Countryside (RU) zone
- Agricultural Zone (AG) zone
- Mineral Aggregate Reserve (MR) zone

Based on the preferred Concept Plan (Appendix D), the proposed land usage consists of the following:

- Low density residential
- Medium density residential
- Industrial lands
- Retained woodlots
- Park land
- Stormwater management block
- Servicing easements

1.7 Supporting Studies

The preferred Concept Plan (Appendix D) was developed in consultation with various stakeholders and multiple city departments to support the various land uses listed in Section 1.6. The plan was prepared with consideration of constraints identified in the Environmental Impact Statement (EIS) and opportunities provided by adjacent subdivisions, as well as collector roads and the capacities of existing linear infrastructure documented in the Existing Conditions Report for the S1 Area (JLR, 2025).

Sections 3.0, 4.0, and 5.0 describe the sizing of proposed infrastructure required to support the S1 Area Concept Plan. This Addendum, completed as an extension to the 2018 Environmental Assessment Master Plan (Master Servicing Study), was developed while considering the following supporting studies:

- Community Design Plan, Foten (2026)

- Natural Heritage Existing Conditions Report (2025), Arcadis Professional Services Canada
- Environmental Impact Statement (2026), Fotenn
- Geotechnical and Hydrogeological Existing Conditions Reports (2025), Paterson Group
- Community Energy Plan Report – Lifting of Future Neighborhood Overlay (2025), Fotenn
- Ontario Drainage Act – Revised Engineers Report (upcoming), Robinson Consultants Inc
- Sizing and Modelling of Linear Infrastructure (J.L. Richards & Associates Limited)

Regulatory approval requirements for this undertaking are listed in Section 8.0 of this Addendum.

2.0 Existing Conditions

The existing site conditions for the S1 Area were identified and outlined in JLR's 2025 Existing Conditions Report (ECR). This document included information pertaining to the site's climate, geology, physiography, drainage, surficial geology, bedrock, aquifer systems and groundwater levels, existing infrastructure at the subject site's boundary as well as additional physical attributes of the site. The latest version of the ECR is included in Appendix B of this document for reference.

2.1 Background Documents

A series of documents were reviewed as part of the 2018 BSUEA MSS, which were listed in a Synopsis of Background Documents (refer to Appendix C for the synopsis). To supplement these background documents, JLR's 2025 ECR (Appendix B) included more recent engineering documents that are applicable to Caivan's recent developments within the former aggregate extraction properties.

2.2 Surface Water Characteristics, Watercourses and Site Hydrology

The S1 Area, accounting for of ≈71 ha of land, is bounded by Quinn's Pointe Subdivision to the east, by Cavain's Greenbank Development (The Ridge Subdivision) to the north, by Barnsdale Road to the south and by Borrisokane Road to the west as shown on Figure 1 (Location Plan) is part of the Barrhaven South Area (BSC) within the former City of Nepean.

Based on the interpretation of both LiDAR data and topographical survey, the S1 Area is currently tributary to two (2) separate sub-watersheds as depicted on Figure 2 (Study Area and Drainage Divide). As shown on this figure, most of the S1 Area is tributary Mud Creek via the Thomas Baxter Municipal Drain while a small area located in the northeastern portion of the Study Area is tributary to the Jock River. Given that a significant portion of the S1 Area is tributary to a Municipal Drain, council appointed Robinson Consultants Inc. (RCI), as the Drainage Engineer, to prepare an update to the Engineer's Report to document the drainage modifications and potential disconnection from the Thomas Baxter Municipal Drain.

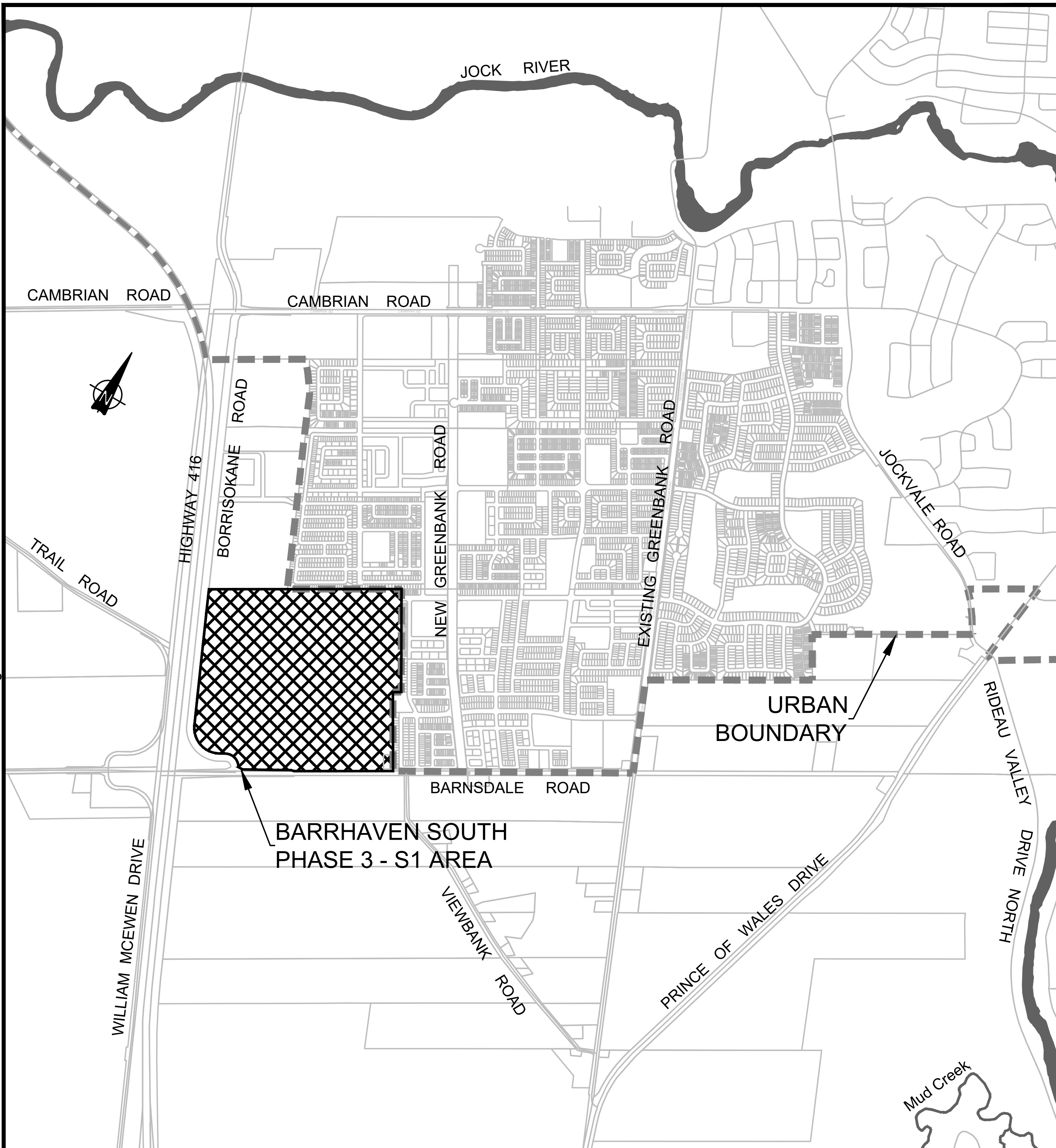
On-site investigations completed by the team's biologist did not identify any watercourse or formal conveyance channels within the S1 Area. The absence of channels or formal watercourses was confirmed by the review of LiDAR, which is generally indicative of areas exhibiting particularly low surface runoff potential.

Catchment areas within the S1 Area have been delineated based on LiDAR as well as surface infrastructure such as roads (which tend to form a drainage path barrier) and culverts (where flow will concentrate into a point source). Information presented in the 2025 ECR (refer to Appendix B), namely Sections 5.2 and 5.3 as well as Figure 5-2, Figure 5-3 and Figure 5-4 show the drainage areas to boundary culverts, land cover and soil types for each of the sub-catchment's that is tributary to each of the boundary culverts located along the perimeter of the site.

Hydrological modelling to establish pre-development conditions was undertaken using the SWMHYMO platform for the BSUEA as part of the 2018 MSS. Given that the analysis was undertaken to assess flows at each boundary culvert bounding both the BSUEA And S1 Area, flows reported in the initial version (R0) of this MSS (dated October 2025) were those extracted from the 2016 ECR (BSUEA) at each of the boundary culverts under infrequent storm events.

Due to additional requirements to refine the modelling undertaken along existing roadway culverts, as part of the 2016 ECR (BSUEA), the SWMHYMO pre-development model was replaced with a pre-development model using the PCSWMM platform. Having pre-development conditions modelled in PCSWMM is consistent with the post-development PCSWMM model. The pre-development simulation results with SWMHYMO are consistent with those generated with PCSWMM and provide an estimate of flood flows at the boundary control points of the site for storm events ranging from the 1:2-year to the 1:100-year recurrence as well as for the 4-hour 25 mm storm. Section 3.13.4 of this Addendum provides refined pre- and post-development modelling using PCSWMM. Both peak flows and runoff volumes were generated for several storm events at several locations along the open diches of Borrisokane Road and Barnsdale Road as well as the headwater of the Thomas Baxter Municipal Drain.

The PCSWMM simulation results under a frequent storm (4-hour 25 mm) show relatively low flow rates at each of the boundary culverts, due to the high infiltration capacity of the native soils in the area and the low imperviousness levels. In general, during larger and less frequent events, runoff will increase as the infiltration capacity decreases due to saturation of the native soils.



PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

LOCATION PLAN

www.jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

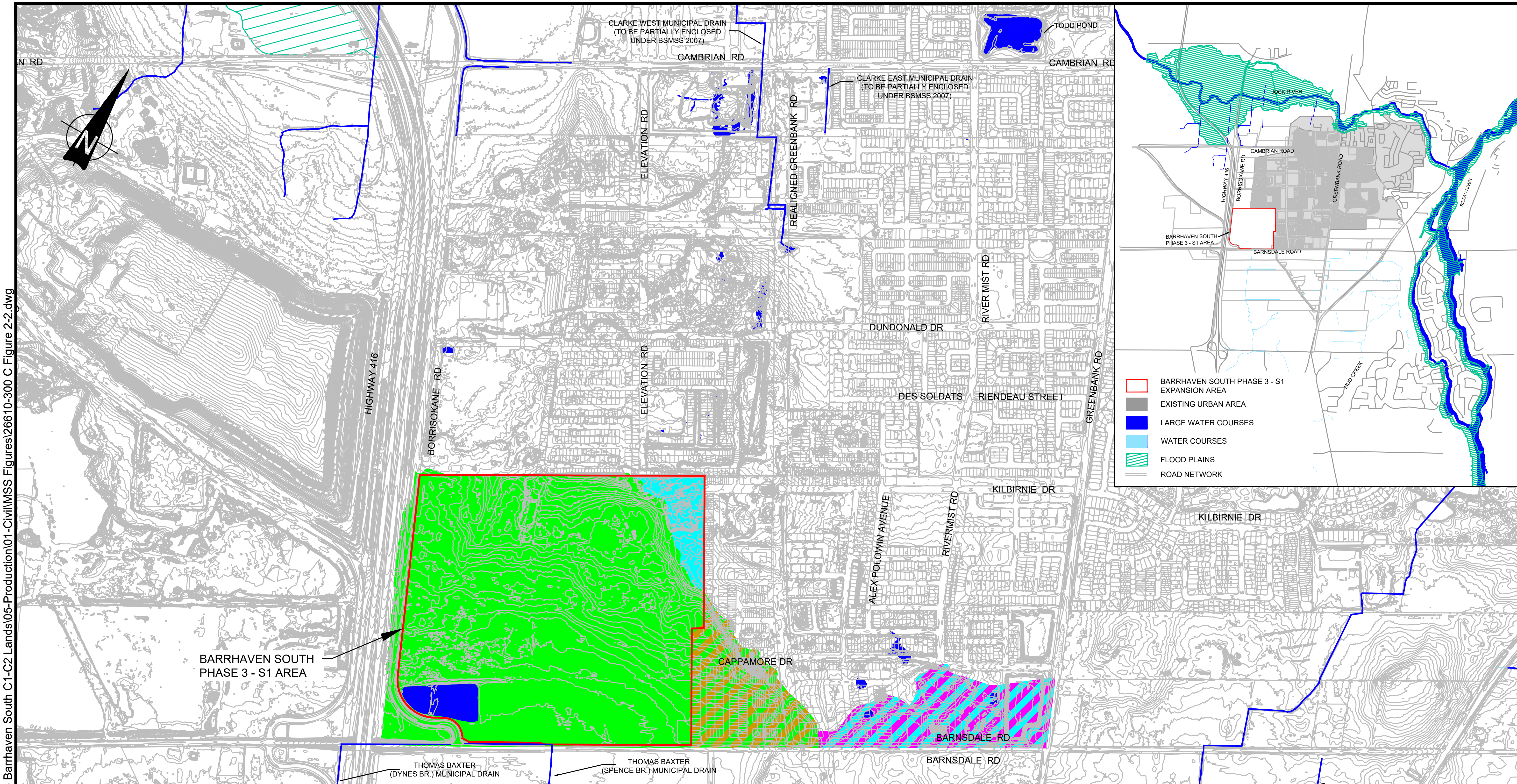
DESIGN:	GF
DRAWN:	KC
CHECKED:	GF
JLR #:	26610-300

DRAWING #:

FIGURE 1

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C LOCATION PLAN.DWG

PLOT DATE: Thursday, April 9, 2026 9:50:57 AM



LEGEND

- S1 URBAN EXPANSION STUDY AREA
- SUBCATCHMENT AREA BOUNDARY
- WATERCOURSE/ MUNICIPAL DRAINS
- AGGREGATE EXTRACTION AREA
- TRIBUTARY AREA TO JOCK RIVER SUBWATERSHED
- TRIBUTARY AREA TO MUD CREEK SUBWATERSHED
- PRE-DEVELOPMENT EXTENTS TRIBUTARY TO RIDEAO RIVER REDIRECTED TO JOCK RIVER SUBWATERSHED WITH URBANIZATION
- CATCHMENT AREA TO HYDROLOGIC BOUNDARY CONTROL POINTS
- WATER BODIES
- FLOOD PLAIN
- PRE-DEVELOPMENT EXTENTS TRIBUTARY TO MUD CREEK REDIRECTED TO JOCK RIVER SUBWATERSHED WITH URBANIZATION

PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

STUDY AREA & DRAINAGE DIVIDE

www.jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	GF
DRAWN:	KC
CHECKED:	GF
JLR #:	26610-300

DRAWING #: FIGURE 2

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C Figure 2-2.dwg

PLOT DATE: Thursday, April 9, 2026 9:52:39 AM

2.3 Site Features

The S1 Area (Figure 2) consists of an undeveloped mix of former agricultural land, two (2) woodlots, which have been identified of significance by the Team's biologist. The subject site also includes a man-excavated pond located at the intersection of Borrisokane Road and Barnsdale Road. The lands are sited adjacent to the current Urban Boundary.

The topography across the site has significant undulations. In general, the lands slope down from the northern to the southern boundary of the lands. Elevations of ±112 m at the highest point near the northern boundary while elevations drop to ±100 m at the lowest point near Barnsdale Road. At the intersection of Borrisokane Road and Barnsdale Road, in the southwest corner of the site, there is an existing man-made pond that was excavated in the 90's as displayed on the aerial on "geoOttawa".

2.4 Source Protection

The Mud Creek Subwatershed Study (2015) identified the S1 Area as being located within the Mississippi-Rideau Source Protection Region (MRSPR) as depicted in Figure 8 of the MRSPR. In addition, the entirety of the S1 Area is located within a Highly Vulnerable Aquifer based on the source protection mapping from the Ministry of the Environment, Conservation and Parks (MECP).

Conceptual storm servicing developed as part of this Addendum will incorporate infiltration measures to the maximum extent, while recognizing constraints listed in Table A2 of the Consolidated Linear Infrastructure Environmental Compliance Approval (CLI-ECA), to minimize the impact on the shallow aquifer/esker.

Section 3.10 and Section 3.11of this Addendum present recommended servicing strategies that are consistent with site specific constraints and opportunities of the Study Area. Specifically, Section 3.10 describes infiltration strategies that are proposed to the maximum extent while accounting for the constraints documented in the CLI-ECA. It should be noted that the proposed servicing strategies for the S1 Area reflect those adopted as part of the 2018 BSUEA MSS. Similarly, Section 3.11 describes the filtration strategies reviewed to the maximum extent with the preferred strategy documented in a screening process.

2.5 Geotechnical and Hydrogeological Investigations

2.5.1 General

A Geotechnical Investigation as well as a Hydrogeological Investigation were carried out by Paterson Group Inc. (Paterson) to assess general subsoil and groundwater conditions within the boundaries of the S1 Area and to provide geotechnical recommendations for the design of municipal services associated as well as sub-surface information to assess infiltration measures with the proposed development.

The latest documents prepared by Paterson are as follows:

- Existing Conditions – Geotechnical Barrhaven South Phase 3 – S1 Area (June 27, 2025)

- Hydrogeological Existing Conditions Report – Barrhaven South Phase 3 S1 Area (March 25, 2025).

Both reports have been submitted to the City by Paterson under separate cover.

2.5.2 Geotechnical

Based on the Existing Conditions – Geotechnical Barrhaven South Phase 3 (S-1 Area) report prepared by Paterson, a total of 34 boreholes and 51 test pits were completed across the site and the immediate surrounding area with limited coverage in the northern wooded area and the southwest portion of the site near the existing stormwater pond. Borehole data indicate that the overburden thickness across the site is substantial, generally ranging from approximately 15 to 25 m, and bedrock was not encountered within the depths explored. The site is predominantly underlain by non-cohesive silty sand to sandy silt, which is considered suitable subgrade material for municipal servicing.

Localized silty clay deposits were encountered within the S-1 Lands, primarily in the northwest portion of the site and in isolated areas of the central-east. These clay deposits are not continuous and occur within an otherwise granular overburden profile dominated by silty sand and sandy silt. Where present, clay is typically encountered at shallow depths of approximately 0.5 to 3.5 m below ground surface, with thicknesses generally ranging from 0.5 to 3.0 m.

From a civil servicing and grading perspective, the presence of silty clay locally governs permissible grade raise, rather than limiting the feasibility of deep servicing. The report recommends a preliminary maximum grade raise of approximately 2.5 m in areas where silty clay remains beneath settlement-sensitive infrastructure, to control long-term total and differential settlement. These restrictions apply only within clay-affected zones and do not impact most of the site, which is underlain by granular soils suitable for conventional municipal servicing. In areas where higher grade raises are required, or where servicing alignments intersect clay-affected zones, supplemental investigation and mitigation measures may be required at later stages of design.

2.5.3 Hydrogeological and Assessment of Infiltration Rates

2.5.3.1 Infiltration Characteristics and Soil Permeability

Paterson's Hydrogeological Existing Conditions Report for the S1 Area (March 2025) states that the site is predominantly underlain by non-cohesive silty sand to sandy silt overburden associated with glaciofluvial and glaciomarine deposits. These materials form an unconfined overburden aquifer with generally favourable infiltration characteristics. Hydraulic conductivity testing of the saturated overburden yielded values ranging from 4.6×10^{-7} to 4.6×10^{-5} m/s, which are consistent with moderate to high permeability soils typically associated with groundwater recharge areas and was found to be consistent those measured as part of the BSUEA.

The in-situ infiltration testing results from the report show that typical infiltration rates generally range between 50 and 100 mm/hr, with higher infiltration rates exceeding 100 mm/hr primarily observed in the northwestern portion of the site. These elevated rates are attributed to coarser granular soils associated with the Kars Esker system. From a stormwater management and Low

Impact Development (LID) perspective, these results confirm that the site is generally suitable for infiltration-based solutions, provided that adequate vertical separation to the groundwater table can be maintained. Simulated unfactored infiltration rates, for the areas intended to be serviced by an EES, is discussed in greater details in Section 3.10.3 as part of the screening process.

2.5.3.2 Groundwater Levels

From the borehole and monitoring well data presented in the Hydrogeological Report for the S1 Area (March 2025), the overburden thickness across the site is substantial, generally ranging from 15 to 25 m. Bedrock was not encountered in boreholes advanced to depths of up to approximately 17 m below ground surface, indicating that bedrock depth does not present a constraint to deep servicing infrastructure. Instead, the depth to the groundwater table represents the primary hydrogeological constraint for servicing and infiltration design.

Groundwater elevations across the S-1 Lands are relatively consistent, generally ranging from approximately 98 m to 101 m in the northern portion of the site and approximately 96 m to 99 m in the southern portion. However, due to the natural site topography, which rises from approximately 99 m near Barnsdale Road to approximately 110 m toward Kilbirnie Drive, the depth to groundwater relative to surface elevation increases toward the northern portions of the site. In these areas, groundwater levels are locally observed at depths of approximately 6 m to 12 m below ground surface, providing sufficient vertical separation to support deeper sewer infrastructure and infiltration systems, including the proposed EES system.

Conversely, the southern portion of the site exhibits shallower groundwater levels due to the lower existing surface elevation and localized perched groundwater conditions, which may constrain the feasibility and extent of infiltration-based allowances in this area.

The Hydrogeological Report provided seasonal high groundwater levels for each borehole. This data was subsequently used to generate seasonal high groundwater contours and was adopted as the basis for design considerations presented in this Addendum. This information has been compiled on a Figure along with other information pertaining to the proposed EES and included in Appendix G.

2.5.3.3 Groundwater Mounding Considerations

An Etobicoke Exfiltration System (EES) was the recommended servicing solution as part of the 2018 BSUEA MSS to achieve distributed infiltration and maintain the pre-development infiltration condition. The same screening process was carried out as part of this Addendum, which has been documented in Section 3.10.3 (below). Similarly to the BSUEA, an EES is being proposed within areas underlain by coarse native materials, such as sand or sandy gravel, as was the case in the BSUEA and some of the areas within the S1 Area. There is a potential risk of groundwater mounding although more probable when native material are mostly fine-grained soils, which is not representative of the areas in the S1 Area. Nonetheless, groundwater mounding remains an important design consideration and must be evaluated to confirm system feasibility and long-term performance in accordance with the Sewer Design Guidelines (Appendix 10). It has been reviewed in greater detail, in Section 3.10.3.

3.0 Storm Drainage and Servicing

3.1 Background

A stormwater management strategy was developed for the S1 Area to ensure that prior to any off-site discharge, runoff would meet both municipal and provincial requirements. In addition, the stormwater management strategy also requires that the integrity of the downstream systems be maintained from both a minor and major systems perspective.

The stormwater management strategy should include measures to promote infiltration, to the maximum extent, while recognizing constraints, supplemented by filtration solutions to the maximum extent. In addition to the above strategies, SWM needs is to be identified, including the facility type, size and location, along with major overland flow paths and proposed storm sewer trunks.

From a surface water perspective, the S1 Area is tributary to the following two (2) sub-watersheds as depicted on Figure 2:

- **Jock River:** A small area located in the northeast portion of the Study Area.
- **Mud Creek:** The majority of the Study Area surrounding the northeast portion.

The S1 Area is bounded by two (2) existing subdivisions and by the current urban boundary along both southern and western limits. Hence, linear infrastructure exists at the northern boundary with Caivan's Greenbank Development (The Ridge) and eastern boundary with Quinn's Pointe Subdivision (existing Stages 3 and 4 and future Stage 5).

There is an existing spill-over pond located within the S1 Area (southeastern corner). This facility was designed as part of Quinn's Pointe Subdivision with the objective of intercepting major overland flow to prevent cascading onto the future Realigned Greenbank Road, an arterial.

There is no inlet sewer originating from Quinn's Pointe Subdivision to the spill-over pond as inflow to this feature is solely via cascading of major overland flow. The spill-over pond is currently connected to Quinn's Pointe Subdivision by means of an outlet structure complete with the 900 mm diameter outlet sewer which slowly releases the captured major overland flow. Figure 3 depicts existing surface drainage conditions, including existing ponds and culverts, in the vicinity of the S1 Area.

3.2 Storm Connections and Limitations

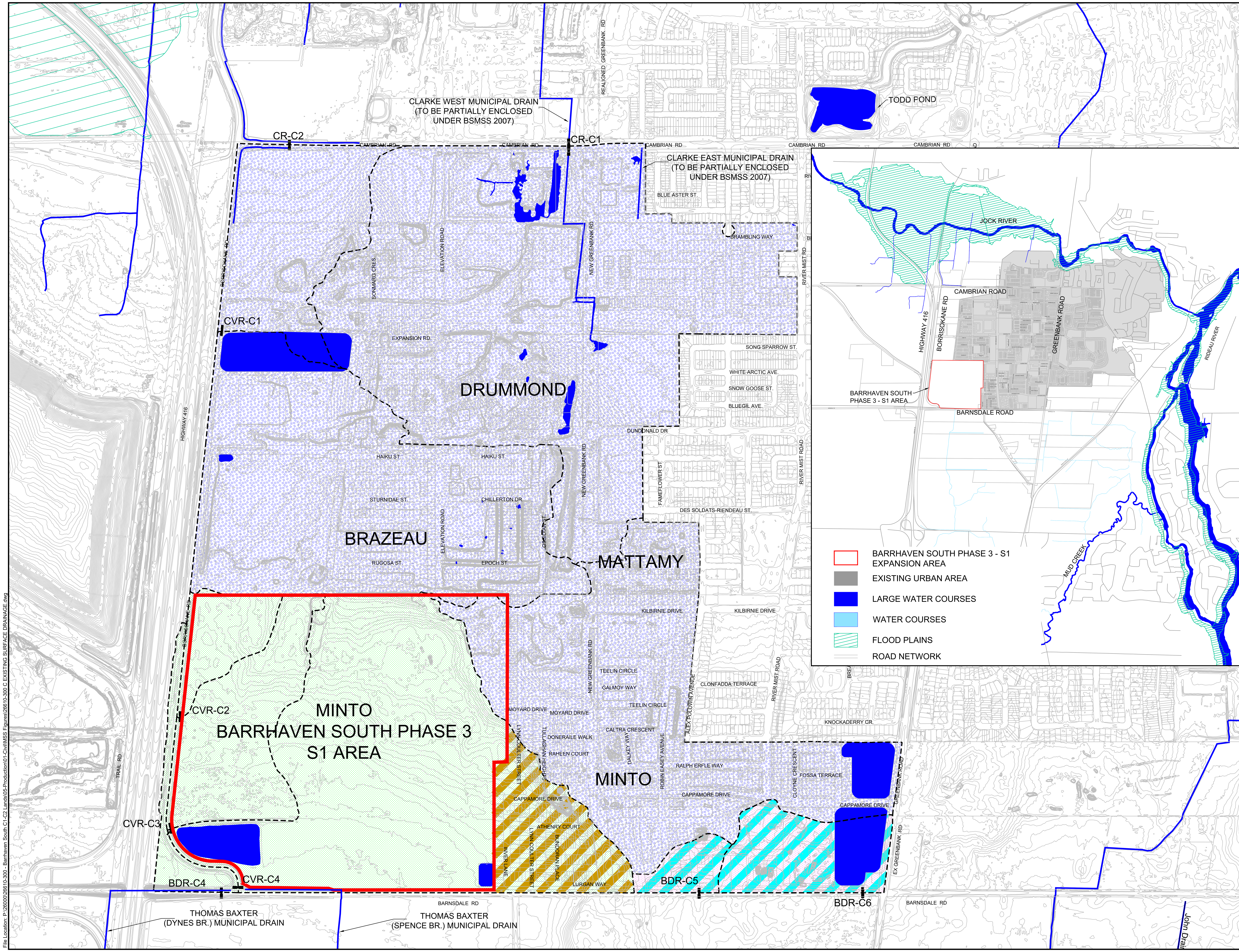
The S1 Area is not directly connected to any receiving water course. Consequently, runoff from the Study Area will be collected and conveyed to proposed and existing storm sewers, end-of-pipe facility and/or open ditches prior to being discharged off-site within the residual capacities in the downstream systems. Figure 3 shows the internal drainage limits within the S1 Area as well as culverts located along the perimeter of the lands.

Figure 4 below shows existing and planned storm sewer servicing infrastructure surrounding the S1 Area. As indicated in Section 7.4.3 of the ECR (Appendix B), several storm sewer systems were reviewed and assessed to determine their viability in providing an outlet to the S1 Area.

Based on this review, it was determined that a storm connection to Elevation Road would not be a viable option as the system does not have residual capacities to accommodate part or full flows from the S1 Area.

In terms of a connection to the open ditch system along Borrisokane Road, the storm strategy was developed to minimize sheet flow drainage from the S1 Area to that drainage system by only allowing local drainage to reach the open ditch system since it is tributary to the Thomas Baxter Municipal Drain. Ultimately, modifications to the serviced area and/or hydrological regime of the Thomas Baxter Municipal Drain will require to be documented in an update to the Engineers Report for a subsequent disconnection (either full or partial) from the Thomas Baxter Municipal Drain.

Based on existing conditions servicing, flows captured and released from the spill-over pond (located in the southeast corner of the S1 Area) is being conveyed by the Quinn’s Pointe storm sewer system, consisting of storm sewers ranging between 900 mm and 1650 mm in diameters. From the downstream end of this storm sewer system, flows are released to Dry Pond 2 before discharging into the Greenbank Road trunk storm sewer system. The storm strategy presented herein meets the flow allowance along the 900 mm diameter storm sewer with Quinn’s Pointe.



LEGEND

- URBAN EXPANSION STUDY AREA
- TRIBUTARY AREA TO JOCK RIVER SUBWATERSHED
- TRIBUTARY AREA TO MUD CREEK SUBWATERSHED
- TRIBUTARY AREA TO MUD CREEK REDIRECTED TO JOCK RIVER SUBWATERSHED WITH URBANIZATION
- TRIBUTARY AREA TO RIDEAU RIVER DIRECTED TO JOCK RIVER SUBWATERSHED WITH URBANIZATION
- CATCHMENT AREA TO HYDROLOGIC BOUNDARY CONTROL POINTS
- WATER COURSE / MUNICIPAL DRAINS
- WATER BODIES
- FLOOD PLAIN

NOTE: KILBIRNIE ROAD, CAPPAMORE DRIVE AND ELEVATION ROAD ARE COLLECTOR STREETS.

No.	ISSUE / REVISION	DD/MM/YY
2	RE-ISSUED AS PART OF DRAFT MSS ADDENDUM	10/04/2026
1	ISSUED AS PART OF DRAFT MSS ADDENDUM	23/10/2025

VERIFY SHEET SIZE AND SCALES. THE BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:4500

CLIENT: minto Communities

CONSULTANT: www.jlrichards.ca J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP

PROJECT NORTH

PROJECT: BARRHAVEN SOUTH PHASE 3 - S1 AREA

3882 BARNSDALE ROAD

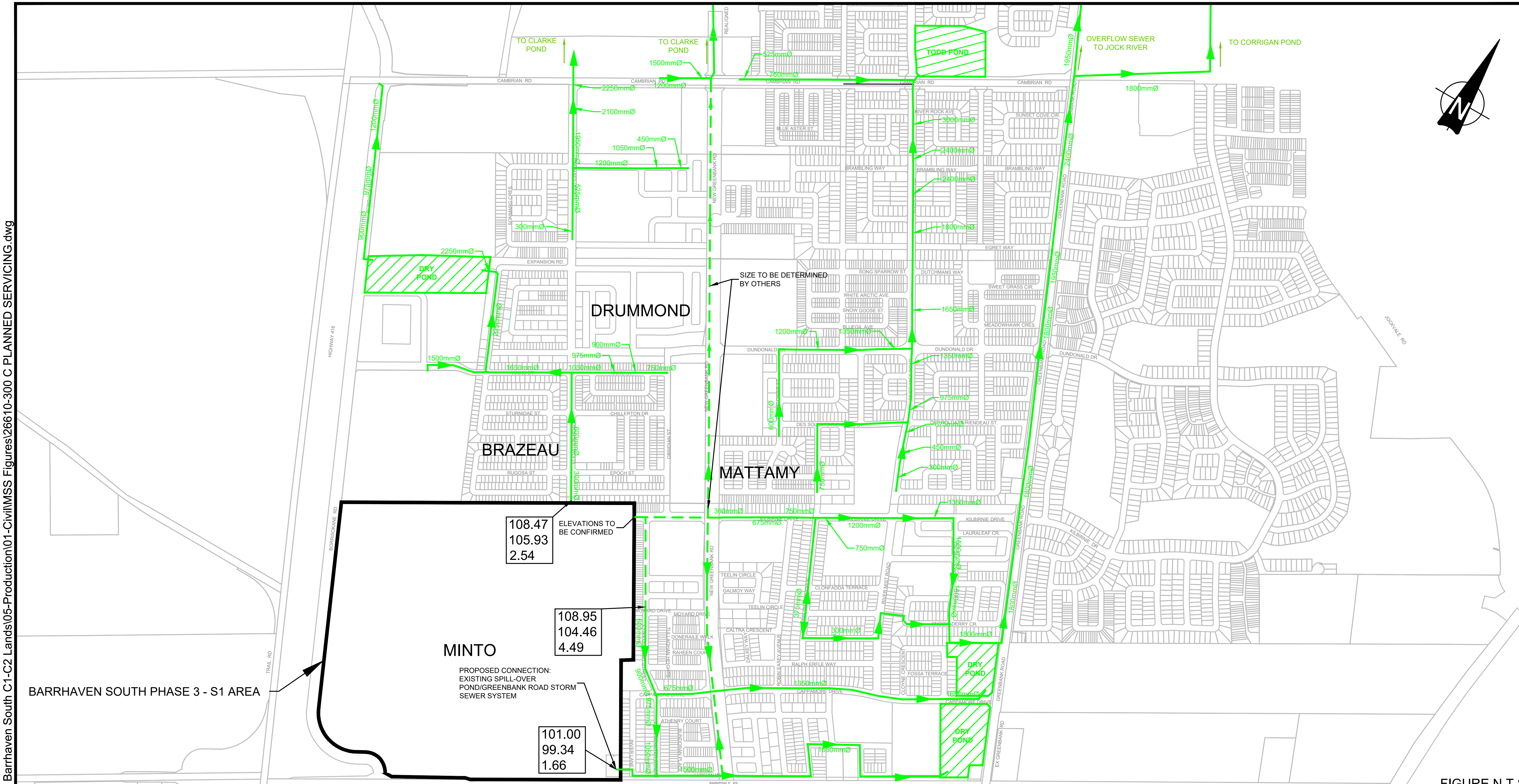
DRAWING: EXISTING SURFACE DRAINAGE CONDITIONS

DESIGN: KF/GF
DRAWN: KC
CHECKED: KF/GF
JLR #: 26610-300

DRAWING #: FIGURE 3

PLOT DATE: Thursday, April 9, 2026 10:55:27 AM

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C EXISTING SURFACE DRAINAGE.dwg



LEGEND

(solid line with arrow)	EXISTING STORM SEWER
(dashed line with arrow)	PLANNED STORM SEWER
98.00	EXISTING GROUND ELEVATIONS (±)
94.07	STORM SEWER OBVERT
3.9	COVER DEPTH (m)

PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

EXISTING AND PLANNED STORM SERVICING INFRASTRUCTURE

www.jlrichards.ca

J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS

DESIGN:	GF
DRAWN:	KC
CHECKED:	GF
JLR #:	26610-300

DRAWING #: FIGURE 4

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C PLANNED SERVICING.dwg

PLOT DATE: Thursday, April 9, 2026 10:58:22 AM

3.3 Roadway Projects

3.3.1 Barnsdale Road Widening

In 2025, the City of Ottawa initiated a Class Environmental Assessment for the Barnsdale Road widening project, from Prince of Wales Drive to Highway 416. It is important to note that there is a section of Barnsdale that bounds the S1 Area and that will be part of the future Highway 416 interchange, an initiative led by the Ministry of Transportation (MTO), as discussed in Section 3.3.2 (below).

The above-noted undertaking will be carried out under a Schedule C Class Environmental Assessment and will examine widening options of Barnsdale Road, from a two (2) to four (4) lanes. A Transportation Environmental Study Report (ESR) will ultimately be prepared that would document outlet locations for the various sections of the roadway, along with high-level water quality and quantity measures to meet regulatory requirements. It should be noted that detailed design of the Barnsdale Road widening will need to be developed in accordance with the requirements of the City of Ottawa CLI-ECA (No 008-S701).

The servicing strategy developed and presented herein did not account for the Barnsdale Road widening project in either the storm sewers or in the end-of-pipe facility within the S1 Area. It has been assumed that drainage for the widening project would be conveyed based on the pre-development flow pattern, which is from the roadway in a southerly direction, away from the S1 Area. It is expected the roadway project would culminate through the hierarchy of the CLI-ECA (i.e. Appendix A and Table A1 and Table A2 with constraints) and could possibly integrate its own surface filtration Low Impact Development (LID) measure or Manufactured Treatment Device (MTD).

From a quantity control perspective, simulation results summarized in Section 3.13.4 have shown a decrease in both peak flows and runoff volumes released to the headwater of the Thomas Baxter Municipal Drain. Hence, an opportunity may exist to outlet some of the runoff from the widening or interchange projects (refer to Section 3.3.2 below) to the Thomas Baxter Municipal Drain and take advantage of the partial disconnection of the majority of the S1 Area as shown in Section 3.13.5.

3.3.2 Highway 416 at Barnsdale Road Interchange

A Transportation Environmental Study Report (ESR) was completed in 2023 by Morrison Hershfield. A series of alternatives were reviewed against six (6) separate criteria with Alternative 5 (Parclo AB/South Side Loop) selected as the technically preferred Alternative for the interchange configuration.

Section 5.1.4 of the Transportation ESR reads as follows:

> "*The recommended option implements a Parclo AB interchange with four (4) free flow ramps servicing movements to and from the north and two (2) inner loop ramps."*

The proposed configuration of the interchange will require the closure of roadways, including the southern portion of Borrisokane Road. Active transportation facilities are located on the north side of Barnsdale Road, with two (2) high risk potential conflict areas.

The preferred Concept Plan (Appendix D) has considered land requirements for the Highway 416 / Borrisokane Road / Barnsdale Road interchange.

3.4 Master Grading Plan

Topography varies significantly throughout the Study Area, from elevation ±109 m at the highest point near the northern boundary and drops to ±99.5 m at the lowest point near Barnsdale Road. At the northern end of the Study Area, near the Ridge Subdivision, there is a vertical difference of 4 m within a horizontal length of 100 m. Overall, there is a grade differential of approximately 10 m from the northern to the southern portion of the Study Area.

A Conceptual Grading Plan (Drawing MG1 in Appendix K) was developed, at a macro-level, for the residential portion of the S1 Area. Centerline high points, with minimum 0.1% slopes from crests to crests, were established along ROWs and corridors, to identify locations and paths for major overland flow routes. Based on the high points and respective slopes between them, assumptions were made to assess where low points could be accommodated for future roadway sag storage. Overall, a target of 70 m³/ha of storage is anticipated to be achievable, which has been incorporated into the stormwater management strategy and dual drainage PCSWMM model as described in the following sections. It should be noted that the Conceptual Grading Plan was developed to target an overall balanced of cut and fill for the residential lands rather than on a phase-by-phase basis.

There are two (2) Blocks zoned as Industrial/Commercial on western part of the Study Limits, bounding Borrisokane Road, as shown on the Concept Plan (Appendix D); the Northern Block (13.22 ha) and Southern Block (3.19 ha).

Given that a Site Plan or Concept Plan was not available for these Blocks, the Master Storm (Drawing MST in Appendix K) and Master Grading (Drawing MG1) were developed for the Industrial/Commercial Lands to consider the following:

- **Northern Industrial Block:** Runoff from the entire northern Industrial Block is proposed to discharge into a storm sewer system along Moyard Drive, along the storm sewer reach from STMH631 to STMH630A to STMH630 (refer to Drawings KS1 and MST in Appendix K). This receiving storm sewer consists of a traditional storm sewer supplemented by an EES, as both contributions do not require any additional quality treatment. Stormwater from this Block combined to the areas with an EES will be conveyed easterly along Moyard Drive and then southerly along Elevation Road to the proposed stormwater management dry pond located within Block 61, at STMH600, thereby by-passing the filtration dry pond.

- **Southern Industrial Block:** Runoff from the entire southern Industrial Block is proposed to discharge into a storm sewer system flowing northerly along Moyard Drive, from reach from STMH680 to STMH651 to STMH650 (refer to Drawings KS1 and MST in Appendix K). The discharge of runoff from the southern block into this storm sewer system consists of a traditional system supplemented by an EES, as contributions do require any additional quality treatment. Runoff from these will be conveyed northerly and then easterly along Moyard Drive and eventually discharge in a dedicated storm sewer system from STMH 606 to STMH605 along Elevation Road, which flows southerly to the proposed stormwater management dry pond within Block 61, at STMH600, thereby by-passing the filtration dry pond.

As a result of the above-noted sewer servicing strategies, the northern and southern Industrial Blocks will entirely be disconnected from the Thomas Baxter Municipal Drain. In support of the urbanization of the southern Industrial Block, Minto had retained Paterson to provide guidance with this future development. A bathymetric survey and Memorandum were prepared by Paterson with geotechnical recommendations to infill the existing man-excavated pond. Refer to Appendix E for the Memorandum and Bathymetric Survey, prepared by Paterson.

3.5 Stormwater Drainage Criteria

3.5.1 General

A thorough review of relevant background reports was completed as part of the 2016 ECR supporting the BSUEA MSS. A synopsis summarizing that review was included in the BSUEA MSS (2018).

The stormwater management design target developed as part of the BSUEA MSS considered all relevant reports to the Study Area, the Existing Conditions Reports prepared by Minto's Consultant Team as well as the Ottawa Sewer Design Guidelines and MECP's Stormwater Management and Planning Manual (2003). Similarly, the adjacent S1 Area is also bound by the recommendations of the Existing Conditions Reports prepared by all Minto's sub-consultants and the following background reports:

- The Jock River Reach 2 Subwatershed Study (2009)
- Corrigan Stormwater Management Facility and Design Brief (2010).
- The Lower Rideau River Subwatershed Report (2012)
- The Mud Creek Subwatershed Study (2015)
- The Barrhaven South Urban Expansion Area Master Servicing Study (BSUEA MSS) (2018).

Given that the BSUEA MSS (2018) was prepared while accounting for the recommendations from the other four (4) studies, the S1 Area should also meet the same stormwater management criteria and design objectives along with the requirements of the latest Sewer Design Guidelines (December 2025).

The following sub-sections summarizes the stormwater management targets as follows: Section 3.5.2.2 provides details on water balance, Section 3.5.2.3 on water quality, Section 3.5.2.4 on erosion while Section 3.5.2.5 on water quantity. Similarly, minor and major systems design criteria, is described in Section 3.5.3 and Section 3.5.4, respectively.

3.5.2 Stormwater Management Design Targets

3.5.2.1 General

The stormwater management design targets established as part of the 2018 BSUEA MSS were extended to the S1 Area in accordance with this Addendum Report. Those targets were combined with those included in the SDG (December 2025) and the city's CLI-ECA (particularly those under Appendix), in establishing the overall design criteria for the S1 Area.

3.5.2.2 Water Balance

A water balance analysis was carried out as part of the BSUEA MSS (2018) which assessed the pre- and post-development infiltration regime while accounting for the proposed infiltration measures. As part of the 2018 BSUEA MSS, a statistical analysis was completed which demonstrated that infiltration measures along local roads, sized to capture and infiltrate the 22 mm event, was sufficient to maintain the pre-development infiltration condition when supplemented with rooftop infiltration within private blocks. This strategy was also found to meet the 80% TSS removal.

The Existing Conditions Report (March 2025) included the pre-development water balance for the S1 Area, which is summarized in Section 3.6 of this document. In light of Table A2 of the CLI-ECA, the following constraints will prevent the use of the EES:

- ✓ Areas of high groundwater levels - Constraint (b)
- ✓ High Risk Activities – Constraint (e)
- ✓ Source protection Restrictions – Constraint (f)

As a result, the implementation of the EES along local roads, to the maximum extent in areas not impacted by the above-noted constraints, is to be targeted to capture/infiltrate the 22 mm event which is to be supplemented by rooftop infiltration using sub-surface systems within both Industrial Blocks.

3.5.2.3 Water Quality

Constraints identified in Section 3.5.2.2 will prevent the use of infiltration measures throughout the S1 Area. In turn, areas impacted by these constraints, will require to be serviced by LID filtration measures, to the maximum extent.

The LID filtration solution should be sized to control the storm event identified as part of a water balance analysis carried as part of the 2018 BSUEA MSS and updated in this document. Accordingly, the design target of 22 mm was used as the design capture for both LID infiltration and filtration solutions.

The proposed LID filtration solution should also achieve an 80% TSS removal, consistent with the water quality objectives associated with the Jock River. The adherence to this water quality objective can be achieved by a single servicing solution or by a combination of measures designed as a treatment train approach. As per the CLI-ECA, an 80% TSS should be targeted for the proposed filtration solution.

3.5.2.4 Erosion Control

Off-site discharges should consider erosion potential for the given sub-watershed if the point of discharge is not a storm sewer system. For any areas serviced by an EES, erosion will not be of concern as the smaller and frequent events will be captured and infiltrated. In terms of erosion for the areas serviced by the preferred LID filtration solution, the peak flows will be captured, detained and slowly released to the dry pond. Erosion targets have been developed based on the following discharge points:

- Off-site discharge to the existing Quinn's Pointe storm sewer system will not require any special provisions as it will be limited to the discharge rates identified as part of the overall Quinn's Pointe Subdivision design, to ensure that the integrity of the storm sewer system is maintained.

- Off-site discharges to existing open ditch systems should be reviewed for both Borrisokane Road and Barnsdale Road. If both peak flows and runoff volumes have been decreased under post-development conditions (i.e., 4-hour 25 mm storm and the 1:2-year storm), erosion potential should not be of concern (refer to Section 3.13.4).

3.5.2.5 Water Quantity

Both minor and major systems should be designed to meet the criteria discussed in the sections below, including Sections 3.5.3 and 3.5.4. Given that this Addendum is developed at the functional level, assumptions were made to evaluate both minor and major systems up to the 100-year and during the climate change event (100-year + 20%) as per the SDG.

In terms of flooding, water quantity control is to be provided to limit the post-development peak flows to either the peak flow limitations of the receiving infrastructure or those under pre-development conditions.

3.5.3 Minor System

Storm sewers servicing the S1 Area are to be designed in accordance with the SDG as summarized below:

<u>Design Capture and Level of Service</u>

- Minimum 1:2-year and 1:5-year capture for local and collector roads, respectively.
- 1:5-year for both Industrial blocks.
- 1:10-year capture for arterial roads, transitway or any depressed driveways, where applicable.

<u>Design Flows</u>

- Initial sizing of storm sewers via the Rational Method design sheets with final sizing to be confirmed via a hydraulic grade line (HGL) analysis.
- Rainfall intensity-duration-frequency (IDF) statistics as per SDG.
- Time of concentration (Tc) calculated based on an inlet time of 10 minutes and 15 minutes for the industrial lands.
- Runoff coefficients (Rc) to reflect proposed development. The Rc for the S1 Area was based on recently approved developments in Quinn's Pointe and consistent with the SDG.

Design Criteria

Design Criteria as per the SDG:

- Minimum velocity 0.80 m/s
- Maximum velocity 6.0 m/s
- Manning roughness coefficient 0.013
- Minimum allowable slopes See Table 6.1 of the OSDG
- Minimum depth of cover 2.0 m
- Minor losses at manholes set in accordance with Appendix 6B of the OSDG
- Inlet control rate to be achieved with inlet control devices (ICDs) with minimum capture of 1:2 year for locals, 1:5 year for collectors and 1:10 year for arterials.

3.5.4 Major System

Storm servicing was developed following the dual drainage concept with the minor system sized based on the criteria set out in Section 3.5.3, while the major system is configured based on the criteria outlined below and evaluated in accordance with the SDG.

Road Types and Allowable Flow Depths

- Local: 350 mm at edge of pavement
- Collector: 250 mm at edge of pavement
- Urban Arterial: No barrier curb overtopping; arterial should be designed to leave one lane free of water in each direction during the 1:100-year design storm.
- In the absence of barrier curbs, flow shall not encroach into adjacent private property.

Maximum Flow Velocity on Streets

The product of velocity (m/s) and depth (m) of overland flow on streets shall not exceed 0.6 during a 1:100-year peak flow.

Major System Flow Outlets

Major system flow should be directed towards either a watercourse/ditch or to a SWMF.

3.5.5 End-of-Pipe Facility

Any end-of-pipe control measures, either dry ponds, wet ponds, or filtration dry ponds recommended in this Addendum should be conceptually sized in accordance the SDG and MOE’s publication entitled “SWM Planning and Design Manual, 2003” and other relevant source of dataa.

Given that the 2008 BSUEA MSS recommended two (2) dry ponds due to significant presence of EES which results in the capture and infiltration of frequent storm events, this service option will also be extended to the S1 Area with the addition of a filtration LID solution in accordance with the CLI-ECA.

3.6 Existing Conditions Water Budget

The water budget of a given area is often studied by hydrologists and hydrogeologists to better understand the movement of water through its various stages. Natural watershed systems maintain a balance between precipitation, runoff to water bodies, infiltration to the groundwater system, evaporation from water surfaces or transpiration from vegetation, completing the natural cycle back into atmospheric moisture and precipitation. This type of analysis establishes the baseline condition and would be used to assess any future changes in infiltration to subsurface water-bearing zones. It is also used to predict changes to the hydrological cycle that will result from urbanization with LID solutions.

A continuous hydrological model is often used to understand the water budget for a given area. As described in the ECR (refer to Appendix B), the PCSWMM software platform was also used to assess the water budget as part of the BSUEA ECR and MSS competed in 2017 and 2018, respectively by JLR. Since the approach and methodology was adopted by both the City and RVCA, the PCSWMM platform and modelling approach was once again utilized for this analysis.

The water balance assessment completed for the S1 Area was based on PCSWMM's simplified groundwater and snowmelt modules that allow continuous simulation of the water budget, including the elements of evapotranspiration, the groundwater table (lower saturated zone), snowfall and snowmelt.

Section 6.2 of the 2025 ECR summarized the continuous simulation results of the water budget. Specifically, Table 6-4 of the ECR (Appendix B) shows each component of the water budget which accounts for the annual precipitation depth of 864 mm. The components of the water budget were reported as followed (refer to the 2025 ECR for PCSWMM water budget modelling files):

- Evapotranspiration accounts for approximately 59% (513 mm).
- Infiltration accounts for approximately 34% (297 mm).
- Surface runoff accounts for 7% (61 mm).

Figure 5 below summarizes graphically the various components of the existing condition water budget while a more detailed breakdown is provided below as reported in the 2025 ECR.

Figure 5: Existing Conditions Water Budget

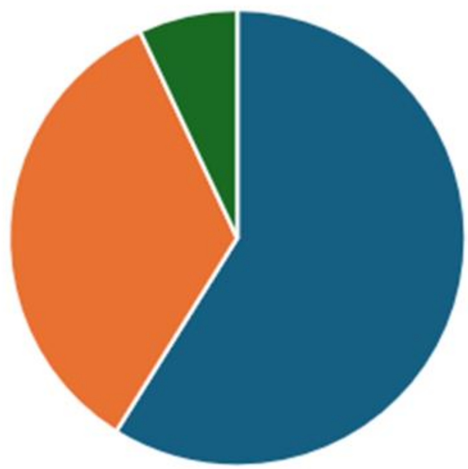


Table 1: Water Budget Continuous Simulation Results

Annual Water Budget Component	Annual Average Depth to Jock River (mm)	Annual Average Depth to Mud Creek (mm)	Annual Average Depth to Rideau River (mm)	Area Weighted Total (mm)	Budget %
Precipitation	864	864	864	864	100%
Evapotranspiration	509	531	509	513	59%
Infiltration	296	314	286	297	34%
Surface Runoff	83	60	0	61	7%

It should be noted that the Rideau River does not receive surface runoff directly from the S1 Area. However, infiltrated runoff does contribute to the groundwater catchment of the Rideau River. This is reflected in the results in the above Table.

Based on the above summary Table, infiltration under existing condition accounts for approximately 34% of the total annual precipitation of 864 mm when the three (3) receivers are combined, while surface runoff accounts for approximately 7% on a yearly average.

3.7 EES Monitoring (On-Going)

3.7.1 Monitored Rainfall Events

Monitoring of the EES was made a condition of approval within the Quinn's Pointe subdivision to gather data and confirm the suitability of the design parameters adopted during the preliminary design of the EES as part of the 2017 BSUEA. To facilitate monitoring, the city advised that it should be completed using the SmartLevel™ technology supported by Link Utility Technology as it has been tested and adopted by the City's Operation Group. In parallel, monitoring of rainfall events was carried out using the SmartRain™ system to collect real-time precipitation data. The objective of the monitoring was as follows:

- Determine the spill occurrences and identify under which rainfall events results in spills into the conventional storm sewer system occur; and
- Determine the drawdown time and identify the time it takes for the drawdown of the EES following a rainfall event.

Three (3) monitoring locations have been set up within Quinn's Pointe Stages 2 and 3. The locations were established to cover various sizes of serviced areas; a small area at MHST82176 (2.6 ha), a mid-size area at MHST82182 (7.6 ha) and a larger serviced area at MHST83698 (20.5 ha).

Level monitoring was initiated once a minimum occupancy of 80% of the serviced area was achieved. Level monitoring was initiated in June 2022 for one of the stations while monitoring for the other two (2) stations was initiated in November 2022. Given the 22 mm capture, the review of the monitored data mainly focused on events of 22 mm or greater magnitude.

Of the 235 monitored events, twenty-seven (27) had total rainfall depths greater than 22 mm. The events greater than 22 mm depth are listed in the Table below in descending order of total rainfall depth.

Table 2: Recorded Rainfall Events (>22 mm and 0°C)

Date	Event Start	Event Duration (hrs)	Peak Intensity (mm/hr)	Total Event Rainfall Depth (mm)
August 7, 2022	2:00 PM	46	19.81	92.07
April 29, 2023	9:00 AM	122	5.33	76.83
June 6, 2024	3:00 AM	60	16.51	61.15
August 10, 2023	12:00 PM	11	28.96	58.2
August 7, 2023	8:00 AM	28	14.73	54.28
August 8, 2024	7:00 PM	22	7.62	48.63
October 30, 2025	10:00 AM	37	4.32	47.07
September 18, 2022	10:00 AM	50	12.95	38.65
August 17, 2024	1:00 AM	63	8.64	38.21
June 21, 2024	9:00 AM	74	9.91	37.88
July 9, 2024	7:00 PM	49	8.38	37.1
May 27, 2024	9:00 AM	33	12.19	33.43
April 11, 2024	8:00 AM	57	4.32	31.8
October 7, 2025	10:00 AM	16	9.4	30.9

Date	Event Start	Event Duration (hrs)	Peak Intensity (mm/hr)	Total Event Rainfall Depth (mm)
July 24, 2024	8:00 AM	13	9.4	30.2
October 6, 2023	10:00 AM	33	12.95	29.64
November 11, 2022	3:00 PM	14	5.84	29.12
July 15, 2023	9:00 PM	12	14.99	28.33
July 11, 2022	7:00 PM	24	17.78	28.27
August 28, 2025	3:00 AM	40	11.43	27.26
November 20, 2024	11:00 PM	47	2.54	27.14
July 21, 2023	12:00 AM	21	8.64	25.19
June 26, 2023	1:00 AM	22	15.24	24.98
July 18, 2022	7:00 AM	15	7.62	24.78
May 21, 2024	6:00 AM	15	14.73	24.33
July 24, 2022	12:00 PM	14	8.89	23.26
April 18, 2025	4:00 PM	18	9.65	22.26

Based on the above, the monitored events spanned, in general, between 22 mm to 92 mm with most of the events ranging between the 25 mm - 40 mm. The most significant event of 92 mm occurred over 46 hours and its 12-hour intensity was established to be comparable to a 1:10-year event when compared to the Ottawa IDF statistics.

3.7.2 EES Performance

Ten (10) out of the 27 events have resulted in flow conveyed by the traditional storm sewer, referred as a spill event. These events are considered to have occurred when the depth recorded in the manhole is above the invert elevation of the conventional sewer. Monitoring details along the three (3) monitoring stations follows (refer to Table 3 below):

- MH309: A single spill occurred on August 7, 2022, which was triggered by a 92.07 mm event.
- MH327; No spills were recorded.
- MH109: Nine (9) spill events were monitored – MH located at the intersection of Edenderry Way and Oranmore Lane.

Table 3: Spill Event Summary

Event	Location	Rainfall up to Spill Event (mm)	Duration of Spill Event (hrs)	Total Event Rainfall Depth (mm)	Drawdown Duration
August 7, 2022	MH309	22.48	5mins	92.07	2hrs 56mins
April 29, 2023	MH109	37.3	2hrs 50mins	76.83	47hrs 12mins
August 7, 2023	MH109	39.13	5hrs 41mins	54.28	56hrs 18mins
August 10, 2023	MH109	12.09	5hrs 5mins	58.2	45hrs 41mins
May 27, 2024	MH109	24.21	4hrs 16mins	33.43	231hrs 15mins
June 6, 2024	MH109	41.33	2hrs 45mins	61.15	16hrs 40mins
June 26, 2024	MH109	17.12	2hrs 25mins	17.12	55hrs
July 9, 2024	MH109	34.83	2hrs 25 mins	37.1	10hrs 10 mins
March 16, 2025	MH109	9.39	3hrs 23 mins	12.88	40hrs 50 mins
October 7, 2025	MH109	21.47	4hrs 46 mins	30.9	23hrs 47 mins

As shown above, the performance of the EES at both MH327 and MH309 by far exceed the design basis of the system, being the capture of a 22 mm rainfall event. The only recorded spill at MH309 was triggered by an event that exceeded 22 mm.

All the spills, apart from one event at MH309, occurred at MH109. The spills were triggered by storms exceeding 22 mm, except for three (3) events with rainfall of ±12 mm (August 10, 2023), ±17 mm (June 26, 2024) and ±9.4 mm (March 16, 2025). Details on these events follow:

- The August 10, 2023, event (58.2 mm) occurred less than 48 hours after the end of the August 7, 2023, rainfall event which had totaled 54.28 mm. On August 10, 2023, the slow drawdown continued, indicating elevated groundwater at that station.
- The spill events that occurred on June 26, 2024 (9:45 PM), was found to occur immediately after three (3) consecutive storms occurring between June 21st, 2024, to June 25th, 2024, totalling 55.24 mm.
- The March 16, 2025, event was during high groundwater reflecting typical spring freshet.

Based on the monitoring completed from 2022-2025, the performance of the EES in general exceeds the design capture of the system at 22 mm. However, one of the three (3) monitoring locations (MH109), has most of the spills shown in the above table. It should be noted that at that location, a separation less than 1 m (actual separation was 0.28 m) exists between the recorded seasonally high groundwater table and the bottom of the granular which explains why spills at that location are encountered more frequently.

3.7.3 Winter Performance

The annual EES monitoring Reports included graphical results showing monitoring results throughout the year including winter months, spanning from December until end of February. Although there are fewer precipitation events during this window, the data indicates that runoff from rain-on-snowmelt events, when applicable, is transmitted to the EES and infiltrated (refer to Annual EES Monitoring Reports), assuming that CB grates are fee of ice. The Table below summarizes a few winter events captured by the EES which were infiltrated.

Table 4: Winter Events Captured by EES

Date	Event Start	Event Duration (hrs)	Peak Intensity (mm/hr)	Total Event Rainfall Depth (mm)
January 9, 2024	5:00 AM	29	6.35	29.3
January 4, 2023	2:00 PM	9	4.32	13.51
December 16, 2024	8:50 PM	13	2.79	8.83

3.7.3.1 Drawdown Time During Winter Months

Based on the review of the monitoring data, it appears that drawdown of the EES (to the invert of the inlet of the EES) during winter months, continues to occur within the duration of the rainfall event or within a short period following the rainfall event based on Figures 6,7 and 8 below.

Rainfall events that occur during the winter are generally smaller in depth and have a smaller storm intensity as is expected during colder periods of the year. However, the below table and figures demonstrate that the EES continues to infiltrate during winter months event if the overall average rate of 18 mm/hr is slightly inferior to the design rates used in the MSS modelling. The design rates varied between 19.96 mm/hr to 20.63 mm/hr to 28.42 mm/hr depending on location. The rates used were as per the on-site testing results from the Geotechnical Engineers with a 2.5 factor of safety applied. Thus, the monitoring data shows a faster drawdown rate when compared to the simulated drawdown. A faster drawdown rate should allow a greater capture of the back-to-back events, which in turn, will generate greater infiltration.

Table 5: Winter Drawdown Rate Calculations (MH309)

Date	Rainfall Event depth up to Dry Period (mm)	Start Recorded Level (mm)	End Recorded Level (mm)	Dry Period Duration (hrs)	Total Event Rainfall Depth (mm/hr)
January 10, 2024, 11:00am	29.3	573	400	6.92	25
December 17, 2024, 10:10am	8.83	511	400	12.33	9
January 4, 2023, 11:00pm	13.51	585	400	9.3	20
Average Rate					18

Figure 6: Drawdown Rate Chart (January 2023 Event)

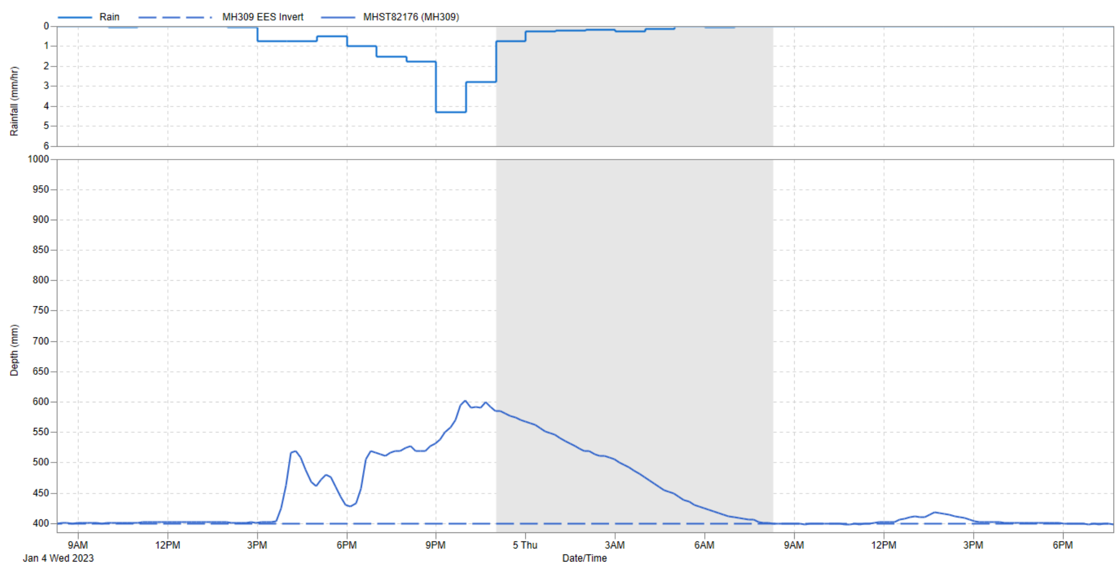


Figure 7: Drawdown Rate Chart (January 2024 Event)

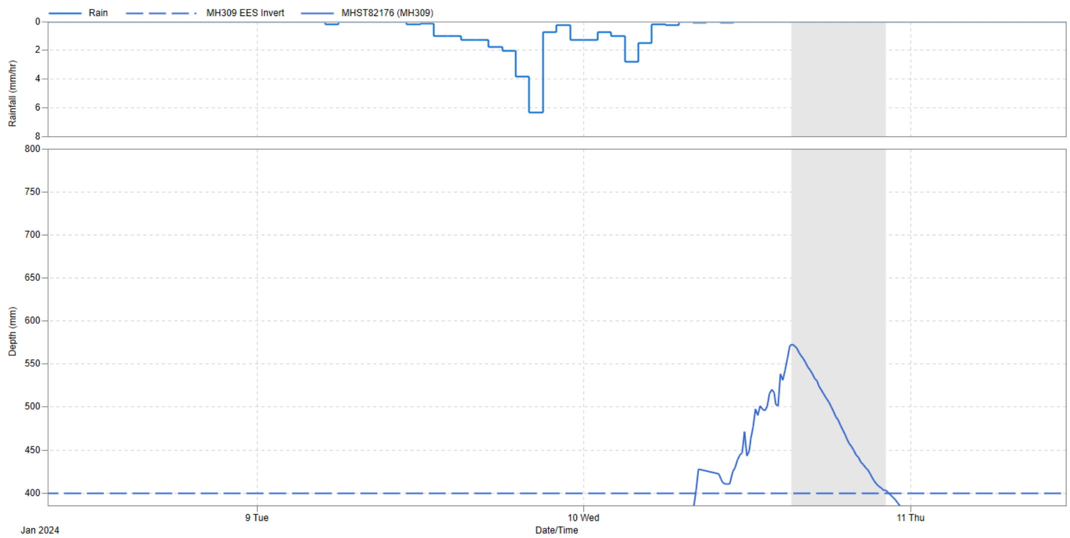
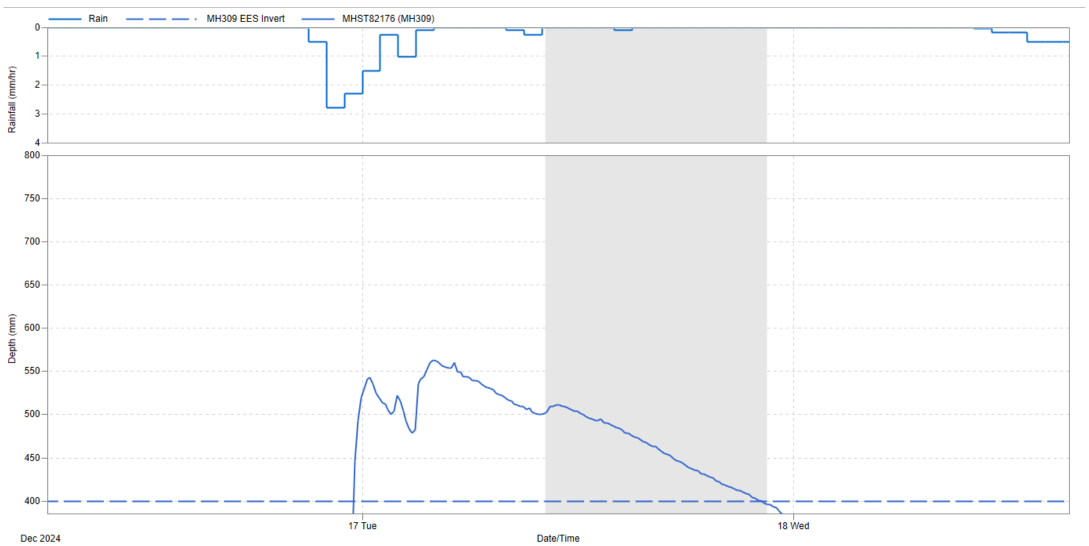


Figure 8: Drawdown Rate Chart (December 2024 Event)



3.7.4 Operation and Maintenance Activities - EES

Operation and Maintenance (O&M) activities are essential to ensure the long-term functionality and performance of a newly installed EES. As for the systems operational in Quinn's Pointe Subdivisions, the proposed EES will become part of the city's wastewater collection system.

A Draft Operation and Maintenance Manual (OMM) was prepared and included in Appendix L. The Manual is intended in assisting the city with typical procedures to reduce the risk of blockages and other events which could trigger costly emergency interventions and would extend the system's service life (refer to Appendix L). The Draft Manual will be updated during detailed design of Stage 6 based on comments issued by the city.

3.8 Consolidated Linear Infrastructure Environmental Compliance Approval

In 2022, the Ministry of the Environment, Conservation and Parks (MECP) launched a new approval process with the goal of modernizing the approach to authorize construction of linear infrastructure and stormwater management facilities. The intent of the framework was to reduce efforts on both the Ministry and with Municipalities by setting up a consistent set of conditions to improve environmental protection. By doing so, the old system which consisted of the issuance of individual Environmental Compliance Approval (ECA) would be replaced by a system that relies on pre-authorization of works with conditions. The new system adopted by MECP is referred to as the Consolidated Linear Infrastructure Environmental Compliance Approval (CLI-ECA).

On December 10, 2025, and January 27, 2026, the City of Ottawa received their CLI-ECA for storm and sanitary, respectively. The transition period for the storm CLI-ECA is identified as December 26, 2026. However, the transition does not apply to the S1 Area as the infrastructure is proposed and will be constructed in 2027. The said infrastructure will need to be designed in accordance with MECP's document entitled "Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under an Environmental Compliance Approval (May 31, 2023)".

3.9 Evaluation of Servicing Strategies

3.9.1 General

A stormwater management strategy has been developed on a functional level basis based on the following constraints/targets:

- Residual capacities of existing storm outlet sewers (Section 3.2).
- Off-site post-development peak flow and runoff volume discharging to MTO's Borrisokane Road open ditch system will be limited to those of the pre-development condition.
- Off-site post-development peak flow and runoff volume discharging to the Barnsdale Road open ditch system will be limited to those of the pre-development condition.
- Off-site post-development peak flow and runoff volume discharging to the Thomas Baxter Municipal Drain, when the above contributions are accounted and will be limited to those of the pre-development condition.
- Runoff volume control target hierarchy, as presented in the screening process of the CLI-ECA, as follows:
    - Hierarchy Priority No. 1: LID Infiltration/retention
    - Hierarchy Priority No. 2: LID Filtration
    - Hierarchy Priority No. 3: Conventional treatment

Similar to the 2018 BSUEA MSS, the implementation of LID infiltration/retention alternatives to maintain pre-development water balance appears to be feasible based on actual measured data compiled by Paterson (Section 2.5.3). However, infiltration LIDs will only be possible in areas not impacted by constraints listed in Table A2.

Sections 3.10 and 3.11 summarize the screening process carried out that identified both preferred alternatives (infiltration-type and filtration LID), respectively within the S1 Area.

3.10 Screening Process - Infiltration-Type Servicing Strategies

3.10.1 General

In light of the runoff volume control hierarchy noted above, infiltration measures are to be maximized to the full extent while recognizing the constraints in Table A2 of the CLI-ECA before contemplating filtration servicing solutions. The following sub-sections summarize the screening process used to develop the preferred infiltration servicing strategies.

3.10.2 BSUEA MSS (2018)

Several infiltration-type measures were reviewed and evaluated in 2016 as part of a screening process undertaken as part of the 2018 BSUEA MSS. Infiltration measures reviewed included the following:

- Roof leader to soak away pits
- Perched rear yard CB with rear yard perforated system
- Previous catch basin with sand filter
- Etobicoke Exfiltration System (EES)
- Sub-surface infiltration trench.

From the screening of the above-noted practices, the 2018 BSUEA MSS determined that measures located within private properties were to be disregarded. It was concluded that the preferred infiltration LID solutions would consist of the following measures (refer to Appendix E of the 2018 BSUEA MSS, in Appendix C):

- **Etobicoke Exfiltration System (EES):** An EES along local roads, sized to capture the 22 mm event, based on measured groundwater levels would be sufficient to maintain the pre-development infiltration condition.
- **Other Infiltration Practice:** Infiltration of rooftop flows, as a source of clean water, should be adopted on all Site Plans, including school, library, Park & Ride, commercial blocks, etc. Infiltration should be conducted using sub-surface LID measures such as infiltration galleries, cistern, etc. that would be sized to capture and infiltrate the 22 mm event.

Several Memoranda were prepared in support of the above-noted recommended infiltration strategy being the EES along local roads (refer to Appendix C for the 2018 BSUEA MSS, with Memoranda included in Appendix E of that MSS).

As part of the 2018 BSUEA MSS, it was concluded that the implementation of an EES sized for a 22 mm capture along local roads was equivalent, on average, to 150 m^3/ha which surpasses the MECP's SWMPDM (20023). Additional details with respect to the achievement of the quality criterion, based on the 2023 SWMPDM, is provided in Section 3.11.6.2 and Section 3.11.6.3.

3.10.3 2026 Screening Process

The infiltration LID solutions recommended as part of the 2018 BSUEA MSS were extended to the S1 Area, when feasible, in areas not impacted by the constraints identified in Table A2.

Given the runoff volume target hierarchy, infiltration servicing solutions are set as highest priority and shall be developed to the maximum extent possible, as per the CLI-ECA. However, the use of infiltration LID solutions is to account for the constraints listed in Table A2, were deemed applicable. Constraints, which preclude the use of infiltration-type LID solutions, include the following:

- ✓ Areas of high groundwater levels - Constraint (b)
- ✓ High Risk Activities – Constraint (e)
- ✓ Source protection Restrictions – Constraint (f)

The above-noted constraints have been accounted for in the selection of areas where infiltration-type servicing solutions can be implemented.

3.10.3.1 Groundwater Mounding Risk

The new SDG (Appendix 10) requires that groundwater mounding calculations be supplied when the separation between the bottom of the EES and seasonal high groundwater is less than 1 m.

The routing of both storm sewer and EES was revisited from the initial version of the MSS (October 2025) with the minimum 1.0 m criterion set as a firm constraint. Based on the revised storm sewer and EES routing, all the proposed EES meet the minimum 1 m separation.

A Figure was prepared that displays the separation for all proposed EES reaches with the high seasonal groundwater level as measured by Paterson. This Figure, included in Appendix G, showed that the 1 m criterion is met.

3.10.3.2 Evaluation of Infiltration LID Servicing Alternatives

The feasibility of infiltration solutions was assessed using several criteria including high-risk activities, land use, areas of high groundwater. Based on this review, the S1 Area was broken down in several areas. For each of these areas, evaluation criteria table was developed based on a color-coding system where:

- Highly positive is shown in green
- Highly Negative is shown in red

Table 6 below provides a summary of the evaluation impact of infiltration LID alternatives being proposed with the design capture as they relate to individual growth areas located below (refer to Figure 9 for Location of Areas).

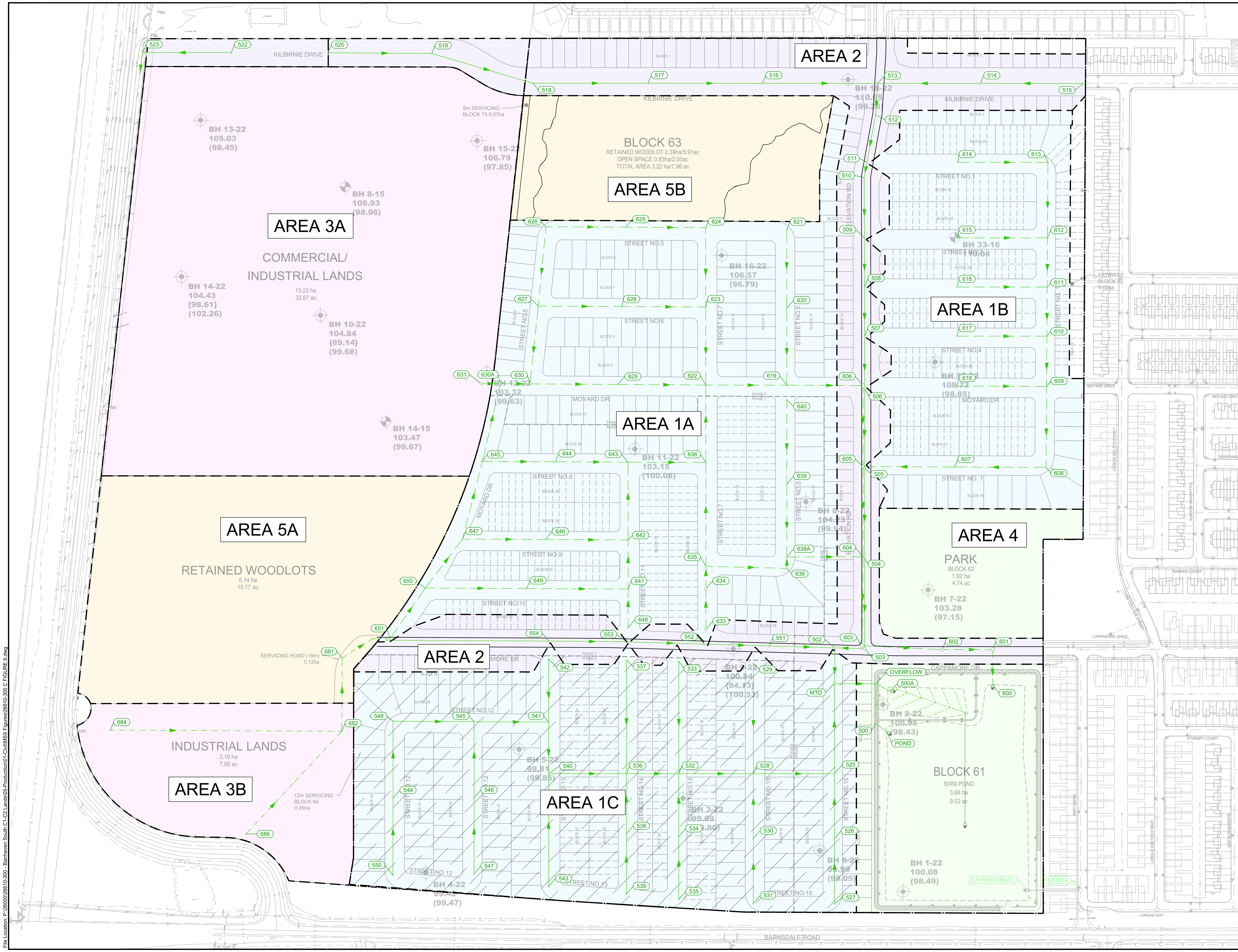
Table 6: Infiltration LID Evaluation Impact

Area No.	Area Type	Infiltration-Type LID	Impact Level	Relative Impact	Design Capture
1A & 1B	Local Roads > 1 m separation to groundwater	EES	Strong Positive Impact	Preferred	22 mm
1C	Local Roads < 1 m separation to groundwater	EES	Negative Impact	Least Preferred Constraint (b)	N/A
2	Collector Roads	EES	Negative Impact	Least Preferred Constraints (e) and (f)	N/A
3A & 3B	High Risk Areas Industrial Lands	Rooftop Infiltration (only)	Strong Positive Impact	Preferred	22 mm
3A & 3B	High Risk Areas Industrial Lands	EES along Roads or Parking	Negative Impact	Least Preferable Constraints (e) and (f)	N/A
4	Park Land[1]	Sub-surface Infiltration	Strong positive Impact	Preferred	22 mm
Area 5A & 5B	Woodlots[2]	N/A	N/A	N/A	N/A

Notes: [1] Servicing within the Park to be developed to maintain: i) pre-development infiltration levels by means of sub-surface methods and ii) pre-development peak flows and runoff volumes. Accordingly, water budget was simulated using the same parameters.
[2] Pre-development and post-development water budget was carried out using same parameters as the ecological function will remain.

Based on the above Infiltration LID evaluation impact table, the following conclusions are drawn:

- An EES system is to be implemented to capture and infiltrate the 22 mm event in Areas 1A & 1B when separation of 1 m exists between the bottom of granular and seasonal high groundwater table.
- Within the Industrial lands (Areas 3A and 3B), infiltration of rooftop flows is to be implemented using a sub-surface system to capture and infiltrate the 22 mm event.
- Filtration LID solutions to be developed to the maximum extent for Areas 1C & 2.
- Given that Areas 3A and 3B when developed, will include on-site stormwater management controls which will meet the applicable quality control criterion at the time of approval, filtration-type solution will not be accounted for these areas.



LEGEND:

- LIMIT OF STUDY AREA
- CONVENTIONAL STORM SEWER
- EES STORM SEWER
- INDUSTRIAL LANDS STORM SEWER
- EXISTING STORM SEWER
- UNCONTROLLED AREAS

OPPORTUNITIES:

- LOCAL ROADS WITH EES
- RETAINED WOODLOTS WITH EXISTING CONDITIONS INFILTRATION WITHOUT EES
- INDUSTRIAL LANDS: ROOFTOP INFILTRATION WITHOUT EES
- PARK AND POND WITHOUT EES INFILTRATION TO BE DETERMINED BY PARKS GROUP

CONSTRAINTS:

- LOCAL ROADS WITHOUT EES
- COLLECTOR ROADS WITHOUT EES

BH 8-15
106.93
(98.96)
BOREHOLE WITH MONITORING WELL FROM PATERSON REPORT PG6197-2 REVISION 1 DATED JUNE 27, 2025

DUAL SYSTEMS MAY BE PRESENT ON ELEVATION ROAD FROM MOYARD TO CAPPAMORE. TO BE CONFIRMED AT DETAILED DESIGN.

NOTE: KILBIRNIE ROAD, CAPPAMORE DRIVE AND ELEVATION ROAD ARE COLLECTOR STREETS.

No.	ISSUE / REVISION	DD/MM/YY
2	RE-ISSUED AS PART OF DRAFT MSS ADDENDUM	10/04/2026
1	ISSUED AS PART OF DRAFT MSS ADDENDUM	23/10/2025

VERIFY SHEET SIZE AND SCALES. THE BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:1500

CLIENT: minto Communities

CONSULTANT: www.jlrichards.ca J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP

PROJECT NORTH

PROJECT:
BARRHAVEN SOUTH
PHASE 3 - S1 AREA
3882 BARNSDALE ROAD

DRAWING:
INFILTRATION CONSTRAINTS AND OPPORTUNITIES

DESIGN:	KF/GF
DRAWN:	KC
CHECKED:	KF/GF
JLR #:	26610-300

DRAWING #: FIGURE 6

PLOT DATE: Friday, April 10, 2026 11:33:30 AM

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C FIGURE 6.dwg

3.11 Screening Process - Filtration-Type Servicing Alternatives

3.11.1 Design Constraints

Filtration LID solutions were developed to the maximum extent within the S1 Area, while recognizing that an EES is only being proposed in Area 1A and Area 1B as shown in Figure 9. As per the CLI-ECA, filtration LID solutions must also be reviewed the maximum extent.

Several filtration LID solutions were reviewed to the maximum extent within Area 1C and Area 2. In addition, the screening of filtration-type LID alternatives was completed while accounting with Constraint (n) - Economic Considerations. As a result, the selection of the filtration LID alternative also accounted for economic considerations when capital, lifecycle and/or operation and maintenance costs are taken into consideration.

3.11.2 Filtration-Type LID Solutions

Five (5) servicing alternatives were developed and screened using a set of criteria identified as having either major or minor influence on the evaluation. The filtration-type LID solutions consist of the following alternatives:

Alternative 1: Do Nothing
Alternative 2: Subdivision Level LIDs (Bio-Retention Bump-Outs and Porous Sidewalks)
Alternative 3: Stand Alone Manufactured Treatment Device (MTD)
Alternative 4: Pre-Treatment MTD + Underground Filtration Chambers
Alternative 5: Pre-Treatment MTD + Infiltration Dry Pond

A short description for each of the above alternatives is provided in the following sub-sections.

3.11.2.1 Alternative 1: Do Nothing

Alternative 1 is the standard “Do Nothing” option. Under this alternative, no servicing measure would be adopted. Accordingly, this alternative is considered as the baseline against the impacts of other alternatives when it is compared. This alternative does not address the identified issues and has only been carried forward as the baseline alternative for evaluation.

3.11.2.2 Alternative 2: Bump-Out Retention and Porous Sidewalks

This alternative consists of subdivision-level LID measures implemented along municipally owned ROWs with bump-out bioretention cells and porous sidewalks.

Bump-out bioretention cells: These are small, landscaped stormwater management features constructed along ROWs with engineered soil media, underdrains (where required), and vegetation tolerant of both dry and inundated conditions. Runoff enters the cell through curb cuts or inlets, allowing sediments and pollutants to settle and be filtered through the soil profile. Treated water would then be conveyed to the storm system via an underdrain. Bump-outs are typically integrated as a traffic calming measure along the ROW.

Given that they would be introduced in areas of high groundwater table (Area 1C) and/or along collector roads (Area 2), they would be designed to capture the 22 mm event and filer roadway and sidewalk runoff before being discharged as treated runoff back into the storm sewer system.

By intercepting runoff at the source, these systems improve water quality, reduce peak flows, and support LID filtration objectives.

In addition to stormwater benefits, roadway bump-out bioretention cells provide urban design and transportation advantages. They visually narrow the roadway, which can help calm traffic, shorten pedestrian crossing distances, and enhance streetscape aesthetics. When properly designed and maintained, these systems contribute to greener, safer, and more resilient urban environments while making efficient use of limited right-of-way.

Porous Sidewalks: would be implemented along the ROWs and allow runoff to flow along its surface where it would infiltrate through its surface and underlying soil or into a filter media. Given that porous sidewalks would be used in either the high groundwater area or along collector roads, this system would be underlain with a filter media. In addition to providing treatment via filtration, it would also provide the advantage of reducing peak flows discharging into the storm sewers.

3.11.2.3 Alternative 3: Stand Alone Manufactured Treatment Device

Another servicing alternative that would achieve the filtration requirements of the CLI-ECA would consist of implementing a single or multiple Manufactured Treatment Device(s) (MTD) at the downstream end of the storm sewer systems to meet the 80% TSS removal on its own. Given the size of the sewershed, multiple MTDs would be sized to meet the ISO 14034 Environmental Technology Verification (ETV) protocol as per Section 5.2.5 of the CLI-ECA.

To meet the ETV protocol, the treatment process of the MTD is based on filtration as opposed to dynamic settling of particulates. Commonly used MTD meeting the ETV protocol, include the Jellyfish® or Stormfilter®, distributed by Imbrium and Contech, respectively which could provide filtration of large sewersheds.

Filtration end-of-pipe MTDs are more onerous than regular oil grit separators (OGS), which no longer complies with the new MECP framework. The capital cost of a filtration type MTD is significantly more than a standard OGS as these are sized on fine particles as opposed to ETV particle size.

In addition to a higher capital cost, the operation and maintenance (O&M) costs for multiple end-of-pipe MTDs is more onerous and labor intensive when compared to the traditional OGS as individual filters would require to be rinsed and cleaned and be replaced on a bi-annual basis. These aggregate costs are in line with Constraint (n) of Table A2 (Economic Considerations).

3.11.2.4 Alternative 4: Pre-Treatment MTD combined with Filtration LID System

This storm servicing alternative would be implemented as a treatment train system, with pre-treatment provided by a manufactured treatment device (MTD) designed to capture the coarsest sediment fraction (TSS removal of ±35-40%). Effective pre-treatment is critical to protect the filtration chambers and underlying native soils from premature clogging and increased long-term maintenance requirements.

The MTD would be sized to achieve removal of coarse-to-medium sediment particles (±35-40% TSS). Following pre-treatment, runoff from the 22 mm event would be conveyed downstream into a flow splitter manhole where flows up to ±1.0 m^3/s would be directed into the underground system consisting of a series of Stormtech chambers, or approved equivalent, while flows in excess would be directed towards the downstream dry pond.

Runoff conveyed to the underground chambers would be spread among the eight (8) isolator rows for TSS removal, where it would be directed downward by gravity through the ADS's proprietary underlying non-woven geotextile. The separation and filtration properties of the geotextile would provide the required 80% TSS removal of total suspended solids (TSS).

3.11.2.5 Alternative 5: Pre-Treatment MTD combined with Filtration Dry Pond

Similar to Alternative 4, this servicing alternative would be implemented as a treatment train system, with pre-treatment provided by a manufactured treatment device (MTD) designed to capture the coarsest sediment fraction (ETV particle size) followed by a filtration dry pond. Effective pre-treatment is critical to protect the downstream filtration dry pond from premature clogging and increased long-term maintenance requirements.

The proposed filtration dry pond would function as a passive stormwater quality control measure that relies on bioretention soil media as the primary treatment mechanism. Runoff entering the facility would be temporarily stored within the pond and treated through vertical filtration as it percolates through the engineered bioretention soil layer, which is designed to promote sedimentation, filtration, and adsorption of pollutants. Beneath the soil media, an underdrain system installed within a clear stone envelope would collect the filtered runoff and convey it to the sub-drain system. The clear stone layer provides structural support, maintains hydraulic conductivity, and facilitates uniform drainage, while the perforated subdrains ensure positive drainage under low-permeability soil conditions and limit prolonged ponding. Together, the pre-treatment MTD and bioretention media and underdrain system provide effective removal of TSS (80% removal) while maintaining reliable long-term performance and manageable maintenance requirements.

3.11.3 Evaluation of Filtration LID Servicing Alternatives

The five (5) filtration-type LID alternatives were evaluated using a similar screening process adopted in Section 3.10.3.1. The evaluation of the five (5) servicing solutions was based on a similar color-coding system which was applied to each criterion to represent its relative level of impact as follows:

- Green: Most Favorable and Least Disruptive Impact
- Yellow: Moderately Favorable and Moderately Disruptive Impact
- Orange: Least Favorable and Most Disruptive Impact

The relative impact of each criterion across the five (5) alternatives was assessed with a different weight placed on the following key considerations:

i. Fish Habitat Protection: 5 Points
ii. Achievement of the CLI-ECA: 5 Points
iii. Impact on Esker: 5 Points
iv. Aesthetics/Safety: 3 Points
v. Construction Considerations: 3 Points

vi. Runoff Control Volume: 5 Points
vii. Operational Requirements: 5 Points
viii. Capital Cost Consideration: 5 Points
ix. Lifecycle Consideration: 5 points
x. O&M Cost Considerations: 5 Points

The alternative demonstrating the lowest overall negative impact and/or the strongest positive performance across these criteria was identified as the preferred solution.

3.11.4 Recommended Filtration-Type LID Solution

The screening of the above-noted five (5) alternatives has been summarized in an Evaluation Matrix in Table 7 (below). As previously noted, an emphasis was made on specific indicators by assigning a more important score of 5 and smaller emphasis on other criteria by assigning a score of 3.

The following conclusions are drawn from the screening process summarized in Table 7:

- **Alternative 1** (Do nothing) approach was deemed the most disruptive solution at a score of -50 and immediately dismissed.
- **Alternative 2** met the filtration objective; however, its score of -14 is indicative of being disruptive mainly due to the potential size of features, lifecycle and operation and maintenance costs (Constraint (n)) and disregarded from any further review/analysis.
- **Alternative 3** met the filtration objective; however, its low score of 1 is indicative of being moderately disruptive due to its substantial operation and maintenance costs (Constraint (n)) and also disregarded from any further review/analysis.
- **Alternative 4** met the filtration objective using the treatment train approach. The alternative shows a score of 21 which is indicative of a neutral rating. Its most adverse criteria lie with lifecycle costs which implicates the replacement of the geotextile fabric and replacement of all chambers. The timing of this costly replacement is unknown as this system appears to be relatively recent on municipally owned projects (less than 5 years old). The unknow lifecycle cost has reduced its rating when compared to other methods (Constraint (n)).
- **Alternative 5** also met the filtration objective using the treatment train approach. The alternative shows the highest score of all alternatives at 36 which is indicative of being the preferred solution. Similar systems have been implemented in Ottawa, and its long-term operation and maintenance requirements would appear to be less than Alternative 4.

Based on the above screening, Alternative 4 and Alternative 5 have scored the highest, with Alternative 5 shown as the preferred solution.

Table 7: Evaluation Matrix (Filtration Alternatives)

MAJOR CRITERIA	MINOR CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2 SUBDIVISION LEVEL LIDS	ALTERNATIVE 3 STANDALONE MTD	ALTERNATIVE 4 MTD UNIT + UNDERGROUND FILTRATION SYSTEM	ALTERNATIVE 5 MTD UNIT + FILTRATION DRY POND
DESIGN COMPONENTS		Do Nothing	ROW Bio-Retention Bump-Outs + Porous Sidewalks	Stand Alone MTD (ETV Sized)	MTD unit as Pre-Treatment Underground ADS Filtration Chambers	**MTD unit as Pre-Treatment + Filtration Dry Pond including**: Filter Media + Perforated drain/clear stone + Filtration Berm
NATURAL ENVIRONMENT	Fish Habitat (Jock River via Corrigan Pond) 5 Points	• Highly Disruptive -5 Points	• Improves water quality and enhances fish habitat protection 5 Points	• Improves water quality and enhances fish habitat protection 5 Points	• Improves water quality and enhances fish habitat protection 5 Points	• Improves water quality and enhances fish habitat protection 5 Points
TECHNICAL/ SOCIAL/ OPERATIONAL	CLI-ECA Objectives: Effectiveness of Alternative 5 Points	• Not Achieved -5 Points	• Bio-retention bump-out sized to capture and provide filtration of 4hr 22 mm • Porous sidewalk to accommodate runoff from the boulevard for the 4hr 22mm Measures in tandem to be sized to meet the filtration requirement of the CLI-ECA 5 Points	• MTD (single of multiple units) sized to achieve an 80% TSS removal (ETV particle) Servicing alternative would meet the filtration requirement of the CLI-ECA achieved 5 Points	• MTD unit sized as pre-treatment only (35-40%) based on ETV particle size • Underground ADS filtration chambers sized to achieve an 80% TSS removal Measures in tandem sized to meet the filtration requirement of the CLI-ECA 5 Points	• MTD Unit sized as pre-treatment (35-40%) based on ETV particle size • Infiltration Dry Pond to incorporate filtration components Measures in tandem sized to meet the filtration requirement of the CLI-ECA 5 Points
	Impact on Esker 5 Points	• Highly Disruptive -5 Points	• No Adverse impact – Filtration is used 5 Points	• No Adverse impact – Filtration is used 5 Points	• No Adverse impact – Filtration is used 5 Points	• No Adverse impact – Filtration is used 5 Points
	Aesthetics and/or Safety 3 Points	• Highly Disruptive -3 Points	• Bio-retention bump-out can adversely impact the aesthetics, if vegetation is overgrown • Safety concerns can exist with overgrown vegetation -3 Points	• MTD is a sub-surface feature not impacting aesthetics nor safety 3 Points	• MTD is a sub-surface feature not impacting aesthetics nor safety • ADS filtration system is a sub-surface system not impacting aesthetics nor safety 3 Points	• MTD is a sub-surface feature not impacting aesthetics nor safety • Infiltration dry pond offering no safety concerns as fully contained within Block 61 3 Points
	Construction Considerations 3 Points	• Highly Disruptive -3 Points	• Reduce on-street parking • Additional constraints with buried utilities • Limits future utility upgrades • Vegetation impacted by salts -3 Points	• MTD and Chambers buried along ROW and SWM Block • No impact on utilities 3 Points	• MTD and Chambers buried along ROW and SWM Block • No impact on utilities 3 Points	• MTD and Dry Pond located along ROW and SWM Block, respectively • No impact on utilities 3 Points
	Runoff Control Volume (22 mm) 5 points	• Highly Disruptive -5 Points	• Disruptive • Difficult to Achieve Solely at Roadway Sags -3 Points	• Can be achieved at a Higher Cost 0 Points	• Can be achieved 5 Points	• Can be achieved 5 Points

MAJOR CRITERIA	MINOR CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2 SUBDIVISION LEVEL LIDS	ALTERNATIVE 3 STANDALONE MTD	ALTERNATIVE 4 MTD UNIT + UNDERGROUND FILTRATION SYSTEM	ALTERNATIVE 5 MTD UNIT + FILTRATION DRY POND
	Operational Requirements **5 Points**	• Highly Disruptive **-5 Points**	• Routine inspections, debris and sediment removal, vegetation management, pruning & replanting • Mulch and bioretention soil media maintenance • Winter and roadway requirements (plowing) **-5 Points**	• Sediment depth monitoring (MTD) • Sediment flushing & removal (MTD) • Potential Cleaning of filters/blades **-5 Points**	• Sediment depth monitoring (MTD & chambers) • Sediment flushing & removal (MTD & Chambers) **0 Points**	• Sediment depth monitoring (MTD) • Sediment removal (MTD) • Sediment monitoring (infiltration dry pond) • Sediment removal (infiltration dry pond) • Bioretention soil media replacement **0 Points**
ECONOMIC CONSIDERATIONS	**Capital Cost** **5 Points**	• Not Applicable **-5 Points**	**High Capital Cost** **-5 Points**	**High Capital Cost** **-5 Points**	**Moderate Capital Cost** **0 Points**	**Least Capital Cost** **5 Points**
	Lifecycle Consideration **5 Points**	• Not Applicable **-5 Points**	• Replacement of vegetation (drought/salt) • Mulch and bioretention soil media replacement **-5 Points**	• Cartridges and/or blades to be replaced **-5 Points**	• Replacement of filtration fabric • Washing/replacement of clear stone **-5 Points**	• Replacement of soil amendment media • Washing/replacement of clear stone **0 Points**
	Operational & Maintenance Cost **5 Points**	• Not Achieved **-5 Points**	• Routine Inspections • Sediment and Debris Removal • Vegetation Management • Watering during plant establishment (first 1–2 growing seasons) • Pruning, replanting, and removal of invasive species • Replacement of dead or damaged plants • Mulch/Soil Media Aeration, Maintenance, and replacement • Winter and Roadway-Related Considerations – avoid stockpiling snow **-5 Points**	• Annual Inspection • Annual sediment and/or oil removal • Filters or blades rinsing every 1.5 year • Reinstallation of clean filters/blades every 1.5 year • Filter/blade replacement every 2-5 years • Other O&M procedures to be completed per manufacturer **-5 Points**	• Routine inspections • Annual sediment depth measurement in ports • Flushing and removal of sediments once 75 mm is exceeded • O&M procedures to be completed per manufacturer. **0 Points**	• Routine inspections • Annual sediment depth measurement in ports • Flushing and removal of sediments once 75 mm is exceeded • O&M procedures to be followed per manufacturer **5 Points**
OVERALL EVALUATION		**-50** **Highly Disruptive** **&** **Least Preferred**	**-14** **Disruptive** **&** **Less Preferred**	**1** **Moderately Disruptive** **&** **Less Preferred**	**21** **Neutral**	**36** **Preferred Solution**

3.11.5 Functional-Level Design Information

Conceptual level information is provided below for Alternative 4 while functional level information is presented for Alternative 5 (refer to Appendix F for details).

Alternative 4 - Pre-Treatment Manufactured Device with Filtration Chambers

High-level information is provided for Alternative 4, the option that scored the second highest at 21 as part of the screening process (Table 7) but not recommended for a more detailed review.

Alternative 4 was developed based on a treatment train servicing approach where an upstream Manufactured Treatment Device (MTD) has been conceptually sized for pre-treatment (35-40% TSS removal) followed by a commercially distributed sub-surface filtration system consisting of a series of underground chambers designed as isolator rows along with a bypass manhole. This system in tandem was sized to capture and provide filtration of the 22 mm design event.

High-level information was supplied at the onset by ADS; however, the information has not been revised to account for the latest changes in the hydraulic profiles which would result by using lower rise chambers and having a larger footprint which would provide increased filtration. Given that Alternative 4 is not the preferred option, the high-level information provided was deemed sufficient for the purpose of evaluating this servicing option. The information consists of the following:

- By-pass manhole (flow splitter) directing the 22 mm event to the filtration system while excess flows would by-pass the filtration system and be conveyed to the downstream dry pond.
- Pre-treatment MTD - Defender Model (FD-8HC) - ETV particle size.
- Stormtech Underground System consisting of:
    - Eight (8) Isolator rows (MC7200 chambers)
    - 88 MC7200 Chambers & 16 MC7200 End Caps
    - Sub-drain system including a by-pass manhole (flow splitter)
    - Clear stone above and between chambers
- The volume requirements of the system (±795 m^3) include the clear stone surrounding the chambers (void ratio of 0.40). Volumetric requirements based on the filtration capacity of the geotextile (4.1 gpm/ft^2) and the runoff hydrograph from the 22 mm storm.

High-level information from ADS is contained in Appendix F, including:

- Data on the proposed MTD (Defender FD-8HC)
- High-level concept of the Stormtech filtration chambers
- Manufacturer's Inspection and Monitoring requirements (page 4/5) of the attachment

The performance of the above-noted system is as follows:

- 37% TSS removal is provided by the MTD (Defender FD-8HC)
- 80% TSS removal by 8 Isolator rows
- 87 TSS removal combined between the MTD & filtration system
- 98.8% of total volume treated

The above-noted performance data is also contained in Appendix F.

Alternative 5 - Pre-Treatment Manufactured Device with Filtration Dry Pond

As per the screening process and Evaluation Table (Table 7), Alternative 5 scored the highest at 36. Consequently, it is recommended as the preferred filtration LID Solution. Functional level information is provided below for Alternative 5 (refer to Appendix F and Appendix K for Drawings).

Alternative 5 was developed based on a treatment train approach where an upstream MTD has been conceptually sized for pre-treatment followed by a filtration dry pond. Both MTD and filtration dry pond was sized to capture, pre-treat and provide filtration of the 22 event prior in being released into the adjacent dry pond.

Alternative 5 consists of the following components:

- Defender Model FD-8HC (ETV particle size)
- Flow-splitter manhole forcing the 22 mm to the filtration dry pond while flows in excess, would by-pass the filtration dry pond and would be conveyed to the downstream dry pond.

The simulated filtration rate of the facility was assumed to be consistent with the measured unfactored infiltration rates reported by Paterson in their Existing Conditions Report at BH2-22, the closest borehole, as the amended soil's performance would be similar.

An average infiltration rate of 126 mm/hr was, therefore, calculated based on two (2) measurements of unfactored infiltration rates at BH2-22. A 2.5 safety factor was then applied to the average unfactored infiltration rate of 126 /mm/hr for an overall effective assumed filtration rate of 50.4 mm/hr. The assumed filtration rate of 50.4 mm/hr is consistent with the amended soil filtration rate of 50 mm/hr recommended by Sustainable Technology Evaluation Program (STEP).

Configuration of Filtration Dry Pond consisting of:

- Operating Levels: 100.10m – 100.80 m
- 3:1 side slope
- Filtration rate: 50.4 mm/hr
- Maximum Ponding Depth prior to Spill: 700 mm
- Spillway (15 m wide): 100.80 m
- Footprint at elevation 100.10 m: 1,822 m^2
- Surface Area at Spill of 100.80 m: 2,235 m^2
- Volume of Filtration Dry Pond: 1,418 m^3
- Hydro-seeded footprint & side slopes
- Amended soil (bio-retention soil media) 500-700 mm filter media
- Choker Layer 100 mm
- Clear stone 300-350 mm
- subdrains (spurs & header) 150 mm and 200 mm
- Inspection/clean-out ports

The proposed servicing within Block 61 along with pre-treatment is shown on Drawing MST (Appendix K) with information included in Appendix F. The above-noted configuration of the filtration pond as well as the filtration rate will be reviewed at detailed design.

3.11.6 Water Quality Control Assessment - Infiltration/Filtration Practices

3.11.6.1 General

An 80% TSS removal has been historically used for any development tributary to the Jock River, Rideau River and/or Thomas Baxter Municipal Drain (Mud Creek). Storage volume requirements for different types of SWM practices to achieve an 80% TSS removal are identified in Table 3.2 of MECP's publication entitled "Stormwater Management Planning and Design Manual, March 2003".

Quality control requirements for municipal works have since evolved with the implementation of MECP's framework which is based on pre-authorized works defined in the CLI-ECA, particularly those described in Appendix A.

Section 3.11.5 identified the preferred filtration alternative as Alternative 5. It consists of a pre-treatment MTD combined to a filtration dry pond. Given that this Addendum extended the analyses and conclusions from the 2018 BSUEA MSS, the design capture of the 22 mm event was maintained. Hence, the capture of the 22 mm event was extended to the sizing of the filtration solution given that it also relies on infiltration/filtration through a bio-retention media.

As a parallel verification, the proposed infiltration and filtration LIDs is being reviewed against Table 3.2 to ensure that it meets its recommendations. Sub-sections 3.11.6.2 and 3.11.6.3 summarize the verification against Table 3.2.

3.11.6.2 Infiltration Practices

An EES is proposed within two (2) residential blocks located north of Cappamore Drive, and east and west of Elevation Road. These Blocks have been identified as Area 1A and Area 1B on Figure 9.

Based on the average imperviousness of ±64% for each residential areas serviced by an EES, a water quality storage of ±33 m^3/ha was calculated to be necessary to achieve 80% TSS removal based on interpolation between imperviousness of 55% (25 m^3/ha) and 70% (35 m^3/ha) for an infiltration SWM Practice. Based on an EES along local roads sized for the 22 mm event (per 2018 BSUEA MSS), the storage volume provided is equivalent, on average, to ±150 m^3/ha. Therefore, the proposed EES along local roads (±150 m^3/ha) by far exceeds the infiltration requirements of 33 m^3/ha, the enhanced level of protection per Table 3.2 of the SWMPDM. Consequently, no further downstream water quality controls are necessary for Areas 1A and 1B apart from the EES as it meets Table 3.2 and the CLI-ECA.

3.11.6.3 Filtration-Type Practices

The screening process presented in Section 3.11.2 to 3.11.5 concluded that the preferred filtration LID solution consisted of Alternative 5. It includes a pre-treatment MTD combined to a filtration dry pond. As noted, the pre-treatment MTD under Alternative 4 will provide a 37% TSS removal based on ETV particle size.

The filtration dry pond was sized to capture and filtrate the 22 mm event using a bio-retention soil media with an underlain sub-drain system and clear stone envelope. Although the effluent is not infiltrated, the filtration mechanism proposed remains equivalent to infiltration; however, the filtered runoff will be conveyed in the dry pond portion of Block 61 for quantity control.

The filtration dry pond described in Section 3.11.5 would service Area 1C (high groundwater table) along with Area 2 consisting of the three (3) collector roads due to roadway salts. When both Area 1C and Area 2 are combined, an overall area of ±20.4 ha and average imperviousness of ±67% was calculated. Given that the proposed filtration dry pond operates as an infiltration SWM practice with an underlain sub-drain system, a storage volume of 34 m^3/ha was estimated by means of interpolation between imperviousness of 55% (25 m^3/ha) and 70% (35 m^3/ha) for this SWM practice. Based on an area of ±20.4 ha and the storage volume of 34 m^3/ha, the filtration dry pond should be sized with ±700 m^3. As shown in Section 3.11.5, the volume provided is 1,629 m^3 thereby exceeding the volume of Table 3.2. Consequently, the filtration dry pond is found to meet both Table 3.2 and CLI-ECA (Appendix A).

The proposed servicing of Block 61 along with pre-treatment is shown on Drawings K1 and MST is well as on Drawing POND and D2 in Appendix K.

3.12 Storm and Stormwater Servicing Assumptions and Methodology

The design and evaluation of the proposed storm servicing strategy was undertaken with the PCSWMM platform. Several design parameters and assumptions have been made to support both minor and major system designs as described in the sub-sections that follow.

3.12.1 Runoff Coefficient

Surface runoff is generated when precipitation exceeds the infiltration capacity of the landscaped surface and/or the initial abstraction of hard surfaces. To assess runoff rates from the various surfaces, hydrological parameters representing different drainage characteristics were calculated. The type of land cover and associated hydrological parameters are based on area weighting of each catchment's imperviousness using the various breakdown shown in Table 8.

Table 8: Land Cover Drainage Parameters

Land Cover	Impervious (%)	Runoff Coefficient	Draining to Pervious (%)
Collector Roads	71	0.70	0
Local Roads	64	0.65	0
Parks	36	0.45	100
Woodlots	0	0.20	100
Single Family Residential	64	0.65	70
Townhouse Residential	64	0.70	70
Back-to-Back Residential	71	0.70	70
Industrial Lands	86	0.8	0

Based on the guidance of the SDG, Runoff Coefficients (C-Factors) associated with the various types of residential usages were based on actual impervious areas for the adjoining Quinn's Pointe subdivision. Similar housing product will be proposed as part of the S1 Area.

3.12.2 Storm Sewer Sizing

Preliminary sizing of storm sewers was carried out based on the design criteria listed in Section 3.5.3 for the proposed road patterns shown on the Concept Plan (Appendix D).

This exercise is intended to demonstrate the feasibility of the overall storm servicing strategy. The preliminary storm sewer layout and associated drainage areas are shown in the following drawings (Appendix K):

- KS1: Key Servicing Plan
- MG1: Master Grading Plan
- MST: Master Storm

Based on the above Drawings, storm sewer design sheets have been prepared and included in Appendix G. The traditional storm sewers along the various road types have been sized in accordance with the level of service identified in Section 3.5.3, being 1:2 year and 1:5-year capture for local and collector roads, respectively.

3.12.3 Roadway Sag Storage

The Master Grading Plan (Drawing MG1 in Appendix K) was developed to provide a route to safely convey major overland flow while minimizing earth works. To fulfill these objectives, grading along the major overland system will be carried out following a saw-tooth profile with low points introduced along the major overland system. Since detailed design will dictate the location and extent of the roadway sag depths, modelling was carried out assuming an on-site storage of 70 m^3/ha which reflects the storage achieved in the Quinn's Pointe Subdivisions. Roadways with flatter slopes will generate greater storage capacity, while those that are steeper will have limited storage capacity.

The design of the major overland system will allow runoff to be stored in the roadway depressions prior to its capture by the catch basins and inlet control devices (ICD). During infrequent events, runoff exceeding the rate of capture of the minor system and roadway sag storage will cascade along the major overland system.

3.12.4 Dual Drainage Modelling – Assumption and Parameters

The PCSWMM software platform was used to simulate hydrology with the given land use and corresponding imperviousness shown in Table 8Table 8 as well as confirming the preliminary minor and major systems and the assessment of the post-development water budget by modelling the infiltration opportunities documented in Section 3.10.3.

The software used combines the EPA SWMM engine within a powerful GIS environment. The PCSWMM dual drainage model will provide preliminary confirmation of the overland flow depths along the local/collector roads, feasibility of the proposed sewer sizing in terms of hydraulic grade line (HGL) elevations, confirm block sizing of Block 61, the assessment of the proposed infiltration measures and the off-site peak flow discharges. Model inputs and results are contained in Appendix L.

The dual drainage analysis uses a dynamic simulation to calculate the hydrology and hydraulics of the major and minor systems. The model has been developed based on the following:

- The Chicago and SCS design storms derived from the Ottawa Intensity-Duration-Frequency (IDF) statistics which were applied across catchments with characteristics area weighted imperviousness.
- Sag storage of 70 m^3/ha applied as a storage node for each residential sub-catchment.
- Both Industrial Blocks have been modelled assuming sufficient storage to self-contain their own runoff up to and including the 1:100-year storm in accordance with the SDG for the given land usage.
- A 1:2 year and 1:5-year design capture for the local and collector roads, respectively.
- Exit losses are applied at the downstream end of each section of sewer based on the SDG.
- Storm Sewers have a minimum cover of 1.3 meters below the proposed centre line grades shown on Drawing MG1. With this minimum freeboard to the HGL elevation, underside of footings (USFs) will meet the prescribed minimum freeboard of 300 mm.
- Several unfactored infiltration rates were used to represent the soil characteristics in areas where an EES is being contemplated. Paterson's unfactored infiltration rates were reduced by 2.5 to account for a safety factor. Simulated unfactored infiltration rates are presented in Section 3.13.1.1.
- The storage and filtration were simulated as a storage node along the minor system. This configuration within residential areas has proven to demonstrate the capture of the 22 mm storm and maintain pre-development infiltration conditions (refer to the BSUEA MSS, Appendix C).
- Roof areas in the Industrial Lands were assumed to reflect 30% of the overall area. The same assumption was used as part of the BSUEA MSS for any of the ICI Blocks. It was assumed that infiltration measures would be implemented to capture and infiltrate by means of sub-surface systems the 22 mm storm.

3.13 Simulation Results

Several types of simulations have been carried out to assess the performance of proposed servicing, including the water budget, sizing of linear infrastructure, major overland flow route, as well as confirming sizing of features in Block 61. Th following sub-sections provides these assessments.

3.13.1 Post-Development Water Budget

The existing condition water budget revealed that existing infiltration across the overall S1 Area accounted for 34% of the total annual precipitation based on long-term simulations (refer to Section 3.6 and ECR in Appendix B).

A similar analysis was carried out to assess the post-development water budget while accounting for constraints within the S1 Area as well as the opportunities within the S1 Area to incorporate an EES. As noted under Section 3.10.3, all EES being proposed provide the minimum 1 m separation between the seasonal high groundwater and the bottom of granular (refer to Appendix G for Figure displaying the separation between EES and groundwater). All EES lengths have been accounted for as part of the water budget and during detailed design best efforts will be made to utilize all EES lengths for the purpose of achieving the pre-development water budget. This is achieved by placing the plugs for the first reach at the downstream end. The sub-sections that follow provides the approach and assumptions made as part of the post-development water budget.

3.13.1.1 Simulated Infiltration Rates

The Existing Conditions Hydrogeological Report prepared by Paterson documented the hydrogeological condition within the S1 Area (refer to Section 2.5.3). As part of this undertaking, Table 3 documented the unfactored infiltration rates measured in the field.

The information summarized in Paterson's Table 3 along with other historical unfactored infiltration rate measurements were used to simulate the performance of the EES in various sub-areas (refer to Figure 9 for details). As shown in the table below, the largest area, namely Area 1A, was broken down into three (3) smaller areas; the northern part which consists of the area north of Moyard Drive, with two (2) smaller areas south of Moyard Drive consisting of an area to the west and one to the east.

It should be noted that the unfactored infiltration rates noted in Paterson's Table 3 were derived based on the Site Evaluation and Soil Testing Protocol (Appendix C) of the CVC/TRCA LID Manual. The simulated unfactored infiltration rates shown in Table 9 below, includes the 2.5 safety factor.

Table 9: Simulated Unfactored Infiltration Rates

Area No.	Borehole No	Average Unfactored Infiltration(mm/hr)	Effective[1] Unfactored Infiltration (mm/hr)
1A (northern) Aea north of Moyard	BH11-22 & BH16-22	109.5	43.8
1A (southwest) Area south of Moyard and west of Street 7	BH11-22 & BH18-15	88.5	35.4
1A (southeast) Area south of Moyard and east of Street 7	BH8-22 & BH9-22	72.5	28.9
1B	BH17-22 & BH18-22	84.0	33.6

Note[1]: Simulated unfactored infiltration was calculated by applying a safety factor of 2.5 on the average unfactored infiltration rate.

3.13.1.2 Post-Development Water Budget Findings

The post-development water budget analysis was carried out while accounting for EES reaches being implemented in the following areas (refer to Figure 9):

- All of Area 1A.
- All of Area 1B.

In terms of simulation of the EES in the above-noted areas, the same configuration and approach used in all stages of the Quinn's Pointe Subdivisions has been extended for the S1 Area. The configuration is based on the following:

- 1000 mm thick clear stone envelope, surrounded by geotextile
- 2-300 mm diameter perforated pipes, surrounded by geotextile
- Width of clear stone envelope is based on the following:
  - ✓ Sewer diameter plus 450 mm clearance on either sides for 900 mm diameter sewer or smaller
  - ✓ Sewer diameter plus 500 mm clearance on either side for sewers over 900 mm diameter.

The analysis was completed using Paterson's unfactored infiltration rates (refer to Section 3.13.1.1). A comparison was made between the existing and post-development water budgets with the modelling approach and assumptions summarized above.

Table 10: Post-Development Water Budget

Annual Water Budget Component	Annual Average Depth to Jock River (mm)	Annual Average Depth to Mud Creek (mm)	Annual Average Depth to Rideau River (mm)	Area Weighted Total (mm)	Budget %
Precipitation	864 [864]	864 [864]	864 [864]	864 [864]	100% [100%]
Evapotranspiration	248 [509]	262 [531]	252 [509]	249 [513]	29% [59%]
Infiltration	301 [296]	214 [314]	274 [286]	297 [297]	34% [34%]
Surface Runoff	316 [83]	389 [60]	339 [0]	319 [61]	37% [7%]

*Values in brackets ([ ]) represent pre-development values for purpose of comparison with post-development water budget values.

The above simulation results show that the infiltration strategy, as depicted on both MST in Appendix K capable in maintaining the existing condition infiltration rate of 34%.

Given that the existing water budget is maintained under post-development conditions with the proposed infiltration measures, the infiltration requirements of the CLI-ECA (Appendix A) will be achieved.

3.13.2 Dual Drainage

3.13.2.1 Minor System

It was generally assumed that the USF elevations are approximately two (2) meters below the road centerline grades. However, in cases where the storm sewers are relatively shallow, such as to prevent the EES from being located within the groundwater, risers and appropriate grading will be required to ensure a minimum freeboard of 300 mm is maintained between the sewer HGL and the USF elevations of the units.

3.13.2.2 Major System

The dual-drainage analysis was reviewed in relation to the performance of the major overland system. Elevations above the major system nodes have been extracted and shown in Table 11. As shown below, there is no ponding in the 1:2-year event and there is no ponding in the 1:5-year in the industrial sites or along collector roads. Moreover, the depth of flow along the major system is below 350 mm during the 1:100-year event. Simulation results for other storm events, including climate change and historical storms, have been summarized in Appendix L.

Table 11: Major Overland Flow Results

Major System Node	1:2 yr - 3 hr Chi Ponding Depth (mm)	1:2 yr - 24 hr Ponding Depth (mm)	1:5 yr - 3 hr Chi Ponding Depth (mm)	1:5 yr - 24 hr Ponding Depth (mm)	1:100 yr 3 hr Chi Ponding Depth (mm)	1:100 yr - 24 hr SCS Ponding Depth (mm)
S_525-MTD	10	10	40	40	230	200
S_528-525	10	10	40	40	190	170
S_536-532	10	10	80	70	250	230
S_619-606	10	10	50	50	230	220
S_622-619_2	10	10	60	60	240	230
S_604-603	10	10	40	40	180	170
S_541-540	10	20	60	60	200	190
S_622-619	20	40	90	90	230	220
S_605-604	10	10	50	50	220	200
S_627-630	10	10	30	30	150	140
S_532-528	10	10	40	40	170	150
S_540-536	10	10	60	60	210	200
S_629-622	10	10	50	50	180	160

As part of the MSS level modelling, only the critical sewers and trunk sewers are modelled to ensure that the site is serviceable and to which further details are typically refined during conceptual/detailed designs. However, to ensure accuracy and conservativeness within such a model, the time of concentration calculated in the Storm Sewer Design Sheet for each downstream sewer reach within a tributary area was used to calculate the Rationale Method minor system inflow from major system node to the minor system. As a result, in some instances Table 11 above will show that there is ponding in some areas during the 1:2-year event and in the 1:5-year in the industrial sites or along collector roads. However, once the model is further refined during the detailed design stage, drainage areas will be further delineated and will be tributary to individual storm sewer reaches in which case the rational inflow for each area will be calculated based on a 10 minutes time of concentration and will in turn eliminate any ponding during the 1:2-year event and in the 1:5-year in the industrial sites or along collector roads. Moreover, the depth of flow along the major system is below 350 mm during the 1:100-year event. Simulation results for other storm events, including climate change and historical storms, have been summarized in Appendix L

3.13.3 Proposed Dry Pond Expansion

An existing spill-over area exists within the S1 Area, in the southeastern portion of Block 61. This facility was constructed as part of Quinn's Pointe Subdivision to capture major overland flow being directed westerly given that it could not cross future Greenbank Road. The existing spill-over area is serviced by an existing outlet sewer (900 mm diameter storm sewer) discharging to the Inver Lane 1500 mm diameter storm sewer system. The 900 mm diameter outlet sewer was sized to empty the spill-over pond during infrequent storm events.

Drawings KS1, MST, POND and D2 provide the configuration of the proposed end-of-pipe facility consisting of the following elements (refer to Section 3.11.5 for additional details and Appendix F for information):

- Pre-treatment device - Defender Model FD-8
- By-pass manhole (flow splitter) forcing the 22 mm to the filtration dry pond while excess flows to by-pass the filtration dry pond and would be conveyed to the downstream dry pond.

  Filtration Dry Pond:
  - Surface Area at Spill of 100.8m: 2,235 m^2
  - Volume of Infiltration Dry Pond: 1,418 m^3
  - 700 mm thick of amended soil (bio-retention soil media)
  - 350 mm thick clear stone
  - 150 mm diameter sub-brains
  - Geosynthetic membrane

  Dry pond:
  - Volume prior to spill: 28.790 m^3
  - Outlet elevation: 98.45 m
  - Internal sloping: 1.0-1.3%
  - 3 m wide perimeter access road
  - Major overland flow route: Barnsdale Road (events > 100-year)

Once storm flows have been filtered by the filtration dry pond, they will merge with the treated flows from the EES and Industrial Lands and will be controlled by the existing outlet consisting of the 900 mm diameter storm sewer system. Table 12 and Table 13 (below) summarize key parameters relating to the configuration of these facilities.

Table 12: Filtration Dry Pond Configuration and Results

Pond Configuration	Filtration Dry Pond
Pond Invert (m)	100.10
Footprint Area (m^2) @ 100.10 m	1,822
Top of Spillway Area (m^2) @ 100.80 m	2,235
Top of Bank (m) at Spill	100.80
Active Storage Depth (m)	0.70
Elevation of 3 m wide Spillway (m)	100.80
Outlet Diameter (m)	N/A
Drawdown Time (hrs) - 4-hour 22mm Design Storm	17
Overall effective filtration rate (mm/hr)	50.4

Table 13: Expanded Dry Pond Configuration and Results

Pond Configuration	Expanded Dry Pond
Pond Invert (m)	98.45
Modelled Release Rate (m^3/s) - 3-hour Chicago Storm	0.349
Pond Top of Bank (m)	100.8
Active Storage Depth (m)	2.35
Freeboard to adjacent building envelopes(m)	>0.3
Outlet Bottom Orifice Elevation (m)	98.45
Outlet Bottom Orifice Diameter (m)	0.335
Outlet Upper Orifice Elevation (m)	100.8
Outlet Upper Orifice Dimensions (m)	250 mm x 900 mm
Drawdown Time (hrs) - 4-hour 22mm Design Storm	18
Surface Area (ha)	3.66

The operation of the filtration pond is provided in Table 14 below for the 3-hour Chicago storm distribution and Table 15 for the 24-hour SCS storm Distribution.

Table 14: Filtration Pond Operation (3-hour Chicago Storm)

Event	Max HGL (m)	Max Depth (m)	Total Inflow (L/s)	Peak Filtration Rate (L/s)	Max Volume (m3)
4-hour, 22 mm	100.67	0.57	768	26	1,139
1:2 year	100.90	0.80	1,729	26	1,654
1:5 year	100.95	0.85	2,190	26	1,764
1:100 year	101.06	0.96	5,807	26	2,009
1:100 year + 20%	101.10	1.00	8.047	26	2,122

Table 15: Filtration Pond Operation (24-hour SCS Type II Storm)

Event	Max HGL (m)	Max Depth (m)	Total Inflow (L/s)	Peak Filtration Rate (L/s)	Max Volume (m3)
1:2 year	100.92	0.82	1,926	26	1,698
1:5 year	100.95	0.85	2,210	26	1,768
1:100 year	101.04	0.94	4,964	26	1,959
1:100 year + 20%	101.08	0.98	6,837	26	2,066

The operation of the dry pond is provided in Table 16 below for the 3-hour Chicago storm distribution and Table 17 for the 24-hour SCS storm Distribution.

Table 16: Dry Pond Operation (3-hour Chicago Storm)

Event	Max HGL (m)	Max Depth (m)	Total Inflow (L/s)	Peak Minor System Release Rate (L/s)	Max Volume (m3)
4-hour, 22 mm	99.40	0.95	1,974	201	2,738
1:2 year	99.77	1.32	4,243	248	7,110
1:5 year	100.08	1.63	6,785	282	12,370
1:100 year	100.80	2.35	11,980	349	28,730
1:100 year + 20%	100.98	2.53	14,540	495	33,230

Table 17: Dry Pond Operation (24-hour SCS Type II Storm)

Event	Max HGL (m)	Max Depth (m)	Total Inflow (L/s)	Peak Minor System Release Rate (L/s)	Max Volume (m3)
1:2 year	99.785	1.34	4,499	249	7,319
1:5 year	100.056	1.61	7,000	279	11,870
1:100 year	100.687	2.24	10,780	340	26,020
1:100 year + 20%	100.915	2.47	12,990	426	31,630

The modelling results demonstrate that the pond contains flow in up to the 1:100-year event. The maximum water level in the pond is 100.8 m, which provides a minimum 300 mm freeboard to adjacent properties (Quinn's Pointe) and a controlled spill occurs in events greater than the 1:100-year storm event onto Barnsdale Road.

3.13.4 Off-Site Peak Flow Discharges

3.13.4.1 General

The proposed storm servicing strategy outlined herein was developed to ensure that there are no net increases in off-site peak flows at any of the discharge points. Due to the constraints of the Thomas Baxter Municipal Drain—the natural receiving outlet with limited conveyance capacity and shallow elevation—the storm servicing approach for most of the S1 Area involves capturing post-development drainage within a storm sewer system and redirecting it to a proposed on-site end-of-pipe facility in Block 61. Outflows from this facility would then discharge into the existing Quinn’s Pointe storm sewer system at a rate equal to the flow rate identified for the Quinn’s Pointe Subdivision under buildout conditions.

This storm servicing approach, referred to as a “disconnection,” aligns with the secondary objective of facilitating approval timelines under the Ontario Drainage Act by minimizing the release of post-development drainage to the Thomas Baxter Municipal Drain. This approach also aligns with a previously completed disconnection of an area (refer to 2018 BSUEA MSS) of which was tributary to the Thomas Baxter Municipal Drain and later formalized by RCI in its report entitled “Engineer’s Report for the Subsequent Disconnection Thomas R. Baxter Municipal Drain (October 2021)”.

Section 3.13.5.3 (below) discusses in greater detail the area being contemplated for disconnection from the Thomas Baxter Municipal Drain. An area of 10.7 ha was initially disconnected as reported in the 2018 BSUEA MSS while the current proposal is to extend an additional disconnection of a 59.8 ha area. This value represents a reduction when compared to the previous MSS Addendum (October 2025) shown as 65.8 ha, as the flow pattern of the southern woodlot would remain unchanged under post-development conditions as it will continue to sheet flow towards the Borrisokane Road open ditch system.

3.13.4.2 Hydrological Analysis and Simulation Results

In addition to the comparison of peak flows at the boundary of the Quinn’s Pointe Subdivision, this hydrological analysis was refined to assess peak flows and runoff volumes at two (2) locations along the Borrisokane Road/Barnsdale Road open ditch systems, as well as at the boundary culvert leading to the headwater of the Thomas Baxter Municipal Drain.

The refined hydrological analysis considered a range of storm events, including the 4-hour Chicago 25 mm storm (the industry-standard water quality event) and typical events ranging from the 1:2-year to the 1:100-year return periods. The analysis also accounted for half of the Barnsdale Road ROW and the eastern half of the Borrisokane Road ROW, as detailed in Figure 5-2 of JLR’s Existing Conditions Report (Appendix B).

Given that the SWMHYMO platform used in 2017 for the Existing Conditions for the BSUEA (as reported in JLR’s ECR - S1 Area) is no longer compatible with current computer and operating systems, the pre-development analysis was revised using the PCSWMM platform, which aligns with the Addendum post-development condition hydrologic analysis.

The refined analysis was conducted under both pre-development and post-development conditions, with peak flows and runoff volumes extracted at several discharge points along the boundary. Figures entitled *Pre-Development Model Schematic* and *Post-Development Model Schematic* are included in Appendix H.

Peak flows and runoff volumes were generated at the following discharge points:

1. **Existing Quinn’s Pointe 900 mm diameter storm sewer:** Peak flows are summarized in Table 18.

2. **Borrisokane open ditch/culvert system** – **Node "EXD_9"** (refer to Table 19 and Table 20)
3. **Borrisokane/Barnsdale Road open ditch/culvert system** and **Node "EXD_12"** (refer to Table 21 and Table 22)
4. **Thomas Baxter Municipal Drain** immediately downstream of the merging contributions between the Barnsdale Road and Borrisokane Road open ditch systems, at **Node "Municipal Drain"** (Table 23 and Table 24), refer to Appendix H for Schematics.

The P*re-Development Model Schematic* and *Post-Development Model* Schematic is contained in Appendix H.

Table 18: Off-Site Peak Flow - Quinn's Pointe 900 mm diameter Sewer

Development Condition	1:100-year Peak Flow (L/s) 3-hour Chicago	1:100-year +20% Peak Flow (L/s) 3-hour Chicago
Quinn's Pointe 900 mm diameter Sewer		
Existing Condition	349	499
Post-Development Condition	349	495

Peak flows and runoff volumes have been summarized under the 4-hour 25 mm storm as well as under the SCS Type II storm, during events ranging between 1:2-year to 1:100-year as follows:

- Table 19 and Table 20 at Node "EXD_9"
- Table 21 and Table 22 at Node "EXD_12"
- Table 23 and Table 24 at Node "Municipal Drain"

Refer to **Appendix H** for pre- and post-development PCSWMM Schematics.

Table 19: Peak Flow Comparison at Node EXD_9

	Design Storm						
	Water Quality Event	**6 hr SCS Type II**					
	Off-Site Peak Flow (m^3/s)	**Off-Site Peak Flow (m^3/s)**					
	Return Period	**Return Period (years)**					
	4 hr 25 MM	**1:2**	**1:5**	**1:10**	**1:25**	**1:50**	**1:100**
EXISTING CONDITIONS	0.162	0.26	0.297	0.332	0.37	0.399	0.427
POST DEVELOPMENT	0.071 (56%)	0.127 (51%)	0.243 (18%)	0.268 (19%)	0.326 (12%)	0.366 (8%)	0.402 (6%)

Note: The values in parentheses are the reduction expressed in percentages

Table 20: Runoff Volume Comparison at Node EXD_9

	Design Storm						
	Water Quality Event	6 hr SCS Type II					
	Off-Site Runoff Volume (m^3)	Off-Site Runoff Volume (m^3)					
	Return Period	Return Period					
	4 hr 25 MM	1:2	1:5	1:10	1:25	1:50	1:100
EXISTING CONDITIONS	518	742	1,148	1,523	2,059	2,544	3,082
POST DEVELOPMENT	354 (32%)	556 (25%)	873 (24%)	1,177 (23%)	1,637 (20%)	2,048 (19%)	2,490 (19%)

Note: The values in parentheses are the reduction expressed in percentages

Table 21: Peak Flow Comparison at Node EXD_12

	Design Storm						
	Water Quality Event	6 hr SCS Type II					
	Off-Site Peak Flow (m3/s)	Off-Site Peak Flow (m^3/s)					
	Return Period	Return Period (years)					
	4 hr 25 MM	1:2	1:5	1:10	1:25	1:50	1:100
EXISTING CONDITIONS	0.41	0.636	0.894	1.057	1.255	1.408	1.560
POST DEVELOPMENT	0.173 (58%)	0.296 (53%)	0.461 (48%)	0.581 (45%)	0.698 (44%)	0.794 (44%)	0.891 (43%)

Note: The values in parentheses are the reduction expressed in percentages

Table 22: Runoff Volume Comparison at Node EXD_12

	Design Storm						
	Water Quality Event	6 hr SCS Type II					
	Off-Site Runoff Volume (m^3)	Off-Site Runoff Volume (m^3)					
	Return Period	Return Period					
	4 hr 25 MM	1:2	1:5	1:10	1:25	1:50	1:100
EXISTING CONDITIONS	1310	1,886	2,766	3,516	4,570	5,508	6,550
POST DEVELOPMENT	977 (25%)	1,508 (20%)	2,189 (21%)	2,757 (22%)	3,539 (23%)	4,208 (24%)	4,916 (25%)

Note: The values in parentheses are the reduction expressed in percentages

Peak flows and runoff volumes have been summarized in Table 23 and Table 24 at the headwater of the Thomas Baxter Municipal Drain Node as reference by Node "Municipal Drain" on the pre- and post-development PCSWMM Schematics (Appendix H).

Table 23: Peak Flow Comparison at Node Municipal Drain

	Design Storm						
	Water Quality Event	6 hr SCS Type II					
	Off-Site Peak Flow (m3/s)	Off-Site Peak Flow (m^3/s)					
	Return Period	Return Period (years)					
	4 hr 25 MM	1:2	1:5	1:10	1:25	1:50	1:100
EXISTING CONDITIONS	0.443	0.709	1.021	1.223	1.471	1.668	1.866
POST DEVELOPMENT	0.213 (52%)	0.374 (47%)	0.614 (40%)	0.774 (37%)	0.948 (36%)	1.076 (35%)	1.219 (35%)

Note: The values in parentheses are the reduction expressed in percentages

Table 24: Runoff Volume Comparison at Node Municipal Drain

	Design Storm						
	Water Quality Event	6 hr SCS Type II					
	Off-Site Runoff Volume (m^3)	Off-Site Runoff Volume (m^3)					
	Return Period	Return Period					
	4 hr 25 MM	1:2	1:5	1:10	1:25	1:50	1:100
EXISTING CONDITIONS	1628	2,334	3,481	4,468	5,849	7,062	8,394
POST DEVELOPMENT	1293 (21%)	1,995 (15%)	2,988 (14%)	3,840 (14%)	5,001 (14%)	5,985 (15%)	7,022 (16%)

Note: The values in parentheses are the reduction expressed in percentages

The following conclusions can be drawn from the review of the above summary Tables:

- The 1:100-year post-development peak flows released to the existing Quinn's Pointe storm sewer are maintained at levels identified for the Quinn's Pointe Subdivision at the build-out conditions (Table 18)
- The lower peak flows and runoff volumes at Node EXD_9 (Table 19 and Table 20) are attributable to a reduction in contributing drainage area from 22.0 ha under pre-development conditions to 9.0 ha under post-development conditions.

- The lower peak flows and runoff volumes at Node EXD_12 (Table 21 and Table 22) are attributed to a reduction in contributing drainage area from 73.2 ha under pre-development conditions to 13.4 ha under post-development conditions.
- As a result of the reductions in contributing drainage area noted above, post-development peak flows and runoff volumes discharging to the Borrisokane Road open ditch system and to the Borrisokane Road/Barnsdale Road at Nodes EXD_9 and EXD_12, respectively are lower than pre-development values for all storm events, as summarized in the above Tables.
- Peak flows and runoff volumes at the Municipal Drain (Table 23 and Table 24) reflect a reduction in the contributing drainage area from 80.3 ha under pre-development conditions to 20.5 ha under post-development conditions. Accordingly, Table 23 ands Table 24 indicate decreases in both peak flows and runoff volumes for all storm events.

3.13.5 Impact of Post-Development Drainage Modifications

3.13.5.1 General

The proposed drainage limit modifications will alter the hydrological regime as highlighted in Section 3.13.4.2. In all cases, the proposed disconnection reduces both peak flows and runoff volumes at the analyzed off-site discharge points.

The following sections provide an impact assessment of the modified hydrological regime at key locations:

- Borrisokane Road open ditch system
- Barnsdale Road open ditch system
- Thomas Baxter Municipal Drain
- Downstream Fisheries

3.13.5.2 Borrisokane Road Open Ditch System

The Borrisokane Road open ditch system is part of Highway 416’s right-of-way (ROW), which is owned and operated by the Ministry of Transportation (MTO). Therefore, any modifications to the hydrological regime of the Borrisokane Road open ditch system should be reviewed by MTO.

As reported in Section 3.13.4.2, peak flows and runoff volumes were evaluated at the downstream end of the Borrisokane Road open ditch system at Node EXD_9 (Appendix H for Schematics). Simulation results indicated the following:

- Post-development peak flows are reduced by ±56% and 6% at Node EXD_9 during the 4-hour 25 mm storm and 1:100-year storm, respectively. Similarly, runoff volumes are reduced by ±32% and ±19% during the 4-hour 25 mm storm and 1:100-year event, respectively.

Based on the above simulation results, the proposed drainage modifications (i.e., disconnection) will provide relief to the Borrisokane Road open ditch system as both peak flows and runoff volumes will be reduced. Therefore, there are no anticipated adverse impacts along this drainage system owned and operated by MTO.

3.13.5.3 Barnsdale Road Open Ditch - Headwater Features

An Environmental Impact Statement (EIS) was prepared by Arcadis, with the latest version of the Report issued by Fotenn (March 3rd, 2026). As part of this EIS, a Headwater Drainage Feature (HDF) Assessment identified three (3) reaches along Barnsdale Road—BN-1-A, BN-1-1B, and BN-2-A—which received a management recommendation of mitigation requiring the following:

> *The reaches identified should have their functions replicated or enhanced through improved conveyance measures, with flows directed to the appropriate downstream receiver.*

A review of topography shows that the invert of the Barnsdale Road open ditch system varies from approximately 99.6 m at BN-1-A to 98.7 m at BN-2-A, matching the measured edge-of-water elevation of the adjacent man-made pond. Most reaches identified in the EIS would appear to be groundwater-fed rather than being fed by the northern areas, based on measured water elevations shown on the topographical map. Additionally, as a secondary source of inflow, the alignment of these HDFs coincide with the Barnsdale Road open ditch system, which receives runoff from half of the Barnsdale Road ROW, including about 4.5 m wide asphalt strip and a gravel shoulder at a typical 3:1 side slope. While part of the S1 Area is proposed to be disconnected from BN-1-A, BN-1-1B, and BN-2-A, runoff from the Barnsdale ROW, including the shoulder and groundwater contribution will be maintained, allowing these reaches to function as they do under existing conditions.

Simulation of runoff volume at BN-2-A (EXD_12), as indicated in the above Table, shows a 25% reduction during the 4-hour 25 mm storm, which should not adversely impact the HDFs given the above-noted sources of inflow will be maintained. However, the EIS provided mitigation measures (Section 8.2.2) should any construction activities be planned to take place below the high-water mark of the HDFs. These are the following:

- Due to their classification as indirect fish habitat, any direct construction below the high-water mark in Features BN-1, BN-2, BN-3, and Feature 416 will require authorization from DFO through the submission of a Request for Review.
- Direct construction in BN-1, BN-2, BN-3, and Feature 416 and at elevations below the high-water mark should incorporate shallow groundwater measures as well as LID construction practices.
- No work within the high-water mark outside of the fish timing window.

No direct construction activities are envisioned to impact directly any of the above-noted HDFs. The following activities are however anticipated:

- Construction of the residential subdivision and infrastructure within the S1 Area, located outside of the HDFs.
- Construction of the Barnsdale Road 375 mm diameter sanitary sewer extension, planned from the existing stub (at Bundoran Place) to Street 17, and northerly. The alignment of this sanitary sewer extension is away from BN-1-A.

Upcoming Infrastructure Work

It is important to note that the MTO and the City of Ottawa plan to widen this section of Barnsdale Road in the future, as an ongoing Class Environmental Assessment was initiated in 2025 by the city. It is unknown at this time whether a rural or urban cross-section will be selected. However, widening will increase the paved surface and encroach on HDF reaches BN-1-A, BN-1-1B, and BN-2-A. Consequently, the function of these reaches will significantly be altered or completely removed as widening occurs over the next 5 to 10 years. Until such time, the function of these HDFs will remain due to groundwater inflow combined with surface runoff from Barnsdale Road.

3.13.5.4 Thomas Baxter Municipal Drain

The partial disconnection of approximately 59.8 ha results in reductions to both peak flows and runoff volumes at the headwaters of the Thomas Baxter Municipal Drain (Node "Municipal Drain"), as illustrated on the Pre-Development and Post-Development Model Schematics provided in Appendix H.

Peak flows and runoff volumes at the Municipal Drain (Table 23 and Table 24) similarly reflect a reduction in the contributing drainage area from 80.3 ha under pre-development conditions to 20.5 ha under post-development conditions. Accordingly, Table 23 and Table 24 indicate decreases in both peak flows and runoff volumes for all storm events. Accordingly, the partial disconnection is not anticipated to adversely affect the Municipal Drain. Subject to approval, the proposed modifications to the hydrologic regime will be documented in an updated Engineer's Report prepared in accordance with the Drainage Act (Section 78, Chapter D.17, R.S.O. 1990).

As shown on Figure 7, the total study area of approximately 69.9 ha is comprised of two different watersheds: Mud Creek Subwatershed and the Jock River Subwatershed. Under existing condition, most of the study area is tributary to the Thomas Baxter Municipal Drain/Mud Creek Subwatershed and a small section in the Northeast corner is tributary to the Jock River. Under post-development condition a partial disconnection of approximately 59.8ha from the Mud Creek Subwatershed is captured tributary to the proposed dry pond which in turn tributary to the Jock River. A breakdown of the tributary areas under pre- and post-development conditions are summarized in the Table below:

Table 25: Study Area Breakdown by Watershed

Subwatershed	Pre-Development Area (ha)	Post-Development Area (ha)
Thomas Baxter Municipal Drain/Mud Creek	66.5	6.7
Jock River	3.4	63.2

3.13.5.5 Downstream Fisheries

Simulation results summarized in Section 3.14 demonstrate reductions in both peak flows and runoff volumes at the headwaters of the Thomas Baxter Municipal Drain, immediately downstream of the southern limit of the Barnsdale Road right-of-way. From a fisheries perspective, the 4-hour, 25-mm storm event is considered more influential than higher return period events, as it occurs approximately four to five times annually, compared to the less frequent 2-year and 100-year events.

Under post-development conditions, the runoff volume associated with the 4-hour, 25-mm rainfall event was estimated at approximately 1,293 m³, representing a reduction of about 335 m³ (approximately 21%) relative to pre-development conditions. As no fish habitat is present at the headwaters of the Thomas Baxter Municipal Drain near Barnsdale Road, this reduction in runoff volume is not expected to adversely affect downstream fish communities, which are primarily located near the confluence with Mud Creek.

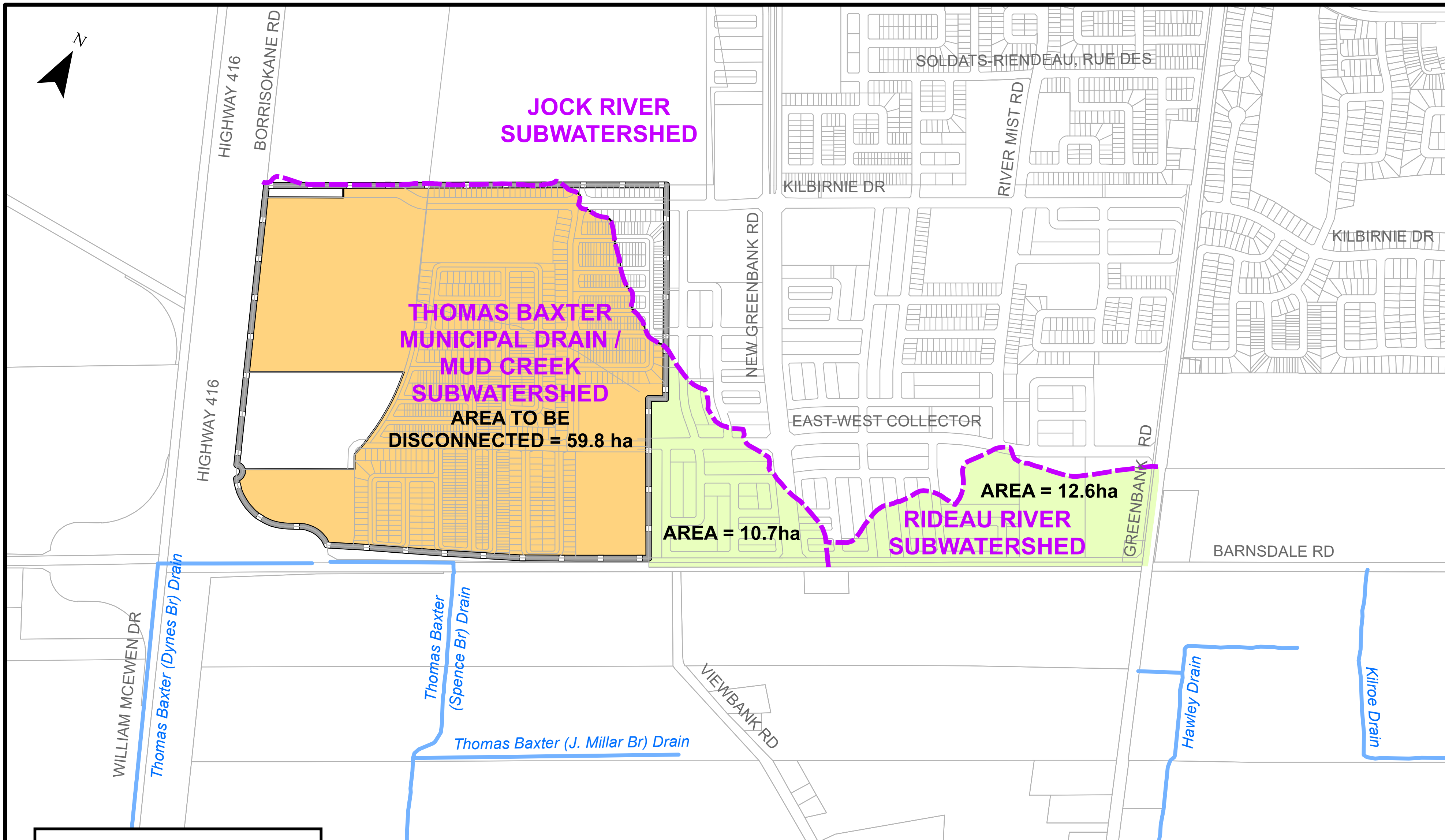
LiDAR analysis indicates that the total drainage area of the Thomas Baxter Municipal Drain at its confluence with Mud Creek is approximately 883 ha, whereas the study area reflects a tributary area of approximately 80.3 ha—representing less than 10% of the total contributing area at Mud Creek. As additional runoff contributions occur along the reach between Barnsdale Road and Mud Creek, the relative influence of the reduced runoff volume diminishes as flow from the remaining ±803 ha of largely unchanged drainage area is incorporated. Consequently, hydrologic conditions in proximity to the Mud Creek fish communities are expected to remain effectively unchanged.

Consistent with this assessment, Section 8.2.2 of the EIS concludes that conditions near the Mud Creek fish communities are anticipated to remain virtually unchanged and align with the HDF Assessment mitigation objective to maintain or replicate existing conveyance functions toward appropriate receivers. Accordingly, the proposed disconnection is not expected to result in adverse impacts to fish communities near Mud Creek.

3.13.6 Water Quality for the Constraint Areas

Calculations presented in Section 3.11.6 demonstrate that water quality control requirements are satisfied for all areas serviced by an EES, as this system exceeds the infiltration criteria outlined in Table 3.2 of the Stormwater Management Planning and Design Manual (SWMPDM). Furthermore, the infiltration strategy detailed in Section 3.13.1 is shown to be comparable to the existing condition water budget. Accordingly, the proposed stormwater servicing approach satisfies the requirements of the CLI-ECA.

Water quality treatment for areas identified as constraints on Figure 10 will be provided at both storm sewer inlets (STMH501 and STMH554) to the expanded dry pond (refer to Drawing MST in Appendix I). As infiltration measures have been implemented to the maximum practical extent and post-development water balance conditions are comparable to existing conditions, the requirements of the CLI-ECA are met. For the areas noted as constraints, water quality will be achieved via a treatment train approach; a pre-treatment MTD (ETV sized) and filtration dry pond sized to provide on its own an 80% TSS removal.



Legend

- Subwatershed Limits
- Municipal Drains
- Area to be disconnected from the Municipal Drain
- Area disconnected from the Municipal Drain (2021)
- Study Area

PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

CHANGES TO MUNICIPAL DRAIN DRAINAGE AREAS

J.L.Richards

ENGINEERS · ARCHITECTS · PLANNERS

www.jlrichards.ca

DESIGN:	GF/KC
DRAWN:	TB/KC
CHECKED:	GF
JLR #:	26610-300

DRAWING #:

FIGURE 7

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\GIS\26610-300 C Figure7.mxd

Plot Date: Friday, April 10, 2026 9:34:24 AM

3.14 Stormwater Summary and Recommendations

This Addendum presented a storm servicing strategy, which was based on the extension of the approved solution described in the 2018 BSUEA MSS. This solution consisted of a traditional storm sewer system, sized based on the SDG, combined with infiltration measures that were developed to the maximum extent possible while recognizing a series of constraints described in Section 3.7.1 and depicted on Figure 9. To supplement this system, the areas referenced as constraints will be serviced by a treatment train approach combining a pre-treatment MTD with a filtration dry pond.

The conceptual servicing design was found to fulfill the following:

- Achieves the prescribed flow rate along the existing 900 mm diameter storm sewer within Quinn's Pointe.
- Achieves the minimum 300 mm freeboard across the S1 Area (residential).
- Achieves flow depths of 350 mm or less along the major overland system of the S1 Area. Achieves the infiltration requirements as specified in Appendix A of the CLI-ECA as the existing condition water budget will be maintained.
- Achieves the filtration requirements as specified in Appendix A of the CLI-ECA as the water quality control will be met.
- Achieves a comparable water budget to existing levels.
- Peak flow and runoff volume reductions to the Borrisokane Road open ditch system, to the Thomas Baxter Municipal Drain and Barnsdale Road open ditch system.

It is recommended that storm servicing in the S1 Area be carried out based on:

- ✓ Conventional storm sewers along with an EES on local roads, when permitting
- ✓ Lot-level sub-surface infiltration measures for each building within the Industrial lands.
- ✓ Areas defined as constraints to be serviced by a treatment train approach, combining a pre-treatment MTD with a filtration dry pond.

Simulation results indicate that the EES along local roads is sufficient to achieve an enhanced level of protection when sized to capture 22 mm of runoff. In contrast, roadway areas not serviced by an EES require a filtration alternative prior to discharging off-site. The recommended filtration solution as identified by the screening process is to provide a filtration dry pond supplemented by pre-treatment MTD.

Overall outflows from both trunk storm sewers are then controlled by the end-of-pipe facility dry pond discharging to the existing sewers in Quinn's Pointe.

Simulation results have revealed that the EES along local roads is sufficient when sized for 22 mm in meeting an enhanced protection level. Similarly, the filtration dry pond which uses the same infiltration principle is sufficient to meet the CLI-ECA.

4.0 Wastewater Servicing

4.1 Background

The wastewater collection system within the S1 Area has been conceptually sized to convey flows to existing gravity sanitary sewers within the Barrhaven South Community. These trunk sanitary sewers ultimately discharge the captured flows to the 900 mm diameter trunk sanitary sewer located along Greenbank Road. From that point, wastewater is then conveyed to the South Nepean Collector, followed by the West Rideau Collector, which ultimately outlets to the Robert O. Pickard Environmental Centre (ROPEC), where it is treated prior to being discharged into the Ottawa River.

In JLR's Serviceability Study (2019), it was demonstrated that the parcels adjacent to the BSUEA, which includes the S1 Area, could be serviced through extensions of the existing and proposed infrastructure in the area. From a wastewater servicing perspective, it was confirmed that the S1 Area could be serviced via a connection to the existing 375 mm diameter sanitary sewer located on Barnsdale Road, south of the existing Quinn's Pointe Stage 4 (refer to Figure 11 and Figure 12).

More recently, the 2025 ECR (Appendix B) identified several critical sewers where residual capacities of the existing trunk sanitary sewer network were to be reviewed to confirm that they could accommodate the increase in peak wastewater flows from the S1 Area. These critical pipe reaches are summarized in Table 26 below.

Table 26: Critical Residual Capacity in Existing Trunk Sanitary Sewers

Trunk Sanitary Sewer	Limiting Pipe Reach
Barnsdale Road	MH203 to MH202
Greenbank Road	MH200C to MH45
Greenbank Road	MH435A to MH501A

The wastewater servicing strategy for the S1 Area was developed in accordance with the design criteria outlined in the OSDG and subsequent technical bulletins, while also respecting the capacity limitations of the existing downstream infrastructure.

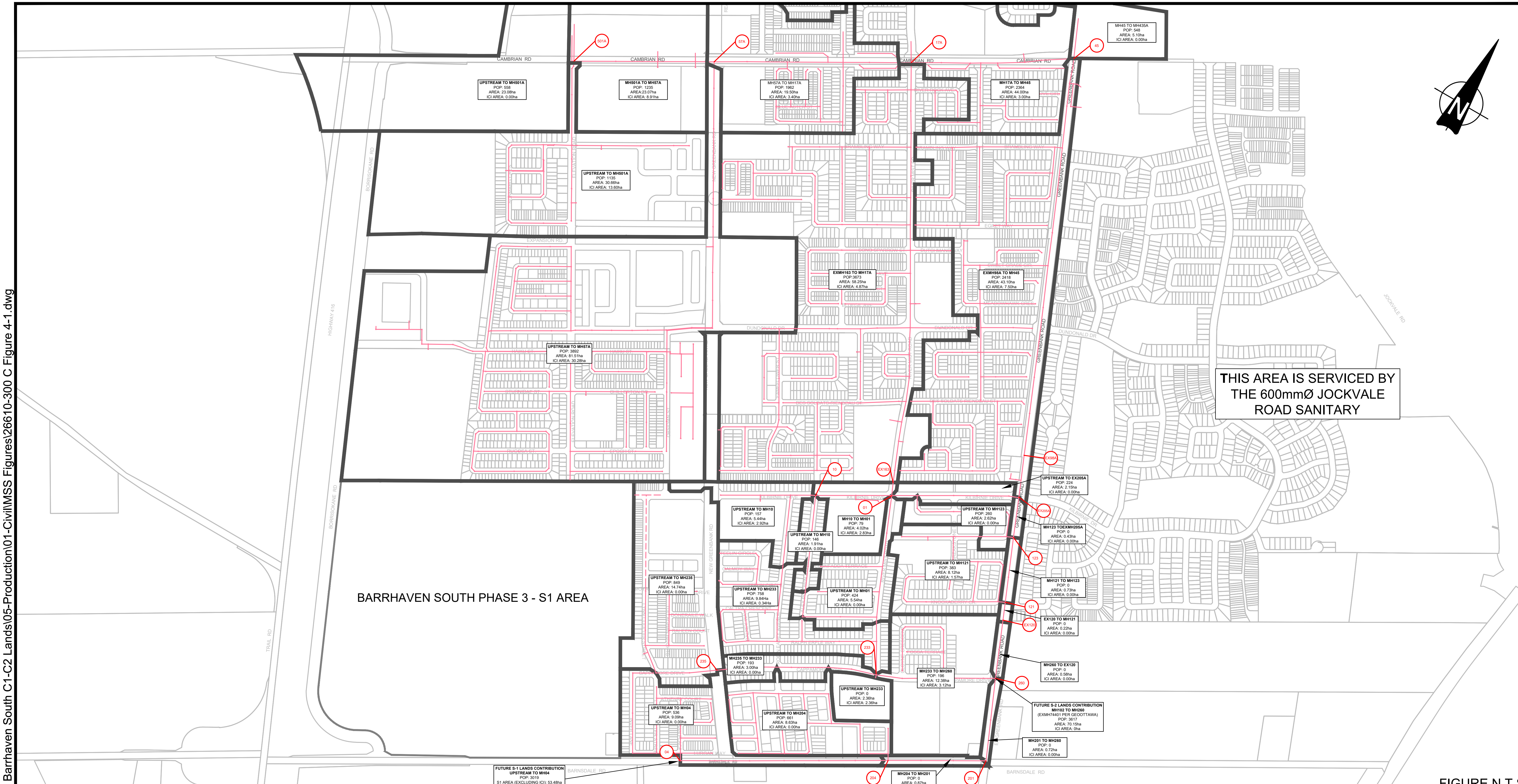


FIGURE N.T.S.

LEGEND

- S1 URBAN EXPANSION STUDY AREA
- EXISTING SANITARY DRAINAGE BOUNDARIES
- 100 — EXISTING SANITARY SEWER AND MANHOLE
- PLANNED SANITARY SEWER

PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

EXISTING OVERALL SANITARY DRAINAGE PLAN

www.jlrichards.ca

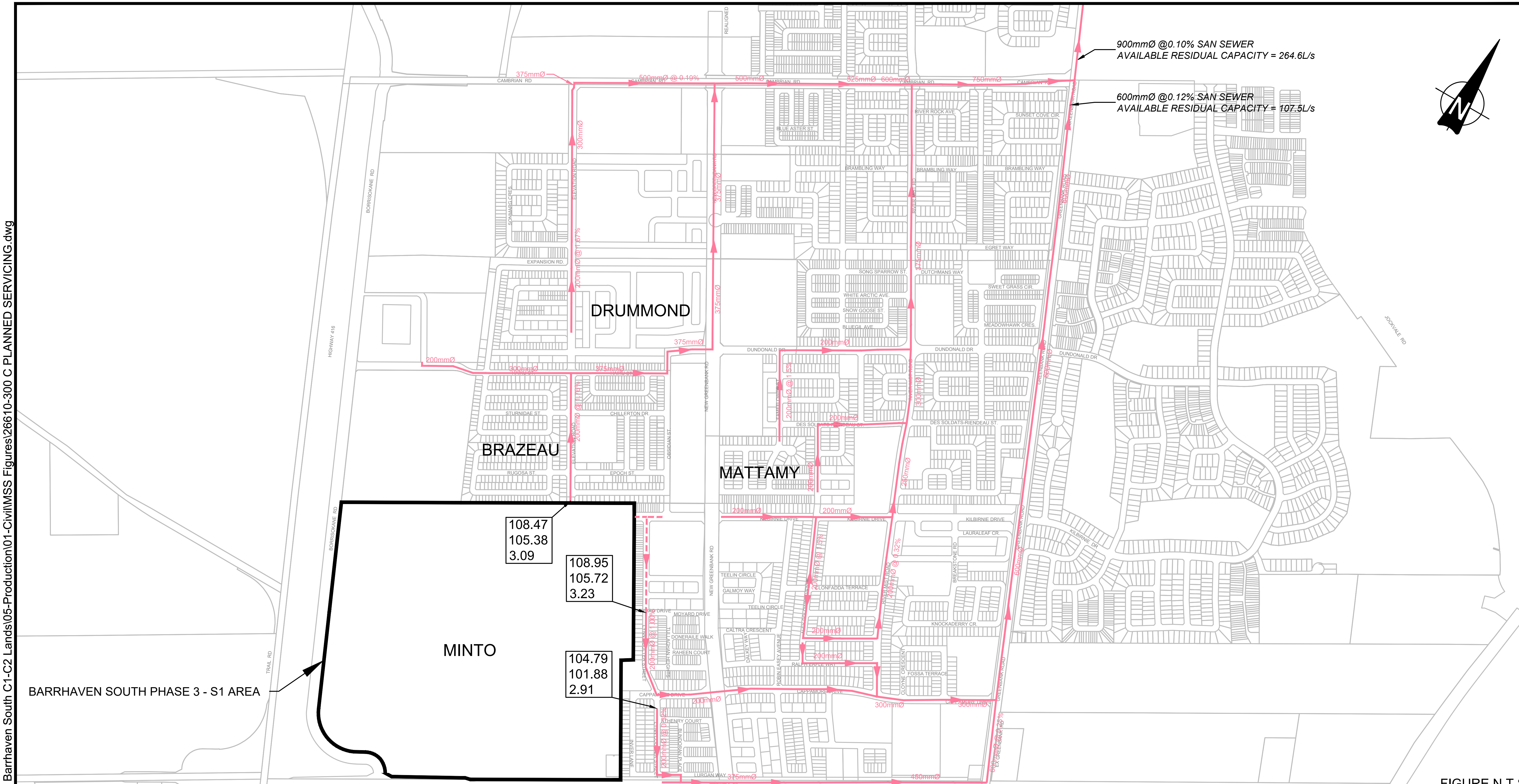
J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	MM
DRAWN:	KC
CHECKED:	KF
JLR #:	26610-300

DRAWING #: FIGURE 8

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C Figure 4-1.dwg

PLOT DATE: Friday, April 10, 2026 10:55:52 AM



LEGEND

EXISTING SANITARY SEWER

PLANNED SANITARY SEWER

98.45	EXISTING GROUND (±)
91.77	SANITARY SEWER OBVERT
6.7	COVER DEPTH (m)

PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

EXISTING AND PLANNED SANITARY SERVICING INFRASTRUCTURE

www.jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	GF
DRAWN:	KC
CHECKED:	GF
JLR #:	26610-300

DRAWING #: FIGURE 9

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C PLANNED SERVICING.dwg

PLOT DATE: Thursday, April 9, 2026 10:58:18 AM

4.2 Wastewater System Servicing

4.2.1 Design Criteria

Trunk sanitary sewers servicing the S1 Lands were designed in accordance with the following criteria from the ODSG and subsequent Technical Bulletins:

Table 27: Sanitary Design Criteria

Design Criteria	Design Value
Residential Average Flow	280 L/cap/day
Residential Peaking Factor	Harmon Formula x 0.8
Light Industrial Average Flow	28,000 L/gross ha/day
ICI Peaking Factor (1)	1.0/1.5
Total Infiltration	0.33 L/s/ha
Minimum Velocity	0.6 m/s
Maximum Velocity	3.0 m/s
Manning Roughness Coefficient (for smooth wall pipes)	0.013
Minimum Allowable Slopes	Varies
Population Density	Single Family: 3.4 ppu Townhouse: 2.7 ppu

(1) 1.5 if ICI Contribution > 20%, 1.0 otherwise.

4.2.2 Residual Capacities in the Existing Sanitary Sewer Network

As part of the BSUEA MSS (2018), a Master Sanitary Design Sheet was developed to assess the available capacity of the existing sanitary sewer infrastructure within the BSUEA, and further downstream in the existing areas. This design sheet was subsequently refined during the 2019 Serviceability Study and further updated in the ECR (2025) to incorporate the most recent design flow data for Quinn's Pointe Stages 2 through 5, as well as the future S1 and S2 Areas. The S2 Area represents a planned expansion located east of Greenbank Road and north of Barnsdale Road which is also in the MSS preparation stage.

The Serviceability Study (2019) identified segments of the existing network with potential capacity limitations. This analysis was further refined in the ECR (2025), with a specific focus on the S1 Area. The sanitary trunk sewers evaluated for this area were located along Barnsdale Road and Greenbank Road. The limiting pipe reaches identified in this report are summarized in Table 26.

At the time of the preparation of the ECR (2025), the Concept Plan for the S1 Area was at a preliminary stage thus the available servicing capacities of the existing system have been re-evaluated in Section 4.4 to reflect the most recent iteration of the Concept Plan (Appendix D).

4.3 Wastewater Collection System Strategy

4.3.1 Phasing

As shown in the preferred Concept Plan (Appendix D), development of the S1 Area is proposed to proceed in three sequential residential phases: Phases 6, Phase 7, and Phase 8, including two industrial land parcels totaling 13.22 ha to the north and 3.19 ha to the south. The ultimate sanitary outlet for the entire S1 Area is located within Phase 6 at Barnsdale Road at Street No. 15. Accordingly, the downstream sewer infrastructure as part of Phase 6 will be designed to accommodate ultimate buildout conditions, including all residential phases and both industrial lands. By sizing the initial phase infrastructure to meet full future capacity requirements, the system will inherently satisfy the servicing needs of all interim development phases.

4.3.2 Proposed Sewer System Layout and Sizing

As shown in the Concept Plan (Appendix D), the wastewater collection system for the S1 Area is intended to service single family units, townhouse blocks, the industrial lands and a park block.

The proposed sanitary sewers within the S1 Area have been conceptually sized based on the design criteria listed in Table 27 and the drainage areas depicted on Drawing MSAN in Appendix K. A trunk sanitary sewer system layout has been developed in accordance with the latest Concept Plan (Appendix D). Within the S1 Area, there are two (2) designated collector roads which are:

- Elevation Road: This roadway serves as the north-south collector from Kilbirnie Drive to Cappamore Drive; and
- Cappamore Drive: This roadway serves as the east-west collector from the retained woodlots adjacent to the Industrial Lands to the existing Quinn's Pointe Stage 4.

Since Elevation Road and Cappamore Drive are the designated collector roads within the S1 Area, the trunk sanitary sewers are proposed to follow their alignments within the Study Area.

The remainder of the sanitary sewer network is to follow the configuration of the local road system, with careful consideration given to maintaining minimum flow velocities, ensuring adequate cover, and avoiding infrastructure conflicts. The sanitary sewer layout is to be developed in coordination with the stormwater and watermain networks.

The Master Sanitary Sewer Design Sheet, prepared as part of the ECR, included the population and corresponding flows for the S1 Area (refer to Appendix I). It also shows trunk sanitary sewer sizing. Based on this assessment, wastewater from the S1 Area is expected to be conveyed primarily through an internal sanitary network consisting of sanitary sewers ranging from 200 mm to 375 mm in diameter. Final pipe sizing will be confirmed during detailed design.

4.3.3 Barnsdale Road Outlet

The 2019 Serviceability Study evaluated potential sanitary sewer connections for the S1 Area and concluded that servicing could be achieved via a connection to the existing 375 mm diameter sanitary sewer located on Barnsdale Road, south of the Quinn's Pointe Stage 4 development. This recommendation was based on the available residual capacity within the Barnsdale Road sewer infrastructure. Additionally, the Master Sanitary Sewer Design Sheet (refer to Appendix I) included in the report confirmed that the existing sanitary sewers on Cappamore Drive do not have sufficient capacity to accommodate additional flows.

4.4 Impact on Downstream System

The ECR (2025) included the refinement of the BSUEA Master Sanitary Design Sheet to assess the available capacity of the existing sanitary sewer infrastructure. This analysis incorporated the most up-to-date design flow data for Quinn's Pointe Stages 2 through 5, along with projected flows for the future S1 and S2 Areas.

This Master Sewer Design Sheet has been refined further as part of this assessment to include design flows from the most recent iteration of the Concept Plan (Appendix D). With the addition of the S1 and S2 Areas, the calculated theoretical peak wastewater flows were found to be within the available residual capacities of the existing downstream sanitary sewer (refer to Master Sanitary Design Sheet in Appendix I). Consequently, no further infrastructure improvements are required along the existing downstream system. Table 28 provides a summary of the impact of the S1 and S2 areas to the critical pipe reaches in Table 26.

Table 28: Residual Capacity in Existing Trunk Sanitary Sewers

Trunk Sanitary Sewer	Limiting Pipe Reach	Residual Capacity
Barnsdale Road	MH203 to MH202	118.4 L/s
Greenbank Road	MH200C to MH45	11.5 L/s
Greenbank Road	MH435A to MH501A	98.8 L/s

4.5 Wastewater Summary and Recommendations

The wastewater collection system illustrated in Drawing MSAN in Appendix K and the accompanying Master Sanitary Sewer Design sheet (Appendix I) has been conceptually sized based on the design criteria outlined in Table 27, while accounting for the residual capacities of the pipe segments identified in Table 28.

As noted in Section 4.3, the layout of the trunk sanitary sewer system has been developed in accordance with the most recent Concept Plan, with Elevation Road and Cappamore Drive designated as the primary north-south and east-west trunk sewers, respectively.

It is expected that wastewater generated by the S1 Area can be accommodated by a series of 200 mm diameter sanitary sewers as shown in the Master Sanitary Sewer Design Sheet (Appendix I). Furthermore, the calculated theoretical peak wastewater flows for the S1 Area were found to be within the available residual capacities of the existing downstream sanitary sewer while accounting for the projected flows from the S2 Area (refer to Appendix I). Consequently, no further infrastructure improvements are required along the existing downstream system.

5.0 Water Distribution

5.1 Background

The 2018 BSUEA MSS reviewed and evaluated servicing options with the identification of preferred trunk watermains, which were subsequently constructed. This Addendum, prepared as an extension to the 2018 BSUEA MSS, identifies feedermains to support the urbanization of the S1 Area.

In 2019, the Serviceability Study water supply assessment confirmed that extensions of existing watermains would provide potable water that met the design criteria and objectives listed in Section 4.2.2 of the Ottawa Design Guidelines for Water Distribution (December 2025).

The review of the existing and future planned watermains was carried out as part of the 2025 ECR (Appendix B). Figure 13 depicted the existing and planned watermains along the boundary of the S1 Area. This review has shown that the current urban development to the east of the Study Area (i.e., Quinn's Pointe Subdivision) and to the north of the Study Area (i.e., The Ridge Subdivision) are both serviced by the municipal distribution system, which draws its water from the Ottawa River at both the Britannia and Lemieux Water Purification Plants. From those purification plants, potable water is distributed via a series of feedermains and water booster stations. The City of Ottawa water distribution system is planned based on achieving the following design objectives:

- Quantity: sufficient water at sufficient pressure (Section 4.2.2 of the Ottawa Design Guidelines for Water Distribution)
- Quality: safe drinking water to the required standards (Section 4.1 of the Ottawa Design Guidelines for Water Distribution).
- Reliability: to ensure water supply under emergency conditions.
- Effectiveness and affordability: to reduce lifecycle costs being sustainable in the long term.

Three (3) feedermains service the Barrhaven South Community from the Barrhaven reservoir, which are as follows:

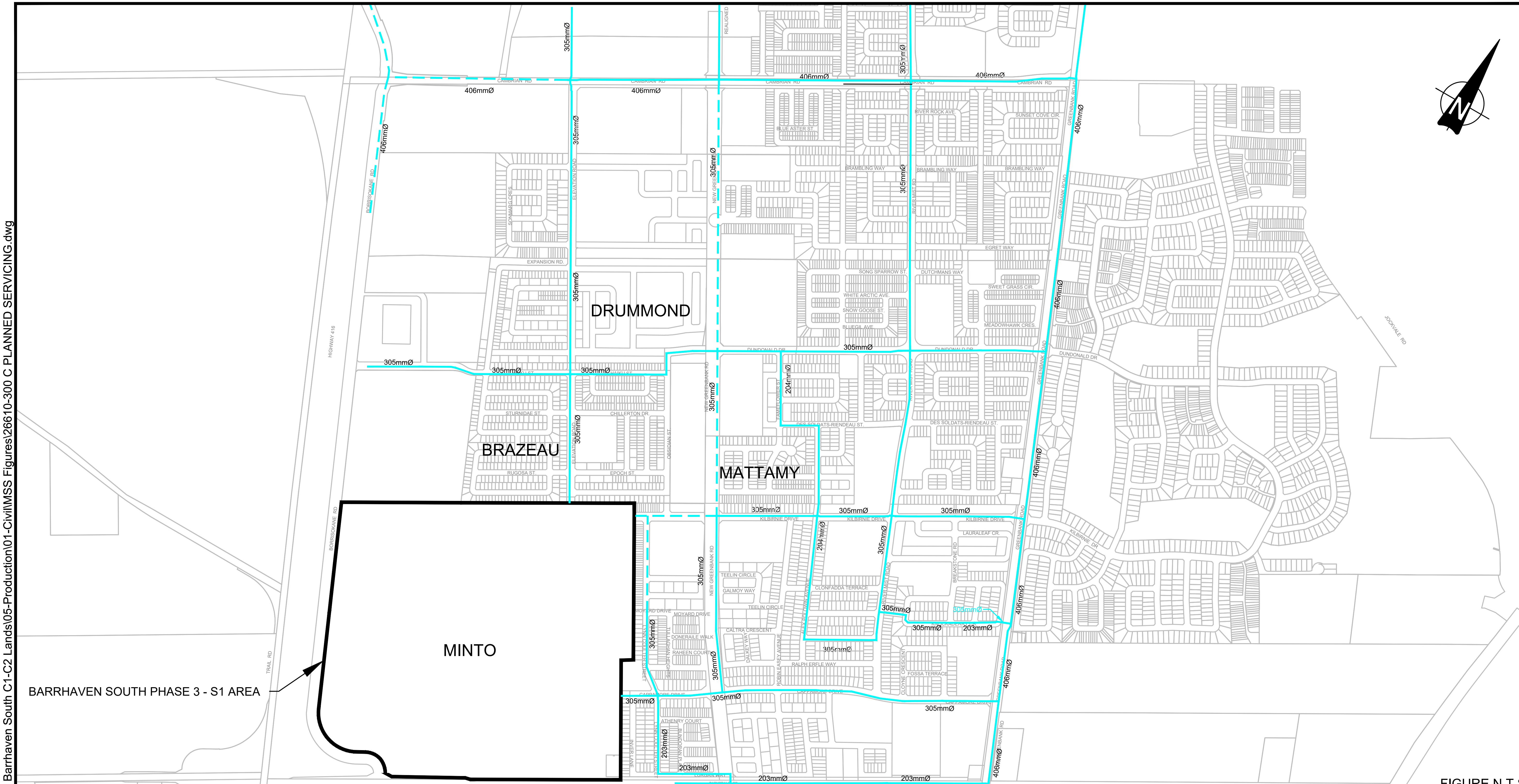
- a 406 mm main along Greenbank Road
- a 406 mm main along Cambrian Road; and
- a 305 mm feeder main along River Mist Road

Two (2) sections of the planned feedermains were also recently constructed as follows:

- 305 mm feedermain along New Greenbank Road, from Barnsdale Road to Kilbirnie Road.
- 406 mm feedermain on Cambrian Road, from Elevation Road to existing Greenbank Road.

Future planned feedermains are as follows:

- 305 mm feedermain on Kilbirnie Drive, from New Greenbank Road to the eastern perimeter of the S1 Area, including a connection to Obsidian Street.



LEGEND

(solid line)	EXISTING WATERMAIN
(dashed line)	PLANNED WATERMAIN

PROJECT:

BARRHAVEN SOUTH PHASE 3 - S1 AREA

OTTAWA, ONTARIO

DRAWING:

EXISTING AND PLANNED WATER MAIN SERVICING INFRASTRUCTURE

www.jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	GF
DRAWN:	KC
CHECKED:	GF
JLR #:	26610-300

DRAWING #: FIGURE 10

File Location: P:\26000\26610-300 - Barrhaven South C1-C2 Lands\05-Production\01-Civil\MSS Figures\26610-300 C PLANNED SERVICING.dwg

PLOT DATE: Thursday, April 9, 2026 10:58:20 AM

5.2 Water Servicing

5.2.1 Design Criteria

The Ottawa Design Guidelines for Water Distribution (December 2025) require that all new development additions to the public water distribution system be designed to conform to the following:

- In general conformance with the MOE Design Guidelines for Drinking-Water Systems the desired range of system pressures should be approximately 350 to 480 kPa (50 to 70 psi) and not less than 275 kPa (40 psi) during normal operating conditions.
- Where fire flow has been provided; during periods of maximum day and fire flow demand the residual pressure at any point in the distribution system shall not be less than 140 kPa (20 psi).
- In accordance with the Ontario Code & Guide for Plumbing, the maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi.)
- The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi.)
- Feedermains, which have been provided primarily for the purpose of redundancy, shall meet, at a minimum, the basic day plus fire flow demand.

In addition to the above targets, servicing should be carried out to minimize the use of dead-end watermains.

5.2.2 Phasing

As shown in the preferred Concept Plan (Appendix D), development of the S1 Area is proposed to proceed through three sequential residential phases: Phase 6 including an industrial land parcel of 13.22 ha to the north, Phase 7, and Phase 8 including an industrial land parcel of 3.19 ha to the south. All watermain connections from the S1 Area to the existing municipal network will be constructed as part of Phase 6, with the subsequent phases and future industrial lands extending from Phase 6.

Accordingly, the analysis and results in this Section are structured to reflect the cumulative staging of development:

- Phase 6 + Northern Industrial Parcel
- Phase 6 + Northern Industrial Parcel + Phase 7
- Phase 6 + Northern Industrial Parcel + Phase 7 + Phase 8 + Southern Industrial Parcel

The proposed connection at Kilbirnie Drive will extend from Quinn’s Pointe Stage 5, which has not yet been constructed but is planned to be completed prior to advancement of the S1 Area. Accordingly, the analysis and results incorporate the units from Quinn’s Pointe Stage 5 (herein referred to as “Stage 5”).

5.2.3 Domestic Water Demands

The water demands calculated for the S1 Area reflect the unit count and land-use areas shown on the Concept Plan (Appendix D).

System level parameters (Table 29) were provided by the City of Ottawa at the onset of this project given that the population of the S1 Area exceeds 3,000 (refer to Appendix J).

The maximum day demand shown in the table below is the sum of the average day demand, the water loss per connection and the outdoor water demand. The peak hour peaking factors shown below were provided by the City.

Table 29: Theoretical Water Consumption Rate

Land Use Type	Consumption Rate (L/cap/day)	Avg. Demand (L/unit/day)	Water Loss per Connection (L/unit/day)	Outdoor Water Demand (L/unit/day)	Max Day Demand (L/unit/day)	Peak Hour Demand
Single Family Homes @ 3.4 ppu	180	612	80	700	1,392	2.1 x Max
Executive and Avenue Towns @ 2.7 ppu	198	535	80	350	965	2.1 x Max
EMP (L/ha/day)	17,000	N/A	N/A	N/A	1.5 x Avg	1.8 x Max

When all the above parameters are applied to the S1 Area along with an assumed constant demand of 4 L/s for the park block, the following water demands were calculated as shown in the detailed water demand spreadsheet in Appendix J.

Table 30: S1 Area Water Demands

Phasing Scenario	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Phase 6	13.65	21.00	33.23
Phase 6, 7	15.46	24.00	39.27
Phase 6, 7, 8	18.11	28.53	48.24

*Note all scenarios include Stage 5.

5.2.4 Required Fire Flow

Based on the City's Design Guidelines, municipal watermains shall be designed to meet fire flow requirements estimated based on the Fire Underwriters Survey (FUS) method. To evaluate the proposed water distribution system, a maximum fire flow of 13,000 L/min (217 L/s), based on the previous MSS Addendum, was targeted in the system for each phasing scenario shown in Table 30. A lesser fire flow of 10,000 L/min (167 L/s) was also assessed based on the City's capped fire flow requirement for single family homes and row townhouses that achieve adequate rear yard spacing.

5.2.5 Internal Water Servicing

Several 300 mm diameter feedermains are being proposed within the S1 Area. These trunk watermain locations have been determined based on the existing watermains surrounding the S1 Area as well as the Concept Plan and hydraulic requirements. The following trunk watermains are proposed, as illustrated on the Master Watermain Drawing (MWM in Appendix K):

- 300 mm diameter watermain westerly extension on Kilbirnie Drive.
- 300 mm diameter watermain westerly extension on Moyard Drive with 300 mm diameter watermain upgrade (±40m) on Moyard Drive west of Lynn Coulter Street.
- 300 mm diameter watermain westerly extension on Cappamore Drive.
- 300 mm diameter watermain southerly extension on Elevation Road.
- 300 mm diameter watermain westerly extension on Barnsdale Road.
- 200 mm or 300 mm diameter watermains at the west side of the S1 Area to provide looping between the extended watermains, including through the Industrial Lands, such to avoid the creation of dead-end feedermains.

5.2.6 Boundary Conditions

At the onset of this Study, boundary conditions were requested from the City for the existing pressure zone configuration and for the future South Urban Community (SUC) pressure zone reconfiguration. As the future SUC pressure zone reconfiguration is not expected to be completed until 2027, this Study analyzes results for both the existing and future pressure zones.

The boundary conditions received from the City (Appendix J) include connections to the existing watermains at Moyard Drive, Kilbirnie Drive, Obsidian Street, Elevation Road, Cappamore Drive, and Barnsdale Road. Boundary conditions were requested with and without a connection to Barnsdale Road as well as for the different phasing scenarios shown in Table 30. Although the boundary conditions indicate a marginal pressure increase with the Barnsdale Road connection, it is recommended that this looped connection be constructed for redundancy purposes given that the trunk sanitary sewer will also be extended westerly along this ROW. Thus, this Study only assesses the water servicing with the Barnsdale Road connection.

Boundary conditions received on November 24, 2025, were used for Phase 6 and Phase 6-7 scenarios and boundary conditions received on August 25, 2025, were used for the Phase 6-8 buildout scenario. It is noted that the current boundary conditions (received November 24, 2025) are generally reduced in pressure as compared to those presented in the previous studies carried out for these lands. This is attributed to the City's recent updates to their hydraulic water model which included updates to the pump controls at Barrhaven Pumping Station and updates to all water demands throughout the model, especially in neighbouring areas.

5.3 Water Servicing Analysis

The Hydraulic Network Analysis (HNA) was conducted using a model in WaterCAD® with a series of trunk watermains with a nominal diameter of 300 mm (modelled with an internal diameter of 297 mm) and 200 mm (modelled with an internal diameter of 204 mm). The 300 mm and 200 mm diameter watermains use a Hazen-Williams roughness coefficient (C-factor) of 120 and 110, respectively, per City Design Guidelines. A model schematic is presented in Appendix J that shows the proposed street centreline elevations and watermain sizing and layout within the S1 Area. The modelled watermain configuration follows the Master Watermain Drawing (MWM in Appendix K). The HNA encompassed system performance under three key scenarios: maximum hydraulic grade line (HGL) conditions, peak hour demand conditions, and maximum day demand plus fire flow conditions. These scenarios were assessed under both existing and future conditions (i.e., without and with the pressure zone reconfiguration). The model result schematics are presented in Appendix J.

The model results are presented for the phasing as follows:

- **Phase 6** = Phase 6 + Northern Industrial Parcel
- **Phase 7** = Phase 6 + Northern Industrial Parcel + Phase 7
- **Phase 8** = Phase 6 + Northern Industrial Parcel + Phase 7 + Phase 8 + Southern Industrial Parcel

5.3.1 Maximum HGL

The maximum HGL simulation was assessed to confirm that system pressures are expected to adhere to the maximum pressure constraint of 552 kPa (80 psi). This simulation was carried out assuming no demands, which is a conservative approach.

5.3.1.1 Existing Conditions

Table 31 below shows the pressure ranges for each phase scenario.

Table 31: Model Results – Maximum HGL Existing Conditions

Phase	Minimum Pressure	Maximum Pressure
Phase 6	443 kPa (59.9 psi)	533 kPa (77.3 psi)
Phase 7	436 kPa (61.5 psi)	527 kPa (76.4 psi)
Phase 8	424 kPa (59.8 psi)	515 kPa (74.7 psi)

Simulations for Phases 6, 7 and 8 result in pressures that are below the maximum allowable system pressure of 552 kPa (80 psi). Accordingly, each phase scenario satisfies the applicable pressure requirements.

5.3.1.2 Future Conditions

Table 32 below shows the pressure ranges for each phase scenario.

Table 32: Model Results – Maximum HGL Future Conditions

Phase	Minimum Pressure	Maximum Pressure
Phase 6	366 kPa (53.1 psi)	456 kPa (66.1psi)
Phase 7	366 kPa (53.1 psi)	456 kPa (66.1 psi)
Phase 8	362 kPa (52.5 psi)	452 kPa (65.6 psi)

Simulations for Phases 6, 7 and 8 result in pressures that are below the maximum allowable system pressure of 552 kPa (80 psi). Accordingly, each phase scenario satisfies the applicable pressure requirements.

5.3.2 Peak Hour

The peak hour simulation was assessed to confirm that system pressures generally comply with the normal operating conditions' minimum pressure constraint of 275 kPa (40 psi). This simulation was carried out by applying the peak hour demands in the model as summarized in Appendix J.

5.3.2.1 Existing Conditions

Table 33 below shows the pressure ranges for each phase scenario.

Table 33: Model Results – Peak Hour Existing Conditions

Phase	Minimum Pressure	Maximum Pressure (kPa)
Phase 6	289 kPa (41.9 psi)	380 kPa (55.1 psi)
Phase 7	260 kPa (37.7 psi)	350 kPa (50.8 psi)
Phase 8	282 kPa (40.9 psi)	373 kPa (54.1 psi)

Under Phase 6 and Phase 8, the pressures under peak hour conditions exceed the minimum pressure requirements.

Under Phase 7, the lowest system pressures occur at the east end of the study area (Appendix J) and along Kilbirnie Drive. Although these pressures fall below the minimum recommended pressure of 275 kPa for normal operating conditions, they are primarily attributable to local topographic high points rather than excessive headlosses within the watermain network. Under the future pressure zone reconfiguration, pressures improve along both the east end of the study area and Kilbirnie Drive, as presented next in section 5.3.2.2. Furthermore, the pressure zone modification will quite possibly occur prior to the construction of Phase 7. While pressures along Kilbirnie Drive during Phase 7 are marginally below guideline values for normal operating conditions, the latest City of Ottawa Design Guidelines do not explicitly define minimum pressures under peak hour conditions. This assessment will be refined at the detailed design stage when more definitive centreline elevation data becomes available.

5.3.2.2 Future Conditions

Table 34 below shows the pressure ranges for each phase scenario.

Table 34: Model Results – Peak Hour Future Conditions

Phase	Minimum Pressure	Maximum Pressure
Phase 6	285 kPa (41.3psi)	376 kPa (54.5 psi)
Phase 7	282 kPa (40.9 psi)	373 kPa (54.1 psi)
Phase 8	274 kPa (39.7 psi)	365 kPa (52.9 psi)

All modeled phase scenarios result in pressures that exceed the maximum allowable system pressure of 275 kPa (40 psi). Accordingly, each phase scenario satisfies the applicable pressure requirements.

5.3.3 Maximum Day plus Fire Flow

To ensure adequate fire protection, a maximum day demand was simulated with a fire flow along the proposed watermains within the S1 Area. As per Section 5.2.4, a fire flow of 10,000 L/min (167 L/s) and 13,000 L/min (217 L/s) was used in this analysis and assessed under existing and future pressure zone configurations.

5.3.3.1 Existing Conditions Fire Flow (167 L/s)

Under existing pressure zone conditions, for Phases 6, 7 and 8, the proposed watermain network is expected to be capable of delivering fire flows of 167 L/s during a maximum day demand.

5.3.3.2 Future Conditions Fire Flow (167 L/s)

Under future pressure zone conditions, for Phases 6, 7 and 8, the proposed watermain network is expected to be capable of delivering fire flows of 167 L/s during a maximum day demand.

5.3.3.3 Existing Conditions Fire Flow (217 L/s)

Under existing pressure zone conditions, for the proposed watermain network for Phase 6, 7 and 8, the network is generally expected to be capable of delivering fire flows of 217 L/s during maximum day demand. Under existing conditions simulations, nodes J-90 and J-34 along the woodlot easement and node J-48 on Kilbirnie Drive are unable to provide 217 L/s.

The lower available fire flow at this node can be attributed to the higher topography in this localized area and the headlosses along the watermains. Currently, on Street 5 there are no residential units along this section of watermain which require 217 L/s. Along Kilbirnie Drive, specifically at J-48, there are no residential units along this section of watermain. This portion of the site will be dedicated to light industrial uses. The required fire flow for the industrial block will be assessed at the detailed design stage for its site plan. It is noted that the available fire flow at these nodes improve with the future pressure zone reconfiguration as discussed in the next section.

5.3.3.4 Future Conditions Fire Flow (217 L/s)

Under future pressure zone conditions, for the proposed watermain network for Phase 6, 7 and 8, the network is generally expected to be capable of delivering fire flows of 217 L/s during maximum day demand. Under future pressure zone conditions simulations, nodes J-90 and J-34 along the woodlot easement are unable to provide 217 L/s.

Currently, there are no residential units requiring 217 L/s along these sections of watermain. It is noted that the available fire flow at this node does improve with the reconfiguration of the future pressure zone. The lower available fire flow at this node can be attributed to the higher topography in this localized area and the headlosses along the watermains.

5.4 Water Summary and Recommendations

The proposed watermain trunk servicing within the S1 Area is shown on the Master Watermain Drawing (MWM in Appendix K). Water demands were calculated for the S1 Area using system level parameters provided by the City of Ottawa. A maximum fire flow target of 10,000 L/min (167 L/s) and 13,000 L/min (217 L/s) was used in this Addendum. Based on the boundary conditions provided by the City and the HNA presented herein, the proposed trunk watermains are generally expected to provide adequate water supply to the S1 Area.

6.0 Impact and Mitigation

6.1 Design, Construction and Operation

The analyses summarized in Sections 3.0 to 5.0 confirm that the preferred servicing strategy for the S1 Area is the extension of existing municipal services from the Quinn's Pointe and Ridge Subdivisions. The recommended servicing framework is illustrated on Drawings KS1, MG1, MST, MSAN, MWM, POND, D1, and D2.

The evaluation process of servicing strategies followed as part of the BSUEA MSS was extended to the S1 Area which had included an assessment of several indicators related to design, construction and operation, social, natural, and economic factors. This Addendum also reviewed both infiltration and filtration-type LID solutions as part of a simplified screening process which identified the preferred LID solutions. The impacts of the preferred servicing strategy on the S1 Area and the mitigation required are outlined in this section.

6.1.1 Storm and Stormwater Management Servicing

The preferred storm sewer and stormwater management servicing strategy for the S1 Area is based on a two-part approach, consisting of both infiltration and filtration measures:

- The infiltration-based solution builds upon the preferred servicing strategy identified in the 2018 BSUEA Master Servicing Study and includes: (i) the implementation of an Etobicoke Exfiltration System (EES) to promote recharge of the overburden aquifer, and (ii) infiltration of rooftop runoff through subsurface infiltration systems located on private properties.
- The filtration-based solution adopts a treatment train approach comprising a filtration dry pond supplemented with a mechanically treated device (MTD) to provide pre-treatment. This solution is proposed to service areas characterized by high groundwater conditions and areas where runoff quality may be influenced by roadway de-icing salts, such as collector roads.

With respect to the EES, one of the earliest known applications in Ontario was implemented in the former City of Etobicoke in 1993 as part of a retrofit project. While EES installations require enhanced inspection relative to conventional storm sewers, over approximately three decades of operation they have demonstrated reliable performance and maintenance requirements comparable to traditional systems. As part of the 2018 BSUEA MSS, several technical deliverables were prepared to support the acceptance of the EES; these documents are included in in Appendix C of this Addendum.

Prior to completion of the 2018 BSUEA MSS, the City confirmed that multiple EES installations form part of its existing municipally owned infrastructure. Since that time, EES has also been implemented within Quinn's Pointe Stages 2 through 4. Monitoring of the existing system indicates that it is operating in accordance with its design intent; however, elevated groundwater levels have the potential to limit system performance, as discussed in Section 3.7.

The preferred filtration-based servicing strategy consists of a filtration dry pond supplemented by an MTD for pre-treatment. This approach has been implemented elsewhere in Ontario and has been accepted by the City as a future municipally owned stormwater management facility.

The storm sewer and stormwater management servicing strategy detailed in this Addendum provides the following benefits:

- Preservation of the overall pre-development infiltration regime (water budget).
- Preservation of the baseflow characteristics.
- Mitigate adverse impacts (water quality) on the esker by means of implementing an filtration LID solution for the high-risk areas and areas where runoff will be impacted by chlorides.
- Reduce post-development peak flows, which in turn, will prevent increases in flood potential downstream.
- Protect downstream water quality by infiltrating or filtrating the first flush (22 mm storm) of the frequent storms, for parts of the Study Area where proper separation exists between the invert of the EES and groundwater levels.
- The servicing strategies meet the requirements of the CLI-ECA where the proposed solutions were developed based on the hierarchy described in Appendix A as follows:
    - ✓ Prioritize infiltration servicing solutions to the maximum extent while accounting for constraints.
    - ✓ Prioritize filtration servicing solutions to the maximum extent.

Since both types of solutions have been maximized, traditional stormwater management works such as a wet pond are not required nor recommended in this Addendum.

6.1.2 Sanitary Servicing

Sanitary servicing of the S1 Area has been described in greater detail in Section 4.0. Wastewater servicing will be achieved via extensions of the existing wastewater collection system. Consequently, there is no need for additional infrastructure to increase downstream conveyance capacity or to implement pumping to achieve gravity connections. In terms of operation, the extension of the gravity systems within the S1 Area will require standard operation and maintenance as for similar systems within the City.

6.1.3 Water Servicing

Water servicing of the S1 Area has been described in greater detail in Section 5.0. Watermain servicing will be achieved via extensions of the existing and planned trunk watermains and supplemented by local watermains. Consequently, there is no need for additional infrastructure to increase capacity or to implement pumping systems for servicing higher elevations.

There is an imminent pressure zone reconfiguration that is envisioned about the same time as the initial stage of the S1 Area will be made operational. The pressure characteristics was simulated and discussed in greater details in Section 5.0. In terms of operation, the extension of trunk watermains within the S1 Area will require standard operation and maintenance as for similar systems within the City.

7.0 Trunk Storm and Sanitary Sewers and Watermains

Sections 3.0, 4.0 and 5.0 documented the technical analyses that were carried out in support of trunk infrastructure sizing within the S1 Area. None of the trunk infrastructure identified will be subject to any additional Class EA review nor Approval.

Given that the BSUEA MSS reviewed several servicing alternatives in accordance with the Class EA, these solutions were extended to this undertaking. Screening of infiltration and filtration servicing solutions were investigated and evaluated as part of a screening process, consistent with municipal Class EA. Linear infrastructure proposed as part of this Addendum is as follows:

7.1 Stormwater Management and Servicing Projects

Several trunk sewers of various diameters are proposed to service the S1 Area, as illustrated on (Drawing MST). The key stormwater management components include the following:

- Trunk storm sewers along future Cappamore Drive, extending from the western limit near the southern Industrial Lands at Manhole STMH556 to the storm inlet at the dry pond (Manhole STMH600).
- Trunk storm sewers along Elevation Road, extending from Kilbirnie Drive at Manhole STMH513 through the pre-treatment device located along Street No. 15 to a flow-splitting manhole (labelled “Overflow”) within Block 61, discharging to either Manhole STMH500A or STMH500.
- A pre-treatment mechanically treated device (MTD; Defender Model FD-8HC), located south of Manhole STMH502 near the western boundary of Block 61.
- A filtration dry pond with inlet at Manhole STMH500A, situated near the future intersection of Cappamore Drive and Elevation Road.
- A flow-splitter manhole, labelled “Overflow,” located east of the proposed MTD.
- An end-of-pipe dry pond encompassing the filtration dry pond, with dual inlets at Manholes STMH500 and STMH600.
- A network of local storm sewers of varying sizes servicing residential and industrial lands within the S1 Area.
- The existing 900 mm diameter storm sewer outlet and outlet control structure near the southeast corner of Block 61 will be retained. The structure will be retrofitted with low- and high-level orifices sized in accordance with the criteria summarized in Table 13 (above).
- On-site storage facilities within both Industrial Blocks, designed to detain the 100-year design storm onsite while releasing flows in accordance with the available minor system capacity.
- Stormwater quality control measures within both Industrial Blocks, to be designed at the Site Plan stage to meet applicable water quality control requirements in effect at the time of approval.
- Implementation of an Etobicoke Exfiltration System (EES) along local roads, with a minimum 1.0 m separation from seasonally high groundwater levels. The EES is proposed within Areas 1A and 1B, as shown on (Figure 9).

7.2 Sanitary Servicing Projects

Several trunk sanitary sewers are proposed to service the S1 Area, as illustrated on Drawing MSAN). The proposed trunk sanitary sewer alignments include the following:

- Along Street No. 15, extending from the future Cappamore Drive extension at Manhole SAMH703 to Barnsdale Road at Manhole SAMH701.
- Along the Barnsdale Road right-of-way, extending from Manhole SAMH701 to the existing stub connection along Barnsdale Road near Sanitary Sewer Access SAEX04 within the Quinn's Pointe Subdivision.

7.3 Water Servicing Projects

Several 305 mm diameter feedermain extensions are being proposed, along the following roadways:

- Future Kilbirnie Drive extension, from the eastern boundary of the existing CDP limit to Borrisokane Road.
- Future Cappamore Drive extension, from the eastern boundary of the existing CDP limit to a point westerly to service the southern portion of the Industrial Lands.
- Future Elevation Road extension, from the northern boundary of the existing CDP limit to future Cappamore Drive extension, and southerly along Street No. 15 to Barnsdale Road.
- Future Moyard Drive extension from the eastern limit of the CDP to Street No. 5, and southerly to the Cappamore Drive extension.
- Conceptual watermain loops; one within the northern and one within the southern portion in the Industrial Lands.

8.0 Regulatory Approval Requirements and Development Applications

City Of Ottawa

This Addendum was prepared as an extension to the 2018 BSUEA MSS which was prepared as an Environmental Assessment Master Plan (i.e., Master Servicing Study). As such, this Addendum will require a technical review by several groups at the city of Ottawa. Ultimately, this Environmental Assessment Master Plan will require approvals under the *Planning Act.*

Given that this Addendum was prepared as an extension to the BSUEA MSS (2018) where several servicing strategies were analyzed under the Municipal Class Environmental Assessment, the proposed servicing strategies presented herein were developed in accordance with the planning principles of the Class Environmental Assessment. As previously noted, a screening process was carried out to assess various LID solutions with the preferred strategy scored the highest.

With the S1 Area being the last growth area in this quadrant bound by Highway 416 and Barnsdale Road, the servicing strategies for both wastewater and water are limited, and consequently, servicing is based on the capacity of linear infrastructure bounding the Site.

Ministry of the Environment, Conservation and Parks

Servicing strategies evaluated herein and in the 2018 BSUEA MSS were analyzed under the Municipal Class Environmental Assessment and are in accordance with the planning principles of the Class Environmental Assessment. Given that pre-authorized conditions of the Municipal CLI-ECA have been issued under the Environmental Protection Act, infrastructure meeting these conditions will fulfill the approval requirements of section 53 of the Ontario Water Resources Act for sewage works (sanitary and stormwater).

Section 7.0 documented trunk infrastructure supporting the urbanization of the S1 Area Concept Plan. All infrastructure listed in Section 7.1, 0 and 7.3 has been found to meet MECP's pre-authorized criteria under the CLI-ECA framework. Therefore, no additional approval from MECP is required.

Ontario Drainage Act

Any modifications to the hydrological regime or alteration to the serviced area of a municipal drain within the Mud Creek subwatershed, will require that it be documented in an Engineers Report, which is to be prepared by the Engineer of Record in accordance with the Ontario Drainage Act (Section 78, Chapter D.17, R.S.O. 1990).

RCI, the appointed Drainage Engineers for this project, will be coordinating this effort upon the approval of this Addendum. Given that a partial disconnection is being proposed, the process will be on-going in parallel and will not interfere with the completion of this MSS Addendum nor with the approval of the initial phase of the S1 Area.

Ministry of Transportation of Ontario

Although no formal approval is required, acceptance by the Ministry of Transportation of Ontario (MTO) of the proposed drainage alteration will be sought. A meeting was held on January 26, 2026, with representatives from MTO, to discuss the project as Borrisokane Road is part of MTO's Highway 416 right-of-way, and future interchange.

As noted in Section 3.3.2, there is a planned interchange in the southwest quadrant of the Barnsdale Road and Highway 416/Borrisokane Road intersection. A partial disconnection is being proposed which will alter the hydrological regime of the Borrisokane Road open ditch system. As per Section 3.13.4, the net impact of the drainage modification results in a reduction in both peak flows and runoff volumes released to this open ditch system. A copy of this MSS will be circulated to MTO for review.

Rideau Valley Conservation

There is no formal approval of this MSS by the RVCA. However, the RVCA may review future development applications within the S1 Area to ensure that it is consistent with the conservation, development and management of natural resources. As part of this process, the RVCA will ensure that property and public are protected from hazards such as flooding and erosion. However, given the storm servicing strategy presented herein, flooding and erosion are not of concern since off-site discharges are less than those under existing conditions. Similar to the Existing Conditions Report (JLR, 2025), the City of Ottawa, to their discretion, will circulate the final version of this MSS to the RVCA as information.

Future Development Applications

Once this Addendum to the Environmental Assessment Master Plan (Master Servicing Study) is approved, it will also require council approval with the goal of lifting of the neighborhood overlay.

The alignment and sizing of infrastructure, as shown herein, is subject to change as part of *Planning Act* approvals and would be treated as minor changes to this MSS as part of Draft Plan approvals.

Subsequent development applications will be made in accordance with the policies outlined in the city of Ottawa Official Plan. The specific studies required under the development approval process are determined at the commencement of the process and provided at the pre-application consultation meeting with City staff. Specific studies may include:

- Geotechnical studies
- Community transportation and traffic studies
- Noise studies
- Site Servicing Study, including stormwater management
- Environmental Impact Studies.

Several of the above-noted Studies have already been completed as part of the Concept Plan Approval process and are unlikely require an update. However, Studies will be confirmed as part of the City of Ottawa pre-consultation process. A planning rationale outlining how the development meets the intent of the overarching plans for the area will also be required.

9.0 Financial Plans

9.1 Local Infrastructure and Development Charges

Local servicing infrastructure is anticipated to be funded by the developer through subdivision or site plan agreements, consistent with standard City of Ottawa development practices.

Infrastructure components that provide benefit beyond the subject lands or are required to support ultimate system build-out may be eligible for reimbursement through front-ending agreements, Development Charges (DC), or future City capital funding, subject to City approval. Based on the current DC By-law, oversizing payment will occur under the following:

- Sanitary sewers are greater or equal to 375 mm in diameter (> 80 L/s)
- Watermains are greater or equal to 406 mm diameter
- Storm Sewers are greater than or equal to 1800 mm diameter.

Based on current servicing and projects depicted on Drawings KS1, MST, MSAN, MWM as well as Drawings POND, D1 and D2, the following largest trunks are being proposed:

- 1800 mm diameter trunk storm sewers leading to STMH600.
- 375 mm diameter trunk sanitary sewers (flows < 80 L/s).
- 305 mm diameter trunk watermains.

Based on the above listed infrastructure, none of the linear infrastructure meets the oversizing policy of the city's Development Charges Act.

9.2 Cost Sharing and Opinion of Probable Costs

Minto is the sole landowner of the S1 Area. Therefore, there is no cost sharing of linear infrastructure envisioned as there are no arterials. However, oversizing cost to support the development of the park may apply.

Opinion of Probable Costs (OPC) will be completed by populating the city's Schedule B items for each of the stages of the development.

10.0 Infrastructure Phasing and Implementation

10.1 Adaptability

Once this Addendum to the MSS is approved and overlay lifted, construction of linear infrastructure can proceed following the typical Draft Plan of Subdivision process. It is, however, acknowledged that there may be changes prior to the construction being initiated/completed which would be documented as part of the subdivision approval process.

The alignment and sizing of infrastructure, as depicted on Drawings KS1, MST, MSAN and MWM and SWM projects depicted on Drawings POND, D1 and D2, is subject to change as part of *Planning Act* approvals and would be treated as minor changes to this Addendum.

10.2 Detailed Design

The objective of the MSS is to provide a high-level servicing solution, which can demonstrate that development is serviceable/feasible in accordance with municipal and provincial standards. Street-by-street detailed design and grading would still be required; however, this process would occur at the Plan of Subdivision or Site Plan applications stage.

10.3 Staging of Infrastructure

The development of the S1 Area will proceed from the eastern boundary of the Study Area, adjacent to the Quinn's Pointe Subdivision where infrastructure currently exists. Given that the Quinn's Pointe Stage 5 has yet been constructed, it could potentially, to the discretion of Minto, be combined with the initial phase of development within the S1 Area, referred to as Stage 6.

The intended phasing limits for the S1 Area is shown on the Concept Plan (Appendix D). As illustrated, the implementation of the S1 Area will proceed into three (3) successive phases; the initial phase noted as Stage 6, with two (2) subsequent phases noted as Stages 7 and 8. At this time, Minto plans to proceed with the development of the Industrial lands once Stages 6-8 have been completed.

Stage 6 would include the construction of the following roadways:

- Kilbirnie Drive extension, from the eastern limit of the S1 Area to the western edge of Block 63 (woodlot) near the eastern boundary of the Industrial Block.
- Elevation Road extension from Kilbirnie Drive extension to Cappamore Drive extension.
- The eastern leg of Street No 15, from Cappamore Drive to the southern limit adjacent to Barnsdale Road.
- Cappamore Drive extension, from the eastern limit of the S1 Area to Elevation Road extension near the northwestern corner of Block 61.
- Moyard Drive extension from the Industrial Lands pass Elevation Road up to the eastern limit of the S1 Area.
- Street No 1, Street No. 2, Street No. 3, and Street No.4.

- Street No. 5, Street No. 6, Street No. 7 (northern portion).

10.4 Construction of Infrastructure

Infrastructure, including storm, water and wastewater for Stage 6 will consist of the following:

- **Etobicoke Exfiltration System**: Street No 1, Street No. 2, Street No. 3, and Street No.4 as well as along Moyard Drive and Street No. 5, Street No. 6, Street No. 7.
- **Local and Trunk Storm sewers:** All storm sewers will be constructed along all roadways identified in Section 10.3
- **Watermains:** All local and trunk watermains will be constructed along the roadways identified in Section 10.3.
- **Sanitary Sewers:** All local and trunk sanitary sewers will be constructed along the roadways identified in Section 10.3.
- **End-of-Pipe Facility:** All the drainage components and associated infrastructure identified within or in the vicinity of Block 61, including the pre-treatment MTD, filtration dry pond and underlain subdrain system, and the dry pond will be constructed as part of the Stage 6 infrastructure work while the existing outlet structure and storm sewer will be maintained.

10.5 Monitoring

As the implementation of infrastructure proceeds with each of the phases of development, it is recommended that the on-going EES monitoring being conducted in Quinn's Pointe Subdivision be extended into the S1 Area once it has been completed in Quinn's Pointe Subdivision. At such time, monitors would be relocated initially in Stage 6 to gather additional data.

10.6 Implementation and Capacity Analysis

The initial phases of development can represent the most vulnerable period from a servicing and operational perspective, as only a portion of the ultimate infrastructure network is in place. During these early stages, temporary conditions such as reduced system redundancy, interim drainage patterns, and incomplete downstream works may exist. Accordingly, the proposed implementation strategy is intended to ensure that each phase of development functions independently and safely, with adequate servicing capacity and controls always provided until the full build-out of the infrastructure is achieved.

10.6.1.1 Storm Sewers and End-of-Pipe Facility

Storm sewers and ultimate end-of-pipe facility, including the MTD, by-pass manhole, filtration dry pond and dry pond including its existing outlet, are proposed to be constructed as part of Stage 6. Given that all drainage works in Stages 6 is intended to serve additional land, to account for future Stage 7, Stage 8, and Industria Lands, there are no capacity limitations for any of the storm sewers within Stage 6.

In terms of interim drainage conditions, the S1 Area is bounded by two (2) existing subdivisions, and by Barnsdale Road and Borrisokane Road. Therefore, there is no interim drainage conditions apart from the installation of temporary ditch inlets at the western and southern boundaries of Stage 6. The interim drainage condition and temporary infrastructure, including ICDs, will be developed as part of detailed design of Stage 6.

10.6.1.2 Sanitary Sewers

Trunk sanitary sewers that are planned to be constructed as part of Stage 6, are intended to serve additional land, to account for future Stage 7, Stage 8 and Industrial Lands, when constructed. Hence, there are no capacity limitations for any of the sanitary sewers in Stage 6.

Under the interim condition, temporary ICDs will be installed along any sanitary sewer that will service additional lands to limit wastewater flows that could be intercepted. Temporary flow restriction and details will be reviewed as part of detailed design of Stage 6.

10.6.1.3 Water Distribution Analysis

Water distribution systems are often vulnerable during the initial phase of a given development. As a result, the performance of each additional interim phase was evaluated under maximum HGL, peak hour and maximum day plus fire flow. It should be noted that as part of Phase 6, all connection points to the existing municipal distribution system will be utilized via trunk watermain extensions.

The Water HNA and modelling assessment presented in Section 5.3 demonstrates the following:

- Under Maximum HGL existing conditions, each phase is expected to adhere to the maximum pressure constraint of 552 kPa (80 psi).
- Under Maximum HGL future conditions, each phase is expected to adhere to the maximum pressure constraint of 552 kPa (80 psi).
- Under Peak Hour existing conditions, Phase 6 and Phase 8 are expected to adhere to the minimum pressure constraint of 275 kPa (40 psi). Phase 7 expects a few localized low-pressure areas, but these results are anticipated to be temporary if not trivial based on the pressure zone modification.
- Under Peak Hour future conditions, each phase is generally expected to adhere to the minimum pressure constraint of 275 kPa (40 psi).
- Under Maximum Day plus Fire Flow existing and future conditions, each phase is expected to provide 167 L/s at all nodes, and 217 L/s at most nodes. All required fire flows can be met with the proposed trunk watermains for each phase.

11.0 Conclusions

This Addendum to Extend Class EA Master Plan (MSS) prepared in 2018 for the BSUEA. The 2018 BSUEA MSS had reviewed a series of servicing strategies in accordance with the Class Environment Assessment (Class EA) and was completed in accordance with the Integrated Planning Process.

A simplified screening process was undertaken as documented in this Addendum. Infiltration LID and filtration LID alternatives were reviewed and documented in Section 3.10 and Section 3.11. The infiltration solution adopted as part of the 2018 BSUEA MSS was extended to the S1 Area while the proposed filtration LID solution that scored the highest has been recommended.

This Addendum has identified a recommended high-level servicing strategy for storm, wastewater and water servicing to support the proposed Concept Plan (Appendix D). The high-level servicing strategy developed herein demonstrates the feasibility of servicing the proposed S1 Area. The design criteria utilized to develop the servicing strategies shall be used to develop detailed design. It is anticipated that the detailed design to be carried out in the Plan of Subdivision application phase will be consistent with the MSS but will adapt for any alterations to the road and layout configurations. The MSS has been developed with this flexibility in the design.

Principal findings of this Addendum are set out below:

Storm Drainage and Stormwater Management

- The design of the storm drainage system has been undertaken using the dual-drainage approach. This Addendum has set out the design criteria for future draft plan and/or site plan applications for the S1 Area. The design criteria are consistent with current design standards.
- A Master Grading Plan was developed based on existing and proposed grades and utilized to develop the Master Storm Drainage Plan.
- The storm servicing solution developed for the S1 Area is being shown on the Key Servicing Plan and reflects the adopted servicing strategy.
- The infiltration servicing strategy was developed to the maximum extent while recognizing opportunities and constraints listed in Table A2 of the CLI-ECA. The strategy incorporates the Etobicoke Exfiltration System (EES), the recommended solution identified as part of the 2018 BSUEA MSS and supplemented by rooftop infiltration using sub-surface infiltration measures within the Industrial Lands.
- Both infiltration measures are to be sized to capture and infiltrate the 22 mm design storm event.
- Five (5) filtration-type servicing solutions were developed for the areas impacted by the constraints identified in the CLI-ECA,
- The five (5) filtration-type solutions were evaluated as part of a screening process which scored each LID solution against several minor and major criteria.
- The recommended filtration solution that scored the highest, Alternative 5, is being proposed.
- This LID solution is based on a treatment train approach where pre-treatment is being proposed by means of a MTD that is supplemented by a filtration dry pond, with bio-

retention media equipped with an underlain subdrain system surrounded by clear stone envelope, geotextile. Due to roadway salts, the filtration dry pond will be lined with a choked later to minimize migration of roadway salts to the aquifer.

- Given the same principle as an EES, the filtration dry pond was also sized to capture and filtrate the 4-hour 22 mm storm.
- Both proposed infiltration and filtration solutions were found to exceed the requirements of Table 3.2 of MECP's SWMPDM for an 80% TSS removal.
- The post-development water budget with proposed infiltration measures showed comparable infiltration identified under the pre-development water budget.
- The downstream storm boundary conditions or targeted flow allowances developed in the Addendum and were based on the design constraints of existing systems.
- A pre- and post-development analysis was completed to assess peak flows and runoff volumes along both Borrisokane Road (system owned by MTO) and Barnsdale Road open ditch systems as well as at the upper reach of the Thomas Baxter Municipal Drain. The analysis showed a reduction in both peak flows and runoff volumes along the open ditches noted above for all storm events. Hence, no adverse impacts were found along both open ditch systems.
- Simulation results along both Barnsdale Road and Thomas Baxter Municipal Drain have been assessed to not cause adverse impacts by the Team's biologist as reported in the Environmental Impact Statement for the S1 Lands.
- The trunk sewer network was conceptually sized based on the approved Concept Plan and modelled to ensure that the hydraulic grade line (HGL) elevations along the system maintained a 300 mm freeboard, which corresponds to 2 meters below proposed centreline elevations.
- The major overland system was simulated to assess ponding depths (static and dynamic) against the requirements of the SDG (December 2025) being that it shall not exceed 350 mm depth.
- Allowable minor system release rates were set at the required storm event, and future design should maintain the same release rate criteria.
- The stormwater management solution contained in Block 61 or proximity includes a pre-treatment MTD, a filtration dry pond which will be supplemented by an expanded dry pond surrounding this facility, replacing the existing spill-over area constructed as part of the Quinn's Pointe Subdivision.
- Post-development peak flows discharged in the existing 900 mm diameter storm outlet are maintained below those reported in the Site Servicing Report of the Quinn's Pointe Subdivisions.
- A significant area of the S1 Area is proposed to be disconnected from the Thomas Baxter Municipal Drain, which will result in a reduction in both peak flows and runoff volumes for all storm events. Once this Addendum is approved, it will be circulated to the appointed Drainage Engineer and used as part of an upcoming update to the Engineers Report.

Wastewater Servicing

- The residual capacities in the surrounding wastewater services were assessed to determine viable servicing outlets to accommodate wastewater flows from the S1 Area.
- Out of the potential connections, the extension of the existing Barnsdale Road 375 mm sanitary sewer was the only viable outlet having sufficient residual capacity and grade to accommodate wastewater flows from the S1 Area.

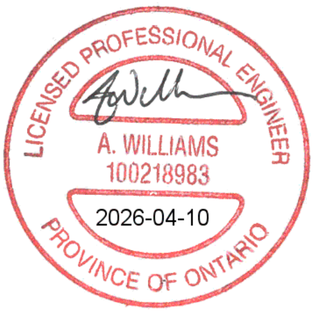
- The existing constructed wastewater system network is capable to accommodate servicing for the S1 Area.
- The MSS Addendum contains design criteria which are to be used for the S1 Area in future draft plan and site plan applications. The design criteria are consistent with current design standards.
- The proposed wastewater system layout has been conceptually sized based on the proposed Concept Plan.

Water Distribution

- The S1 Area can be serviced under current conditions with watermain extensions from the existing surrounding watermains within both the Quinn's Pointe and the Ridge Subdivisions.
- The S1 Area can also be serviced from the reconfigured pressure zone anticipated for implementation in 2027.
- The analysis confirmed that there are no upgrades to the existing nor to the planned distribution network identified in the latest Infrastructure Master Plan.
- Demand allocation for water supply servicing has been derived based on the Concept Plan and associated densities. The allocations were based on system level water consumption rates, and peaking factors provided by the City as the population for the S1 Area exceeds 3,000.
- Trunk watermain sizing has been carried out based on the Concept Plan and reflects trunk watermain extensions at the boundary of the S1 Area.
- This MSS has set design criteria which is to be used for the future draft plan and site plan applications for lands included in the S1 Area. The design criteria are consistent with current design standards.
- Individual potable water assessments will be carried out as part of the detailed design of the various phases of the subdivision as well as the Site Plans for the Industrial Lands using parameters consistent with the Water Distribution Design Guidelines (December 2025).

J.L. RICHARDS & ASSOCIATES LIMITED

Water Servicing
Reviewed by:



Annie Williams, P.Eng.
Manager, Ottawa Civil Department
Senior Civil Engineer

Stormwater Management
Prepared by:

Mathieu Lacelle, P.Eng.
Civil Engineer

Reviewed by:

Karla Ferrey, P.Eng.
Senior Associate,
Director of National Capital Region
Operations

Prepared/Reviewed by:

Guy Forget, P.Eng.
Senior Water Resources Engineer

Appendix A

Study Terms of Reference

Appendix B

Existing Conditions Report (2025)

Appendix C

2018 BSUEA MSS

Appendix D

Concept Plan (V54)

Appendix E

Paterson Memorandum and

Bathymetric Survey

Appendix F

Alternatives 4 and 5 – Conceptual Information

Appendix G

Figure (EES separation) and
Storm Sewer Design Sheets

Appendix H

PCSWMM Model Inputs and Results and Schematics

Appendix I

Sanitary Sewer Design Sheets and Calculations

Appendix J

Water Distribution

Appendix K

Drawings

Appendix L

Operation and Maintenance Manual (EES)
and Modelling Files

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

Ottawa
343 Preston Street
Tower II, Suite 1000
Ottawa ON Canada
K1S 1N4
613-728-3571
ottawa@jlrichards.ca

Kingston
203-863 Princess Street
Kingston ON Canada
K7L 5N4
613-544-1424
kingston@jlrichards.ca

Sudbury
314 Countryside Drive
Sudbury ON Canada
P3E 6G2
705-522-8174
sudbury@jlrichards.ca

Timmins
834 Mountjoy Street South
Timmins ON Canada
P4N 7C5
705-360-1899
timmins@jlrichards.ca

North Bay
122 Main Street West, Suite 3
North Bay ON Canada
P1B 2T5
705-495-7597
northbay@jlrichards.ca

Guelph
107-450 Speedvale Avenue West
Guelph ON Canada
N1H 7Y6
519-763-0713
guelph@jlrichards.ca

London
380 Wellington Street
Tower B, 7th Floor
London ON Canada
N6A 5B5
226-700-5127
london@jlrichards.ca

CANADA BEST MANAGED COMPANIES Platinum member