J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

MEMO

Date: September 10, 2025

To: Jonathan Amor

From: Mahad Musse, EIT – J.L. Richards and Associates
Annie Williams, P.Eng. – J.L. Richards and Associates

CC: Andrew Duncan, P.Eng. – J.L. Richards and Associates

Subject: City of Ottawa – 1500 St. Laurent Blvd – OCT South Garage Upgrades – Phase 2

Rev 1: South Garage Water Servicing Memo Updates

JLR No.: 31489-023

Purpose of Undertaking

The Climate Change Master Plan recently approved by the City of Ottawa (January 2020) provided a framework on how to mitigate and adapt to climate change in the next 30 years. This Master Plan identified Greenhouse Gas (GHG) emission reduction as one of the goals and identified priority targets for the next five (5) years. One of the primary actions identified in the Master Plan is the transition to a zero-emissions fleet of vehicles which includes transit buses.

To achieve this ambitious goal over the next five (5) years, the north and south garages sited at 1500 St Laurent Blvd will need to be upgraded to accommodate pantograph chargers for E-Buses. Similarly, the chargers will also be implemented for the proposed garage which is under design by AECOM. The three (3) buildings will also need to incorporate a sprinkler system sized to achieve regulatory fire protection.

As a result of the proposed pantograph chargers and EV-Buses that are highly flammable, the existing garages (north and south) and proposed garage will require an increase in fire flow availabilities. As a result, a need was identified to evaluate the adequacy of the existing on-site distribution system to determine whether it can deliver sufficient flow at the existing garages and new buildings to meet this increase in fire flow requirements. If the on-site watermains are found not to be capable in meeting the increased in fire flow availabilities, watermain servicing upgrades were to be developed and evaluated as part of this Memorandum.

Summary of Updates

This memo serves as a revision to the servicing strategies outlined in the original document prepared by J.L. Richards and Associates, titled *"City of Ottawa – 1500 St. Laurent Blvd – OCT South Garage Upgrades – Phase 2"*, dated June 2024.

Since the issuance of that memo, the proposed watermain servicing strategy for the proposed garage has been revised as follows:

- A new 254 mm diameter watermain is proposed to extend from the existing 254 mm watermain at 899 Belfast Road. This new watermain will provide two (2) separate connections: one (1) to a proposed fire hydrant south of the proposed garage, and one (1) to the existing 200 mm diameter watermain loop that services the north and south garages.

- A 200 mm diameter water service is proposed to extend from the existing 200 mm loop (near the existing north garage) to directly service the proposed garage.

The updated hydraulic network analysis reflecting these changes is presented in this memo. The revised watermain servicing option described above can be found in the engineering drawings prepared by EXP for the City of Ottawa, titled *"New Watermain Loop and Water Service – OC Transpo Campus, 1500 St. Laurent Boulevard, Ottawa, Ontario, Contract No. CF000471.09 – Issued for Tender,"* dated August 13, 2025, as well as in the drawings prepared by AECOM, titled *"OTC ZEB – New Garage,"* dated April 15, 2025.

In addition to revisions to the proposed servicing, the water demand estimates have been revised and reduced due to the removal of the bus wash from the design. The updated demand values are as follows:

- Total Average Day Demand: 5,100 L/day (0.06 L/s)
- Total Peak Hour Demand: 950,040 L/day (11.00 L/s)

Furthermore, the flow and pressure requirements for the proposed garage sprinkler system have been revised from 101 L/s at 46 psi to 117 L/s at 50 psi. It is noted that for the existing north and south garages the sprinkler flow of 101 L/s at 46 psi is to be maintained.

Background

To evaluate the on-site fire flow capabilities, a hydraulic water model was developed and used as a modelling tool to assess conformance of the distribution system in achieving regulatory requirements. The hydraulic model was developed using water servicing information depicted on Drawings provided by the City of Ottawa and subsequently confirmed via a comparison with the information displayed on "geoOttawa".

The hydraulic model is now updated to incorporate the proposed servicing strategies indicated in the separate engineering drawings prepared by EXP and AECOM respectively.

Based on the review of the background information, the existing north and south garages at 1500 St Laurent Blvd are currently being serviced by an on-site 200 mm diameter watermain loop. This privately owned 200 mm diameter looped system receives its water supply from the Municipal system from two (2) service connections:

- a 152 mm diameter lateral crossing the St Laurent Blvd right-of-way.
- a 200 mm diameter watermain lateral along Belfast Road, immediately west of St Laurent Blvd.

In addition to the 200 mm diameter loop, there is a 254 mm diameter watermain which extends from 899 Belfast Road and is immediately west of the 200mm diameter noted above.

The above-noted service laterals are connected to the St Laurent Blvd 400 mm diameter feedermain and to the Belfast Road 300 mm diameter feedermain, respectively. It should also be noted that other buildings adjacent to 1500 St Laurent Blvd property have also their own service lateral which are all fed by the Belfast Road 300 mm diameter feedermain, including buildings sited at 925 Belfast Road (150 mm diameter lateral), 899 Belfast Road (254 mm diameter lateral) and 875 Belfast Road (150 mm diameter lateral).

Water Servicing Design Criteria

A Hydraulic Network Analysis (HNA) was carried out to evaluate the performance of the existing on-site watermains to confirm whether it meets regulatory requirements and to subsequently identify system upgrades, if any, are required to demonstrate that it can achieve the pressure constraints described in the City of Ottawa Design Guidelines for Water Distribution (July 2010) and subsequent Technical Bulletins ISDTB-2014-02, ISDTB-2018-02, and ISTB-2021-03. These documents are herein referred to as the Design Guidelines and TB-2014-02, TB-2018-02, and TB-2021-03, respectively.

Section 4.2.2 of the Design Guidelines requires that all new development additions to the private and public water distribution network be designed such that the minimum and maximum residual pressures, as well as flow rates, comply with the following design criteria:

- Under maximum hourly demand conditions (peak hour), the residual pressures are not less than 276 kPa (40 psi).
- During periods of maximum day combined to a fire flow demand, the residual pressure at any point in the distribution system shall not be less than 140 kPa (20 psi).
- Per the Ontario Building Code (OBC) in occupied areas, the static pressure at any fixture shall not exceed 552 kPa (80 psi); and
- The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi).

Buildings Under Review

The fire flow availability from the on-site distribution system was estimated via a water model for both existing garages (north and south) as well as for the proposed garage designed by others. The north and south garages are currently serviced by the on-site 200 mm diameter watermain loop. There is a proposed 254 mm diameter watermain extension to increase water supply on the 200 mm diameter watermain loop, as identified by AECOM and EXP.

Water Demands

Proposed Garage

The average day and peak hour water demands for the proposed garage are provided in the table below. These values exclude the bus wash, which was included in the previous memorandum. In addition, the maximum day demand has been estimated by applying a peaking factor of 1.5 to the average day demand, in accordance with Table 4.2 of the Design Guidelines.

Existing Garages

Domestic water demands consisting of those of the proposed garage as described above and those associated with the existing garages (north and south) were estimated using water metered data provided by OC Transpo. The data was processed and lumped together given that the supply originates from the on-site 200 mm diameter loop.

Once processed, the flow metering data for the garages yielded an average day demand of 1.09 L/s and a maximum day demand of 1.63 L/s. Since the data did not allow for extracting of the peak hour demand, it was assumed that each building would have the same peak hour demand of 11.00 L/s as the proposed garage as estimated by AECOM. The total peak hour demand for both the north and south buildings combined was 22.00 L/s.

The overall domestic demands as described above have been summarized in Table 1 below while Appendix A includes the detailed water demand calculations.

Table 1: Total Water Demand

	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Proposed Garage	0.06 1.15	0.09 1.72	11.00 3.10
Existing Garages (North and South)	1.09	1.63	22.00
Total	1.15	1.72	33.00

Watermain Sizing and Roughness

The water model, which was developed using the WaterCAD® platform, requires roughness coefficients to enable the software to estimate headlosses along the distribution system.

Given that the existing systems consist of non-PVC watermains, a separate simulation confirmed that the impact of the age/roughness of ductile and cast-iron pipes was found to be negligible as the fire flow and pressure results in the water model did not differ significantly compared to the results with typical pipe roughness coefficient as shown in Table 2. Consequently, the roughness coefficients used in the water model were set by using Section 4.2.12 of the Design Guidelines and summarized in Table 2 (below) while the internal pipe diameters were modelled based on Section 4.3.5 of the Design Guidelines and are summarized in Table 3 (below).

Table 2: Watermain Roughness Coefficients

Watermain Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120

Table 3: PVC Watermain Internal Diameters

Nominal Diameter (mm)	Inside Diameter (mm)
150	155
200	204
300	297
400	393

Fire Flow Requirements and Pressure Requirements

In Ontario, fire protection is governed by two (2) distinct design standards; the Ontario Building Code (OBC) governs private property, while the Fire Underwriters Survey (FUS) is applied by some municipalities along right-of-way (ROW).

Within the City of Ottawa, fire flow protection is governed by the FUS standard and TB-2018-02 and TB-2024-05. The Guideline entitled "Water Supply for Public Fire Protection (2020)" developed by the FUS provides the guidance with respect fire flow calculations within private properties.

The proposed garage and both existing garages will be equipped with pantograph chargers for the E-Buses. Each of these buildings will be equipped by an automated, fully supervised sprinkler system designed in accordance with the Ontario Building Code (OBC).

For the proposed garage, the location of the siamese connection and mechanical room, as well as water demands, including sprinkler flows, were reviewed with the project's mechanical engineer. The fire flow requirement for the sprinkler system, including the hose stream allowance were established at 117 L/s as detailed in the correspondence in Appendix B. Thus, in addition to the requirements noted in the Water Design and Servicing Criteria section, the sprinkler demand of 117 L/s at a minimum pressure of 50 psi (344 kPa) was also reviewed. For the existing north and south garages, applying a sprinkler demand of 101 L/s at 46 psi (317 kPa) was reviewed.

The required fire flows (RFF) for the existing garages (north and south) were calculated as per the FUS Guidelines based on building size, properties, exposure to adjacent units and TB-2018-02 which includes City Technical Bulletin ISDTB-2014-02. The required fire flow for the proposed garage was provided by AECOM and has been included in Appendix B. The required fire flows for each building are summarized below (refer to Appendix C for detailed fire flow calculations for the existing buildings).

183 L/S

- Proposed Garage RFF = 233 L/s
- North Garage RFF = 250 L/s

- South Garage RFF = 267 L/s

Hydraulic Water Model and Boundary Conditions

The hydraulic water model was developed for the subject site using the WaterCAD® software platform. At the onset, the model included the existing private watermains with two (2) connections to the feedermains; one connection to the Belfast Road 300 mm diameter feedermain (noted as Connection 1, Table 4 below) and one connection to the St-Laurent Boulevard 400 mm diameter feedermain (noted as Connection 2, Table 4 below).

Given that the simulation of the watermain loop did not yield results that met the pressure constraint of 140 kPa (20 psi), a second supply from the Belfast Road 300 mm diameter feedermain was also added to the model noted as Connection 3, Table 4 below.

Thus, the water model, with two (2) sources of supply was used to simulate the existing conditions while the model was revised with three (3) sources of supply to investigate servicing upgrades to meet the pressure constraints noted in the above Water Servicing and Design Criteria section.

An updated boundary condition request (dated May 7, 2024) was made to the City of Ottawa to obtain the supply characteristics at each of the connection points. An email correspondence was subsequently received from the City on May 22, 2024 (Appendix B). The supply elevations are shown in Table 4 below.

Table 4: Summary of Boundary Conditions Provided by City

	Connection 1 - Belfast	Connection 2 – St. Laurent	Connection 3 - Belfast
Minimum HGL (m)	110.1	110.1	110.1
Maximum HGL (m)	118.3	118.2	118.4
Max Day + Fire Flow (233 L/s) (m)	108.0	110.8	107.4
Max Day + Fire Flow (250 L/s) (m)	107.2	110.5	106.6
Max Day + Fire Flow (267 L/s) (m)	106.4	110.1	105.7

Description of Servicing Alternatives

Several simulations were carried out using the water model to evaluate whether fire protection at each of the three (3) buildings was met. This memorandum presents two servicing scenarios. Note that Scenario 2, initially recommended as a 200 mm watermain extension in the June 2024 JLR memo, has since been revised to a 254 mm diameter extension.

- **Scenario 1 – Existing Conditions**: The first scenario that was evaluated consisted of the existing conditions under only two (2) supply connections, which included a 150 mm diameter watermain identified by AECOM extending from the existing 200 mm loop that would service the proposed garage. Under Scenario 1, there were no upgrades applied to the existing system.

  The simulation results showed that the required fire flow of 233 L/s at the proposed garage (J-29 in WaterCAD) could not be achieved as the nearby hydrants (H-3 and H-7 in WaterCAD) did not have sufficient supply. The deficient fire flow at the proposed garage was found to be approximately 146 L/s. It should be noted that under Scenario 1, the required fire flows (250 L/s and 267 L/s) for the existing garages (north and south) were achieved (refer to Appendix D for the WaterCAD model results). Thus, different scenarios were to be evaluated with proposed upgrades to ensure that the fire flow requirements are met at each of the three (3) garages (proposed, north, and south).

- **Scenario 2 – Third Supply with Proposed 254 mm Watermain Extension**: The second scenario that was evaluated with a 254 mm watermain extension (approx. 270 m) from a separate supply from 899 Belfast Road that will service a hydrant south of the proposed garage. This extension will also tie into the existing 200 mm diameter onsite loop at the north garage (at J-60 in the model, refer to Appendix D) to increase the supply of the existing watermain loop. Additionally, a service connection is proposed at the northern portion of the existing 200 mm diameter watermain loop, near the north garage, to service the proposed garage (at J-29 in model).

  Scenario 2 was identified as the preferred servicing scenario as it optimized the system and was found to be the most cost effective of the servicing solutions that were investigated while providing adequate fire flows at each of the three (3) buildings (proposed, north, and south).

Recommended Water Servicing

The proposed servicing and servicing upgrades described under Scenario 2 are as follows:

- A 200 mm diameter water service, identified by AECOM, will connect the proposed building to the existing on-site 200 mm diameter watermain loop.

- A new 254 mm diameter watermain is proposed to extend from the existing 254 mm watermain at 899 Belfast Road. This new watermain will provide supply to two (2) locations: one (1) to a proposed fire hydrant south of the proposed garage, and one (1) to the existing 200 mm diameter watermain loop that services the north and south garages

Simulation Results

Scenario 1 – Existing Conditions (no upgrades)

Maximum Day Demand Plus Fire Flow Demand

Under the automated fire flow simulation, the simulated fire flow of 146 L/s and 197 L/s at hydrants near the proposed building was found not to meet the fire flow requirement of 233 L/s as shown in Appendix D. Thus, servicing upgrades are required to increase fire flow availability at the proposed building. It should be noted that under the automated fire flow simulation, no sprinkler demands were applied to any of the junctions and as such, the overall fire flow requirement of 233 L/s was targeted for the proposed building at either H-7 or H-3. The simulated fire flows at H-3 and H-7 were only 197 L/s and 146 L/s, respectively. Similarly, the existing garages (north and south) do not achieve their required fire flows.

Scenario 2 – Proposed 254 mm Watermain Extension

Scenario 2 consists of the recommended servicing described above that was developed to meet regulatory requirements. Thus, the peak hour, maximum day plus fire demand and maximum HGL simulation results are summarized below.

Peak Hour Demand

For the existing garages (north and south), the peak hour demand of 22.0 L/s was distributed across junctions throughout the site to reflect the various service laterals into the north and south buildings. The peak hour demand of 11.0 L/s was applied on the representative junction in the model (J-29 in WaterCAD) of the proposed building. Similarly, the demand of the existing building of 0.32 L/s that extends from the existing 254 mm diameter watermain on 899 Belfast Road was applied at Node J-58. Under the peak hour demands identified in Table 1, the simulation results show a minimum residual pressure of 382 kPa (55.4 psi) at node J-54 which exceeds the minimum pressure requirement of 276 kPa (40 psi) (refer to Appendix D for junction and pipe summary reports).

Maximum Day plus Fire Flow Demand

To ensure that the proposed building has adequate fire protection the upgrade was modelled first under the automated fire flow simulator in WaterCAD. The RFF for the proposed building was calculated to be 233 L/s per the FUS, which is inclusive of the sprinkler demand and hose stream allowance determined by the mechanical engineer to be 117 L/s. Manual fire flow simulations were carried out as detailed below to confirm that the RFF is met for all three (3) buildings.

Manual Fire Flow Simulation 1 (Proposed Building)

Under this simulation, the overall RFF (233 L/s) was spread over J-29 for the sprinkler demand of 117 L/s while two (2) hydrants (H-3 and H-7) combined were assigned the 116 L/s (58 L/s for each hydrant). Simulation results show that all nodes exceed the 140 kPa with the minimum pressure of 166 kPa observed at J-29.

Manual Fire Flow Simulation 1 (North Building)

Under this simulation, the overall RFF (250 L/s) was spread over J-12 for the sprinkler demand of 101 L/s while two (2) hydrants (H-5 and H-6) combined were assigned the 132 L/s (66 L/s for each hydrant). Simulation results show that all nodes exceed the 140 kPa with the minimum pressure of 215 kPa observed at J-12.

Manual Fire Flow Simulation 1 (South Building)

Under this simulation, the overall RFF (267 L/s) was spread over J-28 for the sprinkler demand of 101 L/s while two (2) hydrants (H-2 and H-6) combined were assigned the 132 L/s (66 L/s for each hydrant). Simulation results show that all nodes exceed the 140 kPa with the minimum pressure of 278 kPa observed at J-28.

Maximum HGL

The maximum pressure (maximum HGL) scenario was simulated to determine the need, if any, for a pressure reducing valves (PRVs) to ensure that the pressure in the water distribution system does not exceed the maximum pressure constraint of 552 kPa (80 psi) set by the OBC. The maximum simulated pressure in the system was found to be 483 kPa (70.1 psi) at several nodes in the model as shown in Appendix D. Therefore, the proposed building will not require the installation of a PRV as the simulated pressures throughout the site are below the maximum pressure constraint of 552 kPa.

Pressure Constraints

The recommended 254 mm watermain extension upgrade satisfies the pressures constraints in Section 4.2.2 of the Design Guidelines. However, the upgrade does not meet the project specific constraints of 50 psi (344 kPa) for the proposed sprinkler system for the proposed garage. Furthermore, the project specific constraint of 46 psi (317 kPa) is not met for the existing north and south garages. It is understood that a fire pump will be included in the proposed and north garages to address pressure constraints and a sprinkler code consultant has determined that a fire pump is not required for the south garage.

Water Summary and Recommendations

The simulation of existing conditions confirmed that the on-site system could not provide adequate fire flow protection for the three (3) garages. Thus, a system upgrade consisting of a 254 mm watermain extension was required to ensure the fire flow requirements are met at all buildings (proposed, north, and south). Under this upgrade, the simulation results under the peak hour condition showed that the simulated pressure at the proposed building and existing garages will exceed the minimum pressure criterion of 276 kPa (40 psi). Hence, no measures are required to mitigate low pressures.

Under the maximum day plus fire flow conditions with the 254 mm watermain extension, the distribution system and hydrants will satisfy the RFF previously described for all three (3) buildings. The simulation results under maximum HGL for the 254 mm watermain extension do not exceed the maximum pressure constraint of 552 kPa (80 psi) and will not require the installation of PRVs.

The simulation results indicate that the proposed, south, and north garages meet the minimum pressure requirement of 140 kPa, in accordance with the Water Design Guidelines. However, the results also show that the pressure requirements for the sprinkler systems cannot be met under current conditions. To address this, a fire pump is expected to be installed in the proposed and south Garages. Meanwhile, a sprinkler code consultant has confirmed that a fire pump is not required for the south garage

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:

Mahad Musse, EIT
Civil Engineering Graduate

Reviewed by:

Annie Williams, P.Eng.
Senior Civil Engineer

MM:aw

Appendix A

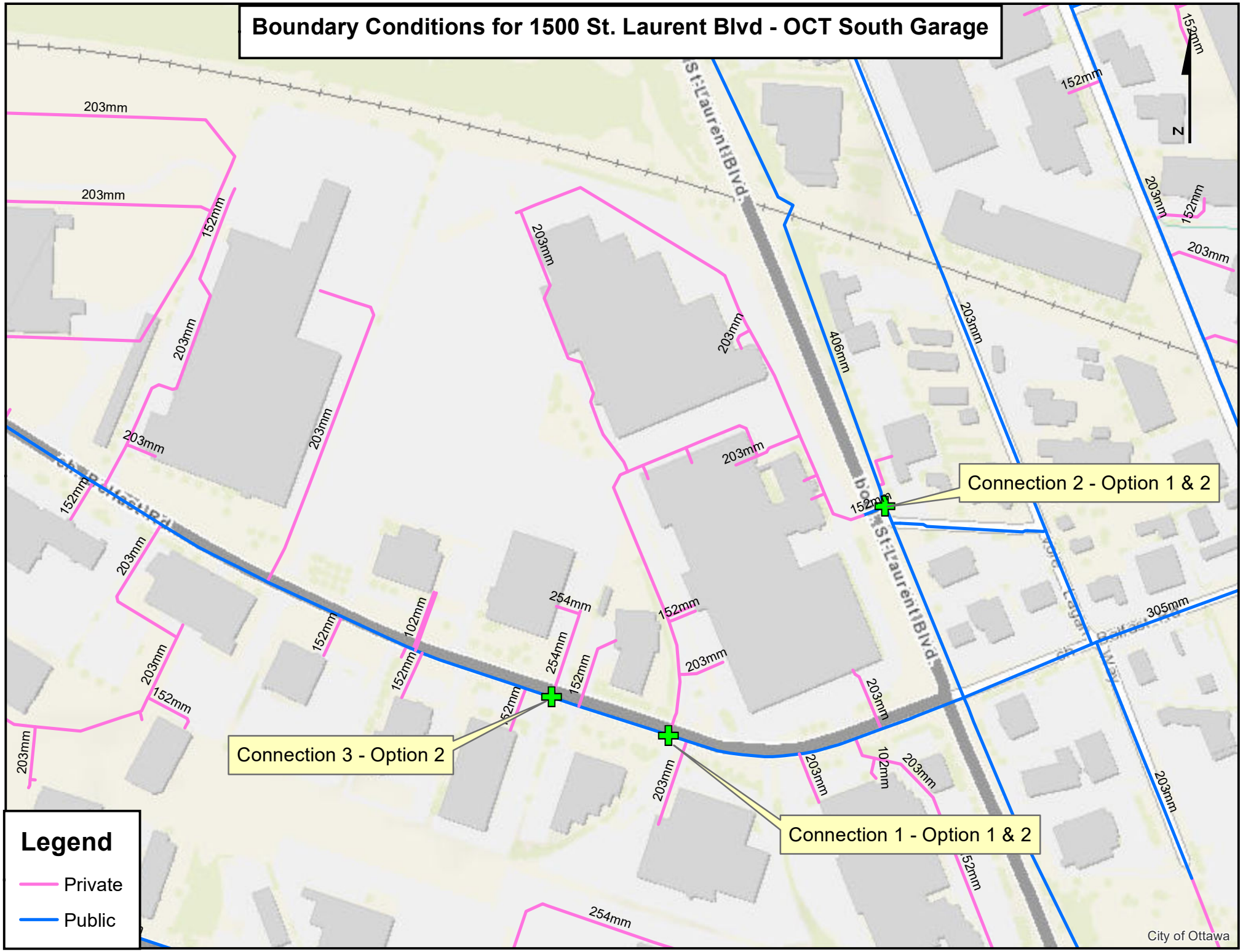
Water Demands

Water Demand Calculations OCT South Garage Upgrades Ph2 (JLR 31489-021)		
Demand Breakdown	**No.**	**Unit**
Peak Hour Demand	**2.94**	**L/s**
Peak Hour Peaking Factor	1.80	
Maximum Day Demand	**1.63**	**L/s**
Maximum Day Peaking Factor	1.50	
Average Day Demand	**1.09**	**L/s**
Total Demands for Storage Facility		
Average Day Demand	**1.09**	**L/s**
Maximum Day Demand	**1.63**	**L/s**
Peak Hour Demand	**2.94**	**L/s**

Peaking factors based on City of Ottawa Water Design Guidelines

Appendix B

Email Correspondence


Boundary Conditions for 1500 St. Laurent Blvd - OCT South Garage
St. Laurent Blvd
St. Laurent Blvd
St. Laurent Blvd
Connection 2 - Option 1 & 2
Connection 3 - Option 2
Connection 1 - Option 1 & 2
Legend
Private
Public
N
City of Ottawa
203mm
152mm
406mm
254mm
102mm
305mm

Tatyana Roumie

From: Andrew Duncan
Sent: June 3, 2024 9:40 AM
To: Annie Williams; Tatyana Roumie; Lee Jablonski
Subject: FW: 31489-021 - OCT South Garage Upgrades Ph2
Attachments: 1500 St. Laurent Blvd - OCT South Garage REVISED May 2024.pdf

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Hi,

Please review the information included below and attached and let me know if we have what we need to finish the site wide water supply investigation.

Andrew

Andrew Duncan, P.Eng.
Senior Associate
Senior Mechanical Engineer
Practice Lead, Environmental Infrastructure
Ottawa, ON
Work: 343-804-4383
Mobile: 613-889-4788

From: Qadan, Sami <Sami.Qadan@ottawa.ca>
Sent: Monday, June 3, 2024 9:37 AM
To: Andrew Duncan <aduncan@jlrichards.ca>
Cc: Amor, Jonathan <jonathan.amor@ottawa.ca>
Subject: FW: 31489-021 - OCT South Garage Upgrades Ph2
Importance: High

[CAUTION] This email originated from outside JLR. Do not click links or open attachments unless you recognize the sender and know the content is safe. Do not forward suspicious emails, if you are unsure, please send a separate message to Helpdesk.

Hi Andrew,

Apology that I forward this late. I was off last week and completely forget to forward it to you.

Let us know if you still have any concerns with the reply below.

Regards

Sami

From: Ahmad, Shohan <Shohan.Ahmad@ottawa.ca>
Sent: May 22, 2024 5:09 PM
To: Qadan, Sami <Sami.Qadan@ottawa.ca>
Cc: Amor, Jonathan <jonathan.amor@ottawa.ca>; Afzalan, Bahar <bahar.afzalan@ottawa.ca>
Subject: RE: 31489-021 - OCT South Garage Upgrades Ph2

Hi Sami,

We do not consider private infrastructure. BC are only provided from Public Infrastructure.

From following scenario's **Option 1** and **Option 2** are provided in the BC.

- Scenario #1: No upgrades. Requesting boundary conditions at Connections 1 and 3 (Connection 3 is located on the St. Laurent Blvd 406mm watermain on the other side of the 152mm stub.) **- Provided as Option 1**
- Scenario #2: Proposed 300 mm pipe upgrade crossing St. Laurent Blvd. Requesting boundary conditions at Connections 1 and 3
- Scenario #3: Proposed third connection to the site from Belfast Rd using existing 254mm water service. Requesting boundary conditions at Connections 1, 2, and 4
- Scenario #4: Proposed third connection to the site from Belfast Rd using existing 254mm water service + proposed 300 mm pipe upgrade crossing St. Laurent Blvd. Requesting boundary conditions at Connections 1, 3, and 4 **- Provided as Option 2 with no private pipe upgrade and addition.**
- Scenario #5: Proposed third connection to the site from Belfast Rd using existing 254mm water service. Requesting boundary conditions at Connections 1, 2, and 5
- Scenario #6: Proposed third connection to the site from Belfast Rd using existing 254mm water service + proposed 300 mm pipe upgrade crossing St. Laurent Blvd. Requesting boundary conditions at Connections 1, 3, and 5

******The following information may be passed on to the consultant, but do NOT forward this e-mail directly.******

The following are boundary conditions, HGL, for hydraulic analysis at OC Transpo at 1500 St. Laurent Blvd. (zone 1E) assumed to be connected via two connections to the 305mm on Belfast Road and 406mm on St. Laurent Street (option #1) **OR** two connections to the 305mm on Belfast Road and one connection to the 406mm on St. Laurent Street (option #2) (see attached PDF for location).

Option 1	305mm on Belfast Connection 1	406 mm on St-Laurent Connection 2
Minimum HGL (m)	110.1	110.1
Maximum HGL (m)	118.3	118.2

Max Day + FF (233 L/s) (m)	108.0	110.8
Max Day + FF (250 L/s) (m)	107.2	110.5
Max Day + FF (267 L/s) (m)	106.4	110.1

Option 2	305mm on Belfast Connection 1	406 mm on St-Laurent Connection 2	305mm on Belfast Connection 3
Minimum HGL (m)	110.1	110.1	110.1
Maximum HGL (m)	118.3	118.2	118.4
Max Day + FF (233 L/s)	108.0	110.8	107.4
Max Day + FF (250 L/s)	107.2	110.5	106.6
Max Day + FF (267 L/s)	106.4	110.1	105.7

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Shohan

Shohan Ahmad, P.Eng., M.E.Sc., Ph.D.
Senior Engineer, Water Resources
City of Ottawa - Infrastructure & Water Services
Shohan.ahmad@ottawa.ca

From: Qadan, Sami <Sami.Qadan@ottawa.ca>
Sent: 2024/05/22 3:29 PM
To: Ahmad, Shohan <Shohan.Ahmad@ottawa.ca>
Cc: Amor, Jonathan <jonathan.amor@ottawa.ca>
Subject: FW: 31489-021 - OCT South Garage Upgrades Ph2

Hi Shohan,

Could you please advise us on the status of the request sent below by the project consultant.

Please let us know if you have any concerns or questions about this request.

Kind regards

Sami Qadan
613 9132715

From: Tatyana Roumie <troumie@jlrichards.ca>
Sent: Tuesday, May 7, 2024 3:47 PM
To: Ahmad, Shohan <Shohan.Ahmad@ottawa.ca>
Cc: Andrew Duncan <aduncan@jlrichards.ca>; Lee Jablonski <ljablonski@jlrichards.ca>; Annie Williams <awilliams@jlrichards.ca>
Subject: RE: 31489-021 - OCT South Garage Upgrades Ph2

Hello Shohan,

As a follow up to our previous boundary condition request, we're now looking at options to achieve higher fire flows on our site.

We are requesting boundary conditions for four (4) of the configuration scenarios below (refer to the attached). We prefer boundary conditions for Scenarios #1, #2, #5 and #6. However, if this information at the end of the 254mm water service is not available, then we request boundary conditions for Scenarios #1, #2, #3 and #4. Please also send meter data for the existing building supplied by the 254mm water service if this is the case.

- Scenario #1: No upgrades. Requesting boundary conditions at Connections 1 and 3 (Connection 3 is located on the St. Laurent Blvd 406mm watermain on the other side of the 152mm stub.)

- Scenario #2: Proposed 300 mm pipe upgrade crossing St. Laurent Blvd. Requesting boundary conditions at Connections 1 and 3
- Scenario #3: Proposed third connection to the site from Belfast Rd using existing 254mm water service. Requesting boundary conditions at Connections 1, 2, and 4
- Scenario #4: Proposed third connection to the site from Belfast Rd using existing 254mm water service + proposed 300 mm pipe upgrade crossing St. Laurent Blvd. Requesting boundary conditions at Connections 1, 3, and 4
- Scenario #5: Proposed third connection to the site from Belfast Rd using existing 254mm water service. Requesting boundary conditions at Connections 1, 2, and 5
- Scenario #6: Proposed third connection to the site from Belfast Rd using existing 254mm water service + proposed 300 mm pipe upgrade crossing St. Laurent Blvd. Requesting boundary conditions at Connections 1, 3, and 5

We kindly request these boundary conditions for the same demands and fire flows provided previously.

Should you have any questions, please do not hesitate to contact me.

Thanks,
Tatyana

Tatyana Roumie, EIT, M.Eng.
Civil Engineering Intern
Ottawa, ON
Work: 343-804-9370

From: Ahmad, Shohan <Shohan.Ahmad@ottawa.ca>
Sent: Wednesday, April 17, 2024 1:44 PM
To: Tatyana Roumie <troumie@jlrichards.ca>
Cc: Andrew Duncan <aduncan@jlrichards.ca>; Lee Jablonski <ljablonski@jlrichards.ca>; Annie Williams <awilliams@jlrichards.ca>
Subject: RE: 31489-021 - OCT South Garage Upgrades Ph2

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Hi Tatyana, BC request received.

Shohan

Shohan Ahmad, P.Eng., M.E.Sc., Ph.D.
Senior Engineer, Water Resources
City of Ottawa - Infrastructure & Water Services

Shohan.ahmad@ottawa.ca

From: Tatyana Roumie <troumie@jlrichards.ca>
Sent: 2024/04/17 9:04 AM
To: Ahmad, Shohan <Shohan.Ahmad@ottawa.ca>
Cc: Andrew Duncan <aduncan@jlrichards.ca>; Lee Jablonski <ljablonski@jlrichards.ca>; Annie Williams <awilliams@jlrichards.ca>
Subject: 31489-021 - OCT South Garage Upgrades Ph2

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Hello Shohan,

We would like to obtain hydraulic boundary conditions for OC Transpo's industrial site located at 1500 Saint Laurent Boulevard.

The site consists of two existing buildings owned by OC Transpo and a third building is proposed to be constructed for the storage of electrical buses.

The site has an existing watermain loop which is connected to the City's system at St. Laurent Blvd. and Belfast Road. We are requesting the boundary conditions at these two existing watermain connections. (See attached)

The demands for the two existing buildings were calculated using the water usage data provided from OC Transpo. For the proposed building, the maximum day demand and peak hour demand were provided by AECOM and the average day demand was derived using the same peaking factor as the existing buildings. The total demands are shown in the table below:

	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Two Existing Buildings	1.09	1.63	36.00
Proposed Building	0.54	0.81	18.00
Total	**1.63**	**2.44**	**54.00**

Average Day = 1.63 L/s
Maximum Day = 2.44 L/s
Peak Hour = 54.00 L/s
Fire Flow 1 (OBC Sprinkler) = 101 L/s
Fire Flow 2 (FUS) = 233 L/s
Fire Flow 3 (FUS) = 250 L/s
Fire Flow 4 (FUS) = 267 L/s

The sprinkler system was calculated by AECOM to be 101 L/s (6,060 L/min). The FUS fire flow requirement for the proposed building was also calculated by AECOM to be 233 L/s (13,980 L/min).

The FUS fire flow requirement of 250 L/s (15,000 L/min) was calculated for the existing north garage building, as detailed in the attachment.

The FUS fire flow requirement of 267 L/s (16,020 L/min) was calculated for the existing south garage building, as detailed in the attachment.

We kindly request hydraulic boundary conditions for minimum and maximum pressures and under maximum day demand based on fire flows of 101 L/s, 233 L/s, 250 L/s, and 267 L/s.
If we could receive the requested boundary conditions at your earliest convenience it would be much appreciated.

Should you have any questions or require any further information, please do not hesitate to contact me.

Thank you,

Tatyana

Tatyana Roumie, EIT, M.Eng.
Civil Engineering Intern

1000-343 Preston Street
Ottawa, ON, K1S 1N4

Work: 343-804-9370
troumie@jlrichards.ca

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FUS Fire Flow Calculations (Per City of Ottawa ISTB-2018-02)
OC Transpo Electrical Bus Storage Facility (Industrial Building)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		
	Coefficient (C)	0.8		Table G1 - ISTB-2018-02
B	Ground Floor Area	9536	m^2	
C	Height in storeys	1	storeys	
	Total Floor Area	9536	m^2	
D	Fire Flow Formula	F=220C√A		
	Fire Flow	17187	L/min	
	Rounded Fire Flow	17000		Rounded to nearest 1000 L/min
E	Occupancy Class	Free Burning		Municipal storgage building - combustible occupancy class
	Occupancy Charge	15%		
	Occupancy Increase or Decrease	2550		
	Fire Flow	19550	L/min	
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-9775	L/min	
G	North Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Non-combustible		
	Length of Exposed Wall:	0	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	0	m-storeys	
	Separation Distance	> 45	m	
	North Side Exposure Charge	0%		Table G5 - ISTB-2018-02
	East Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Non-combustible		
	Length of Exposed Wall:	196	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	196	m-storeys	
	Separation Distance	10.2	m	
	East Side Exposure Charge	15%		Table G5 - ISTB-2018-02
	South Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Non-combustible		
	Length of Exposed Wall:	0	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	0	m-storeys	
	Separation Distance	>45	m	
	South Side Exposure Charge	0%		Table G5 - ISTB-2018-02
	West Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Non-combustible		
	Length of Exposed Wall:	20	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	20	m-storeys	
	Separation Distance	40	m	
	West Side Exposure Charge	5%		Table G5 - ISTB-2018-02
	Total Exposure Charge	20%		
	Increase for Exposures	3910	L/min	
H	Fire Flow	13685	L/min	E + F + G
	Rounded Fire Flow	14000	L/min	Rounded to nearest 1000 L/min
City Cap	Required Fire Flow (RFF)	14000	L/min	City Cap Does Not Apply
		233	L/sec	

OC Transpo Ottawa - Bus Garage
Prelim Water Demand
20 Feb 2024

1) Limitations

The following water requirements for this proposed ZEB Bus Garage at 1500 St. Laurent Boulevard are estimated on the basis of very preliminary design stage information. Process water requirements are not fully developed, and usage patterns are estimated but will be refined in the tertiary stages of design.

Fire water requirements including Sprinkler flows and pressures are also preliminary, and are not based on any hydraulic calculations.

FUS fire flow requirement are not included, as it is assumed that this will be part of the site-wide water service investigation, and feeds to hydrants to serve the proposed building, will not affect preliminary demands. This is to be confirmed.

2) Current Preliminary Design

Fire Sprinkler System will tentatively include zones with Extra high Hazard Group II classification, and this results in large nominal flows. Actual design flows may be slightly higher but can only be confirmed when hydraulic calculations are done by the installation contractor. Flow requires to be maintained for a minimum of a 2-hour fire-fighting period.

Tentatively, a fire pump has been allowed in the design but may be omitted later if available pressures are found to be adequate, over this 2-hour duration. This is based on an assumed pressure at water entry point of 50psi (345Kpa)

There are only a few washrooms in this building. Fixture usage has been based on congested use and domestic water flow calculated accordingly. Domestic water will also be used for Garage floor wash washdown and this results in much heavier demands.

Process water is mainly the make-up supply for the Bus Wash. Estimates are based on initial considerations of Wash Equipment supplier and with assumed frequency of Bus washing. This will be confirmed later at detailed design stage.

3) Preliminary Water Demand

a) Water

Peak Flow rates:

Domestic	3.5 L/s
Floor Wash	12 L/s
Bus Wash	2.5 L/s
Total	18 L/s

Maximum Day Demand :

Domestic	2,000L
Floor Wash	2,400 L
Bus Wash	66,000 L
Total	70,400 L

Fire

Sprinkler, Hose demand and assumed Hydraulic calculation adjustment: 1600gpm.	101 L/s

Mahad Musse

From: Annie Williams
Sent: Wednesday, September 3, 2025 1:05 PM
To: Mahad Musse
Subject: FW: ZEB - Site Waterloop Memo Update - New Garage sprinklers

Follow Up Flag: Follow up
Flag Status: Flagged

Annie Williams, P.Eng. (she/her)
Senior Civil Engineer

Ottawa ON
Work: 343-803-4523
Mobile: 613-324-7085

From: Amor, Jonathan <jonathan.amor@ottawa.ca>
Sent: Wednesday, September 3, 2025 12:30 PM
To: Tatyana Roumie <troumie@jlrichards.ca>
Cc: Phil Jones <pjones@jlrichards.ca>; Qadan, Sami <Sami.Qadan@ottawa.ca>; Craig, Ian <Ian.Craig@ottawa.ca>; Faris, Robert W <Robert.Faris@ottawa.ca>; Annie Williams <awilliams@jlrichards.ca>
Subject: FW: ZEB - Site Waterloop Memo Update - New Garage sprinklers

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Hi Tatyana,

Please see the updated flow and pressure to be used for the New Garage water service when updating the site watermain loop memo. Let us know if you have any questions.

Thanks,

Jonathan Amor, P. Eng., PMP
Program Manager
Design & Construction – Facilities Branch, Zero Emission Bus (ZEB)
Infrastructure and Water Services Department
City of Ottawa
100 Constellation Cres., Sixth Floor West, Ottawa, ON, K2G 6J8
Office (613)580-2424 ext. 21049 | Cell (613)914-1712 | Fax (613)560-6064
Jonathan.amor@ottawa.ca | www.ottawa.ca

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From: Fleith, Ross <ross.fleith@aecom.com>
Sent: September 03, 2025 12:18 PM
To: Amor, Jonathan <jonathan.amor@ottawa.ca>
Cc: Craig, Ian <Ian.Craig@ottawa.ca>; Qadan, Sami <Sami.Qadan@ottawa.ca>; Alex Leung <aleung@provencherroy.ca>; Faris, Robert W <Robert.Faris@ottawa.ca>; Patel, Sha <Sha.Patel@aecom.com>
Subject: RE: ZEB - Site Waterloop Memo Update - New Garage sprinklers

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Hi Jonathan,

According to our Mechanical team, for the purposes of the site-wide water distribution system, an allowance of **117L/s at 50psi** is recommended at this stage, and until the fire sub-contractor completes hydraulic calculations.

Let us know if you have any further questions.

Cheers,

Ross Fleith, B.Arch
He, His, Him

Architectural Lead, OMSF
Buildings & Places, Canada Region
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From: Amor, Jonathan <jonathan.amor@ottawa.ca>
Sent: August 26, 2025 8:58 AM
To: Fleith, Ross <ross.fleith@aecom.com>
Cc: Craig, Ian <Ian.Craig@ottawa.ca>; Qadan, Sami <Sami.Qadan@ottawa.ca>; Alex Leung <aleung@provencherroy.ca>; Faris, Robert W <Robert.Faris@ottawa.ca>
Subject: ZEB - Site Waterloop Memo Update - New Garage sprinklers

Good morning Ross,

JLR are in the process of updating the site waterloop memo report and wanted to confirm that the sprinkler system requirements for the New Garage have not changed since the previous memo: 101 L/s at 46 psi. Can you confirm if there's any change?

Thanks,

Jonathan Amor, P. Eng., PMP
Program Manager
Design & Construction – Facilities Branch, Zero Emission Bus (ZEB)
Infrastructure and Water Services Department
City of Ottawa
100 Constellation Cres., Sixth Floor West, Ottawa, ON, K2G 6J8
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Appendix C

FUS Calculations

FUS Fire Flow Calculations

OCT South Garage Upgrades Ph2 - Industrial Building

(JLR 31489-021)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		
	Coefficient (C)	0.8		
B	Ground Floor Area	24675	m^2	Inlcuded 4 storey office building here (same as total floor area)
C	Height in storeys	1	storeys	1 storey warehouse with 4 storey office accounted above
	Total Floor Area	24675	m^2	
D	Fire Flow Formula	$F=220C\sqrt{A}$		
	Fire Flow	27647	L/min	
	Rounded Fire Flow	28000	L/min	Flow rounded to nearest 1000 L/min.
E	Occupancy Class	Combustible		
	Occupancy Charge	2%		Weighted average of the 3 different occupancy classes within the building
	Occupancy Increase or Decrease	456.8510638		
	Fire Flow	28456.85106	L/min	No rounding applied.
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-14228	L/min	
G	*North Side Exposure*			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	89.8	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	89.8	m-storeys	
	Separation Distance	33.36	m	
	North Side Exposure Charge	5%		
	East Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	All buildings are greater than 50 m away
	East Side Exposure Charge	0%		
	South Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	83.27	m	Mixed use commercial building further than 50 m
	South Side Exposure Charge	0%		
	West Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	70.71	m	Existing building further than 50 m away
	West Side Exposure Charge	0%		
	Total Exposure Charge	5%		The total exposure charge is below the maximum value of 75%.
	Increase for Exposures	1423	L/min	
H	Fire Flow	15651	L/min	
	Rounded Fire Flow	16000	L/min	Flow rounded to nearest 1000 L/min.
City Cap	**Required Fire Flow (RFF)**	**16000**	**L/min**	
		267	**L/s**	

Fire Underwriters Survey (FUS) Fire Flow Calculations

In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 dated March 21, 2018

FUS Fire Flow Calculations

OCT South Garage Upgrades Ph2 - Industrial Building

(JLR 31489-021)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		
	Coefficient (C)	0.8		
B	Ground Floor Area	16485	m^2	Inlcuded 4 storey office building here (same as total floor area)
C	Height in storeys	1	storeys	1 storey warehouse with 4 storey office accounted above
	Total Floor Area	16485	m^2	
D	Fire Flow Formula	$F=220C\sqrt{A}$		
	Fire Flow	22597	L/min	
	Rounded Fire Flow	23000	L/min	Flow rounded to nearest 1000 L/min.
E	Occupancy Class	Combustible		
	Occupancy Charge	2%		Weighted average of the 3 different occupancy classes within the building
	Occupancy Increase or Decrease	477.4772036		
	Fire Flow	23477.4772	L/min	No rounding applied.
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-11739	L/min	
G	*North Side Exposure*			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	No building within 50 m away
	North Side Exposure Charge	0%		
	East Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	68	m	
	East Side Exposure Charge	0%		
	South Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	89.8	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	89.8	m-storeys	
	Separation Distance	36.36	m	
	South Side Exposure Charge	5%		
	West Side Exposure			
	Exposing Wall:	Non-combustible		
	Exposed Wall:	Wood Frame		
	Length of Exposed Wall:	73.1	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	73.1	m-storeys	
	Separation Distance	29	m	
	West Side Exposure Charge	9%		
	Total Exposure Charge	14%		The total exposure charge is below the maximum value of 75%.
	Increase for Exposures	3287	L/min	
H	Fire Flow	15026	L/min	
	Rounded Fire Flow	15000	L/min	Flow rounded to nearest 1000 L/min.
City Cap	**Required Fire Flow (RFF)**	**15000**	**L/min**	
		250	**L/s**	

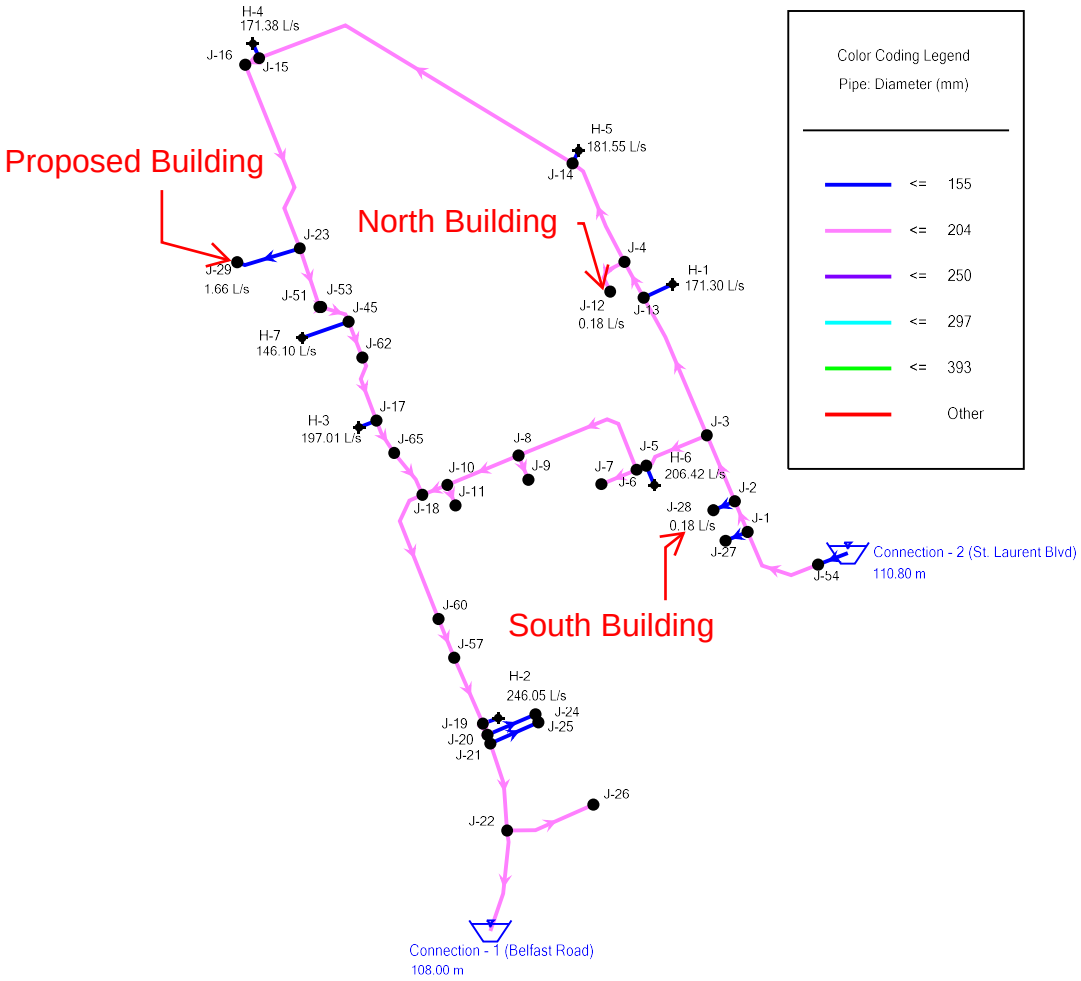
Fire Underwriters Survey (FUS) Fire Flow Calculations

In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 dated March 21, 2018

Appendix D

WaterCAD Schematics

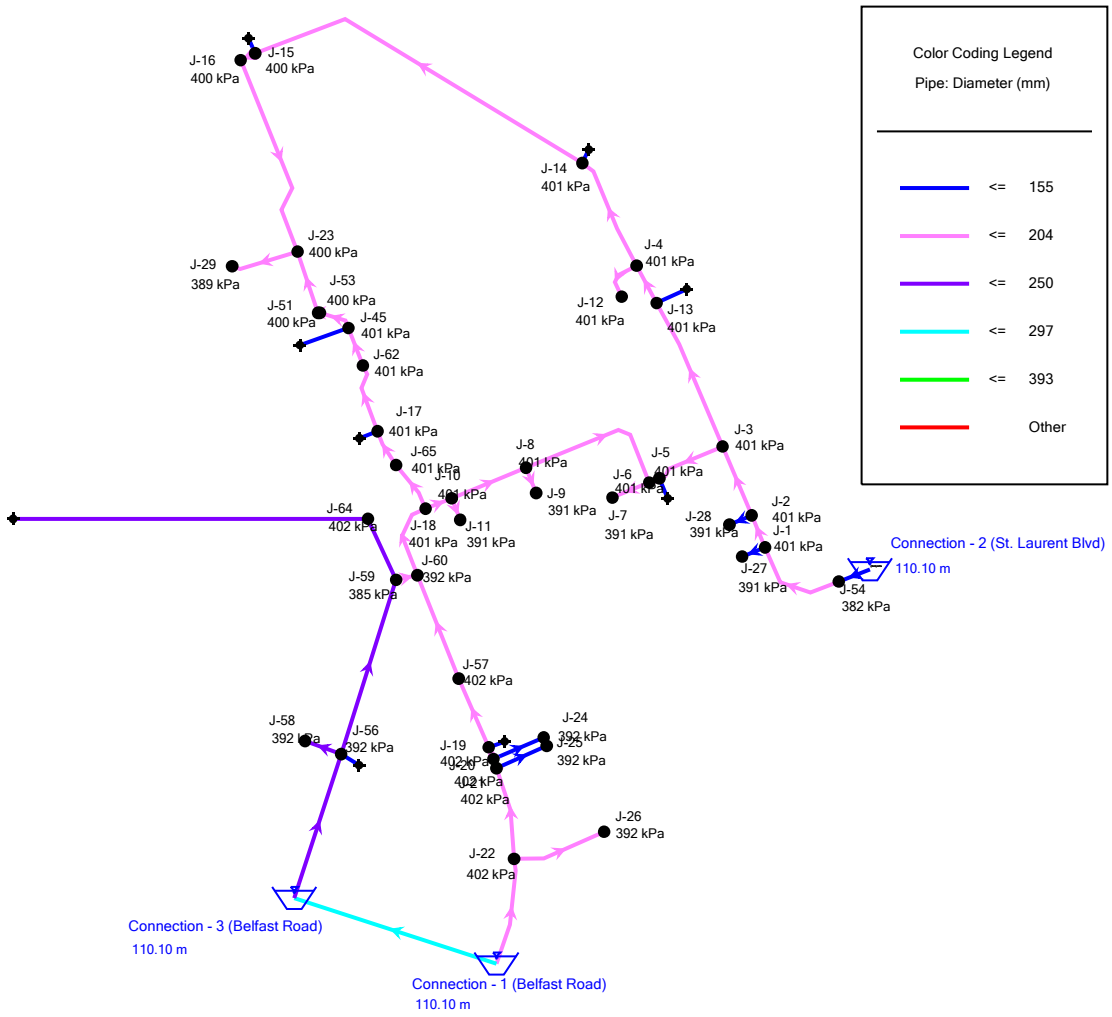
OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Option 1 - No Upgrade - Automatic FF
Maximum Day Demand + Fire Flow (RFF = 233 L/s)
Proposed Building (J-29)



OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Option 1 - No Upgrade - Automatic FF
Maximum Day Demand + Fire Flow (RFF = 233 L/s)

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-7	146.10	146.10	True	140	268	140	J-29
H-1	171.30	171.30	True	140	245	140	J-13
H-4	171.38	171.38	True	140	193	140	J-15
H-5	181.55	181.55	True	140	193	140	J-14
H-3	197.01	197.01	True	140	215	140	H-7
H-6	206.42	206.42	True	140	230	140	J-7
H-2	246.05	246.05	True	140	239	140	J-60

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Peak Hour Demand



OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Peak Hour Demand
Junction Table

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)	Hydraulic Grade (m)
215	J-54	71.00	0.00	382	110.02
231	J-59	70.70	0.00	385	110.04
142	J-29	70.10	11.00	389	109.86
48	J-7	70.00	2.44	391	109.95
54	J-9	70.00	2.44	391	109.96
131	J-28	70.00	2.44	391	109.96
58	J-11	70.00	2.44	391	109.96
129	J-27	70.00	2.44	391	109.97
233	J-60	70.00	0.00	392	110.03
123	J-24	70.00	2.44	392	110.03
125	J-25	70.00	2.44	392	110.03
127	J-26	70.00	2.44	392	110.06
229	J-58	70.00	0.32	392	110.07
221	J-56	70.00	0.00	392	110.07
120	J-23	69.00	0.00	400	109.90
77	J-16	69.00	0.00	400	109.91
71	J-15	69.00	0.00	400	109.91
210	J-53	69.00	0.00	400	109.91
204	J-51	69.00	0.00	400	109.91
168	J-45	69.00	0.00	401	109.92
69	J-14	69.00	0.00	401	109.93
60	J-12	69.00	2.44	401	109.93
40	J-4	69.00	0.00	401	109.93
261	J-62	69.00	0.00	401	109.93
62	J-13	69.00	0.00	401	109.94
81	J-17	69.00	0.00	401	109.95
46	J-6	69.00	0.00	401	109.96
44	J-5	69.00	0.00	401	109.96
38	J-3	69.00	0.00	401	109.96
277	J-65	69.00	0.00	401	109.96
52	J-8	69.00	0.00	401	109.96
56	J-10	69.00	0.00	401	109.96
36	J-2	69.00	0.00	401	109.97
83	J-18	69.00	0.00	401	109.97
34	J-1	69.00	0.00	401	109.98
225	J-57	69.00	0.00	402	110.03
86	J-19	69.00	0.00	402	110.04
88	J-20	69.00	0.00	402	110.04
275	J-64	69.00	0.00	402	110.04
90	J-21	69.00	0.00	402	110.04
94	J-22	69.00	0.00	402	110.06

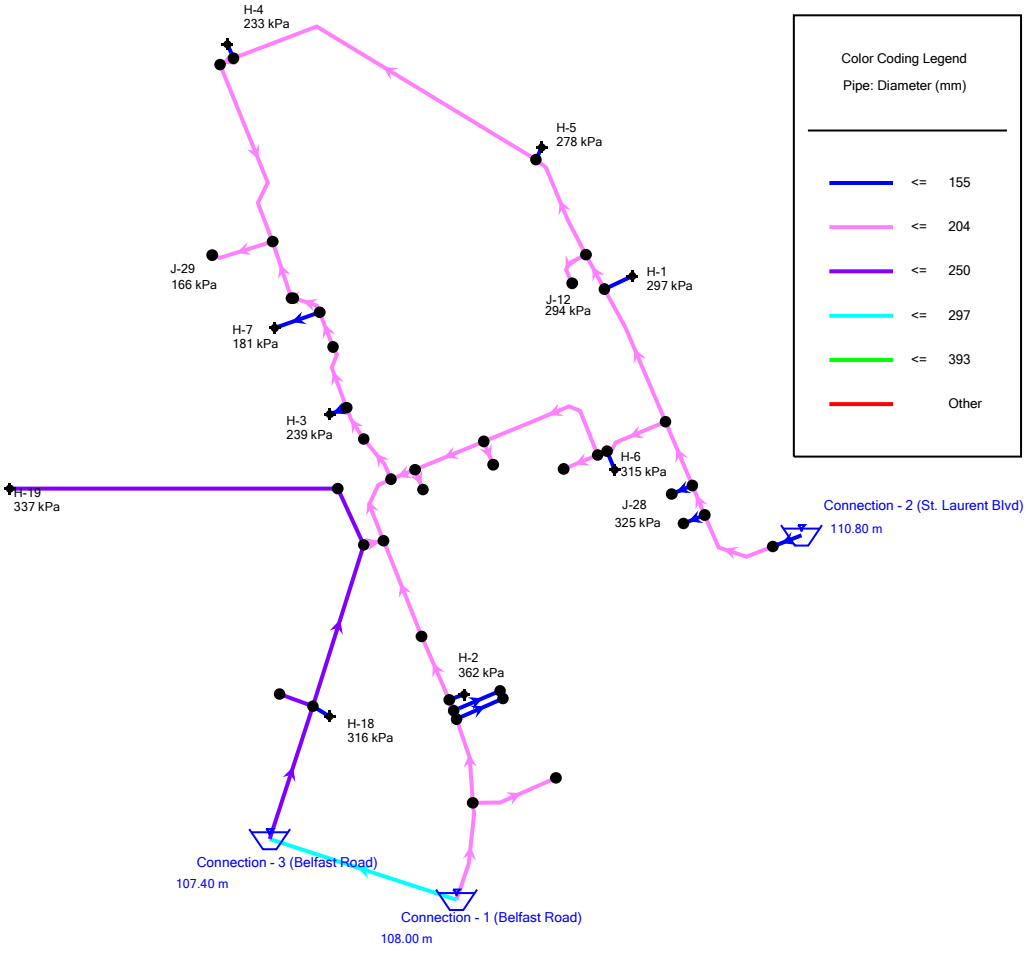
OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Peak Hour Demand
Pipe Table

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
37	P-2	15.7	204	PVC	110.0	8.52	0.26	109.98	109.97
39	P-3	33.9	204	PVC	110.0	6.08	0.19	109.97	109.96
45	P-4	32.9	204	PVC	110.0	0.47	0.01	109.96	109.96
47	P-5	5.0	204	PVC	110.0	0.47	0.01	109.96	109.96
49	P-6	18.0	204	PVC	110.0	2.44	0.07	109.96	109.95
51	P-7	9.9	155	PVC	100.0	0.00	0.00	109.96	109.96
53	P-8	74.3	204	PVC	110.0	-1.97	0.06	109.96	109.96
55	P-9	12.3	204	PVC	110.0	2.44	0.07	109.96	109.96
57	P-10	36.4	204	PVC	110.0	-4.41	0.13	109.96	109.96
59	P-11	10.5	204	PVC	110.0	2.44	0.07	109.96	109.96
61	P-12	20.1	204	PVC	110.0	2.44	0.07	109.93	109.93
63	P-13	71.6	204	PVC	110.0	5.61	0.17	109.96	109.94
64	P-14	19.2	204	PVC	110.0	5.61	0.17	109.94	109.93
68	P-15	15.1	155	PVC	100.0	0.00	0.00	109.94	109.94
70	P-16	53.3	204	PVC	110.0	3.17	0.10	109.93	109.93
72	P-17	169.3	204	PVC	110.0	3.17	0.10	109.93	109.91
78	P-18	7.2	204	PVC	110.0	3.17	0.10	109.91	109.91
85	P-20	12.7	204	PVC	110.0	-6.85	0.21	109.96	109.97
89	P-21	5.7	204	PVC	110.0	-2.89	0.09	110.04	110.04
91	P-22	4.4	204	PVC	110.0	-5.33	0.16	110.04	110.04
95	P-23	42.2	204	PVC	110.0	-7.77	0.24	110.04	110.06
97	P-24	48.7	204	PVC	110.0	-10.21	0.31	110.06	110.10
108	P-25	7.7	155	PVC	100.0	0.00	0.00	110.04	110.04
111	P-26	8.8	155	PVC	100.0	0.00	0.00	109.95	109.95
113	P-27	7.5	155	PVC	100.0	0.00	0.00	109.91	109.91
115	P-28	6.7	155	PVC	100.0	0.00	0.00	109.93	109.93
121	P-30	93.8	204	PVC	110.0	3.17	0.10	109.91	109.90
124	P-33	24.8	155	PVC	100.0	2.44	0.13	110.04	110.03
126	P-34	24.9	155	PVC	100.0	2.44	0.13	110.04	110.03
128	P-35	43.3	204	PVC	110.0	2.44	0.07	110.06	110.06
130	P-36	11.2	155	PVC	100.0	2.44	0.13	109.98	109.97
132	P-37	10.9	155	PVC	100.0	2.44	0.13	109.97	109.96
172	P-38	23.3	155	PVC	100.0	0.00	0.00	109.92	109.92
175	P-39	31.1	200	PVC	100.0	-11.00	0.35	109.86	109.90
206	P-31 (2)	15.7	204	PVC	110.0	-7.83	0.24	109.91	109.92
211	P-31 (1)(1)	29.2	204	PVC	110.0	-7.83	0.24	109.90	109.91
212	P-31 (1)(2)	0.8	204	PVC	110.0	-7.83	0.24	109.91	109.91
216	P-56	15.1	155	Cast Iron	100.0	-10.96	0.58	110.02	110.10
217	P-57	45.4	204	PVC	110.0	10.96	0.34	110.02	109.98
219	P-58	96.3	297	Cast Iron	120.0	0.20	0.00	110.10	110.10

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Peak Hour Demand
Pipe Table

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
222	P-59	68.5	250	PVC	110.0	12.10	0.25	110.10	110.07
224	P-60	9.5	155	PVC	100.0	0.00	0.00	110.07	110.07
227	P-29 (2)	33.9	204	PVC	110.0	-2.89	0.09	110.03	110.04
230	P-62	17.4	250	PVC	110.0	0.32	0.01	110.07	110.07
232	P-63	82.8	250	PVC	110.0	11.78	0.24	110.07	110.04
234	P-29 (1)(1)	36.4	204	PVC	110.0	-14.68	0.45	109.97	110.03
235	P-29 (1)(2)	50.4	204	PVC	110.0	-2.89	0.09	110.03	110.03
262	P-32 (1)	18.2	204	PVC	110.0	-7.83	0.24	109.92	109.93
263	P-32 (2)	32.0	204	PVC	110.0	-7.83	0.24	109.93	109.95
276	P-67	30.4	250	PVC	110.0	0.00	0.00	110.04	110.04
278	P-19 (1)	17.6	204	PVC	110.0	-7.83	0.24	109.95	109.96
279	P-19 (2)	24.0	204	PVC	110.0	-7.83	0.24	109.96	109.97
284	P-69	9.9	204	PVC	110.0	11.78	0.36	110.04	110.03
286	P-70	160.7	250	PVC	110.0	0.00	0.00	110.04	110.04

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 233 L/s)
Proposed Garage Sprinkler Demand = 117 L/s



OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 233 L/s)
Proposed Garage Sprinkler Demand = 117 L/s

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
142	J-29	70.10	118.66	166
120	J-23	69.00	0.00	208
210	J-53	69.00	0.00	213
204	J-51	69.00	0.00	213
168	J-45	69.00	0.00	215
261	J-62	69.00	0.00	228
77	J-16	69.00	0.00	233
71	J-15	69.00	0.00	235
81	J-17	69.00	0.00	249
277	J-65	69.00	0.00	275
69	J-14	69.00	0.00	280
60	J-12	69.00	0.18	294
40	J-4	69.00	0.00	294
62	J-13	69.00	0.00	299
58	J-11	70.00	0.18	301
54	J-9	70.00	0.18	302
48	J-7	70.00	0.18	306
83	J-18	69.00	0.00	310
56	J-10	69.00	0.00	310
52	J-8	69.00	0.00	312
46	J-6	69.00	0.00	316
44	J-5	69.00	0.00	316
38	J-3	69.00	0.00	318
233	J-60	71.50	0.00	324
131	J-28	70.00	0.18	325
231	J-59	71.20	0.00	330
129	J-27	70.00	0.18	333
36	J-2	69.00	0.00	335
34	J-1	69.00	0.00	343
215	J-54	71.00	0.00	347
275	J-64	69.00	0.00	351
123	J-24	70.00	0.18	355
221	J-56	70.00	0.00	355
229	J-58	70.00	0.00	355
125	J-25	70.00	0.18	355
225	J-57	69.00	0.00	357
127	J-26	70.00	0.18	363
86	J-19	69.00	0.00	363
88	J-20	69.00	0.00	364
90	J-21	69.00	0.00	365
94	J-22	69.00	0.00	373

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 233 L/s)
Proposed Garage Sprinkler Demand = 117 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
37	P-2	15.7	204	PVC	110.0	94.64	2.90	104.05	103.24
39	P-3	33.9	204	PVC	110.0	94.46	2.89	103.24	101.49
45	P-4	32.9	204	PVC	110.0	27.48	0.84	101.49	101.32
47	P-5	5.0	204	PVC	110.0	27.48	0.84	101.32	101.29
49	P-6	18.0	204	PVC	110.0	0.18	0.01	101.29	101.29
51	P-7	9.9	155	PVC	100.0	0.00	0.00	101.32	101.32
53	P-8	74.3	204	PVC	110.0	27.30	0.84	101.29	100.91
55	P-9	12.3	204	PVC	110.0	0.18	0.01	100.91	100.91
57	P-10	36.4	204	PVC	110.0	27.12	0.83	100.91	100.72
59	P-11	10.5	204	PVC	110.0	0.18	0.01	100.72	100.72
61	P-12	20.1	204	PVC	110.0	0.18	0.01	99.01	99.01
63	P-13	71.6	204	PVC	110.0	66.98	2.05	101.49	99.54
64	P-14	19.2	204	PVC	110.0	66.98	2.05	99.54	99.01
68	P-15	15.1	155	PVC	100.0	0.00	0.00	99.54	99.54
70	P-16	53.3	204	PVC	110.0	66.79	2.04	99.01	97.57
72	P-17	169.3	204	PVC	110.0	66.79	2.04	97.57	92.97
78	P-18	7.2	204	PVC	110.0	66.79	2.04	92.97	92.77
85	P-20	12.7	204	PVC	110.0	26.94	0.82	100.72	100.66
89	P-21	5.7	204	PVC	110.0	-53.86	1.65	106.13	106.24
91	P-22	4.4	204	PVC	110.0	-54.04	1.65	106.24	106.32
95	P-23	42.2	204	PVC	110.0	-54.22	1.66	106.32	107.10
97	P-24	48.7	204	PVC	110.0	-54.40	1.66	107.10	108.00
108	P-25	7.7	155	PVC	100.0	0.00	0.00	106.13	106.13
111	P-26	8.8	155	PVC	100.0	58.00	3.07	94.43	93.59
113	P-27	7.5	155	PVC	100.0	0.00	0.00	92.97	92.97
115	P-28	6.7	155	PVC	100.0	0.00	0.00	97.57	97.57
121	P-30	93.8	204	PVC	110.0	66.79	2.04	92.77	90.23
124	P-33	24.8	155	PVC	100.0	0.18	0.01	106.24	106.24
126	P-34	24.9	155	PVC	100.0	0.18	0.01	106.32	106.32
128	P-35	43.3	204	PVC	110.0	0.18	0.01	107.10	107.10
130	P-36	11.2	155	PVC	100.0	0.18	0.01	104.05	104.05
132	P-37	10.9	155	PVC	100.0	0.18	0.01	103.24	103.24
172	P-38	23.3	155	PVC	100.0	58.00	3.07	91.01	88.79
175	P-39	31.1	200	PVC	100.0	-118.66	3.78	87.02	90.23
206	P-31(2)	15.7	204	PVC	110.0	-51.87	1.59	90.74	91.01
211	P-31(1) (1)	29.2	204	PVC	110.0	-51.87	1.59	90.23	90.72
212	P-31(1) (2)	0.8	204	PVC	110.0	-51.87	1.59	90.72	90.74
216	P-56	15.1	155	Cast Iron	100.0	-94.82	5.03	106.41	110.80
217	P-57	45.4	204	PVC	110.0	94.82	2.90	106.41	104.05

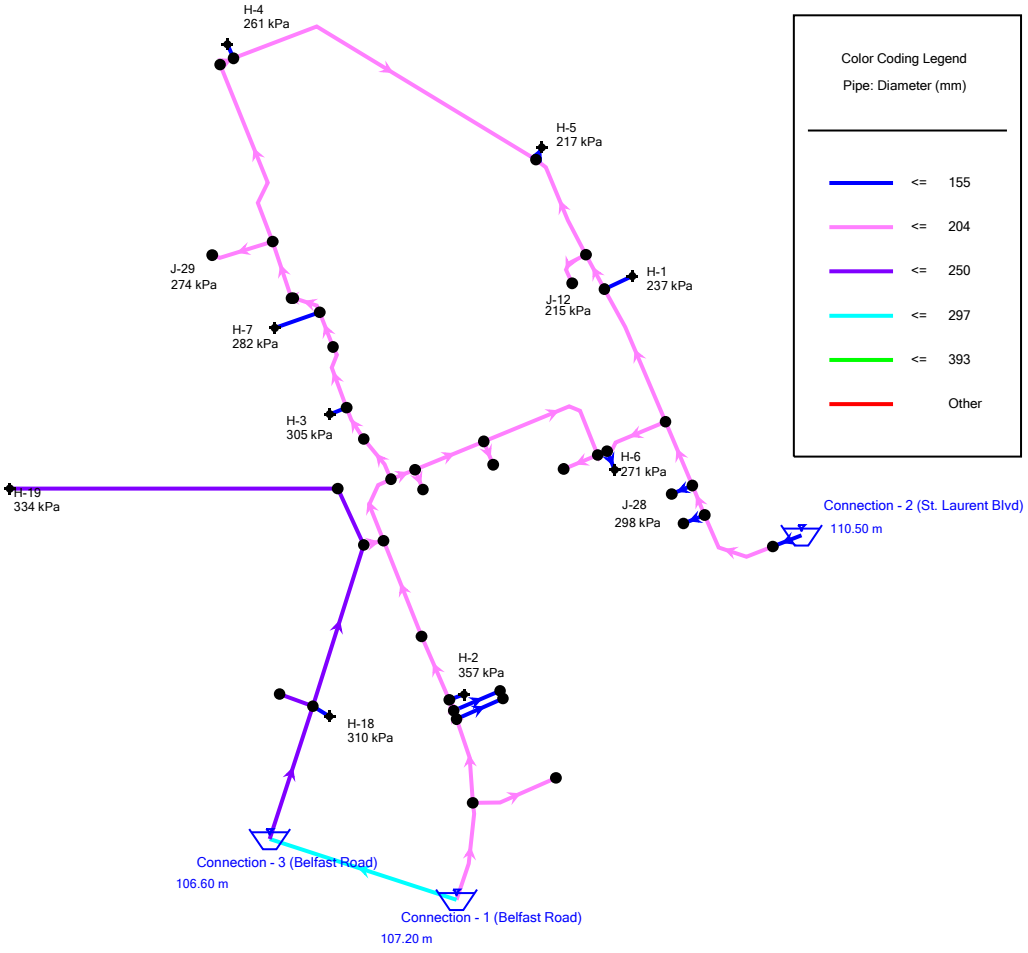
OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 233 L/s)
Proposed Garage Sprinkler Demand = 117 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
219	P-58	96.3	297	Cast Iron	120.0	88.40	1.28	108.00	107.40
222	P-59	68.5	250	PVC	110.0	87.06	1.77	107.40	106.27
224	P-60	9.5	155	PVC	100.0	0.00	0.00	106.27	106.27
227	P-29(2)	33.9	204	PVC	110.0	-53.86	1.65	105.52	106.13
230	P-62	17.4	250	PVC	110.0	0.00	0.00	106.27	106.27
232	P-63	82.8	250	PVC	110.0	87.06	1.77	106.27	104.91
234	P-29(1) (1)	36.4	204	PVC	110.0	-140.92	4.31	100.66	104.60
235	P-29(1) (2)	50.4	204	PVC	110.0	-53.86	1.65	104.60	105.52
262	P-32(1)	18.2	204	PVC	110.0	-109.87	3.36	91.01	92.25
263	P-32(2)	32.0	204	PVC	110.0	-109.87	3.36	92.25	94.43
276	P-67	30.4	250	PVC	110.0	0.00	0.00	104.91	104.91
278	P-19(1)	17.6	204	PVC	110.0	-167.87	5.14	94.43	97.06
279	P-19(2)	24.0	204	PVC	110.0	-167.87	5.14	97.06	100.66
284	P-69	9.9	204	PVC	110.0	87.06	2.66	104.91	104.60
286	P-70	160.7	250	PVC	110.0	0.00	0.00	104.91	104.91

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 233 L/s)
Proposed Garage Sprinkler Demand = 117 L/s

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
67	H-1	69.15	0.00	297
107	H-2	69.15	0.00	362
110	H-3	69.15	58.00	239
112	H-4	69.15	0.00	233
114	H-5	69.15	0.00	278
119	H-6	69.15	0.00	315
174	H-7	70.30	58.00	181
223	H-18	74.00	0.00	316
287	H-19	70.50	0.00	337

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 250 L/s)
North Garage Sprinkler Demand = 101 L/s



OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 250 L/s)
North Garage Sprinkler Demand = 101 L/s

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
60	J-12	69.00	101.18	215
69	J-14	69.00	0.00	226
40	J-4	69.00	0.00	226
62	J-13	69.00	0.00	239
71	J-15	69.00	0.00	263
77	J-16	69.00	0.00	264
142	J-29	70.10	1.66	274
48	J-7	70.00	0.18	276
120	J-23	69.00	0.00	284
44	J-5	69.00	0.00	285
38	J-3	69.00	0.00	285
46	J-6	69.00	0.00	286
210	J-53	69.00	0.00	291
204	J-51	69.00	0.00	291
54	J-9	70.00	0.18	294
168	J-45	69.00	0.00	295
131	J-28	70.00	0.18	298
261	J-62	69.00	0.00	299
58	J-11	70.00	0.18	303
52	J-8	69.00	0.00	304
81	J-17	69.00	0.00	306
36	J-2	69.00	0.00	307
129	J-27	70.00	0.18	308
277	J-65	69.00	0.00	310
56	J-10	69.00	0.00	312
83	J-18	69.00	0.00	316
34	J-1	69.00	0.00	318
233	J-60	71.50	0.00	322
231	J-59	71.20	0.00	327
215	J-54	71.00	0.00	329
275	J-64	69.00	0.00	349
221	J-56	70.00	0.00	350
229	J-58	70.00	0.00	350
123	J-24	70.00	0.18	350
125	J-25	70.00	0.18	351
225	J-57	69.00	0.00	354
127	J-26	70.00	0.18	357
86	J-19	69.00	0.00	359
88	J-20	69.00	0.00	360
90	J-21	69.00	0.00	360
94	J-22	69.00	0.00	367

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 250 L/s)
North Garage Sprinkler Demand = 101 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)
37	P-2	15.7	204	PVC	110.0	110.59	3.38	101.50
39	P-3	33.9	204	PVC	110.0	110.41	3.38	100.41
45	P-4	32.9	204	PVC	110.0	2.87	0.09	98.08
47	P-5	5.0	204	PVC	110.0	-63.13	1.93	98.08
49	P-6	18.0	204	PVC	110.0	0.18	0.01	98.20
51	P-7	9.9	155	PVC	100.0	66.00	3.50	98.08
53	P-8	74.3	204	PVC	110.0	-63.31	1.94	98.20
55	P-9	12.3	204	PVC	110.0	0.18	0.01	100.03
57	P-10	36.4	204	PVC	110.0	-63.49	1.94	100.03
59	P-11	10.5	204	PVC	110.0	0.18	0.01	100.93
61	P-12	20.1	204	PVC	110.0	101.18	3.10	92.13
63	P-13	71.6	204	PVC	110.0	107.54	3.29	98.08
64	P-14	19.2	204	PVC	110.0	107.54	3.29	93.38
68	P-15	15.1	155	PVC	100.0	0.00	0.00	93.38
70	P-16	53.3	204	PVC	110.0	6.36	0.19	92.13
72	P-17	169.3	204	PVC	110.0	-59.64	1.82	92.11
78	P-18	7.2	204	PVC	110.0	-59.64	1.82	95.83
85	P-20	12.7	204	PVC	110.0	-63.67	1.95	100.93
89	P-21	5.7	204	PVC	110.0	-48.50	1.48	105.66
91	P-22	4.4	204	PVC	110.0	-48.68	1.49	105.75
95	P-23	42.2	204	PVC	110.0	-48.86	1.49	105.81
97	P-24	48.7	204	PVC	110.0	-49.04	1.50	106.45
108	P-25	7.7	155	PVC	100.0	0.00	0.00	105.66
111	P-26	8.8	155	PVC	100.0	0.00	0.00	100.28
113	P-27	7.5	155	PVC	100.0	0.00	0.00	95.83
115	P-28	6.7	155	PVC	100.0	66.00	3.50	92.11
121	P-30	93.8	204	PVC	110.0	-59.64	1.82	95.99
124	P-33	24.8	155	PVC	100.0	0.18	0.01	105.75
126	P-34	24.9	155	PVC	100.0	0.18	0.01	105.81
128	P-35	43.3	204	PVC	110.0	0.18	0.01	106.45
130	P-36	11.2	155	PVC	100.0	0.18	0.01	101.50
132	P-37	10.9	155	PVC	100.0	0.18	0.01	100.41
172	P-38	23.3	155	PVC	100.0	0.00	0.00	99.11
175	P-39	31.1	200	PVC	100.0	-1.66	0.05	98.05
206	P-31(2)	15.7	204	PVC	110.0	-61.30	1.88	98.75
211	P-31(1) (1)	29.2	204	PVC	110.0	-61.30	1.88	98.05
212	P-31(1) (2)	0.8	204	PVC	110.0	-61.30	1.88	98.73
216	P-56	15.1	155	Cast Iron	100.0	-110.77	5.87	104.64
217	P-57	45.4	204	PVC	110.0	110.77	3.39	104.64

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 250 L/s)
North Garage Sprinkler Demand = 101 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
37	P-2	15.7	204	PVC	110.0	110.59	3.38	101.50	100.41
39	P-3	33.9	204	PVC	110.0	110.41	3.38	100.41	98.08
45	P-4	32.9	204	PVC	110.0	2.87	0.09	98.08	98.08
47	P-5	5.0	204	PVC	110.0	-63.13	1.93	98.08	98.20
49	P-6	18.0	204	PVC	110.0	0.18	0.01	98.20	98.20
51	P-7	9.9	155	PVC	100.0	66.00	3.50	98.08	96.88
53	P-8	74.3	204	PVC	110.0	-63.31	1.94	98.20	100.03
55	P-9	12.3	204	PVC	110.0	0.18	0.01	100.03	100.03
57	P-10	36.4	204	PVC	110.0	-63.49	1.94	100.03	100.93
59	P-11	10.5	204	PVC	110.0	0.18	0.01	100.93	100.93
61	P-12	20.1	204	PVC	110.0	101.18	3.10	92.13	90.95
63	P-13	71.6	204	PVC	110.0	107.54	3.29	98.08	93.38
64	P-14	19.2	204	PVC	110.0	107.54	3.29	93.38	92.13
68	P-15	15.1	155	PVC	100.0	0.00	0.00	93.38	93.38
70	P-16	53.3	204	PVC	110.0	6.36	0.19	92.13	92.11
72	P-17	169.3	204	PVC	110.0	-59.64	1.82	92.11	95.83
78	P-18	7.2	204	PVC	110.0	-59.64	1.82	95.83	95.99
85	P-20	12.7	204	PVC	110.0	-63.67	1.95	100.93	101.24
89	P-21	5.7	204	PVC	110.0	-48.50	1.48	105.66	105.75
91	P-22	4.4	204	PVC	110.0	-48.68	1.49	105.75	105.81
95	P-23	42.2	204	PVC	110.0	-48.86	1.49	105.81	106.45
97	P-24	48.7	204	PVC	110.0	-49.04	1.50	106.45	107.20
108	P-25	7.7	155	PVC	100.0	0.00	0.00	105.66	105.66
111	P-26	8.8	155	PVC	100.0	0.00	0.00	100.28	100.28
113	P-27	7.5	155	PVC	100.0	0.00	0.00	95.83	95.83
115	P-28	6.7	155	PVC	100.0	66.00	3.50	92.11	91.30
121	P-30	93.8	204	PVC	110.0	-59.64	1.82	95.99	98.05
124	P-33	24.8	155	PVC	100.0	0.18	0.01	105.75	105.75
126	P-34	24.9	155	PVC	100.0	0.18	0.01	105.81	105.81
128	P-35	43.3	204	PVC	110.0	0.18	0.01	106.45	106.45
130	P-36	11.2	155	PVC	100.0	0.18	0.01	101.50	101.50
132	P-37	10.9	155	PVC	100.0	0.18	0.01	100.41	100.41
172	P-38	23.3	155	PVC	100.0	0.00	0.00	99.11	99.11
175	P-39	31.1	200	PVC	100.0	-1.66	0.05	98.05	98.05
206	P-31(2)	15.7	204	PVC	110.0	-61.30	1.88	98.75	99.11
211	P-31(1) (1)	29.2	204	PVC	110.0	-61.30	1.88	98.05	98.73
212	P-31(1) (2)	0.8	204	PVC	110.0	-61.30	1.88	98.73	98.75
216	P-56	15.1	155	Cast Iron	100.0	-110.77	5.87	104.64	110.50
217	P-57	45.4	204	PVC	110.0	110.77	3.39	104.64	101.50

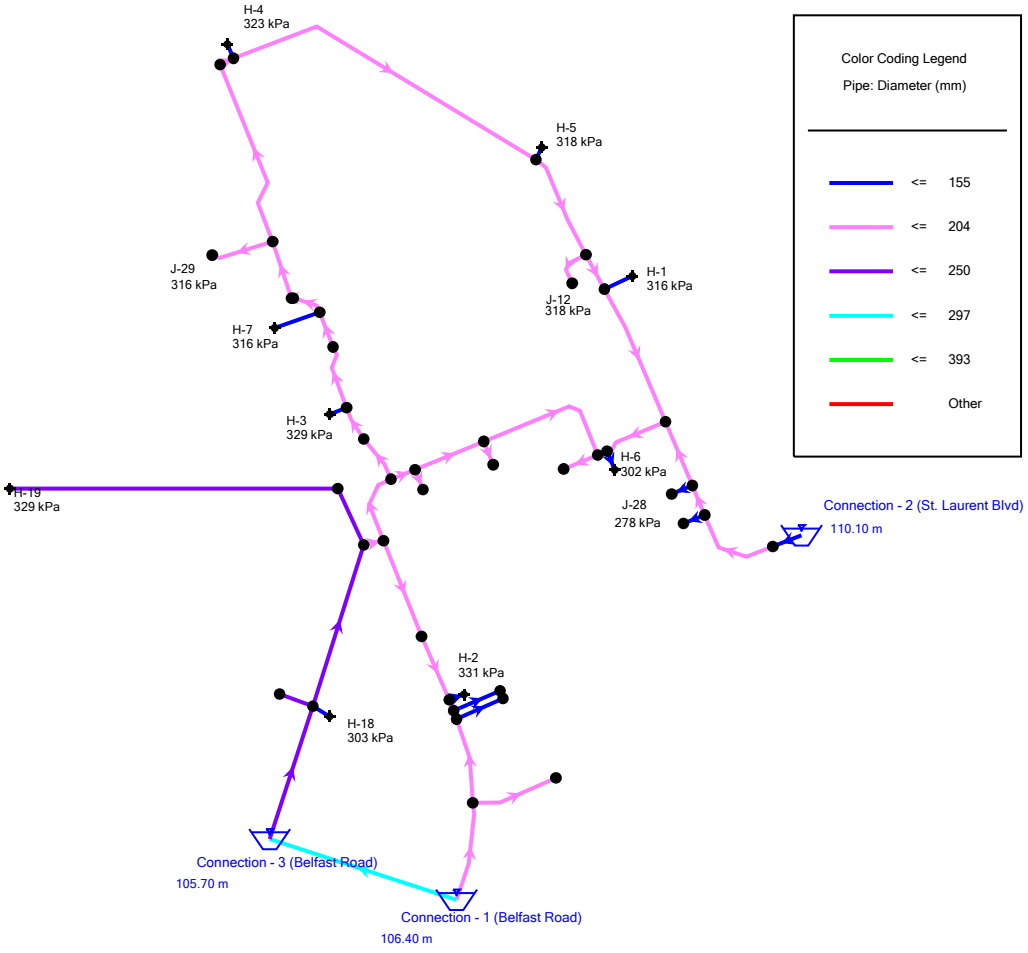
OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 250 L/s)
North Garage Sprinkler Demand = 101 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
219	P-58	96.3	297	Cast Iron	120.0	88.40	1.28	107.20	106.60
222	P-59	68.5	250	PVC	110.0	76.47	1.56	106.60	105.71
224	P-60	9.5	155	PVC	100.0	0.00	0.00	105.71	105.71
227	P-29(2)	33.9	204	PVC	110.0	-48.50	1.48	105.15	105.66
230	P-62	17.4	250	PVC	110.0	0.00	0.00	105.71	105.71
232	P-63	82.8	250	PVC	110.0	76.47	1.56	105.71	104.64
234	P-29(1)(1)	36.4	204	PVC	110.0	-124.97	3.82	101.24	104.40
235	P-29(1)(2)	50.4	204	PVC	110.0	-48.50	1.48	104.40	105.15
262	P-32(1)	18.2	204	PVC	110.0	-61.30	1.88	99.11	99.54
263	P-32(2)	32.0	204	PVC	110.0	-61.30	1.88	99.54	100.28
276	P-67	30.4	250	PVC	110.0	0.00	0.00	104.64	104.64
278	P-19(1)	17.6	204	PVC	110.0	-61.30	1.88	100.28	100.68
279	P-19(2)	24.0	204	PVC	110.0	-61.30	1.88	100.68	101.24
284	P-69	9.9	204	PVC	110.0	76.47	2.34	104.64	104.40
286	P-70	160.7	250	PVC	110.0	0.00	0.00	104.64	104.64

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 250 L/s)
North Garage Sprinkler Demand = 101 L/s

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
67	H-1	69.15	0.00	237
107	H-2	69.15	0.00	357
110	H-3	69.15	0.00	305
112	H-4	69.15	0.00	261
114	H-5	69.15	66.00	217
119	H-6	69.15	66.00	271
174	H-7	70.30	0.00	282
223	H-18	74.00	0.00	310
287	H-19	70.50	0.00	334

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 267 L/s)
South Garage Sprinkler Demand = 101 L/s



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OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 267 L/s)
South Garage Sprinkler Demand = 101 L/s

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
131	J-28	70.00	101.18	278
48	J-7	70.00	0.18	306
44	J-5	69.00	0.00	315
54	J-9	70.00	0.18	315
129	J-27	70.00	0.18	315
46	J-6	69.00	0.00	316
38	J-3	69.00	0.00	316
36	J-2	69.00	0.00	316
142	J-29	70.10	1.66	316
233	J-60	71.50	0.00	317
62	J-13	69.00	0.00	318
60	J-12	69.00	0.18	318
40	J-4	69.00	0.00	318
69	J-14	69.00	0.00	320
58	J-11	70.00	0.18	320
231	J-59	71.20	0.00	322
71	J-15	69.00	0.00	324
77	J-16	69.00	0.00	325
52	J-8	69.00	0.00	325
34	J-1	69.00	0.00	325
120	J-23	69.00	0.00	327
210	J-53	69.00	0.00	328
204	J-51	69.00	0.00	328
168	J-45	69.00	0.00	329
261	J-62	69.00	0.00	329
56	J-10	69.00	0.00	330
81	J-17	69.00	0.00	330
277	J-65	69.00	0.00	331
83	J-18	69.00	0.00	332
215	J-54	71.00	0.00	333
123	J-24	70.00	0.18	333
125	J-25	70.00	0.18	334
86	J-19	69.00	0.00	341
225	J-57	69.00	0.00	341
221	J-56	70.00	0.00	342
229	J-58	70.00	0.00	342
88	J-20	69.00	0.00	343
275	J-64	69.00	0.00	343
90	J-21	69.00	0.00	344
127	J-26	70.00	0.18	344
94	J-22	69.00	0.00	354

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 267 L/s)
South Garage Sprinkler Demand = 101 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
37	P-2	15.7	204	PVC	110.0	102.79	3.14	102.23	101.29
39	P-3	33.9	204	PVC	110.0	1.61	0.05	101.29	101.29
45	P-4	32.9	204	PVC	110.0	20.95	0.64	101.29	101.18
47	P-5	5.0	204	PVC	110.0	-45.05	1.38	101.18	101.25
49	P-6	18.0	204	PVC	110.0	0.18	0.01	101.25	101.25
51	P-7	9.9	155	PVC	100.0	66.00	3.50	101.18	99.98
53	P-8	74.3	204	PVC	110.0	-45.23	1.38	101.25	102.23
55	P-9	12.3	204	PVC	110.0	0.18	0.01	102.23	102.23
57	P-10	36.4	204	PVC	110.0	-45.41	1.39	102.23	102.71
59	P-11	10.5	204	PVC	110.0	0.18	0.01	102.71	102.71
61	P-12	20.1	204	PVC	110.0	0.18	0.01	101.54	101.54
63	P-13	71.6	204	PVC	110.0	-19.35	0.59	101.29	101.48
64	P-14	19.2	204	PVC	110.0	-19.35	0.59	101.48	101.54
68	P-15	15.1	155	PVC	100.0	0.00	0.00	101.48	101.48
70	P-16	53.3	204	PVC	110.0	-19.53	0.60	101.54	101.68
72	P-17	169.3	204	PVC	110.0	-19.53	0.60	101.68	102.16
78	P-18	7.2	204	PVC	110.0	-19.53	0.60	102.16	102.18
85	P-20	12.7	204	PVC	110.0	-45.59	1.39	102.71	102.88
89	P-21	5.7	204	PVC	110.0	-63.63	1.95	103.87	104.01
91	P-22	4.4	204	PVC	110.0	-63.81	1.95	104.01	104.12
95	P-23	42.2	204	PVC	110.0	-63.99	1.96	104.12	105.17
97	P-24	48.7	204	PVC	110.0	-64.17	1.96	105.17	106.40
108	P-25	7.7	155	PVC	100.0	66.00	3.50	103.87	102.94
111	P-26	8.8	155	PVC	100.0	0.00	0.00	102.75	102.75
113	P-27	7.5	155	PVC	100.0	0.00	0.00	102.16	102.16
115	P-28	6.7	155	PVC	100.0	0.00	0.00	101.68	101.68
121	P-30	93.8	204	PVC	110.0	-19.53	0.60	102.18	102.44
124	P-33	24.8	155	PVC	100.0	0.18	0.01	104.01	104.01
126	P-34	24.9	155	PVC	100.0	0.18	0.01	104.12	104.12
128	P-35	43.3	204	PVC	110.0	0.18	0.01	105.17	105.17
130	P-36	11.2	155	PVC	100.0	0.18	0.01	102.23	102.23
132	P-37	10.9	155	PVC	100.0	101.18	5.36	101.29	98.38
172	P-38	23.3	155	PVC	100.0	0.00	0.00	102.59	102.59
175	P-39	31.1	200	PVC	100.0	-1.66	0.05	102.44	102.44
206	P-31(2)	15.7	204	PVC	110.0	-21.19	0.65	102.53	102.59
211	P-31(1) (1)	29.2	204	PVC	110.0	-21.19	0.65	102.44	102.53
212	P-31(1) (2)	0.8	204	PVC	110.0	-21.19	0.65	102.53	102.53
216	P-56	15.1	155	Cast Iron	100.0	-102.97	5.46	104.98	110.10
217	P-57	45.4	204	PVC	110.0	102.97	3.15	104.98	102.23

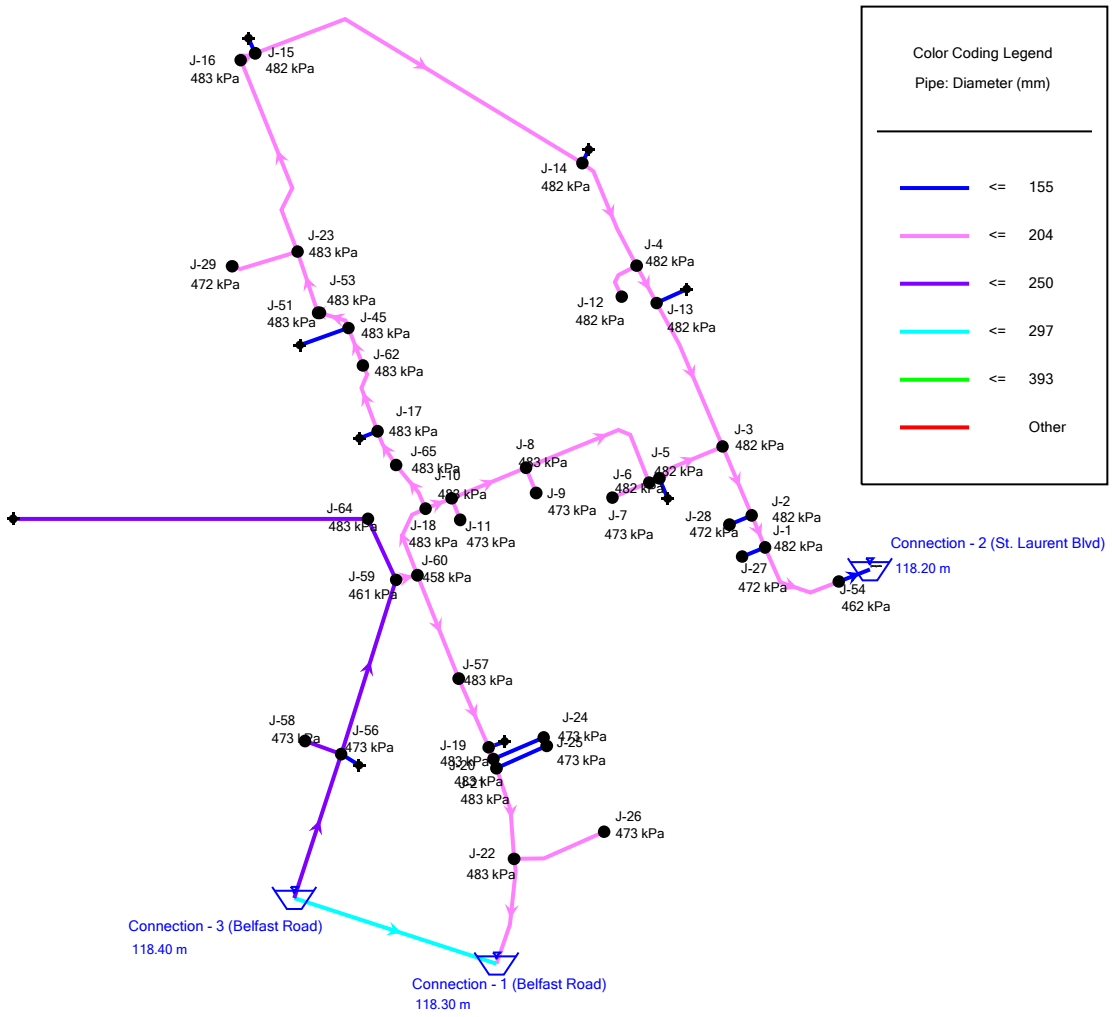
OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 267 L/s)
South Garage Sprinkler Demand = 101 L/s

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
219	P-58	96.3	297	Cast Iron	120.0	96.08	1.39	106.40	105.70
222	P-59	68.5	250	PVC	110.0	69.15	1.41	105.70	104.96
224	P-60	9.5	155	PVC	100.0	0.00	0.00	104.96	104.96
227	P-29(2)	33.9	204	PVC	110.0	2.37	0.07	103.87	103.87
230	P-62	17.4	250	PVC	110.0	0.00	0.00	104.96	104.96
232	P-63	82.8	250	PVC	110.0	69.15	1.41	104.96	104.07
234	P-29(1) (1)	36.4	204	PVC	110.0	-66.78	2.04	102.88	103.87
235	P-29(1) (2)	50.4	204	PVC	110.0	2.37	0.07	103.87	103.87
262	P-32(1)	18.2	204	PVC	110.0	-21.19	0.65	102.59	102.64
263	P-32(2)	32.0	204	PVC	110.0	-21.19	0.65	102.64	102.75
276	P-67	30.4	250	PVC	110.0	0.00	0.00	104.07	104.07
278	P-19(1)	17.6	204	PVC	110.0	-21.19	0.65	102.75	102.80
279	P-19(2)	24.0	204	PVC	110.0	-21.19	0.65	102.80	102.88
284	P-69	9.9	204	PVC	110.0	69.15	2.12	104.07	103.87
286	P-70	160.7	250	PVC	110.0	0.00	0.00	104.07	104.07

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max Day + Fire Flow (RFF = 267 L/s)
South Garage Sprinkler Demand = 101 L/s

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
67	H-1	69.15	0.00	316
107	H-2	69.15	66.00	331
110	H-3	69.15	0.00	329
112	H-4	69.15	0.00	323
114	H-5	69.15	0.00	318
119	H-6	69.15	66.00	302
174	H-7	70.30	0.00	316
223	H-18	74.00	0.00	303
287	H-19	70.50	0.00	329

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max HGL



OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max HGL
Junction Table

ID	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)	Hydraulic Grade (m)
233	J-60	71.50	0.00	458	118.33
231	J-59	71.20	0.00	461	118.34
215	J-54	71.00	0.00	462	118.24
142	J-29	70.10	0.00	472	118.31
129	J-27	70.00	0.00	472	118.26
131	J-28	70.00	0.00	472	118.27
48	J-7	70.00	0.00	473	118.29
54	J-9	70.00	0.00	473	118.31
127	J-26	70.00	0.00	473	118.31
58	J-11	70.00	0.00	473	118.31
125	J-25	70.00	0.00	473	118.32
123	J-24	70.00	0.00	473	118.32
221	J-56	70.00	0.00	473	118.37
229	J-58	70.00	0.00	473	118.37
34	J-1	69.00	0.00	482	118.26
36	J-2	69.00	0.00	482	118.27
38	J-3	69.00	0.00	482	118.28
62	J-13	69.00	0.00	482	118.29
40	J-4	69.00	0.00	482	118.29
60	J-12	69.00	0.00	482	118.29
44	J-5	69.00	0.00	482	118.29
46	J-6	69.00	0.00	482	118.29
69	J-14	69.00	0.00	482	118.29
71	J-15	69.00	0.00	482	118.30
77	J-16	69.00	0.00	483	118.30
52	J-8	69.00	0.00	483	118.31
120	J-23	69.00	0.00	483	118.31
94	J-22	69.00	0.00	483	118.31
210	J-53	69.00	0.00	483	118.31
204	J-51	69.00	0.00	483	118.31
168	J-45	69.00	0.00	483	118.31
261	J-62	69.00	0.00	483	118.31
56	J-10	69.00	0.00	483	118.31
81	J-17	69.00	0.00	483	118.31
277	J-65	69.00	0.00	483	118.31
83	J-18	69.00	0.00	483	118.32
90	J-21	69.00	0.00	483	118.32
88	J-20	69.00	0.00	483	118.32
86	J-19	69.00	0.00	483	118.32
225	J-57	69.00	0.00	483	118.32
275	J-64	69.00	0.00	483	118.34

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max HGL
Pipe Table

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
37	P-2	15.7	204	PVC	110.0	-7.34	0.22	118.26	118.27
39	P-3	33.9	204	PVC	110.0	-7.34	0.22	118.27	118.28
45	P-4	32.9	204	PVC	110.0	-4.84	0.15	118.28	118.29
47	P-5	5.0	204	PVC	110.0	-4.84	0.15	118.29	118.29
49	P-6	18.0	204	PVC	110.0	0.00	0.00	118.29	118.29
51	P-7	9.9	155	PVC	100.0	0.00	0.00	118.29	118.29
53	P-8	74.3	204	PVC	110.0	-4.84	0.15	118.29	118.31
55	P-9	12.3	204	PVC	110.0	0.00	0.00	118.31	118.31
57	P-10	36.4	204	PVC	110.0	-4.84	0.15	118.31	118.31
59	P-11	10.5	204	PVC	110.0	0.00	0.00	118.31	118.31
61	P-12	20.1	204	PVC	110.0	0.00	0.00	118.29	118.29
63	P-13	71.6	204	PVC	110.0	-2.49	0.08	118.28	118.29
64	P-14	19.2	204	PVC	110.0	-2.49	0.08	118.29	118.29
68	P-15	15.1	155	PVC	100.0	0.00	0.00	118.29	118.29
70	P-16	53.3	204	PVC	110.0	-2.49	0.08	118.29	118.29
72	P-17	169.3	204	PVC	110.0	-2.49	0.08	118.29	118.30
78	P-18	7.2	204	PVC	110.0	-2.49	0.08	118.30	118.30
85	P-20	12.7	204	PVC	110.0	-4.84	0.15	118.31	118.32
89	P-21	5.7	204	PVC	110.0	4.35	0.13	118.32	118.32
91	P-22	4.4	204	PVC	110.0	4.35	0.13	118.32	118.32
95	P-23	42.2	204	PVC	110.0	4.35	0.13	118.32	118.31
97	P-24	48.7	204	PVC	110.0	4.35	0.13	118.31	118.30
108	P-25	7.7	155	PVC	100.0	0.00	0.00	118.32	118.32
111	P-26	8.8	155	PVC	100.0	0.00	0.00	118.31	118.31
113	P-27	7.5	155	PVC	100.0	0.00	0.00	118.30	118.30
115	P-28	6.7	155	PVC	100.0	0.00	0.00	118.29	118.29
121	P-30	93.8	204	PVC	110.0	-2.49	0.08	118.30	118.31
124	P-33	24.8	155	PVC	100.0	0.00	0.00	118.32	118.32
126	P-34	24.9	155	PVC	100.0	0.00	0.00	118.32	118.32
128	P-35	43.3	204	PVC	110.0	0.00	0.00	118.31	118.31
130	P-36	11.2	155	PVC	100.0	0.00	0.00	118.26	118.26
132	P-37	10.9	155	PVC	100.0	0.00	0.00	118.27	118.27
172	P-38	23.3	155	PVC	100.0	0.00	0.00	118.31	118.31
175	P-39	31.1	200	PVC	100.0	0.00	0.00	118.31	118.31
206	P-31(2)	15.7	204	PVC	110.0	-2.49	0.08	118.31	118.31
211	P-31(1) (1)	29.2	204	PVC	110.0	-2.49	0.08	118.31	118.31
212	P-31(1) (2)	0.8	204	PVC	110.0	-2.49	0.08	118.31	118.31
216	P-56	15.1	155	Cast Iron	100.0	7.34	0.39	118.24	118.20
217	P-57	45.4	204	PVC	110.0	-7.34	0.22	118.24	118.26
219	P-58	96.3	297	Cast Iron	120.0	-33.60	0.48	118.30	118.40
222	P-59	68.5	250	PVC	110.0	11.69	0.24	118.40	118.37

OC Transpo - 1500 St. Laurent Boulevard
Boundary Condition - Scenario 2 - 254mm dia. WM extension
Max HGL
Pipe Table

ID	Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)
224	P-60	9.5	155	PVC	100.0	0.00	0.00	118.37	118.37
227	P-29(2)	33.9	204	PVC	110.0	4.35	0.13	118.32	118.32
230	P-62	17.4	250	PVC	110.0	0.00	0.00	118.37	118.37
232	P-63	82.8	250	PVC	110.0	11.69	0.24	118.37	118.34
234	P-29(1)(1)	36.4	204	PVC	110.0	-7.34	0.22	118.32	118.33
235	P-29(1)(2)	50.4	204	PVC	110.0	4.35	0.13	118.33	118.32
262	P-32(1)	18.2	204	PVC	110.0	-2.49	0.08	118.31	118.31
263	P-32(2)	32.0	204	PVC	110.0	-2.49	0.08	118.31	118.31
276	P-67	30.4	250	PVC	110.0	0.00	0.00	118.34	118.34
278	P-19(1)	17.6	204	PVC	110.0	-2.49	0.08	118.31	118.31
279	P-19(2)	24.0	204	PVC	110.0	-2.49	0.08	118.31	118.32
284	P-69	9.9	204	PVC	110.0	11.69	0.36	118.34	118.33
286	P-70	160.7	250	PVC	110.0	0.00	0.00	118.34	118.34