FUNCTIONAL SERVICING STUDY
LEBRETON FLATS PLAN OF SUBDIVISION

September 6, 2024

Prepared for:
National Capital Commission

Prepared by:
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1	Draft Plan Application	MW	2024-08-30	PM	2024-09-05	KS	2024-09-05

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1 Introduction

Stantec Consulting Ltd. has been retained by the National Capital Commission (NCC) to prepare a Functional Servicing Study for the LeBreton Flats Plan of Subdivision in support of a Draft Plan of Subdivision application. The subdivision lands are currently zoned Parks and Open Space (O1), General Mixed-Use Zone (GM7), and Residential Fifth Density Zone (R5), and is bordered by Wellington Street and the Kichi Zibi Mikan Parkway to the north, the O-Train Trillium Line rail corridor and Trillium Pathway to the west, Albert Street to the south, and Booth Street to the east. The subdivision lands are shown in blue in **Figure 1.1** below. Other lands owned by the NCC subject to the LeBreton Flats Master Concept Plan are identified in green. These lands fall outside of the plan of subdivision and development of the parcels will be approved in the future through Site Plan Control.

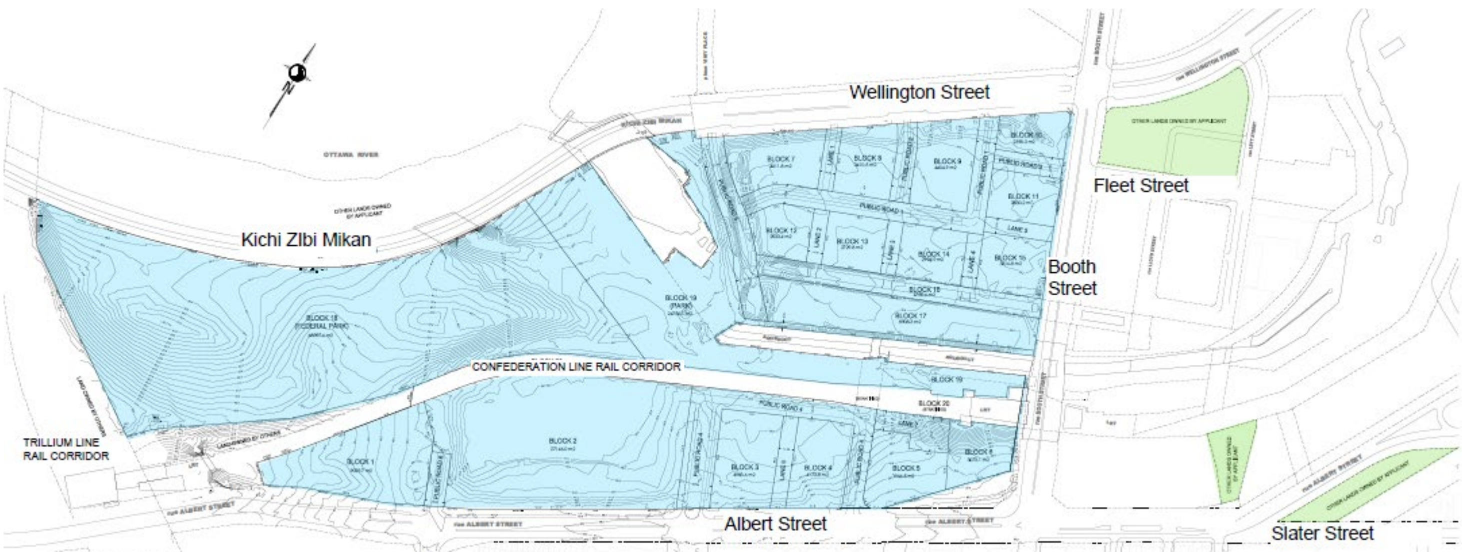


Figure 1.1: LeBreton Flats Subdivision Lands

The 21.5 ha subdivision development comprises of a total of 19 blocks, with public roadways and private lanes. The subdivision will include a block for an NCC park, a block for a municipal park and a block over the covered aqueduct to be conveyed to the City of Ottawa. The Confederation Line rail corridor and the open aqueduct bisect the subdivision lands. The draft plan of subdivision has been prepared by Stantec Geomatics Ltd. dated March 12, 2024, and density tables are included **Appendix A.1**.

The intent of this report is to build on the servicing principals outlined in the earlier master servicing studies to develop a servicing strategy specific to the subject site. The report will establish criteria for future detailed design of the subdivision in accordance with the associated background studies, City of Ottawa Design Guidelines, and all other relevant regulations.

1.1 Master Plan Context

In 1962, pursuing the modernist vision set out in the 1950 Gréber Plan, the federal government expropriated lands and cleared much of LeBreton Flats. The plan was to use the site as a federal office campus, but it was never fully realized. In subsequent years, efforts were undertaken to determine a suitable future for this important site.

In 1989, the NCC, the former Regional Municipality of Ottawa-Carleton (RMOC), and the City of Ottawa launched a joint planning process. The issues that were addressed and recommendations that were endorsed by all three parties included:

- the Transitway alignment;
- the condition of the heritage aqueduct and related bridge crossings;
- the reinforcement of the street grid;
- environmental assessment processes; and
- the sanitary sewer servicing capacity.

This process led to a land agreement that consolidated land ownership under the NCC and created the 1997 LeBreton Flats Master Plan. It analyzed and developed policies for density, land uses, urban design, servicing, roads, and the environment. The master plan was approved by Official Plan amendment in 1997, adopted following the Ontario Municipal Board decision in 1999, and zoning was updated by the City of Ottawa in 2000. The 1997 Plan still forms much of the policy basis that applies to the site today.

In 2002, the NCC hired Dessau-Soprin to complete a Master Servicing Study for LeBreton Flats and the Master Serving Plan (LeBreton Flats Infrastructure and Remediation Project: Master Servicing Report, 2004) was submitted and approved under the Municipal Class EA Process. The Site Development Plan from the 2004 Master Servicing Report is included in **Figure 1.2** below.

Based on that 2004 Master Servicing Study, in 2005 the NCC and the City entered into a servicing agreement to construct a new sanitary pumping station at LeBreton Flats. Pursuant to the agreement, the NCC undertook the environmental assessment in accordance with the Canadian Environmental Assessment Act and financed the design and construction of the facility, while the City obtained the provincial requirements. In 2008, the NCC built the LeBreton Flats Sanitary Pumping Station to accommodate the anticipated servicing requirements for the full build-out of LeBreton Flats. The NCC then transferred ownership of the pumping station to the City for operation and maintenance.

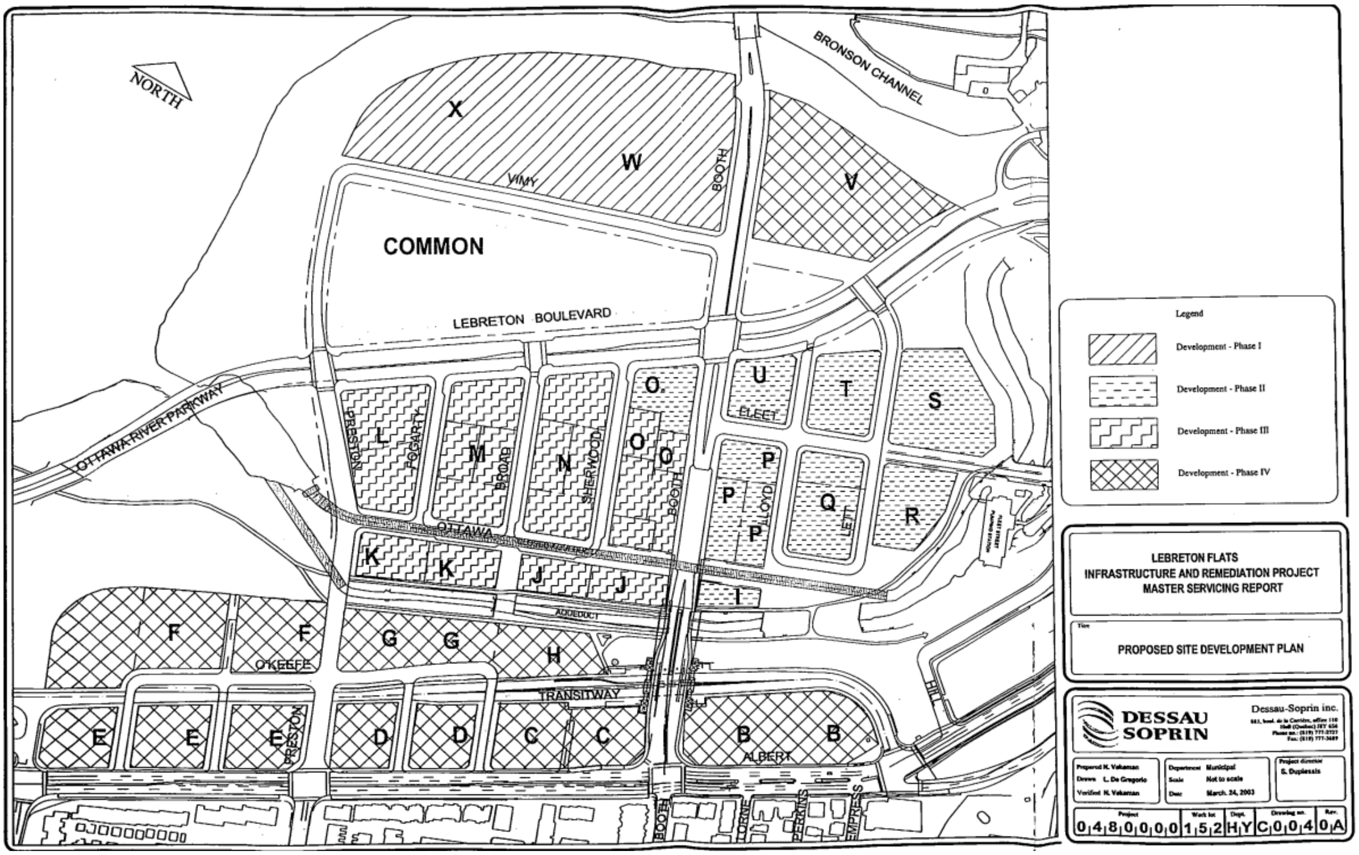


Figure 1.1.2: Proposed Site Development Plan (Appendix D, LeBreton Flats Infrastructure and Remediation Project: Master Servicing Report, Dessau-Soprin, 2004)

In 2014, motivated to enhance the attractiveness of the Capital and bring civic life back to LeBreton Flats, the NCC launched a competitive process seeking a development proposal for the entire site. With the cancellation of that process in 2019, the NCC chose to lead a new approach that would establish a comprehensive vision for LeBreton Flats, re-establishing the area as a Capital destination and a vibrant community. That new vision finds its expression in the 2021 LeBreton Flats Master Concept Plan (MCP), which serves as the guiding document for the draft plan of subdivision.

Supporting development of the LeBreton Flats MCP, the Master Servicing Report: Renewed Master Concept Plan & Development Strategy by CIMA+ was completed in 2021. The report is based on the 2004 Dessau-Soprin report and incorporates minor updates to reflect updated site conditions and the updated vision and plan for LeBreton Flats. While the CIMA+ report was not formally approved by the City of Ottawa, City staff reviewed the report and contributed to its development in support of the Master Concept planning process. See figure below of the block layout used in the master servicing report (CIMA+, 2021).

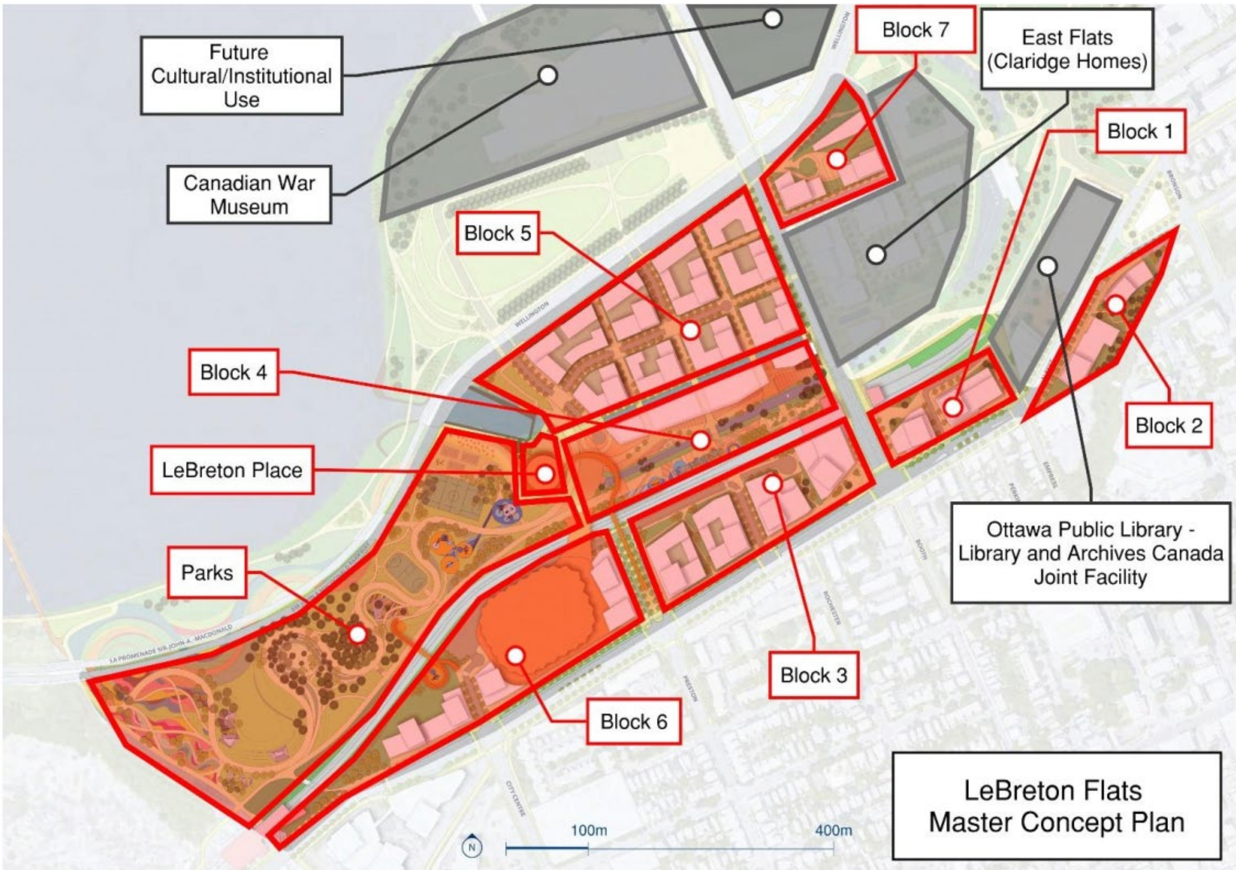


Figure 1.3: Master Servicing Plan Block Layout of LeBreton Flats Master Concept Plan (Master Servicing Report: Renewed Master Concept Plan & Development Strategy, CIMA+, 2021)

As required under the West Downtown Core Secondary Plan, the master servicing study is to be updated for the LeBreton Flats MCP area prior to development as outlined by Policy 7 under Section 10.2 from the Pimisi and LeBreton Flats District chapter:

> *The City shall require an updated master servicing study for the district, prior to development of lands within the LeBreton Flats Master Concept Plan area, west of Booth Street.*

The intent of this report is to fulfill this policy condition by preparing a Functional Servicing Study for the subdivision lands west of Booth Street, maintaining the overall intent of the 2004 Dessau-Soprin report while building on the servicing principles outlined in the LeBreton Flats Master Servicing Report (CIMA+, 2021) to develop a servicing strategy specific to the subject site to support the draft plan of subdivision.

This report demonstrates that the municipal servicing can support the proposed development, establishes the functional design for future detailed design of the subdivision and the design criteria for the detailed design of the subdivision development blocks subject to future Site Plan Control approval.

The overall development plan for LeBreton Flats has evolved from the 1997 LeBreton Flats Master Plan to reflect the current vision and address the impacts of the Confederation Line. The West Downtown Core Secondary Plan was developed based on the current MCP for LeBreton Flats and this update to the Master Servicing Study addresses the land uses, road network, and densities established in the master plans while meeting current design criteria.

2 References

The following documents were referenced in the preparation of this report:

- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012 (and all subsequent technical bulletins).
- *City of Ottawa Design Guidelines – Water Distribution*, Infrastructure Services Department, City of Ottawa, First Edition, July 2010 (and all subsequent technical bulletins).
- *LeBreton Flats Master Concept Plan, NCC, 2021*
- *LeBreton Flats Infrastructure and Remediation Project, Master Servicing Report,* Dessau Soprin, February 2004
- *LeBreton Flats Master Servicing Report Amendment (Draft), Parsons, June 2019*
- *Building LeBreton Master Servicing Report – Renewed Master Concept Plan & Development Strategy*, CIMA+, March 2021
- *Geotechnical Desktop Review: The LeBreton Flats Plan of Subdivision*, Stantec Consulting Ltd., May 7, 2024.
- *Draft Phase One Environmental Site Assessment, LeBreton Flats,* Stantec Consulting Ltd., February 2024.
- *LeBreton Flats Hydrogeological Memo,* Stantec Consulting Ltd., July 4, 2024.
- *LeBreton Flats Master Concept Plan,* National Capital *Commission, 2021*
- *Cave Creek Collector Realignment (Preliminary Design Drawings),* Robinson Consultants, January 23, 2024.
- *Albert/Queen/Slater Renewal (Construction Drawings),* Parsons, June 20, 2022.
- *Albert Street Reconstruction (Drawings),* Robinson Consultants, August 28, 2014.
- *Low Pressure Transmission Main Replacement Program – Lemieux Island WPP to Fleet Street (As-built Drawing)*, Stantec Consulting Ltd., March 2007.
- *Confederation Line Guideway Design – Segment 1 (As-built Drawings),* RTGE Joint Venture / MMM Group, July 22, 2019.
- *The Canada Central Railway Bridge – General Arrangement (Record Drawing),* Stantec Consulting Ltd. / Morrison Hershfield, November 12, 2001.

3 Water Servicing

3.1 Background

The proposed development is located within Pressure Zone 1W of the City of Ottawa's water distribution system. The development will be serviced with proposed connections to existing watermains along the boundaries of the development. These include the 406 mm diameter PVC watermains in Albert Street and Booth Street, and the 305 mm diameter PVC watermain in Wellington Street. A 1676 mm concrete backbone watermain is located within the open aqueduct and a 1220 mm diameter backbone watermain is located within Albert Street. These are critical components of the City of Ottawa water infrastructure that are not to be impacted as part of the subdivision development.

3.2 Functional Water Servicing Design

3.2.1 WATER DISTRIBUTION LAYOUT

The functional layout of the municipal water distribution system ensures the servicing of all development blocks based on the NCC Master Concept Plan, planned densities and applicable design criteria. The functional layout of the water distribution system in shown on **Drawing WTR-1**.

Watermains within the new public roads will be fed through connections to the existing watermains Albert Street, Booth Street and Wellington Street. Watermain stubs were installed with the construction of the 305 mm watermain in Wellington Street and the 406 mm watermain in Albert Street in anticipation of future connections for the servicing of the LeBreton Flats Subdivision. It is assumed that these stubs will be used as connection points for the municipal servicing where possible and will be confirmed through the detailed design phase.

The water distribution layout ensures that development blocks can be designed with redundant supply through secondary connections to the proposed distribution system. Block 6 can be provided with redundancy with a service connection to the 406 mm Albert Street watermain. The detailed design of each block will form part of future site plan development applications. The NCC park does not have frontage on a public watermain, as such, a private water service will be required to cross the Block 19 park to service the NCC park. Size and alignment of the services will be established as part of the future detailed design of the parks.

The watermains have been sized to meet City of Ottawa design criteria for pressure and flow for both domestic and fire flow demands.

3.2.2 DOMESTIC WATER DEMANDS

Preliminary water demands were estimated based on the assumed development densities and gross parcel areas established by the NCC in accordance with the West Downtown Core Secondary Plan. The density table is included in **Appendix A.1.**

The City of Ottawa's Water Distribution Guidelines (July 2010), ISD-2010-02 and ISTB 2021-03 Technical Bulletins were used to determine water demands based on projected population densities for residential areas and peaking factors. The population was estimated using an occupancy of 1.8 persons per apartment unit and 2.7 persons per townhome.

A daily rate of 280 L/cap/day has been used to estimate average daily (AVDY) potable water demand for residential areas, 28000 L/gross floor ha/day for commercial areas, 225 L/bedspace/day for hotels. A density of 185.3 persons/ha was assumed for the park blocks with a water demand of 20 L/persons/day based on the picnic and flush toilet demands from the City of Ottawa Sewer Design Guidelines.

Maximum day (MXDY) demands were determined by multiplying the AVDY demands by a factor of 2.5 for residential areas and 1.5 for commercial areas, hotels, and parks. Peak hourly (PKHR) demands were determined by multiplying the MXDY by a factor of 2.2 for residential areas and 1.8 for commercial areas, hotels, and parks. The estimated demands are shown in **Table 3.1** below and detailed in **Appendix B.1**.

Table 3.1: Water Demands

Demand Type	Area (ha)	Total Units	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Residential	-	4448	8276	26.8	67.0	147.5
Commercial	6.7	-	-	2.3	3.5	6.3
Hotel	-	305	-	1.6	2.4	4.3
Parks	9.3	-	-	0.5	0.8	1.4
Total	**16.5**	**4448**	**8276**	**30.3**	**72.3**	**156.9**

3.2.3 FIRE FLOW DEMANDS

At the draft plan level, no details pertaining to the building footprints for each block are available. Therefore, a fire flow demand of 200 L/s (12,000 L/min) was assumed based on the Simple Method for a typical family dwelling in a subdivision summarized in Table 8 of the 2020 FUS, in which the 200 L/s is the worst-case scenario. This conservative estimate, which is applied to all blocks, exceeds the fire flow demands of non-combustible and sprinklered buildings that are anticipated for the development. Further details of the fire flow demands will be provided once the building construction and floor area details are made available at the detailed design stage for each site plan block.

3.2.4 BOUNDARY CONDITIONS

The estimated domestic water and fire flow demands were used to define the supply required for the proposed development from the existing watermains. **Table 3.2** below summarizes the boundary conditions received from the City of Ottawa on June 24, 2024. A copy of the boundary condition correspondence and the accompanying schematic received from the City of Ottawa is included in **Appendix B.2**.

Table 3.2: Boundary Conditions

Street	Wellington			Booth	Albert			
Connection	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Min. HGL (m)	107.4	107.4	107.4	107.5	107.6	107.6	107.6	107.6
Max. HGL (m)	115.2	115.2	115.2	115.2	115.1	115.0	115.0	114.9
MXDY + FF (200 L/s) (m)	105.0	106.5	107.1	108.4	110.1	109.9	110.0	110.0

3.3 Hydraulic Assessment

3.3.1 LEVEL OF SERVICE

A preliminary watermain network was compiled and modeled on PCSWMM to verify adequacy of watermain pressures to service the subdivision, based on the provided boundary conditions from the City. Through the City of Ottawa Design Guidelines, the normal demand conditions (average day, maximum day and peak hour) should be in the range of 350 kPa to 480 kPa (50 psi to 70 psi) and no less than 275 kPa (40 psi) at the ground elevation on the streets (i.e., at hydrant level).

As per the Ontario Building Code (OBC) & Guide for Plumbing, if pressures greater than 550 kPa (80 psi) are anticipated, pressure relief measures are required. The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). Under emergency fire flow conditions, the minimum pressure objective in the distribution system is 138 kPa (20 psi).

Hazen-Williams coefficients (“C-Factors”) are applied to the simulated watermains in accordance with the City of Ottawa’s Water Distribution Design Guidelines and as shown in **Table 3.3** below.

Table 3.3: Proposed Watermain C-Factors

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
> 600	130

Results of the preliminary watermain hydraulic analysis is available in **Appendix B.3**.

3.3.2 AVERAGE DAY DEMAND (AVDY)

The hydraulic modeling results indicate that under the average day demand, the pressure in the proposed watermain ranges from 550 kPa to 614 kPa (79.8 psi to 89.1 psi). These pressures exceed the serviceable limit of 276 kPa to 550 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines - Water Distribution, indicating that pressure reducing valves may be required for the development. Results are shown in **Figure 3.1** below. Requirements for pressure-reducing measures will be confirmed by the mechanical or civil engineering consultant at the future detailed design phase for the residential and park development blocks.

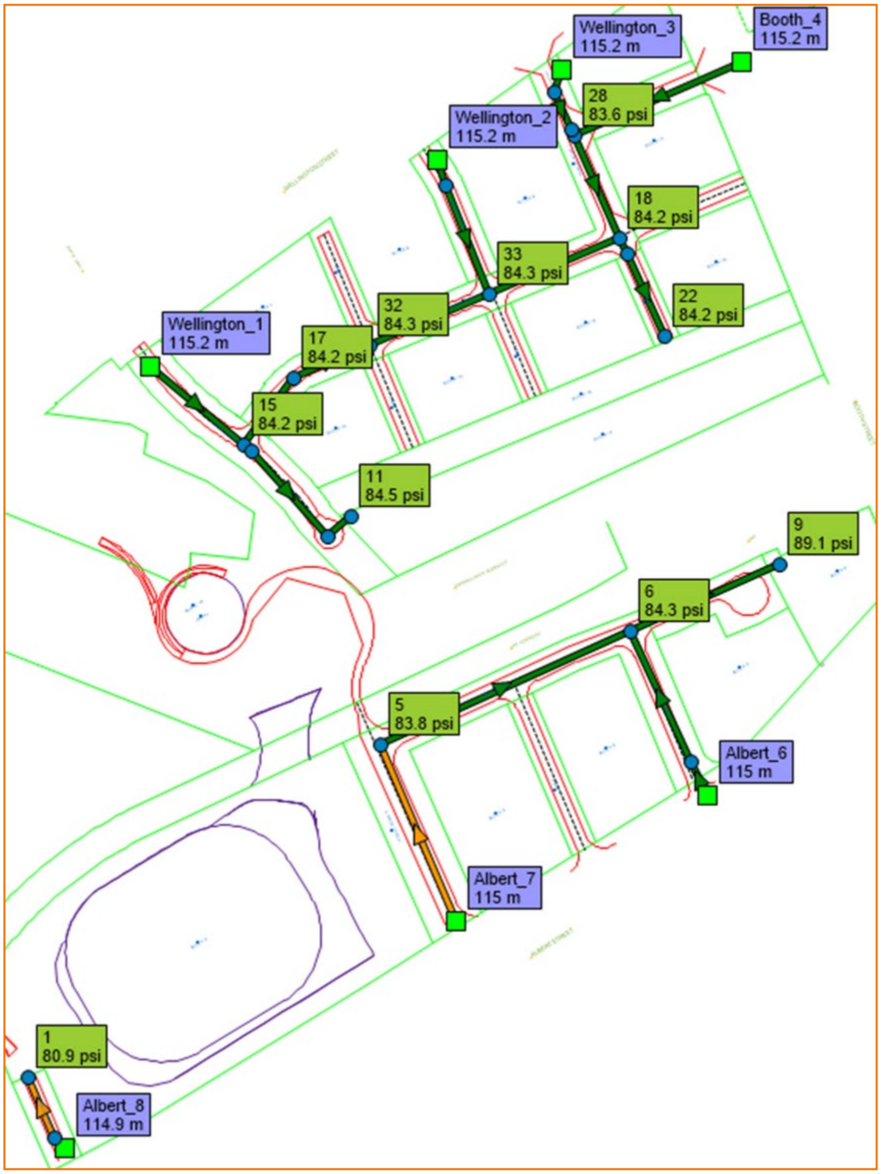


Figure 3.1: AVDY Pressure Results

3.3.1 PEAK HOUR DEMAND (PKHR)

The hydraulic modeling results indicate that under the peak hour demands, the pressure in the proposed watermain ranges from 477 kPa to 539 kPa (69.2 psi to 78.2 psi). These pressures are within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Results are shown in **Figure 3.2** below.

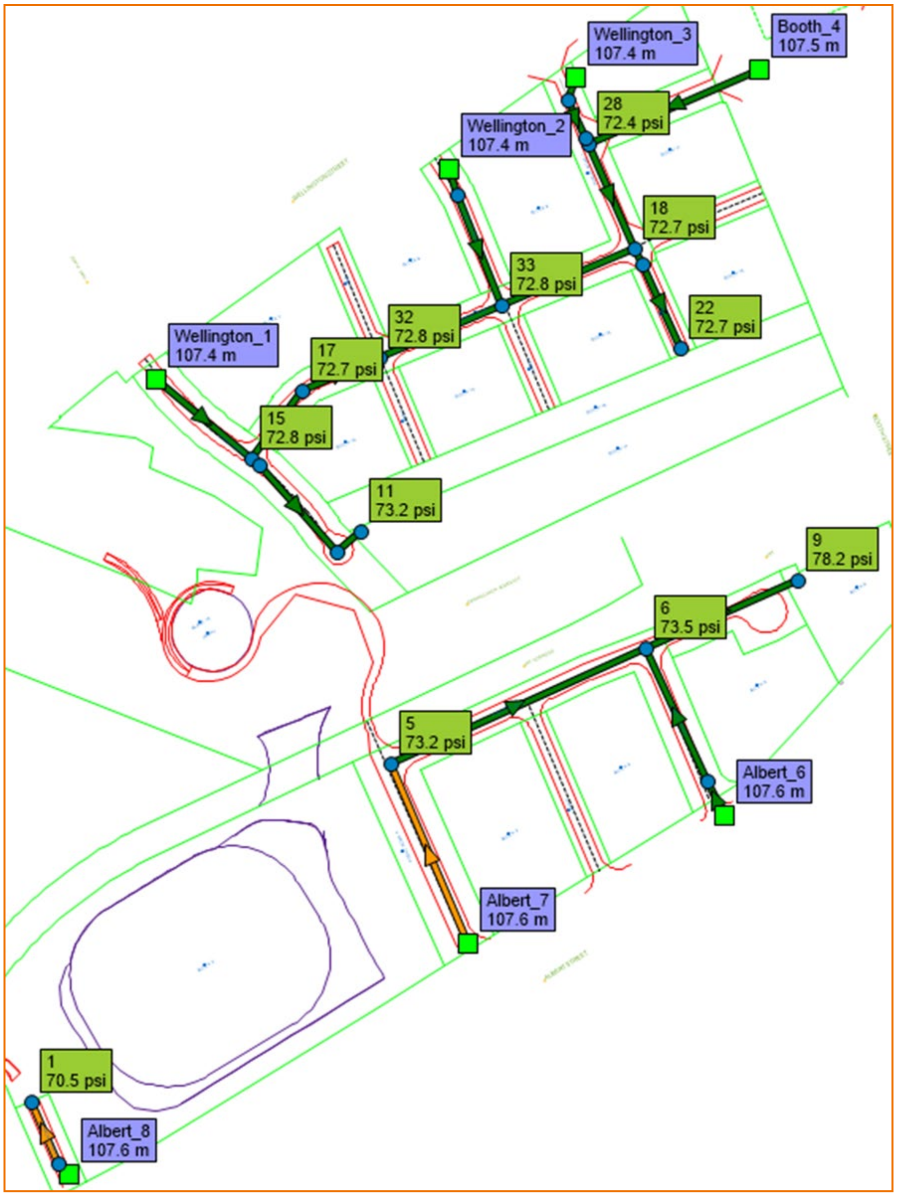


Figure 3.2: PKHR Pressure Results

3.3.2 MAXIMUM DAY DEMAND + FIRE FLOW (MXDY+FF)

The hydraulic modeling was also used to assess the maximum day and fire flow demands while maintaining a residual pressure of 138 kPa (20 psi), per the City of Ottawa Design Guidelines – Water Distribution. The modeling is conducted using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of H2OMAP. The fire flow demand is set to 200 L/s as per the demands noted in **Section 3.2.3**.

Figure 3.3 illustrates that the proposed networks can deliver flows exceeding 200 L/s while maintaining the required residual pressure of 138 kPa (20 psi).

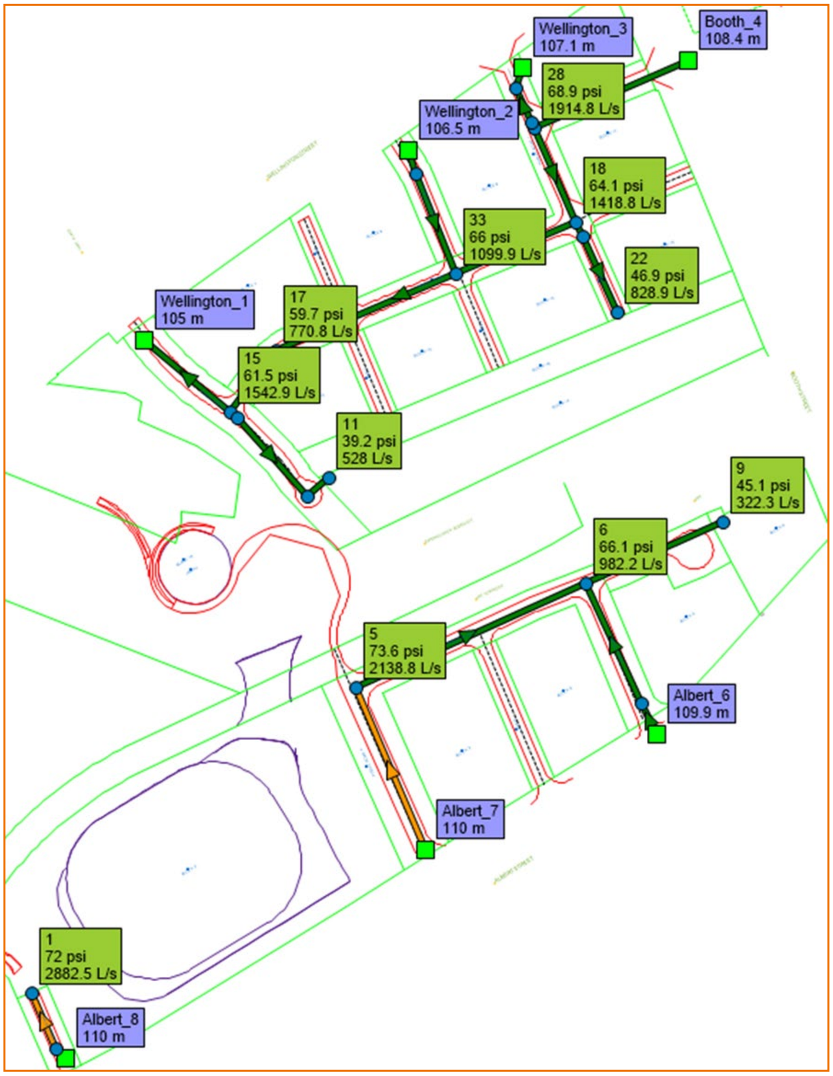


Figure 3.3: Fire Flow Results – Residual Pressure and Available Fire Flows

3.4 Conclusion

The proposed watermain alignment and sizing can achieve the required level of service within the LeBreton Flats subdivision. Based on the hydraulic analysis, the following conclusions were made:

- The proposed water distribution system is recommended to include a combination of 200 mm, and 300 mm diameter watermains.
- During peak hour conditions, the proposed system is capable of operating above the minimum required pressure of 275 kPa (40 psi).

- Under fire flow conditions, the proposed networks can provide sufficient fire flows (200 L/s and above) while maintaining a residual pressure of 138 kPa (20 psi) in the LeBreton Flats development.

Watermain sizing and hydrant placement will be confirmed as part of the detailed design of subdivision.

4 Wastewater Servicing

4.1 Background

The LeBreton Flats subdivision lands are located within the central core of the City of Ottawa immediately adjacent to the Ottawa River. Public wastewater infrastructure is available to service the subdivision lands. The 1050 mm diameter Cave Creek Collector (CCC) sanitary sewer, crosses the southern portion of the development land (Block 2, Block 4 and Street 4). Design is underway for the realignment of the CCC. The CCC is intended to be relocated to the Albert Street ROW (by others) prior to the development of the impacted subdivision blocks. 250 mm diameter and 300 mm diameter sanitary sewers on Wellington Street, and a 375 mm diameter sanitary sewer on Booth Street also front the subdivision lands. These sewers direct wastewater to the LeBreton Flats Pumping Station (LFPS) via Fleet Street. The LFPS was designed to service the full buildout of LeBreton Flats subdivision north of the closed aqueduct, including the existing Claridge development and the Canadian War Museum. A flow allotment was also assigned for potential future development of Victoria Island. The design and construction of the LFPS was funded by the NCC.

4.2 Wastewater Generation and Servicing Design

The following criteria have been used to calculate the estimated wastewater flow rates and to determine the size and location of the sanitary sewers. Design criteria are in accordance with the City of Ottawa Sewer Design Guidelines, and the Ministry of Environment Conservation and Parks (MECP) Design Guidelines for Sewage Works. Park design criteria are consistent with previous background studies.

- Minimum velocity = 0.6 m/s (0.8 m/s for upstream sections)
- Maximum velocity = 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes = 0.013
- Minimum size of sanitary sewers inside the greenbelt = 250 mm
- Minimum grade of sanitary sewer service = 0.34% (0.65% where less than 10 contributing residential units)
- Residential average wastewater generation = 280 L/person/day
- Commercial average wastewater generation = 28,000 L/gross floor ha/day
- Hotel average wastewater generation = 225 L/bedspace/day
- Picnic space and flushing toilets average wastewater generation = 20 L/persons/day
- Residential Peaking Factor = based on Harmon Equation; maximum of 4.0, minimum of 2.0

- Commercial and Hotel Peaking Factor = 1.5
- Park Contingency Factor = 25 %
- Harmon correction factor = 0.8
- Infiltration allowance = 0.33 L/s/ha
- Minimum cover for sewers = 2.5 m
- Population density for apartment units = 1.8 persons/unit
- Population density for townhome units = 2.7 persons/unit
- Bedspace per hotel unit = 2 bedspaces/hotel unit
- Population density for park areas = 183.5 persons/ha

4.3 Functional Sanitary Servicing Design

4.3.1 FUNCTIONAL LAYOUT

The functional layout of the municipal sanitary collection system ensures the servicing of all development blocks based on the NCC Master Concept Plan, planned densities and applicable design criteria.

The functional servicing layout and drainage area plan for the LeBreton Flats Plan of Subdivision is detailed on **Drawing SAN-1**. The LeBreton Flats development will be serviced by two separate networks of sanitary sewers. Wastewater from the subdivision lands north of the covered aqueduct will outlet to the 375 mm diameter sanitary sewer in Booth Street, which directs flow to the LFPS via Fleet Street. Wastewater from the subdivision lands south of the covered aqueduct will outlet to the Cave Creek Collector (CCC). In **Figure 4.**1 below, lands serviced by the LFPS are green and those serviced by the CCC are shown in pink.

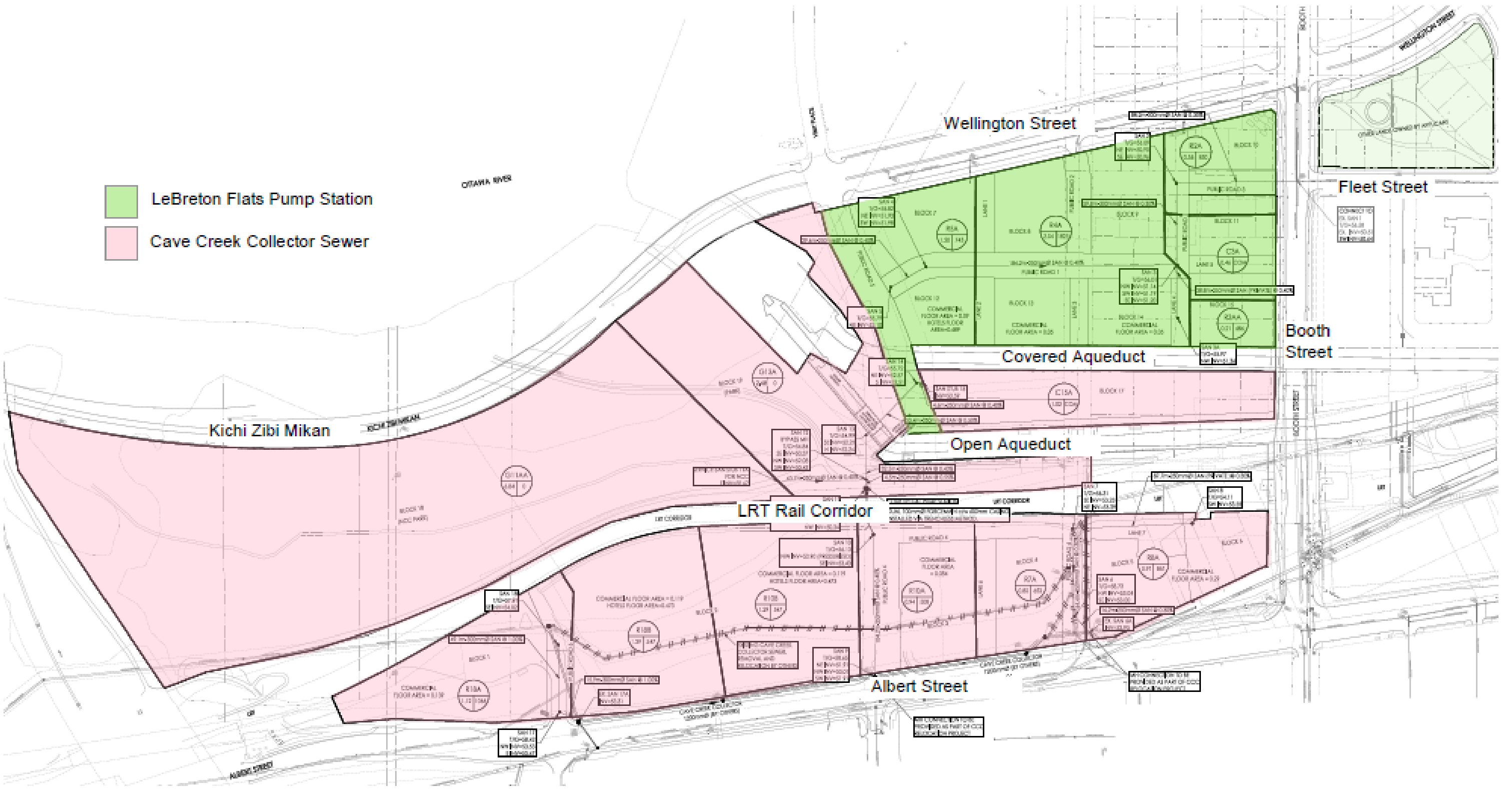


Figure 4.1: Sanitary Drainage Outlets

There is no restriction to flows directed to the CCC, however, the LFPS has a firm rated capacity of 100 L/s. The remaining available capacity in the LFPS has been allocated to the subdivision lands north of the covered aqueduct and to development lands outside of the LeBreton Flats Subdivision. A peak flow rate of 40.95 L/s has been allocated to the LeBreton Flats Subdivision.

A network of sanitary sewers will service the subdivision lands with connections to the existing municipal sewers within Booth Street and Albert Street as outlined in earlier master servicing studies. New municipal sewers will be located within the public roadways to provide a wastewater outlet for each of the development blocks and park blocks.

Functional design flows were estimated based on the assumed development densities and gross parcel areas established by the NCC in accordance with the West Downtown Core Secondary Plan. The density table is included in **Appendix A.1**. Although the density table assumes primarily residential and hotel use for Block 2, the proposed municipal sanitary sewers have the capacity to service the block should it become a major events centre.

A sanitary pumping station will be required to service the sanitary sewers receiving flows from the Block 17 (commercial/office) and park blocks 18 and 19 due to their relative elevation to the municipal gravity sewers and the need for the transmission infrastructure to cross the open aqueduct and the rail corridor. City of Ottawa Wastewater Operations have advised that the sanitary pump station will require back up power, dual forcemains and vehicular access. The have also specified that the infrastructure crossing the rail line is required to be sleeved. The functional location and layout of the proposed pumping station (Option 1 per section 4.3.2 below) is included on **Drawing SAN-1**. Peak design flow to the station is calculated to be 2.6 L/s as detailed in the sanitary design sheet included in **Appendix C.1.**

The proposed design peak flows for the subdivision to each outlet are outlined in **Table 4.1** below and detailed in **Appendix C.1**. As shown in **Table 4.2** below, the design peak flows fall within the allotted capacity from the CIMA+ MSS.

Table 4.1: Estimated Total Wastewater Peak Flow

Outlet	Residential			Hotel	Park	Commercial			Infiltration Flow (L/s)	Total Peak Flow (L/s)
	Population	Peak Factor	Peak Flow (L/s)	Peak Flow (L/s)	Peak Flow (L/s)	Area (ha)	Peak Factor	Peak Flow (L/s)		
LFPS	4104	2.86	38.0	0.8	-	0.66	1.5	0.2	1.5	40.5
CCC	4172	2.85	38.6	1.6	0.5	6.04	1.5	2.9	5.5	52.7
Total Estimated Wastewater Peak Flow (L/s):										**93.2**

Table 4.2: Comparison of demands with CIMA+ MSS allocations

Outlet	Sanitary Peak Flows for Draft Plan of Subdivision (L/s)	LeBreton Flats MSS (CIMA+, 2021) Sanitary Flow Allocation (L/s)
LFPS	40.57	40.95
CCC	52.67	66.99

4.3.2 SANITARY PUMP STATION

The existing infrastructure crossing the site and the relative elevations of the land and existing sewer outlets constrain the servicing of the lands between the covered aqueduct and the Confederation Line rail corridor. A small sanitary pumping station is required as part of the sanitary servicing infrastructure to service Block 17, the City park block, and the NCC park block.

Options for the pump station siting were evaluated based on the station requirements and constraints. A technical memo and schematics examining the options has been included in **Appendix C.2.** The memo includes the functional layout of both options. Option 1 is depicted on the Functional Sanitary Sewer System layout, **Drawing SAN-1** and is the recommended option based on the review of pros and cons identified.

The wet well will receive wastewater flow from the two parks and Block 17 by gravity where sewage will be pumped across the rail corridor. The forcemains will outlet to SAN 10 within Public Road 4 where sewage will flow by gravity to the CCC. The detailed design of the pump station will form part of the detailed design of the subdivision.

4.4 Conclusion

The proposed sanitary sewer alignment and sizing can achieve the required level of service for the LeBreton Flats subdivision development.

The capacity of the receiving wastewater systems can accommodate design flows based on proposed densities.

A small sanitary pump station will be required to service the blocks that do not have a gravity outlet to the municipal collection system, Blocks 17, 18 and 19.

The detailed design of the sanitary collection system and components will be established as part of the detailed design of subdivision.

5 Stormwater Management and Stormwater Servicing

5.1 Background

The objective of this stormwater management plan is to determine the measures necessary to control the quantity and quality of stormwater released from the proposed development to the design criteria established in earlier Master Servicing Studies and subsequent pre-consultation with City of Ottawa staff.

5.2 Stormwater Management (SWM) Design Criteria

The Stormwater Management (SWM) criteria are established by combining current design practices outlined by the City of Ottawa Sewer Design Guidelines (SDG) (October 2012), as amended, consultation with City of Ottawa staff, and review of the LeBreton Flats MSS (LFMSS) and other background studies. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Use of the dual drainage principle (City of Ottawa SDG)
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff (City of Ottawa SDG)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on the major and minor drainage systems (City of Ottawa SDG)

Storm Sewer and Inlet Controls

- The minor system will be designed to convey the 5-year post event, and quantity control will be required for the individual blocks up to and including the 100-year event (LFMSS, CIMA+ 2021)
- Discharge from the blocks and ROWs should be controlled to the 5-year storm event with C=0.70 (City of Ottawa pre-consultation).
- Tc should be not less than 10 minutes (City of Ottawa SDG).

Surface Storage and Overland Flow

- Building openings to be a minimum of 0.30 m above the 100-year water level (City of Ottawa SDG)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35 m for local streets (City of Ottawa SDG)

- Provide adequate emergency overflow conveyance off-site with a minimum vertical clearance of 0.15 m between the spill elevation and the ground elevation at the building envelope in the proximity of the flow route or ponding area (City of Ottawa SDG)

Quality Control

- An Enhanced level of quality control of 80% removal of Total Suspended Solids (TSS) has been requested for all stormwater outlets (City of Ottawa pre-consultation)

5.3 Functional Stormwater Management Design

The LeBreton Flats development is to be designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5-year design storm and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties.

In keeping with the 5-year inlet restriction criterion, inlet control devices (ICDs) or orifice plates will be specified during the detailed design stage for the individual blocks and street catchbasins to limit the inflow to the minor system. Restricted inlet rates to the sewers are necessary to prevent the hydraulic grade line (HGL) from surcharging storm sewers into basements and other underground infrastructure during major storms.

The Modified Rational Method has been employed to assess the rate and volume of runoff anticipated during post-development rainfall events. Based on the draft plan and preliminary Grading Plan, drainage area boundaries have been defined. Runoff coefficient values were then assigned to each drainage area based on a conservative estimate of built-form imperviousness. Runoff coefficients for each area are assigned based on City of Ottawa SDG and accepted practices. Full details can be found in **Appendix D.1**, while **Drawing STM-1** illustrates the conceptual post-development drainage conditions.

The major system flows generated from larger events (beyond the 100-year storm) will be safely conveyed to the open aqueduct as per existing conditions by engineered (overland) channels such as roadways, ditches, and walkways. The overland channels immediately north of Albert Street have also been proposed to receive overland flow from approximately 21 ha of land south of Albert Street, which is tributary to the open aqueduct under historical conditions (see Major Overland Flow section below). It is of note that construction of the Confederation Line has effectively blocked existing overland flow path to the open aqueduct, with no option for overland conveyance identified in the stormwater management report for the Confederation Line guideway.

The minor system from the proposed subdivision will be conveyed and modelled up to the point of discharge to three storm sewer outlets, comprising of the open aqueduct, the 2100 mm diameter storm trunk sewer in Albert Street, and a 525 mm diameter section of storm sewer immediately upstream of the trunk sewer within Albert Street.

5.3.1 PRE-DEVELOPMENT DRAINAGE CONDITIONS

The existing drainage conditions for the site have been determined by evaluating available topographic mapping to delineate the existing flow patterns and subdrainage areas, with the study area split into subcatchments based on existing surface inlets. The runoff coefficients for the existing subdrainage areas have been determined based on the relative imperviousness of the respective areas. A network of existing culverts and catch basins direct the drainage from most areas to either the open aqueduct, the Confederation Line ditch line, and the Ottawa River. Existing areas to be retained as NCC or City of Ottawa park land largely drain to existing catch basin and culvert infrastructure to the Ottawa River or open aqueduct. The pre-development subdrainage areas are shown on **Drawing EX STM-1**.

An external area to the south measuring approximately 21 ha as identified by City of Ottawa personnel contributes overland flow to the open aqueduct as identified in previous background studies. This emergency overland flow route enters LeBreton Flats Subdivision via a low point at the intersection of Albert and Preston Streets, with grading indicating a potential for major system flows to overtop the centerline of Albert Street allowing major system runoff to enter the proposed subdivision.

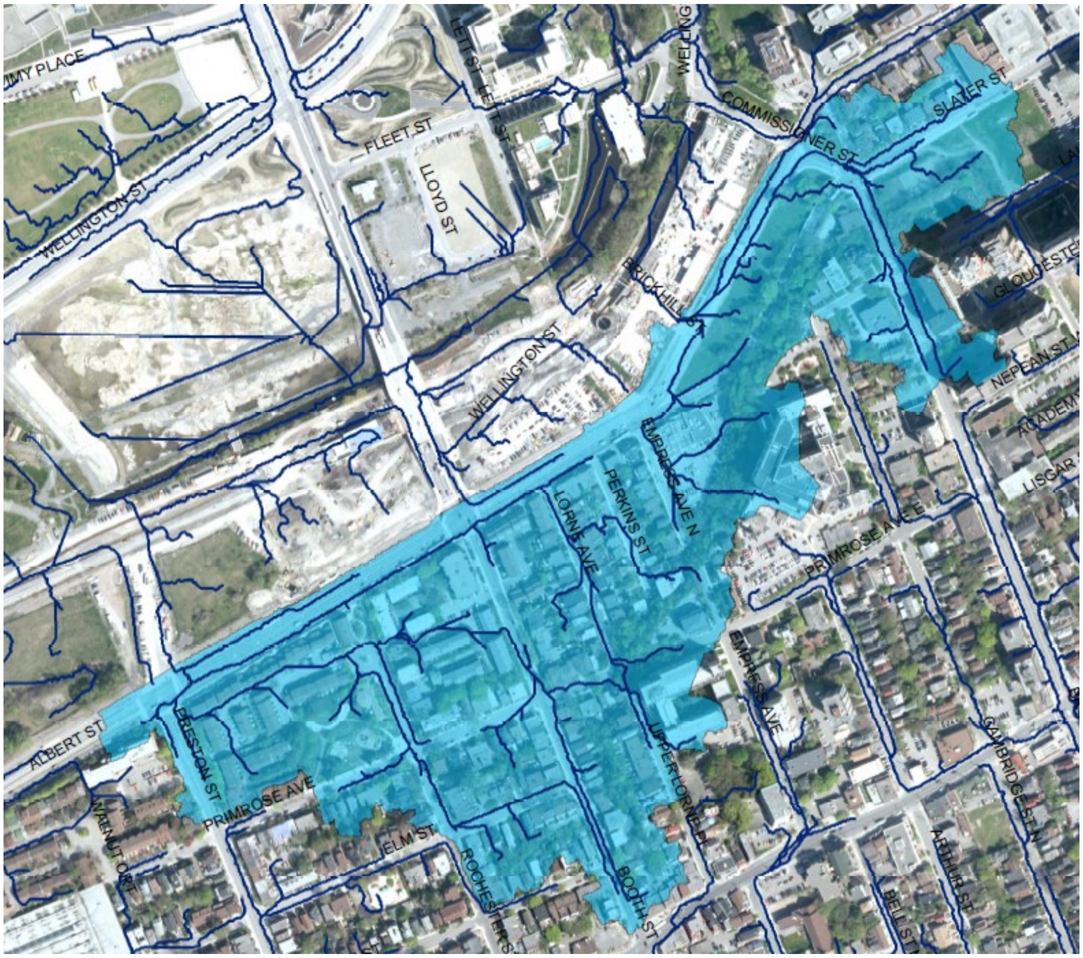


Figure 5.1: External Stormwater Drainage Area Crossing Albert Street (LeBreton Flats Master Servicing Report Amendment, Parsons, June 2019)

The target release rate for the site was calculated using the rational method, a time of concentration of 10 minutes, and the City of Ottawa IDF curves. The rational method equation is as follows:

- Q = 2.78 CiA
- Where:
  - Q = peak flow rate, L/s
  - A = drainage area, ha
  - I = rainfall intensity, mm/hr (per Ottawa IDF curves)
  - C = site runoff coefficient

The release rates are summarized in **Table 5.1**. The post-development peak flows for the study area for the 5-year and the 100-year event must be restricted to be less than or equal to the 5-year pre-development with a C of 0.7.

Table 5.1: Target Release Rate

Design Storm	Target Flow Rate (L/s)
5-Year	4360

5.3.2 POST-DEVELOPMENT DRAINAGE CONDITIONS

The post-development drainage patterns for the site were established based on the draft plan and shown on **Drawing STM-1**, where the subdrainage areas have been delineated based on their drainage outlet, storage treatment, and design criteria. The subdrainage areas have been grouped into the following categories as shown in **Table 5.2**.

Table 5.2: Summary of Post-Development Subdrainage Areas

Category	Applicable Blocks	Subdrainage Areas	Total Area (ha)	Outlet
Block Areas – Tributary to Fleet Street	Blocks 7 to 15	C6B, C6C, C5A, C5B, C5C, C4D, C4AA, C4C, C3AA	2.90	Fleet Street 2100 mm diameter storm sewer
ROWs – Tributary to Fleet Street	Public Roads 1 to 3, 5, and Lanes 1 to 5	C6A, C6D, C4B, C3B	1.55	Fleet Street 2100 mm diameter storm sewer
Block Areas – Tributary to Albert Street	Blocks 1 to 6	C19A, C16A, C16B, C12B, C12A, C13A	5.22	Albert Street 525 mm and 2100 mm diameter storm sewers
ROWs – Tributary to Albert Street	Public Roads 4 and 6, and Lanes 6 to 7	C19B, C15A, C14A, C14B, C13B	1.13	Albert Street 525 mm and 2100 mm diameter storm sewers

Category	Applicable Blocks	Subdrainage Areas	Total Area (ha)	Outlet
Block Area – Tributary to the Open Aqueduct	Block 17	C17A	0.89	Open Aqueduct
City Park	Block 19	PARK-1, PARK-2	2.48	Open Aqueduct / Nepean Bay / Ottawa River
NCC Lands, Closed Aqueduct Block	Blocks 16 and 18	UNC-1, NCC-1	7.33	Ottawa River / Open Aqueduct

The post-development subdrainage areas and runoff coefficients are summarized in **Appendix D.1**.

5.3.2.1 Quantity Control

The LeBreton Flats development will lead to a significant increase in the site's overall runoff coefficient, as the site is presently vacant and predominantly pervious area. In addition, the C coefficient values have been increased by 25 % for the post-development 100-year storm event based on MTO Drainage Manual recommendations and City of Ottawa Sewer Design Guidelines. Quantity control measures are required on this site to meet the restrictive stormwater release criteria.

To assess the post-development runoff, a runoff coefficient of C=0.85 was assigned to all the development blocks, save for the parks (C=0.40) and the covered aqueduct (Block 16, C=0.20), while C=0.70 was assigned to the public roads and private lane ROWs.

Detailed design for each block is expected to progress through individual Site Plan Control (SPC) processes. To demonstrate the serviceability of the subdivision, the Block areas and ROWs have been treated as a single consolidated area with a combined runoff coefficient, overall storage requirements, and a single outflow rate that satisfies the 5-year pre-development release rate. To demonstrate the serviceability of each individual Block, the stormwater management design calculations also provide the required release rates at the Block level.

It is anticipated that surface storage with inlet control devices (ICDs) in catch basins be provided in the public roadway and private lane ROWs, while onsite storage methods (i.e. controlled rooftop storage, cisterns, underground tanks, oversized pipes, or a combination thereof with restricted release) will be provided onsite within the blocks to meet the target discharge. Further details of the stormwater storages for each block and the surface storages within the ROWs will be provided at the detailed plan of subdivision and individual block site plan control stages for the development.

The storage requirements for the site were determined using the Modified Rational Method (MRM). The detailed MRM analysis have been provided in **Appendix D.1**. The 100-year storage requirements per outlet are summarized in **Table 5.3**, where:

- Qactual is the 100-year rainfall runoff rate generated from the Block area as determined by the Rational Method Calculation at tc = 10 min
- Vstored is the volume of storage required.

Table 5.3: 100-Year Storage Requirements for Block Areas and ROWs

Outlet	Area Type	Area	C	C	Qactual	Qcontrol	Vstored
		(ha)	(5-yr)	(100-yr)	(L/s)	(L/s)	(m^3)
Fleet Street	Blocks	2.90	0.85	1.00	1441	588	511
	ROWs	1.55	0.70	0.88	673	314	215
Albert Street	Blocks	5.22	0.85	1.00	2591	1533	920
	ROWs	1.13	0.70	0.88	490	229	157
Open Aqueduct	Block 17	0.89	0.85	1.00	442	180	157

5.3.2.2 Quality Control

On-site quality control measures are expected for the proposed development per pre-consultation with the City of Ottawa. An enhanced level of protection (80% removal of total suspended solids) was identified for the site before discharging to the storm sewer outlet. The use of LIDs may be limited for the development based on elevated bedrock as well as historic land use for a portion of the development as a landfill. As such quality control measures will largely be limited to oil/grit separators, surface filtration measures, and filtration manufactured treatment devices (MTDs). The MECP has recently advised that OGS units should be sized for quality control based on revised particle size distributions which largely limit OGS units to providing 50-55% removal of total suspended solids. Jellyfish membrane systems are proposed as an end-of-pipe filtration MTD solution to achieve quality control where treatment train processes are not possible given spatial requirements within municipal rights-of-way.

Jellyfish membrane systems are proposed in the most downstream storm manholes within the subdivision before the connections into the existing storm sewers within Albert and Fleet Streets. These end-of-pipe systems are to be designed to treat runoff from the 90^{th} percentile annual storm event (approx. 25mm storm) to satisfy MECP criteria for design. The drainage area for the Fleet Street outlet is too large to permit a single end-of-pipe MTD to treat the entire development, and so individual blocks in this area as well as Block 2 (previously an area noted for an arena) will require quality control prior to discharge to the municipal system. The quality control unit for the outlet into the open aqueduct will be incorporated into the stormwater design by others at the detailed design phase.

The Hydrogeological Review (Stantec, 2024) recommended using low impact development (LID) systems designed to promote sediment filtration, evapotranspiration, and/or capture stormwater from the parks and direct it toward a stormwater sewer that conveys the water away from any proposed buildings. Furthermore, the LeBreton Flats Master Servicing Report (CIMA+, 2021) also identified bio-swales and/or rain gardens as the preferred LID measures for park blocks.

See **Appendix D.3** for conceptual quality MTD sizing calculations.

5.4 Functional Storm Servicing

A functional storm servicing design featuring conceptual sewer alignments, emergency overland flows, and storm drainage areas is provided in **Drawing STM-1**. Preliminary storage requirements and supporting calculations are provided in Appendix. The sewers are to be designed in conformance with all City of Ottawa and MECP Guidelines, policies, and design parameters.

The proposed roadways will have urban cross sections complete with curb, gutter, and catch basins to inlet to the minor storm system. Design of the storm sewer (including catch basin design and locations) are to be determined at the detailed design phase when a dynamic model will be developed to evaluate the post-development conditions and sewer hydraulic design. At present, the functional sewer design is free of conflicts with other services (SAN and WTR) and has adequate cover for frost protection.

The buildings in each development block are anticipated to be serviced by storm service laterals, which will accommodate the controlled release of rooftop runoff, building foundation drain flow, and release of stormwater runoff from building area drains or stormwater storage cistern(s). It is assumed that sump pits and pumps will be required to accommodate the foundation drains and the possible stormwater storage cistern(s) at the basement (underground) parking levels.

The mechanical consultant or plumbing contractor will ultimately be responsible to confirm the building service lateral sizing; sump pump requirements and designs; and ensure conformance to building code requirements. Building service sizing and sump pump requirements will be confirmed at the detailed design phase.

5.5 Major System Flow

During preconsultation discussions, the City of Ottawa identified that the Confederation Rail Line is situated in the overland flow path of runoff from an area of approximately 21 hectares external to the subdivision, south of Albert Street. Infrastructure for conveyance of the external drainage has not been accommodated with works undertaken to date including the construction of the Confederation Line. The City of Ottawa advised that an emergency overland flow outlet would have to be designed to support the plan of subdivision to safely convey the external stormwater drainage across the rail line to the open aqueduct. It was agreed that responsibility for funding and construction as well as timing of the outlet would be negotiated between the City of Ottawa and the NCC.

Using available 2K mapping topography, the catchment area for the external drainage was delineated, and an overall runoff coefficient of 0.70 was applied based on prevailing imperviousness of existing areas.

A PCSWMM model for the major system within the catchment area was developed in consideration of the typical 18m ROW cross section for all streets with the exception of Preston and the south side of Albert Street which were developed based on existing photogrammetry. Subcatchments within the area are generally sloped from southeast to northwest to the intersection of Albert/Preston Street. Given the relatively high average longitudinal slope of the roadways, it was conservatively assumed that no additional storage would be available within ponded areas beyond that already determined for the given road cross sections. Subcatchment slopes were conservatively set at 3% on average, and subcatchment widths defined as subcatchment area x 225 per recommendations of the SDG for lumped drainage areas.

Each street intersection or major incoming driveway was modeled with a storage node in the PCSWMM model without surface storage to permit routing of the major system from street to street. At each storage node, runoff was removed from the model using catch basin capture curves for inlets on continuous grade as noted in the SDG, and for capacity of surface grates within sags from Design Charge 4.19 in the MTO Drainage Manual. Catch basin counts for each area were estimated based on direct take-offs from available City of Ottawa GIS mapping (GeoOttawa). It is assumed that the minor system in this area does not surcharge to surface during major storm events, and that the area is not equipped with inlet control devices given the overall existing sewer age.

The 100yr 3hr Chicago storm and 100yr 3hr +20% climate change storm was then run on the resulting model to verify at a high level whether considerable major system flows could be expected to discharge over the centerline of Albert Street at the Preston intersection. Results of the model are noted in **Table 5.4** below, and PCSWMM model input and output files are included in **Appendix D.4**.

Table 5.4: Major System Spillage at Albert/Preston

Design Storm	Major System Spillage (L/s)
100-Year	372
100-Year + 20%	983

It is proposed to permit major system spillage from Albert to progress northwards through the subdivision along public ROWs, with eventual capture via a bank of surface catch basins or high-flow trench drain to a proposed storm sewer. This sewer is anticipated to be directed northwards under the Confederation Line rail corridor to connect directly to the open aqueduct complete with a sluice gate on the outgoing manhole to permit maintenance of the system and isolate the sewer from aqueduct normal water elevations. Flows to the open aqueduct in this manner are only anticipated for extreme storm events (100yr and above). See **Drawing PP-STM** for conceptual major system capture sewer details. Responsibility for funding and construction of the works, as well as timing for the outlet, are to be negotiated between the City of Ottawa and the NCC.

5.6 Conclusion

The proposed storm sewer alignment and sizing will provide the required level of service for the LeBreton Flats subdivision development and meet quantity and quality control requirements.

- On site storage within the blocks and ROWs are proposed to limit inflow from the subdivision into the existing storm sewers on Albert and Fleet Streets to the 5-year storm event based on City of Ottawa IDF curves and to a maximum runoff coefficient of 0.70.
- Major overland flow is directed to City managed rights-of-way.
- A major system overland capture point located south of the open aqueduct is proposed to manage spillage from Albert Street and approximately 21ha of external contributing area during the climate change (100yr +20%) storm event. Captured flows are to be directed to the open aqueduct. City of Ottawa and NCC to establish responsibilities for funding and construction.
- Quality control is proposed to be provided by end-of-pipe filtration MTDs for urban rights-of-way, with additional on-site quality control required for site plan blocks north of the aqueduct, and for the hotel/potential arena parcel.
- Quality control for the proposed park blocks is anticipated to be provided by on-site surface filtration through the use of bioswales, enhanced grass swales, or other infiltration measures.

6 Site Grading

The site measures approximately 21.5 ha in area and is mostly vacant, save for the two aqueducts and the existing multi-use pathways (MUPs). Per Appendix D of the LFMSS (CIMA+, March 2021) and topographic survey data, the existing terrain generally slopes from the edges of the site towards the open aqueduct and Broad Street, with portions of the NCC and City Park blocks draining to the Ottawa River.

A functional grading plan (see **Drawing GP-1**) is provided to support the stormwater management review presented in **Section 5**. The functional grading scheme verifies stormwater management calculations and allows for major system flow routes to progress along public ROWs as per City design criteria, and ultimately to the open aqueduct as per existing conditions. It provides preliminary high-point to high-point elevations in critical areas to demonstrate the proposed overall drainage patterns. The plan ties-in to existing elevations at the rail corridor and adjacent right of ways and no drainage is proposed to be directed to the adjacent private properties.

7 Utilities

Overhead (OH) hydro-wires run east-west along Albert Street and north-south along Preston Street, and significant hydro underground plant exists along Albert and Booth Street. Limited hydro plant exists along the northern boulevard of the Kichi Zibi Mikan and Wellington Street.

Within the subdivision boundaries, Hydro Ottawa duct runs along the southern limit of Block 2. Overhead electrical lines extend across the subdivision lands from the underground duct at Albert Street at Preston Street and extend to underground duct north of the covered aqueduct. A 100mm hydro duct extends from the covered aqueduct at the Inlet from the Ottawa River to Booth Street.

The detailed design of utility services will be further investigated as part of the composite utility planning process as part of the detailed design of subdivision. Existing utilities within the site boundaries may require relocation where they are not being incorporated into the detailed design.

Enbridge gas plant exists within the rights-of-way in the vicinity of the proposed site. Gas servicing is anticipated to be via the existing 300 mm diameter medium pressure system that runs along Preston and Albert Streets and via the existing 150mm line within Booth Street north of Fleet Street. The site is expected to be serviced through connections to these existing services.

Bell utilities exist near the development along Albert, Booth, and the Parkway. It is anticipated that the future development will be serviced by Bell fibre optic cables which will be extended through the subdivision.

The exact size, location, and routing of utilities is to be finalized during detailed design. Detailed design of the required utility services will be completed by the respective utility companies. Any relocation and protection of existing utilities in conflict with the proposed development will be coordinated with the individual utility providers.

8 Municipal Rights-of-Way

The widths of the proposed municipal roadways for the plan of subdivision were established to ensure that all right-of-way (ROW) infrastructure including municipal servicing, utility servicing, sidewalks, trees, streetlights and vehicular travel lanes can be accommodated while maintaining minimum offsets to adjacent infrastructure. The City standard ROW sections developed for greenfield development are not suitable for use in the urban core and do not meet the intent of the MCP.

Functional sections have been included on the Details Sheet, **Drawing DS-1** to demonstrate that the proposed ROW widths are adequate to support the required infrastructure. Alternative ROW sections will be established for the subdivision development as part of the detailed design.

9 Approvals

The City of Ottawa will review and approve the functional design report to support the Draft Plan of Subdivision application for the development and issue conditions to be satisfied prior to early servicing and/or registration of the subdivision.

At the detailed design stage, an MECP Environmental Compliance Approval (ECA) will be required for the proposed public storm and sanitary sewage and stormwater management works. Approval for the new sewage pump station is expected to require approval through direct submission to the MECP, however this will be confirmed based on the final detailed design, and potentially via the Consolidated Linear Infrastructure (CLI) ECA process.

At the subdivision construction phase, registration on the Environmental Activity Registry (EASR) or A Permit to Take Water (PTTW) may be required depending on the volume of water. Expected permitting requirements can be provided by the geotechnical engineer at the detailed design phase.

10 Erosion and Sediment Control During Construction

To protect downstream water quality and prevent sediment build-up in catch basins and storm sewers, erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the contract documents and communicated to the Contractor.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit the extent of the exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with geotextiles, geogrid, or synthetic mulches.
6. Install silt barriers/fencing around the perimeter of the site to prevent the migration of sediment offsite.
7. Install track out control mats (mud mats) at the entrance/egress as shown in **Drawing EC-1** to prevent migration of sediment into the public ROW.
8. Provide sediment traps and basins during dewatering works.
9. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
10. Schedule the construction works at times which avoid flooding due to seasonal rains.

The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

- Verification that water is not flowing under silt barriers.
- Cleaning and changing the sediment traps placed on catch basins.

Refer to **Drawing EC-1** in for the proposed location of silt fences, sediment traps, and other erosion control measures.

11 Geotechnical and Environmental Considerations

A Geotechnical Desktop Review (Stantec, May 7, 2024), Phase One Environmental Site Assessment (Stantec, August 2, 2024 and Hydrogeological Memo (Stantec, August 14, 2024) were prepared for the proposed development to support the draft plan of subdivision application. These reports form part of the submission package for the Planning Act approval.

11.1 Geotechnical Investigation

Subsurface soil conditions within the subject area were determined through field investigations from February 1992 through to June 2018. In total the site has been divided into 4 portions (North, South, West, and East) based on subsurface conditions. The soil stratigraphy for the North, South, and West portions of site are summarized as follows:

- West Portion of Site: The proposed parklands north of the Confederation Line rail corridor sits on the former Nepean Bay landfill and consists of a layer of silty sand and gravel fill, complete with various amounts of debris, including wood, brick, and plastic, with a thickness of up to 19 m. Bedrock was encountered at 3.7 m to 15.4 m depth. South of the rail corridor, the fill layer is generally 1.5 m to 4.9 m thick, and bedrock was encountered at 5.6 m to 11.0 m depth.

- North Portion of Site: Bedrock was encountered at ground surface at some borehole locations. Elsewhere, bedrock was encountered at 2.7 m to 4.8 m depth. At the multi-use pathway where Preston Street formerly extended to the Ottawa River Parkway, the bedrock is overlain by a silty sand fill and gravel. Silty sand with gravel and cobbles fill material is the cover material for the buried aqueduct.

- South Portion of Site: The fill material comprises of loose to compact silty sand and containing gravel, cobbles, boulders, and construction debris, such as brick, wood, slag, and ashes. A silty clay and clayey silt deposit was encountered under the fill layer between the former Preston Street extension and the former Broad Street right of way. Bedrock was encountered at 3.5 m to 9.2 m depth.

Groundwater levels were measured at depths between 1.1 m to 9.8 m, though seasonal variations in the water table should be expected and would need to be monitored continuously at key locations where underground infrastructures are proposed. It is expected that construction may occur below the existing groundwater table and therefore a permit to take water may be required. No grade raise restrictions were identified for the site.

11.2 Environmental Site Assessment

A Phase One Environmental Site Assessment (ESA) was conducted to determine if Areas of Potential Environmental Concern (APECs) exists on the proposed site due to current and/or past Potential

Contaminating Areas (PCAs) on the proposed site or nearby properties within 250 m of the perimeter of the site boundary.

The Phase One ESA determined the presence of APECs on the proposed site potentially impacting soil and groundwater quality, on account of the past industrial, commercial, and mixed-use residential usage of the site before the site was cleared out in the 1960s. Specifically, the proposed parks at the western end of the site north of the Confederation Line rail corridor sits in areas identified as PCAs due to it being a former landfill, with the potential contaminants the result from importation of fill material of unknown quality and the use for waste disposal and management. As such, a Phase Two ESA will be required to assess the issues before a Record of Site Condition can be submitted for the site.

11.3 Hydrogeological Review

A hydrogeological review was conducted to evaluate the hydrogeologic conditions on the site and potential for Low Impact Development (LID) infrastructure/techniques to be implemented at the site and the potential dewatering requirements.

The ability to infiltration stormwater within the development will be limited by space constraints and the shallow depth of bedrock. Capture and infiltration of groundwater is not recommended in the vicinity of building foundations due to the risk of short circuiting. Further, there is risk that infiltration systems may transport contaminants from the subsurface.

LID systems designed to promote sediment filtration, evapotranspiration, and/or capture stormwater and direct it toward a stormwater sewer that conveys the water away from buildings are recommended. Bio-swales, rain gardens, and green roofs were also identified as the preferred LID measures for the site.

12 Conclusions and Recommendations

12.1 Potable Water Servicing

The proposed watermain network and pipe sizing are capable of achieving the required level of service in the proposed development:

- During peak hour (PKHR) conditions, the proposed watermain network is expected to operate above the minimum pressure objective of 276 kPa (40 psi);
- The proposed system is capable of providing sufficient fire flow while maintaining a residual pressure of 138kPa (20 psi) in all areas.

12.2 Wastewater Servicing

The LeBreton Flats subdivision will be serviced by a network of gravity sewers which will direct wastewater flows to two different outlets. The area north of the covered aqueduct contributing to the 375 mm diameter storm sewer in Fleet Street, and ultimately to the LeBreton Flats Pumping Station. The balance of the subdivision will be serviced by the 1200 mm diameter Cave Creek Collector which runs along Albert Street.

A small pump station will be required to service the two park blocks and Block 17.

The preferred cover requirement of 2.5 m for the sanitary sewer system has been satisfied in all locations, and requirements for slope and velocities have been met within the local internal sewers. The downstream sewers have been adequately sized to receive peak sanitary discharge from the proposed subdivision.

12.3 Stormwater Management

The proposed stormwater management plan is in compliance with the goals specified in the background reports and the 2012 City of Ottawa Sewer Guidelines:

- On site storage within the blocks and ROWs are proposed to limit inflow from the subdivision into the existing storm sewers on Albert and Fleet Streets to the 5-year storm event based on City of Ottawa IDF curves and to a maximum runoff coefficient of 0.70;
- Major overland flow is directed to City managed rights-of-way;
- A major system overland capture point located south of the open aqueduct is proposed to manage spillage from Albert Street and approximately 21ha of external contributing area during the climate change (100yr +20%) storm event. Captured flows are to be directed to the open aqueduct. City of Ottawa and NCC to establish responsibilities for funding and construction.

- Quality control is proposed to be provided by end-of-pipe filtration MTDs for urban rights-of-way, with additional on-site quality control required for site plan blocks north of the aqueduct, and for the hotel/potential arena parcel.
- Quality control for the proposed park blocks is anticipated to be provided by on-site surface filtration through the use of bioswales, enhanced grass swales, or other infiltration measures.

12.4 Utilities

Utility infrastructure is available on the surrounding municipal roadways and will be extended to service the subdivision. Designs will be prepared by each of the respective utilities at the detailed design stage.

12.5 Municipal Right's of Way

Alternative ROW cross sections will be used for this urban development to meet the intent of the MCP. Municipal ROW widths proposed are sufficient to accommodate all infrastructure needs. The alternative ROW sections will be established at detailed design.

12.6 Grading

The functional grading scheme has been developed to allow for an emergency overland flow outlet to downstream rights-of-way as per City standards, and ultimately to the open aqueduct as per existing conditions.

12.7 Approvals/Permits

At the detailed design stage, an MECP Environmental Compliance Approval (ECA) will be required for the proposed public storm sewage and stormwater management works. Approval for the new sewage pump station is expected to require approval through direct submission to the MECP, however this will be confirmed based on the final detailed design. The ECA for sanitary sewer works is anticipated to be required through the CLI ECA process.

At the subdivision construction phase, registration on the Environmental Activity Registry (EASR) or A Permit to Take Water (PTTW) may be required depending on the volume of water. Expected permitting requirements can be provided by the geotechnical engineer at the detailed design phase.

APPENDICES

Appendix A Background

A.1 Draft Plan and Densities

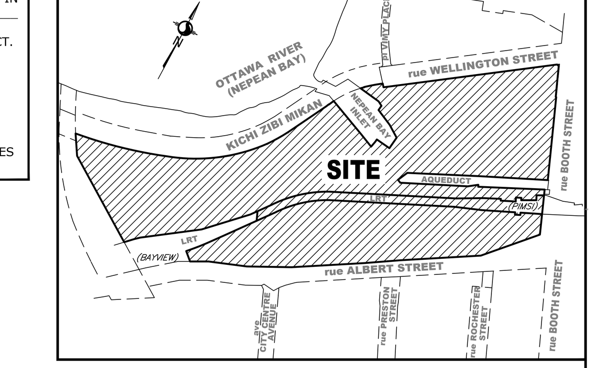
SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED ______________________20____
THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT.
THIS____DAY OF_____________,20___.

____

ANDREW MCCREIGHT, MCIP, RPP, MANAGER
DEVELOPMENT REVIEW-CENTRAL
PLANNING, DEVELOPMENT AND BUILDING SERVICES
DEPARTMENT, CITY OF OTTAWA

KEY PLAN

(NOT TO SCALE)



DRAFT PLAN OF SUBDIVISION OF

PART OF LOTS 38, 39 AND 40
CONCESSION A (OTTAWA FRONT)
PART OF THE BED OF THE OTTAWA RIVER
IN FRONT OF LOT 38 & LOT 39,
CONCESSION A (OTTAWA FRONT)
PART OF DUCK ISLAND
IN FRONT OF LOT 38,
CONCESSION A (OTTAWA FRONT)
PART OF PRESTON STREET
(CLOSED BY BY-LAW OC1899021)
(GEOGRAPHIC TOWNSHIP OF NEPEAN)
PART OF BLOCKS A, B & C
PART OF MILL STREET
(CLOSED BY BY-LAW CR588682)
PART ENGINE HOUSE AREA
REGISTERED PLAN 60
LOTS 1 & 2 AND PART OF LOTS 3, 4 & 5
IN BLOCK E
PART OF LOTS 1, 2 & 3
IN BLOCK F
LOTS 2 TO 12 (BOTH INCLUSIVE)
IN BLOCK G
LOTS 2, 4, 6, 8, 10 & 11 AND PART OF LOTS 3, 5, 7, 9 & 12
IN BLOCK H
LOT 4 AND PART OF LOTS 1, 2 & 3
IN BLOCK S
LOTS 1 & 4 AND PART OF LOTS 2 & 3
IN BLOCK T
PART OF THE LANE AT REAR OF BLOCK S
(CLOSED BY BY-LAW LT1243121)
THE LANE AT REAR OF BLOCK T
(CLOSED BY BY-LAW LT1243121)
PART OF BROAD STREET
(CLOSED BY BY-LAW LT1243127)
PART OF BROAD STREET
(CLOSED BY BY-LAW LT1243121)
PART OF FLEET STREET
(FORMERLY QUEEN STREET)
(CLOSED BY BY-LAW LT1243127)
PART OF OTTAWA STREET
(CLOSED BY BY-LAW LT1243127)
PART OF SHERWOOD STREET
(CLOSED BY BY-LAW LT1243127)
PART OF SHERWOOD STREET
(CLOSED BY BY-LAWS CR280019)
REGISTERED PLAN 2
LOTS A, B, C & D
REGISTERED PLAN 31129
CITY OF OTTAWA

Scale 1:1000

20 0 20 40 60 METRES

METRIC CONVERSION

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

STRATA NOTE:

THIS PLAN IS STRATIFIED TO SHOW NCC AIR RIGHTS ON BLOCK 20.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51 OF THE PLANNING ACT.

(A)-AS SHOWN ON DRAFT PLAN
(B)-AS SHOWN ON DRAFT PLAN
(C)-AS SHOWN ON DRAFT AND KEY PLANS
(D)-
(E)-AS SHOWN ON DRAFT PLAN
(F)-AS SHOWN ON DRAFT PLAN
(G)-AS SHOWN ON DRAFT PLAN
(H)-
(I)-
(J)-AS SHOWN ON DRAFT PLAN
(K)-
(L)-AS SHOWN ON DRAFT PLAN

LAND USE

NUMBER OF RESIDENTIAL BLOCKS: 6
NUMBER OF COMMERCIAL OR MIXED-USE BLOCKS: 11
NUMBER OF LANES: 7
NUMBER OF PUBLIC ROADS: 6
NUMBER OF PARKS: 2

AREA OF DEVELOPMENT BLOCKS (1-17) =	9.506 Ha
AREA OF PARKS (BLOCKS 18-19)=	9.315 Ha
AREA OF LANES =	0.668 Ha
AREA OF PUBLIC ROADS =	1.995 Ha
TOTAL AREA OF SUBDIVISION =	21.484 Ha

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE STANTEC GEOMATICS LTD. TO SUBMIT THIS DRAFT PLAN OF SUBDIVISION ON MY BEHALF

______________ DATE

____
-
-
I HAVE THE AUTHORITY TO BIND THE CORPORATION

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE SUBJECT LANDS AND THEIR RELATIONSHIP TO ADJOINING LANDS HAVE BEEN ACCURATELY AND CORRECTLY SHOWN.

______________ DATE

____
FRANCIS LAU
ONTARIO LAND SURVEYOR

Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
1331 CLYDE AVENUE, SUITE 300
OTTAWA, ONTARIO, K2C 3G4
TEL. 613.722.4420
stantec.com

DRAWN: ME	CHECKED: *	DATE: August 28, 2024	PROJECT No.: 160401780-112

SUBDIVISION: PROPOSED LAND USES AND DENSITIES

MCP Block	MCP Block Area (m2)	Subdivision Block	Subdivision Block Area	Land Use	Floor Area (m2)	Dwelling Units Apartment	Dwelling Units Townhouse	Population	Number of Buildings	Building Storeys
A1	5,095	1	9,030	Residential	59,213	592	-	1,066		
				Commercial	1,389					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**60,602**				2	30,40
A2 to 4	25,055	2	27,146	Residential	60,750	608	-	1,094		
				Commercial	2,370					
				Office (/ loft)	-					
				Hotel (201 rooms)	9,450					
				Total Floor Area	**72,570**				4	20,20,20,30
A5	4,454	3	4,984	Residential	27,861	267	10	508		
				Commercial	838					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**28,699**				1	20
A6	4,428	4	3,995	Residential	35,914	348	10	653		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**35,914**				1	30
A7	5,569	5	3,967	Residential	20,250	203	-	365		
				Commercial	2,035					
				Office (/ loft)	13,391					
				Hotel	-					
				Total Floor Area	**35,676**				1	30
A8	3,306	6	3,073	Residential	27,000	270	-	486		
				Commercial	2,811					
				Office (/ loft)	10,922					
				Hotel	-					
				Total Floor Area	**40,733**				1	40
F1	4,563	7	4,412	Residential	16,781	81	74	346		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**16,781**				1	12
F2	3,536	8	3,410	Residential	20,059	135	56	394		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**20,059**				1	20
F3	4,583	9	4,405	Residential	22,422	135	76	448		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**22,422**				1	20
F4	2,706	10	2,390	Residential	18,899	135	46	367		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**18,899**				1	20
F12	3,772	11	2,830	Residential	26,811	268	-	482		
				Commercial	1,792					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**28,603**				1	30
F8	3,086	12	2,533	Residential	22,067	221	-	398		
				Commercial	884					
				Office (/ loft)	-					
				Hotel	4,896					
				Total Floor Area	**27,847**				1	20
F9	3,617	13	2,730	Residential	23,229	216	14	427		
				Commercial	514					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**23,743**				1	20
F10	3,721	14	2,995	Residential	30,476	288	14	556		
				Commercial	546					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**31,021**				1	30
F11	4,365	15	3,317	Residential	38,130	381	-	686		
				Commercial	2,860					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**40,990**				1	40
Buried Aqueduct	Unknown	16	4,756	Residential	-	-	-	-		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**-**				-	-
AD2-5	7,340	17	8,908	Residential	-	-	-	-		
				Commercial	3,717					
				Office (/ loft)	22,950					
				Hotel	-					
				Total Floor Area	**26,667**				1	5
Park (federal)	Unknown	18	68,398	Residential	-	-	-	-		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**-**				-	-
Park (city)	Unknown	19	24,756	Residential	-	-	-	-		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**-**				-	-

TOTALS (Blocks 1-19)			
Res. Units (apt. / towns / total)	4,148	300	4,448
Res. Pop. (apt. / towns / total)	7,466	810	8,276
Res. Floor Area (m2)			449,861
Comm. Floor Area (m2)			19,756
Office (/ loft) Floor Area (m2)			47,263
Hotel Floor Area (m2)			14,346
Total Floor Area (m2)			531,226
MCP Block Area (m2)			89,195
Subdivision Block Area (m2)			188,034

Population	person/DU
Apartment pop.	1.8
Townhouse pop.	2.7

MCP BLOCKS EXCLUDED FROM SUBDIVISON BUT RELEVANT FOR SERVICING AND TRANSPO

MCP Block	MCP Block Area (m2)	Subdivision Block	Subdivision Block Area	Land Use	Floor Area (m2)	Dwelling Units Apartment	Dwelling Units Townhouse	Population	Number of Buildings	Building Storeys
A9	4,357	NA	NA	Residential	22,824	228	-	410		
				Commercial	960					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**23,784**				1	25
A10	4,357	NA	NA	Residential	24,356	244	-	439		
				Commercial	1,368					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**25,724**				1	25
A10B	2,930	NA	NA	Residential	20,775	208	-	374		
				Commercial	521					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**21,295**				1	25
A11	4,575	NA	NA	Residential	31,410	314	-	565		
				Commercial	1,046					
				Office (/ loft)	-					
				Hotel	-					
				High School	1,645					
				Total Floor Area	**32,455**				1	20
A12	3,349	NA	NA	Residential	19,499	195	-	351		
				Commercial	600					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**20,098**				1	20
F5	3,312	NA	NA	Residential	19,125	191	-	344		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**19,125**				1	20
F6	2,777	NA	NA	Residential	18,395	184	-	331		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**18,395**				-	-
F7	2,173	NA	NA	Residential	5,518	55	-	99		
				Commercial	-					
				Office (/ loft)	-					
				Hotel	-					
				Total Floor Area	**5,518**				1	20

TOTALS (Blocks 1-19 + excluded NCC land)			
Res. Units (apt. / towns / total)	5,767	300	6,067
Res. Pop. (apt. / towns / total)	10,380	810	11,190
Res. Floor Area (m2)			611,762
Comm. Floor Area (m2)			24,250
Office (/ loft) Floor Area (m2)			47,263
Hotel Floor Area (m2)			14,346
High School Floor Area (m2)			1,645
Total Floor Area (m2)			699,266
MCP Block Area (m2)			117,024

A.2 Background Report Excerpts

Building LeBreton

Master Servicing Report

Renewed Master Concept Plan & Development Strategy

CIMA+ file number: A000958
March 5th, 2021

Major Event Centre demands were based on the values provided in the Parsons Servicing Vision 2019, which is based on flow monitoring of an arena. The value obtained of 110 L/seat/d corresponds to the OBC value (20 L/d) (Ontario Building Code, 2017) multiplied by a factor of 5.5. Commercial peaking factors were assumed for this demand.

A breakdown of the resulting estimated potable water demands for each phase is presented in Table 4.2. The water demand calculation sheet supporting these values is included in Appendix E.

Table 4.2 : LeBreton Water Demands

Concept Dev. Block	Residential Population (persons)	Gross Floor Area (m^2)			Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
		Commercial/ Institutional	Office/ Loft	Hotel			
Block 1	726	3 063	19 307	-	4.84	10.20	21.31
Block 2	512	1 559	-	11 246	2.76	6.21	13.25
Block 3	1 834	5 169	27 000	-	10.12	22.61	48.12
Block 4	-	3 717	24 098	-	2.37	3.55	6.40
Block 5	3 114	3 921	-	7 956	13.19	32.40	70.93
Block 6	1 716	2 687	-	-	28.68	71.62	135.86
Block 7	571	-	-	-	2.31	5.78	12.72
LeBreton Place	-	2722			0.09	0.13	0.24
Parks	-	-	-	-	0.42	0.85	1.87
Total	**8 473**	**22 838**	**70 405**	**19 202**	**64.78**	**153.35**	**310.70**

4.2.2 Fire Protection

Given the design is at a conceptual stage with limited available building information, it would not be appropriate to develop fire flows in accordance with the FUS and City requirements at this time. For a preliminary analysis and determination of boundary conditions, a fire flow demand of 217 L/s (13 000 L/min) was considered per the maximum fire demand level of service in core areas as stipulated in the 2013 City of Ottawa Water Master Plan (Stantec, 2013).

4.2.3 Proposed Connections

The proposed LeBreton Flats water servicing configuration utilizes the connection points proposed in the *LeBreton Flats Servicing Vision* (Parsons, 2019) and the *Servicing and Stormwater Management Report 557-584 Wellington Street & 550 Albert Street* (Stantec, 2017). Table 4.3 summarises the proposed primary and secondary connection points while the water servicing plan provided in Appendix A demonstrates the proposed water servicing layout.

For each individual building, multiple connections will be required if the average day demand is over 50 m^3/d, as per the requirements of the City of Ottawa Water Design Guidelines.

The 2019 Parsons report also highlighted a need for pressure reducing valves at each building. The updated boundary conditions may also highlight this requirement, which will need to be confirmed at detailed design.

Table 4.3 : LeBreton Proposed Watermain Connection Points

Concept Dev. Phase	Primary Connection	Size*	Secondary Connection	Size*
Block 1	Albert St.	406mm PVC	Albert St.	406mm PVC
Block 2	Albert St.	406mm PVC	Albert St.	406mm PVC
Block 3	Preston Street North of Albert	406mm DR 18 PVC	Albert St. near Rochester St.	406mm PVC
Block 4	Preston Street North of Albert	406mm DR 18 PVC	Albert St. near Rochester St.	406mm PVC
Block 5	Wellington St. and Preston St.	305mm Class 52 DI (+300mm PVC and Stubs)	Booth St. and Fleet St.	406 mm booth st. / 305mm Fleet street PVC
Block 6	Albert St. and City Centre Ave.	406mm DR 18 PVC	Preston Street North of Albert	406mm DR 18 PVC
Block 7	Wellington St. and Preston St.	305mm Class 52 DI (+300mm PVC and Stubs)	Booth St. and Fleet St.	406 mm booth st. / 305mm Fleet street PVC
LeBreton Place	Connected to Block 4 Network	-	-	-
Parks	Connected to LeBreton Place Network	-	-	-

**Based on a review of as-built drawings available to CIMA+ at the time of publication of this report*

4.2.4 Watermain Boundary Conditions

The following boundary condition was obtained from the City of Ottawa on March 16th, 2020, using a fire flow of 217 L/s at each connection. The connection points used are shown in Appendix A. Based on the boundary conditions, and the proposed site grading, the resulting pressure at the connection points ranges approximately from 59 to 89 psi. To satisfy the City of Ottawa hydraulic objectives and Ontario Building Code requirements, pressure-reducing valves will be required at the building connections where the watermain pressure exceeds 80 psi, as per the City of Ottawa Water Design Guidelines.

Table 4.4 : LeBreton Proposed Watermain Connection Points

Concept Dev. Phase	Connection points	Min. HGL (m)	Max HGL (m)	Max Day + Fire Flow (m)
Block 1	Connection 1A,1B	107.0	116.5	109.0
Block 2	Connection 2A, 2B*	107.0	116.5	109.0
Block 3	Connection 3A, 3B	107.0	116.0	109.0
Block 4, Block 5, LeBreton Place, Parks	Connection 5A	107.0	116.5	97.0
	Connection 5B	107.0	116.5	107.0
Block 6	Connection 6A, 6B	107.0	116.0	109.0
Block 7	Connection 7A	107.0	116.5	107.0
	Connection 7B, 7C	107.0	116.5	108.0

**Assuming a connection to a future 406mm diameter watermain on Albert St.*

4.3 Conclusions and Recommendations – Water Servicing

Water Servicing for the LeBreton Flats development is feasible and meets the City of Ottawa hydraulic objectives provided that connection 2B connects to a future 406mm dia. watermain. However, it should be noted that actual fire protection requirements may dictate otherwise.

Actual fire flow demands will need to be assessed and fire scenarios analysed as part of the detailed design. It should also be noted that there may be difficulty in achieving FUS fire flow requirements depending on construction type, gross floor area and percent of unprotected openings. The final design will need to meet the available fire flow with capacity of the existing network or provide additional measures to meet the requirements of the Fire Marshall and appropriate governing bodies.

5.1.1 Capacity analysis for existing outfall infrastructure

A review of the available information on the principal sanitary infrastructure was undertaken to assess the available capacity in each outlet. Table 5.1 summarises estimated capacities, per the principal outlet and its components.

Table 5.1 : Summary of outlet-specific sanitary flow allocations and estimated capacity, including external contributions

Outlets	Element	Estimated Capacity (L/s)	Source
LFPS	Fleet St. Sewer	117.6	Dessau-Soprin, 2004; Novatech 2017
	Pumping station (Current Capacity)	100	ECA - MOE 2010
	Flowrate until overflow to Storm	140	City of Ottawa 2018
Albert St. Sewer	Sewer + ICD	233	City of Ottawa 2020
	Design Sanitary Flow	110	Robinson 2015
CCC	-	Capacity not limited	Parsons, 2019; City of Ottawa, 2018

5.1.1.1 Fleet street gravity sewer, LFPS and IOS

The Fleet street sanitary sewer conveys sewage to the LFPS, and its capacity was estimated at 117.6 L/s in the 2004 LeBreton Master Servicing Report (Dessau-Soprin, 2004). In discussions with the City, the City has indicated that it could be acceptable for this sewer to surcharge in order to accommodate the required flow, provided acceptable justification and analysis.

The LFPS itself has a current firm rated at a capacity of 100L/s, as indicated in its associated Environmental Compliance Approval No. 8494-84GSRF (MOE, 2010), and in the LFPS Design Brief (Stantec 2006, 2008).

As referred to in the LeBreton Flats Servicing Vision (Parsons, 2019), the City of Ottawa's analysis demonstrated additional capacity of 130 L/s in the downstream pipe connecting the effluent of the LFPS to the IOS (Tousignant, 2018).

5.1.1.2 Albert St. Sanitary Sewer

The Albert St. Sanitary sewer is the planned outlet for the Chaudière and Albert Island developments as well as the outlet of a 600mm combined sewer. The outlet of the combined sewer contains an inlet control device (ICD) to control the flow going into the sanitary sewer. It also has a 450mm overflow pipe that discharges to the 900mm storm sewer when the flow exceeds the ICD's capacity. Design sanitary capacity for this outlet were determined at 110.68 L/s (Robinson, 2015). However, it should be noted that this structure is part of the combined sewer system and that sanitary flows directed to this outlet impact the return period of combined sewer overflow at this location (Tousignant, 2020).

Table 5.8 : LeBreton Flats Pumping Station proposed redistribution of unallocated flows

Outlet	Concept Dev. Phase	Sanitary Flow Allocation (L/s)	Distributed Remaining Capacity (L/s)	Total Sanitary Allocation (L/s)
LFPS	**Block 5**	**32.43**	**8.52 (60.14%)**	**40.95**
	Block 7	**6.60**	**1.73 (12.24%)**	**8.33**
	Victoria Island	20.0[1]		20.0
	Future Cultural/ Institutional	**1.52**	**0.40 (2.82%)**	**1.92**
	Canadian War Museum	3.18[1]		3.18
	Claridge ph. I-III	8.73[1,2]		8.73
	Claridge ph.IV-V	**13.37**[2]	**3.51 (24.80%)**	**16.88**
	Subtotal	85.83	14.17 (100%)	100.00

Note: Values in bold denote proposed developments

[1] Values Previously Approved by the City of Ottawa, based on the Dessau-Soprin Servicing Report

[2] Novatech 2020 – RE: Phase 1 LeBreton Flats – Revised Building Statistics & City of Ottawa Comments (May 12th 2020); Flow split confirmed by NCC.

5.4.4.2 Albert St. Sanitary Sewer

For the Albert Street Sewer, the capacity of the sewers and ICD is sufficient to accommodate both the Windmill Developments Phase 1 (noted as Chaudiere and Albert Isl.) and the LeBreton Developments Block 1 and 2 flows (Stantec, 2017; Robinson Consultants, 2015).

5.4.4.3 Cave Creek Collector

As mentioned previously in Section 5.1.1.3, the City of Ottawa has indicated that there is likely no capacity limitation for this collector but has requested to be provided with the proposed design flows to this collector in order to update their models.

Table 5.9 : Albert Street Sewer and the Cave Creek Collector proposed sanitary flow allocations vs. estimated capacity.

Outlet	Concept Dev. Phase	Sanitary Allocation (L/s)		Total Sanitary Allocation (L/s)	Current Estimated Capacity (L/s)	
Albert St. Sewer	**Block 1**	**9.29**	**17.18**	75.08	110	Capacity OK
	Block 2	**7.89**				
	Ottawa Central Library	4.3[2]				
	Chaudière and Albert Isl.	53.6[3]				
CCC	**Block 3**	**20.85**		**66.99**	Capacity not limited	Capacity OK
	Block 4	**2.34**				
	Block 6	**40.26**				
	LeBreton Place	**0.29**				
	Park Area	**3.25**				

Note: Values in bold denote proposed developments

[1] Values Previously Approved by the City of Ottawa, based on the Dessau-Soprin Servicing Report

[2] Stantec 2017 – Servicing and Stormwater Mangement Report 557-584 Wellington Street & 550 Albert Street (September 11, 2017)

[3] DSEL. 2018. – Master Servicing Study (Phase 1) – Revision 7. Ottawa

6.1.6 Overland Flow

An emergency overland flow route from an offsite area of approximately 20ha extending south of Albert Street, drains through the LeBreton Flats land and discharges to the open aqueduct. The low point of the flow route is located at the intersection of Preston and Albert Street before it enters the LeBreton Flats lands (Figure 6.2).

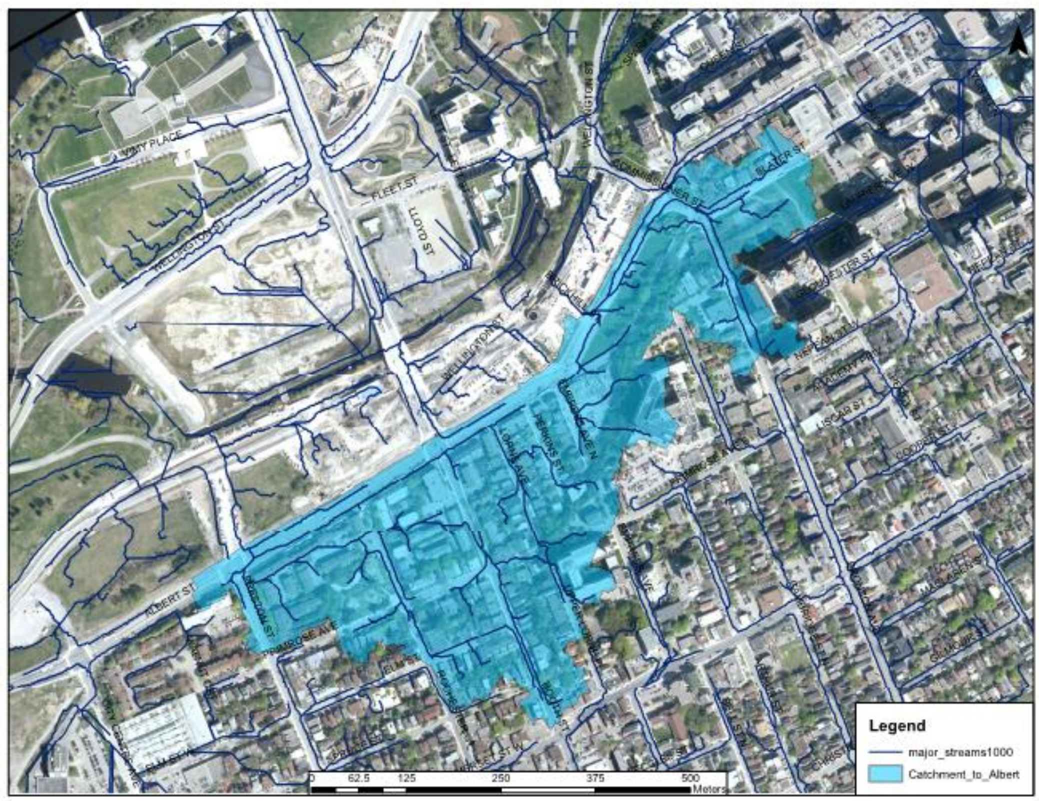


Figure 6.2 : Drainage Area South of Albert Street

6.2 Summary of Available Background Documentation

CIMA+ has completed a thorough review of available documentation for the proposed LeBreton Flats Development Area and external lands. The following is a summary of the pertinent information available concerning the evolution of the SWM strategy for this area:

6.2.1 Dessau-Soprin LeBreton Flats Infrastructure and Remediation Project – Master Servicing Report (2004)

In 2002, the National Capital Commission hired Dessau-Soprin to complete a master servicing study of for the LeBreton Flats development area. The recommendations included the construction of three stormwater management facilities:

- A wet pond to the northwest of Wellington Street and Preston Street discharging to the Ottawa River
- A wet pond in the northeast corner (adjacent to Mill Street Restaurant) discharging to the Ottawa River

6.3.1 Quantity Control

Quantity control for the LeBreton Flats Development Area is not required given the proximity to the Ottawa River.

As discussed with the City, the minor system will be designed to convey the 5-year post event with a run-off coefficient of 0.7 and quantity control will be required for the individual blocks up to and including the 100-year event.

The allowable release rate for Block 1 and 2 will be limited to the 5-year pre-development flow as per Stantec Servicing and Stormwater Management Report, with quantity control on site up to and including the 100-year event.

The major system must provide an appropriate outlet for overland flows meeting the City of Ottawa flow depth requirements.

6.3.2 Quality Control

As per the Stantec *LeBreton Flats Stormwater Management Feasibility Options* (Stantec, 2002) (Appendix J, appended to the Dessau-Soprin Report), the following quality control requirements are in place for the LeBreton Flats site.

Fish habitat designation:

+ Type 1 in the Fleet Street Pumping Station Tailrace requiring 80% removal of Total Suspended Solids.
+ Type 2 in the Ottawa River requiring 70% removal of Total Suspended Solids.

These requirements are based on fish habitat protection in accordance with the Federal Fisheries Act.

Quality control of 80% TSS removal is to be met through the installation of several mechanical separators (Oil and Grit) in combination with other source control elements, using a treatment train approach. The use of Oil and Grit separators in conjunction with low impact development source control measures for quality control corresponds with the findings and recommendations of previous studies.

Low-impact development measures seek to mitigate the impacts of increased runoff and stormwater pollution by managing and reducing runoff. The LID strategies mimic natural or predevelopment hydrology through the process of infiltration, evapotranspiration, harvesting, filtration and detention of stormwater. These practices can effectively remove nutrients, pathogens and metals from runoff and reduce the volume and intensity of stormwater flows. Based on the current site plan, the preferred LID measures for the LeBreton Flats Development area should include bio-swales, rain gardens and green roofs.

The option of using a wet pond to treat the water quality of the site was considered but abandoned given several concerns relating to submerged outlets and surcharges conditions, fluctuating river water level, environmental issues and approvals, as well as significant fill requirements.

6.3.3 Sewer Design Constraint and Considerations

The use of inlet control devices on stormwater structures must be implemented on-site to ensure that only the 5-year event enters the minor system to ensure allowable flows to the municipal networks are not exceeded during major storm events.

Figure 6.15 : Block 7 Storm Servicing

6.4.15 Albert Street Overland Flow

As indicated in section 6.1.5, 20ha of land south of Albert Street has an overland flow route that crosses the LeBreton Flats land and discharges to the open aqueduct. The portion of land between the LRT and Albert street at the Preston intersection has a grade difference of approximately 3.3m. The proposed LeBreton Flats grading will generally follow the existing topography of the land and will keep the overland flow towards the open Aqueduct. (Figure 6.16)

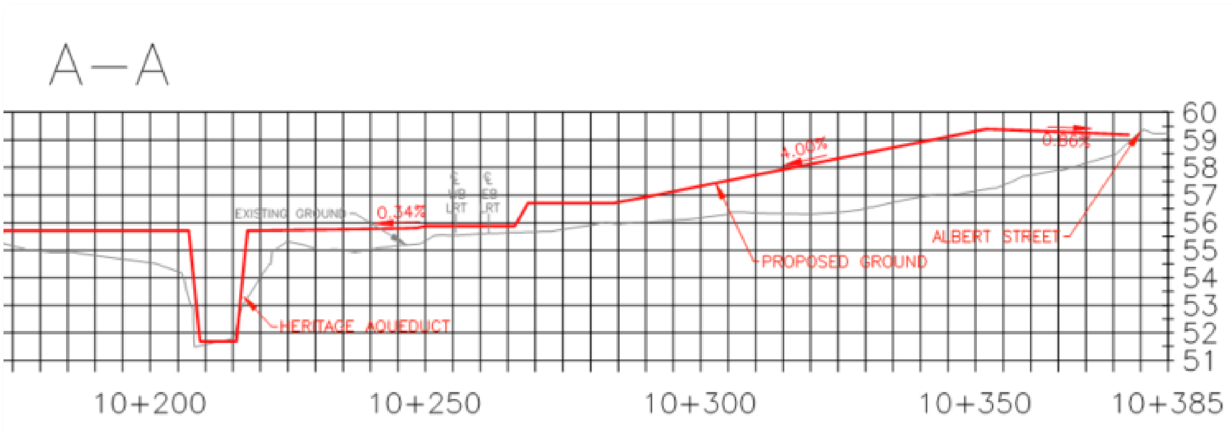


Figure 6.16 : Overland Flow – Section A–A

The existing overland flow currently flows over the LRT track which was opened in 2019. With an increased runoff coefficient, it is expected that the overflow would cross the LRT track at greater velocities and possibly damage the track. In order to mitigate the damaging of the LRT, a box culvert is proposed before the LRT crossing to capture the overland flow and direct it towards the open Aqueduct. This would require approximately 52m of box culvert and would need to be bored beneath the LRT track.

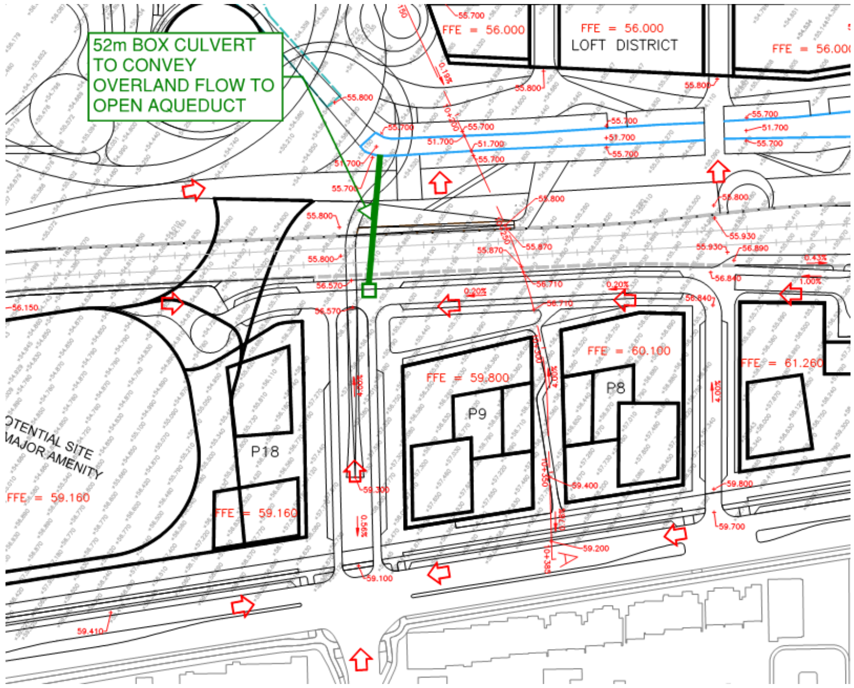
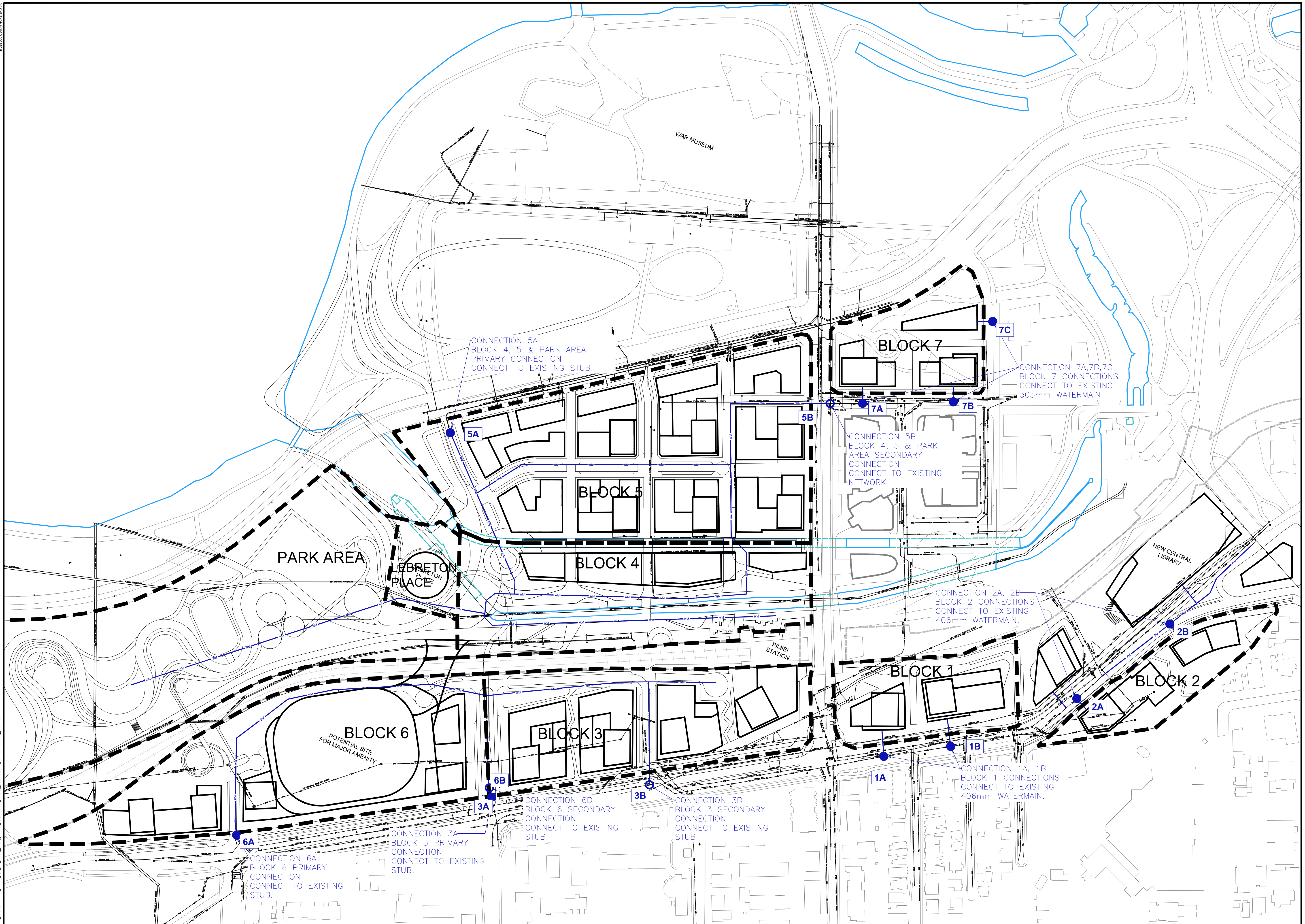


Figure 6.17 : Overland Flow to Box Culvert Under OLRT Track

A detailed analysis of the flow generated from the overland route will be required to size the box culvert. Further discussion with the city will also be required.

6.5 Conclusions and Recommendations – Storm Servicing

In conclusion, the discharging of storm water flow into the city's municipal network and Open Aqueduct will be feasible. Quality requirements are expected to be achieved using a combination of Oil and Grit separators and LID methods.



No.	Date	Description	By
2	20/04/03	PRELIMINARY DRAFT REPORT REV-2	-
1	20/03/13	PRELIMINARY DRAFT REPORT	-

ENGINEER: CIMA+

DISCIPLINE: CIVIL

CLIENT: CLIENT_NAME

PROJECT NAME: LE BRETON MASTER CONCEPT

SHEET TITLE: WATERMAIN SERVICING

DRAFTER: S.C POGGIOLI	SCALE: 1:1000
DESIGNER: J.SAUVÉ	DATE: 2020/02/07
APPROVER: C.L.LEBEL	APPROVER: C.L.LEBEL
PROJECT No: A000958	DRAWING No: 1
SHEET No: 1 of 1	

1	20/03/13	PRELIMINARY DRAFT REPORT	-
No.	Date	Description	By

ENGINEER: CIMA+

DISCIPLINE: CIVIL

CLIENT: NCC / O2

PROJECT NAME: LE BRETON MASTER CONCEPT

SHEET TITLE: SANITARY SERVICING

DRAFTER: S.C POGGIOLI

SCALE: 1:1000

DESIGNER: J.SAUVÉ

DATE: 2020/02/07

APPROVER: C.L.LEBEL

APPROVER: C.L.LEBEL

PROJECT No: A000958

SHEET No: 1 of 1

DRAWING No: 1

No.	Date	Description	By
2	20/04/03	PRELIMINARY DRAFT REPORT REV-2	-
1	20/03/13	PRELIMINARY DRAFT REPORT	-

DESIGNED BY

APPROVED BY

ENGINEER: CIMA+

DISCIPLINE: CIVIL

CLIENT: NCC / O2

PROJECT NAME: LE BRETON MASTER CONCEPT

SHEET TITLE: STORM SERVICING

DRAFTER: S.C POGGIOLI

SCALE: 1:1000

DESIGNER: J.SAUVÉ

DATE: 2020/02/07

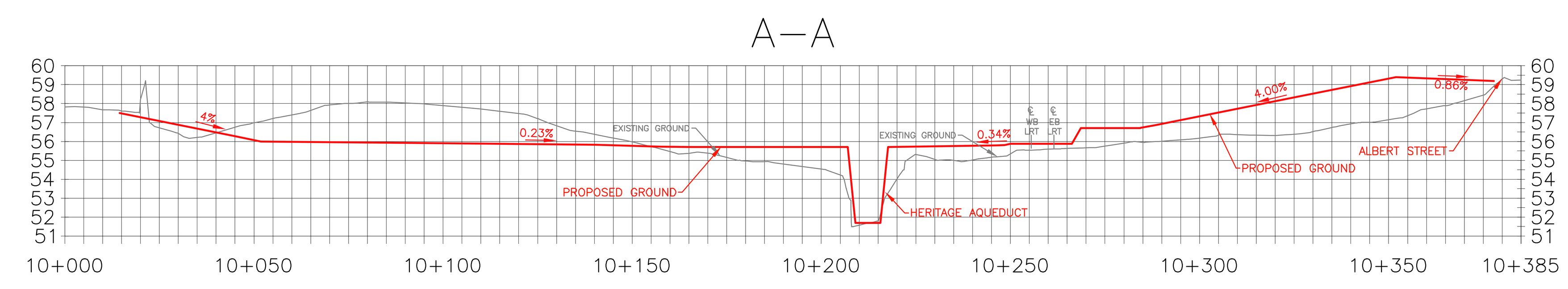
APPROVER: C.L.LEBEL

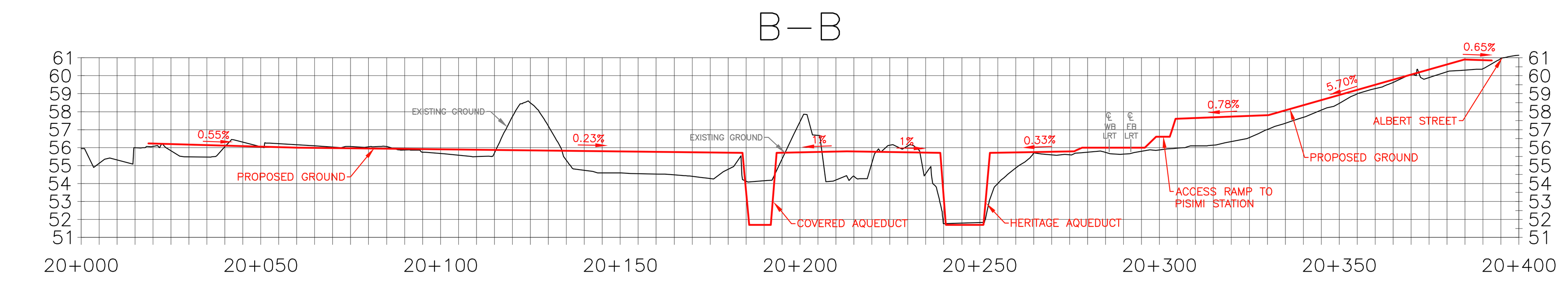
APPROVER: C.L.LEBEL

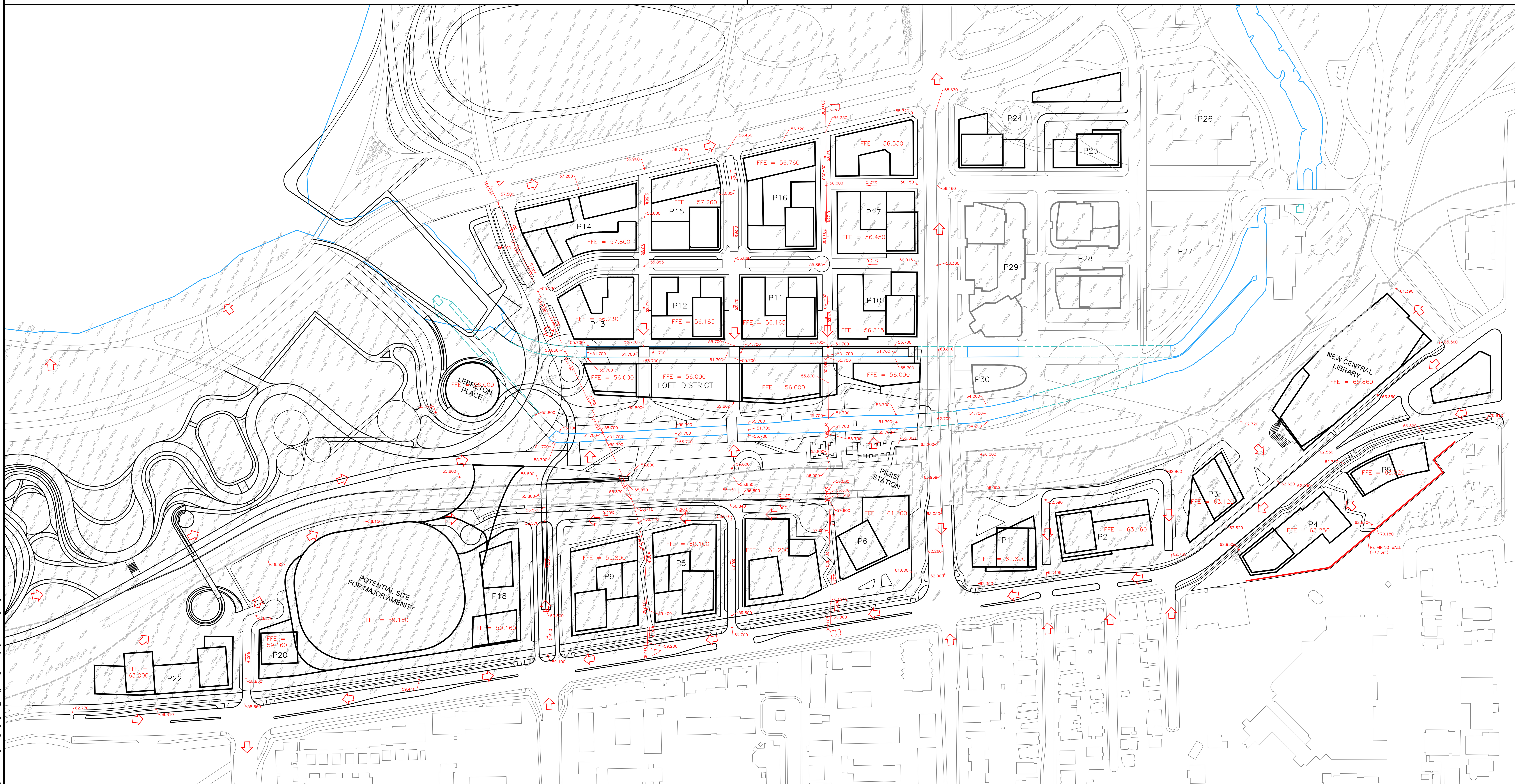
PROJECT No: A000958

DRAWING No: 1

SHEET No: 1 of 1







STAMPS:					ENGINEER:	CLIENT: NCC / O2	DRAFTER: S.C POGGIOLI	SCALE: 1:1000
	3	20/04/03	PRELIMINARY GRADING REV-2	-	CIMA+	PROJECT NAME: LE BRETON MASTER CONCEPT	DESIGNER: J.SAUVÉ	DATE: 2020/02/07
	2	20/03/20	PRELIMINARY GRADING	-		SHEET TITLE: GRADING - MASTER PLAN	APPROVER: C.L.LEBEL	APPROVER: C.L.LEBEL
DESIGNED BY / APPROVED BY	1	20/03/13	PRELIMINARY GRADING	-	DISCIPLINE: CIVIL		PROJECT No: A000958	DRAWING No: 1
	No.	Date	Description	By			SHEET No: 1 of 3	

R-0813

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National Capital Commission
Commission de la Capitale nationale

Canada

LeBreton Flats Infrastructure and Remediation Project

Project N°: SC436

Master Servicing Report

Final Report (5th Revision)

O/File: 480000-100-Hy-07

Dessau Soprin

LeBreton Flats Infrastructure and Remediation Project

Master Servicing Report

FINAL REPORT (5th Revision)

REVIEWED BY
INFRASTRUCTURE APPROVALS
SIGNED
DATE March 4, 2004

February 2004

Y/Ref.: SC-436
O/Ref.: 480000-100-Hy-07

DESSAU
SOPRIN

LeBreton Flats Infrastructure and Remediation Project

MASTER SERVICING REPORT

FINAL REPORT (5th Revision)

February 2004

Prepared by : Dominique Deveau, P.Eng., M.Eng.

Approved by : Daniel Lépine, Eng.

RECORD OF REVISIONS AND EMISSIONS		
REVISION #	DATE	DESCRIPTION OF THE MODIFICATION AND / OR OF THE EMISSION
05	05/16/2003	For Approval
06	10/11/2003	Final
07	13/02/2004	Final

Dessau-Soprin inc.
885 de la Carrière Blvd., suite 110
Hull (Quebec) Canada J8Y 6S6
Telephone : (819) 770-6832
Fax : (819) 777-3689
E-mail : laval@dessausoprin.com
Web Site : www.dessausoprin.com

Y/Ref. : SC-436
O/Ref. : 480000-100-Hy-07

From:	Montgomery, Paul
To:	O"Connell, Erin; Smadella, Karin
Cc:	Mottalib, Abdul; Thiffault, Dustin
Subject:	Re: Lebreton Flats Draft Plan of Subdivision - Engineering Discussion
Date:	Tuesday, November 14, 2023 7:55:22 PM
Attachments:	image001.gif image002.png

Hello Karen; all is well and I hope the same for you and yours.

Below is what information I have regarding water elevations, in and around the two Fleet Street aqueducts:

The **open aqueduct** is largely connected, together with the **covered aqueduct**, with and at the forebay of the Fleet Street Pumping Station. With little usual flow through the **open aqueduct**, I would guess that its usual water elevation would be fairly level along its length and would follow the usual operating level of the forebay; currently between 51.82m and 52.03m (per Record Drawings: ISB05-3013, Sheet 1, Delcan). Peak and surge operating levels, in the forebay, can be higher and sometimes spill over the forebay's stoplog weir. I don't have a precise elevation of this weir but, from previous visual observations, I would roughly estimate its current crest elevation to be ~52.2m.

The hydraulic grade line along the length of the **covered aqueduct** is much steeper and will, of course, vary with flow rate. Usual and optimal flow rates through the **covered aqueduct** were estimated to be between 25 to 35m3/s (Fleet Street Pumping Station Hydraulic Capacity Study, October 1998, Delcan).

For the **open aqueduct**, Water Production has no records of upstream water elevations, estimated or observed, for or during storm events. It is worth noting that there is a small diameter (~200mm?) pipe connection, at the upper end of the **open aqueduct**, which flows water from the river and from just above the headworks facility, to maintain some flow through. This small pipe connection, along with any other seepage, piped or overland flows entering into the **open aqueduct**, would steepen its operating hydraulic grade line somewhat but, to what degree, I cannot precisely say.

For the **covered aqueduct**, data taken from personal survey notes on April 30, 2019, recorded the peak river water elevation, just upstream of the Headworks flow control gates, at 53.7m. I then estimated an additional river level increase of ~0.5m would begin to bypass at/around the Headworks facility and down into the lower Lebreton Flats area. From the same Delcan study noted above, the usual river water elevation, just above Headworks, was noted as 52.8m (as controlled by the Chaudiere Ring Dam). Much of the then observed headloss, through the **covered aqueduct**, was attributed to the Headworks trash racks and gatehouse structure.

Lastly, I do recall finished grades, adjacent to the **open aqueduct** and by the Pimisi Station, being quite close the usual operating level of the forebay. I did not keep copies of those early station drawings but Erin should know where they can be found.

I hope you find this information helpful!

Paul

From:	Montgomery, Paul
To:	Smadella, Karin
Cc:	Moroz, Peter; Tousignant, Eric; Duquette, Vincent; Fawzi, Mohammed
Subject:	RE: Open Aqueduct Configuration - Upstream end.
Date:	Monday, March 25, 2024 8:56:41 PM
Attachments:	~WRD2863.jpg image001.png SN 015120 STRUCTURAL EVALUATION FINAL REPORT MARCH 2015.pdf B01512001-01 .pdf

Hi Karin,

Unfortunately, I am fairly certain that the City has very little detailed record information on this former rail bridge. I recall a concerted effort made by several staff to locate any such details, in advance of the construction of the temporary Preston Street Extension but, to my knowledge, very little was found. I have attached what I could find through the City's Geoinformation site, about this immediate area, for your reference. Much of the structure is on NCC property so I can only speculate who might now own this structure. From the attached 2014 report's photos, it would also appear that the LPTM has been routed under a portion of the southerly end of the former (and now heritage) 1870 railway bridge (SN015120). This 2014 report mentions an earlier 2006 condition report but I could not find a copy of it on the Geoinformation site. If the City's structures folks have more detail, perhaps try reaching out to Jack Zhao?

As you may already know, the original open aqueduct extended through to Nepean Bay and had its own headworks structure (i.e. separate from the current headworks structure). Historical photos and the attached report appear to confirm that this open aqueduct was, at one time, entirely routed underneath this former rail bridge. I have checked and no detailed records, about this abandoned section of open aqueduct or former headworks structure, are here at Lemieux or on the same geoinformation site. As such, precisely how and how much of this aqueduct section was filled in, I cannot say, but I would guess that any original rock cut, for this aqueduct section, was simply filled in, from the then shore and back towards this former rail bridge. The attached MH report suggests likewise and notes that only a southerly ~10m section of the arch structure still acts as a bridge, with the rest underlain by some manner of fill material.

The dashed line, as highlighted in red below, shows a rather ***approximate*** location of the pipe, as I understand it, but I would suggest that its terminus lies somewhere underneath the old rail bridge and not beyond. Again, like much of this area, details on this pipe are few. I can confirm that the pipe exists and it is valved off, from time to time, coincident with the draining of the aqueducts. I would guess that the pipe was installed along and with the filling in of the upstream section of the old aqueduct. Again, I have no details of the pipe's depth but there is a valve box inside our fenced headworks compound, like those used for watermains, which we can operate.

The attached drawing, by Stantec, details some circa 2001 rehabilitation work completed on the bridge. This was the only drawing I found, for this particular structure, so I hope this, and the above information will be helpful.

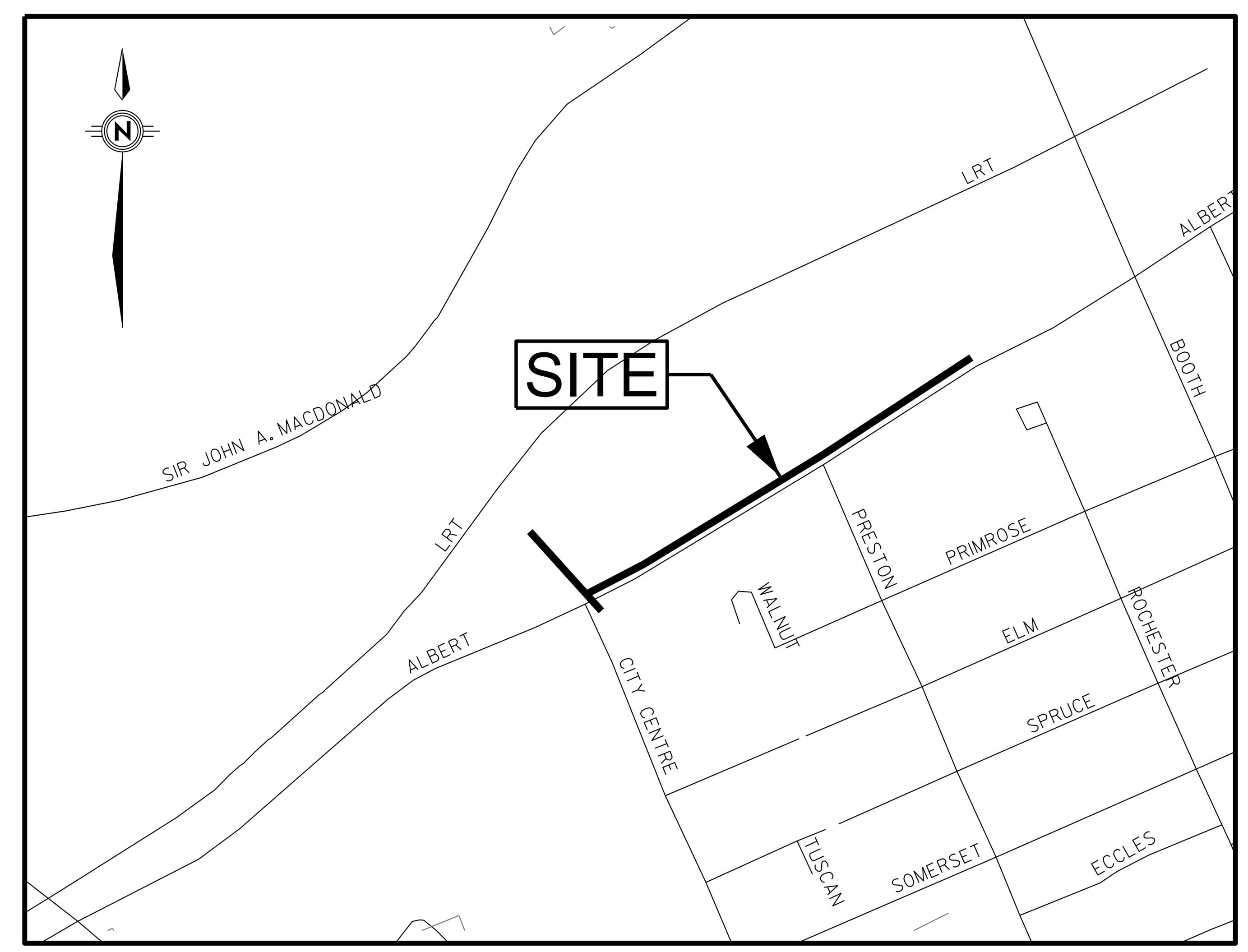
Take care,

Paul

M. Paul Montgomery, P.Eng.
Plant Manager, Water Production East
Infrastructure and Water Services Department, City of Ottawa
1 Onigam Street, Ottawa, Ontario, K1Y 2C4
tel / tél: (613) 580-2424, ext / poste: 23302
cell: (613) 223-0907
e-mail / courriel: Paul.Montgomery@ottawa.ca

From: Smadella, Karin <Karin.Smadella@stantec.com>

INFRASTRUCTURE SERVICES



C. DUCLOS, P.ENG.
DIRECTOR
INFRASTRUCTURE SERVICES

Robinson Consultants

CAVE CREEK COLLECTOR REALIGNMENT

CONTRACT NO. CP000511

ISSUED FOR FINAL PRELIMINARY DESIGN
JAN. 23, 2024

SYMBOLS

	EXISTING	PROPOSED	REMOVALS
Structure Adjustment			ADJ DENOTES ADJUSTMENT ONLY
Self Leveling Frame & Cover		(SL)	
Clay Seal		CS	
San. Sewer & Manhole	250mm SANITARY SEWER MHSAN	PROP.250mmØ SAN	MHSAN LIMIT OF REMOVAL
Comb. Sewer & Manhole	250mm SANITARY SEWER (COMBINED) MHSAN	PROP.250mmØ COMB	MHSAN LIMIT OF REMOVAL
Storm Sewer & Manhole	450mm STORM SEWER MHST	PROP.450mmØ STM	MHST LIMIT OF REMOVAL
Single Curb Inlet Catch Basin	CICB	CICB#	CICB
Single Catch Basin	CB	CB#	CB
Ditch Inlet Catch Basin	DICB	DICB#	DICB
Double Curb Inlet Catch Basin	DCICB	DCICB#	DCICB
Double Catch Basin	DCB	DCB#	DCB
Subdrain (with direction of flow)			
Water Main	400mm WATERMAIN	PROP. 406mmØ WM	400mm WATERMAIN
Hydrant & Valve Box	VB 2012	V&VB FH	VB 2012
Valve & Valve Box	VB	V&VB	VB
Valve & Valve Chamber	VC	V&VC	VC
Valves (Water services only)	WV WK	SP	WV WK
Sanitary Service Lateral		SA	
Storm Service Lateral		ST	
Water Lateral & Stand Pipe		SP	
Gas Main & Valve	GV 100mm GAS		
Property Line			
Concrete Curb			
Depressed Curb		DC	
Ditch	EX. DITCH		
Fence & Gate	CHAIN LINK FENCE GATE		
Guide Rail	CABLE GUARD RAIL		
Retaining Wall	CONC RWALL		
Trees (Dripline & Trunk Dia. / Small Tree)	20		20
Hedge / Brush Area			
Concrete Sidewalk / Median	CONCRETE		
Asphalt Sidewalk / Pathway	ASPHALT		
Asphalt Laneways & Entrances	ASPHALT		
Asphalt (Full Depth)			
Asphalt (Partial Depth)			
Gravel Laneways & Entrances	GRAVEL		
Paving Stones	PSTONE		
TWSI			
Bell Utility Pole & Anchor	WP BP		WP BP
Bell Manhole	MHU BELL		MHU BELL
Bell Box / Pedestal	BELL BOX		
Hydro Utility Pole & Anchor	WP HP		WP HP
Hydro Manhole	MHU HYDRO		MHU HYDRO
Hydro Transformer / Pedestal	HYDRO TRANS		HYDRO TRANS
Light Standard	LS		LS
Traffic Manhole	MHU TRAFFIC		MHU TRAFFIC
Traffic Handhole	THH		THH
Traffic Control Box	TRAFFIC CONTROL		TRAFFIC CONTROL
Traffic Mast Arm Foundation	TL		TL
Metal Pole	MP		MP
Wood Pole	WP		WP

REFERENCE POINTS

BM ELEV.	BENCH MARK
CM	CONCRETE MONUMENT
	ROCK BAR
IP	IRON TUBE OR PIPE
IB	IRON BAR
PK	PK NAIL
ISCM 2-	2ND ORDER INTEGRATED SURVEY CONTROL MONUMENT
ISCM 3-	3RD ORDER INTEGRATED SURVEY CONTROL MONUMENT
	CUT CROSS
V	CUT VEE
RIB	ROUND IRON BAR
Ø	REINFORCING BAR
SIB	STANDARD IRON BAR
SSIB	SHORT STANDARD IRON BAR

MISCELLANEOUS

CUT

ROADWAY — GRADING

FILL

BUILDINGS

MW4 — MONITORING WELL (PLAN VIEW)

BH4 — BOREHOLE (PLAN VIEW)

AG4 — AUGER HOLE (PLAN VIEW)

HV4 — HYDROVAC HOLE (PLAN VIEW)

SUPPLEMENTAL

Topsoil & Sod

Rip Rap

CAVE CREEK
COLLECTOR REALIGNMENT

Ottawa

LEGEND, INDEX, AND NOTES

Contract No. CP-000511 — Dwg. No. I1

Sheet - of -

Asset No.

Asset Group

C. Duclos, P.Eng. — Director, Infrastructure Services

J. Trudel, P.Eng. — Senior Engineer, Infrastructure Services

Robinson Consultants

Des.	Chk'd.
I.M.	D.S.
Dwn.	Chk'd.
I.M.	D.S.
Utility Circ. No.	Index No.

Const. Inspector

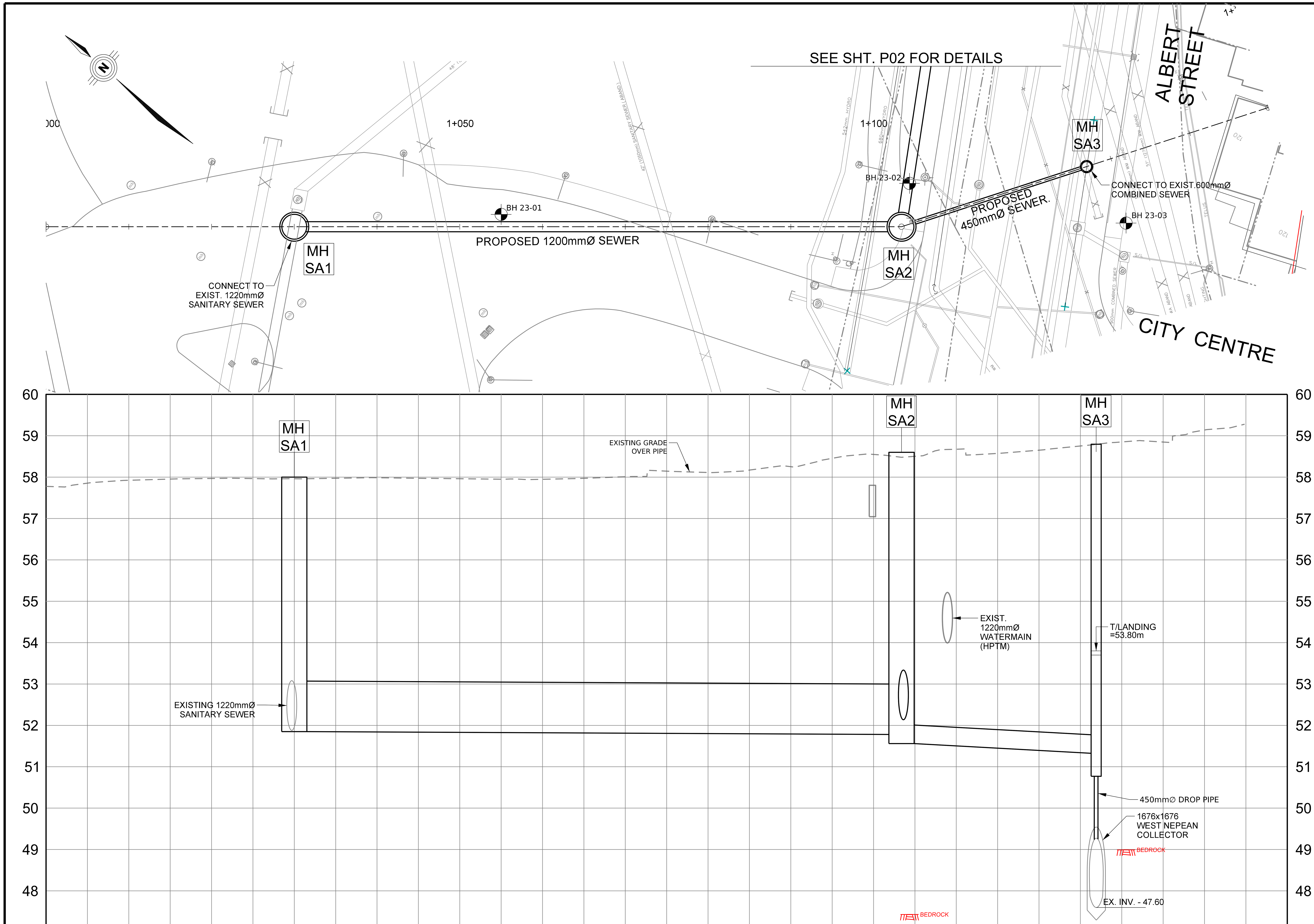
Scale: HORIZONTAL 0m — VERTICAL 0m

NOTE: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

REVISIONS

No.	Description	By	Date (dd/mm/yy)
1	ISSUED FOR PRELIMINARY DESIGN CIRCULATION	D.S.	24/11/23
2	ISSUED FOR FINAL PRELIMINARY DESIGN	D.S.	23/01/24

NOT FOR CONSTRUCTION



EXISTING GRADE OVER PIPE	57.776	57.854	57.923	57.952	57.968	57.965	57.962	57.973	57.986	57.972	57.961	57.949	57.949	57.972	58.009	58.144	58.112	58.171	58.252	58.454	58.549	58.503	58.675	58.572	58.651	58.752	58.850	58.848	59.139

PROPOSED TOP OF WATERMAIN	
PROPOSED STORM SEWER INVERT	
PROPOSED SANITARY SEWER INVERT	51.850; 70.38m - PROPOSED 1200mm Concrete SANITARY SEWER @ 0.10%; 51.780; 51.560; 21.39m - PROPOSED 450 mm PVC SANITARY SEWER @ 1.10%; 51.325
STATION	1+000; 1+025; 1+050; 1+075; 1+100; 1+125

CAVE CREEK
COLLECTOR REALIGNMENT

PLAN & PROFILE
STA. 1+000 TO STA. 1+150

C. Duclos, P.Eng. *Director Infrastructure Services*	J. Trudel, P.Eng. *Senior Engineer Infrastructure Services*

Robinson Consultants

Ottawa

Contract No. CP-000511	Dwg. No. P01
Sheet _ of _	
Asset No. --------	
Asset Group ---	
Des. I.M.	Chk'd. D.S.
Dwn. I.M.	Chk'd. D.S.
Utility Circ. No. -------	Index No. --------
Const. Inspector ----------------	

Scale: HORIZONTAL 0m 5 10; VERTICAL 0m 1 2

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REVISIONS

No.	Description	By	Date (dd/mm/yy)
1	ISSUED FOR PRELIMINARY DESIGN CIRCULATION	D.S.	24/11/23
2	ISSUED FOR FINAL PRELIMINARY DESIGN	D.S.	23/01/24

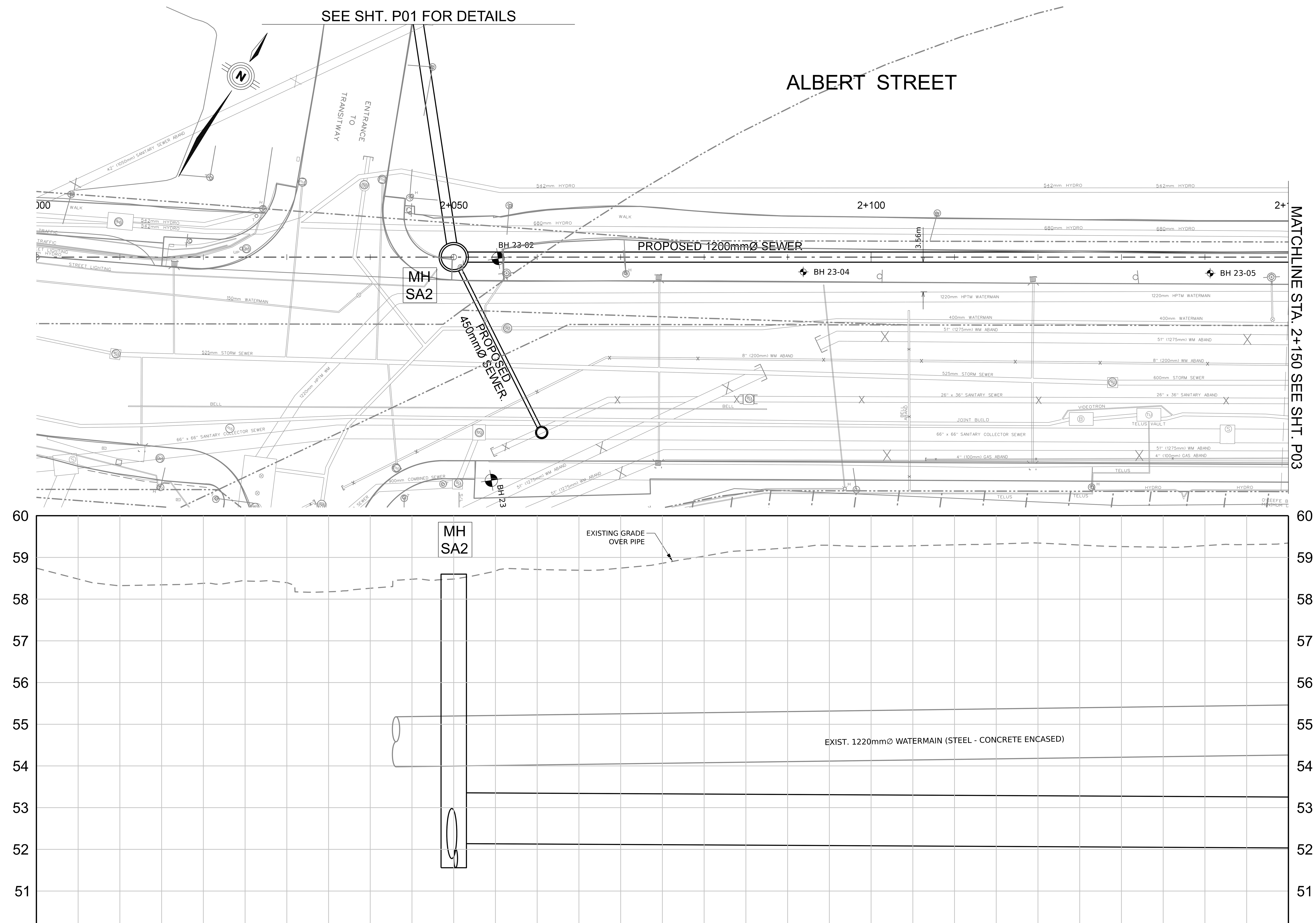
NOT FOR CONSTRUCTION

SANITARY SEWER MH DATA

No.	Station	Offset (m)	Type		Elevations		Grate to Invert
			Structure	Cover	Grate	Low Inv.	
MHSA1	1+030.00	0.00	701.014	S24	58.00	51.85	6.15
MHSA2	1+103.38	0.00	701.014	S24	58.60	51.56	7.04
MHSA3	1+126.90	0.00	701.010	S24 / SL	58.80	50.73	8.08

SL DENOTES SELF LEVELLING COVER

NOTE:
CITY OF OTTAWA IS IN CONSULTATION WITH HYDRO OTTAWA REGARDING THE IMPACTED HYDRO UNDERGROUND INFRASTRUCTURE



EXISTING GRADE OVER PIPE	58.840	58.888	58.788	58.772	58.629	58.495	58.476	58.457	58.409	58.443	58.531	58.637	58.654	58.637	58.643	58.644	58.638	58.634	58.652	58.649	58.658	58.694	58.711	58.747	58.765	58.817	58.858	58.866	58.897	58.911	58.891

PROPOSED TOP OF WATERMAIN

PROPOSED STORM SEWER INVERT

PROPOSED SANITARY SEWER INVERT: 51.780-N, 51.560-S, 52.136-E; 106.73m - PROPOSED 1200mm Concrete SANITARY SEWER @ 0.10%

STATION: 2+000, 2+025, 2+050, 2+075, 2+100, 2+125, 2+150

CAVE CREEK
COLLECTOR REALIGNMENT

PLAN & PROFILE
STA 2+000 TO STA 2+150

C. Duclos, P.Eng. Director Infrastructure Services	J. Trudel, P.Eng. Senior Engineer Infrastructure Services

Robinson Consultants

Ottawa

Contract No. CP-000511	Dwg. No. P02
Sheet _ of _	
Asset No. --------	
Asset Group ---	
Des. I.M.	Chk'd. D.S.
Dwn. I.M.	Chk'd. D.S.
Utility Circ. No.	Index No.
Const. Inspector	

Scale: HORIZONTAL 0m 5 10; VERTICAL 0m 1 2

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REVISIONS

No.	Description	By	Date (dd/mm/yy)
1	ISSUED FOR PRELIMINARY DESIGN CIRCULATION	D.S.	24/11/23
2	ISSUED FOR FINAL PRELIMINARY DESIGN	D.S.	23/01/24

NOT FOR CONSTRUCTION

SANITARY SEWER MH DATA

No.	Station	Offset (m)	Type: Structure	Type: Cover	Elevations: Grate	Elevations: Low Inv.	Grate to Invert
MHSA2	2+050.00	0.00	SEE DWG. P01 FOR DETAILS				
SL DENOTES SELF LEVELLING COVER							

NOTE:
CITY OF OTTAWA IS IN CONSULTATION WITH HYDRO OTTAWA REGARDING THE IMPACTED HYDRO UNDERGROUND INFRASTRUCTURE

CAVE CREEK
COLLECTOR REALIGNMENT

PLAN & PROFILE
STA 2+150 TO STA 2+300

Contract No. CP-000511	Dwg. No. P03		
Sheet _ of _			
Asset No. --------			
Asset Group ---			
Des. I.M.	Chk'd. D.S.		
Dwn. I.M.	Chk'd. D.S.		
Utility Circ. No.	Index No.		
Const. Inspector			

C. Duclos, P.Eng.
Director
Infrastructure Services

J. Trudel, P.Eng.
Senior Engineer
Infrastructure Services

Robinson Consultants

Scale: HORIZONTAL 0m 5 10; VERTICAL 0m 1 2

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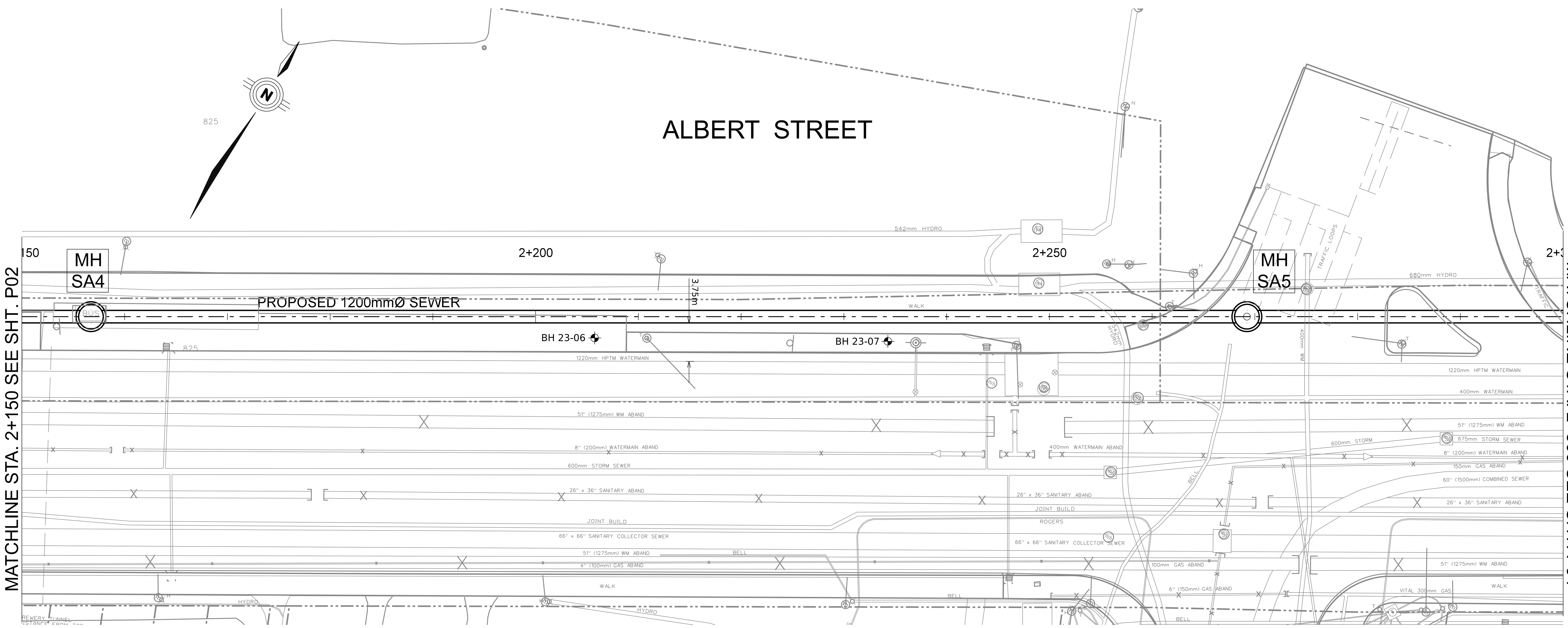
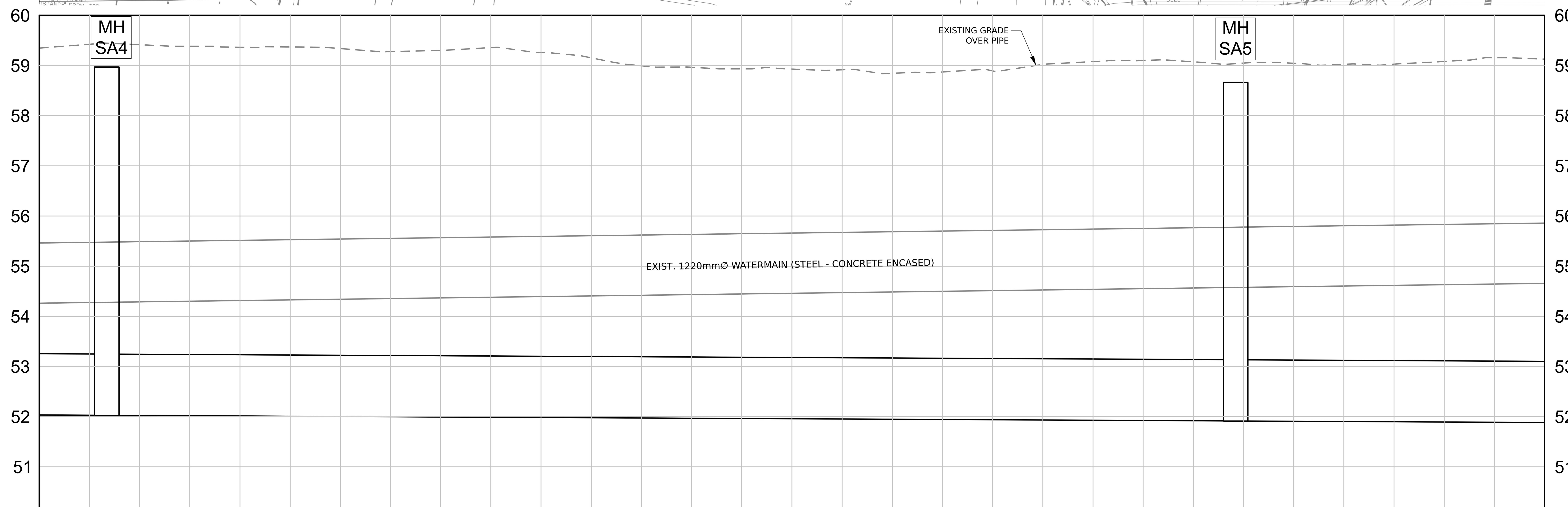
2	ISSUED FOR FINAL PRELIMINARY DESIGN	D.S.	23/01/24

NOT FOR CONSTRUCTION

SANITARY SEWER MH DATA							
No.	Station	Offset (m)	Type		Elevations		Grate to
			Structure	Cover	Grate	Low Inv.	
MHSA4	2+156.73	0.00	701.013	S24	58.97	52.03	6.94
MHSA5	2+269.22	0.00	701.013	S24 / SL	58.66	51.91	6.75
SL DENOTES SELF LEVELLING COVER							

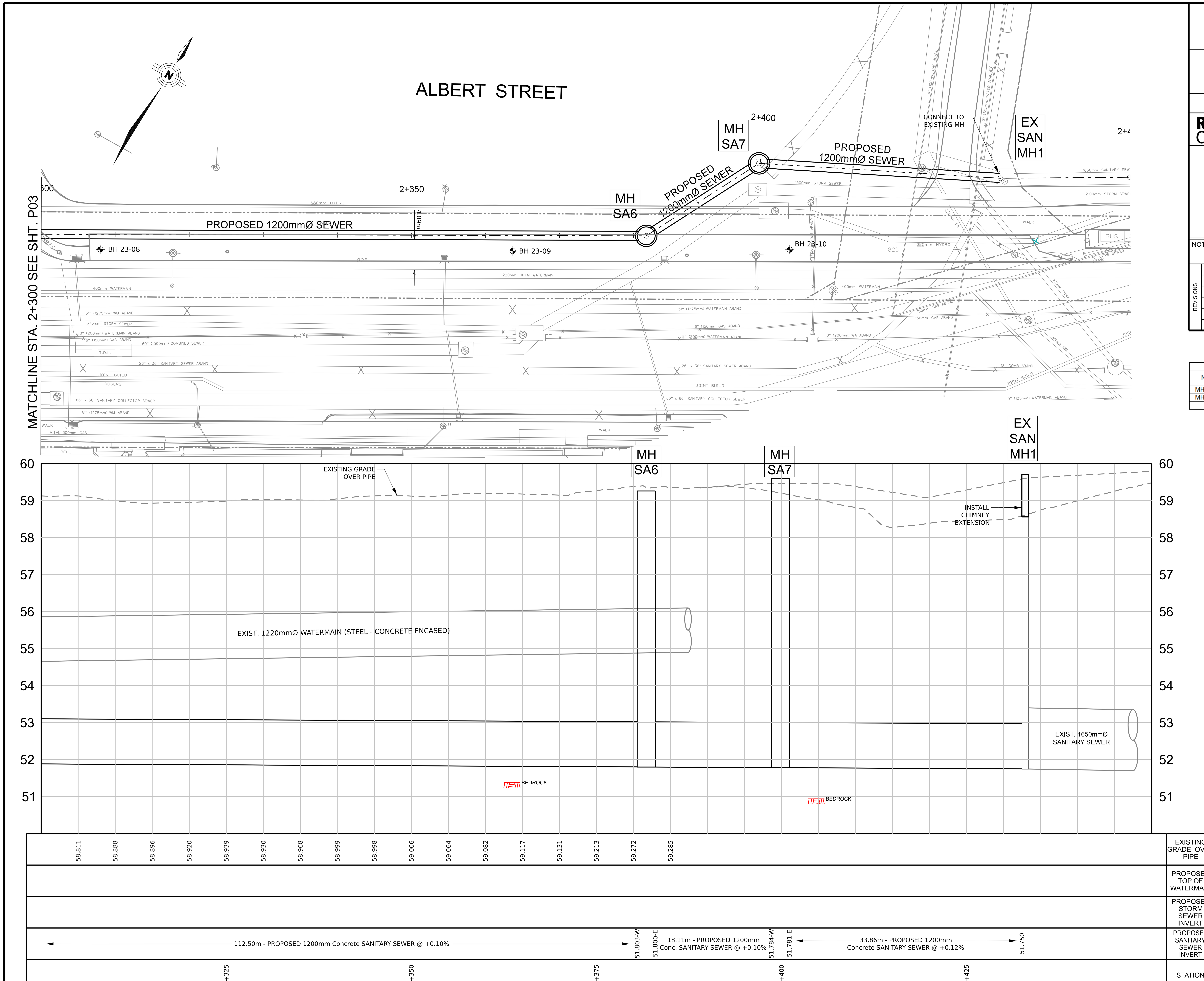
NOTE:
CITY OF OTTAWA IS IN CONSULTATION WITH HYDRO OTTAWA REGARDING THE IMPACTED HYDRO UNDERGROUND INFRASTRUCTURE





EXISTING GRADE OVER PIPE	58.943, 58.978, 59.000, 59.015, 59.030, 59.049, 59.063, 59.082, 59.115, 59.126, 59.129, 59.161, 59.149, 59.164, 59.162, 59.118, 59.096, 59.093, 59.107, 58.997, 59.044, 58.813, 58.674, 58.693, 58.665, 58.658, 58.635, 58.601, 58.512, 58.647
PROPOSED TOP OF WATERMAIN	
PROPOSED STORM SEWER INVERT	
PROPOSED SANITARY SEWER INVERT	52.029-W, 52.026-E; 112.50m - PROPOSED 1200mm Concrete SANITARY SEWER @ 0.10%; 51.916-W, 51.913-E; 112.50 - PROPOSED 1200mm Concrete SANITARY SEWER @ 0.10%
STATION	2+175, 2+200, 2+225, 2+250, 2+275, 2+300

22047-PROF-Albert-Sheets.dgn 2024-01-23 3:53:58 PM



CAVE CREEK
COLLECTOR REALIGNMENT

PLAN & PROFILE
STA 2+300 TO STA 2+450

C. Duclos, P.Eng.
Director
Infrastructure Services

J. Trudel, P.Eng.
Senior Engineer
Infrastructure Services

Robinson Consultants

Ottawa

Contract No. CP-000511 | Dwg. No. P04

Sheet _ of _

Asset No. --------

Asset Group ---

Des. I.M. | Chk'd. D.S.

Dwn. I.M. | Chk'd. D.S.

Utility Circ. No. | Index No.

Const. Inspector

Scale: HORIZONTAL 0m 5 10; VERTICAL 0m 1 2

NOTE: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

REVISIONS

No.	Description	By	Date (dd/mm/yy)
1	ISSUED FOR PRELIMINARY DESIGN CIRCULATION	D.S.	24/11/23
2	ISSUED FOR FINAL PRELIMINARY DESIGN	D.S.	23/01/24

NOT FOR CONSTRUCTION

SANITARY SEWER MH DATA

No.	Station	Offset (m)	Type: Structure	Type: Cover	Elevations: Grate	Elevations: Low Inv.	Grate to Invert
MHSA6	2+381.02	0.00	701.013	S24	59.26	51.80	7.46
MHSA7	2+399.84	0.00	701.013	S24	59.60	51.78	7.82

SL DENOTES SELF LEVELLING COVER

NOTE:
CITY OF OTTAWA IS IN CONSULTATION WITH HYDRO OTTAWA REGARDING THE IMPACTED HYDRO UNDERGROUND INFRASTRUCTURE

22047-PROF-Albert-Sheets.dgn 2024-01-23 3:55:35 PM mmddyy DGN_FILE_NAME

Record Drawing

These drawings have been prepared based on information provided by others. Stantec Consulting Ltd. has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

Stantec

NO.	REVISIONS	BY	DATE
1.	ISSUED FOR TENDER	B.B.	2004-11-19
2.	ISSUED FOR CONSTRUCTION	B.B.	2005-03-11
3	AS RECORDED	JvW	2007-03

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

LOW PRESSURE TRANSMISSION MAIN
REPLACEMENT PROGRAM
LEMIEUX ISLAND W.P.P. TO FLEET STREET PUMPING STATION

Ottawa

CONTRACT NO. ISB04-3023

DWG. NO. 3023-P1

SHEET 11 OF 25

PROPOSED 1676MM WATERMAIN
PLAN & PROFILE
STATIONS 5+043 TO 5+140

M.J. WILLMETS, Project Manager | R. G. HEWITT, P.ENG., Director Infrastructure Services | W.R. NEWELL, P.ENG., Manager Construction Services West

Date: 2005-03-11 | Scale: Horizontal 0m 2.5 5 10; Vertical 0m 0.5 1 2

Dwn: C.V. | Chkd: B.B. | Des: B.B. | Chkd: J.D.K.

NOTES:

1- RESTORE DISTURBED AREAS, CULVERTS, SIDEWALK, DECORATIVE LANDSCAPING (FLOWER GARDEN), PAVEMENT TO ORIGINAL CONDITION UNLESS INDICATED OTHERWISE ON THE DRAWING, IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY OF OTTAWA.

2- ENDS OF PIPE AT THE LIMIT OF CONTRACT TO BE MARKED BEFORE BACK FILLING. TIE-IN TO THE EXISTING FEATURES FOR FUTURE LOCATING.

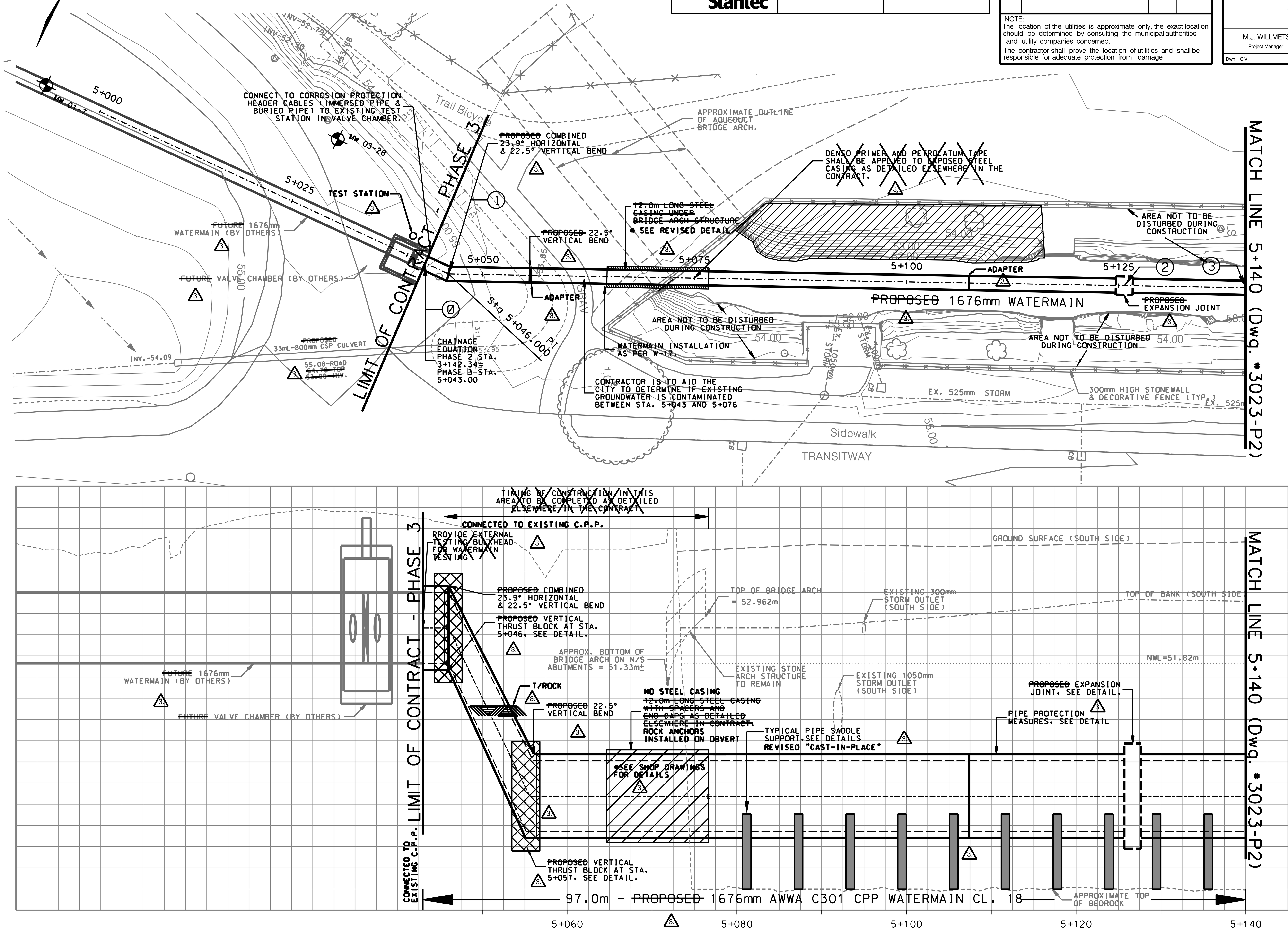
3- SITE SECURITY FENCING SHALL BE INSTALLED ALONG THE LIMITS OF CONSTRUCTION BEFORE CONSTRUCTION WORK STARTS AND SHALL REMAIN IN PLACE UNTIL REINSTATEMENT IS COMPLETED, EXCEPT WHERE OTHERWISE NOTED.

4- PRESERVE AND PROTECT HYDRO POLES.

5- MAINTAIN EXISTING PEDESTRIAN MOVEMENTS AT ALL TIMES DURING CONSTRUCTION. PROVIDE INFORMATION SIGNAGE, DIRECTIONAL SIGNAGE AND BARRICADES TO DIRECT PEDESTRIANS AROUND THE CONSTRUCTION ACTIVITY AREA.

6- PIPE SADDLE SUPPORT LOCATIONS AND SPACING ARE FOR ILLUSTRATION PURPOSES ONLY. PIPE SADDLE SUPPORTS ARE TO BE SPACED SO THAT EACH PIPE SECTION IS SUPPORTED BY AT LEAST ONE (1) SADDLE (MAXIMUM SPACING TO BE NO GREATER THAN 6.1m FROM CENTER TO CENTER). A PIPE SADDLE SUPPORT TO BE LOCATED NO GREATER THAN 1.0m FROM EACH SIDE OF THE CENTERLINE OF THE EXPANSION JOINTS. THE SADDLE SUPPORT ADJACENT TO EXPANSION JOINTS TO BE EMBEDDED 1.0m INTO SOUND BEDROCK AS DETAILED. THE MIDDLE PIPE SUPPORT BETWEEN EXPANSION JOINTS AND TUNNEL SECTION OR PIPE BLOCK ANCHORS OR THRUST ANCHORS SHALL BE EMBEDDED 1.0m INTO SOUND BEDROCK, AS DETAILED.

AREA CAN BE USED AS AN OPTIONAL ACCESS INTO THE AQUEDUCT DURING CONSTRUCTION. AREA TO BE REINSTATED TO ORIGINAL CONDITION UPON COMPLETION OF PROJECT. EXISTING ROCK FACE NOT TO BE DISTURBED.



STATION	PROPOSED C.L. OF WM	FINISHED GRADE	
5+043.0	52.66	55.25	
5+046.0	52.66	55.12	
5+055.1 / 5+056.5	48.69	54.66	ADAPTER S/S
5+060.0	48.69	54.65	
5+064.6	48.69		
5+076.7	48.69		
5+080.0	48.69		
5+100.0	48.69		
5+107.4			B/B ADAPTER
5+120.0	48.69		
5+127.26	48.69		
5+140.0	48.69		

AS-BUILT

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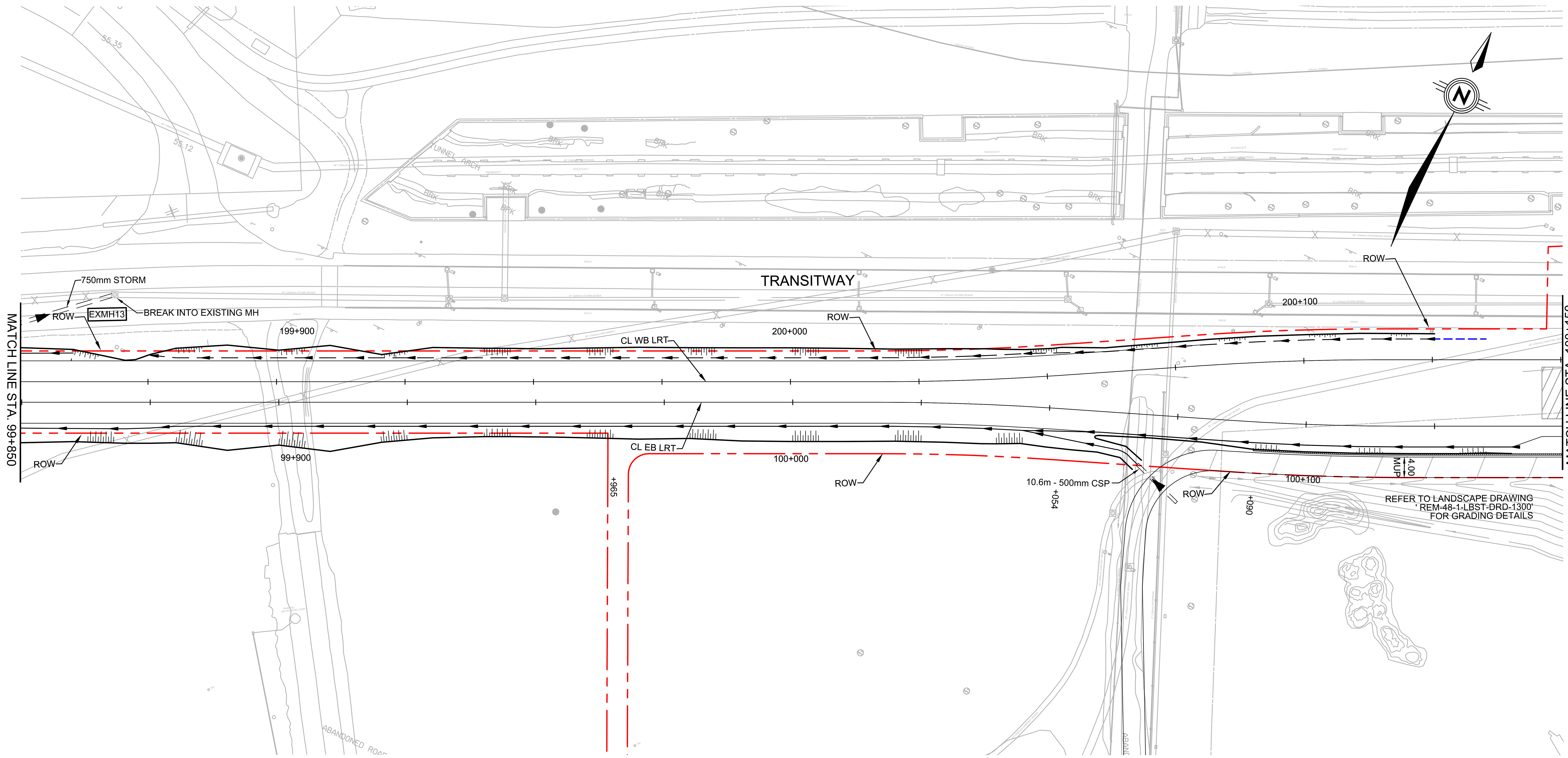


Confederation Line
Ligne de la Confédération

Ottawa

GUIDEWAY DESIGN - SEGMENT 1
GRADING AND DRAINAGE

CONTRACT No. OILC-11-00-P006

DESIGNED	CHECKED
-	-
DRAWN	SEALED
KUSUM	-

DRAWING NUMBER REM-20-1-0000-DRD-2716

PRIMARY SEAL

Refer to Rev 3 for the originally sealed version

DESIGN/BUILDER OLRT CONSTRUCTORS CONSTRUCTEURS

ENGINEERING JV RTGE Joint Venture

SECONDARY SEAL (IF REQUIRED)

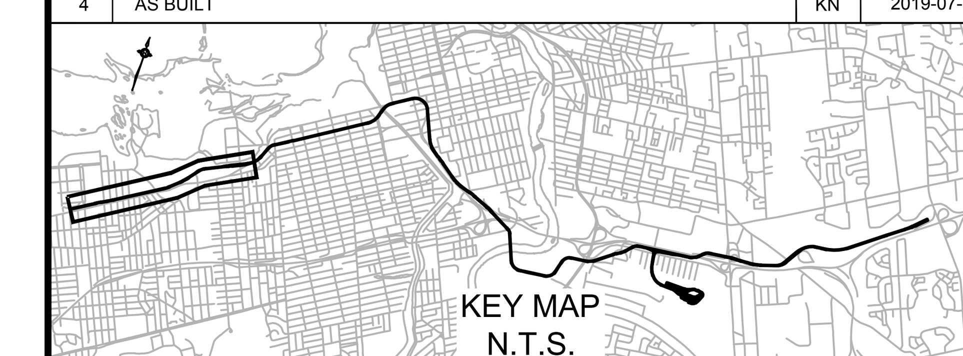
DESIGN FIRM MMM GROUP

SCALE HORIZONTAL 1:500 FULL SIZE 1:1000 HALF SIZE 0 5 10 20 40

ASSET No. -

ASSET GROUP -

REV	DESCRIPTION	BY	DATE
0	SIN-0518: ISSUED FOR CONSTRUCTION	RC	2016-01-15
1	SIN-0649: ISSUED FOR CONSTRUCTION	RC	2016-04-12
2	SIN-1396: ISSUED FOR CONSTRUCTION	RC	2017-08-31
3	SIN-1506: ISSUED FOR CONSTRUCTION	RC	2017-11-22
4	AS BUILT	KN	2019-07-22



This As-Built Document has been prepared based upon information furnished by OLRT Constructors.

LAYOUT INFORMATION BASED ON 3 DEGREE MTM ZONE 9 NAD 83 (OLRT) COORDINATE SYSTEM COMBINED SCALE FACTOR 0.999946

GENERAL NOTES:

A. THE LOCATION OF EXISTING UTILITIES ARE APPROXIMATE AND SHOULD BE VERIFIED BY THE CONTRACTOR IN THE FIELD. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.

B. REFER TO 'STRAY CURRENT REPORT' FOR ADDITIONAL CORROSION CONTROL SYSTEMS, INCLUDING THE LOCATION AND TYPICAL ARRANGEMENT, MEASURING POINTS, AND STRAY CURRENT MONITORING SYSTEMS. CORROSION CONTROL MEASURES SHALL BE PROVIDED FOR BURIED PIPES AND PIPES SUBJECT TO DIRECT CURRENT (DC) STRAY CURRENTS.

C. MATERIAL SUBSTITUTIONS MAY BE CONSIDERED AT THE DISCRETION OF THE OLRTC REPRESENTATIVE. SUBSTITUTIONS SHALL NOT BE MADE WITHOUT THE PRIOR APPROVAL OF THE OLRTC REPRESENTATIVE. THE APPROVAL OR REJECTION OF A PROPOSED SUBSTITUTION WILL BE MADE AT THE DISCRETION OF THE OLRTC REPRESENTATIVE.

D. CONNECTION POINTS TO EXISTING UTILITIES TO BE VERIFIED BY VISUAL EXPOSURE AND SURVEY AS REQUIRED.

E. ROW BASED ON PROPERTY REQUEST PLANS (PRP) PROVIDED BY THE CITY.

F. REFER TO OLRTC'S ENVIRONMENTAL MANAGEMENT PLAN(LATEST REVISION) FOR EROSION AND SEDIMENT CONTROL, TREE PROTECTION AND OTHER ENVIRONMENTAL REQUIREMENTS FOR CONFEDERATION LINE.

CULVERT DATA

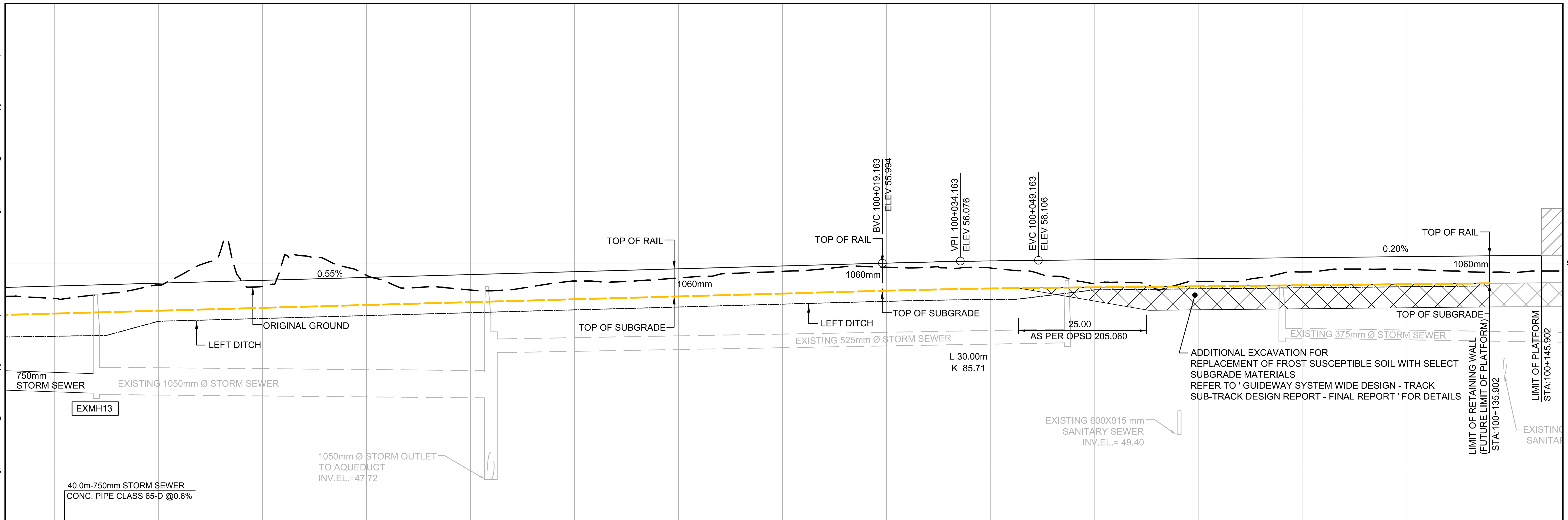
	STATION	OFFSET (m)	ELEVATIONS (m)
INVERT 1	100+067.77	9.79RT	54.701
INVERT 2	100+075.87	16.70RT	54.742

OFFSETS ARE FROM CENTER LINE OF EB LRT

TITLEBLOCK: 790mm x 534mm RTGE JV 2013

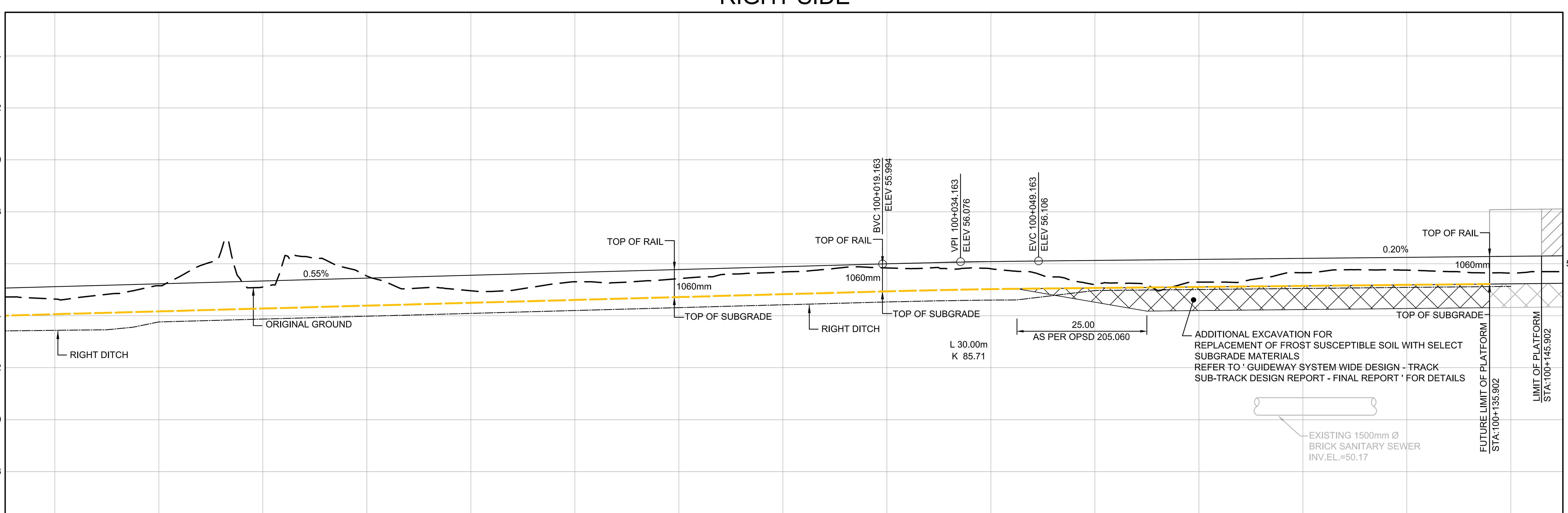
2019-Jul-22 11:13:28 AM O:\Drawings\WIP As-Built\SUB-03122 Guideway - Civil - Segment 1\Submitted\20190722\CAD\REM-20-1-0000-DRD-2704-2719_4_GRADING AND DRAINAGE.dwg

LEFT SIDE



℄ TOP OF RAIL (LB LRT)	55.116	55.226	55.336	55.446	55.556	55.666	55.776	55.886	55.996	56.081	56.127	56.167	56.207	56.247	56.287	
LEFT STORM INVERT	W51.000 E50.941															
STATION	99+860	99+880	99+900	99+920	99+940	99+960	99+980	100+000	100+020	100+040	100+060	100+080	100+100	100+120	100+140	100+150

RIGHT SIDE



℄ TOP OF RAIL (EB LRT)	55.118	55.228	55.338	55.448	55.558	55.668	55.778	55.888	55.998	56.083	56.128	56.168	56.208	56.248	56.288	
RIGHT STORM INVERT																
STATION	99+860	99+880	99+900	99+920	99+940	99+960	99+980	100+000	100+020	100+040	100+060	100+080	100+100	100+120	100+140	100+150

Confederation Line
Ligne de la Confédération

Ottawa

GUIDEWAY DESIGN - SEGMENT 1
GRADING AND DRAINAGE

CONTRACT No. OILC-11-00-P006
DESIGNED - CHECKED -
DRAWN KUSUM SEALED -

DRAWING NUMBER REM-20-1-0000-DRD-2717

PRIMARY SEAL
Refer to Rev 4 for the originally sealed version

DESIGN/BUILDER
OLRT CONSTRUCTORS CONSTRUCTEURS

SECONDARY SEAL (IF REQUIRED)

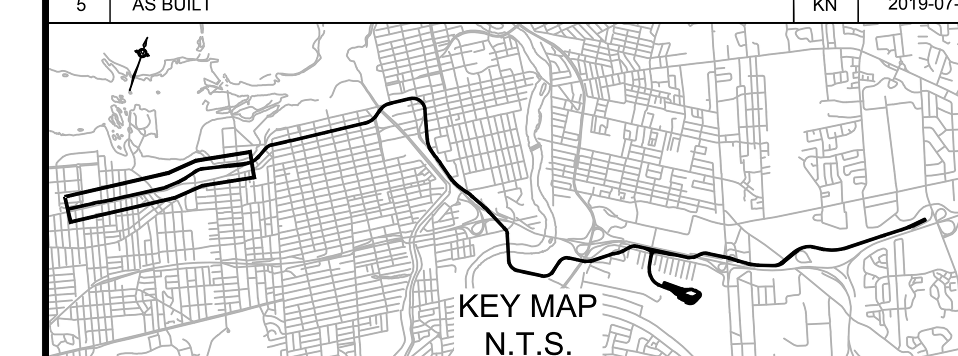
ENGINEERING JV
RTGE Joint Venture

DESIGN FIRM
MMM GROUP

SCALE
HORIZONTAL 1:500 FULL SIZE 1:1000 HALF SIZE (0 5 10 20 40)
VERTICAL 1:100 FULL SIZE 1:200 HALF SIZE (0 1 2 4 8)

ASSET No. -
ASSET GROUP -

REV	DESCRIPTION	BY	DATE
1	SIN-0649: ISSUED FOR CONSTRUCTION	RC	2016-04-12
2	SIN-0824: ISSUED FOR CONSTRUCTION	RC	2016-06-23
3	SIN-1396: ISSUED FOR CONSTRUCTION	RC	2017-08-31
4	SIN-1506: ISSUED FOR CONSTRUCTION	RC	2017-11-22
5	AS BUILT	KN	2019-07-22



This As-Built Document has been prepared based upon information furnished by OLRT Constructors.

LAYOUT INFORMATION BASED ON 3 DEGREE MTM ZONE 9 NAD 83 (OLRT) COORDINATE SYSTEM COMBINED SCALE FACTOR 0.999946

TITLEBLOCK: 790mm x 534mm RTGE JV 2013

2019-Jul-22 11:13:28 AM O:\Drawings\WIP As-Built\SUB-03122 Guideway - Civil - Segment 1\Submitted\20190722\CAD\REM-20-1-0000-DRD-2704-2719_4_GRADING AND DRAINAGE.dwg

DRAWING FRAME: 790mm x 534mm City of Ottawa 2008

CANADIAN CENTRAL RAILWAY BRIDGE
(SN015120)

GENERAL ARRANGEMENT

Ottawa

Contract No. ISD14-7114	Dwg. No.
Sheet of	
Asset No.	
Asset Group	
Des. HL	Chk'd. JBE
Dwn. GK	Chk'd. HL
Utility Circ. No.	Index No.
Const. Inspector	
Scale: AS NOTED	

MORRISON HERSHFIELD

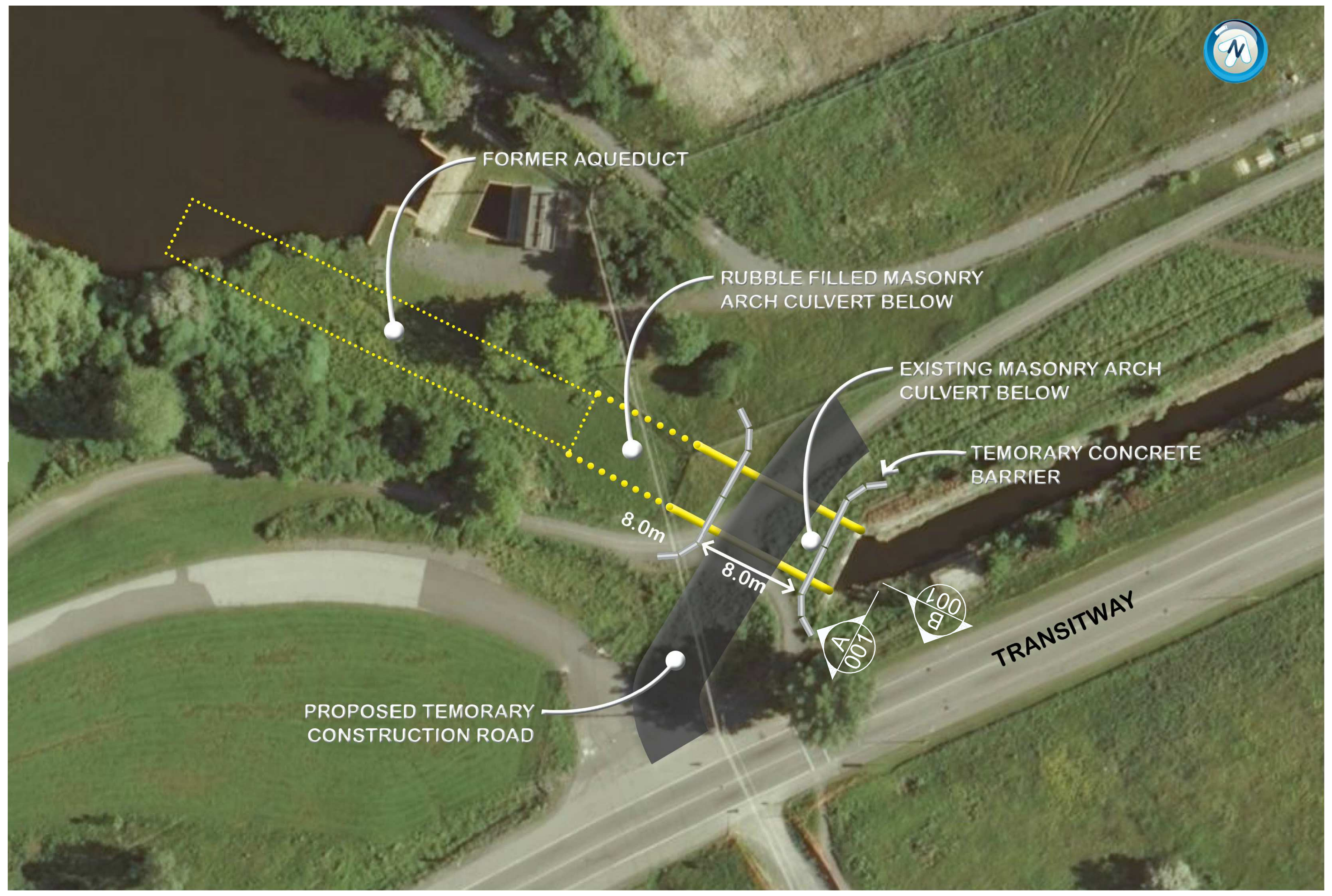
NOTE: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

REVISIONS

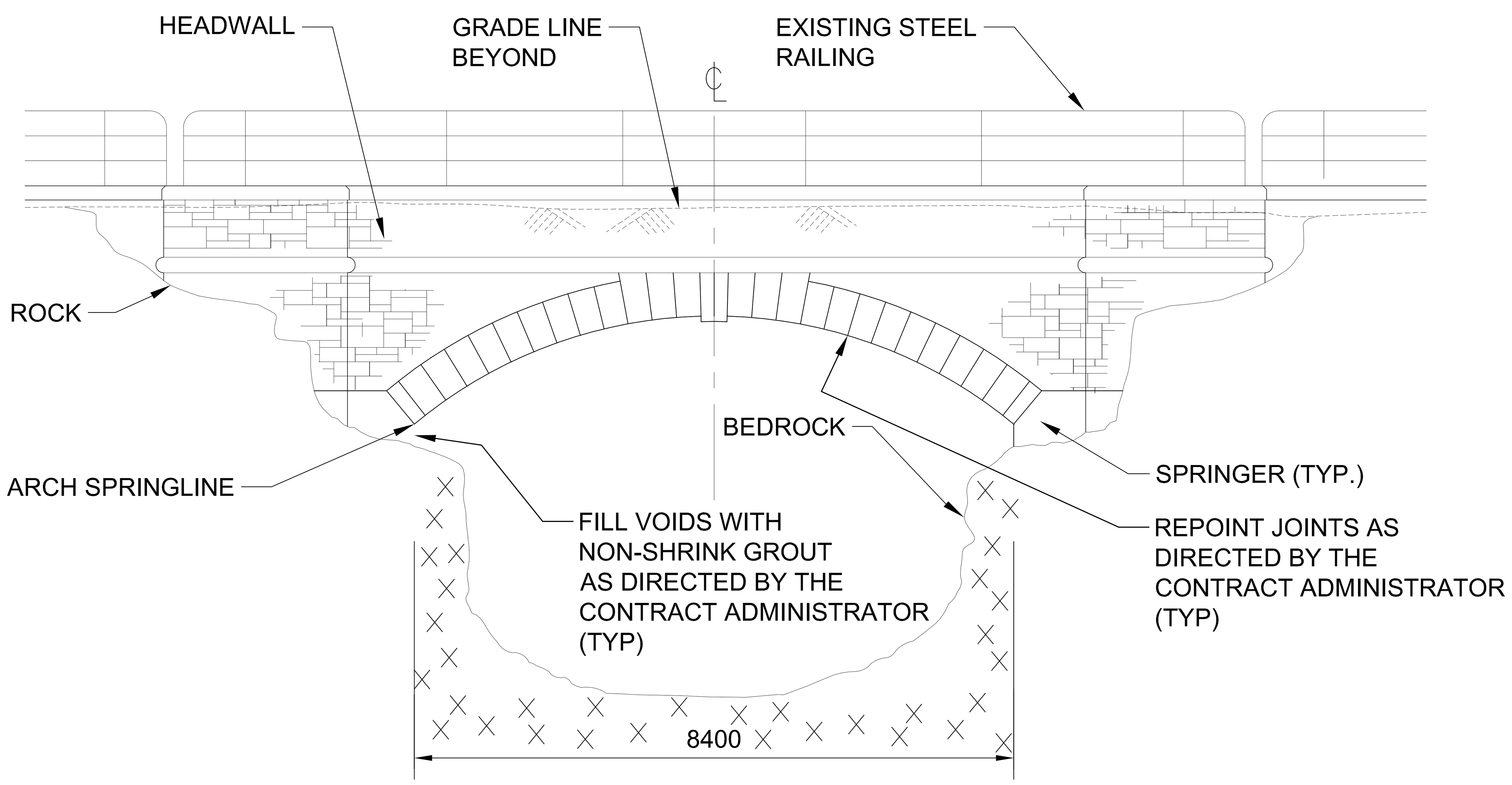
No.	Description	By	Date (dd/mm/yy)

NOTES:

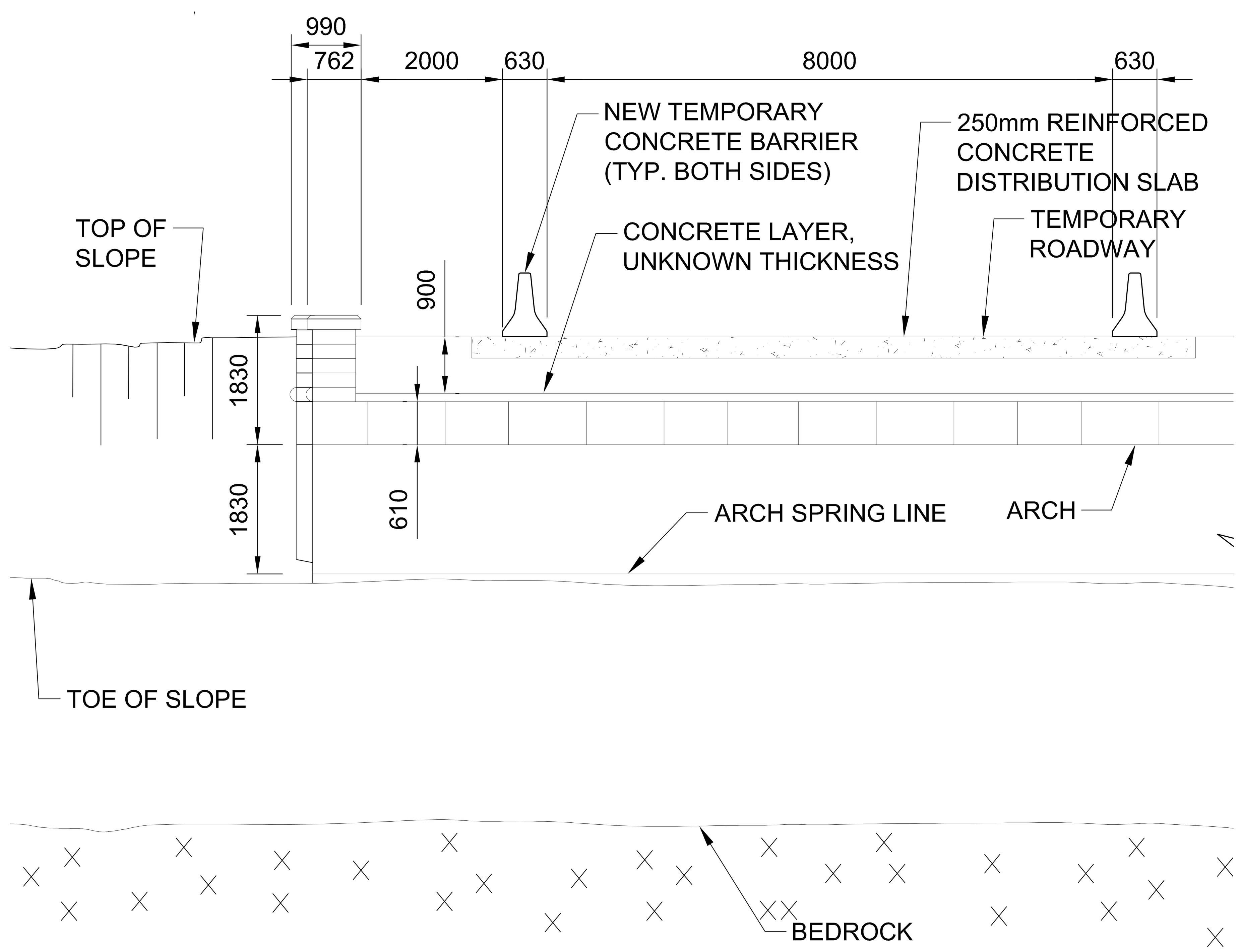
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER APPLICABLE CONTRACT DRAWINGS. INFORMATION SHOWN ON THIS DRAWING HAS BEEN EXTRACTED FROM xxxx AND SUPPLEMENTED BY FIELD INVESTIGATIONS.



PLAN
1:60



ELEVATION A 001
1:60



SECTION B 001
1:60

No.	REVISION	BY	DATE
1	RECORD SET	P.C.M.	12 NOV 01

Stantec

Ottawa-Carleton

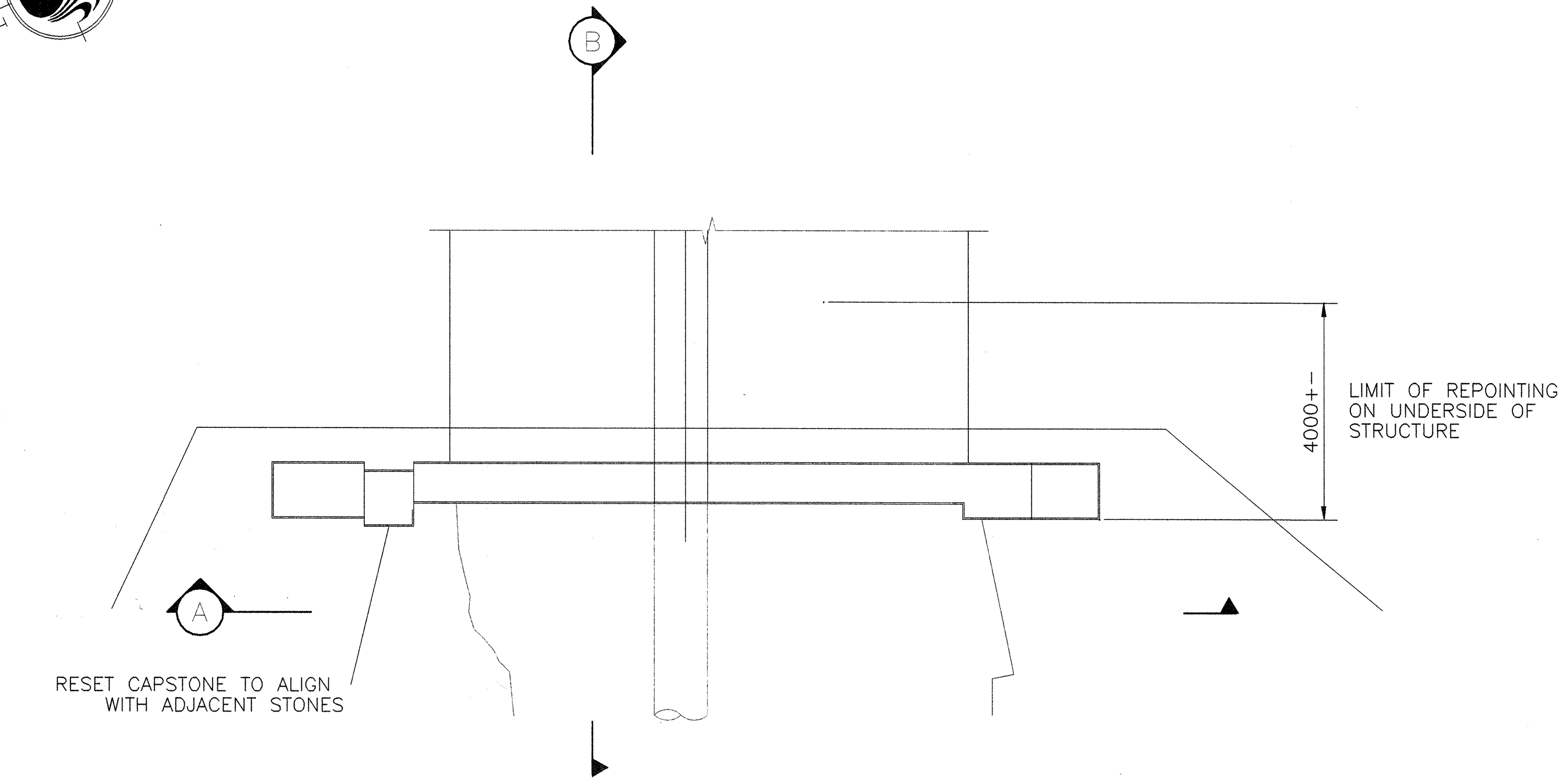
THE CANADA CENTRAL RAILWAY BRIDGE

GENERAL ARRANGEMENT

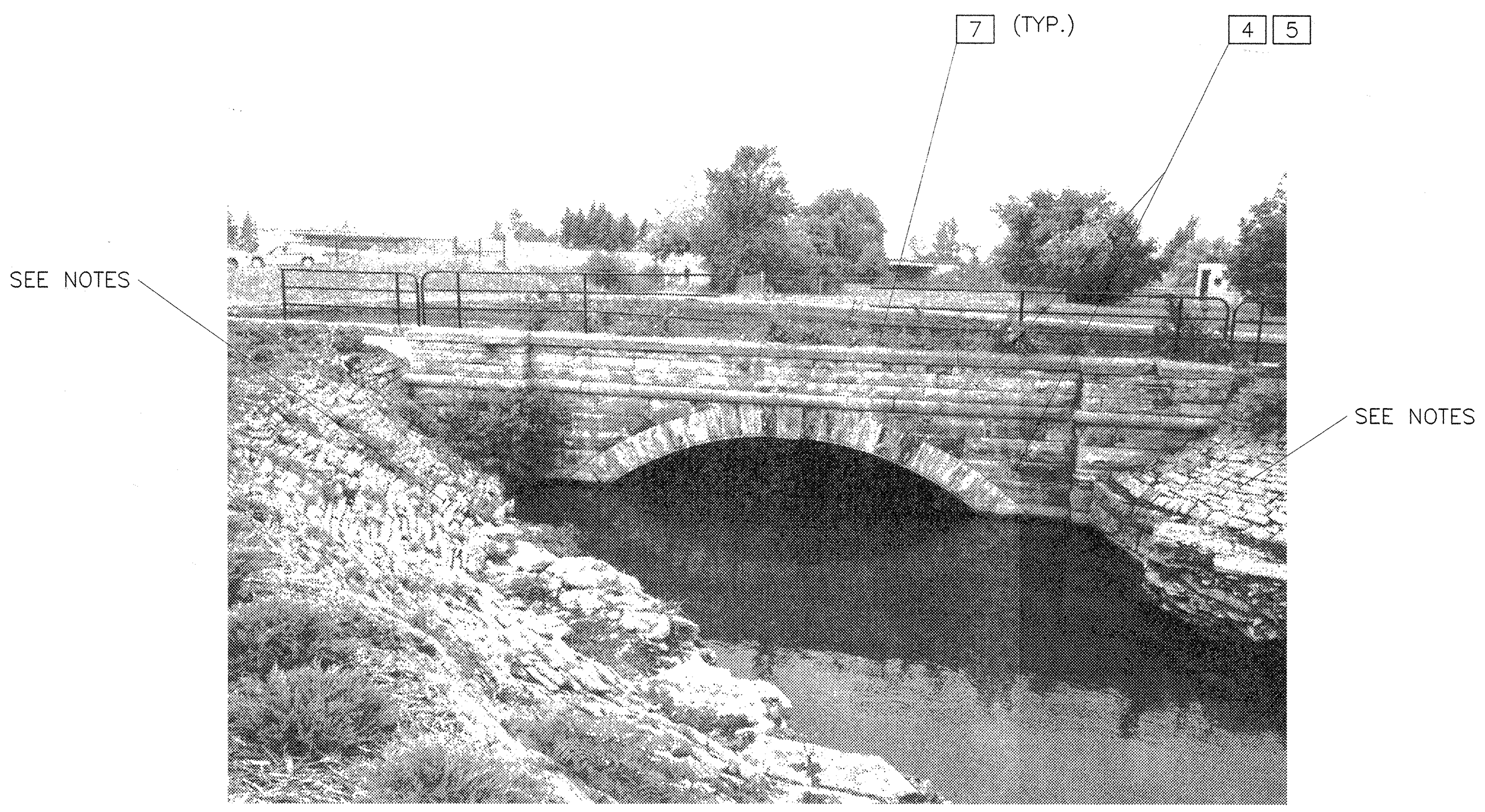
J. MILLER, P.ENG. Director of Engineering

V.K. SAHNI, P.ENG. Manager Structural Branch

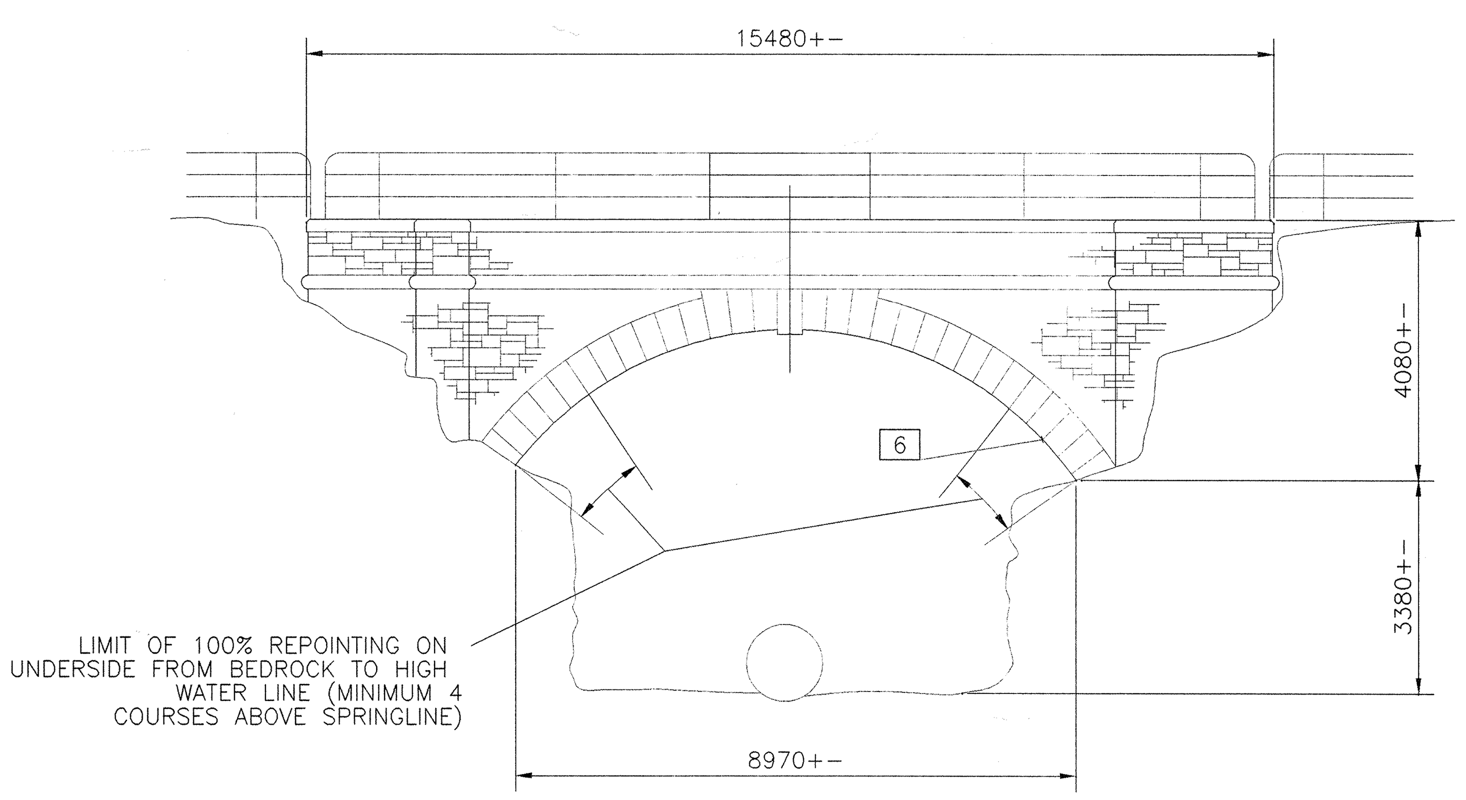
DWG. No.	B-051201-001
Sheet	of
CONTRACT No.	ETL00-7000
Des. S.T.R.	Chk. D.A.H.
Dwn.	Chk. J.M.
Date:	10 MAR 00
Scale:	1:100



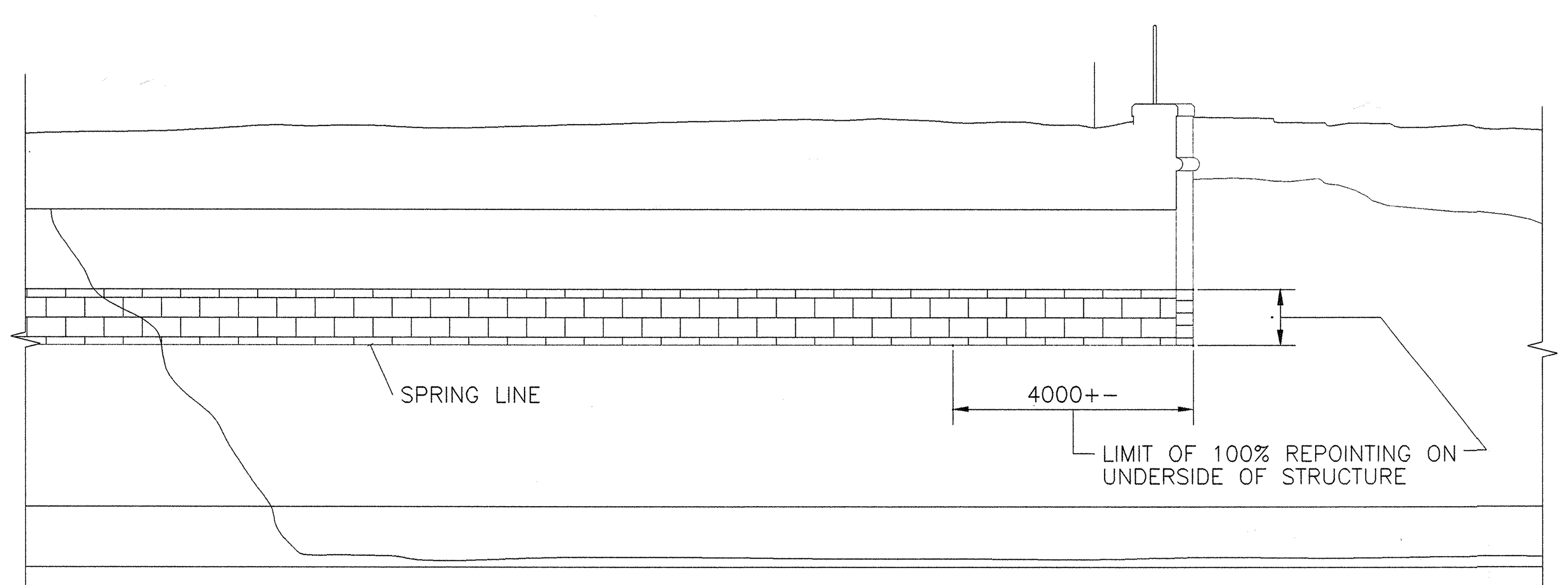
PLAN
1:100



WEST ELEVATION
EXISTING



(A) WEST ELEVATION
1:100



(B) SECTION
1:100

SCOPE of WORK:

1 INSTALL FENCING, BARRICADES, ETC. AS REQUIRED TO PREVENT PUBLIC ACCESS TO THE WORK SITE.

2 DO NOT BLOCK EXISTING PATH. CONFINE ACCESS ACROSS PATH TO ONE LOCATION, APPROXIMATELY 4.0m WIDE.

3 PROVIDE ACCESS SCAFFOLDING, FALSE WORK AND DEMOLITION CATCHMENT SYSTEM.

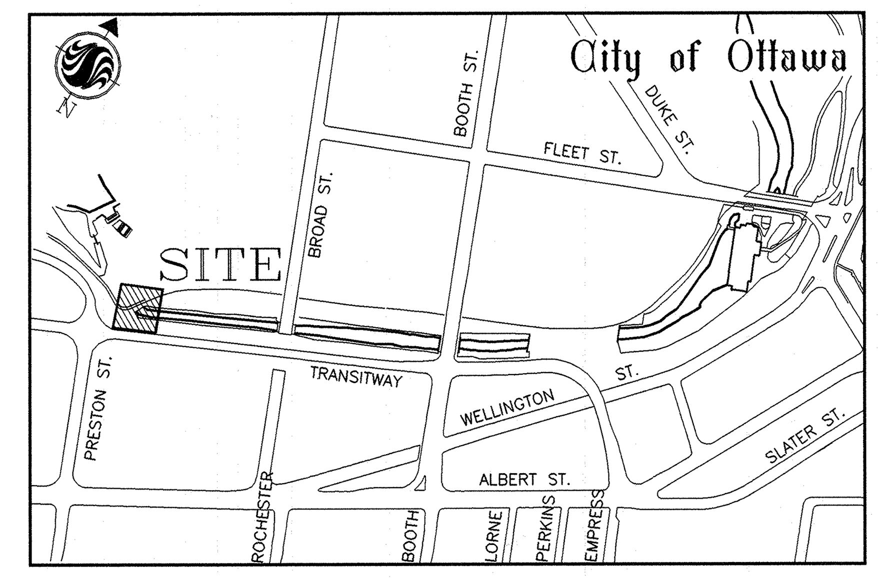
4 REPLACE DETERIORATED STONE IN SPANDREL WALL AS DIRECTED BY THE ENGINEER.

5 CHIP AND REPOINT MASONRY JOINTS (100%) ON EXTERIOR.

6 CHIP AND REPOINT ARCH BARREL UNDERSIDE AT WATERLINE (100% OF AREA). CHIP AND REPOINT REMAINDER OF ARCH SOFFIT ONLY AS DIRECTED BY THE CONTRACT ADMINISTRATOR.

7 SEAL SKYWARD FACING JOINTS.

8 REINSTATE LANDSCAPING.



GENERAL NOTES:

- THE CANADA CENTRAL RAILWAY BRIDGE IS A DESIGNATED HISTORIC STRUCTURE. ALL MASONRY RESTORATION IS TO PRESERVE THE HERITAGE APPEARANCE.
- THE AREA IN AND AROUND THE BRIDGE MAY CONTAIN VALUABLE AND SENSITIVE ARCHAEOLOGICAL RESOURCES. RESTRICT WORK TO DESIGNATED AREAS AND NOTIFY CONTRACT ADMINISTRATOR UPON DISCOVERY OF RELICS, ETC.
- ACCESS, WORK AND STORAGE AREAS SHALL BE LIMITED TO THOSE AREAS SHOWN ON THE DRAWINGS.
- DO ALL MASONRY RESTORATION WORK TO CAN3-A371-M94, EXCEPT AS MODIFIED BY THESE DRAWINGS AND THE CONTRACT SPECIFICATIONS.
- WHERE STONEWORK IS REMOVED, STABILIZE AND PROVIDE PROTECTION TO EXPOSED MASONRY REMAINING. PROVIDE TEMPORARY SHORING AND BRACING AS REQUIRED.
- UNLESS OTHERWISE NOTED, NO STONES ARE TO BE REPAIRED OR REPLACED WITHOUT PRIOR INSPECTION AND APPROVAL OF THE CONTRACT ADMINISTRATOR.
- NO CLEANING OF THE STONEWORK IS TO BE CARRIED OUT (UNLESS NOTED OTHERWISE) EXCEPT FOR THAT REQUIRED TO RESTORE PRECONTRACT APPEARANCE AS A RESULT OF SPILLAGE OF MORTAR, CONCRETE, GROUT, ETC.
- DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE. ELEVATIONS AND STATIONS ARE IN METERS.
- THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND DETAILS OF EXISTING FEATURES BEFORE PROCEEDING WITH THE WORK. ANY DISCREPANCIES SHALL BE PROMPTLY REPORTED TO THE CONTRACT ADMINISTRATOR.
- FIELD MEASURE TO ENSURE PROPER FIT.
- THE AQUADUCT WILL BE DRAINED FOR A PERIOD OF 4 WEEKS BEGINNING SEPTEMBER 18th TO PERMIT WORK TO BE COMPLETED ON THE ARCH BARREL UNDERSIDES. CATCHMENT SYSTEMS MUST BE IN PLACE TO PREVENT ANY REMOVALS OR OTHER MATERIALS FROM BLOCKING OR FALLING INTO THE AQUADUCT. COMPLY WITH THE ENVIRONMENT OPERATIONAL CONSTRAINTS OUTLINED IN THE CONTRACT SPECIFICATIONS.
- MAINTAIN WORK SITE IN A NEAT AND ORDERLY MANNER AT ALL TIMES AND REINSTATE ALL DISRUPTED AREAS TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
- DESIGN CRITERIA AND LOADING TO OHBDC 1991 3RD EDITION FOR PEDESTRIAN BRIDGES.
- THE NCC HAS RECENTLY COMPLETED RESTORATION WORKS OF THE AQUADUCT AREA ADJACENT TO THIS STRUCTURE INCLUDING THE RAILING OVER THE STRUCTURE. THESE WORKS ARE NOT TO BE DISTURBED BY THE WORK OF THIS CONTRACT AND ANY DAMAGE SHALL BE REPAIRED AT THE CONTRACTORS EXPENSE TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.

01512001

Appendix B Water Servicing

B.1 Domestic Water Demands

LeBreton Flats, Ottawa, ON - Domestic Water Demand Estimates
Draft Plan of Subdivision, Stantec Geomatics, April 5, 2024 & associated densities
Project No. 160401780

Population densities per Table 4.1 City of Ottawa Water Design Guidelines:		
Apartment	1.8	ppu
Townhome	2.7	ppu

Demand conversion factors per Table 4.2 of the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03:		
Residential	280	L/cap/day
Hotel	225	L/bedspace/d
Commercial and Institutional	28000	L/gross ha/day

Block ID	Commercial / Institutional (m²)	No. of Units	Population	Avg Day Demand		Max Day Demand [1 2]		Peak Hour Demand [1 2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Block 1									
Apartment		592	1066	207.2	3.45	518.0	8.63	1139.6	18.99
Commercial	1389		0	2.7	0.05	4.1	0.07	7.3	0.12
Block 1 Subtotal	1389	592	1066	209.9	3.50	522.1	8.70	1146.9	19.11
Block 2									
Apartment		608	1094	212.8	3.55	532.0	8.87	1170.4	19.51
Hotel[3]		201		62.8	1.05	94.2	1.57	169.6	2.83
Commercial	2370		0	4.6	0.08	6.9	0.12	12.4	0.21
Block 2 Subtotal	2370	809	1094	280.2	4.67	633.1	10.55	1352.4	22.54
Block 3									
Apartment		267	481	93.5	1.56	233.6	3.89	514.0	8.57
Townhome		10	27	5.3	0.09	13.1	0.22	28.9	0.48
Commercial	838		0	1.6	0.03	2.4	0.04	4.4	0.07
Block 3 Subtotal	838	277	508	100.3	1.67	249.2	4.15	547.2	9.12
Block 4									
Apartment		348	626	121.8	2.03	304.5	5.08	669.9	11.17
Townhome		10	27	5.3	0.09	13.1	0.22	28.9	0.48
Block 4 Subtotal	0	358	653	127.1	2.12	317.6	5.29	698.8	11.65
Block 5									
Apartment		203	365	71.1	1.18	177.6	2.96	390.8	6.51
Commercial	2035		0	4.0	0.07	5.9	0.10	10.7	0.18
Office	13391		0	26.0	0.43	39.1	0.65	70.3	1.17
Block 5 Subtotal	15426	203	365	75.0	1.25	183.6	3.06	401.5	6.69
Block 6									
Apartment		270	486	94.5	1.58	236.3	3.94	519.8	8.66
Commercial	2811		0	5.5	0.09	8.2	0.14	14.8	0.25
Office	10922		0	21.2	0.35	31.9	0.53	57.3	0.96
Block 6 Subtotal	13733	270	486	100.0	1.67	244.4	4.07	534.5	8.91
Block 7									
Apartment		81	146	28.4	0.47	70.9	1.18	155.9	2.60
Townhome		74	200	38.9	0.65	97.1	1.62	213.7	3.56
Block 7 Subtotal	0	155	346	67.2	1.12	168.0	2.80	369.6	6.16
Block 8									
Apartment		135	243	47.3	0.79	118.1	1.97	259.9	4.33
Townhome		56	151	29.4	0.49	73.5	1.23	161.7	2.70
Block 8 Subtotal	0	191	394	76.7	1.28	191.6	3.19	421.6	7.03
Block 9									
Apartment		135	243	47.3	0.79	118.1	1.97	259.9	4.33
Townhome		76	205	39.9	0.67	99.8	1.66	219.5	3.66
Block 9 Subtotal	0	211	448	87.2	1.45	217.9	3.63	479.3	7.99
Block 10									
Apartment		135	243	47.3	0.79	118.1	1.97	259.9	4.33
Townhome		46	124	24.2	0.40	60.4	1.01	132.8	2.21
Block 10 Subtotal	0	181	367	71.4	1.19	178.5	2.98	392.7	6.55
Block 11									
Apartment		268	482	93.8	1.56	234.5	3.91	515.9	8.60
Commercial	1792		0	3.5	0.06	5.2	0.09	9.4	0.16
Block 11 Subtotal	1792	268	482	97.3	1.62	239.7	4.00	525.3	8.76

Block 12									
Apartment		221	398	77.4	1.29	193.4	3.22	425.4	7.09
Hotel[3] [4]		104		32.5	0.54	48.8	0.81	87.9	1.46
Commercial	884		0	1.7	0.03	2.6	0.04	4.6	0.08
Block 12 Subtotal	884	325	398	111.6	1.86	244.8	4.08	517.9	8.63
Block 13									
Apartment		216	389	75.6	1.26	189.0	3.15	415.8	6.93
Townhome		14	38	7.4	0.12	18.4	0.31	40.4	0.67
Commercial	514		0	1.0	0.02	1.5	0.02	2.7	0.04
Block 13 Subtotal	514	230	427	83.9	1.40	208.9	3.48	458.9	7.65
Block 14									
Apartment		288	518	100.8	1.68	252.0	4.20	554.4	9.24
Townhome		14	38	7.4	0.12	18.4	0.31	40.4	0.67
Commercial	546		0	1.1	0.02	1.6	0.03	2.9	0.05
Block 14 Subtotal	546	302	556	109.2	1.82	272.0	4.53	597.7	9.96
Block 15									
Apartment		381	686	133.4	2.22	333.4	5.56	733.4	12.22
Commercial	2860		0	5.6	0.09	8.3	0.14	15.0	0.25
Block 15 Subtotal	2860	381	686	138.9	2.32	341.7	5.70	748.4	12.47
Block 17									
Commercial	3717		0	7.2	0.12	10.8	0.18	19.5	0.33
Office	22950		0	44.6	0.74	66.9	1.12	120.5	2.01
Block 17 Subtotal	26667	0	0	51.9	0.86	77.8	1.30	140.0	2.33
Block 18									
Park[5]	68398		1268	22.0	0.37	33.0	0.55	59.4	0.99
Block 18 Subtotal	68398	0	1268	22.0	0.37	33.0	0.55	59.4	0.99
Block 19									
Park[5]	24756		459	8.0	0.13	11.9	0.20	21.5	0.36
Block 19 Subtotal	24756	0	459	8.0	0.13	11.9	0.20	21.5	0.36
Total Site :	**160173**	**4753**	**10003**	**1817.7**	**30.29**	**4335.8**	**72.26**	**9413.7**	**156.90**

Notes:

1 The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate (as per Technical Bulletin ISD-2010-02)

2 Water demand criteria used to estimate peak demand rates for commercial areas, hotels, and parks are as follows:
maximum daily demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate (as per Technical Bulletin ISD-2010-02)

3 Hotel bedspace assumed to be 2 bedspace/room per LeBreton Flats MSS (CIMA+ 2021)

4 Block 12 hotel unit counts estimated based on density of hotel room/gross floor area (201 rooms/9450 m^2) established in Block 2 in density table.

5 Park population based on 185.3 persons/ha density; 20 L/p/d water demand based on park picnic and flush toilet demand from City Sewer Design Guidelines

B.2 Boundary Conditions

From:	Fawzi, Mohammed
To:	Smadella, Karin
Cc:	Duquette, Vincent; Moroz, Peter; Mottalib, Abdul; Thiffault, Dustin; Wu, Michael; binitha.chakraburtty@ncc-ccn.ca
Subject:	RE: LeBreton Flats Boundary Conditions Request
Date:	Monday, June 24, 2024 12:33:05 PM
Attachments:	~WRD2598.jpg image004.png image005.png image006.png image007.png LeBreton Flats June 2024.pdf

Hi Karin,

The following are boundary conditions, HGL, for hydraulic analysis at LeBreton Flats (zone 1W) assumed to be connected to via 8 Connections to the 305mm watermain on Wellington Avenue, 406mm on Booth Street and 406mm on Albert Street (see attached PDF for location).

-

Notes:

1. Analysis has been completed by classifying the demands into three groups:
   North Block: Blocks 7 to 19
   South Block: Blocks 1 to 5
   South Individual Block: Block 6
2. Private main looping has been assumed for North Blocks.
3. *For Connections 1,2,3,4 and 8: The maximum pressure is estimated to be more than 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.*

	Connection 1	**Connection 2**	**Connection 3**	**Connection 4**	**Connection 5**	**Connection 6**	**Connection 7**	**Connection 8**
Minimum HGL (m)	107.4	107.4	107.4	107.5	107.6	107.6	107.6	107.6
Maximum HGL (m)	115.2	115.2	115.2	115.2	115.1	115.0	115.0	114.9
MaxDay + FireFlow (200 L/s)	105.0	106.5	107.1	108.4	110.1	109.9	110.0	110.0

-

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.

Best Regards,

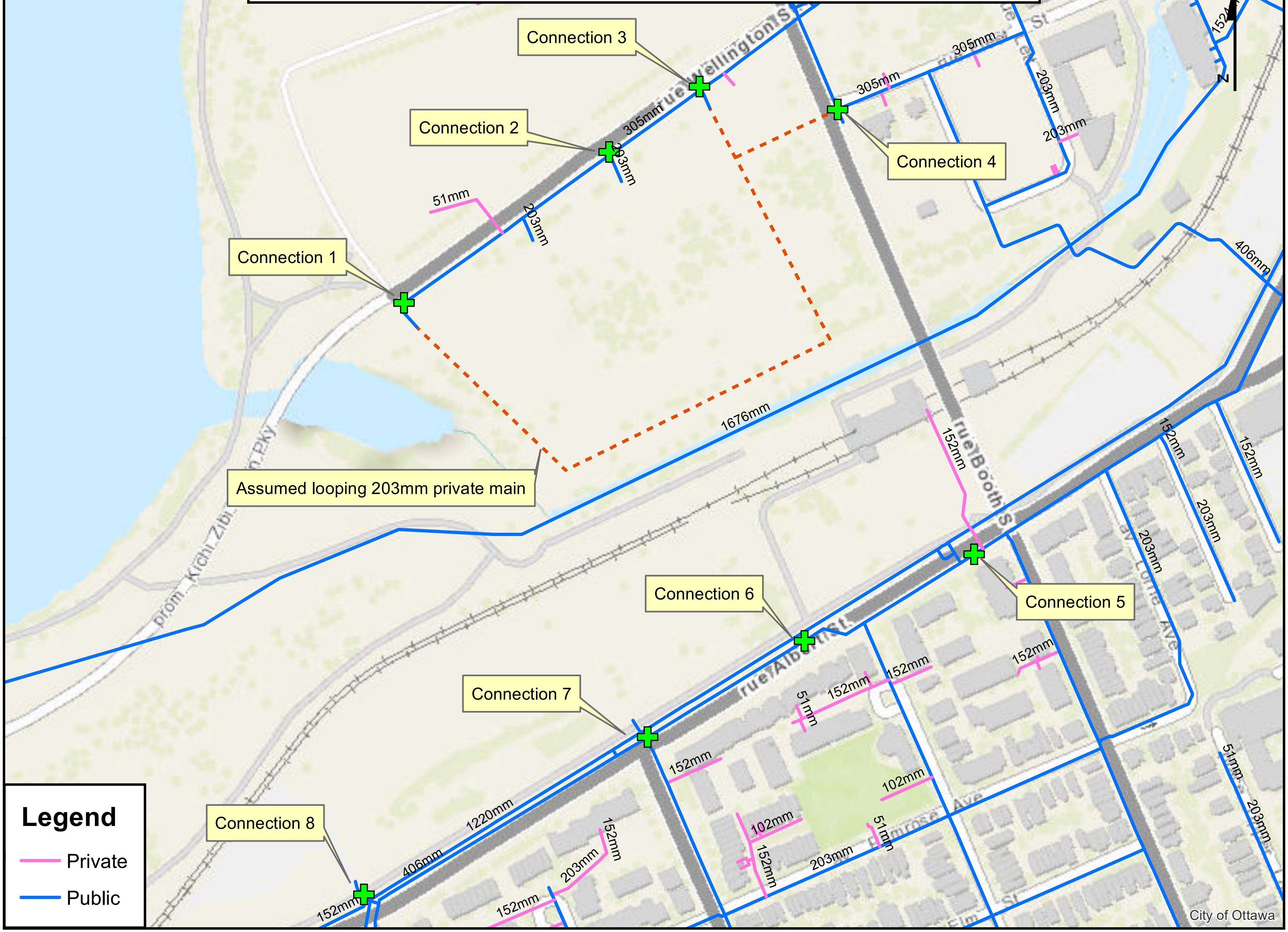
Mohammed Fawzi, P.Eng.

Project Manager, Infrastructure - Gestionnaire de projet, Projets d'infrastructure

Development Review All Wards (DRAW) | Direction de l'examen des projets d'aménagement - Tous les quartiers (EPATQ)

Planning, Development and Building Services Department (PDBS)| Direction générale des services de la planification, de l'aménagement
110 Laurier Avenue West | 110 Avenue Laurier Ouest
Ottawa, ON K1P 1J1
613.580.2424 ext./poste 20120, Mohammed.Fawzi@ottawa.ca

Boundary Conditions for LeBreton Flats



B.3 Preliminary Hydraulic Analysis

Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
8	0.00	58.89	115.00	56.11	79.79	550.14
2	0.00	58.55	114.90	56.35	80.13	552.45
1	8.17	57.98	114.90	56.92	80.93	558.02
28	0.00	56.43	115.20	58.77	83.56	576.15
29	0.00	56.42	115.20	58.78	83.58	576.25
5	1.67	56.08	115.00	58.92	83.79	577.68
25	1.45	56.17	115.20	59.03	83.93	578.70
30	1.19	56.11	115.20	59.09	84.03	579.35
18	1.62	56.01	115.19	59.18	84.16	580.23
15	0.00	56.00	115.19	59.19	84.16	580.28
23	0.00	56.00	115.19	59.19	84.17	580.31
16	0.00	55.98	115.19	59.21	84.19	580.50
17	2.98	55.96	115.18	59.23	84.22	580.65
22	2.32	55.95	115.19	59.24	84.23	580.75
6	3.37	55.74	114.99	59.25	84.25	580.89
33	1.82	55.93	115.19	59.26	84.26	580.97
32	2.68	55.87	115.18	59.31	84.34	581.52
11	0.86	55.73	115.19	59.45	84.54	582.89
12	0.50	55.72	115.19	59.47	84.57	583.06
9	1.67	52.36	114.99	62.63	89.06	614.06

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1001	Albert_8	2	7.98	297.00	120.00	8.17	0.12
1002	5	Albert_7	99.73	297.00	120.00	-3.74	0.05
1003	5	6	143.55	204.00	110.00	2.07	0.06
1004	8	Albert_6	19.71	204.00	110.00	-2.97	0.09
1005	6	8	74.71	204.00	110.00	-2.97	0.09
1006	9	6	84.55	204.00	110.00	-1.67	0.05
1008	12	11	15.52	204.00	110.00	0.86	0.03
1009	16	12	59.34	204.00	110.00	1.36	0.04
1010	15	Wellington_1	63.13	204.00	110.00	-4.60	0.14
1011	16	15	5.45	297.00	120.00	-1.36	0.02
1012	17	15	42.92	204.00	110.00	-3.24	0.10
C3	32	33	68.12	204.00	110.00	-2.42	0.07
1017	23	22	46.88	204.00	110.00	2.32	0.07
1018	25	Wellington_2	13.71	204.00	110.00	-5.42	0.17
C2	17	32	42.82	204.00	110.00	0.26	0.01
1020	28	Booth_4	95.52	204.00	110.00	-1.71	0.05
1022	30	29	21.74	204.00	110.00	2.51	0.08
1023	Wellington_3	30	12.02	204.00	110.00	3.70	0.11
C1	2	1	34.20	297.00	120.00	8.17	0.12
C4	33	18	73.85	204.00	110.00	-0.27	0.01
C6	25	33	60.97	204.00	110.00	3.97	0.12
C11	23	18	8.86	204.00	110.00	-2.32	0.07
C12	29	28	3.77	297.00	120.00	2.51	0.04
C13	28	18	58.08	204.00	110.00	4.21	0.13

Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)	Pressure (psi)2	Pressure (kPa)
8	0.00	58.89	107.56	48.68	69.22	477.24
2	0.00	58.55	107.59	49.04	69.73	480.78
1	41.66	57.98	107.54	49.56	70.47	485.84
28	0.00	56.43	107.36	50.93	72.42	499.34
29	0.00	56.42	107.36	50.94	72.44	499.45
17	14.79	55.96	107.08	51.12	72.70	501.23
22	12.47	55.95	107.08	51.13	72.71	501.32
23	0.00	56.00	107.14	51.14	72.72	501.41
18	8.76	56.01	107.15	51.15	72.73	501.43
25	7.99	56.17	107.33	51.16	72.74	501.54
15	0.00	56.00	107.19	51.19	72.78	501.82
16	0.00	55.98	107.19	51.21	72.82	502.05
32	14.67	55.87	107.08	51.21	72.82	502.06
33	9.96	55.93	107.15	51.22	72.83	502.16
30	6.55	56.11	107.38	51.27	72.91	502.68
11	2.33	55.73	107.18	51.44	73.15	504.36
12	1.35	55.72	107.18	51.46	73.18	504.55
5	9.12	56.08	107.56	51.48	73.21	504.75
6	18.34	55.74	107.42	51.67	73.48	506.62
9	8.91	52.36	107.36	55.01	78.22	539.29

Link Results - Peak Hour

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1001	Albert_8	2	7.98	297.00	120.00	41.66	0.60
1002	5	Albert_7	99.73	297.00	120.00	-20.30	0.29
1003	5	6	143.55	204.00	110.00	11.18	0.34
1004	8	Albert_6	19.71	204.00	110.00	-16.07	0.49
1005	6	8	74.71	204.00	110.00	-16.07	0.49
1006	9	6	84.55	204.00	110.00	-8.91	0.27
1008	12	11	15.52	204.00	110.00	2.33	0.07
1009	16	12	59.34	204.00	110.00	3.68	0.11
1010	15	Wellington_1	63.13	204.00	110.00	-21.72	0.66
1011	16	15	5.45	297.00	120.00	-3.68	0.05
1012	17	15	42.92	204.00	110.00	-18.04	0.55
C3	32	33	68.12	204.00	110.00	-11.42	0.35
1017	23	22	46.88	204.00	110.00	12.47	0.38
1018	25	Wellington_2	13.71	204.00	110.00	-27.96	0.86
C2	17	32	42.82	204.00	110.00	3.25	0.10
1020	28	Booth_4	95.52	204.00	110.00	-13.64	0.42
1022	30	29	21.74	204.00	110.00	9.01	0.28
1023	Wellington_3	30	12.02	204.00	110.00	15.56	0.48
C1	2	1	34.20	297.00	120.00	41.66	0.60
C4	33	18	73.85	204.00	110.00	-1.42	0.04
C6	25	33	60.97	204.00	110.00	19.97	0.61
C11	23	18	8.86	204.00	110.00	-12.47	0.38
C12	29	28	3.77	297.00	120.00	9.01	0.13
C13	28	18	58.08	204.00	110.00	22.65	0.69

Fire Flow Results - Max Day + 200 L/s

ID	Static Demand (L/s)	Static Pressure (m)	Static Pressure (psi)	Static Pressure (kPa)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (m)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
9	4.09	57.52	81.79	563.92	109.88	200.00	31.74	45.13	322.3	20
11	0.43	49.52	70.42	485.50	105.25	200.00	27.59	39.23	528.0	20
12	0.00	49.54	70.44	485.68	105.25	200.00	30.86	43.88	562.1	20
17	6.15	49.47	70.35	485.05	105.43	200.00	41.96	59.66	770.8	20
32	6.78	49.83	70.86	488.58	105.70	200.00	42.36	60.23	817.6	20
22	5.72	50.69	72.08	496.96	106.64	200.00	32.96	46.87	828.9	20
6	8.45	54.15	76.99	530.85	109.89	200.00	46.51	66.13	982.2	20
8	0.00	51.01	72.54	500.14	109.90	200.00	48.17	68.50	1000.7	20
33	4.65	50.40	71.67	494.13	106.33	200.00	46.38	65.96	1099.9	20
25	3.63	50.29	71.51	493.03	106.46	200.00	48.27	68.64	1229.8	20
23	0.00	50.66	72.03	496.64	106.65	200.00	43.13	61.33	1339.5	20
18	4.05	50.65	72.02	496.57	106.66	200.00	45.05	64.07	1418.8	20
16	0.00	49.28	70.07	483.11	105.25	200.00	43.11	61.29	1457.7	20
15	0.00	49.25	70.04	482.88	105.25	200.00	43.24	61.48	1542.9	20
30	2.98	51.00	72.52	500.01	107.11	200.00	49.51	70.40	1554.9	20
29	0.00	50.71	72.10	497.12	107.13	200.00	48.45	68.90	1860.3	20
28	0.00	50.70	72.09	497.02	107.13	200.00	48.44	68.88	1914.8	20
5	4.35	53.91	76.65	528.50	109.98	200.00	51.76	73.60	2138.8	20
1	19.26	52.00	73.95	509.85	109.98	200.00	50.61	71.96	2882.5	20
2	0.00	51.45	73.16	504.39	110.00	200.00	51.18	72.78	7042.4	20

Appendix C Sanitary Servicing

C.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION:
LeBreton Flats
Draft Plan of Subdivision

DATE: 2024-07-23
REVISION: 1
DESIGNED BY: AR
CHECKED BY: MW

FILE NUMBER: 160401780

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8	HOTEL	225 l/bedspace/day	BEDSPACE/HOTEL UNIT	2.00

LOCATION			RESIDENTIAL AREA AND POPULATION									HOTEL			
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	UNITS	BEDSPACE	ACCU. BED	PEAK FLOW (l/s)
R5A	SAN 5	SAN 4	1.20	0	74	302	743	1.20	743	3.30	8.0	104	208	208	0.8
R4A	SAN 4	SAN 3	2.04	0	160	774	1825	3.24	2569	3.00	25.0	0	0	208	0.8
R3AA	SAN 3A	SAN 3	0.21	0	0	381	686	0.21	686	3.32	7.4	0	0	0	0.0
C3A	SAN 3	SAN 2	0.00	0	0	0	0	3.45	3254	2.93	30.9	0	0	208	0.8
R2A	SAN 2	SAN 1	0.56	0	46	403	850	4.01	4104	2.86	38.0	0	0	208	0.8
C15A	SAN 15	SAN 14	0.00	0	0	0	0	0.00	0	3.80	0.0	0	0	0	0.0
	SAN 14	SAN 13	0.00	0	0	0	0	0.00	0	3.80	0.0			0	0.0
G13A	SAN 13	SAN 11	0.00	0	0	0	0	0.00	0	3.80	0.0	0	0	0	0.0
G11AA	SAN 11A	SAN 11	0.00	0	0	0	0	0.00	0	3.80	0.0	0	0	0	0.0
See Note 2. below	SAN 11	SAN 10	0.00	0	0	0	0	0.00	0	3.80	0.0	0	0	0	0.0
R10A, R10B	SAN 10	SAN 9	2.22	0	10	571	1055	2.22	1055	3.23	11.0	101	201	201	0.8
R18A, R18B	SAN 18	SAN 17	2.41	0	0	896	1613	2.41	1613	3.13	16.3	101	201	201	0.8
	SAN 17	SAN 17A	0.00	0	0	0	0	2.41	1613	3.13	16.3	0	0	201	0.8
R8A	SAN 9	SAN 7	0.91	0	0	473	851	0.91	851	3.28	9.0	0	0	0	0.0
R7A	SAN 7	SAN 6	0.80	0	10	348	653	1.71	1505	3.14	15.3	0	0	0	0.0
	SAN 6	SAN 6A	0.00	0	0	0	0	1.71	1505	3.14	15.3	0	0	0	0.0
									4172	2.85	38.6				
					300	**4148**	**8276**		**8276**						

LOCATION			PARKS				COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	POP.	ACCU. POP.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
R5A	SAN 5	SAN 4	0.00	0	0	0.00	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R4A	SAN 4	SAN 3	0.00	0	0	0.00	0.11	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R3AA	SAN 3A	SAN 3	0.00	0	0	0.00	0.29	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3A	SAN 3	SAN 2	0.00	0	0	0.00	0.18	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2A	SAN 2	SAN 1	0.00	0	0	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C15A	SAN 15	SAN 14	0.00	0	0	0.00	2.67	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SAN 14	SAN 13	0.00	0	0	0.00	0.00	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G13A	SAN 13	SAN 11	2.48	459	459	0.13	0.00	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G11AA	SAN 11A	SAN 11	6.84	1268	1268	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
See Note 2. below	SAN 11	SAN 10	0.00	0	1727	0.50	0.00	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R10A, R10B	SAN 10	SAN 9	0.00	0	0	0.00	0.20	2.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R18A, R18B	SAN 18	SAN 17	0.00	0	0	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SAN 17	SAN 17A		0	0	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R8A	SAN 9	SAN 7	0.00	0	0	0.00	2.92	2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R7A	SAN 7	SAN 6	0.00	0	0	0.00	0.00	2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SAN 6	SAN 6A		0	0	0.00	0.00	2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							6.04									

LOCATION			C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)
R5A	SAN 5	SAN 4	0.0	1.20	1.20	0.4	9.2	29.6	250	PVC	SDR 35	0.40	38.3	**23.98%**	0.77
R4A	SAN 4	SAN 3	0.1	2.04	3.24	1.1	26.9	184.2	250	PVC	SDR 35	0.40	38.3	**70.17%**	0.77
R3AA	SAN 3A	SAN 3	0.2	0.21	0.21	0.1	7.7	38.8	250	PVC	SDR 35	0.40	38.3	**20.03%**	0.77
C3A	SAN 3	SAN 2	0.2	0.46	3.91	1.3	33.2	59.8	300	PVC	SDR 35	0.30	52.6	**63.16%**	0.75
R2A	SAN 2	SAN 1	0.2	0.56	4.47	1.5	40.5	88.2	300	PVC	SDR 35	0.30	52.6	**77.06%**	0.75
C15A	SAN 15	SAN 14	1.3	1.02	1.02	0.3	1.6	4.6	250	PVC	SDR 35	0.70	50.7	**3.22%**	1.02
	SAN 14	SAN 13	1.3	0.00	1.02	0.3	1.6	53.4	250	PVC	SDR 35	0.50	42.9	**3.81%**	0.86
G13A	SAN 13	SAN 11	1.3	2.48	3.50	1.2	2.6	38.9	250	PVC	SDR 35	0.38	37.4	**6.91%**	0.75
G11AA	SAN 11A	SAN 11	0.0	6.84	6.84	2.3	2.6	63.9	300	PVC	SDR 35	0.41	61.5	**4.27%**	0.87
See Note 2. below	SAN 11	SAN 10	1.3	0.00	10.34	3.4	5.2								
R10A, R10B	SAN 10	SAN 9	1.4	2.22	12.56	4.1	17.4	104.2	250	PVC	SDR 35	0.40	38.3	**45.27%**	0.77
R18A, R18B	SAN 18	SAN 17	0.1	2.41	2.41	0.8	18.0	49.1	300	PVC	SDR 35	1.00	96.0	**18.75%**	1.36
	SAN 17	SAN 17A	0.1	0.00	2.41	0.8	18.0	15.9	300	PVC	SDR 35	1.00	96.0	**18.75%**	1.36
R8A	SAN 9	SAN 7	1.4	0.91	0.91	0.3	10.8	87.7	250	PVC	SDR 35	0.30	33.2	**32.39%**	0.67
R7A	SAN 7	SAN 6	1.4	0.80	1.71	0.6	17.3	64.4	250	PVC	SDR 35	0.30	33.2	**52.12%**	0.67
	SAN 6	SAN 6A	1.4	0.00	1.71	0.6	17.3	16.2	250	PVC	SDR 35	0.30	33.2	**52.12%**	0.67
			2.9		16.69	5.5	**52.7**								
					21.16		**93.2**								

1. Sanitary manhole numbers taken from functional sanitary servicing plan Drawing SAN-1 attached as part of submission package.
2. PPS for proposed pumping station to service Blocks 17-19 and located upstream of SAN 11 with forcemain connecting SAN 11 to SAN 10; outflow from PPS assumed to be the same as intake flow
3. Hotel bedspace assumed to be 2 bedspace/room per LeBreton Flats MSS (CIMA+ 2021)
4. Block 12 hotel unit counts estimated based on density of hotel room/gross floor area (201 rooms/9450 m²) established for Block 2 in density table.
5. Park area population estimated based on 185.3 persons/ha density in LeBreton Flats MSS (CIMA+ 2021); 20 L/p/d demand based on park picnic and flush toilet demands

C.2 Proposed Preliminary Pump Station Design Memo

Stantec

Memo

To:	Peter Moroz, P.Eng.	From:	Gregory Chochlinski, P. Eng. Stantec, Ottawa
Project/File:	160401780	Date:	July 23, 2024

Reference: LeBreton Flats Subdivision Sewage PS – Functional Design

INTRODUCTION

Further to your request we prepared a Functional Design and location options for the proposed Sewage PS at LeBreton Flats. We understand that this Memo will be reviewed by the stakeholders and one of the two options will be selected to advance to the preliminary design.

We understand that the proposed PS would receive a peak flow of about 3.6 L/s but we propose a pumping rate of about 7.0 L/s through 100 mm diameter forcemain to maintain self-cleaning velocity of 0.90 m/s. Twin forcemains are proposed for redundancy, as per the City guidelines. After construction and commissioning the PS will be taken over and operated by the City of Ottawa.

Two location options are presented and evaluated in this Memo:

Option 1: PS location close to LRT corridor (south of the arch bridge)

Option 2: PS location north of the arch bridge

In both cases the twin discharge forcemains would need to be installed under the existing LRT tracks using trenchless construction method.

Refer to the **Attachment** for the proposed plan and profile drawings for two options.

PS DESIGN COMPONENTS

The proposed PS will be a wet well type with two submersible pumps, one duty, one standby, with the following components:

- Prefabricated Fiberglass wet well, 2.4 m diameter (minimum size acceptable to the City)
- Inlet sewer 250 mm dia. with an isolation valve and trash basket
- Two submersible sewage pumps capable of pumping about 7.0 L/s
- Twin forcemains, 100 mm dia. each (HDPE/PVC, SS inside the swabbing chamber)
- Bypass MH (upstream of the wet well) to allow bypassing the wet well during inspections/repairs or emergency situations
- Swabbing/Bypass Chamber d/s of the wet well
- Precast concrete control building with HVAC, for process, electrical and SCADA equipment
- Permanent power supply
- Soft starters for well pumps
- Standby Power: Generator (diesel or natural gas)

- SCADA control and communication

The Swabbing/Bypass Chamber downstream of the wet well will have the following components:

- Swab launcher at each of the two 100 mm forcemains (FMs)
- 75 mm Bypass Connections with isolation valves at each of the two FMs
- Flowmeters at each of the two FMs
- Isolation valves at entry and exist within the chamber
- Drain valves and sump pit (gravity drain back to the well could be an option)

The PS facility with be equipped with the following:

- Security fence, 2.4 m tall with a sliding access gate 4.0 m wide.
- Asphalt access road and parking (2 spots) with a turning point
- Granular or asphalt walkways to the control building and generator
- Protective bollards
- Yard hydrant and flow metering chamber (if connection to the City water supply system is possible). Or water trucks will be used when occasional cleanup of the wet well is required.

TRENCHLESS CROSSING OF LRT CORRIDOR

The proposed 100 mm dia. twin FMs will cross the existing LRT corridor using trenchless construction method. More detailed geotechnical evaluation is required to determine the most suitable trenchless method, installation depth, allowable vibration and settlement limits etc.

At this point it appears that a 600 mm dia. casing installed by pipe ramming might be a suitable option. The pipe material for two 100 mm FMs crossing the LRT inside the casing are anticipated to be HDPE. The casing would be grouted or filled with blown-in sand after the installation of FMs.

REVIEW OF PROPOSED LOCATION OPTIONS

In both options part of the arch of the existing old bridge would need to be removed to allow installation of pipes. The first 10 m of the arch bridge will remain intact as it is considered a heritage structure. The remaining portion of the arch bridge (about 20 m) is already abandoned, buried and filled with stone under the arch. The proposed open cut will remove a section of the abandoned arch for installation of the FMs/sewer/access road.

In both options the proposed new pipes will cross above the existing 1,650 mm dia. watermain, this will greatly reduce the risk of any damage to the watermain.

The pros and cons of two options are presented below:

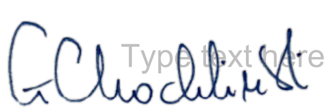
Description	Option 1: PS near the LRT	Option 2: PS north of arch bridge
PS Layout	Simpler	More complicated
Lot size requirement	Approx. 14.0 x 23.0 m	Approx. 20.0 x 20.0 m (irreg.)

Pipe alignment	Simple, straight, FM easier to swab. Only one pipe (gravity sewer) crossing the arch bridge. Swabbing connection might not be needed as the short FM could be cleaned with water jets from the MH side, if ever needed.	Longer, more bends for FM, more difficult to swab. Three pipes crossing the arch bridge.
Access Road	Longer access road needed, wider cut at arch bridge needed	Short road, no road over the arch bridge
Water Supply and YH for cleaning	Longer water line needed (water truck could be more economical for occasional cleaning of wet well)	Shorter line, from the new development
Trenchless crossing of LRT	Same	Same
Power Supply	Likely from Street 5, to be designed as part of the plan of subdivision.	Likely from Street 5, to be designed as part of the plan of subdivision
Property/easement acquisition issues	On the NCC property to be conveyed to the City of Ottawa for City park.	On the NCC property to be conveyed to the City of Ottawa for City park

Please let us know if you have any comments or questions. We look forward to discussing this Memo with all interested parties and stakeholders.

Regards,

STANTEC CONSULTING LTD.



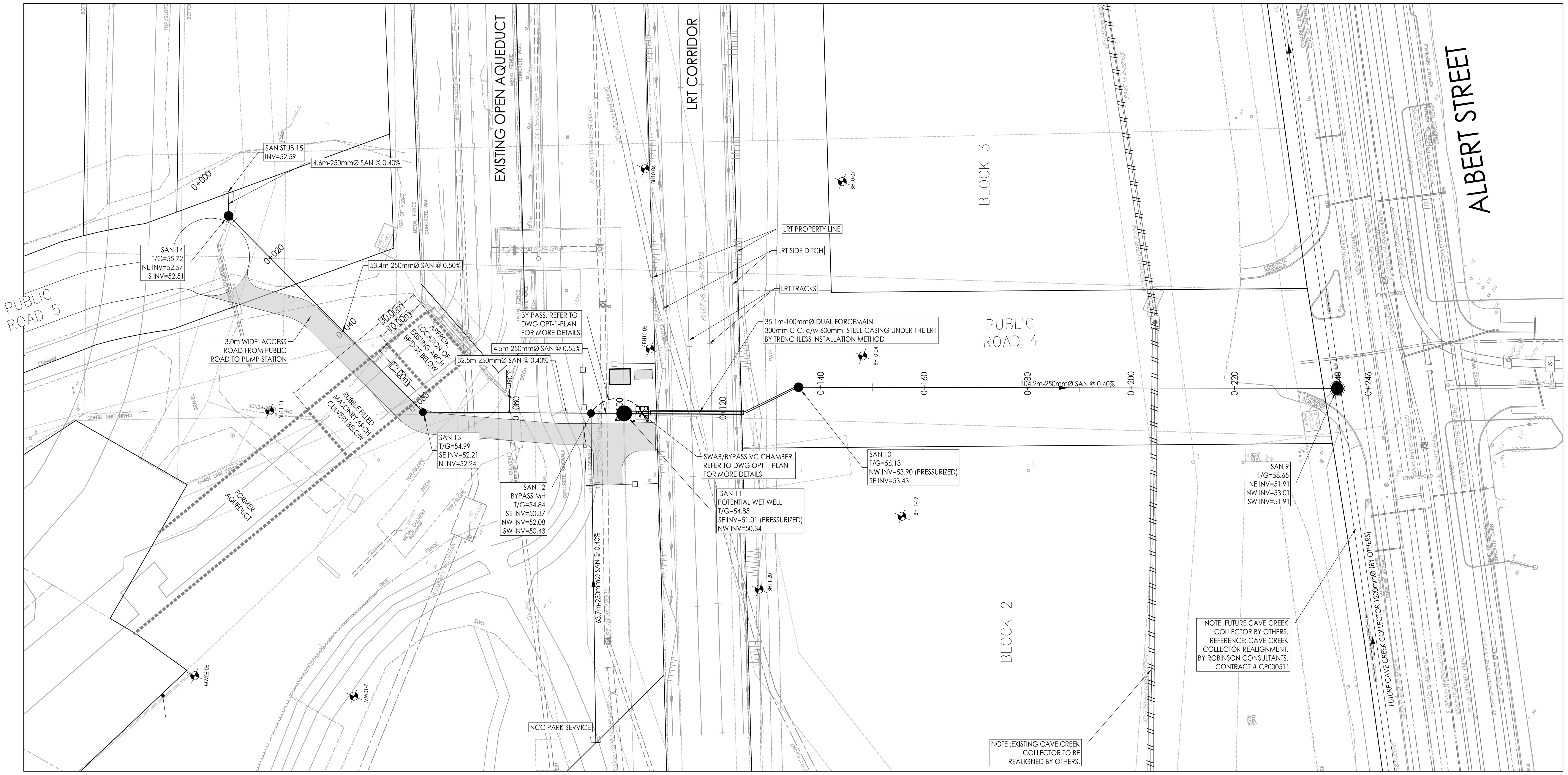
Gregory Chochlinski P.Eng., M.Eng.
Senior Associate
Mobile: 613-290-2322
gregory.chochlinski@stantec.com
stantec.com

Attachments:

1. Functional Design Drawings – Plan and Profile – Option 1 and 2

Attachment 1

Functional Design Drawings



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Notes

1. APPROXIMATE DEPTH OF BEDROCK RETRIEVED FROM GEOTECHNICAL REPORT BY STANTEC CONSULTING, TITLED GEOTECHNICAL DESKTOP REVIEW, LEBRETON FLATS PLAN OF SUBDIVISION, OTTAWA, ONTARIO, PREPARED FOR NATIONAL CAPITAL COMMISSION, DATED MAY 7, 2024
2. LRT DESIGN LAYOUT RETRIEVED FROM: MMM GROUP, DRAWING # REM-20-1-0000-DRD-2714, DATED: 2019-07-22
3. TOPOGRAPHIC SURVEY RETRIEVED FROM: STANTEC GEOMATICS LTD. PROJECT # 160401780-112, DATED AUGUST 31,2023
4. DRAFT PLAN RETRIEVED FROM: STANTEC GEOMATICS LTD. PROJECT # 160401780-112, DATED MARCH 12,2024

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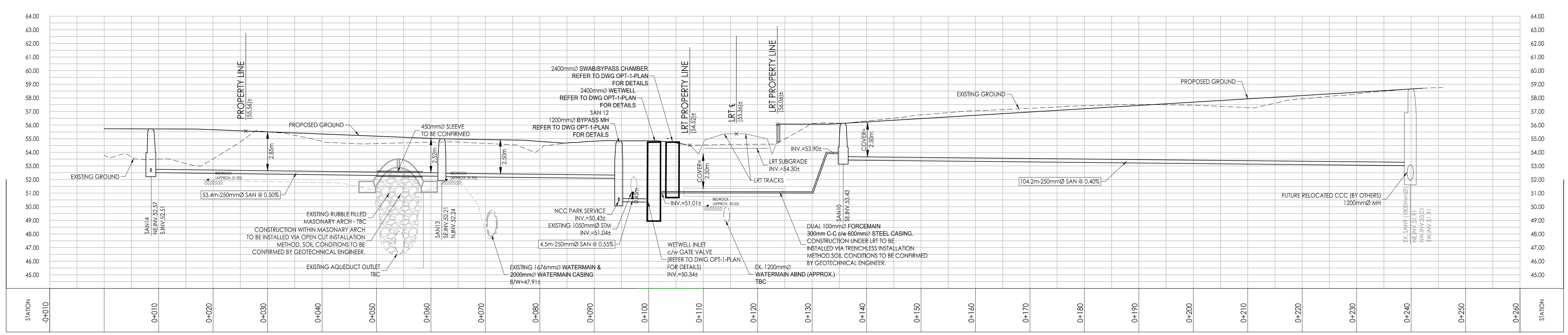

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Stantec

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Legend

- PROPOSED PUMP STATION
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN

1	DRAFT PLAN APPROVAL, 1ST SUBMISSION	JP	KS	24.07.19
Revision		By	Appd.	YY.MM.DD

File Name: 160401780-FSR.dwg	JP	DT	JP	24.06.10
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

PRELIMINARY
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Client/Project

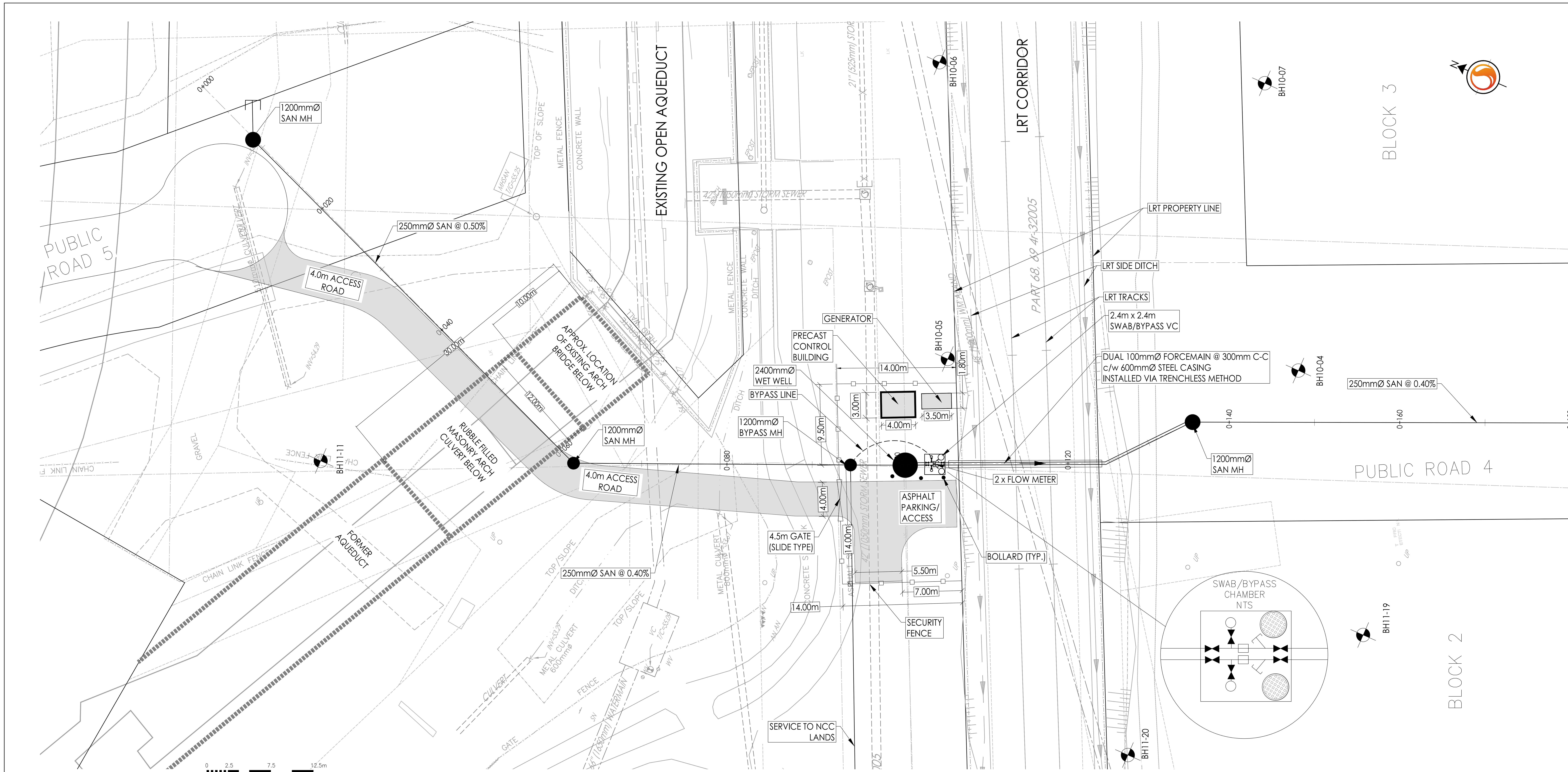
NCC (NATIONAL CAPITAL COMMISSION)
40 Elgin Street, Suite 202
OTTAWA, ON, K1P 1C7

LEBRETON FLATS DRAFT PLAN OF SUBDIVISION

Title

SANITARY PUMP STATION
OPTION 1

Project No.	Scale	
160401780		
Drawing No.	Sheet	Revision
OPT-1	1 of 3	1



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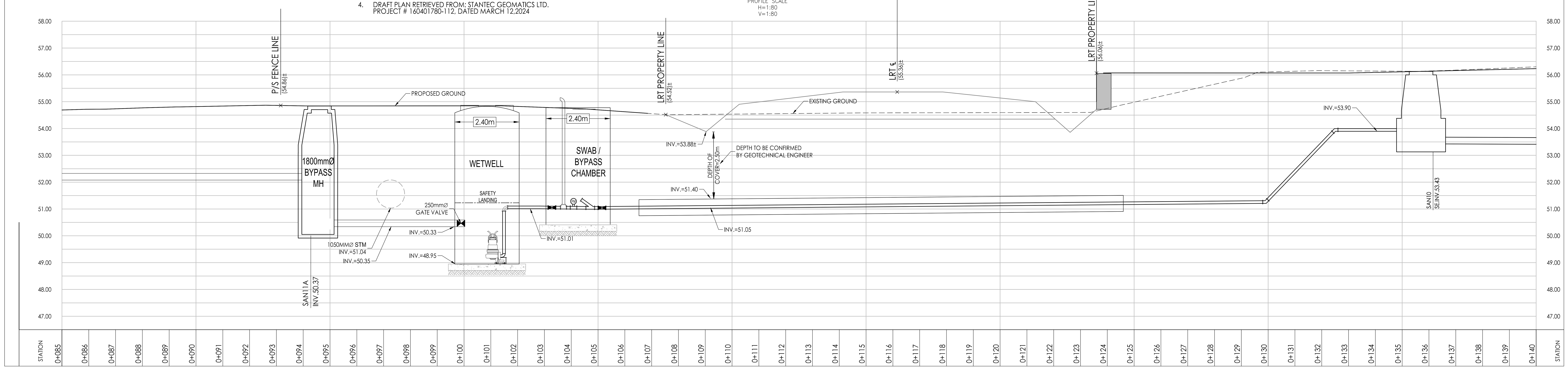

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Legend

- CONCEPTUAL PUMP STATION
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN

Notes

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File Name: 160401780-FSR.dwg	JP	DT	JP	24.06.10
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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LEBRETON FLATS DRAFT PLAN OF SUBDIVISION

Title
SANITARY PUMP STATION
OPTION 1-PLAN

Project No.	Scale	
160401780		
Drawing No.	Sheet	Revision
OPT-1P	2 of 3	1

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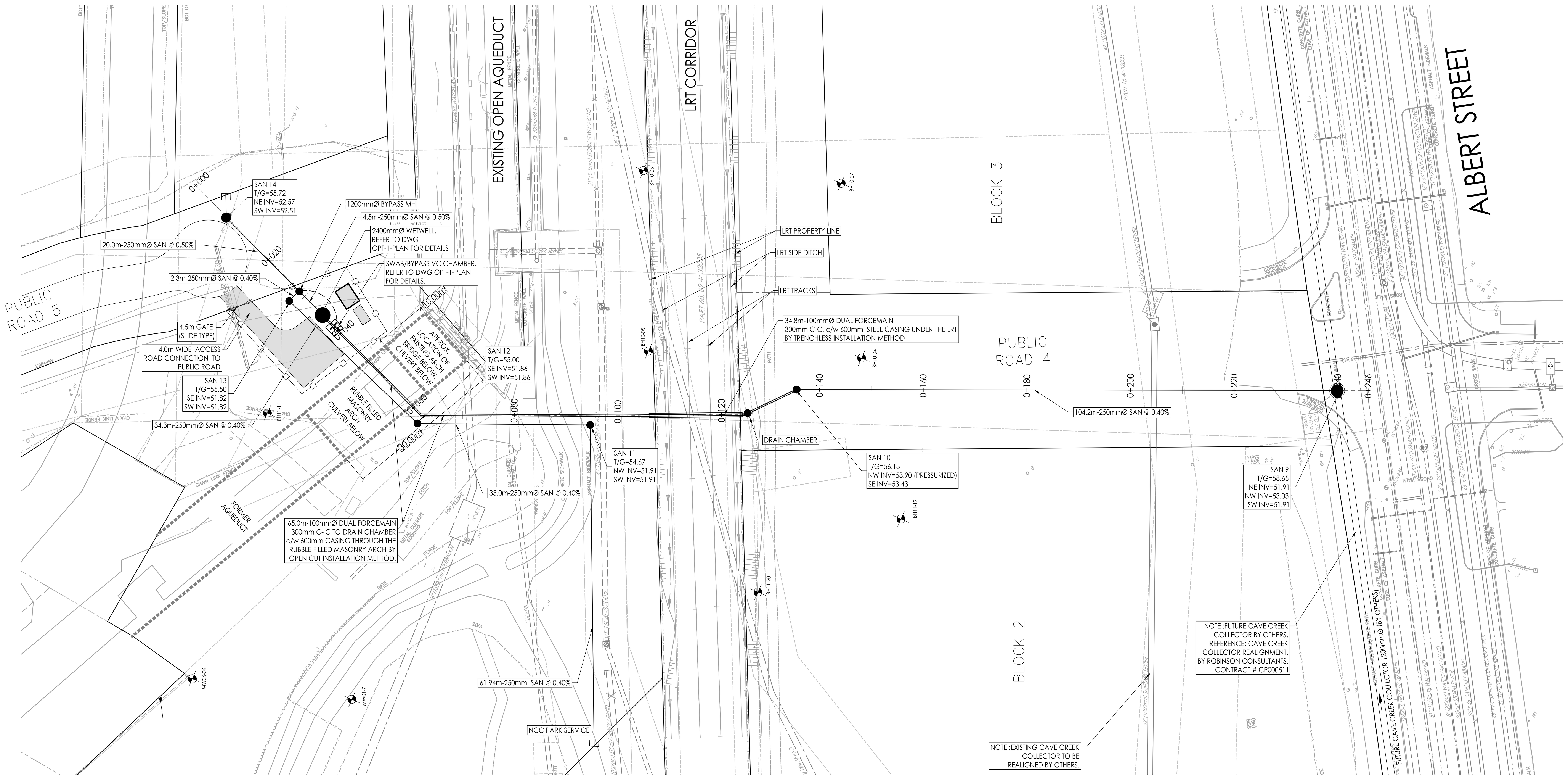

Notes

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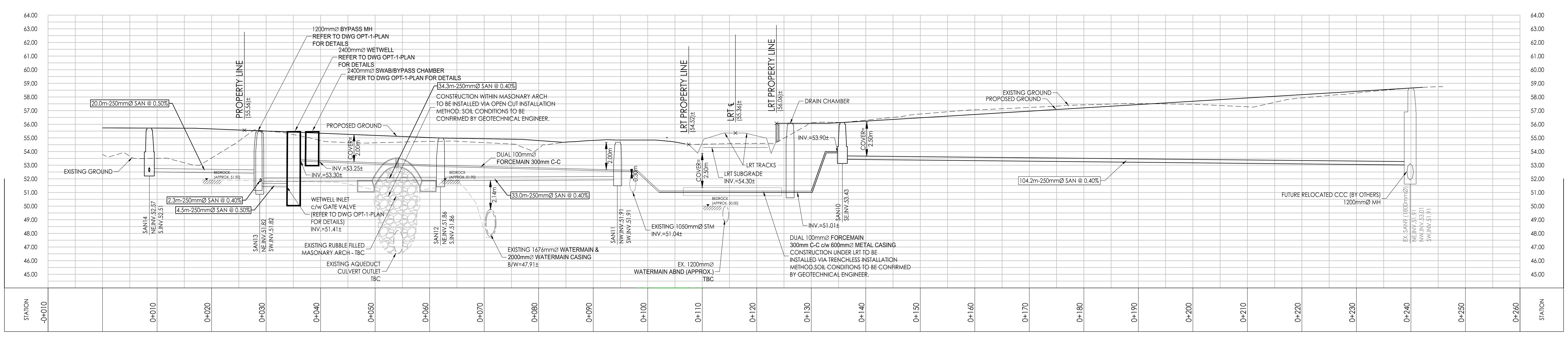

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LEBRETON FLATS DRAFT PLAN OF SUBDIVISION

Title

SANITARY PUMP STATION
OPTION 2

Project No. 160401780
Scale

Drawing No. OPT-2
Sheet 3 of 3
Revision 1

Appendix D Stormwater Management

D.1 Modified Rational Method Calculations

Stormwater Management Calculations

File No: **160401780**
Project: **LeBreton Flats**
Date: **23-May-24**

SWM Approach:
Post-development to 5-yr Storm C=0.7, Tc=10min

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Catchment Type	**Sub-catchment Area ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**		**"A x C"**	**Overall Runoff Coefficient**
Controlled - Tributary	BLK-17	Hard	0.827		0.9	0.744		
		Soft	0.064		0.2	0.013		
		Subtotal		0.89			0.757	0.850
Controlled - Tributary	BLK-15	Hard	0.308		0.9	0.277		
		Soft	0.024		0.2	0.005		
		Subtotal		0.33			0.282	0.850
Controlled - Tributary	BLK-14	Hard	0.278		0.9	0.250		
		Soft	0.021		0.2	0.004		
		Subtotal		0.30			0.255	0.850
Controlled - Tributary	BLK-13	Hard	0.253		0.9	0.228		
		Soft	0.019		0.2	0.004		
		Subtotal		0.27			0.232	0.850
Controlled - Tributary	BLK-12	Hard	0.235		0.9	0.212		
		Soft	0.018		0.2	0.004		
		Subtotal		0.25			0.215	0.850
Controlled - Tributary	BLK-11	Hard	0.263		0.9	0.237		
		Soft	0.020		0.2	0.004		
		Subtotal		0.28			0.241	0.850
Controlled - Tributary	BLK-10	Hard	0.222		0.9	0.200		
		Soft	0.017		0.2	0.003		
		Subtotal		0.24			0.203	0.850
Controlled - Tributary	BLK-9	Hard	0.409		0.9	0.368		
		Soft	0.031		0.2	0.006		
		Subtotal		0.44			0.374	0.850
Controlled - Tributary	BLK-8	Hard	0.317		0.9	0.285		
		Soft	0.024		0.2	0.005		
		Subtotal		0.34			0.290	0.850
Controlled - Tributary	BLK-7	Hard	0.410		0.9	0.369		
		Soft	0.032		0.2	0.006		
		Subtotal		0.44			0.375	0.850
Controlled - Tributary	BLK-6	Hard	0.285		0.9	0.257		
		Soft	0.022		0.2	0.004		
		Subtotal		0.31			0.261	0.850
Controlled - Tributary	BLK-5	Hard	0.368		0.9	0.331		
		Soft	0.028		0.2	0.006		
		Subtotal		0.40			0.337	0.850
Controlled - Tributary	BLK-4	Hard	0.371		0.9	0.334		
		Soft	0.029		0.2	0.006		
		Subtotal		0.40			0.340	0.850
Controlled - Tributary	BLK-3	Hard	0.463		0.9	0.416		
		Soft	0.036		0.2	0.007		
		Subtotal		0.50			0.424	0.850
Controlled - Tributary	BLK-2	Hard	2.521		0.9	2.269		
		Soft	0.194		0.2	0.039		
		Subtotal		2.71			2.307	0.850
Controlled - Tributary	BLK-1	Hard	0.838		0.9	0.755		
		Soft	0.064		0.2	0.013		
		Subtotal		0.90			0.768	0.850
Total				**9.01**			**7.661**	
Overall Runoff Coefficient= C:								**0.85**

Total Roof Areas	**0.000**	**ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**9.013**	**ha**
Total Tributary Area to Outlet	**9.013**	**ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000**	**ha**
Total Site	**9.013**	**ha**

Stormwater Management Calculations

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

5 yr Intensity $I = a/(t + b)^c$
City of Ottawa

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
10	104.19
20	70.25
30	53.93
40	44.18
50	37.65
60	32.94
70	29.37
80	26.56
90	24.29
100	22.41
110	20.82
120	19.47

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLK-17 Controlled - Tributary
Area (ha): 0.89
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	219.33	180.62	38.71	**23.22**
20	70.25	147.88	147.88	0.00	0.00
30	53.93	113.52	113.52	0.00	0.00
40	44.18	93.01	93.01	0.00	0.00
50	37.65	79.26	79.26	0.00	0.00
60	32.94	69.35	69.35	0.00	0.00
70	29.37	61.83	61.83	0.00	0.00
80	26.56	55.91	55.91	0.00	0.00
90	24.29	51.13	51.13	0.00	0.00
100	22.41	47.17	47.17	0.00	0.00
110	20.82	43.83	43.83	0.00	0.00
120	19.47	40.98	40.98	0.00	0.00

Storage: Block 17 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.89	0.70	10.00	104.19	180.62

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
23.22	157.00	OK	133.78

Subdrainage Area: BLK-15 Controlled - Tributary
Area (ha): 0.33
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	81.66	67.25	14.41	**8.65**
20	70.25	55.06	55.06	0.00	0.00
30	53.93	42.27	42.27	0.00	0.00
40	44.18	34.63	34.63	0.00	0.00
50	37.65	29.51	29.51	0.00	0.00
60	32.94	25.82	25.82	0.00	0.00
70	29.37	23.02	23.02	0.00	0.00
80	26.56	20.82	20.82	0.00	0.00
90	24.29	19.04	19.04	0.00	0.00
100	22.41	17.56	17.56	0.00	0.00
110	20.82	16.32	16.32	0.00	0.00
120	19.47	15.26	15.26	0.00	0.00

Storage: Block 15 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.33	0.70	10.00	104.19	67.25

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
8.65	59.00	OK	50.35

Subdrainage Area: BLK-14 Controlled - Tributary
Area (ha): 0.30
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	73.74	60.72	13.01	**7.81**
20	70.25	49.72	49.72	0.00	0.00
30	53.93	38.16	38.16	0.00	0.00
40	44.18	31.27	31.27	0.00	0.00
50	37.65	26.65	26.65	0.00	0.00
60	32.94	23.31	23.31	0.00	0.00
70	29.37	20.79	20.79	0.00	0.00
80	26.56	18.80	18.80	0.00	0.00
90	24.29	17.19	17.19	0.00	0.00
100	22.41	15.86	15.86	0.00	0.00
110	20.82	14.74	14.74	0.00	0.00
120	19.47	13.78	13.78	0.00	0.00

Storage: Block 14 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.30	0.70	10.00	104.19	60.72

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
7.81	53.00	OK	45.19

Subdrainage Area: BLK-13 Controlled - Tributary
Area (ha): 0.27
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	67.21	55.35	11.86	**7.12**
20	70.25	45.32	45.32	0.00	0.00
30	53.93	34.79	34.79	0.00	0.00
40	44.18	28.50	28.50	0.00	0.00
50	37.65	24.29	24.29	0.00	0.00
60	32.94	21.25	21.25	0.00	0.00
70	29.37	18.95	18.95	0.00	0.00
80	26.56	17.13	17.13	0.00	0.00
90	24.29	15.67	15.67	0.00	0.00
100	22.41	14.45	14.45	0.00	0.00
110	20.82	13.43	13.43	0.00	0.00
120	19.47	12.56	12.56	0.00	0.00

Storage: Block 13 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.27	0.70	10.00	104.19	55.35

Onsite Storage

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

100 yr Intensity $I = a/(t + b)^c$
City of Ottawa

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLK-17 Controlled - Tributary
Area (ha): 0.89
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	442.20	180.62	261.58	**156.95**
20	119.95	297.06	180.62	116.43	139.72
30	91.87	227.51	180.62	46.89	84.40
40	75.15	186.10	180.62	5.47	13.14
50	63.95	158.38	158.38	0.00	0.00
60	55.89	138.42	138.42	0.00	0.00
70	49.79	123.30	123.30	0.00	0.00
80	44.99	111.42	111.42	0.00	0.00
90	41.11	101.81	101.81	0.00	0.00
100	37.90	93.87	93.87	0.00	0.00
110	35.20	87.18	87.18	0.00	0.00
120	32.89	81.46	81.46	0.00	0.00

Storage: Block 17 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.89	0.70	10.00	104.19	180.62

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
156.95	157.00	OK	0.05

Subdrainage Area: BLK-15 Controlled - Tributary
Area (ha): 0.33
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	164.64	67.25	97.39	**58.44**
20	119.95	110.60	67.25	43.35	52.02
30	91.87	84.71	67.25	17.46	31.42
40	75.15	69.29	67.25	2.04	4.89
50	63.95	58.97	58.97	0.00	0.00
60	55.89	51.54	51.54	0.00	0.00
70	49.79	45.91	45.91	0.00	0.00
80	44.99	41.48	41.48	0.00	0.00
90	41.11	37.91	37.91	0.00	0.00
100	37.90	34.95	34.95	0.00	0.00
110	35.20	32.46	32.46	0.00	0.00
120	32.89	30.33	30.33	0.00	0.00

Storage: Block 15 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.33	0.70	10.00	104.19	67.25

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
58.44	59.00	OK	0.56

Subdrainage Area: BLK-14 Controlled - Tributary
Area (ha): 0.30
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	148.67	60.72	87.94	**52.76**
20	119.95	99.87	60.72	39.14	46.97
30	91.87	76.49	60.72	15.76	28.37
40	75.15	62.56	60.72	1.84	4.42
50	63.95	53.25	53.25	0.00	0.00
60	55.89	46.54	46.54	0.00	0.00
70	49.79	41.45	41.45	0.00	0.00
80	44.99	37.46	37.46	0.00	0.00
90	41.11	34.23	34.23	0.00	0.00
100	37.90	31.56	31.56	0.00	0.00
110	35.20	29.31	29.31	0.00	0.00
120	32.89	27.39	27.39	0.00	0.00

Storage: Block 14 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.30	0.70	10.00	104.19	60.72

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
52.76	53.00	OK	0.24

Subdrainage Area: BLK-13 Controlled - Tributary
Area (ha): 0.27
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	135.51	55.35	80.16	**48.09**
20	119.95	91.03	55.35	35.68	42.82
30	91.87	69.72	55.35	14.37	25.86
40	75.15	57.03	55.35	1.68	4.03
50	63.95	48.53	48.53	0.00	0.00
60	55.89	42.42	42.42	0.00	0.00
70	49.79	37.78	37.78	0.00	0.00
80	44.99	34.14	34.14	0.00	0.00
90	41.11	31.20	31.20	0.00	0.00
100	37.90	28.76	28.76	0.00	0.00
110	35.20	26.71	26.71	0.00	0.00
120	32.89	24.96	24.96	0.00	0.00

Storage: Block 13 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.27	0.70	10.00	104.19	55.35

Onsite Storage

Stormwater Management Calculations

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
7.12	49.00	OK	41.88

Subdrainage Area: BLK-12 Controlled - Tributary
Area (ha): 0.25
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	62.37	51.37	11.01	**6.60**
20	70.25	42.06	42.06	0.00	0.00
30	53.93	32.28	32.28	0.00	0.00
40	44.18	26.45	26.45	0.00	0.00
50	37.65	22.54	22.54	0.00	0.00
60	32.94	19.72	19.72	0.00	0.00
70	29.37	17.58	17.58	0.00	0.00
80	26.56	15.90	15.90	0.00	0.00
90	24.29	14.54	14.54	0.00	0.00
100	22.41	13.41	13.41	0.00	0.00
110	20.82	12.47	12.47	0.00	0.00
120	19.47	11.65	11.65	0.00	0.00

Storage: Block 12 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.25	0.70	10.00	104.19	51.37

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
6.60	45.00	OK	38.40

Subdrainage Area: BLK-11 Controlled - Tributary
Area (ha): 0.28
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	69.68	57.39	12.30	**7.38**
20	70.25	46.98	46.98	0.00	0.00
30	53.93	36.07	36.07	0.00	0.00
40	44.18	29.55	29.55	0.00	0.00
50	37.65	25.18	25.18	0.00	0.00
60	32.94	22.03	22.03	0.00	0.00
70	29.37	19.64	19.64	0.00	0.00
80	26.56	17.76	17.76	0.00	0.00
90	24.29	16.24	16.24	0.00	0.00
100	22.41	14.99	14.99	0.00	0.00
110	20.82	13.93	13.93	0.00	0.00
120	19.47	13.02	13.02	0.00	0.00

Storage: Block 11 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.28	0.70	10.00	104.19	57.39

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
7.38	50.00	OK	42.62

Subdrainage Area: BLK-10 Controlled - Tributary
Area (ha): 0.24
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	58.85	48.47	10.39	**6.23**
20	70.25	39.68	39.68	0.00	0.00
30	53.93	30.46	30.46	0.00	0.00
40	44.18	24.96	24.96	0.00	0.00
50	37.65	21.27	21.27	0.00	0.00
60	32.94	18.61	18.61	0.00	0.00
70	29.37	16.59	16.59	0.00	0.00
80	26.56	15.00	15.00	0.00	0.00
90	24.29	13.72	13.72	0.00	0.00
100	22.41	12.66	12.66	0.00	0.00
110	20.82	11.76	11.76	0.00	0.00
120	19.47	11.00	11.00	0.00	0.00

Storage: Block 10 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.24	0.70	10.00	104.19	48.47

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
6.23	43.00	OK	36.77

Subdrainage Area: BLK-9 Controlled - Tributary
Area (ha): 0.44
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	108.45	89.31	19.14	**11.48**
20	70.25	73.12	73.12	0.00	0.00
30	53.93	56.13	56.13	0.00	0.00
40	44.18	45.99	45.99	0.00	0.00
50	37.65	39.19	39.19	0.00	0.00
60	32.94	34.29	34.29	0.00	0.00
70	29.37	30.57	30.57	0.00	0.00
80	26.56	27.65	27.65	0.00	0.00
90	24.29	25.28	25.28	0.00	0.00
100	22.41	23.32	23.32	0.00	0.00
110	20.82	21.67	21.67	0.00	0.00
120	19.47	20.26	20.26	0.00	0.00

Storage: Block 9 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.44	0.70	10.00	104.19	89.31

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
11.48	78.00	OK	66.52

Subdrainage Area: BLK-8 Controlled - Tributary
Area (ha): 0.34
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	83.97	69.15	14.82	**8.89**
20	70.25	56.62	56.62	0.00	0.00

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
48.09	49.00	OK	0.91

Subdrainage Area: BLK-12 Controlled - Tributary
Area (ha): 0.25
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	125.76	51.37	74.39	**44.63**
20	119.95	84.48	51.37	33.11	39.73
30	91.87	64.70	51.37	13.33	24.00
40	75.15	52.92	51.37	1.56	3.74
50	63.95	45.04	45.04	0.00	0.00
60	55.89	39.37	39.37	0.00	0.00
70	49.79	35.07	35.07	0.00	0.00
80	44.99	31.69	31.69	0.00	0.00
90	41.11	28.95	28.95	0.00	0.00
100	37.90	26.69	26.69	0.00	0.00
110	35.20	24.79	24.79	0.00	0.00
120	32.89	23.17	23.17	0.00	0.00

Storage: Block 12 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.25	0.70	10.00	104.19	51.37

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
44.63	45.00	OK	0.37

Subdrainage Area: BLK-11 Controlled - Tributary
Area (ha): 0.28
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	140.49	57.39	83.10	**49.86**
20	119.95	94.38	57.39	36.99	44.39
30	91.87	72.28	57.39	14.90	26.81
40	75.15	59.12	57.39	1.74	4.17
50	63.95	50.32	50.32	0.00	0.00
60	55.89	43.98	43.98	0.00	0.00
70	49.79	39.17	39.17	0.00	0.00
80	44.99	35.40	35.40	0.00	0.00
90	41.11	32.35	32.35	0.00	0.00
100	37.90	29.82	29.82	0.00	0.00
110	35.20	27.70	27.70	0.00	0.00
120	32.89	25.88	25.88	0.00	0.00

Storage: Block 11 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.28	0.70	10.00	104.19	57.39

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
49.86	50.00	OK	0.14

Subdrainage Area: BLK-10 Controlled - Tributary
Area (ha): 0.24
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	118.65	48.47	70.19	**42.11**
20	119.95	79.71	48.47	31.24	37.49
30	91.87	61.05	48.47	12.58	22.65
40	75.15	49.93	48.47	1.47	3.52
50	63.95	42.50	42.50	0.00	0.00
60	55.89	37.14	37.14	0.00	0.00
70	49.79	33.09	33.09	0.00	0.00
80	44.99	29.90	29.90	0.00	0.00
90	41.11	27.32	27.32	0.00	0.00
100	37.90	25.19	25.19	0.00	0.00
110	35.20	23.39	23.39	0.00	0.00
120	32.89	21.86	21.86	0.00	0.00

Storage: Block 10 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.24	0.70	10.00	104.19	48.47

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
42.11	43.00	OK	0.89

Subdrainage Area: BLK-9 Controlled - Tributary
Area (ha): 0.44
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	218.66	89.31	129.34	**77.61**
20	119.95	146.89	89.31	57.57	69.09
30	91.87	112.50	89.31	23.18	41.73
40	75.15	92.02	89.31	2.71	6.50
50	63.95	78.32	78.32	0.00	0.00
60	55.89	68.45	68.45	0.00	0.00
70	49.79	60.97	60.97	0.00	0.00
80	44.99	55.09	55.09	0.00	0.00
90	41.11	50.34	50.34	0.00	0.00
100	37.90	46.41	46.41	0.00	0.00
110	35.20	43.11	43.11	0.00	0.00
120	32.89	40.28	40.28	0.00	0.00

Storage: Block 9 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.44	0.70	10.00	104.19	89.31

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
77.61	78.00	OK	0.39

Subdrainage Area: BLK-8 Controlled - Tributary
Area (ha): 0.34
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	169.30	69.15	100.14	**60.09**
20	119.95	113.73	69.15	44.58	53.49

Stormwater Management Calculations

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

30	53.93	43.46	43.46	0.00	0.00
40	44.18	35.61	35.61	0.00	0.00
50	37.65	30.34	30.34	0.00	0.00
60	32.94	26.55	26.55	0.00	0.00
70	29.37	23.67	23.67	0.00	0.00
80	26.56	21.41	21.41	0.00	0.00
90	24.29	19.57	19.57	0.00	0.00
100	22.41	18.06	18.06	0.00	0.00
110	20.82	16.78	16.78	0.00	0.00
120	19.47	15.69	15.69	0.00	0.00

Storage: Block 8 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.34	0.70	10.00	104.19	69.15

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
8.89	61.00	OK	52.11

Subdrainage Area: BLK-7 Controlled - Tributary
Area (ha): 0.44
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	108.62	89.45	19.17	**11.50**
20	70.25	73.24	73.24	0.00	0.00
30	53.93	56.22	56.22	0.00	0.00
40	44.18	46.06	46.06	0.00	0.00
50	37.65	39.25	39.25	0.00	0.00
60	32.94	34.34	34.34	0.00	0.00
70	29.37	30.62	30.62	0.00	0.00
80	26.56	27.69	27.69	0.00	0.00
90	24.29	25.32	25.32	0.00	0.00
100	22.41	23.36	23.36	0.00	0.00
110	20.82	21.71	21.71	0.00	0.00
120	19.47	20.30	20.30	0.00	0.00

Storage: Block 7 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.44	0.70	10.00	104.19	89.45

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
11.50	78.00	OK	66.50

Subdrainage Area: BLK-6 Controlled - Tributary
Area (ha): 0.31
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	75.66	62.31	13.35	**8.01**
20	70.25	51.01	51.01	0.00	0.00
30	53.93	39.16	39.16	0.00	0.00
40	44.18	32.09	32.09	0.00	0.00
50	37.65	27.34	27.34	0.00	0.00
60	32.94	23.92	23.92	0.00	0.00
70	29.37	21.33	21.33	0.00	0.00
80	26.56	19.29	19.29	0.00	0.00
90	24.29	17.64	17.64	0.00	0.00
100	22.41	16.27	16.27	0.00	0.00
110	20.82	15.12	15.12	0.00	0.00
120	19.47	14.14	14.14	0.00	0.00

Storage: Block 6 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.31	0.70	10.00	104.19	62.31

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
8.01	55.00	OK	46.99

Subdrainage Area: BLK-5 Controlled - Tributary
Area (ha): 0.40
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	97.66	80.42	17.23	**10.34**
20	70.25	65.85	65.85	0.00	0.00
30	53.93	50.55	50.55	0.00	0.00
40	44.18	41.41	41.41	0.00	0.00
50	37.65	35.29	35.29	0.00	0.00
60	32.94	30.88	30.88	0.00	0.00
70	29.37	27.53	27.53	0.00	0.00
80	26.56	24.90	24.90	0.00	0.00
90	24.29	22.77	22.77	0.00	0.00
100	22.41	21.00	21.00	0.00	0.00
110	20.82	19.52	19.52	0.00	0.00
120	19.47	18.25	18.25	0.00	0.00

Storage: Block 5 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.40	0.70	10.00	104.19	80.42

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
10.34	70.00	OK	59.66

Subdrainage Area: BLK-4 Controlled - Tributary
Area (ha): 0.40
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	98.37	81.01	17.36	**10.42**
20	70.25	66.32	66.32	0.00	0.00
30	53.93	50.91	50.91	0.00	0.00
40	44.18	41.71	41.71	0.00	0.00
50	37.65	35.55	35.55	0.00	0.00
60	32.94	31.10	31.10	0.00	0.00
70	29.37	27.73	27.73	0.00	0.00
80	26.56	25.08	25.08	0.00	0.00
90	24.29	22.93	22.93	0.00	0.00
100	22.41	21.15	21.15	0.00	0.00
110	20.82	19.66	19.66	0.00	0.00
120	19.47	18.38	18.38	0.00	0.00

Storage: Block 4 Onsite

Design Discharge

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

30	91.87	87.10	69.15	17.95	32.31
40	75.15	71.25	69.15	2.10	5.03
50	63.95	60.64	60.64	0.00	0.00
60	55.89	52.99	52.99	0.00	0.00
70	49.79	47.21	47.21	0.00	0.00
80	44.99	42.66	42.66	0.00	0.00
90	41.11	38.98	38.98	0.00	0.00
100	37.90	35.94	35.94	0.00	0.00
110	35.20	33.38	33.38	0.00	0.00
120	32.89	31.19	31.19	0.00	0.00

Storage: Block 8 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.34	0.70	10.00	104.19	69.15

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
60.09	61.00	OK	0.91

Subdrainage Area: BLK-7 Controlled - Tributary
Area (ha): 0.44
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	219.00	89.45	129.55	**77.73**
20	119.95	147.12	89.45	57.66	69.20
30	91.87	112.67	89.45	23.22	41.80
40	75.15	92.16	89.45	2.71	6.51
50	63.95	78.44	78.44	0.00	0.00
60	55.89	68.55	68.55	0.00	0.00
70	49.79	61.07	61.07	0.00	0.00
80	44.99	55.18	55.18	0.00	0.00
90	41.11	50.42	50.42	0.00	0.00
100	37.90	46.49	46.49	0.00	0.00
110	35.20	43.18	43.18	0.00	0.00
120	32.89	40.34	40.34	0.00	0.00

Storage: Block 7 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.44	0.70	10.00	104.19	89.45

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
77.73	78.00	OK	0.27

Subdrainage Area: BLK-6 Controlled - Tributary
Area (ha): 0.31
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	152.55	62.31	90.24	**54.14**
20	119.95	102.48	62.31	40.17	48.20
30	91.87	78.48	62.31	16.17	29.11
40	75.15	64.20	62.31	1.89	4.53
50	63.95	54.64	54.64	0.00	0.00
60	55.89	47.75	47.75	0.00	0.00
70	49.79	42.54	42.54	0.00	0.00
80	44.99	38.44	38.44	0.00	0.00
90	41.11	35.12	35.12	0.00	0.00
100	37.90	32.38	32.38	0.00	0.00
110	35.20	30.07	30.07	0.00	0.00
120	32.89	28.10	28.10	0.00	0.00

Storage: Block 6 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.31	0.70	10.00	104.19	62.31

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
54.14	55.00	OK	0.86

Subdrainage Area: BLK-5 Controlled - Tributary
Area (ha): 0.40
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	196.89	80.42	116.47	**69.88**
20	119.95	132.27	80.42	51.84	62.21
30	91.87	101.30	80.42	20.88	37.58
40	75.15	82.86	80.42	2.44	5.85
50	63.95	70.52	70.52	0.00	0.00
60	55.89	61.63	61.63	0.00	0.00
70	49.79	54.90	54.90	0.00	0.00
80	44.99	49.61	49.61	0.00	0.00
90	41.11	45.33	45.33	0.00	0.00
100	37.90	41.80	41.80	0.00	0.00
110	35.20	38.82	38.82	0.00	0.00
120	32.89	36.27	36.27	0.00	0.00

Storage: Block 5 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.40	0.70	10.00	104.19	80.42

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
69.88	70.00	OK	0.12

Subdrainage Area: BLK-4 Controlled - Tributary
Area (ha): 0.40
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	198.32	81.01	117.31	**70.39**
20	119.95	133.22	81.01	52.22	62.66
30	91.87	102.03	81.01	21.03	37.85
40	75.15	83.46	81.01	2.45	5.89
50	63.95	71.03	71.03	0.00	0.00
60	55.89	62.08	62.08	0.00	0.00
70	49.79	55.30	55.30	0.00	0.00
80	44.99	49.97	49.97	0.00	0.00
90	41.11	45.66	45.66	0.00	0.00
100	37.90	42.10	42.10	0.00	0.00
110	35.20	39.10	39.10	0.00	0.00
120	32.89	36.54	36.54	0.00	0.00

Storage: Block 4 Onsite

Design Discharge

Stormwater Management Calculations

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.40	0.70	10.00	104.19	81.01

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
10.42	71.00	OK	60.58

Subdrainage Area: BLK-3 — Controlled - Tributary
Area (ha): 0.50
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	122.70	101.05	21.65	**12.99**
20	70.25	82.73	82.73	0.00	0.00
30	53.93	63.51	63.51	0.00	0.00
40	44.18	52.03	52.03	0.00	0.00
50	37.65	44.34	44.34	0.00	0.00
60	32.94	38.80	38.80	0.00	0.00
70	29.37	34.59	34.59	0.00	0.00
80	26.56	31.28	31.28	0.00	0.00
90	24.29	28.60	28.60	0.00	0.00
100	22.41	26.39	26.39	0.00	0.00
110	20.82	24.52	24.52	0.00	0.00
120	19.47	22.93	22.93	0.00	0.00

Storage: Block 3 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.50	0.70	10.00	104.19	101.05

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
12.99	88.00	OK	75.01

Subdrainage Area: BLK-2 — Controlled - Tributary
Area (ha): 2.71
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	668.36	550.41	117.95	**70.77**
20	70.25	450.63	450.63	0.00	0.00
30	53.93	345.92	345.92	0.00	0.00
40	44.18	283.43	283.43	0.00	0.00
50	37.65	241.53	241.53	0.00	0.00
60	32.94	211.32	211.32	0.00	0.00
70	29.37	188.41	188.41	0.00	0.00
80	26.56	170.39	170.39	0.00	0.00
90	24.29	155.80	155.80	0.00	0.00
100	22.41	143.73	143.73	0.00	0.00
110	20.82	133.57	133.57	0.00	0.00
120	19.47	124.88	124.88	0.00	0.00

Storage: Block 2 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
2.71	0.70	10.00	104.19	550.41

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
70.77	479.00	OK	408.23

Subdrainage Area: BLK-1 — Controlled - Tributary
Area (ha): 0.90
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	222.32	183.09	39.23	**23.54**
20	70.25	149.90	149.90	0.00	0.00
30	53.93	115.07	115.07	0.00	0.00
40	44.18	94.28	94.28	0.00	0.00
50	37.65	80.34	80.34	0.00	0.00
60	32.94	70.29	70.29	0.00	0.00
70	29.37	62.67	62.67	0.00	0.00
80	26.56	56.68	56.68	0.00	0.00
90	24.29	51.82	51.82	0.00	0.00
100	22.41	47.81	47.81	0.00	0.00
110	20.82	44.43	44.43	0.00	0.00
120	19.47	41.54	41.54	0.00	0.00

Storage: Block 1 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.90	0.70	10.00	104.19	183.09

Onsite Storage			
5-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
23.54	160.00	OK	136.46

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	9.013	ha			
Total 5yr Flow to Sewer	1,827	L/s	235	1,596 m^3	Ok
Non-Tributary Area	0.000	ha			
Total 5yr Flow Uncontrolled	0	L/s			
Total Area	9.013	ha			
Total 5yr Flow	1,827	L/s			

Project #160401780, LeBreton Flats
Modified Rational Method Calculations for Storage

Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.40	0.70	10.00	104.19	81.01

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
70.39	71.00	OK	0.61

Subdrainage Area: BLK-3 — Controlled - Tributary
Area (ha): 0.50
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	247.38	101.05	146.34	**87.80**
20	119.95	166.18	101.05	65.14	78.16
30	91.87	127.28	101.05	26.23	47.22
40	75.15	104.11	101.05	3.06	7.35
50	63.95	88.60	88.60	0.00	0.00
60	55.89	77.44	77.44	0.00	0.00
70	49.79	68.98	68.98	0.00	0.00
80	44.99	62.33	62.33	0.00	0.00
90	41.11	56.96	56.96	0.00	0.00
100	37.90	52.51	52.51	0.00	0.00
110	35.20	48.77	48.77	0.00	0.00
120	32.89	45.57	45.57	0.00	0.00

Storage: Block 3 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.50	0.70	10.00	104.19	101.05

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
87.80	88.00	OK	0.20

Subdrainage Area: BLK-2 — Controlled - Tributary
Area (ha): 2.71
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	1347.51	550.41	797.10	**478.26**
20	119.95	905.22	550.41	354.81	425.77
30	91.87	693.29	550.41	142.88	257.18
40	75.15	567.09	550.41	16.68	40.03
50	63.95	482.64	482.64	0.00	0.00
60	55.89	421.81	421.81	0.00	0.00
70	49.79	375.74	375.74	0.00	0.00
80	44.99	339.53	339.53	0.00	0.00
90	41.11	310.25	310.25	0.00	0.00
100	37.90	286.04	286.04	0.00	0.00
110	35.20	265.66	265.66	0.00	0.00
120	32.89	248.24	248.24	0.00	0.00

Storage: Block 2 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
2.71	0.70	10.00	104.19	550.41

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
478.26	479.00	OK	0.74

Subdrainage Area: BLK-1 — Controlled - Tributary
Area (ha): 0.90
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	448.23	183.09	265.14	**159.09**
20	119.95	301.11	183.09	118.02	141.62
30	91.87	230.61	183.09	47.53	85.55
40	75.15	188.63	183.09	5.55	13.32
50	63.95	160.54	160.54	0.00	0.00
60	55.89	140.31	140.31	0.00	0.00
70	49.79	124.98	124.98	0.00	0.00
80	44.99	112.94	112.94	0.00	0.00
90	41.11	103.20	103.20	0.00	0.00
100	37.90	95.15	95.15	0.00	0.00
110	35.20	88.37	88.37	0.00	0.00
120	32.89	82.57	82.57	0.00	0.00

Storage: Block 1 Onsite

Design Discharge				
Area (ha)	C	tc (min)	I (5-yr) (mm/hr)	Release (L/s)
0.90	0.70	10.00	104.19	183.09

Onsite Storage			
100-year Vreq (m^3)	Vminimum (m^3)	Volume Check	Vexcess (m^3)
159.09	160.00	OK	0.91

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	9.013	ha			
Total 100yr Flow to Sewer	1,827	L/s	1,588	1,596 m^3	Ok
Non-Tributary Area	0.000	ha			
Total 100yr Flow Uncontrolled	0	L/s			
Total Area	9.013	ha			
Total 100yr Flow	1,827	L/s			

File No: 160401780
Project: LeBreton Flats - Block Sites
Date: 15-May-2024

Created By: MW
Checked By: DT
Revision: 1

100-YEAR SUMMARY OF BLOCK (SITE) STORAGE

SWM Approach: Post-development to 5-year with C=0.70 and tc = 10 min

100-year IDF
City of Ottawa

$I = a/(t + b)^c$		
	a =	1735.688
	b =	6.014
	c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

All Mixed-Use Blocks (Site) Post-Development Conditions:

Tributary	(ha)
Fleet	2.90
Albert	5.22
Aqueduct	0.89
Total Area:	**9.01**
Overall C:	1.00

Target	(L/s)
To Fleet	588
To Albert	1059
To Aqueduct	181
Total Target	**1828**

t_c	Runoff Rate	Maximum Allowable Discharge	Required Storage Volume	Required Storage Rate
(min)	(L/s)	(L/s)	(m^3)	(m^3/ha)
10	4474	1828	1588	176
20	3006	1828	1414	157
30	2302	1828	854	95
40	1883	1828	133	15
50	1602	1828	0	0
60	1401	1828	0	0

BLOCK ID	Area	C	C	Runoff Rate	Maximum Allowable Discharge	Required Storage Volume
	(ha)	(5-yr)	(100-yr)	(L/s)	(L/s)	(m^3)
BLOCK 1	0.90	0.85	1.00	448	183	159
BLOCK 2	2.71	0.85	1.00	1348	550	478
BLOCK 3	0.50	0.85	1.00	247	101	88
BLOCK 4	0.40	0.85	1.00	198	81	70
BLOCK 5	0.40	0.85	1.00	197	80	70
BLOCK 6	0.31	0.85	1.00	153	62	54
BLOCK 7	0.44	0.85	1.00	219	89	78
BLOCK 8	0.34	0.85	1.00	169	69	60
BLOCK 9	0.44	0.85	1.00	219	89	78
BLOCK 10	0.24	0.85	1.00	119	48	42
BLOCK 11	0.28	0.85	1.00	140	57	50
BLOCK 12	0.25	0.85	1.00	126	51	45
BLOCK 13	0.27	0.85	1.00	136	55	48
BLOCK 14	0.30	0.85	1.00	149	61	53
BLOCK 15	0.33	0.85	1.00	165	67	58
BLOCK 17	0.89	0.85	1.00	442	181	157

D.2 Storm Sewer Design Sheet

Stantec

LeBreton Flats Draft Plan	
DATE:	2024-07-23
REVISION:	1
DESIGNED BY:	JP
CHECKED BY:	DT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160401780**

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr			
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00 m	
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10 min	

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)
C15A	15	16	0.00	0.44	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.306	0.306	0.000	0.000	0.000	0.000	10.00
C16A, C16B	16	14	0.00	3.21	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	2.732	3.038	0.000	0.000	0.000	0.000	10.84
C14B, C14A	14	12	0.00	0.43	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.299	3.337	0.000	0.000	0.000	0.000	11.82
																				12.63
C13B, C13A	13	12	0.00	0.48	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.000	0.000	0.381	0.381	0.000	0.000	0.000	0.000	10.00
																				11.75
C12A, C12B	12	11	0.00	0.80	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.677	4.394	0.000	0.000	0.000	0.000	12.63
	11	11A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	4.394	0.000	0.000	0.000	0.000	13.49
																				13.58
C19B, C19A	19	18	0.00	0.99	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.000	0.000	0.830	0.830	0.000	0.000	0.000	0.000	10.00
																				10.86
C7A	7	7A	0.00	0.89	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.757	0.757	0.000	0.000	0.000	0.000	10.00
																				10.25
C6A, C6D, C6C, C6B	6	5	0.00	1.79	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.000	0.000	1.355	1.355	0.000	0.000	0.000	0.000	10.00
C5A, C5B, C5C	5	4	0.00	0.91	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.777	2.131	0.000	0.000	0.000	0.000	10.40
																				13.18
C4AA	4A	4	0.00	0.33	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.282	0.282	0.000	0.000	0.000	0.000	10.00
																				10.93
C4B, C4C, C4D	4	3	0.00	1.07	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.000	0.000	0.859	3.272	0.000	0.000	0.000	0.000	13.18
																				14.08
C3AA	3A	3	0.00	0.24	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.203	0.203	0.000	0.000	0.000	0.000	10.00
																				10.46
C3B	3	2	0.00	0.11	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.080	3.555	0.000	0.000	0.000	0.000	14.08
	2	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.555	0.000	0.000	0.000	0.000	15.08
	1	1A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.555	0.000	0.000	0.000	0.000	16.42
	1A	1B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.555	0.000	0.000	0.000	0.000	16.46
																				16.57
	10	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00
	9	9B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00
	9B	9A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.00

DRAINAGE AREA (continued) / PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
C15A	15	16	76.81	104.19	122.14	178.56	0.0	0.0	88.5	90.2	300	300	CIRCULAR	PVC	-	2.00	136.0	**65.09%**	1.93	1.80	0.84
C16A, C16B	16	14	73.73	99.97	117.17	171.25	0.0	0.0	843.5	78.5	975	975	CIRCULAR	CONCRETE	-	0.20	1045.6	**80.68%**	1.36	1.34	0.98
C14B, C14A	14	12	70.47	95.49	111.89	163.51	0.0	0.0	885.0	66.6	975	975	CIRCULAR	CONCRETE	-	0.20	1045.6	**84.65%**	1.36	1.36	0.82
C13B, C13A	13	12	76.81	104.19	122.14	178.56	0.0	0.0	110.3	84.8	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**82.93%**	0.81	0.81	1.75
C12A, C12B	12	11	67.99	92.08	107.88	157.61	0.0	0.0	1124.0	74.7	1050	1050	CIRCULAR	CONCRETE	-	0.20	1274.0	**88.22%**	1.43	1.45	0.86
	11	11A	65.57	88.77	103.98	151.89	0.0	0.0	1083.6	7.8	1050	1050	CIRCULAR	CONCRETE	-	0.20	1274.0	**85.05%**	1.43	1.43	0.09
											1050	1050									
C19B, C19A	19	18	76.81	104.19	122.14	178.56	0.0	0.0	240.3	64.4	600	600	CIRCULAR	CONCRETE	-	0.41	409.6	**58.66%**	1.40	1.25	0.86
											600	600									
C7A	7	7A	76.81	104.19	122.14	178.56	0.0	0.0	219.2	15.5	600	600	CIRCULAR	CONCRETE	-	0.25	320.5	**68.38%**	1.10	1.04	0.25
											600	600									
C6A, C6D, C6C, C6B	6	5	76.81	104.19	122.14	178.56	0.0	0.0	392.0	42.7	600	600	CIRCULAR	CONCRETE	-	0.70	535.9	**73.15%**	1.84	1.77	0.40
C5A, C5B, C5C	5	4	75.29	102.11	119.69	174.95	0.0	0.0	604.5	185.2	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**82.64%**	1.11	1.11	2.78
C4AA	4A	4	76.81	104.19	122.14	178.56	0.0	0.0	81.6	54.2	375	375	CIRCULAR	PVC	-	0.40	104.3	**78.27%**	0.99	0.97	0.93
C4B, C4C, C4D	4	3	66.41	89.92	105.34	153.88	0.0	0.0	817.3	63.6	1050	1050	CIRCULAR	CONCRETE	-	0.15	1103.3	**74.08%**	1.23	1.19	0.89
C3AA	3A	3	76.81	104.19	122.14	178.56	0.0	0.0	58.8	28.9	300	300	CIRCULAR	PVC	-	0.60	74.5	**78.95%**	1.06	1.04	0.46
C3B	3	2	64.03	86.66	101.50	148.25	0.0	0.0	855.8	72.1	1050	1050	CIRCULAR	CONCRETE	-	0.15	1103.3	**77.56%**	1.23	1.20	1.00
	2	1	61.59	83.31	97.56	142.46	0.0	0.0	822.7	95.3	1050	1050	CIRCULAR	CONCRETE	-	0.15	1103.3	**74.56%**	1.23	1.19	1.34
	1	1A	58.62	79.25	92.78	135.46	0.0	0.0	782.6	3.1	1050	1050	CIRCULAR	CONCRETE	-	0.15	1103.3	**70.93%**	1.23	1.17	0.04
	1A	1B	58.52	79.12	92.63	135.24	0.0	0.0	781.3	8.0	1050	1050	CIRCULAR	CONCRETE	-	0.15	1103.3	**70.81%**	1.23	1.17	0.11
											1050	1050									
	10	9	76.81	104.19	122.14	178.56	0.0	0.0	0.0	20.2	1200	1200	CIRCULAR	CONCRETE	-	0.15	1575.3	**0.00%**	1.35	0.00	0.00
	9	9B	76.81	104.19	122.14	178.56	0.0	0.0	0.0	21.4	1200	1200	CIRCULAR	CONCRETE	-	0.15	1575.3	**0.00%**	1.35	0.00	0.00
	9B	9A	76.81	104.19	122.14	178.56	0.0	0.0	0.0	8.9	1200	1200	CIRCULAR	CONCRETE	-	0.15	1575.3	**0.00%**	1.35	0.00	0.00
											1200	1200									

D.3 Quality Control MTD Sizing Calculations

Quality Manufactured Treatment Device (MTD) Sizing

Lebreton Flats 19-Jul-24

	Area	C	I (25mm) (Per MECP SWMPDM Equation 4.9)	Q (25mm) (Rational Method)	Q (5yr) (Per Sewer Design Sheet)	
C3B	0.11	0.70				
C4B	0.35	0.70				
C6A	0.36	0.70				
C6D	0.73	0.70				
Total	**1.55**	**0.70**	**36.0**	**109**	**781**	1x JF12 (Offline)
C12A	0.40	0.85				
C13B	0.17	0.70				
C13A	0.31	0.85				
Total	**0.88**	**0.82**	**41.2**	**83**	**209**	1x JF10 (Online)
C12B	0.40	0.85				
C14A	0.12	0.70				
C14B	0.31	0.70				
C15A	0.44	0.70				
C16B	0.50	0.85				
Total	**1.77**	**0.78**	**39.3**	**150**	**885**	1x JF12 (Offline)
C19A	0.90	0.85				
C19B	0.09	0.70				
Total	**0.99**	**0.84**	**41.9**	**96**	**240**	1 X JF10 (Online)

Jellyfish Model #	Max Treatment Flow Rate	Max Online Flow Rate
JF6	32.8	146.1
JF8	55.5	197.1
JF10	106.2	332.7
JF12	148.9	375.4

D.4 Conceptual Major System PCSWMM Model Input/Output Files

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           07/17/2024
START_TIME           00:00:00
REPORT_START_DATE    07/17/2024
REPORT_START_TIME    00:00:00
END_DATE             07/17/2024
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
```



```
MINIMUM_STEP         0.5
THREADS              8

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 03H120C

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack

;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
;0.7
33               RG1              SPR-BOO          0.769436 71.43    173.123  3        0

;0.7
34               RG1              ELM-BOO          0.784973 71.43    176.619  3        0

;0.7
37               RG1              BOO-LP1          0.699023 71.43    157.28   3        0

;0.7
38               RG1              ELM-ROC          0.788085 71.43    177.319  3        0

;0.7
39               RG1              PRI-LOR          1.208135 71.43    271.83   3        0

;0.7
40               RG1              ALB-PRI          0.227745 71.43    51.243   3        0

;0.7
```

```
41               RG1              ALB-LOR          0.196647 71.43    44.246   3        0

;0.7
42               RG1              PRI              0.677902 71.43    152.528  3        0

;0.7
43               RG1              PRI-EMP          0.379017 71.43    85.279   3        0

;0.7
44               RG1              LOR              0.781348 71.43    175.803  3        0

;0.7
45               RG1              ALB-ROC          0.684771 71.43    154.073  3        0

;0.7
46               RG1              ALB-BOO          0.436649 71.43    98.246   3        0

;0.7
47               RG1              ALB-PRE          0.76698  71.43    172.57   3        0

;0.7
48               RG1              ROC-LP1          1.407692 71.43    316.731  3        0

;0.7
49               RG1              BOO-LP2          0.62678  71.43    141.026  3        0

;0.7
50               RG1              PRI-BOO          0.735359 71.43    165.456  3        0

;0.7
51               RG1              PRE              0.556116 71.43    125.126  3        0

;0.7
52               RG1              ELM-PRI          1.137188 71.43    255.867  3        0


[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
```



```
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
33               0.013      0.25       1.57       4.67       0          OUTLET
34               0.013      0.25       1.57       4.67       0          OUTLET
37               0.013      0.25       1.57       4.67       0          OUTLET
38               0.013      0.25       1.57       4.67       0          OUTLET
39               0.013      0.25       1.57       4.67       0          OUTLET
40               0.013      0.25       1.57       4.67       0          OUTLET
41               0.013      0.25       1.57       4.67       0          OUTLET
42               0.013      0.25       1.57       4.67       0          OUTLET
43               0.013      0.25       1.57       4.67       0          OUTLET
44               0.013      0.25       1.57       4.67       0          OUTLET
45               0.013      0.25       1.57       4.67       0          OUTLET
46               0.013      0.25       1.57       4.67       0          OUTLET
47               0.013      0.25       1.57       4.67       0          OUTLET
48               0.013      0.25       1.57       4.67       0          OUTLET
49               0.013      0.25       1.57       4.67       0          OUTLET
50               0.013      0.25       1.57       4.67       0          OUTLET
51               0.013      0.25       1.57       4.67       0          OUTLET
52               0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
33               76.2       13.2       4.14       7          0
34               76.2       13.2       4.14       7          0
37               76.2       13.2       4.14       7          0
38               76.2       13.2       4.14       7          0
39               76.2       13.2       4.14       7          0
40               76.2       13.2       4.14       7          0
41               76.2       13.2       4.14       7          0
42               76.2       13.2       4.14       7          0
43               76.2       13.2       4.14       7          0
44               76.2       13.2       4.14       7          0
45               76.2       13.2       4.14       7          0
46               76.2       13.2       4.14       7          0
47               76.2       13.2       4.14       7          0
48               76.2       13.2       4.14       7          0
49               76.2       13.2       4.14       7          0
```

```
50               76.2       13.2       4.14       7          0
51               76.2       13.2       4.14       7          0
52               76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
ALB-OF           0          FREE                        NO
OF1              0          FREE                        NO
OF2              0          FREE                        NO
OF3              0          FREE                        NO
OF4              0          FREE                        NO
OF5              0          FREE                        NO
OF6              0          FREE                        NO
OF7              0          FREE                        NO
SU1              0          FREE                        NO
SU10             0          FREE                        NO
SU11             0          FREE                        NO
SU12             0          FREE                        NO
SU13             0          FREE                        NO
SU14             0          FREE                        NO
SU15             0          FREE                        NO
SU16             0          FREE                        NO
SU17             0          FREE                        NO
SU2              0          FREE                        NO
SU3              0          FREE                        NO
SU4              0          FREE                        NO
SU5              0          FREE                        NO
SU6              0          FREE                        NO
SU7              0          FREE                        NO
SU8              0          FREE                        NO
SU9              0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            SurDepth Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------
-------- -------- --------
```



```
ALB-BOO          61.78    0.4        0          FUNCTIONAL  0         0         0         0         0
ALB-LOR          62.33    0.4        0          FUNCTIONAL  0         0         0         0         0
ALB-PRE          58.95    0.4        0          FUNCTIONAL  0         0         0         0         0
ALB-PRI          62.47    0.4        0          FUNCTIONAL  0         0         0         0         0
ALB-ROC          60.67    0.4        0          FUNCTIONAL  0         0         0         0         0
BOO-LP1          62.23    0.4        0          FUNCTIONAL  0         0         0         0         0
BOO-LP2          62.25    0.4        0          FUNCTIONAL  0         0         0         0         0
ELM-BOO          64.98    0.4        0          FUNCTIONAL  0         0         0         0         0
ELM-PRI          62.36    0.4        0          FUNCTIONAL  0         0         0         0         0
ELM-ROC          63.04    0.4        0          FUNCTIONAL  0         0         0         0         0
LOR              76.87    0.4        0          FUNCTIONAL  0         0         0         0         0
PRE              61.31    0.4        0          FUNCTIONAL  0         0         0         0         0
PRI              62.87    0.4        0          FUNCTIONAL  0         0         0         0         0
PRI-BOO          62.37    0.4        0          FUNCTIONAL  0         0         0         0         0
PRI-EMP          80.19    0.4        0          FUNCTIONAL  0         0         0         0         0
PRI-LOR          72       0.4        0          FUNCTIONAL  0         0         0         0         0
ROC-LP1          61.36    0.4        0          FUNCTIONAL  0         0         0         0         0
SPR-BOO          71.56    0.4        0          FUNCTIONAL  0         0         0         0         0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
C1               SPR-BOO          ELM-BOO          81.637     0.013      71.56      64.98      0          0

C10              PRE              ALB-PRE          120.656    0.013      61.31      59.03      0          0

C11              PRI-BOO          BOO-LP1          71.962     0.013      62.37      62.23      0          0

C12              BOO-LP1          BOO-LP2          41.708     0.013      62.23      62.25      0          0

C13              BOO-LP2          ALB-BOO          59.074     0.013      62.25      61.88      0          0

C14              ELM-PRI          ROC-LP1          91.928     0.013      62.36      61.36      0          0

C15              ROC-LP1          ALB-ROC          65.3       0.013      61.36      60.77      0          0
```

```
C16              ALB-BOO          ALB-ROC          123.296    0.013      61.78      60.67      0          0

C17              ALB-ROC          ALB-PRE          192.513    0.013      60.67      58.95      0          0

C2               ELM-BOO          PRI-BOO          79.055     0.013      64.98      62.37      0          0

C3               LOR              PRI-LOR          68.101     0.013      76.87      72         0          0

C4               PRI-LOR          ALB-LOR          185.838    0.013      72         62.43      0          0

C5               PRI-EMP          PRI-LOR          96.195     0.013      80.19      72         0          0

C6               PRI              ALB-PRI          91.889     0.013      62.87      62.57      0          0

C7               ALB-PRI          ALB-LOR          48.944     0.013      62.47      62.33      0          0

C8               ALB-LOR          ALB-BOO          77.391     0.013      62.33      61.78      0          0

C9               ELM-ROC          ELM-PRI          80.486     0.013      63.04      62.36      0          0


[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff     Gated    EndCon
EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- --------
---------- ---------- ---------- ---------- ----------------
W1               ALB-PRE          ALB-OF           TRANSVERSE   59.18      1.67       NO       0        0
       YES

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon
Gated
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ----------
--------
OL1              ALB-PRE          SU17             58.95      TABULAR/HEAD    10CB_S0.03
NO
OL10             PRI-LOR          OF2              72         TABULAR/HEAD    10CB_S0.03
NO
```



```
OL11             PRI-EMP          SU15             80.19      TABULAR/HEAD    1CB_S0.03
NO
OL12             PRI              SU14             62.87      TABULAR/HEAD    8CB_S0.03
NO
OL13             ALB-PRI          SU13             62.47      TABULAR/HEAD    4CB_S0.03
NO
OL14             ALB-LOR          SU12             62.33      TABULAR/HEAD    4CB_S0.03
NO
OL15             ALB-BOO          SU10             61.78      TABULAR/HEAD    4CB_S0.03
NO
OL16             BOO-LP2          SU9              62.25      TABULAR/HEAD    3CB_SAG
NO
OL17             BOO-LP1          SU8              62.23      TABULAR/HEAD    3CB_SAG
NO
OL18             PRI-BOO          OF3              62.37      TABULAR/HEAD    3CB_S0.03
NO
OL19             PRI-LOR          OF1              72         TABULAR/HEAD    6CB_S0.03
NO
OL2              PRE              SU1              61.31      TABULAR/HEAD    1CB_S0.03
NO
OL20             PRI-BOO          SU7              62.37      TABULAR/HEAD    10CB_S0.03
NO
OL21             ELM-BOO          SU5              64.98      TABULAR/HEAD    10CB_S0.03
NO
OL22             ELM-PRI          SU3              62.36      TABULAR/HEAD    10CB_S0.03
NO
OL23             PRE              OF7              61.31      TABULAR/HEAD    10CB_S0.03
NO
OL24             ROC-LP1          SU2              61.36      TABULAR/HEAD    2CB_SAG
NO
OL3              ALB-ROC          SU11             60.67      TABULAR/HEAD    10CB_S0.03
NO
OL4              ROC-LP1          OF6              61.36      TABULAR/HEAD    10CB_S0.03
NO
OL5              ELM-PRI          OF5              62.36      TABULAR/HEAD    4CB_S0.03
NO
OL6              ELM-ROC          SU4              63.04      TABULAR/HEAD    6CB_S0.03
NO
```

```
OL7              ELM-BOO          OF4              64.98      TABULAR/HEAD     3CB_S0.03
NO
OL8              SPR-BOO          SU6              71.56      TABULAR/HEAD     9CB_S0.03
NO
OL9              LOR              SU16             76.87      TABULAR/HEAD     2CB_S0.03
NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
C1               IRREGULAR    18m
C10              IRREGULAR    20m_Preston
C11              IRREGULAR    18m
C12              IRREGULAR    18m
C13              IRREGULAR    18m
C14              IRREGULAR    18m
C15              IRREGULAR    18m
C16              IRREGULAR    15.5m_Albert_OS
C17              IRREGULAR    15.5m_Albert_OS
C2               IRREGULAR    18m
C3               IRREGULAR    18m
C4               IRREGULAR    18m
C5               IRREGULAR    18m
C6               IRREGULAR    18m
C7               IRREGULAR    15.5m_Albert_OS
C8               IRREGULAR    15.5m_Albert_OS
C9               IRREGULAR    18m
W1               RECT_OPEN    0.2              10         0          0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.013    0.013    0.013
X1 15.5m_Albert_OS   4        0.0      11.5     0.0      0.0      0.0      0.0      0.0
GR 0.23     0        0        11.5     0.15     11.5     0.23     15
;
NC 0.2      0.2      0.013
X1 18m               7        4.25     13.75    0.0      0.0      0.0      0.0      0.0
```



```
GR 0.35     0        0.15     4.25     0        4.25     0.13     9        0        13.75
GR 0.15     13.75    0.35     18
;
NC 0.013    0.013    0.013
X1 20m_Preston       7        2.5      17.5     0.0      0.0      0.0      0.0      0.0
GR 0.2      0        0.15     2.5      0        2.5      0.15     10       0        17.5
GR 0.15     17.5     0.2      20

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
10CB_S0.03       Rating     0          0
10CB_S0.03                  0.01       5
10CB_S0.03                  0.02       17
10CB_S0.03                  0.03       57
10CB_S0.03                  0.04       110
10CB_S0.03                  0.05       146
10CB_S0.03                  0.06       179
10CB_S0.03                  0.07       216
10CB_S0.03                  0.08       256
10CB_S0.03                  0.09       298
10CB_S0.03                  0.1        335
10CB_S0.03                  0.11       380
10CB_S0.03                  0.12       390
10CB_S0.03                  0.4        390

1CB_S0.03        Rating     0          0
1CB_S0.03                   0.01       0.5
1CB_S0.03                   0.02       1.7
1CB_S0.03                   0.03       5.7
1CB_S0.03                   0.04       11
1CB_S0.03                   0.05       14.6
1CB_S0.03                   0.06       17.9
1CB_S0.03                   0.07       21.6
```

POST-DEVELOPMENT MODEL

1CB_S0.03		0.08	25.6
1CB_S0.03		0.09	29.8
1CB_S0.03		0.1	33.5
1CB_S0.03		0.11	38
1CB_S0.03		0.12	39
1CB_S0.03		0.4	39
1CB_SAG	Rating	0	0
1CB_SAG		0.01	1
1CB_SAG		0.02	2
1CB_SAG		0.03	4
1CB_SAG		0.04	7
1CB_SAG		0.05	11
1CB_SAG		0.06	16
1CB_SAG		0.07	20
1CB_SAG		0.08	36
1CB_SAG		0.09	48
1CB_SAG		0.1	61
1CB_SAG		0.11	73
1CB_SAG		0.12	86
1CB_SAG		0.13	99
1CB_SAG		0.14	109
1CB_SAG		0.15	120
1CB_SAG		0.16	129
1CB_SAG		0.17	136
1CB_SAG		0.18	145
1CB_SAG		0.19	150
1CB_SAG		0.2	156
1CB_SAG		0.21	161
1CB_SAG		0.22	167
1CB_SAG		0.23	172
1CB_SAG		0.24	176
1CB_SAG		0.25	181
1CB_SAG		0.26	186
1CB_SAG		0.27	189
1CB_SAG		0.28	194
1CB_SAG		0.29	199
1CB_SAG		0.3	202

POST-DEVELOPMENT MODEL

2CB_S0.03	Rating	0	0
2CB_S0.03		0.01	1
2CB_S0.03		0.02	3.4
2CB_S0.03		0.03	11.4
2CB_S0.03		0.04	22
2CB_S0.03		0.05	29.2
2CB_S0.03		0.06	35.8
2CB_S0.03		0.07	43.2
2CB_S0.03		0.08	51.2
2CB_S0.03		0.09	59.6
2CB_S0.03		0.1	67
2CB_S0.03		0.11	76
2CB_S0.03		0.12	78
2CB_S0.03		0.4	78
2CB_SAG	Rating	0	0
2CB_SAG		0.01	2
2CB_SAG		0.02	4
2CB_SAG		0.03	8
2CB_SAG		0.04	14
2CB_SAG		0.05	22
2CB_SAG		0.06	32
2CB_SAG		0.07	40
2CB_SAG		0.08	72
2CB_SAG		0.09	96
2CB_SAG		0.1	122
2CB_SAG		0.11	146
2CB_SAG		0.12	172
2CB_SAG		0.13	198
2CB_SAG		0.14	218
2CB_SAG		0.15	240
2CB_SAG		0.16	258
2CB_SAG		0.17	272
2CB_SAG		0.18	290
2CB_SAG		0.19	300
2CB_SAG		0.2	312
2CB_SAG		0.21	322

2CB_SAG		0.22	334
2CB_SAG		0.23	344
2CB_SAG		0.24	352
2CB_SAG		0.25	362
2CB_SAG		0.26	372
2CB_SAG		0.27	378
2CB_SAG		0.28	388
2CB_SAG		0.29	398
2CB_SAG		0.3	404
3CB_S0.03	Rating	0	0
3CB_S0.03		0.01	1.5
3CB_S0.03		0.02	5.1
3CB_S0.03		0.03	17.1
3CB_S0.03		0.04	33
3CB_S0.03		0.05	43.8
3CB_S0.03		0.06	53.7
3CB_S0.03		0.07	64.8
3CB_S0.03		0.08	76.8
3CB_S0.03		0.09	89.4
3CB_S0.03		0.1	100.5
3CB_S0.03		0.11	114
3CB_S0.03		0.12	117
3CB_S0.03		0.4	117
3CB_SAG	Rating	0	0
3CB_SAG		0.01	3
3CB_SAG		0.02	6
3CB_SAG		0.03	12
3CB_SAG		0.04	21
3CB_SAG		0.05	33
3CB_SAG		0.06	48
3CB_SAG		0.07	60
3CB_SAG		0.08	108
3CB_SAG		0.09	144
3CB_SAG		0.1	183
3CB_SAG		0.11	219
3CB_SAG		0.12	258

3CB_SAG		0.13	297
3CB_SAG		0.14	327
3CB_SAG		0.15	360
3CB_SAG		0.16	387
3CB_SAG		0.17	408
3CB_SAG		0.18	435
3CB_SAG		0.19	450
3CB_SAG		0.2	468
3CB_SAG		0.21	483
3CB_SAG		0.22	501
3CB_SAG		0.23	516
3CB_SAG		0.24	528
3CB_SAG		0.25	543
3CB_SAG		0.26	558
3CB_SAG		0.27	567
3CB_SAG		0.28	582
3CB_SAG		0.29	597
3CB_SAG		0.3	606
4CB_S0.03	Rating	0	0
4CB_S0.03		0.01	2
4CB_S0.03		0.02	6.8
4CB_S0.03		0.03	22.8
4CB_S0.03		0.04	44
4CB_S0.03		0.05	58.4
4CB_S0.03		0.06	71.6
4CB_S0.03		0.07	86.4
4CB_S0.03		0.08	102.4
4CB_S0.03		0.09	119.2
4CB_S0.03		0.1	134
4CB_S0.03		0.11	152
4CB_S0.03		0.12	156
4CB_S0.03		0.4	156
5CB_S0.03	Rating	0	0
5CB_S0.03		0.01	2.5
5CB_S0.03		0.02	8.5
5CB_S0.03		0.03	28.5

```
5CB_S0.03                 0.04       55
5CB_S0.03                 0.05       73
5CB_S0.03                 0.06       89.5
5CB_S0.03                 0.07       108
5CB_S0.03                 0.08       128
5CB_S0.03                 0.09       149
5CB_S0.03                 0.1        167.5
5CB_S0.03                 0.11       190
5CB_S0.03                 0.12       195
5CB_S0.03                 0.4        195

6CB_S0.03        Rating   0          0
6CB_S0.03                 0.01       3
6CB_S0.03                 0.02       10.2
6CB_S0.03                 0.03       34.2
6CB_S0.03                 0.04       66
6CB_S0.03                 0.05       87.6
6CB_S0.03                 0.06       107.4
6CB_S0.03                 0.07       129.6
6CB_S0.03                 0.08       153.6
6CB_S0.03                 0.09       178.8
6CB_S0.03                 0.1        201
6CB_S0.03                 0.11       228
6CB_S0.03                 0.12       234
6CB_S0.03                 0.4        234

7CB_S0.03        Rating   0          0
7CB_S0.03                 0.01       3.5
7CB_S0.03                 0.02       11.9
7CB_S0.03                 0.03       39.9
7CB_S0.03                 0.04       77
7CB_S0.03                 0.05       102.2
7CB_S0.03                 0.06       125.3
7CB_S0.03                 0.07       151.2
7CB_S0.03                 0.08       179.2
7CB_S0.03                 0.09       208.6
7CB_S0.03                 0.1        234.5
7CB_S0.03                 0.11       266
```



```
7CB_S0.03                 0.12       273
7CB_S0.03                 0.4        273

8CB_S0.03        Rating   0          0
8CB_S0.03                 0.01       4
8CB_S0.03                 0.02       13.6
8CB_S0.03                 0.03       45.6
8CB_S0.03                 0.04       88
8CB_S0.03                 0.05       116.8
8CB_S0.03                 0.06       143.2
8CB_S0.03                 0.07       172.8
8CB_S0.03                 0.08       204.8
8CB_S0.03                 0.09       238.4
8CB_S0.03                 0.1        268
8CB_S0.03                 0.11       304
8CB_S0.03                 0.12       312
8CB_S0.03                 0.4        312

9CB_S0.03        Rating   0          0
9CB_S0.03                 0.01       4.5
9CB_S0.03                 0.02       15.3
9CB_S0.03                 0.03       51.3
9CB_S0.03                 0.04       99
9CB_S0.03                 0.05       131.4
9CB_S0.03                 0.06       161.1
9CB_S0.03                 0.07       194.4
9CB_S0.03                 0.08       230.4
9CB_S0.03                 0.09       268.2
9CB_S0.03                 0.1        301.5
9CB_S0.03                 0.11       342
9CB_S0.03                 0.12       351
9CB_S0.03                 0.4        351

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
03H100C                     0:00       0
03H100C                     0:10       6.05
```

```
03H100C                  0:20      7.54
03H100C                  0:30      10.16
03H100C                  0:40      15.97
03H100C                  0:50      40.65
03H100C                  1:00      178.56
03H100C                  1:10      54.05
03H100C                  1:20      27.32
03H100C                  1:30      18.24
03H100C                  1:40      13.74
03H100C                  1:50      11.06
03H100C                  2:00      9.29
03H100C                  2:10      8.02
03H100C                  2:20      7.08
03H100C                  2:30      6.35
03H100C                  2:40      5.76
03H100C                  2:50      5.28
03H100C                  3:00      4.88

03H120C                  0:00      0
03H120C                  0:10      7.26
03H120C                  0:20      9.048
03H120C                  0:30      12.192
03H120C                  0:40      19.164
03H120C                  0:50      48.78
03H120C                  1:00      214.272
03H120C                  1:10      64.86
03H120C                  1:20      32.784
03H120C                  1:30      21.888
03H120C                  1:40      16.488
03H120C                  1:50      13.272
03H120C                  2:00      11.148
03H120C                  2:10      9.624
03H120C                  2:20      8.496
03H120C                  2:30      7.62
03H120C                  2:40      6.912
03H120C                  2:50      6.336
03H120C                  3:00      5.856
```



```
[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       366080.2087      5030220.22155    366695.2693      5030739.82745
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
ALB-OF           366143.745         5030491.113
OF1              366561.224         5030486.487
OF2              366561.962         5030485.749
OF3              366487.932         5030457.828
OF4              366521.881         5030385.55
OF5              366379.435         5030410.818
OF6              366346.034         5030492.952
OF7              366197.772         5030338.959
SU1              366196.986         5030339.745
SU10             366423.129         5030613.526
SU11             366317.45          5030549.462
SU12             366489.932         5030653.498
SU13             366534.832         5030681.424
SU14             366570.424         5030600.933
SU15             366652.01          5030522.084
SU16             366589.041         5030422.427
SU17             366152.634         5030447.615
SU2              366345.376         5030493.61
SU3              366378.777         5030411.476
SU4              366408.893         5030335.912
SU5              366521.143         5030386.288
```

```
SU6              366554.544       5030311.272
SU7              366487.194       5030458.566
SU8              366459.816       5030525.917
SU9              366443.389       5030564.793
ALB-BOO          366429.516       5030630.229
ALB-LOR          366495.464       5030670.72
ALB-PRE          366161.116       5030463.904
ALB-PRI          366537.409       5030695.935
ALB-ROC          366323.562       5030567.191
BOO-LP1          366468.067       5030537.126
BOO-LP2          366451.58        5030575.434
ELM-BOO          366528.923       5030398.925
ELM-PRI          366386.601       5030423.171
ELM-ROC          366418.363       5030349.222
LOR              366595.842       5030437.476
PRE              366210.835       5030353.976
PRI              366575.96        5030612.53
PRI-BOO          366497.404       5030471.42
PRI-EMP          366657.702       5030537.068
PRI-LOR          366568.929       5030500.03
ROC-LP1          366349.02        5030507.061
SPR-BOO          366561.898       5030324.249

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OL19             366561.087       5030495.555
OL20             366486.731       5030467.56
OL21             366519.9         5030396.484
OL22             366377.233       5030420.154
OL23             366209.658       5030342.429
OL24             366340.592       5030502.152

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
33               366619.39        5030289.71
33               366592.332       5030253.03
```



```
33               366592.332       5030253.03
33               366552.97        5030243.84
33               366552.97        5030243.84
33               366527.372       5030297.603
33               366527.372       5030297.603
33               366544.282       5030311.094
33               366544.282       5030311.094
33               366537.925       5030336.48
33               366537.925       5030336.48
33               366541.376       5030359.772
33               366541.376       5030359.772
33               366581.91        5030377.77
33               366581.91        5030377.77
33               366619.39        5030289.71
34               366467.569       5030415.215
34               366548.303       5030449.668
34               366548.303       5030449.668
34               366548.485       5030449.745
34               366548.485       5030449.745
34               366581.91        5030377.77
34               366581.91        5030377.77
34               366541.376       5030359.772
34               366541.376       5030359.772
34               366537.925       5030336.48
34               366537.925       5030336.48
34               366516.325       5030327.358
34               366516.325       5030327.358
34               366512.08        5030329.18
34               366512.08        5030329.18
34               366508.26        5030333.8
34               366508.26        5030333.8
34               366503.303       5030331.783
34               366503.303       5030331.783
34               366467.569       5030415.215
37               366473.55        5030550.784
37               366503.256       5030564.221
37               366503.256       5030564.221
37               366523.663       5030511.484
```

POST-DEVELOPMENT MODEL

37	366523.663	5030511.484
37	366475.109	5030502.782
37	366475.109	5030502.782
37	366418.8	5030478.49
37	366418.8	5030478.49
37	366409.03	5030482.37
37	366409.03	5030482.37
37	366408.26	5030482.17
37	366408.26	5030482.17
37	366401.53	5030479.211
37	366401.53	5030479.211
37	366395.54	5030498.39
37	366395.54	5030498.39
37	366385.68	5030511.057
37	366385.68	5030511.057
37	366378.272	5030523.863
37	366378.272	5030523.863
37	366392.307	5030530.098
37	366392.307	5030530.098
37	366452.237	5030556.15
37	366452.237	5030556.15
37	366473.55	5030550.784
38	366397.9	5030385.485
38	366467.569	5030415.215
38	366467.569	5030415.215
38	366503.303	5030331.783
38	366503.303	5030331.783
38	366494.117	5030328.046
38	366494.117	5030328.046
38	366500.756	5030313.631
38	366500.756	5030313.631
38	366490.04	5030303.83
38	366490.04	5030303.83
38	366454.418	5030288.218
38	366454.418	5030288.218
38	366450.874	5030289.664
38	366450.874	5030289.664
38	366415.316	5030342.551

POST-DEVELOPMENT MODEL

38	366415.316	5030342.551
38	366397.9	5030385.485
39	366548.485	5030449.745
39	366548.303	5030449.668
39	366548.303	5030449.668
39	366531.64	5030490.871
39	366531.64	5030490.871
39	366523.663	5030511.484
39	366523.663	5030511.484
39	366503.256	5030564.221
39	366503.256	5030564.221
39	366481.219	5030621.173
39	366481.219	5030621.173
39	366502.985	5030642.015
39	366502.985	5030642.015
39	366531.021	5030654.341
39	366531.021	5030654.341
39	366539.111	5030632.511
39	366539.111	5030632.511
39	366563.37	5030585.01
39	366563.37	5030585.01
39	366573.07	5030551.98
39	366573.07	5030551.98
39	366589.47	5030530.98
39	366589.47	5030530.98
39	366617.51	5030534.77
39	366617.51	5030534.77
39	366626.497	5030514.457
39	366626.497	5030514.457
39	366583.83	5030495.579
39	366583.83	5030495.579
39	366574.4	5030463.87
39	366574.4	5030463.87
39	366548.485	5030449.745
40	366515.191	5030686.248
40	366562.582	5030716.209
40	366562.582	5030716.209
40	366566.792	5030706.813

POST-DEVELOPMENT MODEL

40	366566.792	5030706.813
40	366576.585	5030690.905
40	366576.585	5030690.905
40	366582.947	5030674.588
40	366582.947	5030674.588
40	366531.021	5030654.341
40	366531.021	5030654.341
40	366522.11	5030675.305
40	366522.11	5030675.305
40	366515.191	5030686.248
41	366466.27	5030655.32
41	366515.191	5030686.248
41	366515.191	5030686.248
41	366522.11	5030675.305
41	366522.11	5030675.305
41	366531.021	5030654.341
41	366531.021	5030654.341
41	366502.985	5030642.015
41	366502.985	5030642.015
41	366481.219	5030621.173
41	366481.219	5030621.173
41	366471.07	5030647.4
41	366471.07	5030647.4
41	366466.27	5030655.32
42	366531.021	5030654.341
42	366582.947	5030674.588
42	366582.947	5030674.588
42	366596.751	5030639.188
42	366596.751	5030639.188
42	366617.63	5030596.572
42	366617.63	5030596.572
42	366619.259	5030561.197
42	366619.259	5030561.197
42	366589.47	5030530.98
42	366589.47	5030530.98
42	366573.07	5030551.98
42	366573.07	5030551.98
42	366563.37	5030585.01

42	366563.37	5030585.01
42	366539.111	5030632.511
42	366539.111	5030632.511
42	366531.021	5030654.341
43	366629.51	5030483.795
43	366627.384	5030512.453
43	366627.384	5030512.453
43	366626.497	5030514.457
43	366626.497	5030514.457
43	366617.51	5030534.77
43	366617.51	5030534.77
43	366589.47	5030530.98
43	366589.47	5030530.98
43	366619.259	5030561.197
43	366619.259	5030561.197
43	366617.63	5030596.572
43	366617.63	5030596.572
43	366620.419	5030596.721
43	366620.419	5030596.721
43	366639.85	5030595.64
43	366639.85	5030595.64
43	366652.84	5030596.3
43	366652.84	5030596.3
43	366656.016	5030582.215
43	366656.016	5030582.215
43	366667.312	5030555.751
43	366667.312	5030555.751
43	366661.449	5030546.897
43	366661.449	5030546.897
43	366653.74	5030529.165
43	366653.74	5030529.165
43	366629.51	5030483.795
44	366581.91	5030377.77
44	366548.485	5030449.745
44	366548.485	5030449.745
44	366574.4	5030463.87
44	366574.4	5030463.87
44	366583.83	5030495.579

POST-DEVELOPMENT MODEL

44	366583.83	5030495.579
44	366626.497	5030514.457
44	366626.497	5030514.457
44	366627.384	5030512.453
44	366627.384	5030512.453
44	366629.51	5030483.795
44	366629.51	5030483.795
44	366653.97	5030470.53
44	366653.97	5030470.53
44	366663.764	5030454.432
44	366663.764	5030454.432
44	366615.153	5030433.885
44	366615.153	5030433.885
44	366632.08	5030396.264
44	366632.08	5030396.264
44	366581.91	5030377.77
45	366301.091	5030575.904
45	366350.63	5030599.04
45	366350.63	5030599.04
45	366357.918	5030587.259
45	366357.918	5030587.259
45	366357.58	5030568.31
45	366357.58	5030568.31
45	366360.287	5030562.069
45	366360.287	5030562.069
45	366361.77	5030544.67
45	366361.77	5030544.67
45	366333.939	5030522.615
45	366333.939	5030522.615
45	366268.163	5030488.683
45	366268.163	5030488.683
45	366259.789	5030504.914
45	366259.789	5030504.914
45	366260.266	5030513.543
45	366260.266	5030513.543
45	366244.367	5030541.042
45	366244.367	5030541.042
45	366267.964	5030555.544

POST-DEVELOPMENT MODEL

45	366267.964	5030555.544
45	366291.967	5030570.296
45	366291.967	5030570.296
45	366301.091	5030575.904
46	366357.918	5030587.259
46	366440.91	5030639.287
46	366440.91	5030639.287
46	366466.27	5030655.32
46	366466.27	5030655.32
46	366471.07	5030647.4
46	366471.07	5030647.4
46	366481.219	5030621.173
46	366481.219	5030621.173
46	366472.49	5030616.02
46	366472.49	5030616.02
46	366447.398	5030604.888
46	366447.398	5030604.888
46	366431.26	5030587.84
46	366431.26	5030587.84
46	366413.62	5030580.29
46	366413.62	5030580.29
46	366387.985	5030574.085
46	366387.985	5030574.085
46	366360.287	5030562.069
46	366360.287	5030562.069
46	366357.58	5030568.31
46	366357.58	5030568.31
46	366357.918	5030587.259
47	366150.516	5030439.185
47	366144.31	5030436.46
47	366144.31	5030436.46
47	366125.161	5030426.264
47	366125.161	5030426.264
47	366108.166	5030455.608
47	366108.166	5030455.608
47	366140.746	5030476.592
47	366140.746	5030476.592
47	366166.263	5030493.026

POST-DEVELOPMENT MODEL

47	366166.263	5030493.026
47	366166.791	5030493.366
47	366166.791	5030493.366
47	366213.887	5030522.31
47	366213.887	5030522.31
47	366225.944	5030529.72
47	366225.944	5030529.72
47	366244.367	5030541.042
47	366244.367	5030541.042
47	366260.266	5030513.543
47	366260.266	5030513.543
47	366259.789	5030504.914
47	366259.789	5030504.914
47	366268.163	5030488.683
47	366268.163	5030488.683
47	366212.111	5030459.768
47	366212.111	5030459.768
47	366212.097	5030459.803
47	366212.097	5030459.803
47	366212.111	5030459.768
47	366212.111	5030459.768
47	366182.194	5030444.334
47	366182.194	5030444.334
47	366150.516	5030439.185
48	366285.83	5030399.63
48	366247.248	5030383.591
48	366247.248	5030383.591
48	366234.603	5030403.004
48	366234.603	5030403.004
48	366212.111	5030459.768
48	366212.111	5030459.768
48	366268.163	5030488.683
48	366268.163	5030488.683
48	366333.939	5030522.615
48	366333.939	5030522.615
48	366361.77	5030544.67
48	366361.77	5030544.67
48	366370.863	5030536.669

POST-DEVELOPMENT MODEL

48	366370.863	5030536.669
48	366378.272	5030523.863
48	366378.272	5030523.863
48	366385.68	5030511.057
48	366385.68	5030511.057
48	366395.54	5030498.39
48	366395.54	5030498.39
48	366401.53	5030479.211
48	366401.53	5030479.211
48	366389.087	5030472.996
48	366389.087	5030472.996
48	366351.34	5030449.657
48	366351.34	5030449.657
48	366307.543	5030424.064
48	366307.543	5030424.064
48	366285.83	5030399.63
49	366503.256	5030564.221
49	366473.55	5030550.784
49	366473.55	5030550.784
49	366452.237	5030556.15
49	366452.237	5030556.15
49	366392.307	5030530.098
49	366392.307	5030530.098
49	366378.272	5030523.863
49	366378.272	5030523.863
49	366370.863	5030536.669
49	366370.863	5030536.669
49	366361.77	5030544.67
49	366361.77	5030544.67
49	366360.287	5030562.069
49	366360.287	5030562.069
49	366387.985	5030574.085
49	366387.985	5030574.085
49	366413.62	5030580.29
49	366413.62	5030580.29
49	366431.26	5030587.84
49	366431.26	5030587.84
49	366447.398	5030604.888

49	366447.398	5030604.888
49	366472.49	5030616.02
49	366472.49	5030616.02
49	366481.219	5030621.173
49	366481.219	5030621.173
49	366503.256	5030564.221
50	366548.303	5030449.668
50	366467.569	5030415.215
50	366467.569	5030415.215
50	366454.19	5030445.56
50	366454.19	5030445.56
50	366432.29	5030449.492
50	366432.29	5030449.492
50	366418.8	5030478.49
50	366418.8	5030478.49
50	366475.109	5030502.782
50	366475.109	5030502.782
50	366523.663	5030511.484
50	366523.663	5030511.484
50	366531.64	5030490.871
50	366531.64	5030490.871
50	366548.303	5030449.668
51	366247.248	5030383.591
51	366246.32	5030366.3
51	366246.32	5030366.3
51	366223.36	5030355.55
51	366223.36	5030355.55
51	366200.48	5030354.42
51	366200.48	5030354.42
51	366182.086	5030395.395
51	366182.086	5030395.395
51	366174.41	5030392.2
51	366174.41	5030392.2
51	366166.84	5030409.15
51	366166.84	5030409.15
51	366150.516	5030439.185
51	366150.516	5030439.185
51	366182.194	5030444.334

51	366182.194	5030444.334
51	366212.111	5030459.768
51	366212.111	5030459.768
51	366234.603	5030403.004
51	366234.603	5030403.004
51	366247.248	5030383.591
52	366467.569	5030415.215
52	366397.9	5030385.485
52	366380.24	5030393.48
52	366339.15	5030374.4
52	366304.45	5030352.87
52	366296.88	5030370.78
52	366285.83	5030399.63
52	366307.543	5030424.064
52	366351.34	5030449.657
52	366389.087	5030472.996
52	366401.53	5030479.211
52	366408.26	5030482.17
52	366409.03	5030482.37
52	366418.8	5030478.49
52	366432.29	5030449.492
52	366454.19	5030445.56
52	366467.569	5030415.215

```
;;Storage Node   X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****

Number of rain gages 1
Number of subcatchments ... 18
Number of nodes 43
Number of links 42
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG1	03H120C	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
33	0.77	173.12	71.43	3.0000	RG1	SPR-BOO
34	0.78	176.62	71.43	3.0000	RG1	ELM-BOO
37	0.70	157.28	71.43	3.0000	RG1	BOO-LP1
38	0.79	177.32	71.43	3.0000	RG1	ELM-ROC
39	1.21	271.83	71.43	3.0000	RG1	PRI-LOR
40	0.23	51.24	71.43	3.0000	RG1	ALB-PRI
41	0.20	44.25	71.43	3.0000	RG1	ALB-LOR
42	0.68	152.53	71.43	3.0000	RG1	PRI
43	0.38	85.28	71.43	3.0000	RG1	

PRI-EMP

44	0.78	175.80	71.43	3.0000	RG1
LOR					
45	0.68	154.07	71.43	3.0000	RG1
ALB-ROC					
46	0.44	98.25	71.43	3.0000	RG1
ALB-BOO					
47	0.77	172.57	71.43	3.0000	RG1
ALB-PRE					
48	1.41	316.73	71.43	3.0000	RG1
ROC-LP1					
49	0.63	141.03	71.43	3.0000	RG1
BOO-LP2					
50	0.74	165.46	71.43	3.0000	RG1
PRI-BOO					
51	0.56	125.13	71.43	3.0000	RG1
PRE					
52	1.14	255.87	71.43	3.0000	RG1
ELM-PRI					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
ALB-OF	OUTFALL	0.00	0.00	0.0	
OF1	OUTFALL	0.00	0.00	0.0	
OF2	OUTFALL	0.00	0.00	0.0	
OF3	OUTFALL	0.00	0.00	0.0	
OF4	OUTFALL	0.00	0.00	0.0	
OF5	OUTFALL	0.00	0.00	0.0	
OF6	OUTFALL	0.00	0.00	0.0	
OF7	OUTFALL	0.00	0.00	0.0	
SU1	OUTFALL	0.00	0.00	0.0	
SU10	OUTFALL	0.00	0.00	0.0	
SU11	OUTFALL	0.00	0.00	0.0	
SU12	OUTFALL	0.00	0.00	0.0	
SU13	OUTFALL	0.00	0.00	0.0	
SU14	OUTFALL	0.00	0.00	0.0	
SU15	OUTFALL	0.00	0.00	0.0	
SU16	OUTFALL	0.00	0.00	0.0	
SU17	OUTFALL	0.00	0.00	0.0	
SU2	OUTFALL	0.00	0.00	0.0	
SU3	OUTFALL	0.00	0.00	0.0	
SU4	OUTFALL	0.00	0.00	0.0	
SU5	OUTFALL	0.00	0.00	0.0	
SU6	OUTFALL	0.00	0.00	0.0	
SU7	OUTFALL	0.00	0.00	0.0	

SU8	OUTFALL	0.00	0.00	0.0
SU9	OUTFALL	0.00	0.00	0.0
ALB-BOO	STORAGE	61.78	0.40	0.0
ALB-LOR	STORAGE	62.33	0.40	0.0
ALB-PRE	STORAGE	58.95	0.40	0.0
ALB-PRI	STORAGE	62.47	0.40	0.0
ALB-ROC	STORAGE	60.67	0.40	0.0
BOO-LP1	STORAGE	62.23	0.40	0.0
BOO-LP2	STORAGE	62.25	0.40	0.0
ELM-BOO	STORAGE	64.98	0.40	0.0
ELM-PRI	STORAGE	62.36	0.40	0.0
ELM-ROC	STORAGE	63.04	0.40	0.0
LOR	STORAGE	76.87	0.40	0.0
PRE	STORAGE	61.31	0.40	0.0
PRI	STORAGE	62.87	0.40	0.0
PRI-BOO	STORAGE	62.37	0.40	0.0
PRI-EMP	STORAGE	80.19	0.40	0.0
PRI-LOR	STORAGE	72.00	0.40	0.0
ROC-LP1	STORAGE	61.36	0.40	0.0
SPR-BOO	STORAGE	71.56	0.40	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	SPR-BOO	ELM-BOO	CONDUIT	81.6	8.0864	0.0130
C10	PRE	ALB-PRE	CONDUIT	120.7	1.8900	0.0130
C11	PRI-BOO	BOO-LP1	CONDUIT	72.0	0.1945	0.0130
C12	BOO-LP1	BOO-LP2	CONDUIT	41.7	-0.0480	0.0130
C13	BOO-LP2	ALB-BOO	CONDUIT	59.1	0.6263	0.0130
C14	ELM-PRI	ROC-LP1	CONDUIT	91.9	1.0879	0.0130
C15	ROC-LP1	ALB-ROC	CONDUIT	65.3	0.9036	0.0130
C16	ALB-BOO	ALB-ROC	CONDUIT	123.3	0.9003	0.0130
C17	ALB-ROC	ALB-PRE	CONDUIT	192.5	0.8935	0.0130
C2	ELM-BOO	PRI-BOO	CONDUIT	79.1	3.3033	0.0130

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  C3                LOR               PRI-LOR           CONDUIT              68.1
7.1695    0.0130
  C4                PRI-LOR           ALB-LOR           CONDUIT             185.8
5.1565    0.0130
  C5                PRI-EMP           PRI-LOR           CONDUIT              96.2
8.5450    0.0130
  C6                PRI               ALB-PRI           CONDUIT              91.9
0.3265    0.0130
  C7                ALB-PRI           ALB-LOR           CONDUIT              48.9
0.2860    0.0130
  C8                ALB-LOR           ALB-BOO           CONDUIT              77.4
0.7107    0.0130
  C9                ELM-ROC           ELM-PRI           CONDUIT              80.5
0.8449    0.0130
  W1                ALB-PRE           ALB-OF            WEIR
  OL1               ALB-PRE           SU17              OUTLET
  OL10              PRI-LOR           OF2               OUTLET
  OL11              PRI-EMP           SU15              OUTLET
  OL12              PRI               SU14              OUTLET
  OL13              ALB-PRI           SU13              OUTLET
  OL14              ALB-LOR           SU12              OUTLET
  OL15              ALB-BOO           SU10              OUTLET
  OL16              BOO-LP2           SU9               OUTLET
  OL17              BOO-LP1           SU8               OUTLET
  OL18              PRI-BOO           OF3               OUTLET
  OL19              PRI-LOR           OF1               OUTLET
  OL2               PRE               SU1               OUTLET
  OL20              PRI-BOO           SU7               OUTLET
  OL21              ELM-BOO           SU5               OUTLET
  OL22              ELM-PRI           SU3               OUTLET
  OL23              PRE               OF7               OUTLET
  OL24              ROC-LP1           SU2               OUTLET
  OL3               ALB-ROC           SU11              OUTLET
  OL4               ROC-LP1           OF6               OUTLET
  OL5               ELM-PRI           OF5               OUTLET
  OL6               ELM-ROC           SU4               OUTLET
  OL7               ELM-BOO           OF4               OUTLET
  OL8               SPR-BOO           SU6               OUTLET
  OL9               LOR               SU16              OUTLET


  *********************
  Cross Section Summary
  *********************
                                       Full     Full     Hyd.     Max.   No. of
 Full
  Conduit           Shape             Depth     Area     Rad.    Width  Barrels
 Flow

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----
  C1                  18m                   0.35      3.56      0.19     18.00          1
25310.06
  C10                 20m_Preston           0.20      2.00      0.10     20.00          1
4499.28
  C11                 18m                   0.35      3.56      0.19     18.00          1
3925.81
  C12                 18m                   0.35      3.56      0.19     18.00          1
1949.04
  C13                 18m                   0.35      3.56      0.19     18.00          1
7044.06
  C14                 18m                   0.35      3.56      0.19     18.00          1
9283.36
  C15                 18m                   0.35      3.56      0.19     18.00          1
8460.47
  C16                 15.5m_Albert_OS       0.23      1.46      0.10     15.00          1
2240.10
  C17                 15.5m_Albert_OS       0.23      1.46      0.10     15.00          1
2231.59
  C2                  18m                   0.35      3.56      0.19     18.00          1
16176.70
  C3                  18m                   0.35      3.56      0.19     18.00          1
23832.00
  C4                  18m                   0.35      3.56      0.19     18.00          1
20211.25
  C5                  18m                   0.35      3.56      0.19     18.00          1
26017.86
  C6                  18m                   0.35      3.56      0.19     18.00          1
5085.65
  C7                  15.5m_Albert_OS       0.23      1.46      0.10     15.00          1
1262.66
  C8                  15.5m_Albert_OS       0.23      1.46      0.10     15.00          1
1990.28
  C9                  18m                   0.35      3.56      0.19     18.00          1
8181.22


  ****************
  Transect Summary
  ****************

  Transect 15.5m_Albert_OS
  Area:
              0.0004     0.0014     0.0033     0.0058     0.0090
              0.0130     0.0177     0.0231     0.0293     0.0362
              0.0438     0.0521     0.0611     0.0709     0.0814
              0.0926     0.1045     0.1172     0.1306     0.1447
              0.1595     0.1751     0.1913     0.2083     0.2261
              0.2445     0.2637     0.2836     0.3042     0.3255
              0.3476     0.3704     0.3939     0.4187     0.4449
```

	0.4724	0.5013	0.5315	0.5631	0.5960
	0.6303	0.6660	0.7030	0.7413	0.7811
	0.8221	0.8646	0.9084	0.9535	1.0000
Hrad:					
	0.0234	0.0467	0.0701	0.0934	0.1168
	0.1402	0.1635	0.1869	0.2102	0.2336
	0.2569	0.2803	0.3037	0.3270	0.3504
	0.3737	0.3971	0.4205	0.4438	0.4672
	0.4905	0.5139	0.5373	0.5606	0.5840
	0.6073	0.6307	0.6540	0.6774	0.7008
	0.7241	0.7475	0.7633	0.7690	0.7764
	0.7854	0.7958	0.8073	0.8198	0.8332
	0.8474	0.8623	0.8779	0.8940	0.9107
	0.9278	0.9453	0.9632	0.9814	1.0000
Width:					
	0.0153	0.0307	0.0460	0.0613	0.0767
	0.0920	0.1073	0.1227	0.1380	0.1533
	0.1687	0.1840	0.1993	0.2147	0.2300
	0.2453	0.2607	0.2760	0.2913	0.3067
	0.3220	0.3373	0.3527	0.3680	0.3833
	0.3987	0.4140	0.4293	0.4447	0.4600
	0.4753	0.4907	0.5113	0.5400	0.5688
	0.5975	0.6263	0.6550	0.6838	0.7125
	0.7413	0.7700	0.7988	0.8275	0.8563
	0.8850	0.9138	0.9425	0.9713	1.0000

Transect 18m

Area:					
	0.0005	0.0020	0.0045	0.0081	0.0126
	0.0181	0.0247	0.0322	0.0408	0.0503
	0.0609	0.0725	0.0851	0.0986	0.1132
	0.1288	0.1454	0.1631	0.1816	0.2003
	0.2190	0.2378	0.2571	0.2770	0.2975
	0.3186	0.3402	0.3625	0.3853	0.4087
	0.4327	0.4573	0.4825	0.5082	0.5346
	0.5615	0.5890	0.6171	0.6458	0.6751
	0.7049	0.7354	0.7664	0.7980	0.8302
	0.8630	0.8964	0.9303	0.9649	1.0000
Hrad:					
	0.0183	0.0366	0.0549	0.0731	0.0914
	0.1097	0.1280	0.1463	0.1646	0.1829
	0.2012	0.2194	0.2377	0.2560	0.2743
	0.2926	0.3109	0.3292	0.3551	0.3911
	0.4270	0.4628	0.4975	0.5304	0.5618
	0.5917	0.6201	0.6471	0.6727	0.6971
	0.7203	0.7424	0.7633	0.7833	0.8023
	0.8203	0.8375	0.8539	0.8695	0.8844
	0.8986	0.9121	0.9249	0.9372	0.9489
	0.9601	0.9708	0.9810	0.9907	1.0000
Width:					

```
            0.0284     0.0568     0.0853     0.1137     0.1421
            0.1705     0.1989     0.2274     0.2558     0.2842
            0.3126     0.3410     0.3694     0.3979     0.4263
            0.4547     0.4831     0.5115     0.5278     0.5278
            0.5278     0.5372     0.5537     0.5703     0.5868
            0.6033     0.6199     0.6364     0.6529     0.6694
            0.6860     0.7025     0.7190     0.7356     0.7521
            0.7686     0.7851     0.8017     0.8182     0.8347
            0.8512     0.8678     0.8843     0.9008     0.9174
            0.9339     0.9504     0.9669     0.9835     1.0000

Transect 20m_Preston
Area:
            0.0004     0.0016     0.0036     0.0064     0.0100
            0.0144     0.0196     0.0256     0.0324     0.0400
            0.0484     0.0576     0.0676     0.0784     0.0900
            0.1024     0.1156     0.1296     0.1444     0.1600
            0.1764     0.1936     0.2116     0.2304     0.2500
            0.2704     0.2916     0.3136     0.3364     0.3600
            0.3844     0.4096     0.4356     0.4624     0.4900
            0.5184     0.5476     0.5776     0.6084     0.6400
            0.6724     0.7056     0.7396     0.7744     0.8100
            0.8464     0.8836     0.9216     0.9604     1.0000
Hrad:
            0.0199     0.0398     0.0597     0.0796     0.0995
            0.1194     0.1393     0.1592     0.1791     0.1990
            0.2189     0.2388     0.2587     0.2786     0.2985
            0.3184     0.3383     0.3582     0.3781     0.3980
            0.4179     0.4378     0.4577     0.4776     0.4975
            0.5175     0.5374     0.5573     0.5772     0.5971
            0.6170     0.6369     0.6568     0.6767     0.6966
            0.7165     0.7364     0.7565     0.7768     0.7971
            0.8173     0.8376     0.8579     0.8782     0.8985
            0.9188     0.9391     0.9594     0.9797     1.0000
Width:
            0.0200     0.0400     0.0600     0.0800     0.1000
            0.1200     0.1400     0.1600     0.1800     0.2000
            0.2200     0.2400     0.2600     0.2800     0.3000
            0.3200     0.3400     0.3600     0.3800     0.4000
            0.4200     0.4400     0.4600     0.4800     0.5000
            0.5200     0.5400     0.5600     0.5800     0.6000
            0.6200     0.6400     0.6600     0.6800     0.7000
            0.7200     0.7400     0.7600     0.7800     0.8000
            0.8200     0.8400     0.8600     0.8800     0.9000
            0.9200     0.9400     0.9600     0.9800     1.0000


****************
Analysis Options
****************
```

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 07/17/2024 00:00:00
Ending Date .............. 07/17/2024 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 8
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         1.106        86.000
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.173        13.470
Surface Runoff ...........         0.920        71.504
Final Storage ............         0.014         1.126
Continuity Error (%) .....        -0.116


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.920         9.198
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.916         9.162
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
```

Continuity Error (%) 0.399

****
Highest Continuity Errors
****
Node ALB-PRE (3.51%)
Node ALB-ROC (-1.21%)

****
Highest Flow Instability Indexes
****
All links are stable.

****
Most Frequent Nonconverging Nodes
****
Convergence obtained at all time steps.

****
Routing Time Step Summary
****
Minimum Time Step : 1.00 sec
Average Time Step : 1.00 sec
Maximum Time Step : 1.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 2.00
% of Steps Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
33	86.00	0.00	0.00	13.47	60.38					

						11.12	71.50	0.55	429.09	0.831
34	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.56	437.76	0.831
37	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.50	389.83	0.831
38	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.56	439.49	0.831
39	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.86	673.74	0.831
40	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.16	127.01	0.831
41	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.14	109.66	0.831
42	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.48	378.05	0.831
43	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.27	211.37	0.831
44	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.56	435.74	0.831
45	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.49	381.88	0.831
46	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.31	243.51	0.831
47	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.55	427.72	0.831
48	86.00	0.00	0.00	13.47	60.38	11.12	71.50	1.01	785.03	0.831
49	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.45	349.54	0.831
50	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.53	410.09	0.831
51	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.40	310.13	0.831
52	86.00	0.00	0.00	13.47	60.38	11.12	71.50	0.81	634.18	0.831

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
ALB-OF	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF3	OUTFALL	0.00	0.00	0.00	0 00:00	0.00

OF4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF7	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU10	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU11	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU12	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU13	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU14	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU15	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU16	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU17	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU2	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU3	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU5	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU6	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU7	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU8	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
SU9	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
ALB-BOO	STORAGE	0.02	0.18	61.96	0	01:10	0.18
ALB-LOR	STORAGE	0.02	0.17	62.50	0	01:10	0.17
ALB-PRE	STORAGE	0.03	0.38	59.33	0	01:13	0.38
ALB-PRI	STORAGE	0.01	0.10	62.57	0	01:10	0.10
ALB-ROC	STORAGE	0.02	0.21	60.88	0	01:10	0.21
BOO-LP1	STORAGE	0.02	0.16	62.39	0	01:10	0.16
BOO-LP2	STORAGE	0.02	0.11	62.36	0	01:10	0.11
ELM-BOO	STORAGE	0.01	0.08	65.06	0	01:10	0.08
ELM-PRI	STORAGE	0.01	0.10	62.46	0	01:10	0.10
ELM-ROC	STORAGE	0.01	0.09	63.13	0	01:10	0.09
LOR	STORAGE	0.01	0.07	76.94	0	01:10	0.07
PRE	STORAGE	0.01	0.05	61.36	0	01:10	0.05
PRI	STORAGE	0.01	0.09	62.96	0	01:10	0.09
PRI-BOO	STORAGE	0.01	0.12	62.49	0	01:10	0.12
PRI-EMP	STORAGE	0.01	0.05	80.24	0	01:10	0.05
PRI-LOR	STORAGE	0.01	0.09	72.09	0	01:10	0.09
ROC-LP1	STORAGE	0.02	0.12	61.48	0	01:10	0.12
SPR-BOO	STORAGE	0.01	0.06	71.62	0	01:10	0.06

```
*******************
Node Inflow Summary
*******************


---------------------------------------------------------------------------------------------
                                    Maximum  Maximum                 Lateral
Total         Flow
```

Node	Type	Lateral Inflow LPS	Total Inflow LPS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Inflow Volume 10^6 ltr	Inflow Volume 10^6 ltr	Balance Error Percent
ALB-OF	OUTFALL	0.00	983.37	0	01:13	0	0.542	0.000
OF1	OUTFALL	0.00	189.10	0	01:10	0	0.343	0.000
OF2	OUTFALL	0.00	315.17	0	01:10	0	0.571	0.000
OF3	OUTFALL	0.00	116.23	0	01:10	0	0.158	0.000
OF4	OUTFALL	0.00	76.34	0	01:10	0	0.121	0.000
OF5	OUTFALL	0.00	136.64	0	01:10	0	0.212	0.000
OF6	OUTFALL	0.00	390.00	0	01:08	0	0.692	0.000
OF7	OUTFALL	0.00	157.38	0	01:10	0	0.241	0.000
SU1	OUTFALL	0.00	15.74	0	01:10	0	0.0241	0.000
SU10	OUTFALL	0.00	156.00	0	01:03	0	0.378	0.000
SU11	OUTFALL	0.00	390.00	0	01:04	0	0.793	0.000
SU12	OUTFALL	0.00	156.00	0	01:03	0	0.343	0.000
SU13	OUTFALL	0.00	132.04	0	01:10	0	0.182	0.000
SU14	OUTFALL	0.00	230.16	0	01:10	0	0.373	0.000
SU15	OUTFALL	0.00	15.37	0	01:10	0	0.0284	0.000
SU16	OUTFALL	0.00	43.45	0	01:10	0	0.0932	0.000
SU17	OUTFALL	0.00	390.00	0	01:03	0	1.06	0.000
SU2	OUTFALL	0.00	176.99	0	01:10	0	0.171	0.000
SU3	OUTFALL	0.00	341.61	0	01:10	0	0.529	0.000
SU4	OUTFALL	0.00	178.45	0	01:10	0	0.326	0.000
SU5	OUTFALL	0.00	254.46	0	01:10	0		

```
0.405       0.000
  SU6                 OUTFALL       0.00   159.88     0  01:10           0
0.271       0.000
  SU7                 OUTFALL       0.00   387.42     0  01:10           0
0.526       0.000
  SU8                 OUTFALL       0.00   395.00     0  01:10           0
0.542       0.000
  SU9                 OUTFALL       0.00   205.36     0  01:10           0
0.238       0.000
  ALB-BOO             STORAGE     243.51  1383.15     0  01:10       0.312
1.19      -0.147
  ALB-LOR             STORAGE     109.66   973.51     0  01:10       0.141
0.892      -0.069
  ALB-PRE             STORAGE     427.72  2117.22     0  01:10       0.548
1.66       3.643
  ALB-PRI             STORAGE     127.01   267.16     0  01:10       0.163
0.275      -0.187
  ALB-ROC             STORAGE     381.88  2146.20     0  01:10        0.49
1.75      -1.198
  BOO-LP1             STORAGE     389.83   641.79     0  01:10         0.5
0.664       0.105
  BOO-LP2             STORAGE     349.54   567.92     0  01:10       0.448
0.57      -0.026
  ELM-BOO             STORAGE     437.76   705.78     0  01:10       0.561
0.841      -0.047
  ELM-PRI             STORAGE     634.18   892.55     0  01:10       0.813
1.05      -0.005
  ELM-ROC             STORAGE     439.49   439.49     0  01:10       0.564
0.564      -0.053
  LOR                 STORAGE     435.74   435.74     0  01:10       0.559
0.559      -0.076
  PRE                 STORAGE     310.13   310.13     0  01:10       0.398
0.398      -0.511
  PRI                 STORAGE     378.05   378.05     0  01:10       0.485
0.485      -0.038
  PRI-BOO             STORAGE     410.09   780.30     0  01:10       0.526
0.841      -0.016
  PRI-EMP             STORAGE     211.37   211.37     0  01:10       0.271
0.271      -0.128
  PRI-LOR             STORAGE     673.74  1259.92     0  01:10       0.864
1.57       0.040
  ROC-LP1             STORAGE     785.03  1190.39     0  01:10        1.01
1.32       0.407
  SPR-BOO             STORAGE     429.09   429.09     0  01:10        0.55
0.55      -0.029


  **********************
  Node Surcharge Summary
  **********************
```

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
ALB-BOO	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	1336.68
ALB-LOR	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	956.33
ALB-PRE	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	1373.37
ALB-PRI	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	264.71
ALB-ROC	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	2002.33
BOO-LP1	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	615.49
BOO-LP2	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	551.81
ELM-BOO	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	701.17
ELM-PRI	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	883.83
ELM-ROC	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	436.88
LOR	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	434.66
PRE	0.000	0.0	0.0	0.0	0.000	0.0	0	

```
00:00     306.18
  PRI                     0.000    0.0    0.0    0.0       0.000    0.0       0
00:00     370.55
  PRI-BOO                 0.000    0.0    0.0    0.0       0.000    0.0       0
00:00     756.65
  PRI-EMP                 0.000    0.0    0.0    0.0       0.000    0.0       0
00:00     210.39
  PRI-LOR                 0.000    0.0    0.0    0.0       0.000    0.0       0
00:00    1236.88
  ROC-LP1                 0.000    0.0    0.0    0.0       0.000    0.0       0
00:00    1168.57
  SPR-BOO                 0.000    0.0    0.0    0.0       0.000    0.0       0
00:00     427.93


  **********************
  Outfall Loading Summary
  **********************

  -----------------------------------------------------------
                         Flow       Avg       Max       Total
                         Freq      Flow      Flow      Volume
  Outfall Node           Pcnt       LPS       LPS    10^6 ltr
  -----------------------------------------------------------
  ALB-OF                 5.69    440.90    983.37       0.542
  OF1                   64.43     24.62    189.10       0.343
  OF2                   68.90     38.37    315.17       0.571
  OF3                   57.48     12.71    116.23       0.158
  OF4                   57.85      9.71     76.34       0.121
  OF5                   61.48     15.93    136.64       0.212
  OF6                   71.42     44.86    390.00       0.692
  OF7                   64.95     17.15    157.38       0.241
  SU1                   52.32      2.13     15.74       0.024
  SU10                  63.86     27.43    156.00       0.378
  SU11                  67.53     54.34    390.00       0.793
  SU12                  58.35     27.21    156.00       0.343
  SU13                  59.06     14.30    132.04       0.182
  SU14                  67.63     25.54    230.16       0.373
  SU15                  64.55      2.03     15.37       0.028
  SU16                  69.19      6.23     43.45       0.093
  SU17                  68.49     71.50    390.00       1.058
  SU2                   63.09     12.54    176.99       0.171
  SU3                   69.12     35.43    341.61       0.529
  SU4                   68.83     21.95    178.45       0.326
  SU5                   66.36     28.24    254.46       0.405
  SU6                   68.52     18.29    159.88       0.271
  SU7                   65.77     37.03    387.42       0.526
  SU8                   67.81     37.03    395.00       0.542
  SU9                   66.99     16.45    205.36       0.238
  -----------------------------------------------------------
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System	62.39	1041.90	5610.57	9.162

****
Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CHANNEL	268.05	0 01:10	1.51	0.01	0.20
C10	CHANNEL	133.06	0 01:10	0.82	0.03	0.63
C11	CHANNEL	253.01	0 01:10	0.35	0.06	0.40
C12	CHANNEL	220.55	0 01:10	0.33	0.11	0.39
C13	CHANNEL	346.64	0 01:10	0.84	0.05	0.30
C14	CHANNEL	405.58	0 01:10	0.89	0.04	0.32
C15	CHANNEL	601.73	0 01:10	1.11	0.07	0.35
C16	CHANNEL	1180.68	0 01:10	1.26	0.53	0.85
C17	CHANNEL	1612.33	0 01:10	1.25	0.72	0.95
C2	CHANNEL	370.37	0 01:10	1.15	0.02	0.28
C3	CHANNEL	391.21	0 01:10	1.89	0.02	0.24
C4	CHANNEL	732.63	0 01:10	2.24	0.04	0.27
C5	CHANNEL	195.02	0 01:10	1.19	0.01	0.21
C6	CHANNEL	140.46	0 01:10	0.56	0.03	0.24
C7	CHANNEL	132.66	0 01:10	0.30	0.11	0.57
C8	CHANNEL	800.33	0 01:10	1.05	0.40	0.76
C9	CHANNEL	258.43	0 01:10	0.77	0.03	0.27
W1	WEIR	983.37	0 01:13			0.76
OL1	DUMMY	390.00	0 01:03			
OL10	DUMMY	315.17	0 01:10			
OL11	DUMMY	15.37	0 01:10			
OL12	DUMMY	230.16	0 01:10			
OL13	DUMMY	132.04	0 01:10			
OL14	DUMMY	156.00	0 01:03			
OL15	DUMMY	156.00	0 01:03			
OL16	DUMMY	205.36	0 01:10			
OL17	DUMMY	395.00	0 01:10			
OL18	DUMMY	116.23	0 01:10			
OL19	DUMMY	189.10	0 01:10			
OL2	DUMMY	15.74	0 01:10			
OL20	DUMMY	387.42	0 01:10			
OL21	DUMMY	254.46	0 01:10			
OL22	DUMMY	341.61	0 01:10			
OL23	DUMMY	157.38	0 01:10			
OL24	DUMMY	176.99	0 01:10			
OL3	DUMMY	390.00	0 01:04			
OL4	DUMMY	390.00	0 01:08			
OL5	DUMMY	136.64	0 01:10			

OL6	DUMMY	178.45	0	01:10
OL7	DUMMY	76.34	0	01:10
OL8	DUMMY	159.88	0	01:10
OL9	DUMMY	43.45	0	01:10

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Flow Classification Summary
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	Adjusted	---------- Fraction of Time in Flow Class ----------								
	/Actual		Up	Down	Sub	Sup	Up	Down	Norm	Inlet
Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd	Ctrl
C1	1.00	0.09	0.03	0.00	0.34	0.54	0.00	0.00	0.47	0.00
C10	1.00	0.12	0.00	0.00	0.09	0.00	0.00	0.79	0.09	0.00
C11	1.00	0.08	0.09	0.00	0.83	0.00	0.00	0.00	0.94	0.00
C12	1.00	0.07	0.02	0.00	0.91	0.00	0.00	0.00	0.68	0.00
C13	1.00	0.09	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00
C14	1.00	0.07	0.07	0.00	0.59	0.27	0.00	0.00	0.93	0.00
C15	1.00	0.08	0.00	0.00	0.00	0.01	0.00	0.91	0.01	0.00
C16	1.00	0.08	0.02	0.00	0.36	0.54	0.00	0.00	0.04	0.00
C17	1.00	0.09	0.07	0.00	0.40	0.44	0.00	0.00	0.88	0.00
C2	1.00	0.12	0.04	0.00	0.31	0.53	0.00	0.00	0.46	0.00
C3	1.00	0.06	0.00	0.00	0.33	0.60	0.00	0.00	0.78	0.00
C4	1.00	0.13	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.00
C5	1.00	0.06	0.00	0.00	0.33	0.61	0.00	0.00	0.48	0.00
C6	1.00	0.09	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00

C7	1.00	0.12	0.05	0.00	0.83	0.00	0.00	0.00	0.92	0.00
C8	1.00	0.08	0.10	0.00	0.78	0.04	0.00	0.00	0.87	0.00
C9	1.00	0.07	0.01	0.00	0.36	0.56	0.00	0.00	0.04	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C10	0.01	0.01	0.23	0.01	0.01
C17	0.01	0.01	0.34	0.01	0.01

Analysis begun on: Fri Jul 19 10:00:24 2024
Analysis ended on: Fri Jul 19 10:00:25 2024
Total elapsed time: 00:00:01