The Ottawa Hospital | L'Hôpital d'Ottawa

# New Civic Development for The Ottawa Hospital

## Master Servicing Plan

July 2021

PARSONS

# The New Civic Development
# The Ottawa Hospital

## Master Servicing Plan

**Final Draft – July 2021**

# DISCLAIMER

In March 2021, Public Services and Procurement Canada (PSPC) was to transfer the infrastructure ownership to Agriculture and Agri-Food Canada (AAFC), although currently it is in dispute and the infrastructure has not been transferred. Because the ownership has not been transferred this report still references the infrastructure as owned by PSPC.

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# 1.0 INTRODUCTION

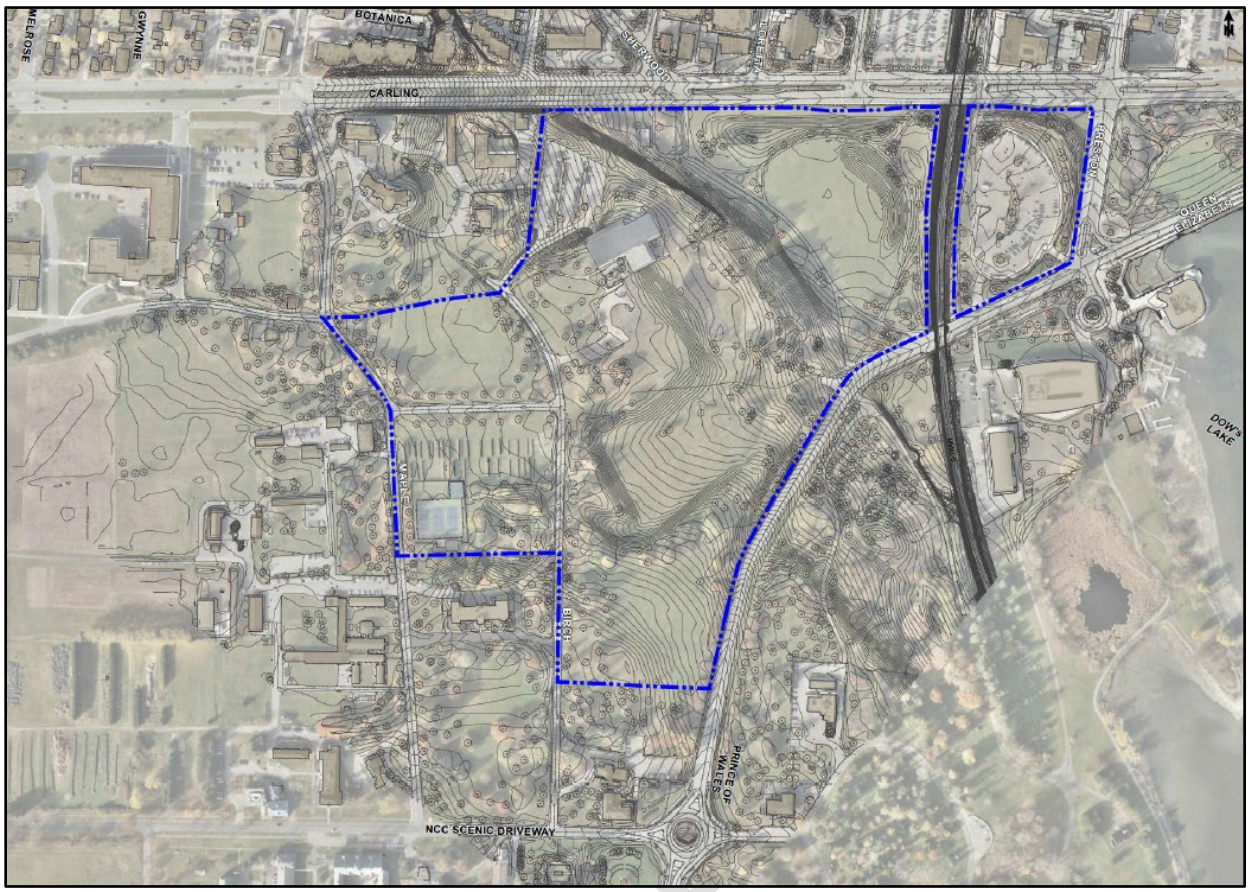
The Ottawa Hospital (TOH) is proposing a New Civic Development (NCD) for the Ottawa Hospital that is currently located at 1053 Carling Avenue. The site is an approximately 20ha property located to the south and west of the Carling Avenue and Preston Street intersection, on two (2) parcels that are separated by the City of Ottawa's existing O-Train line, refer to **Figure 1-1**. The larger parcel is located to the west of the O-Train line and is mostly vacant green space; referred to as the westerly parcel throughout the report. The smaller parcel is located to the east of the O-Train line and hosts an asphalt parking lot; referred to as the easterly parcel throughout the report.

**Figure 1-1: Site Location**


In accordance with the City of Ottawa Zoning By-Law, the easterly and westerly parcels are currently zoned Major Institutional Subzone 2 with a holding provision (I2 [2491]-h). The holding zones requires submission and approval of a Master Site Plan, Transportation Impact Assessment and Mobility Study, Cultural Heritage Impact Statement and Master Servicing Plan.

The topography of the site is quite variable, refer to **Figure 1-2**. A wooded ridge (or escarpment) cuts diagonally across the westerly parcel, and there are some landscape undulations to the south and west of the wooded ridge. This results in an upper western plateau that is associated with the relatively flat landscape of the Central Experimental Farm (CEF), a central portion that is either ridge or undulating (site of the former Sir. John Carling Building), and a lower relatively flat eastern plateau which slopes gently towards Dow's Lake. The easterly parcel is more or less flat.

Figure 1-2: Site Topography




The new hospital site will benefit from its adjacency to the City of Ottawa's Light Rail Transit (LRT) Trillium Line (replacing and augmenting the existing O-Train service), Carling Avenue, Prince of Wales Drive, the Experimental Farm, Dow's Lake, and the surrounding community. From work done by The New Ottawa Hospital's Architects (HDR), the NCD aims to demonstrate architectural and urban design excellence by respecting the historical, cultural and physical environmental of the site.

The objective of this report is to provide sufficient detail to demonstrate that the proposed development can be supported by the existing municipal services.

# 2.0 BACKGROUND DOCUMENTS

## 2.1 Design Guidelines

A list of the design guidelines referenced in the preparation of this report include the following:

- City of Ottawa Sewer Design Guidelines 2nd Edition, City of Ottawa, October 2012
  - Technical Bulletin ISDTB-2012-2, December 15, 2012
  - Technical Bulletin ISDTB-2014-01, *City of Ottawa*, February 5, 2014
  - Technical Bulletin PIEDTB-2016-01, *City of Ottawa*, September 6, 2016
  - Technical Bulletin ISTB-2018-01, *City of Ottawa*, March 21, 2018
- City of Ottawa Design Guidelines – Water Distribution, *City of Ottawa*, July 2010
  - Technical Bulletin ISDTB-2014-02, *City of Ottawa*, May 27, 2014
  - Technical Bulletin ISTB-2018-02, *City of Ottawa*, March 21, 2018
  - Technical Bulletin ISD-2010-2, *City of Ottawa*, December 15, 2010
- Design Guidelines for Drinking Water Systems, *Ministry of the Environment*, 2008
- Design Guidelines for Sewage Works, *Ministry of the Environment*, 2008
- Stormwater Management Planning and Design Manual, *Ministry of the Environment*, March 2003
- City of Ottawa Fire Flow Study Survey Report, *National Research Council Canada*, June 10, 2016
- Water Supply for Public Fire Protection, *Fire Underwriters Survey*, 1999
- City of Ottawa Accessibility Design Standards, 2012
- Ottawa Standard Tender Documents, 2019
- Ontario Provincial Standards for Roads & Public Works, November 2020

## 2.2 Distribution Mapping

A list of the mapping sourced reference in the preparation of this report includes the following:

- City of Ottawa Water Distribution System Interactive Map;
- City of Ottawa Sanitary (Sanitary, Storm, and Combined) Collection System Interactive Map;
- City of Ottawa GeoOttawa;
- City of Ottawa 1:1000 Topography Mapping;
- City of Ottawa Utility Coordinating Committee (UCC) Mapping; and
- Public Service and Procurement Canada Utility Mapping.

## 2.3 Background Reports & Drawings

- An information request was sent to the City of Ottawa on February 6, 2020 and a response was received on March 4, 2020. A list of the background drawings and reports received has been included in **Appendix A**.
- An information request was sent to Public Services and Procurement Canada (PSPC) and a response was received on May 20, 2020. A list of the background drawings received has been included in **Appendix A**. It should be noted that a Master Servicing Study exists for the PSPC infrastructure but was not available at the time this report was prepared. We were advised that only a hard copy of the report exists and due to COVID-19 restrictions, a copy of the report could not be provided.

## 2.4 Projects In Close Proximity

The City of Ottawa identified the following projects within the immediate vicinity of the NCD:

- CTY2010164 - 2021-2024 Resurfacing Program 7 of 8;
- CTY2010166 - 2021-2024 Sidewalk & Pathway Program 1 of 3;
- CTY1910208 - Carling Avenue Integrated Road, Sewer, and Water (part of LRT Project LN00626 ISD15-5022): Carling Avenue Reconstruction – Bayswater Avenue to Bronson Avenue; CP000128 Preliminary

Design Circulation. The proposed work is the reconstruction of Carling Avenue between Bayswater Avenue and Bronson Avenue. The construction start date is to be determined, coordinated with other local projects;

- HOT2114297 - RIO2 RUSH Confederation Line West Carling Station. The proposed works is the installation of ducts to service the LRT2 Carling Station. Construction of this project is anticipated for the summer of 2021;
- CTY2110041 - Preliminary Design Circulation CP000439 Carling Avenue Transit Priority Measures Lincoln Fields to Bayswater Avenue. The project involves implementing exclusive bus lanes along Carling Avenue between Lincoln Fields Station and Bayswater Avenue by conversion of existing traffic lanes using pavement markings and a combination of overhead and side-mounted signage. Construction of this project is anticipated for the summer of 2021; and
- CTY2110009 - Carling Avenue from Merivale Road to Melrose Avenue is included in this resurfacing project. Carling Avenue is identified as a City arterial road. As per the new Road Activity By-Law, there is a 3-year period of restrictions on cuts into new pavement structures that have been constructed, reconstructed, or resurfaced.

The City of Ottawa Construction and Infrastructure Projects Mapping identifies the following projects in the immediate vicinity of the NCD:

- Sidewalk Renewal on Preston Street between Carling Avenue to Prince of Wales Drive, Targeted Start: 2-3 Years;
- Road Resurfacing on Prince of Wales Drive between Preston Street and Baseline Road. Road, Targeted Start: 3-5 Years;
- Retaining Wall Renewal on Carling Avenue east of Maple Avenue, Targeted Start: 3-5 Years; and
- Sewer Renewal on Carling Avenue between Gwynne Avenue and Melrose Avenue, Targeted Start: This Year.

## 2.5 Specialist Studies

The following specialist studies have been commissioned by The Ottawa Hospital under the direction of Parsons and form part of the complete application for Site Plan Control Approval and Lifting of the Holding Zone.

- Stage 1 Archaeological Assessment (Draft), prepared by Golder Associates Ltd., April 2020;
- Cultural Heritage Impact Statement, prepared by Golder Associates Ltd, May 2021;
- Environmental Noise & Vibration Assessment, prepared by Gradient Wind Engineers & Scientists, May 2021
- Environmental Impact Statement and Tree Conservation Report – Master Site Plan, prepared by Parsons, May 2021;
- Preliminary Geotechnical Review (Draft), prepared by Golder Associates Ltd., April 2020; and
- Phase One Environmental Site Assessment The Ottawa Hospital – New Civic Campus, prepared by Golder Associates Ltd. April 2020.

## 2.6 Meetings

The following meetings were held and attended to discuss the existing public and private infrastructure in the vicinity of the NCD:

- City of Ottawa Meeting – April 30th, 2020
  - A meeting was attended with the City of Ottawa on April 30th, 2020 to discuss the existing public infrastructure in the vicinity of the NCD; and
  - Prior to the meeting, the City of Ottawa circulated the potential site's evaluation, **Appendix B**, that was completed during the selection process in 2016. The constraints presented within the potential site's evaluation are summarized in more detail throughout the report.

- PSPC Meeting – May 27th, 2020
  - A meeting was attended with PSPC on May 27th, 2020 to discuss the existing private infrastructure in the vicinity of the NCD;
  - Need to ensure that all private servicing remains functional;
  - No easements were reserved during negotiations;
  - Further discussion is required on how the existing lands and proposed development will be serviced;
  - A Master Servicing Study was previously completed for the PSPS lands. Only a hard copy exists and due to COVID-19 restrictions, a copy of the report could not be provided;
  - All private sanitary sewers on PSPC lands have sufficient capacity to accommodate existing demands;
  - Further discussion is required regarding how the existing lands and proposed development will outlet to existing public sanitary infrastructure (one (1) connection versus two (2) connections));
  - The PSPC lands are currently serviced by two (2) public watermains - one (1) from Carling Avenue and one (1) from Fisher Avenue;
  - A bulk meter would be required if the proposed development is to be serviced from the existing private watermain on Maple Drive;
  - Servicing the proposed development from the existing private watermain on Maple Drive has associated risks;
  - An existing bulk meter is located on the existing watermain at the Carling Avenue and Maple Drive intersection;
  - Further discussion with the City of Ottawa would be required regarding redundancy;
  - All private storm sewers on PSPC lands have sufficient capacity to accommodate existing demands;
  - The storm sewer outlet for the PSPC lands discharges to Dow's Lake/Canal (maintained by Parks Canada) and is owned by PSPC;
  - The storm sewer outlet has been rehabilitated; and
  - The existing infrastructure might be transferred over to the Central Experimental Farm sometime in the future.

# 3.0 EXISTING ENVIRONMENTAL SITE CONDITIONS

## 3.1 Archaeological Resources

A Stage 1 Archaeological Assessment was undertaken for the site to determine areas with archaeological potential. Recommended future work includes the completion of a Stage 2 Archaeological Assessment in accordance with the Ministry of Heritage, Sport, Tourism and Culture Industries Standards and Guidelines for Consultant Archaeologists for areas of the site identified as retaining archaeological potential. Previously disturbed areas (roadways and demolished buildings) are cleared of archaeological potential.

## 3.2 Built Heritage Resources and Cultural Heritage Landscapes

The existing conditions with respect to built heritage resources and cultural heritage landscapes was completed for the site and adjacent properties. The existing conditions were completed utilizing the Ministry of Heritage, Sport, Tourism and Culture Industries Criteria for Evaluating Potential for Built Heritage and Cultural Landscapes (2016) checklist, correspondence with interested agencies/landowners, and review of available databases/previously completed reports. Two (2) cultural heritage resources are located with the site and fourteen (14) directly adjacent. The cultural heritage resources are as follows:

Located Within the Site

- Central Experimental Farm; and
- Sir John Carling Building Annex.

Located Adjacent to the Site

- Rideau Canal;
- Dominion Observatory (Building No. 1);
- Observatory House (Building No. 2);
- Geophysical Laboratory Building (Building No. 3);
- Machine Shop (Building No. 4);
- Seismology Survey Building (Building No. 7);
- South Azimuth Building (Building No. 8);
- Photo Equatorial Building (Building No. 9);
- Arc Biotech Building (Building No. 34);
- William Saunders Building (Building No. 49);
- Main Greenhouse Range (Building No. 50);
- Central Experimental Farm Nutrition Building (Building No. 59);
- Heritage House (Building No. 60); and
- Central Experimental Farm Horticultural Building (Building No. 74).

No listed buildings will remain on the hospital site, government approval has been issued for the demolition of the Sir John Carling Annex.

Since the hospital site is within and adjacent to cultural heritage landscapes and features of national importance, design efforts will be required to pursue a new hospital campus that does not detract from the cultural heritage value of those landscapes, and ideally, strengthens those values.

Recommend future work includes conducting a Cultural Heritage Impact Statement compliant with the requirements of the City of Ottawa's Official Plan and A Guide to Preparing Cultural Heritage Impact Statements to identify the potential direct and indirect impacts resulting from the proposed works. The Cultural Heritage Impact Statement will also recommend mitigation measures to avoid and/or reduce any adverse effects to the identified cultural heritage resources.

## 3.3 Wind, Air Quality, Noise and Ground Vibrations

Existing conditions for wind, air quality, noise, and ground vibrations were assessed within the site.

### 3.3.1 Wind

The statistical model of the Ottawa area wind climate provides the directional character on a seasonal basis development from approximately 40 years of hourly meteorological data recorded at the Ottawa MacDonald Cartier International Airport, obtained from Environment and Climate Change Canada. For Ottawa, the most common winds occur for westerly wind directions, followed by those from the east, while the most common wind speeds are below 36km/h. The directional preference and relative magnitude of wind speed changes from season to season. The site has an open exposure for prominent west and southwest winds, which are anticipated to create wind conditions suitable for a mix of standing, strolling, and walking during most times of the year.

### 3.3.2 Air Quality

Roadway vehicle traffic is the primary source of air-borne pollutants. Emissions from roadway vehicles, Carbon Monoxide, Hydrocarbons, Oxides of Nitrogen, Particulate Matter, and other Volatile Organic Compounds, contribute to ambient air quality levels. The concentration of pollutants produces by vehicle emissions are low throughout the site.

### 3.3.3 Noise and Vibration

Environmental noise levels for the site range based on proximity to high-volume roadways and the O-Train. The City of Ottawa's Environmental Noise Control Guidelines (2016) objective level is 55 decibel unit before noise attenuation should be provided as part of transportation infrastructure projects and mitigation. Environmental noise levels are generally moderate to elevated depending on proximity to roadways and railways. Beyond 100m from arterial roadways and 300m from railways, noise levels fall below the Environmental Noise Control Guidelines objective level of 55 decibel unit.

## 3.4 Natural Environment

An Environmental Impact Statement and Tree Conservation Report was completed. For the purposes of the report, the study area was defined as the site with a 120m buffer around it. The natural environment is limited to the terrestrial environment as the only aquatic environment within the study area is Dow's Lake (part of the Rideau Canal), located greater than 100m northeast of the site.

### 3.4.1 Urban Natural Features

An Urban Natural Feature is located adjacent to the study area (east side of Prince of Wales Drive). A portion of this Urban Natural Feature is part of the Natural Heritage System and include the Dominion Arboretum and the Arboretum Woods, considered to have an overall sensitivity rating of 'low'. If offers locally uncommon habitat and contains a number of tress that are significant is age, size and/or species.

### 3.4.2 Greenspace Master Plan

The study area includes lands identified in Map 1 (Natural Lands), Map 2 (Open Space and Leisure Lands), and Map 3 (A Greenspace Network for Ottawa) of the City of Ottawa Greenspace Master Plan (2006).

### 3.4.3 Trees

The study area includes a number of trees and treed features which have value both as unique aspects to the urban environment and as individual specimens. The following treed features are found within the site:

- Carling Avenue Woodlot

  - Extends from the northwest corner of the site at Carling Avenue, westward approximately 360m to Prince of Wales Drive; and
  - Two (2) areas of closed canopy's (0.70ha and 0.45ha) separated by grass.
- Trees
  - The majority of the site area is comprised of manicured lawn interspersed with mature, planted trees;
  - These trees do not form a contiguous canopy cover but individually they may be significant; and
  - Larger trees may include trees meeting municipal distinctive tree criteria (City of Ottawa, 2009), species at risk, and/or specimens of horticultural, historic, or cultural interest.
- The Old Hedge Collection
  - Located within the southwest corner of the site between Birch Drive and Maple Drive;
  - Consists of two (2) rows of planted shrub specimens;
  - The old hedge collection is part of the Central Experimental Farm's Ornamental Garden; and
  - The hedge collections contain sixty-five (65) different species, with thirty-two (32) of them located in the old hedge collection.

### 3.4.4 Species at Risk and Species of Conservation Concern

The project area is located on federally owned property; therefore, it is subject to the *Species at Risk Act*. A conservative approach on federal lands may also include protections for species listed under the provincial Environmental Site Assessment, although there is no regulatory requirement to do so. Cultivated trees are not protected under the *Species at Risk Act* or the *Environmental Site Assessment* but might meet other criteria for significance (**Section 3.4.3**).

Based on review, correspondence, and a site visit, a number of Species at Risk with potential to occur within the study area were identified.

The proposed site and surrounding land are located in a moderately sensitive area from a natural environment perspective due to the close proximity of the following natural heritage features and functions:

- Presence of Significant Trees and Shrubs
  - Distinctive Trees (City of Ottawa, 2009);
  - Species at Risk Trees including Butternut and Kentucky Coffeetree; and
  - Trees and shrubs of historical and horticultural interest.
- City of Ottawa Office Plan and Greenspace Master Plan Designations:
  - Urban Natural Feature;
  - Natural Heritage System;
  - Contributing and Primary Natural Lands;
  - Major Open Space; and
  - Linkage Features
- Potential for Species at Risk
- Potential Nesting Habitat for Migratory Birds.

Further studies are recommended to determine potential impacts to the natural environment as a result of the proposed work:

- Species at Risk Assessment; and
- Tree Inventory and Tree Conservation Report (City of Ottawa Bylaw 2009-200)

## 3.5 Physical Environment

### 3.5.1 Subsurface Conditions

A preliminary geotechnical review was undertaken to characterize the subsurface for the site.

Surficial geology mapping for the sire indicated it is underlain by a number of soil types. The southwestern portion of the site is indicated to be overlain by marine deposits (silt and clay), while the northern and eastern portions are indicated to be underlain by shallow bedrock and glacial till, refer to **Figure 3-1**.

The site is underlain by limestone and shale of the Bobcaygeon and Lindsay formations, refer to **Figure 3-2**. Both formations are typically sound rock and are generally favorable for construction of foundations, open-cut exactions, etc.

Drift thickness (depth to bedrock) mapping varies considerably across the site, refer to **Figure 3-3**. The deepest soil deposits are indicated to be in the southwestern portion of the site. Bedrock is indicated to be relatively shallow in the central portion of the site and becomes deeps again to the northeast. On the east side of the O-Train right-of-way, the bedrock is relatively shallow.

Groundwater levels have been measured in multiple historical boreholes and have generally been found to be relatively shallow. The most recent environmental investigation encountered groundwater levels ranging between 1.2m and 4.6m below the existing ground surface.

Additional geotechnical investigations will be required for the project.

**Figure 3-1: Surficial Geology for the Site**

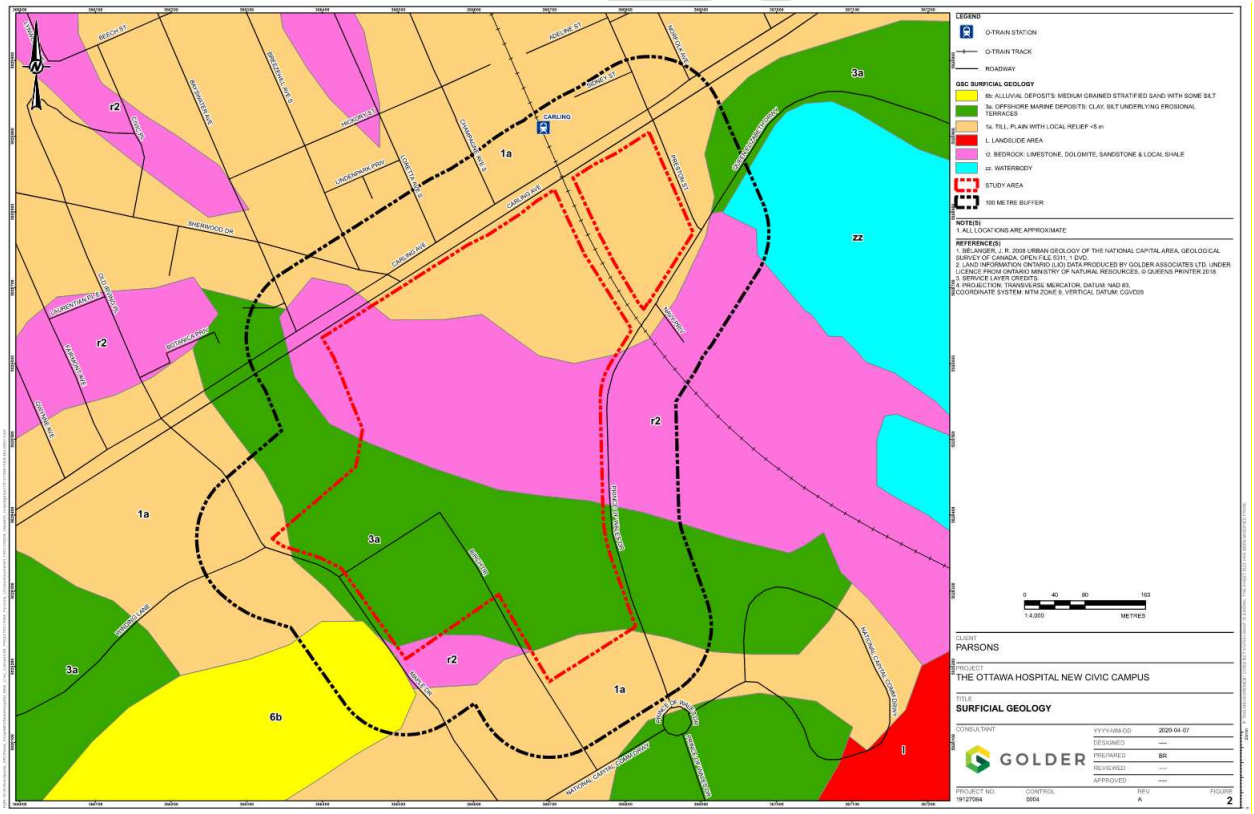


Figure 3-2: Bedrock Geology for the Site

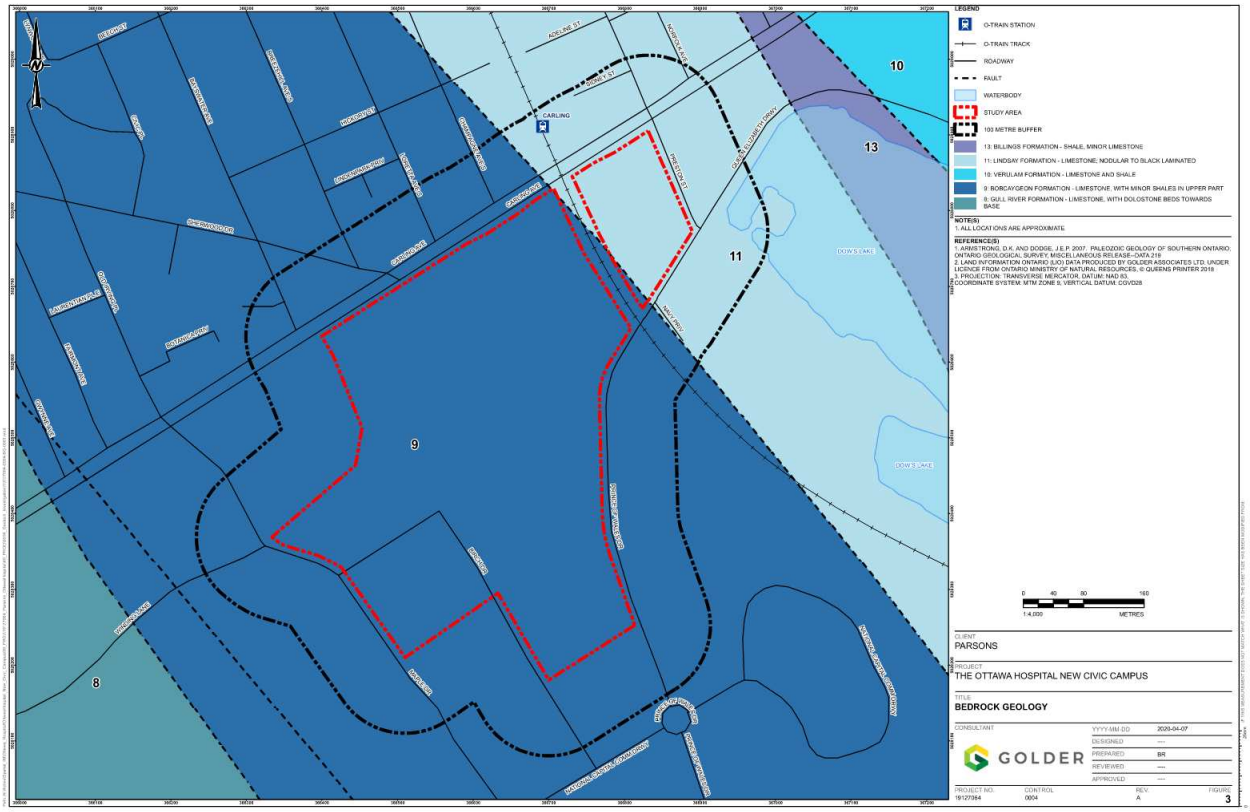
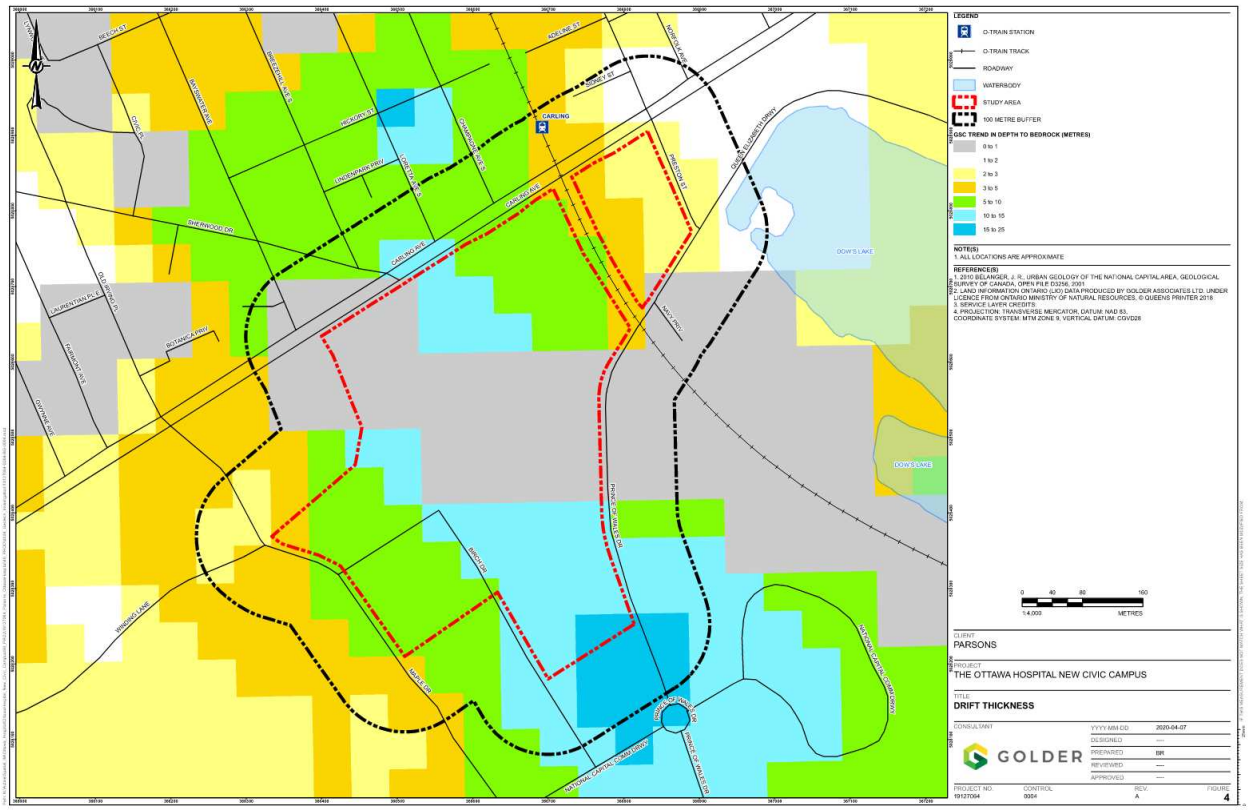



Figure 3-3: Depth to Bedrock for the Site

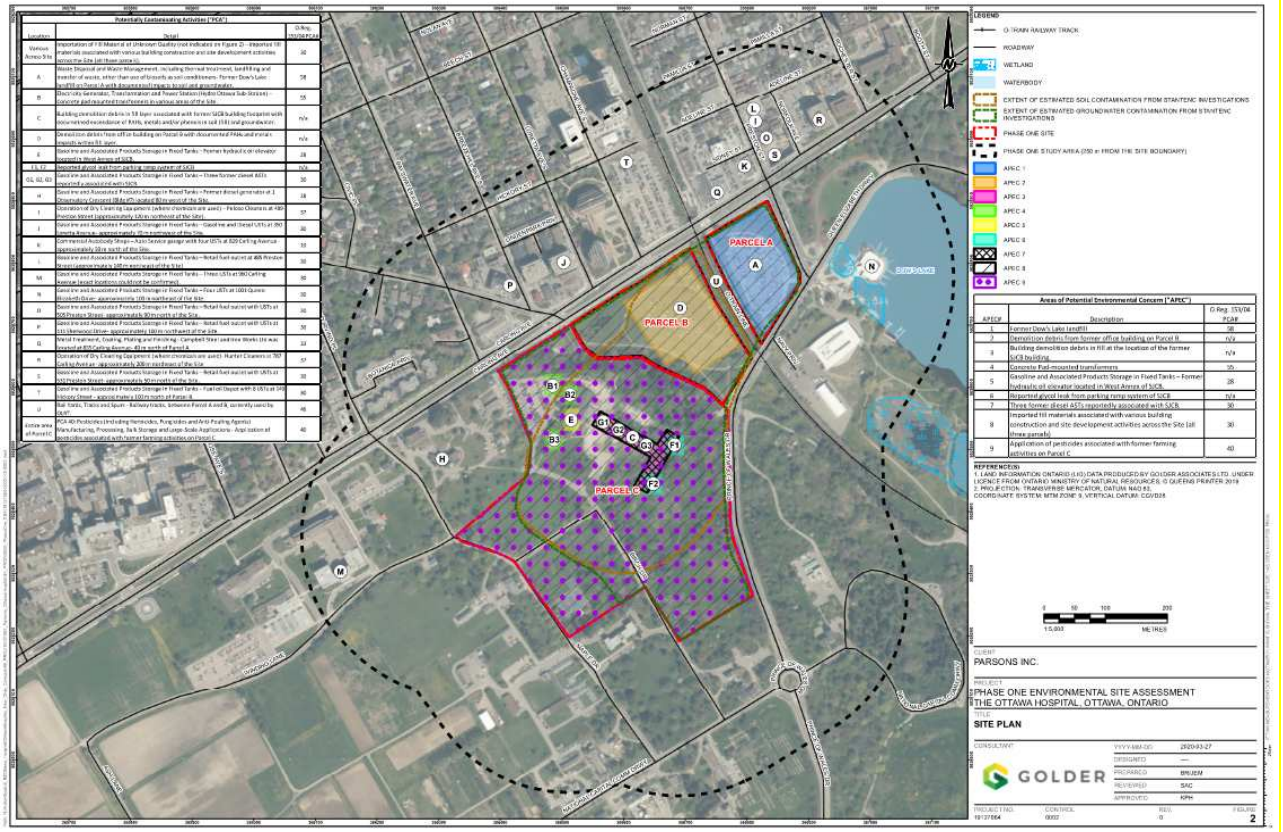


### 3.5.2 Contamination and Hazardous Materials

A Phase One Environmental Site Assessment was completed for the site and within a 250m buffer around the site. The purpose of the Phase One Environmental Assessment is to identify actual and/or potential issues of environmental concern which have the potential to impact the soil and/or groundwater related to former activities and to identify the need for further Environmental Site Assessment activities. Nine (9) individual areas of potential environmental concern were identified on the site, refer to **Figure 3-4**.

Further work is only required for four (4) of the potential environmental concern areas and the scope of future Environmental Site Assessment work is dependent on whether a Record of Site Condition is triggered.

**Figure 3-4: Areas of Potential Environmental Concern for the Site**



# 4.0 SITE DEVELOPMENT PLAN

## 4.1 Phasing

The NCD plan has been divided into the following ten (10) preliminary phases:

- **Phase 1 (2021) – Existing Dow's Lake Station and Rail Trench Widening**

  The existing O-Train corridor runs north/south through the northeast corner of the site. The existing rail trench needs to be widened to accommodate the future Dow's Lake Station (Phase 5 – 2027)

- **Phase 2 (2022 – 2023) – Parking Garage**

  A multi-level parking structure, gross floor area of approximately 1,000,000 square feet, will be located in the northeast corner of the site and provide parking spaces for the campus.

- **Phase 3 (2024 – 2026) – Hospital Central Utility Plant and Hydro Services**

  The central utility plant and incoming hydro, required to service the new campus, will be located in the southwest corner of the site as well as a surface parking lot.

- **Phase 4 (2024 – 2028) – New Hospital**

  The new hospital will be located in the middle of the site, with the main entrance looking northeast towards the Carling Avenue and Preston Street intersection. This is the first phase of development for the hospital building and will include a gross floor area of approximately 2,400,000 square feet.

  - *Main Plaza*

    The main plaza includes the main entrance to the hospital at grade at the top of the escarpment. The emergency department ambulatory entrance, access off of Carling Avenue at Maple Drive, is located in a protected area below grade directly underneath the main entrance. The corporate education area, which includes the auditorium, is located adjacent to the main plaza along the south side in a centrally accessible area. This location also allows for full segregation from the main hospital as needed to minimize and/or eliminate cross over traffic flows. Public areas, food services and retail space are located between the auditorium and main entrance to offer convenient amenity to all campus users.

  - *Central Podium*

    The central podium expands towards the west from the main plaza and includes a double height public concourse along the exterior. The public concourse acts as a front porch relative to the outdoor amenity and main plaza and connects the two (2) public elevator lobbies serving the patient towers. The central podium acts as a central wayfinding element connecting to the third public elevator lobby at the center of the podium. The central podium is bisected by a central north-south back of house corridor that links to two (2) of the four (4) main service elevator cores in the hospital.

  - *North and South Towers*

    The north and south towers extend along the north and south edges of the podium and continue eastward to flank the main plaza. Each of the towers optimize both inpatient departmental configurations on higher floors while aligning with ambulatory clinical function on the lower and front facing areas. The south tower extends above the acute components of the facility and includes the intensive care inpatient areas. The south tower is intended to be built to its maximum height in the initial phase to allow for the permanent location of the helipad on the twelfth (12$^{th}$) floor. The north tower ends at the seventh (7$^{th}$) floor mechanical penthouse which offers the potential for vertical expansion above the penthouse in the future to accommodate increased inpatient capacity.

- *Patient Access Zone*

  The patient access zone is located along the western edge of the central podium and includes the ambulance garage and adjacent first responders parking (Emergency 1 Floor). Non-urgent patient transfer, special access, and nephrology patient access is on Level 1. Parking is located along the western service road above the central utility plant. The central utility plant is located adjacent to this area for ease of infrastructure connectivity and to minimize visual impact.

- **Phase 5 (2025 – 2027) - Dow's Lake Station**

  The Dow's Lake Station will be located in the northeast corner of the site, adjacent to Carling Avenue, and will include a pedestrian connection to the hospital campus.

- **Phase 6 (2024 – 2029) – Research Tower**

  The research tower will be located in the northwest corner of the site, adjacent to Carling Avenue, and will have an approximate building footprint of approximately 46,000 square feet. The number of building storeys is currently unknown. The maximum number of building storeys permitted based on the site zoning is fifteen (15).

- **Phase 7 (2029 – 2039) – Carling Avenue Towers**

  The Carling Avenue towers will be located in the northeast corner of the site, adjacent to Carling Avenue, and will have a combined building footprint of approximately 107,000 square feet. The number of building storeys is currently unknown. The maximum number of building storeys permitted based on the site zoning is fifteen (15). The towers will be mixed use with retail space at grade, office space in the west tower, and office space and/or resident space for employees and patients of the hospital space in the east tower.

- **Phase 8 (2024 – 2028) – Hospital Rehabilitation**

  The north tower of the hospital will be rehabilitated to accommodate future expansion.

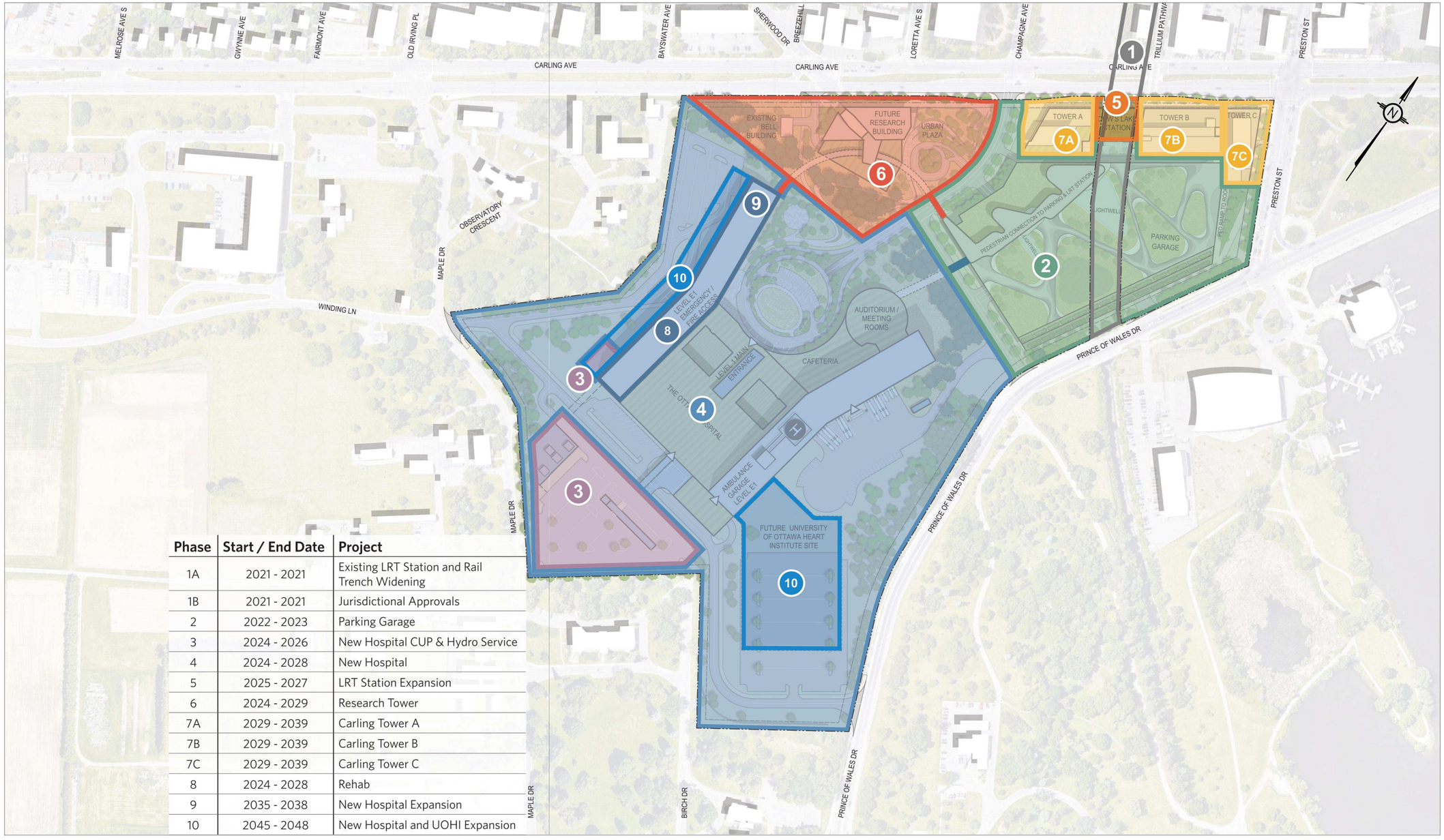
- **Phase 9 (2035 - 2038) – Hospital Expansion**

  The north tower of the hospital will be vertical expanded to accommodate increased inpatient capacity. The expansion will have a gross floor area of approximately 600,000 square feet, resulting in a gross floor area of 3,000,000 square feet for the hospital.

- **Phase 10 (2045 - 2048) – Hospital and University of Ottawa Heart Institute Expansion**

  The hospital will be expanded to accommodate a below grade expansion on the west side of the north tower and the University of Ottawa Heart Institute on the south side. The expansions will have a combined gross floor area of approximately 1,200,000 square feet, resulting in an ultimate gross floor area of 4,200,000 square feet for the hospital.

Refer to **Figure 4-1** for the location of the ten (10) preliminary development phases.




| Phase | Start / End Date | Project |
|---|---|---|
| 1A | 2021 - 2021 | Existing LRT Station and Rail Trench Widening |
| 1B | 2021 - 2021 | Jurisdictional Approvals |
| 2 | 2022 - 2023 | Parking Garage |
| 3 | 2024 - 2026 | New Hospital CUP & Hydro Service |
| 4 | 2024 - 2028 | New Hospital |
| 5 | 2025 - 2027 | LRT Station Expansion |
| 6 | 2024 - 2029 | Research Tower |
| 7A | 2029 - 2039 | Carling Tower A |
| 7B | 2029 - 2039 | Carling Tower B |
| 7C | 2029 - 2039 | Carling Tower C |
| 8 | 2024 - 2028 | Rehab |
| 9 | 2035 - 2038 | New Hospital Expansion |
| 10 | 2045 - 2048 | New Hospital and UOHI Expansion |

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Site De elD ment P asing

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Figure 4-1

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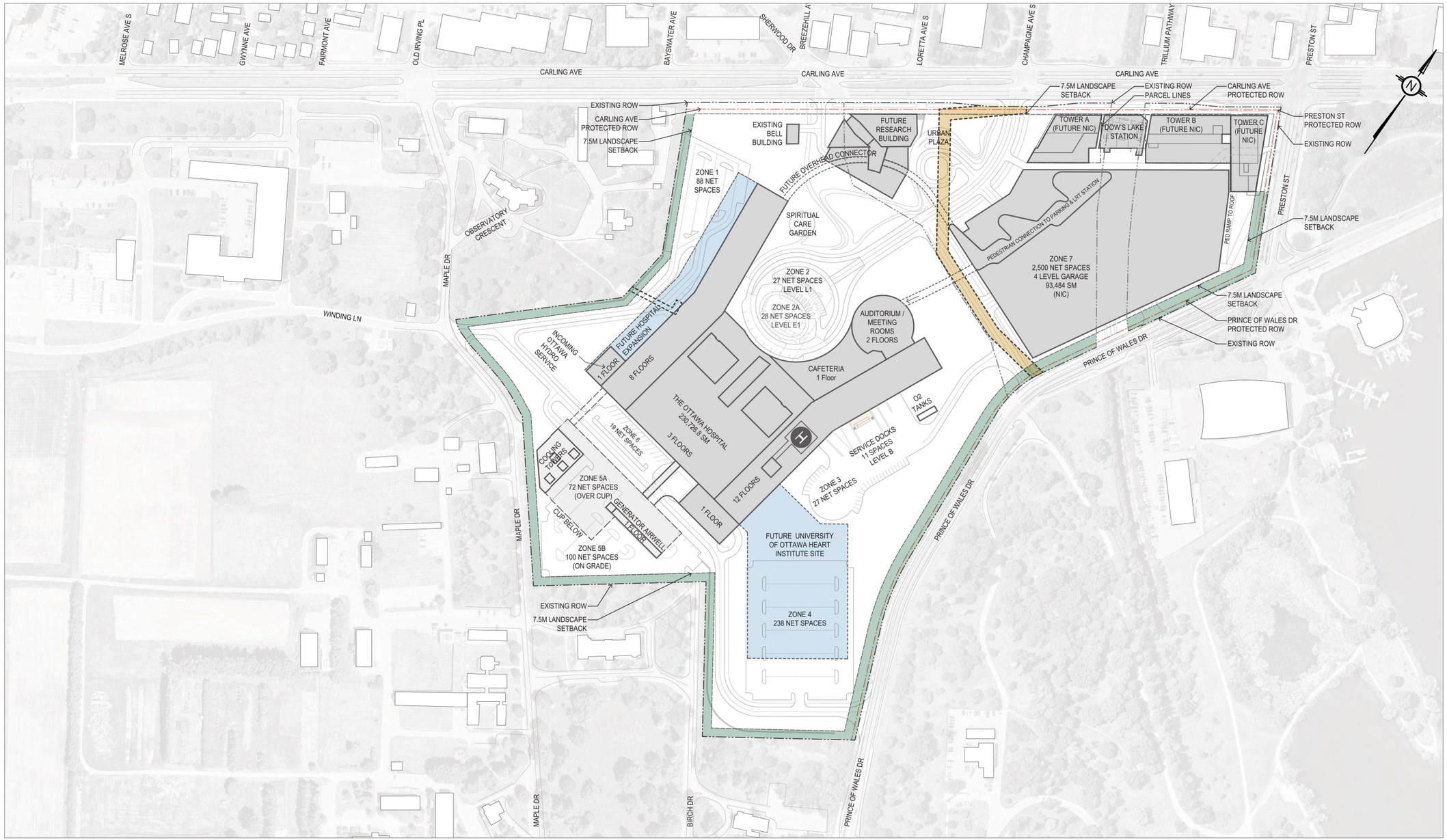
## 4.2 Land Use

The land use information used within this report for the NCD is summarized in **Table 4-1**. Refer to **Figure 4-2** for the proposed Master Site Plan.

**Table 4-1: Land Use**

| Building | Land Use | Site Area | Gross Floor Area |
|---|---|---|---|
| Hospital | Institutional | 18.02 ha | 441,300 m² |
| Research Building | Commercial | 1.61 ha | 63,000 m² |
| Carling Village Tower #1 | Commercial | 0.26 ha | 27,300 m² |
| Carling Village Tower #2 | Commercial | 0.35 ha | 43,100 m² |
| Carling Village Tower #3 | Commercial | 0.25 ha | 28,400 m² |

The land use information should be reviewed and revised as necessary during the design phase. The final detailed land use information is of high significance, as it is used to estimate the actual servicing demands for the site.

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Master Site Plan

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Figure 4-2

# 5.0 WATER SERVICING

When reviewing the watermain infrastructure servicing for the site, there are two (2) main factors that need to be considered: (1) The existing property was previously owned and operated by Agriculture and Agri-Food Canada (AAFC) and Natural Resources Canada (NRCan), and PSPC has existing privately owned watermain infrastructure throughout the site that are still in operation and require relocation for continued service; and (2) The proposed water servicing for the site.

## 5.1 Existing Water Infrastructure

The NCD is located within the 1W and 2W2C pressure zones, south of the Lemieux Island Water Treatment Plant. The easterly parcel is located within the 1W pressure zone and the westerly parcel is located within the 1W and 2W pressure zones. The City of Ottawa Water Distribution System Facilities & Feedermains Map is included in Appendix C.

The existing watermain infrastructure within the vicinity of the NCD is illustrated in Figure 5-1.

### 5.1.1 Public Watermains

- Carling Avenue → 1067mm diameter public watermain
- Carling Avenue → 406mm diameter public watermain
- Preston Street → 152mm diameter public watermain (east)
- Preston Street → 152mm diameter public watermain (west)

#### 5.1.1.1 Carling Avenue Backbone Watermain

A 1067mm diameter public backbone watermain is located in between the eastbound and westbound lanes of Carling Avenue and extends from Loretta Avenue to Rochester Street. This backbone watermain comes directly from the Lemieux Island Water Purification Plant, located directly north of Loretta Avenue. At Rochester Street the 1067mm diameter backbone watermain continues south along the east side of Queen Elizabeth Driveway and crosses the Canal just east of Bronson Avenue. This backbone watermain continues south past Leitrim Road.

#### 5.1.1.2 Carling Avenue Distribution Watermain

A 406mm diameter public distribution watermain is located along the south side of the westbound Carling Avenue lanes and extends from Bronson Avenue to Archibald Street. At Archibald Street the 406mm diameter watermain continues along the north side of eastbound Carling Avenue lanes until Lady Ellen Place. At Lady Ellen Place the 406mm diameter watermain extends south and connects to the 406mm diameter watermain on Laperriere Avenue.

#### 5.1.1.3 Preston Street Distribution Watermain

A 152mm diameter public distribution watermain is located along the east side of Preston Street, south of Carling Avenue, that services Dow's Lake Pavilion, the Navy Curling Club and the Navy Marine Force Building and connects to the 406mm diameter distribution watermain on Carling Avenue.

A 152mm diameter public distribution watermain is located along the west side of Preston Street, south of Carling Avenue that services Dow's Lake Pavilion, the Navy Curling Club and the Navy Marine Force Building and connects to the 406mm diameter distribution watermain on Carling Avenue.

### 5.1.2 Private Watermains

- Maple Drive → 406mm diameter private watermain
- Birch Drive → 305mm diameter private watermain
- National Capital Commission Driveway → 406mm/305mm diameter private watermain

#### 5.1.2.1 Maple Drive Distribution Watermain

A 406mm diameter private distribution watermain is located within Maple Drive and extends from Carling Avenue to National Capital Commission Driveway. This watermain services the Central Experimental Farm Site and is not owned, operated and/or maintained by the City of Ottawa. This watermain is owned, operated and maintained by PSPC.

#### 5.1.2.2 Birch Drive Distribution Watermain

A 305mm diameter private distribution watermain is located within Birch Drive and extends from Maple Drive to National Capital Commission Driveway on the east side of Prince of Wales Drive. This watermain services the Central Experimental Farm Site and is not owned, operated and/or maintained by the City of Ottawa. This watermain is owned, operated and maintained by PSPC.

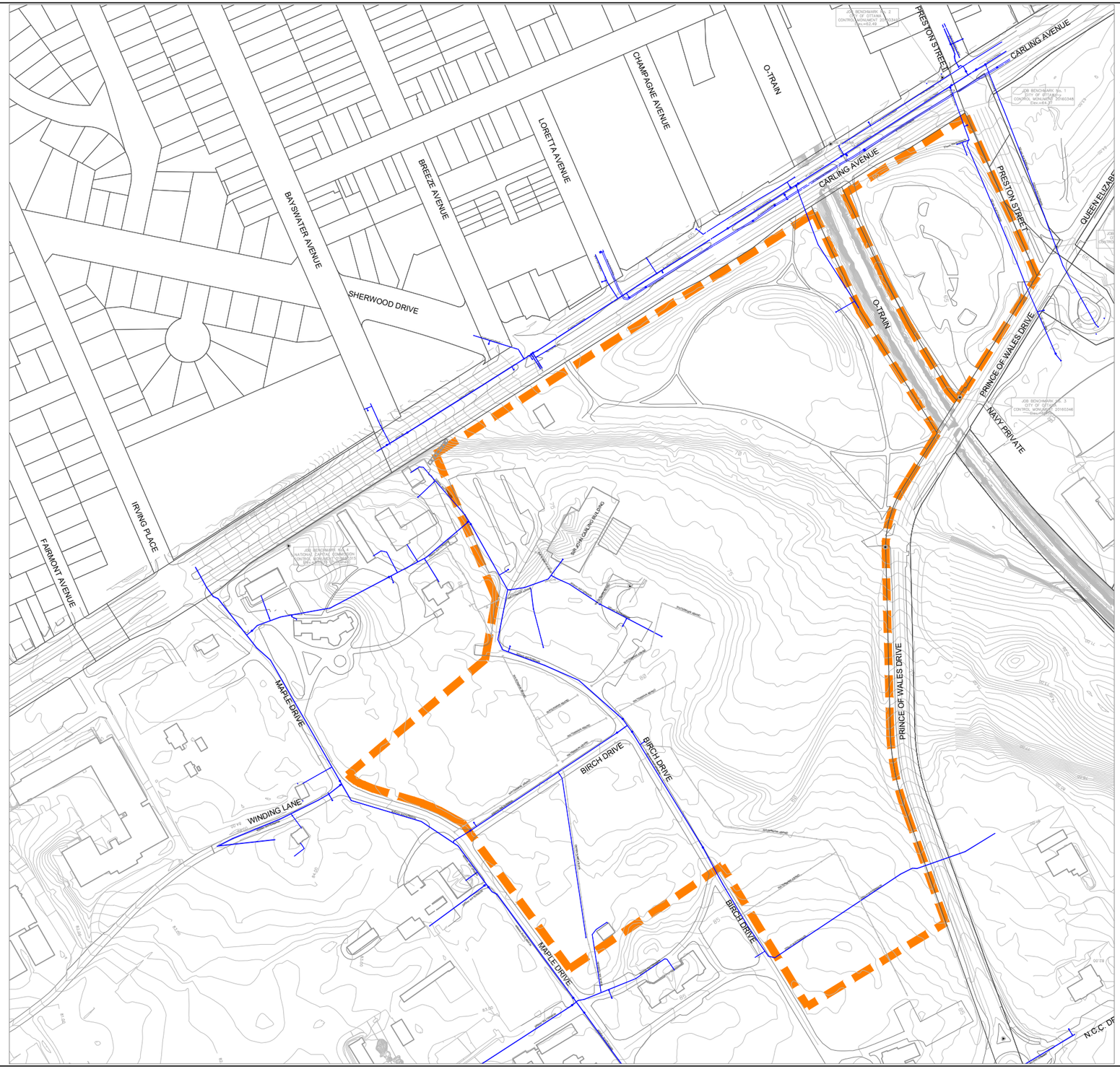
#### 5.1.2.3 National Capital Commission Driveway Distribution Watermain

A 406mm diameter private distribution watermain is located within National Capital Commission Driveway and extends from Morningside Lane to Maple Drive. At Maple Drive, it reduces to a 305mm diameter private distribution watermain and continues within National Capital Commission Driveway until just east of Prince of Wales Drive and connects into the 305mm diameter private distribution watermain from Birch Avenue. This watermain services the Central Experimental Farm Site and is not owned, operated and/or maintained by the City of Ottawa. This watermain is owned, operated and maintained by PSPC.

## 5.2 Watermain Constraints

The following existing conditions factors will influence the servicing design for the NCD:

- The existing 406mm diameter public watermain on Carling Avenue within the 2W pressure zone operates between 70psi and 92psi;
- The existing 127mm, 406mm, and 1067mm diameter public watermains on Carling Avenue within the 1W pressure zone operate between 62psi and 78psi;
- The westerly parcel needs to be serviced from the 2W pressure zone;
- The easterly parcel can be serviced from the 1W pressure zone;
- Redundant feeds for the westerly parcel include the existing 406mm diameter public watermain on Carling Avenue and the existing 203mm diameter public watermain on Gwynne Avenue. Depending on the demands for the new development, the 203mm diameter public watermain might not be sufficient to be a redundant feed;
- Redundant feeds for the easterly parcel include the existing 406mm diameter public watermain on Carling Avenue, the existing check valve between the 1W and 2W pressure zones, and the existing 406mm diameter public watermain on Preston Street;
- Two (2) functioning connections on Carling Avenue will be required to service the hospital;
- The westerly parcel cannot be serviced from the existing private watermains located to the west. These private watermains service PSPC lands. A bulk meter is located at the intersection of Carling Avenue and Maple Drive;
- The existing 300mm diameter private watermain within Birch Drive and the westerly parcel will need to be relocated outside the westerly parcel;




NOTES:

1. 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 THE UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.

LEGEND

- STUDY SITE BOUNDARY
- WATERMAIN

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Existing Watermain Infrastructure

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 5-1

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- The existing 152mm diameter public watermain located along the west side of Preston Street is within the easterly parcel and will need to be relocated outside of the easterly parcel;
- The maximum pressure under normal operating conditions shall be 552 kPa (80psi);
- The minimum pressure under normal operating conditions shall be 275 kPa (40psi);
- The ideal pressure range under normal operating conditions shall be between 345 kPa (50psi) to 480kPa (70psi);
- The minimum pressure under fire flow operating conditions shall be 140 kPa (20psi); and
- The Ottawa Hospital is considered a critical customer.

The site evaluation received from the City of Ottawa is included in **Appendix B**.

## 5.3 Watermain Relocations/Realignments

The following watermain relocations/realignments are anticipated to accommodate the NCD on both the easterly and westerly parcels of land.

### 5.3.1 Public Watermains

#### 5.3.1.1 Preston Street Distribution Watermain

The 152mm diameter public distribution watermain located along the west side of Preston Street, south of Carling Avenue is within the easterly parcel of land. This watermain would need to be relocated/realigned within the Preston Street right-of-way to accommodate the proposed development. The relocation/realignment of this watermain is illustrated in **Figure 5-2**.

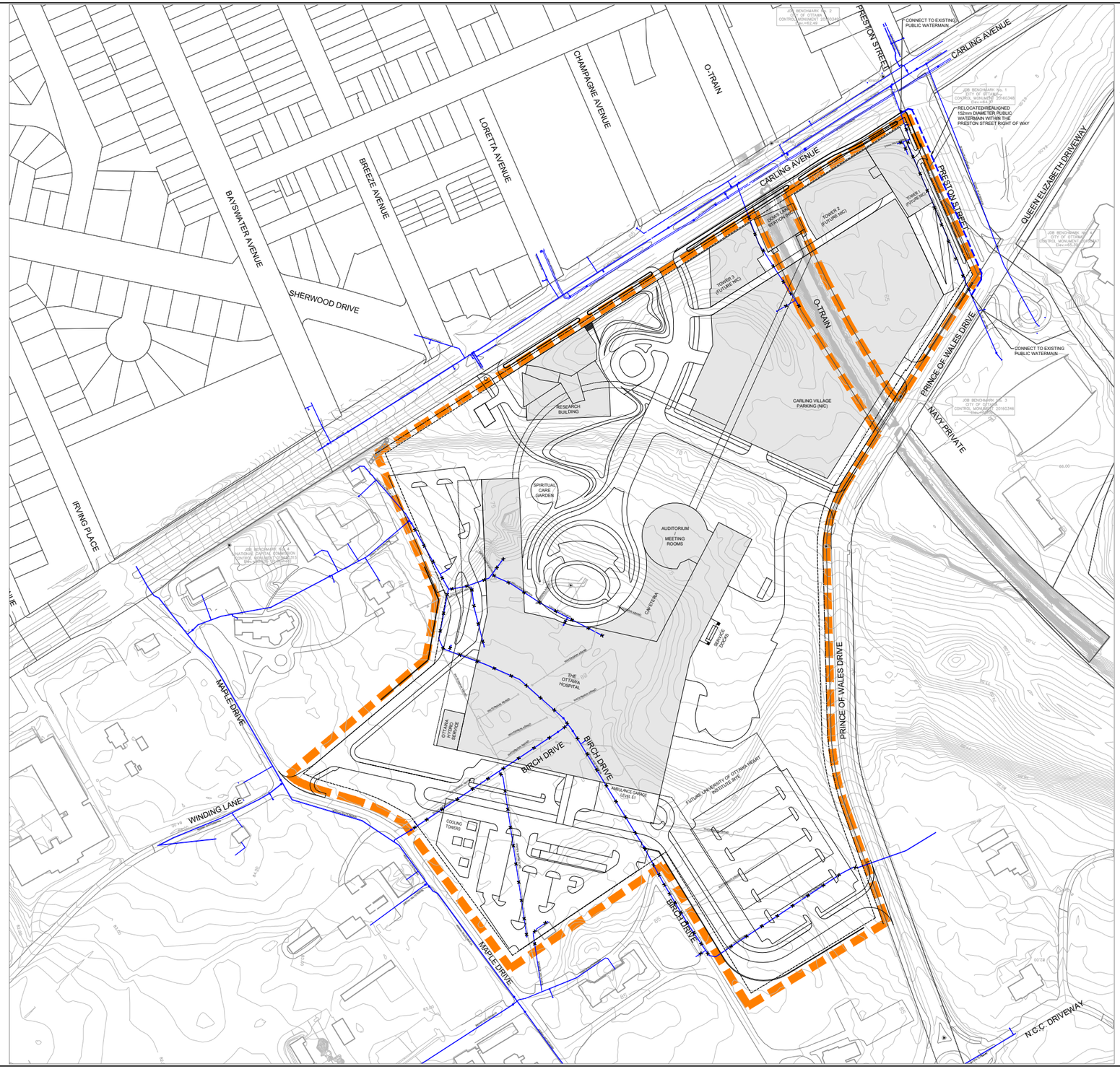
### 5.3.2 Private Watermains

#### 5.3.2.1 Birch Drive (South) Distribution Watermain

The 300mm diameter private distribution watermain located within Birch Drive crosses the westerly parcel, east of Birch Drive, approximately 170m north of National Capital Commission Driveway and continues east across Prince of Wales Drive. The portion between Birch Avenue and Prince of Wales Drive is within the westerly parcel of land. This section of the watermain would need to be relocated/realigned to accommodate the proposed development.

The watermain would need to extend south, approximately 70m, along the west side of the Prince of Wales right-of-way. It would then continue west across federal land and connect into the existing 400mm diameter private watermain on Maple Drive to maintain a looped system. The relocation/realignment of this watermain is illustrated in **Figure 5-3**.

Coordination and approval from the City of Ottawa will be required to ensure a portion of the watermain can be relocated/realigned within the Prince of Wales right-of-way.




LEGEND

- STUDY SITE BOUNDARY
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED/ABANDONED
- PROPOSED WATERMAIN

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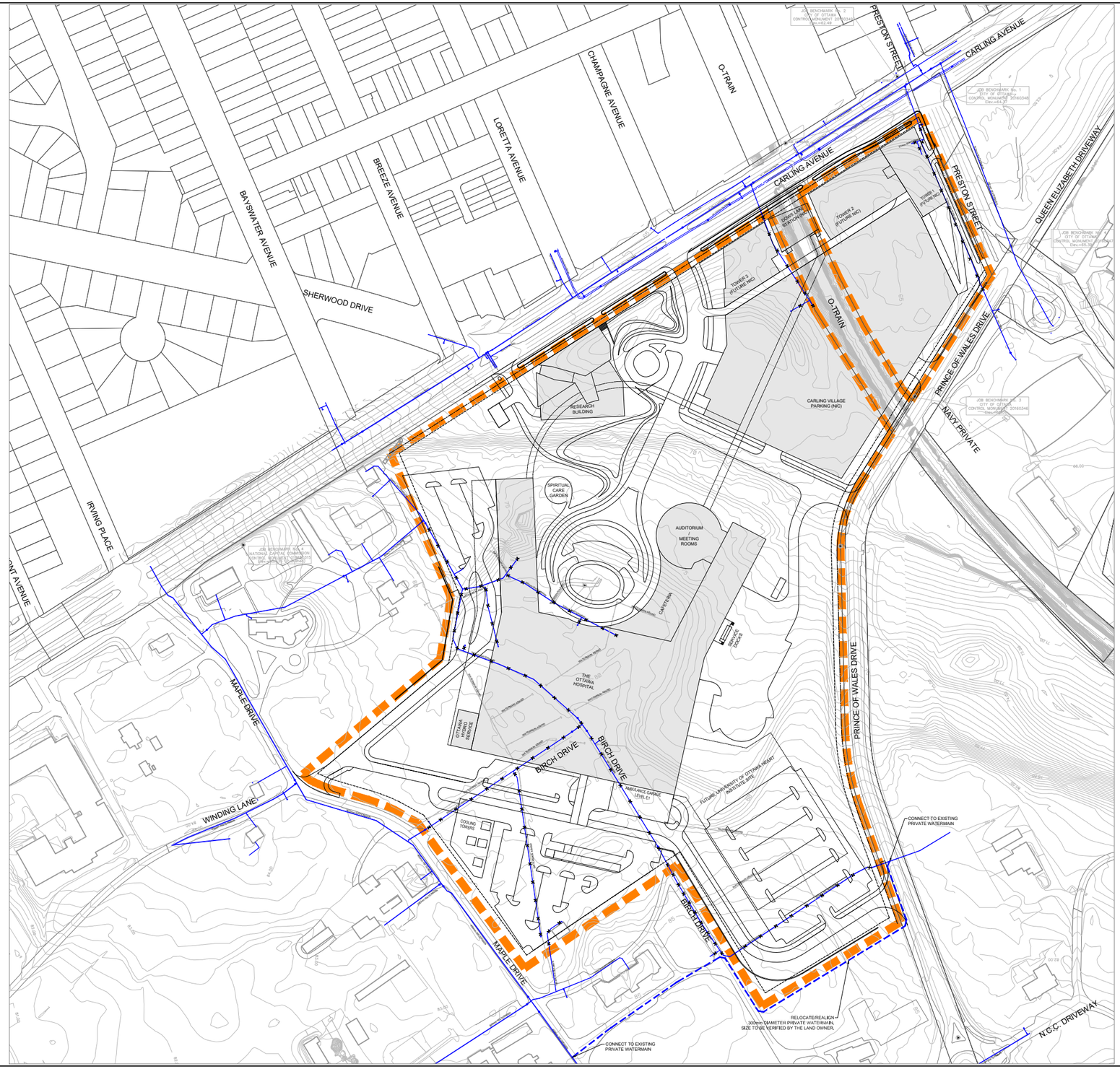
PARSONS

# The New Civic Development

## Pu lic Watermain RelDcatiDn/Realignment - PrestDn Street

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 5-2




LEGEND

- STUDY SITE BOUNDARY
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED/ABANDONED
- PROPOSED WATERMAIN

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PARSONS

# The New Civic Development

Pri ate Watermain RelDcatiDn/Realignment - Birc Dri e (SDut )

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 5-3

#### 5.3.2.2 Birch Drive (North) Distribution Watermain

The 300mm diameter private distribution watermain located within Birch Drive crosses the westerly parcel, north of Birch Drive, and provides a looped system to the existing federal land buildings located southeast of the Carling Avenue and Maple Drive intersection. This watermain would need to be relocated/realigned to accommodate the proposed development.

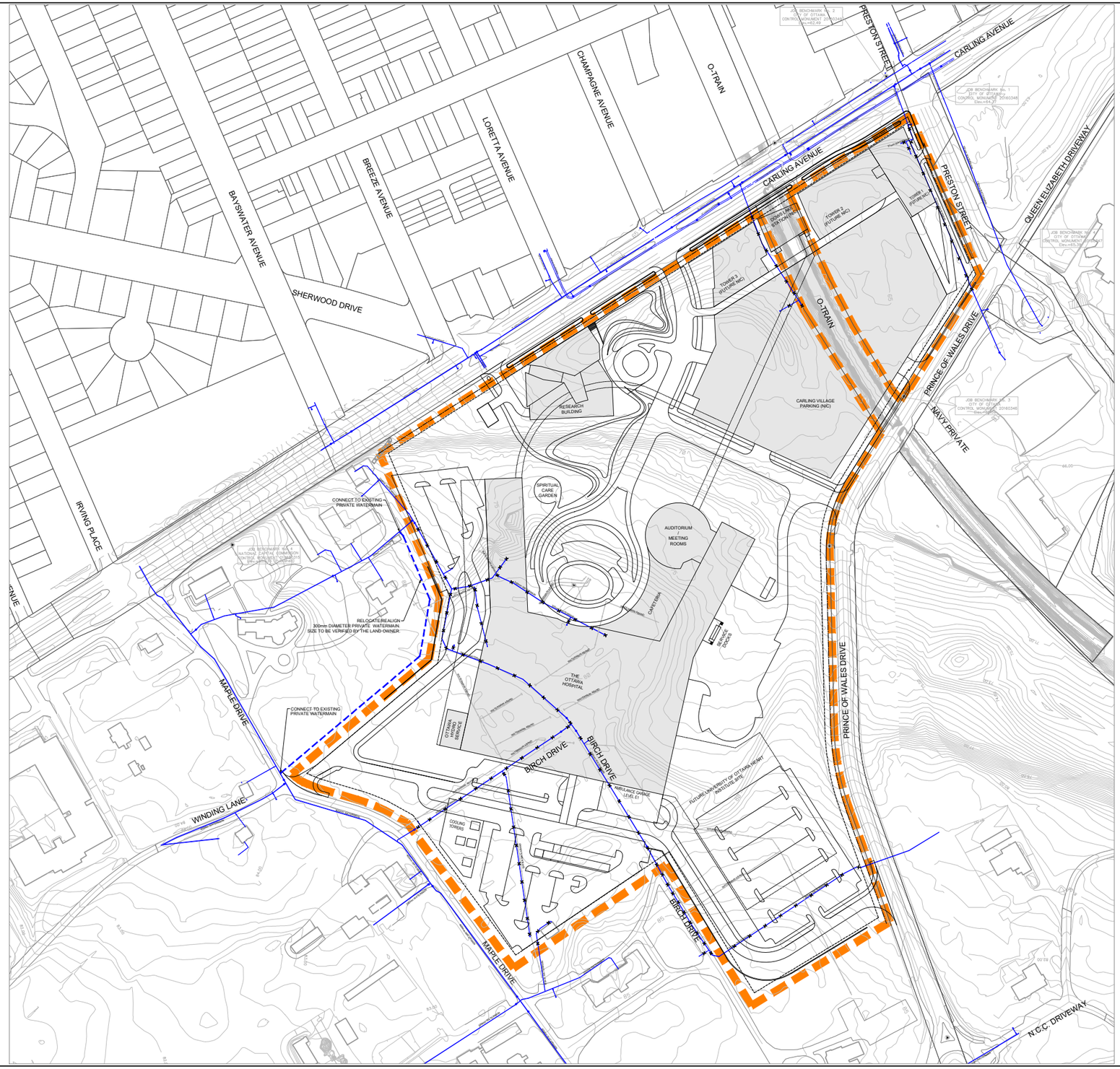
The two (2) options that were investigated are as follows: (Option 1) Relocate/realign the existing 300mm diameter private watermain and connect into the existing 400mm private diameter watermain on Maple Drive; and (Option 2) The existing 300mm diameter private watermain that services the existing federal buildings located southeast of the Carling Avenue and Maple Drive intersection would be a dead end watermain. The preferred option is Option 2, although it would require further analysis during preliminary design to ensure that a dead end watermain has sufficient pressures to accommodate the existing federal land buildings.

**Option 1**

The 300mm diameter private watermain would extend south and west along the westerly limit of the proposed development and connect into the existing 400mm private diameter watermain on Maple Drive to maintain a looped system. The relocation/realignment of this watermain is illustrated in **Figure 5-4**.

**Option 2**

The existing 300mm diameter private watermain within the westerly parcel would be removed/abandoned and the existing 300mm diameter private watermain that services the existing federal land buildings located southeast of the Carling Avenue and Maple Drive intersection would remain as a dead end watermain. This is illustrated in **Figure 5-5**.




LEGEND

- STUDY SITE BOUNDARY
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED/ABANDONED
- PROPOSED WATERMAIN

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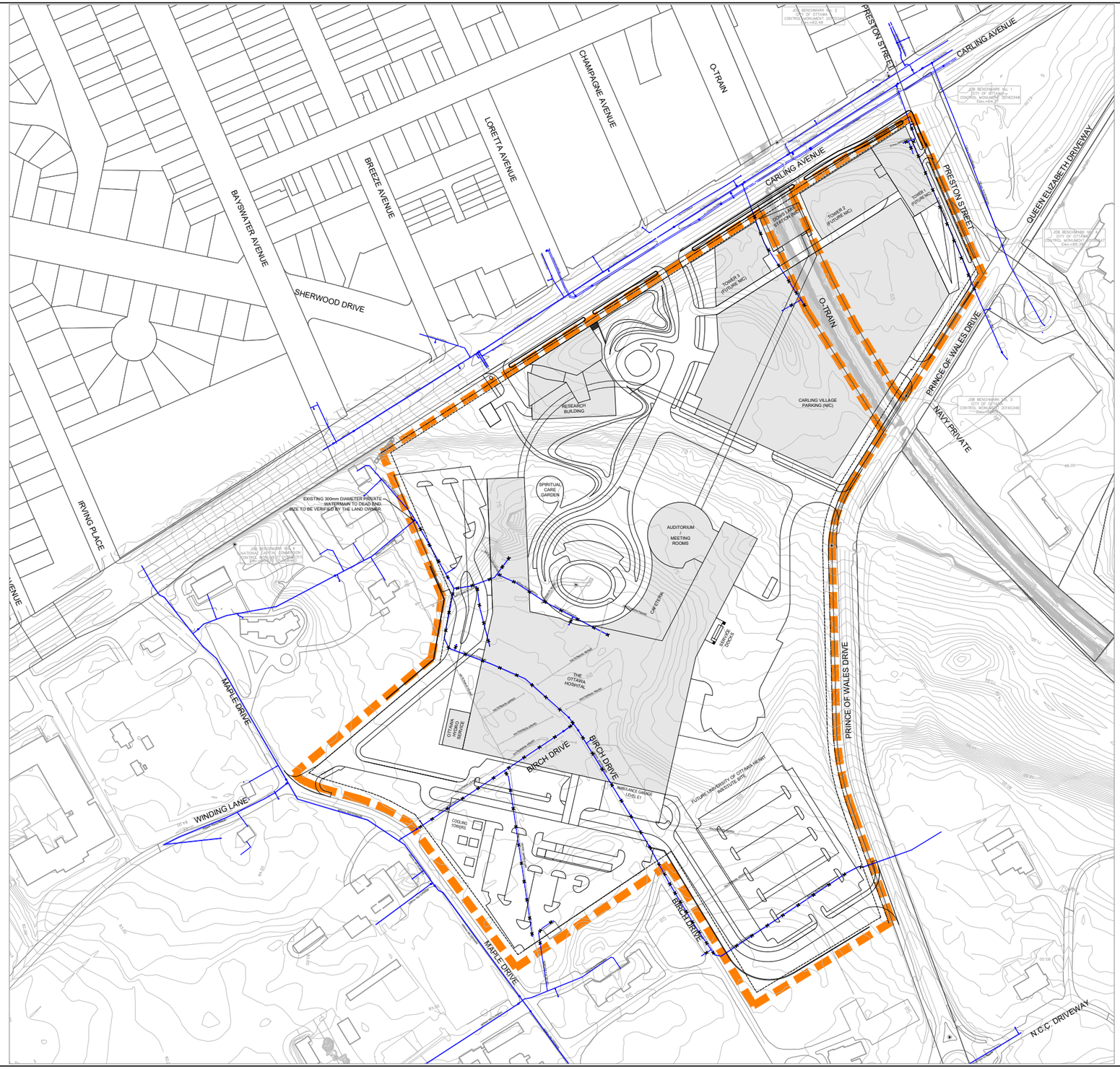
PARSONS

# The New Civic Development

## Pri ate Watermain RelDcatiDn/Realignment - Birc Dri e (NDrt ) O tiDn 1

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 5-4




# The New Civic Development

## Pri ate Watermain RelDcatiDn/Realignment - Birc Dri e (NDrt ) O tiDn 2

Figure 5-5

## 5.4 Water Design Criteria

The design criteria from the *City of Ottawa Design Guidelines – Water Distribution (July 2010)* including City of *Ottawa Technical Bulletin ISDTB-2010-02 (December 15, 2010), ISTB-20184-02 (May 27, 2014), and ISTB-2018-02 (March 21, 2018)* were applied to estimate preliminary water demands and are presented in **Table 5-1**.

**Table 5-1: Water Design Criteria**

| Design Parameter | Value |
|---|---|
| **AVERAGE DAILY DEMAND** | |
| Residential** | 350 L/c/day |
| Institutional | 28,000 L/gross ha/day |
| Commercial | 28,000 L/gross ha/day |
| Office | 75 L/person/day<br>8.06 L/m²/day |
| Civic Hospital Average Water Use*** | 1.3 m3/m²/year |
| **MAXIMUM DAILY DEMAND** | |
| Residential | 2.5 x Average Daily Demand<br>4.9 x Average Daily Demand* |
| Institutional | 1.5 x Average Daily Demand |
| Commercial | 1.5 x Average Daily Demand |
| **MAXIMUM HOUR DEMAND** | |
| Residential | 2.2 x Maximum Daily Demand<br>7.4 x Maximum Daily Demand* |
| Institutional | 1.8 x Maximum Daily Demand |
| Commercial | 1.8 x Maximum Daily Demand |
| **OPERATIONAL CONDITIONS** | |
| Minimum Watermain Size | 150mm Diameter |
| Minimum Depth of Cover | 2.4m from top of watermain to finished grade |
| Maximum Pressure – Normal Operating Conditions | 552 kPa (80 psi) |
| Minimum Pressure – Normal Operating Conditions | 275 kPa (40 psi) |
| Ideal Pressure Range – Normal Operating Conditions | 345 kPa (50 psi) to 480 kPa (70 psi) |
| Minimum Pressure – Fire Flow Operating Conditions | 140 kPa (20 psi) |

**Peaking factor as per MOE Guidelines for Drinking Water Systems Table 3-3 for 0 to 500 persons.*
***Residential in this case means a residential care facility for patients and residents of the hospital or other primary use.*
****Based on 2020 water records from the Ottawa Civic Hospital.*

Fire flow requirements shall be in accordance with the method developed by the Fire Underwriters Survey and follow the protocol for application of the method as provided in *Appendix H: Protocol to Clarify the Application of the Fire Flow Calculation Method published by Fire Underwriters Survey(FUS)* of the *City of Ottawa Design Guidelines – Water Distribution*

The *City of Ottawa Design Guidelines – Water Distribution* requires that "service areas with a basic demand greater than 50m3/day shall be connected with a minimum of two watermains, separated by an isolation valve, to avoid the creation of a vulnerable service area. Individual residential facilities with a basic demand greater than 50m3/day shall be connected with a minimum of two watermains, separated by an isolation valve, to avoid creation of a vulnerable service area".

## 5.5 Water Demands

The water demands were estimated based on the land use information (**Table 4-1**) and the design criteria (**Table 5-1**). The estimated water demands are summarized in **Table 5-2** and detail calculations are included in **Appendix D**.

Table 5-2: Estimated Water Demands

| Building/Area | Site Area (ha) | Gross Floor Area ($m^2$) | | Average Day Demand (L/s) | Maximum Day Demand (L/s) | Maximum Hour Demand (L/s) |
|---|---|---|---|---|---|---|
| | | Institutional | Commercial | | | |
| **THE NEW CIVIC DEVELOPMENT SITE** | | | | | | |
| Hospital | 18.02 | 441,300 | - | 19.21 | 28.81 | 51.86 |
| Research Building | 1.61 | - | 63,000 | 5.88 | 8.82 | 15.88 |
| Carling Village Tower #1 | 0.26 | | 27,280 | 2.55 | 3.82 | 6.87 |
| Carling Village Tower #2 | 0.35 | | 43,120 | 4.02 | 6.04 | 10.87 |
| Carling Village Tower #3 | 0.25 | | 28,430 | 2.65 | 3.98 | 7.16 |
| **PSPC SITE (EXISTING)** | | | | | | |
| PSPC Lands* | 13.02 | - | - | 4.22 | 6.33 | 11.39 |

**Existing development adjacent to the New Civic Development – infrastructure relocations are required to continue servicing the existing federal buildings. Demands estimated since Master Servicing Report and water records were not available.*

### 5.5.1 Assumptions

The demands for the existing buildings located on PSPC lands were estimated as a place holder since actual data/records were not available at the time this report was prepared. The estimated demands should be updated to reflect the actual demand based on water meter records.

Since the Master Site Plan for the NCD lands is currently at the conceptual stage, the following assumptions were made:

- Detailed information on proposed buildings along Carling Avenue (Carling Tower #1, Carling Tower #2, Carling Tower #3, and Research Building) were not available to estimate the proposed building fire flow requirements in conjunction with the *"Protocol to Clarify the Application of the Fire Flow Calculation Method Published by Fire Underwriters Survey (FUS)"* included in *Appendix H of the City of Ottawa Design Guidelines – Water Distribution*. According to the *"City of Ottawa 2013 Water Master Plan"* prepared by Stantec Consulting Limited (September 20, 2013), the City of Ottawa's existing water supply and distribution systems can provide a fire demand level of service of 13,000L/min (217L/s) in core areas. Since the New Civic Development is located within the City's core, a fire flow of 217L/s was used when determining servicing requirements for each proposed building;
- A preliminary fire flow was estimated for the proposed Hospital building based on the Fire Underwriters Survey method. The preliminary calculated flow exceeded the maximum allowable demand of 750 L/s based on the Fire Underwriters Survey method. Therefore, the maximum demand of 750L/s is being used for the building. This demand is extremely high and further coordination with the design team and City of Ottawa and the completion of additional design analysis will be required to reduce the preliminary fire flow estimate;
- A preliminary fire flow (approximately 433L/s) was estimated for the proposed Parking Garage building (assuming fire resistive construction) based on the Fire Underwriters Survey method. Further coordination

with the design team and City of Ottawa and the completion of additional design analysis will be required to reduce the preliminary fire flow estimate prior to finalization;

- The gross floor area for the future Research Building, Carling Village Tower #1, Carling Village Tower #2, and Carling Village Tower #3 were estimated assuming fifteen (15) storeys in height; and
- The future Carling Village Towers were assumed to be all commercial floor space.

### 5.5.2 Conclusion

The estimated water demands for the proposed hospital site and existing PSPC lands will need to be reviewed and updated accordingly during preliminary design. The demands will need to be recalculated based on the final concept/land use plan for the NCD and the Master Servicing Report and/or water records for the existing PSPC lands.

Further coordination with the design team and the City of Ottawa and the completion of additional design analysis will be required to try and reduce the preliminary fire flow estimates prior to finalization.

## 5.6 Water Servicing

### 5.6.1 Hospital

A preliminary water servicing analysis was previously completed based on the ultimate build out of the NCD. The previously estimated demands were provided to the City of Ottawa to develop boundary conditions at the two (2) connections points to the existing 406mm diameter public watermain on Carling Avenue. Revised boundary conditions will be provided by the City of Ottawa, and will be added to **Appendix C**, once further coordination with the design team and the City of Ottawa, and the completion of additional design analysis is completed to reduce the preliminary fire flow estimates.

The proposed distribution service is expected to loop around the NCD site with two (2) connection points to the existing 406mm diameter public watermain on Carling Avenue. The WaterCAD model will be revised once further coordination with the design team and the City of Ottawa and completion of additional design analysis is completed to reduce the preliminary fire flow estimates. Revised boundary conditions will be obtained from the City of Ottawa and a scenario will be completed for the ultimate build out of the NCD as well as the first phase of development which includes the parking garage building.

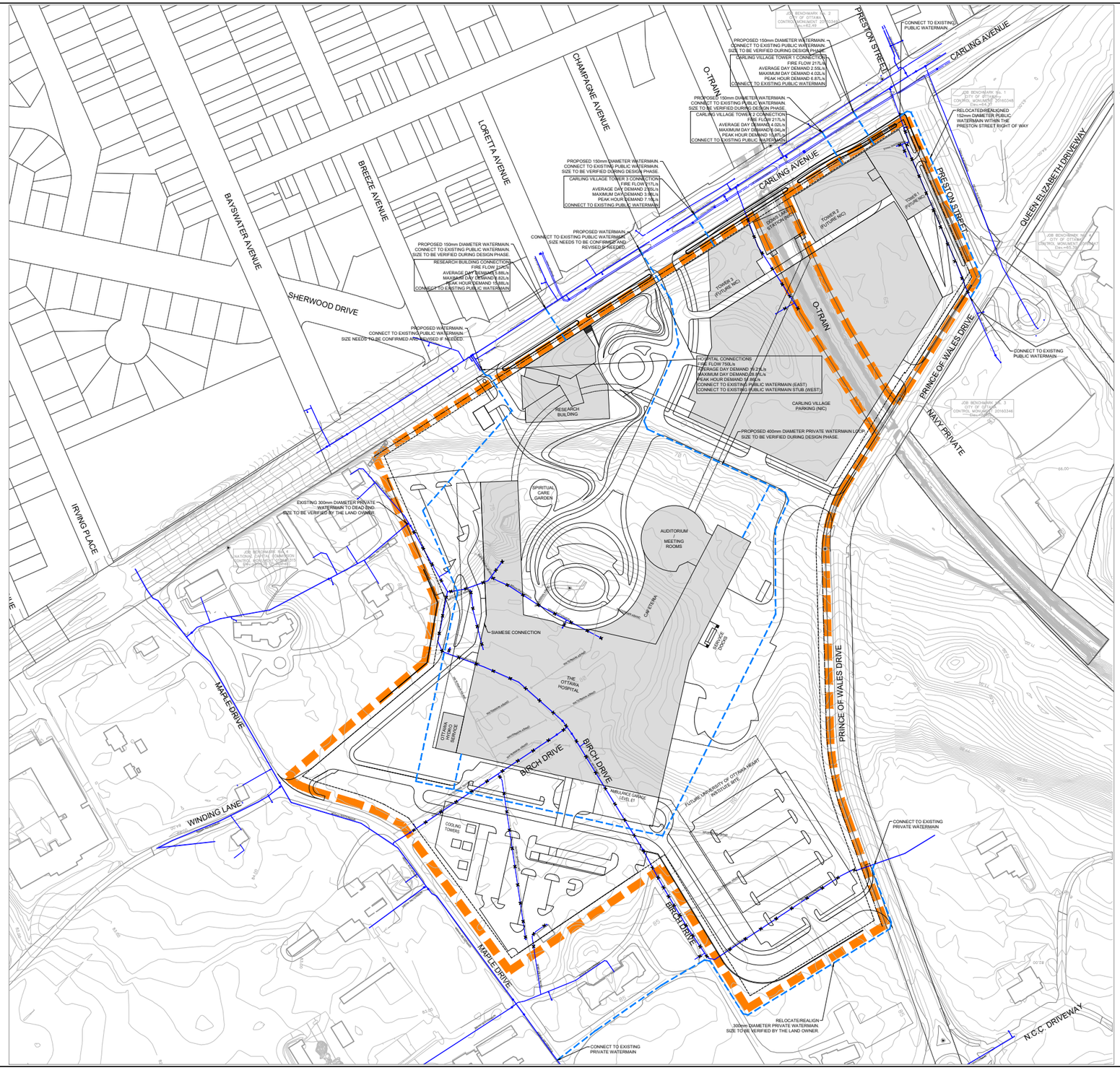
The high-level WaterCAD assessment will determine the watermain size required to service the land in accordance with the City of Ottawa's hydraulic objectives for minimum pressure (140Kpa or 20psi) under maximum day plus fire demand and minimum normal operating pressure (276Kpa or 40 psi) under peak hour demand. If the pressures are below the minimum requirements, a booster station would be required to ensure the minimum operating pressures can be achieved throughout the entire watermain loop.

The revised WaterCAD output results and model schematics for each scenario will be added to **Appendix E** once complete. The WaterCAD output results and model schematics completed to date are included in the previous report submission.

Another water servicing option that could be considered and modelled, is if the two (2) proposed watermain connections to Carling Avenue for the hospital are located within the 2W pressure zone (west of Sherwood Drive) instead of the 1W pressure zone (east of Sherwood Drive).

Fire hydrants, serviced off the proposed watermain loop, will be required throughout the site. The location and spacing of the fire hydrant shall be in accordance with the *City of Ottawa Water Distribution Design Guidelines*.

Further analysis and more detailed modeling will be required during preliminary design based on the final concept/land use plan for the NCD.




NOTES:

1. ESTIMATED DEMANDS AND PIPE SIZE TO BE VERIFIED DURING THE DESIGN PHASE AND ADJUSTED AS REQUIRED.
2. LOCATION AND NUMBER OF BUILDING CONNECTIONS TO BE FINALIZED DURING THE DESIGN PHASE.

LEGEND

- STUDY SITE BOUNDARY
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED/ABANDONED
- PROPOSED WATERMAIN
- FUTURE WATERMAIN

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Watermain Servicing

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 5-6

H:\SO\477458\1000\DWGS\01--Servicing\04--FIGURES.dwg Jul 28, 2021 - 2:20pm

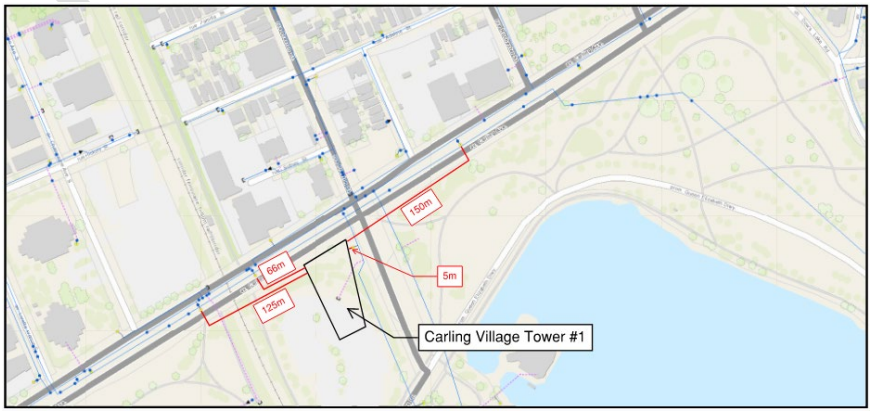
### 5.6.2 Future Research Building and Carling Village Towers

There are two (2) fire hydrants within 75m of the proposed Research Building, **Figure 5-7**. Assuming both hydrants are Class AA, the total maximum flow from the two (2) fire hydrants is **190L/s**, calculations are included in **Appendix D**. Additional fire protection measures will need to be implemented within the Research Building site to achieve a fire flow of **217L/s**. Since these are City of Ottawa hydrants, a simulation was not completed to determine if these hydrants all remain above 20psi. A multiple flow hydrant analysis will be required to determine the maximum flow that can be drawn simultaneously from the existing City of Ottawa hydrants. A 150mm diameter watermain service, from the existing 400mm diameter public watermain on Carling Avenue, should be sufficient to service the building based on the estimated demands. The estimated building demands, fire flow, and service connection pipe size will need to be verified and finalized during preliminary design. Coordination with the City of Ottawa should be completed during preliminary design to obtain existing hydrant flow testing data.

**Figure 5-7: Existing Fire Hydrants – Research Building**

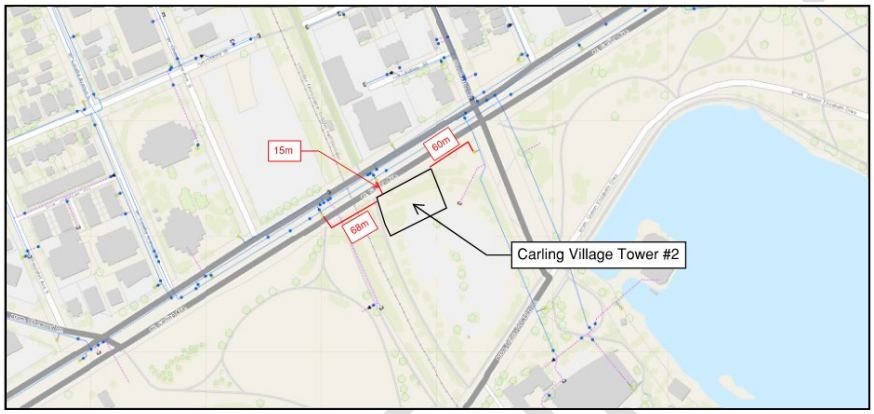

There are four (4) fire hydrants within the vicinity of the site of the proposed Carling Village Tower #1, two (2) hydrants are within 75m and two (2) hydrants are within 150m, **Figure 5-8**. Assuming all hydrants are Class AA, the total maximum flow from the four (4) fire hydrants is **317L/s**, calculations are included in **Appendix D**. A fire flow of **217L/s** is available within the existing system. Since these are City of Ottawa hydrants, a simulation was not completed to determine if these hydrants all remain above 20psi. A multiple flow hydrant analysis will be required to determine the maximum flow that can be drawn simultaneously from the existing City of Ottawa hydrants. A 150mm diameter watermain service, from the existing 400mm diameter public watermain on Carling Avenue, should be sufficient to service the building based on the estimated demands. The estimated building demands, fire flow, and service connection pipe size will need to be verified and finalized during preliminary design. Coordination with the City of Ottawa should be completed during preliminary design to obtain existing hydrant flow testing data.

**Figure 5-8 Existing Fire Hydrants – Carling Village #1**



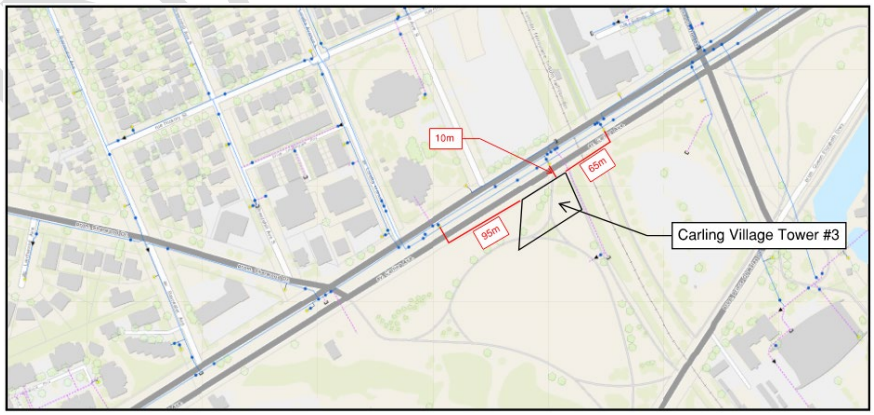
There are three (3) fire hydrants within 75m of the proposed Carling Village #2, **Figure 5-9**. Assuming all hydrants are Class AA, the total maximum flow from the three (3) fire hydrants is **285L/s**, calculations are included in **Appendix D**. A fire flow of **217L/s** is available within the existing system. Since these are City of Ottawa hydrants, a simulation was not completed to determine if these hydrants all remain above 20psi. A multiple flow hydrant analysis will be required to determine the maximum flow that can be drawn simultaneously from the existing City of Ottawa hydrants. A 150mm diameter watermain service, from the existing 400mm diameter public watermain on Carling Avenue, should be sufficient to service the building based on the estimated demands. The estimated building demands, fire flow, and service connection pipe size will need to be verified and finalized during preliminary design. Coordination with the City of Ottawa should be completed during preliminary design to obtain existing hydrant flow testing data.

**Figure 5-9: Existing Fire Hydrants – Carling Village #2**




There are three (3) fire hydrants within the vicinity of the site of the proposed Carling Village Tower #3, two (2) hydrants are within 75m and one (1) hydrant within 150m, **Figure 5-10**. A fire flow of **217L/s** is available within the existing system. Since these are City of Ottawa hydrants, a simulation was not completed to determine if these hydrants all remain above 20psi. A multiple flow hydrant analysis will be required to determine the maximum flow that can be drawn simultaneously from the existing City of Ottawa hydrants. A 150mm diameter watermain service, from the existing 400mm diameter public watermain on Carling Avenue, should be sufficient to service the building based on the estimated demands. The estimated building demands, fire flow, and service connection pipe size will need to be verified and finalized during preliminary design. Coordination with the City of Ottawa should be completed during preliminary design to obtain existing hydrant flow testing data.

**Figure 5-10: Existing Fire Hydrants – Carling Village #3**



## 5.7 Water Servicing Conclusion

A preliminary water servicing analysis was previously completed based on the ultimate build out of the NCD. The previously estimated demands were provided to the City of Ottawa to develop boundary conditions at the two (2) connections points to the existing 406mm diameter public watermain on Carling Avenue. Revised boundary conditions will be provided by the City of Ottawa once further coordination with the design team and the City of Ottawa, and the completion of additional design analysis is completed to reduce the preliminary fire flow estimates.

The proposed distribution service is expected to loop around the NCD site with two (2) connection points to the existing 406mm diameter public watermain on Carling Avenue. The WaterCAD model will be revised once further coordination with the design team and the City of Ottawa and completion of additional design analysis is completed to reduce the preliminary fire flow estimates. Revised boundary conditions will be obtained from the City of Ottawa and a scenario will be completed for the ultimate build out of the NCD as well as the first phase of development which includes the parking garage building.

The high-level WaterCAD assessment will determine the watermain size required to service the land in accordance with the City of Ottawa's hydraulic objectives for minimum pressure (140Kpa or 20psi) under maximum day plus fire demand and minimum normal operating pressure (276Kpa or 40 psi) under peak hour demand. If the pressures are below the minimum requirements, a booster station would be required to ensure the minimum operating pressures can be achieved throughout the entire watermain loop.

Another water servicing option that could be considered and modelled, is if the two (2) proposed watermain connections to Carling Avenue for the hospital are located within the 2W pressure zone (west of Sherwood Drive) instead of the 1W pressure zone (east of Sherwood Drive).

Fire hydrants, serviced off the proposed watermain loop, will be required throughout the site. The location and spacing of the fire hydrant shall be in accordance with the *City of Ottawa Water Distribution Design Guidelines*.

In accordance with the *City of Ottawa Water Distribution Design Guidelines Technical Bulletin ISTB-2018-02*, the total maximum fire hydrant flow was estimated for the Research Building, Carling Village Tower #1, Carling Village Tower #2, and Carling Village Tower #3. A fire flow of 217L/s is available within the existing system for Carling Village Tower #1, Carling Village Tower #2, and Carling Village Tower #3. Additional fire protection measures will need to be implemented within the Research Building site to achieve a fire flow of 217L/s. Since these are City of Ottawa hydrants, a simulation was not completed to determine if these hydrants all remain above 20psi. A multiple flow hydrant analysis will be required to determine the maximum flow that can be drawn simultaneously from the existing City of Ottawa hydrants. A 150mm diameter watermain service, from the existing 400mm diameter public watermain on Carling Avenue, should be sufficient to service the four (4) buildings based on the estimated demands. The estimated building demands, fire flows, and service connection pipe sizes will need to be verified and finalized during preliminary design. Coordination with the City of Ottawa should be completed during preliminary design to obtain existing hydrant flow testing data.

Further analysis and detailed modeling will be required during preliminary design based on the final concept/land use plan for the NCD. Further analysis and detailed modeling will also be required for the relocation of PSPC water services.

The watermains will need to be designed in accordance with the *City of Ottawa Water Distribution Design Guidelines*.

# 6.0 COMBINED SERVICING

## 6.1 Existing Combined Infrastructure

The NCD parcel is located within an area of the City of Ottawa that contains a complex network of hydraulic sewer structures. One of those trunk systems is the Preston Trunk Sewer which is composed of combined sewer flow.

### 6.1.1 Public Combined Sewers

- Preston-Booth Trunk → 1800mm diameter combined sewer
- Preston Street → 300mm diameter combined sewer

The eastern parcel of the NCD conveys runoff to the Preston-Booth Trunk, located within Preston Street, which is composed of combined sewer flow.

The drainage area for the Preston-Booth Trunk is included in **Appendix H.**

The existing combined infrastructure within the vicinity of the NCD is illustrated in **Figure 7-1**.

#### 6.1.1.1 Preston-Booth Trunk Sewer

The Preston-Booth Trunk is a combined sewer that drains an area of more than 200ha, with the Preston Trunk draining most of the area. The Preston Trunk extends south to Carling Avenue from Albert Street. At Spruce Street, the Preston Trunk is diverted to the Booth Trunk. The Booth Trunk is diverted to the Ottawa Interceptor Sewer. There is a control chamber at Booth Street, north of Albert Street, where a combined sewer overflow sends excess water to the Tailrace during large wet weather events (flow that does not go to the Combined Central Storage Tunnel (CCST)).

During the Albert Street road reconstruction, the combined sewers within the Albert Street area were separated into sanitary sewers and storm sewers. As such, sanitary sewer flows within the proximity of Albert Street no longer outlet into the Preston Street Trunk Sewer. Shallower storm sewer systems were also constructed along Albert Street and adjoining side streets with an outlet to the newly configured Preston Trunk Sewer. The Preston Trunk Sewer was originally located within the LeBreton Flats Lands. The Albert Street road reconstruction reconfigured the Preston Trunk Sewer to flow east at Albert Street toward Booth Street.

The old Preston combined sewer north of Spruce Street was converted to a storm sewer a couple years ago which eventually discharges to the Tailrace.

#### 6.1.1.2 Preston Street Combined Sewer

A 300mm diameter public sanitary sewer is located on the east side of Preston Street that services Dow's Lake Pavilion, the Navy Curling Club and the Navy Marine Force Building and connects to the 1200mm diameter combined sewer on Carling Avenue.

# 7.0 SANITARY SERVICING

When reviewing the sanitary infrastructure servicing for the site, there are two (2) main factors that need to be considered: (1) The existing property was previously owned and operated by Agriculture and Agri-Food Canada (AAFC) and Natural Resources Canada (NRCan), and PSPC has existing privately owned sanitary infrastructure throughout the site that are still in operation and require relocation for continued service; and (2) The proposed sanitary servicing for the site.

## 7.1 Existing Sanitary Infrastructure

The NCD parcel is located within an area of the City of Ottawa that contains a complex network of hydraulic sewer structures. One of those trunk systems is the Mooney's Bay Collector.

The existing sanitary infrastructure within the vicinity of the NCD is illustrated in **Figure 7-1**.

### 7.1.1 Public Sanitary Sewers

- Carling Avenue → 225mm/300mm diameter public sanitary sewers
- Mooney's Bay Collector → 1050mm diameter public sewers

#### 7.1.1.1 Carling Avenue Sanitary Sewer

A 225mm diameter public sanitary sewer is located within the westbound lanes of Carling Avenue just east of Bayswater Avenue and extends to Breezehill Avenue. At Breezehill Avenue, it increases to a 300mm diameter public sanitary sewer.

A 300mm diameter public sanitary sewer is located within the westbound lanes of Carling Avenue and extends just east of the O-Train corridor to Preston Street. At Preston Street, it connects into the 1500mm diameter public Preston Street Trunk Sewer

#### 7.1.1.2 Mooney's Bay Collector

The Mooney's Bay Collector is a 1050mm diameter concrete sewer that cuts through the westerly parcel (within an existing easement). The Mooney's Bay Collector outlets into the West Nepean Collector. The Mooney's Bay Collector is located to the west of the Trillium Line and extends as far as Carling Avenue.

The lower end of the Mooney's Bay Collector is reported to be operating under extreme surcharge during large rainfall events. This is due to a large contributing drainage area that is not sufficiently controlled. Not only is there no available capacity, but the hydraulic operation of this sewer poses a significant flooding risk in the vicinity of the sewer during surcharge conditions.

### 7.1.2 Private Sanitary Sewers

- Maple Drive → 250mm diameter private sanitary sewer
- Birch Drive → 250mm diameter private sanitary sewer
- National Capital Commission Driveway → 250mm diameter private sanitary sewer

#### 7.1.2.1 Maple Drive Sanitary Sewer

A 250mm diameter private sanitary sewer is located within Maple Drive and extends from Winding Lane to Birch Drive. It connects into the 300mm diameter private sanitary sewer on Birch Street.

A 250mm diameter private sanitary sewer is located within Maple Drive and extends from approximately 45m south of Birch Drive to Birch Drive. It connects into the 300mm diameter private sanitary sewer on Birch Street.

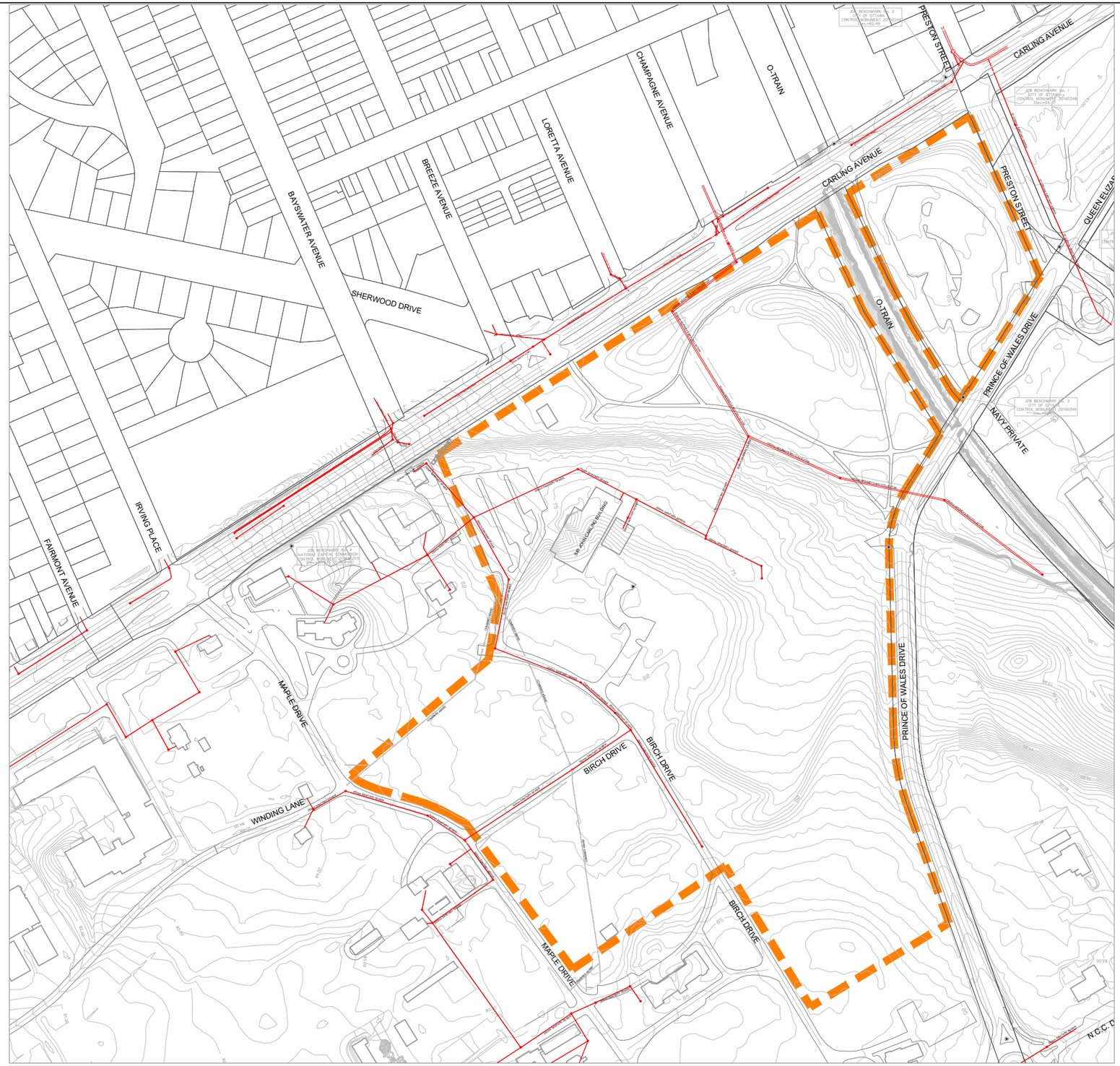
These private sanitary sewers service the Central Experimental Farm Site and are not owned, operated and/or maintained by the City of Ottawa. These sanitary sewers are owned, operated and maintained by PSPC.

#### 7.1.2.2 Birch Drive Sanitary Sewer

A 250mm diameter private sanitary sewer is located within the portion of Birch Drive that runs east/west and extends from Maple Drive to Birch Drive. A 250mm diameter private sanitary sewer is located within the portion of Birch Drive that runs north/south and extends from approximately 100m south of Birch Drive to Birch Drive. These two (2) sanitary sewers on Birch Drive connect at the bend and continue as a 250mm diameter private sanitary sewer north and east around the existing building. It increases to a 300mm diameter private sanitary sewer prior to connecting into the 1050mm diameter public Mooney's Bay Collector Sewer. This private sanitary sewer services the Central Experimental Farm Site and is not owned, operated and/or maintained by the City of Ottawa. This sanitary sewer is owned, operated and maintained by PSPC.

#### 7.1.2.3 National Capital Commission Driveway Sanitary Sewer

A 250mm diameter private sanitary sewer is located within National Capital Commission Driveway and extends from Maple Drive to the public Mooney's Bay Collector Sewer. After crossing Prince of Wales Drive, it continues along the northern portion of the National Capital Commission Driveway loops before connecting to the 1050mm diameter public Mooney's Bay Collector Sewer just east of Dow's Lake. This private sanitary sewer services the Central Experimental Farm Site and is not owned, operated and/or maintained by the City of Ottawa. This sanitary sewer is owned, operated and maintained by PSPC.




NOTES:

1. 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 THE UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.

LEGEND

STUDY SITE BOUNDARY

SANITARY SEWER

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Existing Sanitary Infrastructure

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-1

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## 7.2 Sanitary Constraints

The following existing conditions factors will influence the servicing design for the NCD:

- The existing 225mm/300mm diameter public sanitary sewer on Carling Avenue (west of the O-Train corridor) and the existing 1050mm diameter public Mooney's Bay Trunk Collector are located within a partially separated area. These sanitary sewers are both located within the Mooney's Bay Trunk Collector sewershed. The City of Ottawa has significant concerns related to basement flooding within this area; therefore, the City of Ottawa will need to assess the impact on their system using the flood risk models based on the estimated flows for the westerly parcel;
- The existing 300mm diameter public sanitary sewer on Carling Avenue (east of the LRT corridor) and the existing 300mm diameter public sanitary sewer on Preston Street are located within the Preston Trunk sewershed. The City of Ottawa has significant concerns related to basement flooding and combined sewer overflow within this area; therefore, the City of Ottawa will need to assess the impact on their system using the flood risk models based on the estimated flows for the easterly parcel;
- Sanitary sewer(s) performance should be assessed during wet weather conditions;
- No proposed development is allowed over top of the Mooney's Bay Trunk Collector;
- The existing 1050mm diameter public Mooney's Bay Trunk Collector will need to remain within the existing 10m easement that crosses the westerly parcel;
- The existing 250mm/300mm diameter private sanitary sewer that crosses the westerly parcel and connects into the public Mooney's Bay Trunk Collector will need to be relocated as it services the PSPC lands to the west of the site; and
- PSPC lands will require their own service connection and the NCD will require their own service connection.

The site evaluation received from the City of Ottawa is included in **Appendix B**.

## 7.3 Sanitary Sewer Relocations/Realignments

The following sanitary sewer relocations/realignments are required to accommodate the NCD.

### 7.3.1 Private Sanitary Sewers

#### 7.3.1.1 Birch Drive Sanitary Sewer

The 250mm/300mm diameter private sanitary sewer located within Birch Drive that extends north and east around the existing Sir John Carling building and outlets to the Mooney's Bay Collector will need to be relocated/realigned to accommodate the proposed development. This sanitary sewer services the existing PSPC buildings located to the west of the NCD.

The two (2) options that were investigated are as follows: (Option 1) Relocate/realign the existing private sanitary sewer and create a new outlet connection to the existing 300mm diameter public sanitary sewer on Carling Avenue; (Option 2) Relocate/realign the existing private sanitary sewer and maintain the existing outlet connection to the existing public Mooney's Bay Collector. Two (2) different alignment scenarios are presented for both Option 1 and Option 2. The preferred option is Option 1A, although it would require further analysis during preliminary design to ensure that the existing 300mm diameter public sanitary sewer on Carling Avenue has sufficient capacity to accommodate the existing federal land buildings.

**Option 1A**

The existing 250mm/300mm diameter private sanitary sewer on Maple Drive between Widening Lane and Birch Drive will be removed and replaced with a new 250mm diameter private sanitary sewer that will drain towards the north. At the intersection of Widening Lane and Birch Drive, a new sanitary sewer will be installed along the northwest limit of the hospital site which will extend east and connect into the existing sanitary manhole structure on the hospital site. The existing 250mm diameter private sanitary sewer, downstream of the existing manhole, will remain in place up to the north hospital tower. A new private sanitary manhole will be installed just west of the proposed north hospital tower and a new sanitary sewer will extend north and connect into the existing 300mm diameter public sanitary sewer on Carling Avenue. The relocation/realignment of this sanitary sewer is illustrated in **Figure 7-2**.

Coordination and approval from the City of Ottawa will be required to ensure the existing sanitary sewer on Carling Avenue has sufficient capacity to accommodate the additional flow.

Coordination between the two (2) property owners (TOH and PSPC) will be required to determine if an easement is required to ensure PSPC can maintain their private sanitary sewer.

**Option 1B**

If the existing 250mm diameter private sanitary sewer portion cannot be maintained and utilized, a new 250mm diameter private sanitary sewer will need to be installed around the proposed parking lot located in the northwest corner of the hospital site. The relocation/realignment of this sanitary sewer is illustrated in **Figure 7-3.**

Coordination and approval from the City of Ottawa will be required to ensure the existing sanitary sewer on Carling Avenue has sufficient capacity to accommodate the additional flow.

Coordination between the two (2) property owners (TOH and PSPC) will be required to determine if an easement is required to ensure PSPC can maintain their private sanitary sewer.

**Option 2A**

The existing 250mm/300mm diameter private sanitary sewer on Maple Drive between Widening Lane and Birch Drive will be removed and replaced with a new sanitary sewer that will drain towards the north. At the intersection of Widening Lane and Birch Drive, a new sanitary sewer will be installed along the northwest limit of the hospital site which will extend east and connect into the existing sanitary manhole structure on the hospital site. The existing 250mm diameter private sanitary sewer, downstream of the existing manhole, will remain in place up to the north hospital tower. A new private sanitary manhole will be installed just west of the proposed north hospital tower and a new 250mm diameter private sanitary sewer will extend east from the north hospital tower and connect into the existing public Mooney's Bay Collector. The relocation/realignment of this sanitary sewer is illustrated in **Figure 7-4**.

Coordination and approval from the City of Ottawa will be required.

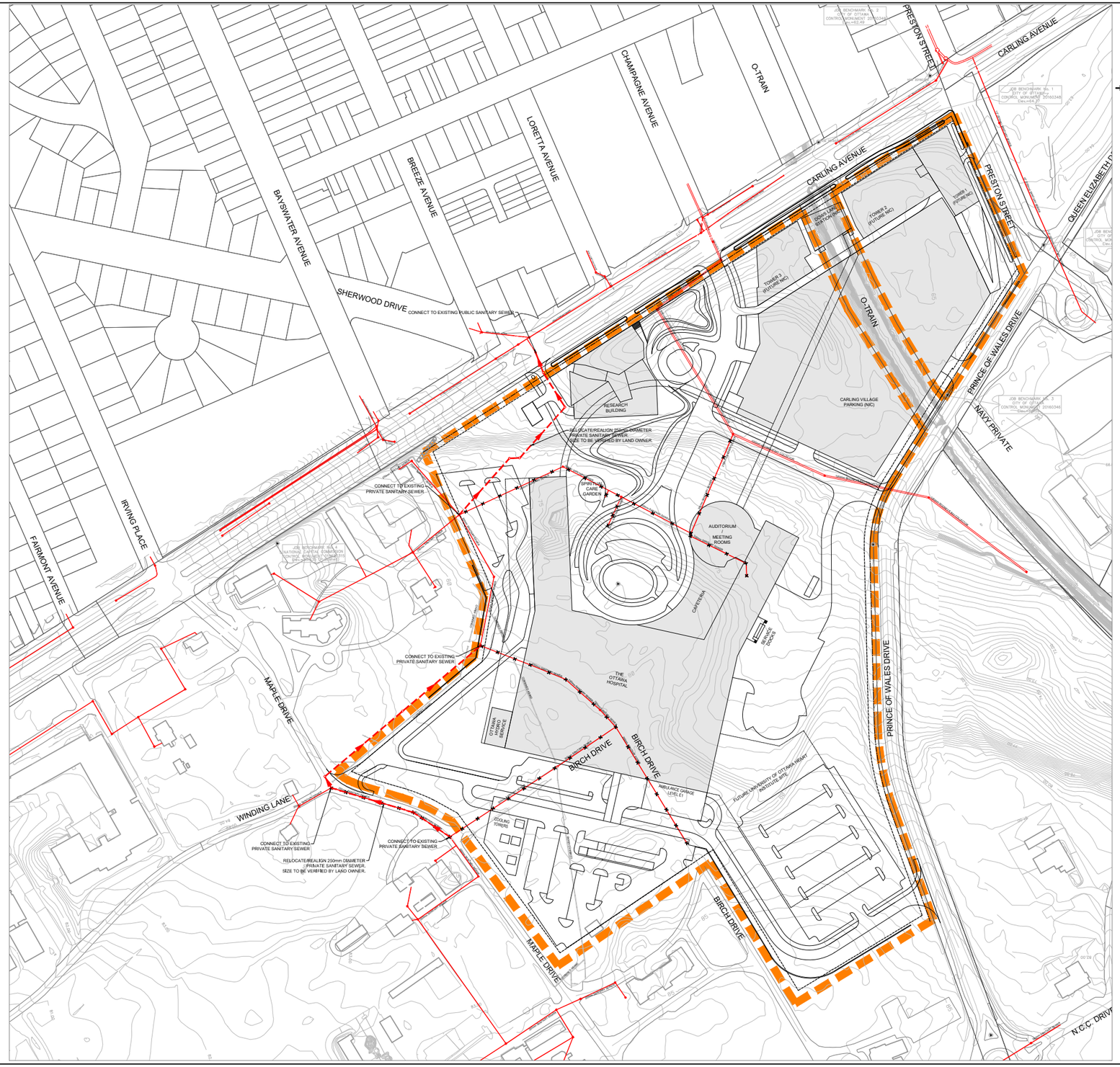
Coordination between the two (2) property owners (TOH and PSPC) will be required to determine if an easement is required to ensure PSPC can maintain their private sanitary sewer.

**Option 2B**

If the existing 250mm diameter private sanitary sewer portion cannot be maintained and utilized, a new 250mm diameter private sanitary sewer will need to be installed around the proposed parking lot located in the northwest corner of the hospital site. The relocation/realignment of this sanitary sewer is illustrated in **Figure 7-5**.

Coordination and approval from the City of Ottawa will be required.

Coordination between the two (2) property owners (TOH and PSPC) will be required to determine if an easement is required to ensure PSPC can maintain their private sanitary sewer.




LEGEND

- STUDY SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER

35m 0 70 140m

SCALE: 1:3500

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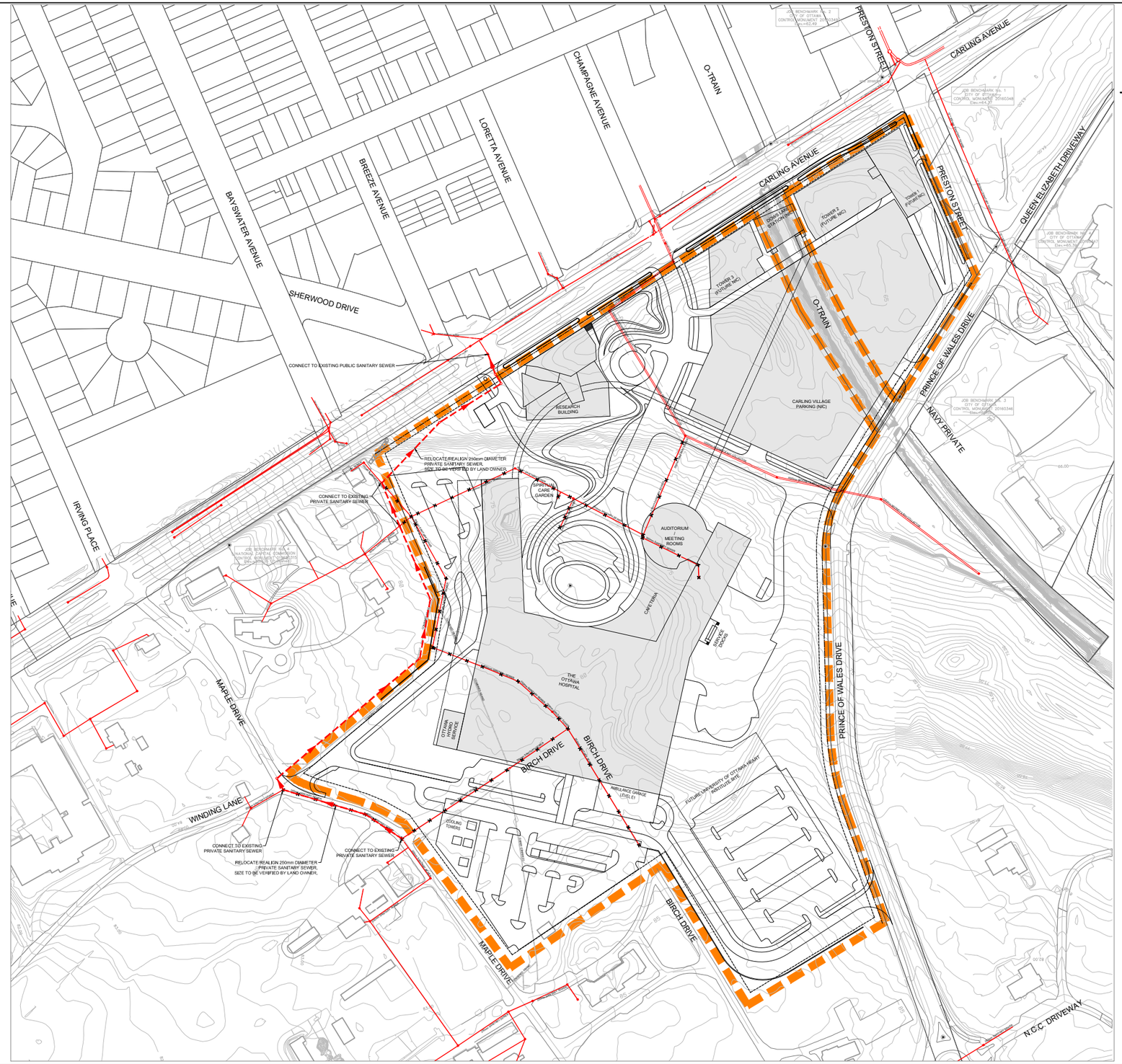
PARSONS

# The New Civic Development

## Pri ate Sanitary RelDcatiDn/Realignment - Birc Dri e O tiDn 1A

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-2




LEGEND

- STUDY SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Pri ate Sanitary RelDcatiDn/Realignment - Birc Dri e O tiDn 1B

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-3

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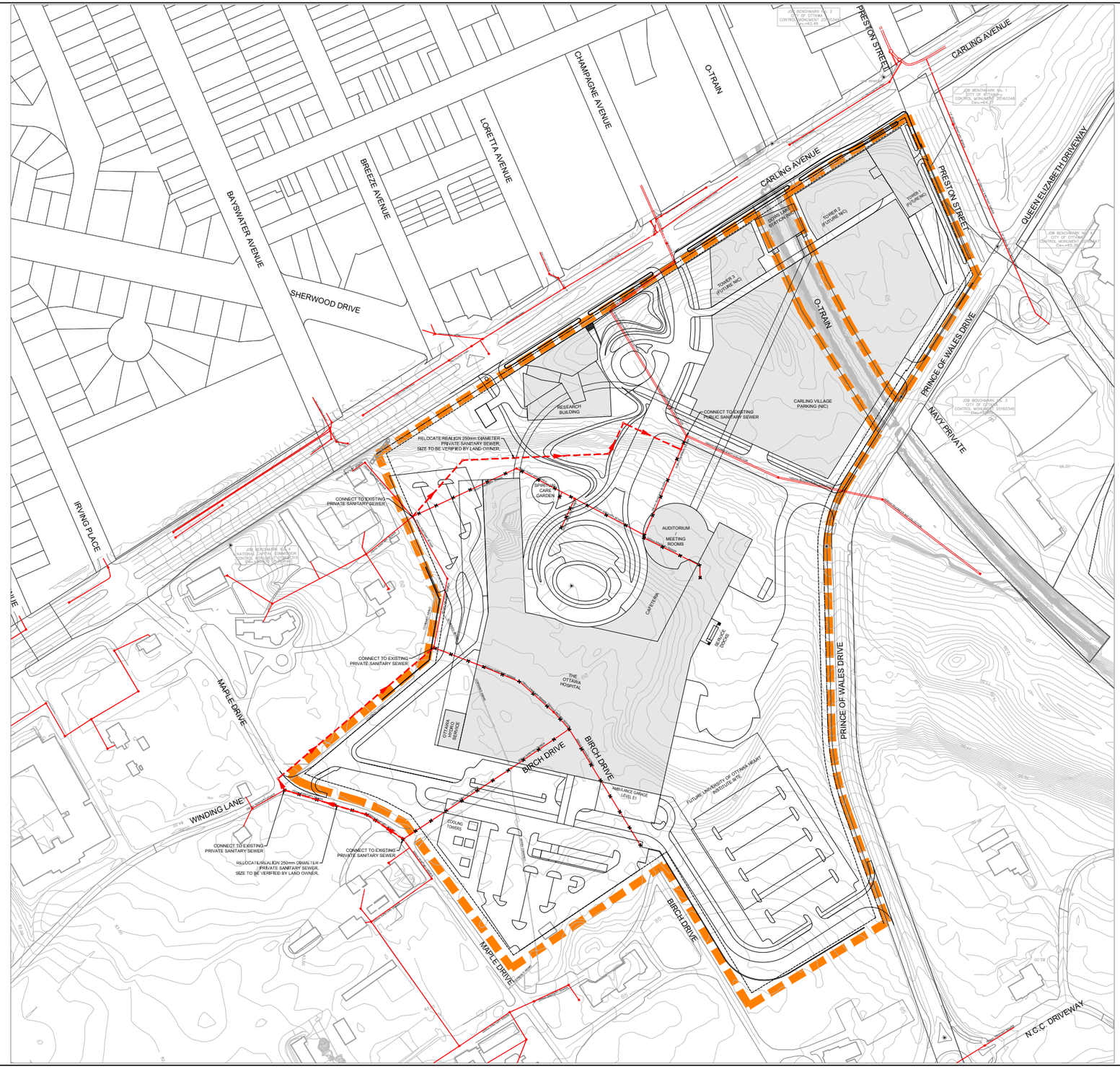


LEGEND

- STUDY SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER

35m 0 70 140m

SCALE: 1:3500

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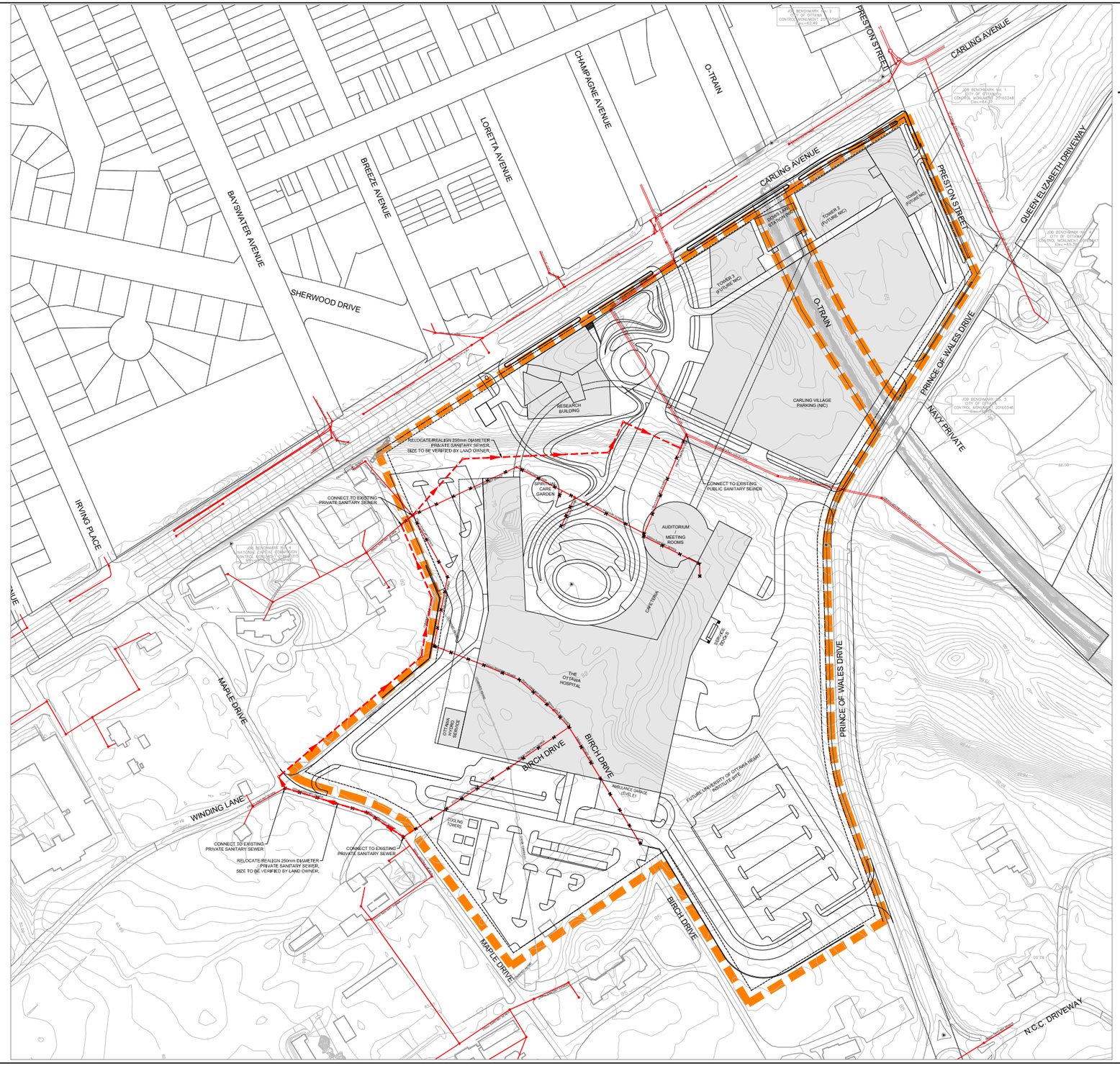
PARSONS

# The New Civic Development

## Pri ate Sanitary RelDcatiDn/Realignment - Birc Dri e O tiDn 2A

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-4




LEGEND

- STUDY SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER

35m 0 70 140m

SCALE: 1:3500

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PARSONS

# The New Civic Development

## Pri ate Sanitary RelDcatiDn/Realignment - Birc Dri e O tiDn 2B

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-5

## 7.4 Sanitary Design Criteria

The design criteria from the *City of Ottawa Sewer Design Guidelines (October 2012)*, *City of Ottawa Technical Bulletins ISTB-2012-6 (October 31, 2012), ISTB-2014-01 (February 5, 20114), PIEDTB-2016-01 (September 6, 2016),* and *ISTB-2018-01 (March 21, 2018)* as well as the existing water usage data for the Civic Hospital were applied to estimate the preliminary sanitary demands and presented in **Table 7-1**.

**Table 7-1: Sanitary Design Criteria**

| Design Criteria | Value |
|---|---|
| **AVERAGE DAILY DEMANDS** | |
| Residential* | 280 L/gross ha/day |
| Institutional | 28,000 L/gross ha/day |
| Commercial | 28,000 L/gross ha/day |
| Office | 75 L/person/day<br>8.06 L/m²/day |
| Existing Civic Hospital Water Use* | 3.5 L/m²/day |
| **PEAK FACTORS** | |
| Residential** | Harmon Equation = $1 + \left(\frac{14}{4+\left(\frac{P}{1000}\right)^{\frac{1}{2}}}\right) * K$<br>Where P = Population and K=0.8 |
| Maximum Residential* | 4.0 |
| Minimum Residential* | 2.0 |
| Institutional | 1.5 if institutional contribution >20%, otherwise use 1.0 |
| Commercial | 1.5 if commercial contribution >20%, otherwise use 1.0 |
| **POPULATION DENSITIES** | |
| Residential* – One (1) Bedroom | 1.4 persons/unit |
| Residential* – Two (2) Bedrooms | 2.1 persons/unit |
| Residential* – Three (3) Bedrooms | 3.1 persons/unit |
| Residential* – Average Apartment | 1.8 persons/unit |
| **EXTRANEOUS FLOW** | |
| Extraneous Flow Allowance | 0.33 L/s/gross ha |
| **OPERATIONAL CONDITIONS** | |
| Minimum Sanitary Sewer Size | 200mm Diameter |
| Minimum Manning's 'n' | 0.013 |
| Minimum Depth of Cover | 2.0m from the pipe obvert to top of finished grade |
| Minimum Full Flow Velocity | 0.6 m/s |
| Maximum Full Flow Velocity | 3.0 m/s |

**Flow rate was estimated based on water usage data for the 2020 calendar year for the Civic Hospital*

***Residential in this case means a residential care facility for patients and residents of the hospital or other primary use.*

## 7.5 Sanitary Demands

The pre-development sanitary demands were estimated based on the sanitary areas illustrated in **Figure 7-6**, and the design criteria presented in **Table 7-1**. The estimated pre-development sanitary demands are summarized in **Table 7-2** and the design calculations are included **Appendix F.**

Table 7-2: Pre-Development - Estimated Sanitary Demands

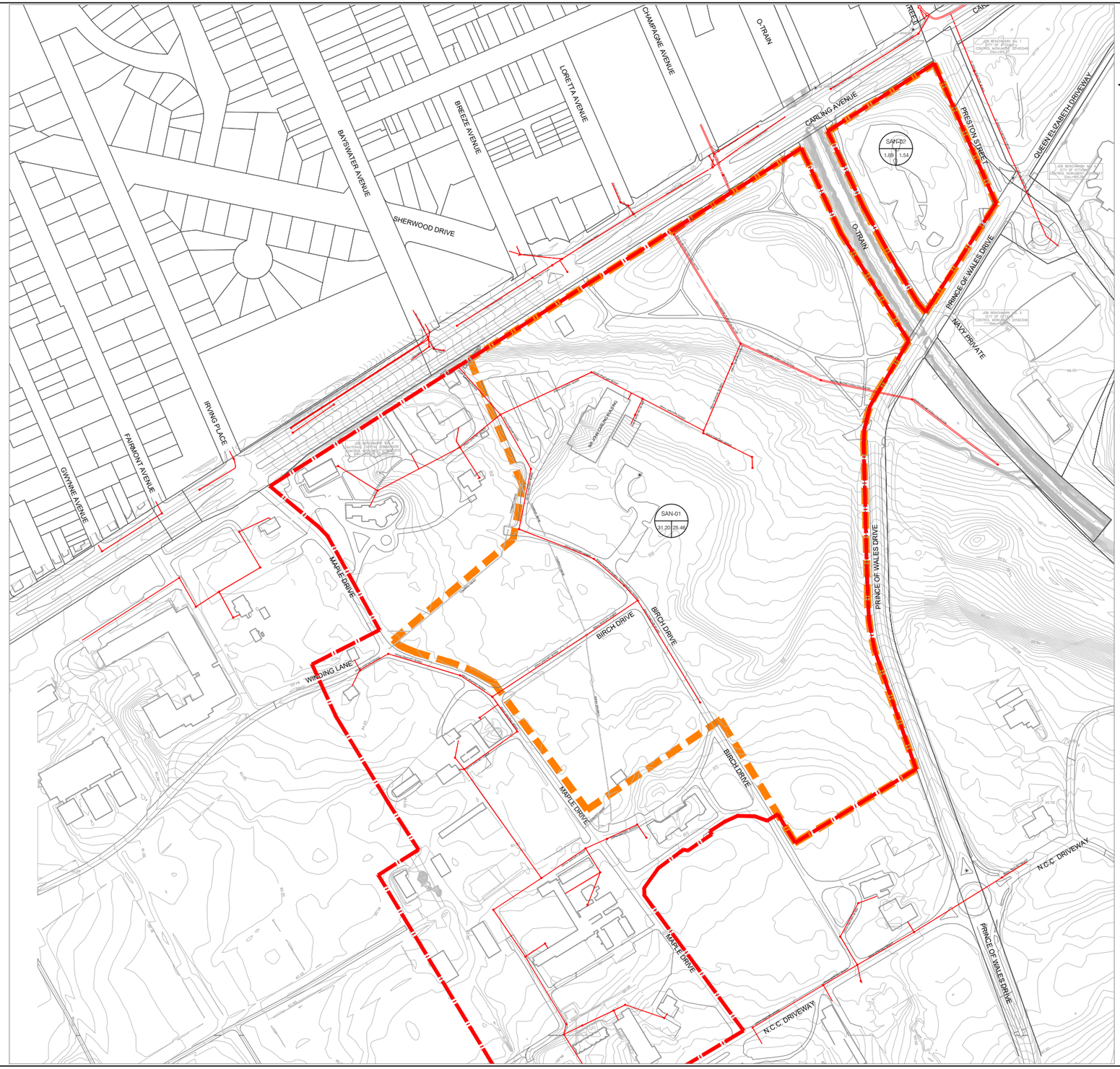
| Area/Building | Site Area (ha) | Peak Flow (L/s) | Infiltration Flow (L/s) | Total Flow (L/s) | Outlet Watershed |
|---|---|---|---|---|---|
| PSPC SITE (EXISTING) | | | | | |
| SAN-01 PSPC Lands | 31.20 | 15.20 | 10.30 | 25.46 | Mooney's Bay Collector |
| SAN-02 PSPC Lands | 1.89 | 0.92 | 0.62 | 1.54 | Preston Street Trunk |

The post development sanitary demands were estimated based on the land use information presented in **Table 4-1**, the sanitary areas illustrated in **Figure 7-7**, and the design criteria presented in **Table 7-1**. The estimated post development sanitary demands are summarized **Table 7-3** and the design calculations are included in **Appendix F**.

Table 7-3: Post Development - Estimated Sanitary Demands

| Area/Building | Site Area (ha) | Gross Floor Area ($m^2$) | | Peak Flow (L/s) | Infiltration Flow (L/s) | Total Flow (L/s) | Outlet Watershed |
|---|---|---|---|---|---|---|---|
| | | Institutional | Commercial | | | | |
| PSPC SITE (EXISTING) | | | | | | | |
| SAN-01 PSPC Lands* | 13.02 | - | - | 6.30 | 4.30 | 10.63 | Mooney's Bay Collector |
| THE NEW CIVIC DEVELOPMENT | | | | | | | |
| SAN-02 Hospital | 18.02 | 441,300 | - | 28.30 | 5.94 | 34.24 | Mooney's Bay Collector |
| SAN-03 Research Building | 1.61 | - | 63,000 | 8.82 | 0.53 | 9.35 | Mooney's Bay Collector |
| SAN-04 Carling Village Tower #3 | 0.25 | - | 28,430 | 3.98 | 0.08 | 4.06 | Mooney's Bay Collector |
| SAN-05 Carling Village Tower #2 | 0.35 | - | 43,120 | 6.03 | 0.12 | 6.15 | Preston Street Trunk |
| SAN-06 Carling Village Tower #1 | 0.26 | - | 27,280 | 3.82 | 0.09 | 3.91 | Preston Street Trunk |

**Existing development adjacent to the New Civic Development – infrastructure relocations are required to continue servicing the existing federal buildings. Demands estimated since Master Servicing Report and water records were not available.*




N

NOTES:

1. PRE-DEVELOPMENT FLOWS BASED ON THE EXISTING LAND ZONING (I2-MAJOR INSTITUTIONAL) AND THE CITY OF OTTAWA SEWER DESIGN GUIDELINES (28000 L/ a/day)

| SEWERSHED AREA | OUTLET | SEWERSHED | PEAK WET WEATHER FLOW RATE |
|---|---|---|---|
| SAN - 01 | MOONEY'S BAY COLLECTOR | MOONEY'S BAY COLLECTOR | 25.46L/s |
| SAN - 02 | 525mm COMBINED SEWER ON CARLING AVENUE | PRESTON STREET TRUNK | 1.54L/s |

LEGEND

- STUDY SITE BOUNDARY
- EXISTING SEWERSHED BOUNDRY
- SEWERSHED NAME
- PEAK WET WEATHER FLOW RATE
- AREA IN HECTARES

80m 40 20 0 40 80 160m

SCALE: 1:4000

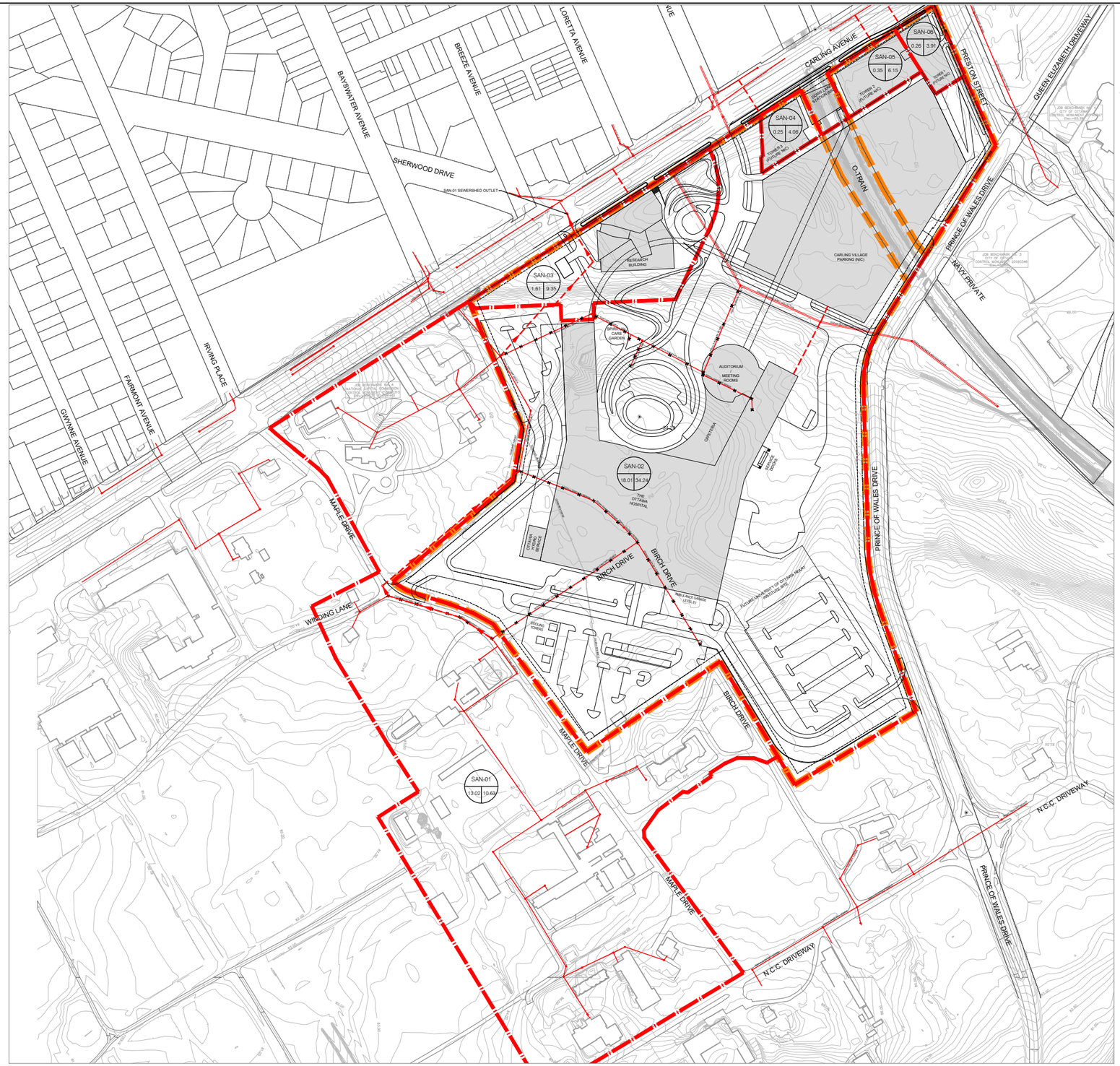
PARSONS

# The New Civic Development

## Pre De elD ment Sanitary Drainage Areas

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-6




| AREA | OUTLET | SEWERSHED | PEAK WET WEATHER FLOW RATE |
|---|---|---|---|
| SAN - 01 | 300mm SANITARY SEWER ON CARLING AVENUE | MOONEY'S BAY COLLECTOR | 10.63L/s |
| SAN - 02 | MOONEY'S BAY COLLECTOR | MOONEY'S BAY COLLECTOR | 34.24L/s |
| SAN - 03 | 300mm SANITARY SEWER ON CARLING AVENUE | MOONEY'S BAY COLLECTOR | 9.35L/s |
| SAN - 04 | 300mm COMBINED SEWER ON CARLING AVENUE | MOONEY'S BAY COLLECTOR | 4.06L/s |
| SAN - 05 | 300mm SANITARY SEWER ON CARLING AVENUE | PRESTON STREET TRUNK | 6.15L/s |
| SAN - 06 | 300mm SANITARY SEWER ON CARLING AVENUE | PRESTON STREET TRUNK | 3.91L/s |

LEGEND

- STUDY SITE BOUNDARY
- PROPOSED SEWERSHED BOUNDRY
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER
- AREA ID
- PEAK WET WEATHER FLOW RATE
- AREA IN HECTARES

80m 40 20 0 40 80 160m

SCALE: 1:4000

PARSONS

# The New Civic Development

## Post Development Sanitary Drainage Areas

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-7

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### 7.5.1 Assumptions

The demands for the PSPC lands were estimated since actual data/records were not available at the time this report was prepared. Based on the existing site zoning (I2 – Major Institutional) and the City of Ottawa Sewer Design Guidelines, the allowable peak flow for the existing land was assumed to be 28,000 L/ha/day. The estimated demands should be updated to reflect the actual demands based on the Master Servicing Report and water meter records.

The water usage data (2020) for the existing Ottawa Hospital Civic Campus, located at the intersection of Carling Avenue and Parkdale Avenue, was used to estimate the average daily demand. The estimated average daily demand for the existing hospital was applied to estimate the peak flow for the new hospital.

Since the site plan for the NCD lands is currently at the Master Site Plan (conceptual stage), the following assumptions were made:

- The gross floor area for the future Research Building, Carling Village Tower #1, Carling Village Tower #2, and Carling Village #3 were estimated assuming fifteen (15) storeys in height;
- The future Carling Village Towers were assumed to be all commercial floor space; and
- There will be additional sanitary flows that will be generated from snow melt off vehicles within the proposed parking garage. The flows are not known at this time but are expected to be negligible compared to the sanitary flows for the domestic use.

### 7.5.2 Conclusion

The estimated sanitary demands for the proposed hospital site and the existing PSPC lands will need to be reviewed and updated accordingly during preliminary design. The demands will need to be recalculated based on the final concept/land use plan for the NCD and the Master Servicing Report and/or water records for the existing PSPC lands.

## 7.6 Sanitary Servicing Design

The sanitary service connection for the future Research Building is proposed to connect into the existing 300mm diameter public sanitary sewer on Carling Avenue between Sherwood Drive and Loretta Avenue. The 300mm diameter public sanitary sewer discharges into the public Mooney's Bay Collector at the intersection of Carling Avenue and Champagne Avenue. A 150mm diameter sanitary sewer connection has sufficient capacity to accommodate the estimated peak wet weather flow (**9.35 L/s**).

The sanitary service connection for the future Carling Village Tower #3 is proposed to connect into the existing 300mm diameter public combined sewer on Carling Avenue between Champagne Avenue and the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor. The 300mm diameter public combined sewer discharges into the public Mooney's Bay Collector at the intersection of Carling Avenue and Champagne Avenue. A 150mm diameter sanitary sewer connection has sufficient capacity to accommodate the estimated peak wet weather flow (**4.06 L/s**).

The sanitary service connection for the future Carling Village Tower #2 is proposed to connect into the existing 300mm diameter public sanitary on Carling Avenue between the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor and Preston Street. The 300mm diameter public sanitary sewer discharges into the public Preston Trunk at the intersection of Carling Avenue and Preston Street. A 150mm diameter sanitary sewer connection has sufficient capacity to accommodate the estimated peak wet weather flow (**6.15 L/s**).

The sanitary service connection for the future Carling Village Tower #1 is proposed to connect into the existing 300mm diameter public sanitary on Carling Avenue between the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor and Preston Street. The 300mm diameter public sanitary sewer discharges into the public Preston Trunk at the intersection of Carling Avenue and Preston Street. A 150mm diameter sanitary sewer connection has sufficient capacity to accommodate the estimated peak wet weather flow (**3.91 L/s**).

The sanitary service connection for the hospital is proposed to exit the front of the south tower and connect into the existing public Mooney's Bay Collector between Prince of Wales Drive and Carling Avenue. The Mooney's Bay Collector runs through the site and continues north along Champagne Avenue. A 300mm diameter sanitary sewer connection has sufficient capacity to accommodate the estimated peak wet weather flow (**34.24 L/s**).

The sanitary outlet for the PSPC lands is proposed wrap around the western limit of the hospital site on federal lands and cross the hospital site near the north hospital tower and connect into the existing 300mm diameter public sanitary sewer on Carling Avenue at Sherwood Drive. A 250mm diameter sanitary sewer has sufficient capacity to accommodate the estimated peak wet weather flow (**10.63 L/s**).

The proposed sanitary servicing approach for the NCD is illustrated in **Figure 7-8.** The sanitary sewers will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines*.

## 7.7 Sanitary Servicing Conclusion

The 150mm diameter sanitary service connection for the future Research Building and the 250mm diameter sanitary sewer for the PSPC lands are proposed to connect into the existing 300mm diameter public sanitary sewer on Carling Avenue, between Sherwood Drive and Loretta Avenue, that ultimately discharges into the public Mooney's Bay Collector at the intersection of Carling Avenue and Champagne Avenue. The proposed service connections have an estimated combined peak wet weather flow of (**19.98 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

The 150mm diameter sanitary service connection for the future Carling Village Tower #3 is proposed to connect into the existing 300mm diameter public combined sewer on Carling Avenue, between Champagne Avenue and the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor, that ultimately discharges into the public Mooney's Bay Collector at the intersection of Carling Avenue and Champagne Avenue. The proposed service connection has an estimated peak wet weather flow of (**4.06 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

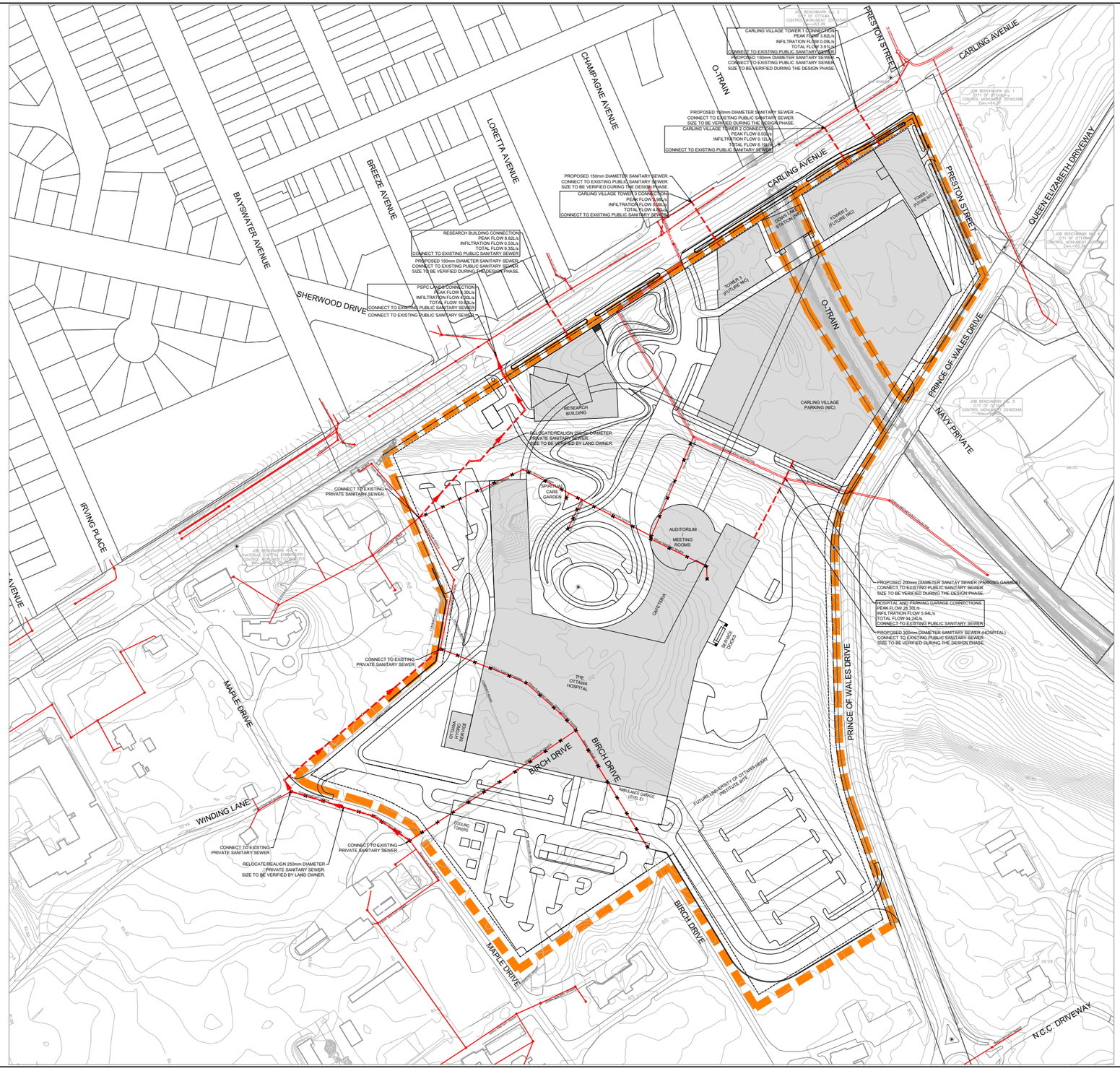
The 300mm diameter sanitary service connection for the hospital is proposed to connect into the existing public Mooney's Bay Collector between Prince of Wales Drive and Carling Avenue. The proposed service connection has an estimated peak wet weather flow of (**34.24 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

The 150mm diameter sanitary service connections for the future Carling Village Tower #1 and Carling Village Tower #2 are proposed to connect into the existing 300mm diameter public sanitary sewer Carling Avenue, between the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor and Preston Street, that ultimately discharges into the public Preston Trunk at the intersection of Carling Avenue and Preston Street. The proposed service connections have an estimated combined peak wet weather flow of (**10.05 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

The total estimated peak wet weather flow to the public Mooney's Bay Collector is (**70.81 L/s**), (**10.63 L/s**) from the existing PSPC lands and (**47.66 L/s**) from the NCD (Hospital, Research Building, Carling Village Tower #3). It is assumed that the public Mooney's Bay Collector has sufficient capacity to accommodate this flow since the existing PSPC buildings discharge to the Mooney's Bay Collector and the New Civic Development will replace the existing Civic Campus (located at the intersection of Carling Avenue and Parkdale Avenue). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

The total estimated peak wet weather flow to the Preston Trunk is (**10.05 L/s**) from the NCD (Carling Village #1 and Carling Village #2). The existing Civic Campus does not outlet to this sewer. The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

The sanitary sewers will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines*.




NOTES:

1. ESTIMATED DEMANDS AND PIPE SIZE TO BE VERIFIED DURING THE DESIGN PHASE AND ADJUSTED AS REQUIRED.
2. LOCATION AND NUMBER OF BUILDING CONNECTIONS TO BE FINALIZED DURING THE DESIGN PHASE.

LEGEND

- STUDY SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Sanitary Servicing

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 7-8

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# 8.0 STORMWATER MANAGEMENT

When reviewing the stormwater infrastructure servicing for the site, there are two (2) main factors that need to be considered: (1) The existing property was previously owned and operated by Agriculture and Agri-Food Canada (AAFC) and Natural Resources Canada (NRCan), and PSPC has existing privately owned stormwater infrastructure throughout the site that are still in operation and require relocation for continued service; and (2) The proposed stormwater servicing for the site.

## 8.1 Existing Stormwater Infrastructure

The western parcel of the NCD is located within the most upstream point of the major tributary drainage area for the Nepean Bay Trunk within the City of Ottawa. The stormwater sewers convey site runoff to the Carling Avenue stormwater sewers which discharge into the public Champagne Avenue stormwater sewer. The Champagne stormwater sewer continues along Loretta Avenue, north of Gladstone Avenue. This stormwater sewer discharges into the Nepean Bay Trunk sewer before ultimately discharging to the Ottawa River.

The existing PSPC private underground stormwater sewer system conveys flows from the federal lands (Experimental Farm), located to the west and south of the NCD, through the NCD towards Prince of Wales Drive and eventually to Dow's Lake. The overland flow from these areas is divided between Dows Lake and the major tributary drainage area for the Nepean Bay Trunk.

The drainage area for the Nepean Bay Trunk is included in **Appendix H.**

The existing stormwater infrastructure within the vicinity of the proposed Ottawa Hospital Campus site is illustrated in **Figure 8-1**.

### 8.1.1 Public Stormwater Sewers

- Carling Avenue → 300mm/375mm/450mm/525mm diameter public stormwater sewers;
- Nepean Bay Trunk → 1800mm diameter public sewers

#### 8.1.1.1 Carling Avenue Stormwater Sewer

A 450mm diameter public stormwater sewer is located within the eastbound lanes of Carling Avenue and extends from just east of the O-Train corridor to Preston Street. At Preston Street, it connects into the public Preston Trunk Sewer. The existing parking lot located within the easterly parcel has a stormwater sewer network that connects into the 450mm diameter public stormwater sewer on Carling Avenue.

A 300mm/375mm diameter public stormwater sewer is located with the eastbound lanes of Carling Avenue and extends from Maple Drive to Champagne Avenue. At Sherwood Drive, the sewer changes in size from 300mm in diameter to 375mm diameter. It connects into the 900mm diameter public stormwater sewer on Champagne Avenue which ultimately outlets to the public Nepean Bay Trunk.

A 300mm diameter public stormwater sewer is located within the eastbound lanes of Carling Avenue and extends from just west of the O-Train corridor to Champagne Avenue. It connects into the 900mm diameter public stormwater sewer on Champagne Avenue which ultimately outlets to the public Nepean Bay Trunk.

A 525mm diameter public stormwater sewer is located within the westbound lanes of Carling Avenue and extends from Sherwood Drive to Champagne Avenue. It connects into the 900mm diameter public stormwater sewer on Champagne Avenue which ultimately outlets to the public Nepean Bay Trunk.


NOTES:

1. 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 THE UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.

LEGEND

STUDY SITE BOUNDARY

STORM SEWER

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

Existing StDrm ater Infrastructure

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 8-1

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#### 8.1.1.2 Nepean Bay Trunk Sewer

The Nepean Bay Trunk outlet to the Ottawa River is partially submerged during normal river flows. According to City of Ottawa staff, in 2007, the Nepean Bay Trunk was one half to two-thirds full of sediment, reducing its hydraulic capacity significantly. The backwater effects of the Ottawa River also affect the hydraulic capacity as well as creating a challenge for removing the existing sediment.

The downstream Nepean Bay Trunk is reported to be operating under extreme surcharge during large rainfall events even if all debris and sediment is removed from the Nepean Bay Trunk. This is due to a large contributing drainage area that is not sufficiently controlled. This poor performance is exacerbated by the deep accumulation of sediment in the submerged part of the Nepean Bay Trunk north of Wellington Street. Not only is there no available capacity, but the hydraulic operation of this sewer poses a significant flooding risk in the vicinity of the sewer during surcharge conditions.

### 8.1.2 Private Stormwater Sewers

- Maple Drive → 300mm/525mm/600mm diameter private stormwater sewer
- Birch Drive → 900mm diameter private stormwater sewer
- Federal Land → 300mm/450mm/600mm diameter private stormwater sewer

#### 8.1.2.1 Maple Drive Stormwater Sewer

A 525mm/600mm diameter private stormwater sewer is located within Maple Drive and extends from just north of Winding Lane to Birch Drive. It connects into the 900mm diameter private stormwater sewer on Birch Drive.

A 300mm/525mm/600mm diameter private stormwater sewer is located within Maple Drive and extends just north of National Capital Commission Scenic Driveway to Birch Drive. It connects into the 900mm private diameter stormwater sewer on Birch Drive which ultimately outlets to Dow's Lake.

These private stormwater sewers service the Central Experimental Farm Site and are not owned, operated and/or maintained by the City of Ottawa. These stormwater sewers are owned, operated and maintained by PSPC.

#### 8.1.2.2 Birch Drive Stormwater Sewer

A 900mm diameter private stormwater sewer is located within the portion of Birch Drive that runs east/west and extends from Maple Drive to Birch Drive. The 900mm diameter private stormwater sewer continues within the portion of Birch Drive that runs north/south. It extends approximately 105m south before crossing the westerly parcel in the east direction and connecting into the 1200mm diameter private stormwater sewer that crosses Prince of Wales Drive and ultimately outlets to the Dow's Lake.

A 450mm diameter private stormwater sewer is located within the portion of Birch Drive that runs north/south and extends from approximately 145m north of National Capital Commission Scenic Driveway to National Capital Commission Scenic Driveway. It connects into the 450mm diameter private stormwater sewer on National Capital Commission Scenic Driveway.

These private stormwater sewers service the Central Experimental Farm Site and are not owned, operated and/or maintained by the City of Ottawa. These stormwater sewers are owned, operated and maintained by PSPC and outlet to Dow's Lake.

#### 8.1.2.3 Federal Land Stormwater Sewer

A 300mm/450mm/600mm diameter private stormwater sewer is located on federal land that services existing infrastructure. The stormwater sewer starts southeast of the Carling Avenue and Maple Drive intersection and continues east and connected into the 1200mm diameter private stormwater sewer that crosses Prince of Wales Drive and ultimately outlets to the Dow's Lake. This stormwater sewer crosses the westerly parcel. This is a private stormwater sewer that services the Central Experimental Farm Site and is not owned, operated and/or

maintained by the City of Ottawa. This stormwater sewer is owned, operated and maintained by PSPC and outlet to Dow's Lake.

## 8.2 Stormwater Constraints

The following existing conditions factors will influence the servicing design for the NCD:

- The existing 300mm/375mm diameter public stormwater sewer on Carling Avenue (west of the O-Train) is located within the City Core subwatershed (Rideau Valley Conservation) and the major tributary drainage area for the Nepean Bay Trunk;
- The existing 1200mm diameter private stormwater sewer that outlets to the Dow's Lake is owned, operated and maintained by Public Service and Procurement Canada (PSPC);
- The existing private stormwater sewers that service PSCP lands will need to be relocated and reconnected to the existing 1200mm diameter private stormwater sewer on the north side of Prince of Wales Drive;
- The pre-development stormwater flow must be maintained to post development and on-site storage must be provided to contain and control the 1:100-year storm event on the westerly parcel; and
- The existing 450mm diameter public stormwater sewer on Carling Avenue (east of the O-Train) is located within the City Core East and Rideau Canal subwatershed (Rideau Valley Conservation) and the major tributary drainage area for the Preston-Booth Trunk. The City of Ottawa has significant concerns related to basement flooding and combined sewer overflow; therefore, there shall be no increase in flow to the Preston Trunk combined sewer;
- The discharge criteria for the existing 1200mm diameter private stormwater sewer that outlets to Dow's Lake will need to be determined by PSPC.

The site elevation received from the City of Ottawa is included in **Appendix B.**

## 8.3 Stormwater Relocations/Realignments

The following stormwater sewer relocations/realignments are required to accommodate the NCD.

### 8.3.1 Private Storm Sewers

#### 8.3.1.1 Birch Drive Stormwater Sewer

The 900mm diameter private Birch Drive stormwater sewer is located within the westerly parcel and will need to be relocated/realigned to accommodate the NCD. This stormwater sewer services the existing PSPC buildings and lands located to the west of the hospital site.

The stormwater sewer would extend around the south side of the proposed hospital and connected into the existing 1200mm diameter private stormwater sewer that crosses Prince of Wales Drive and ultimately outlets to the Dow's Lake. The relocation/realignment of this stormwater sewer is illustrated in **Figure 8-2**.

Coordination between the two (2) property owners (TOH and PSPC) will be required as the hospital building is proposed to outlet into this private stormwater sewer.

#### 8.3.1.2 Federal Land Stormwater Sewer

The 300mm/450mm/600mm diameter private federal land stormwater sewer is located within the westerly parcel and will need to be relocated/realigned to accommodate the proposed development. This stormwater sewer services the existing PSPC buildings and lands located to the west of the NCD.

The stormwater sewer would extend around the north side of the proposed hospital and connected into the existing 1200mm diameter private stormwater sewer that crosses Prince of Wales Drive and ultimately outlets to the Dow's Lake. The relocation/realignment of this stormwater sewer is illustrated in **Figure 8-3**.


LEGEND

- STUDY SITE BOUNDARY
- EXISTING STORM SEWER
- EXISTING STORM SEWER TO BE REMOVED
- PROPOSED STORM SEWER
- FUTURE STORM SEWER

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Pri ate StDrm ater RelDcatiDn/Realignment - Birc Dri e

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 8-2

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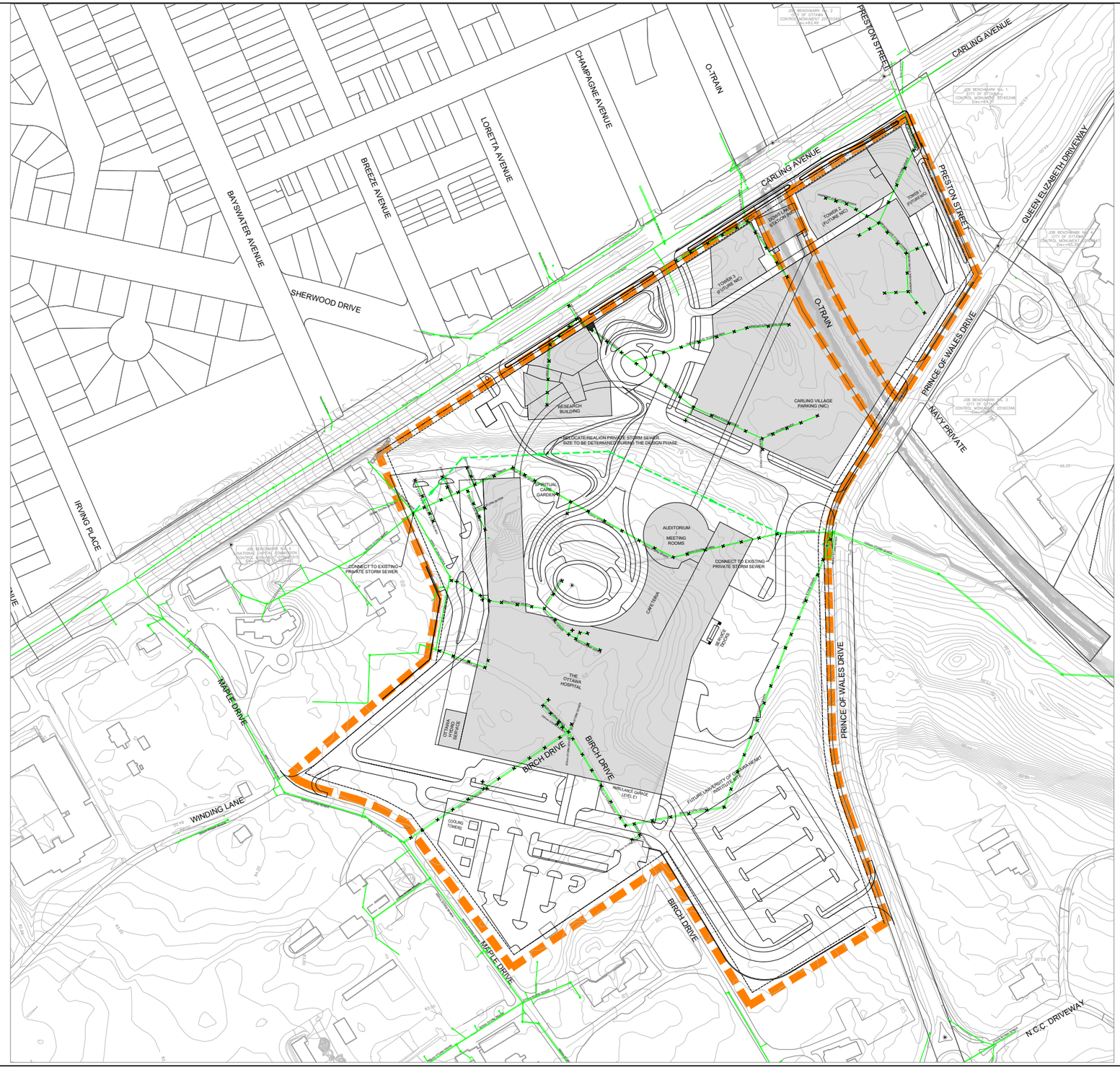


LEGEND

- STUDY SITE BOUNDARY
- EXISTING STORM SEWER
- EXISTING STORM SEWER TO BE REMOVED
- PROPOSED STORM SEWER
- FUTURE STORM SEWER

35m 0 70 140m

SCALE: 1:3500

# The New Civic Development

## Private Stormwater Relocation/Realignment - Federal Lands

Figure 8-3

PARSONS

The Ottawa Hospital | L'Hôpital d'Ottawa

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## 8.4 Stormwater Design Criteria

The following design criteria from the *City of Ottawa Sewer Design Guidelines (October 2012)*, *City of Ottawa Technical Bulletins ISTB-2012-6 (October 31, 2012),ISTB-2014-01 (February 5, 20114), PIEDTB-2016-01 (September 6, 2016),* and *ISTB-2018-01 (March 21, 2018)* will need to be applied in determining a stormwater management plan:

- The capacity of the downstream receiving system must be assessed and approved by the City of Ottawa;
- A detailed major system analysis using dynamic models must be undertaken to assess the impact of additional flow on the major system if inlet control devices are implemented;
- Proposed developments draining to an existing system that does not have stormwater treatment is subject to on-site treatment (i.e., best management practice, oil grit separators, etc.);
- Stormwater management for the portion of the site that outlets to the Nepean Bay Trunk and the Preston Trunk combined sewer shall be based on the 2-year storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997;
- Stormwater management for the portion of the site that outlets to Dow's Lake shall be based on the 5-year storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997;
- Pre-development runoff coefficient to be determined as per existing conditions but shall not exceed 0.4 when discharging to a combined City system;
- Pre-development runoff coefficient to be determined as per existing conditions but shall not exceed 0.5 when discharging to a storm City system;
- A calculated time of concentration cannot be less than 10 minutes;
- Storm flows to the Preston combined Trunk in excess of the 2-year storm release rate, up to and including the 100-year storm event, must be detained on site;
- Flows to Dow's Lake in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site;
- IDF curve equations used with the Rational formula:
  - 2-year $=732.951/(Tc+6.199)^{0.810}$
  - 5-year $=998.071/(Tc+6.053)^{0.814}$
  - 100-year $= 1735.688/(Tc+6.014)^{0.820}$
- The rational method uses runoff coefficients (C) for various surfaces. The runoff coefficient for a 100-year storm event is increased by 25% in accordance with the *City of Ottawa Sewer Design Guidelines* to a maximum of 1.0. The following C values were used in within this study:
  - 5-year runoff coefficient asphalt/concrete/buildings = 0.90
  - 100-year runoff coefficient asphalt/concrete/buildings = 1.00
  - 5-year runoff coefficient grass = 0.20
  - 100-year runoff coefficient grass = 0.25
  - 5-year runoff coefficient forest = 0.40
  - 100-year runoff coefficient forest = 0.50
  - 5-year runoff coefficient green roof = 0.30
  - 100-year runoff coefficient green roof = 0.38

The following design criteria from the National Capital Commission FLUDTA File (CP2299-18853) will need to be applied in determining a stormwater management plan:

- Integrated best management practices for a sustainable stormwater management on site;
- Achieve improved water quality by controlling rainwater at its point of impact, managing infiltration and conveying any excess off-site by systems (such as swales, ditches and stormwater sewers;
- Respect the hydraulic capacity and erosion thresholds of receiving watercourses with an appropriate water quantity peak flow discharge rate;

- Seek to adhere to the following design strategies when possible:
  - Infiltration;
  - Bio-Retention/Bio-Filtration: Rainwater Harvesting (cisterns and rain barrels);
  - Water quality enhancement: oil and grit separators;
  - Detention ponds and permanent check dams in swales; and
  - Green roofs, rooftop gardens, and green walls.

## 8.5 Stormwater Management

### 8.5.1 Allowable Release Rate

The allowable release rate for the 32ha area (approximately 20ha from the NCD and 12ha from PSPC lands) was calculated using the rational method formula based on the 2-year and 5-year flow (dependent on the outlet) and the existing average runoff coefficient.

$$Q = 2.78\ CiA$$

where

Q = Flow Rate (L/s)
C = Runoff Coefficient
i = Rainfall Intensity (mm/hr)
A = Area (ha)

The resultant allowable release rates are as follows:

- Dow's Lake Outlet = **2390.10L/s**
- Preston Trunk Outlet = **155.61L/s**
- Nepean Bay Trunk Outlet = **466.45L/s**

The allowable release rate for the Preston Trunk is a combination of the sanitary and storm flows as the flows as the Preston Trunk is a combined sewer. As a result, the allowable release rate for the storm flows is decreased by the equivalent amount of sanitary flows that are additional compared to the flows associated with the existing usage. The proposed building usage for Carling Village Tower #1 and Carling Village Tower #2 results in a total estimated flow of 10.05L/s. Therefore, the allowable storm release rate for the Preston Trunk is reduced to the following:

- Preston Trunk Outlet = **145.56L/s**

The pre-development stormwater drainage areas are illustrated in **Figure 8-4** and design calculations are included in **Appendix I**.

### 8.5.2 On Site Storage

The on-site stormwater management must be designed at attenuate the 2-year (Preston Trunk Outlet and Nepean Bay Trunk Outlet), 5-year (Dow's Law Outlet) and 100-year post development flows to the pre-development flow rates.

A high-level analysis was completed using the Rational Method to estimate volume of runoff generated during post-development conditions.

The pre-development release for the Dow's Lake Outlet (STM01, STM02, STM03, STM04, STM11, STM12) was estimated to be **2390.10L/s**. The storage volume required for the 100-year event based on the estimated release rate of 2390.10L/s was estimated to be **5400m³**. The estimated storage volume includes a portion of the federal lands to the west (approximately 12ha). A green roof is proposed on a portion of the proposed hospital building.

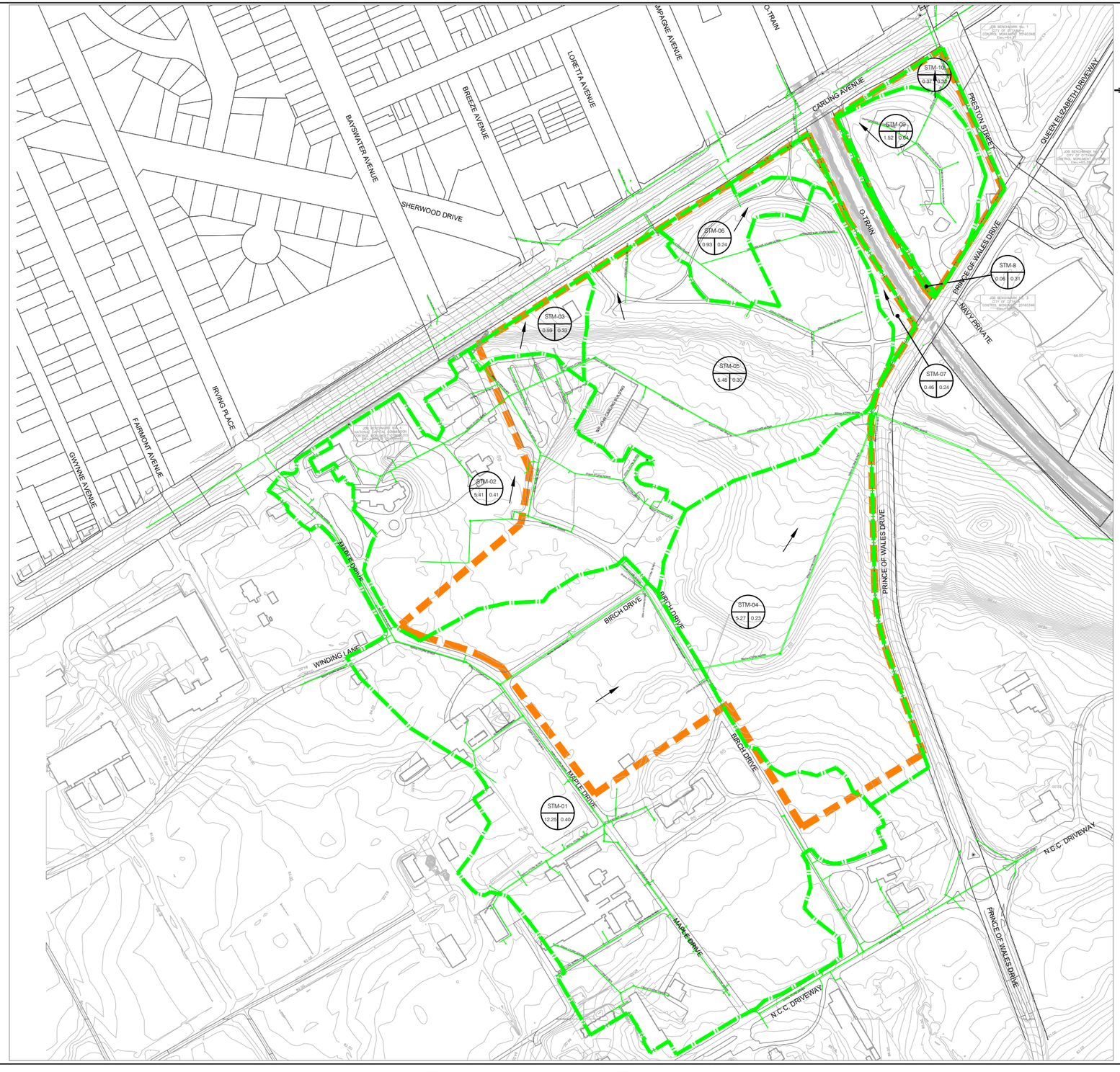
The pre-development release for the Preston Trunk Outlet (STM09, STM10) was estimated to be **145.56L/s**. The storage volume required for the 100-year event based on the estimated release rate of 145.56L/s was estimated to be **135m³**.

The pre-development release for the Nepean Bay Trunk Outlet (STM05, STM06, STM07, STM08) was estimated to be **466.45L/s**. The storage volume required for the 100-year event based on the estimated release rate of 466.45L/s was estimated to be **2555m³**. A green roof is proposed on the parking structure, a portion of the Research Building, and a portion of Carling Village Tower #3.

Underground storage will be required to control the development to the pre-development flow rates. An underground storage tank could be located on the south side of the hospital by the loading zone.

The post development stormwater drainage areas are illustrated in **Figure 8-5** and design calculations are included in **Appendix I.** The location of the proposed green roofs is illustrated in **Figure 8-6**.

A detailed stormwater management study will be required during the design phase once the development plan is finalized, and a detailed grading plan has been completed.




LEGEND

- STUDY SITE BOUNDARY
- EXISTING STORM SEWERSHED BOUNDRY
- MAJOR OVERLAND FLOW
- AREA ID (XXX-XX)
- 5 YEAR RUNOFF COEFFICIENT (XX.XX)
- AREA IN HECTARES (X.XX)

80m 40 20 0 40 80 160m

SCALE: 1:4000

PARSONS

# The New Civic Development

## Pre De elD ment StDrm ater Drainage Areas

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 8-4

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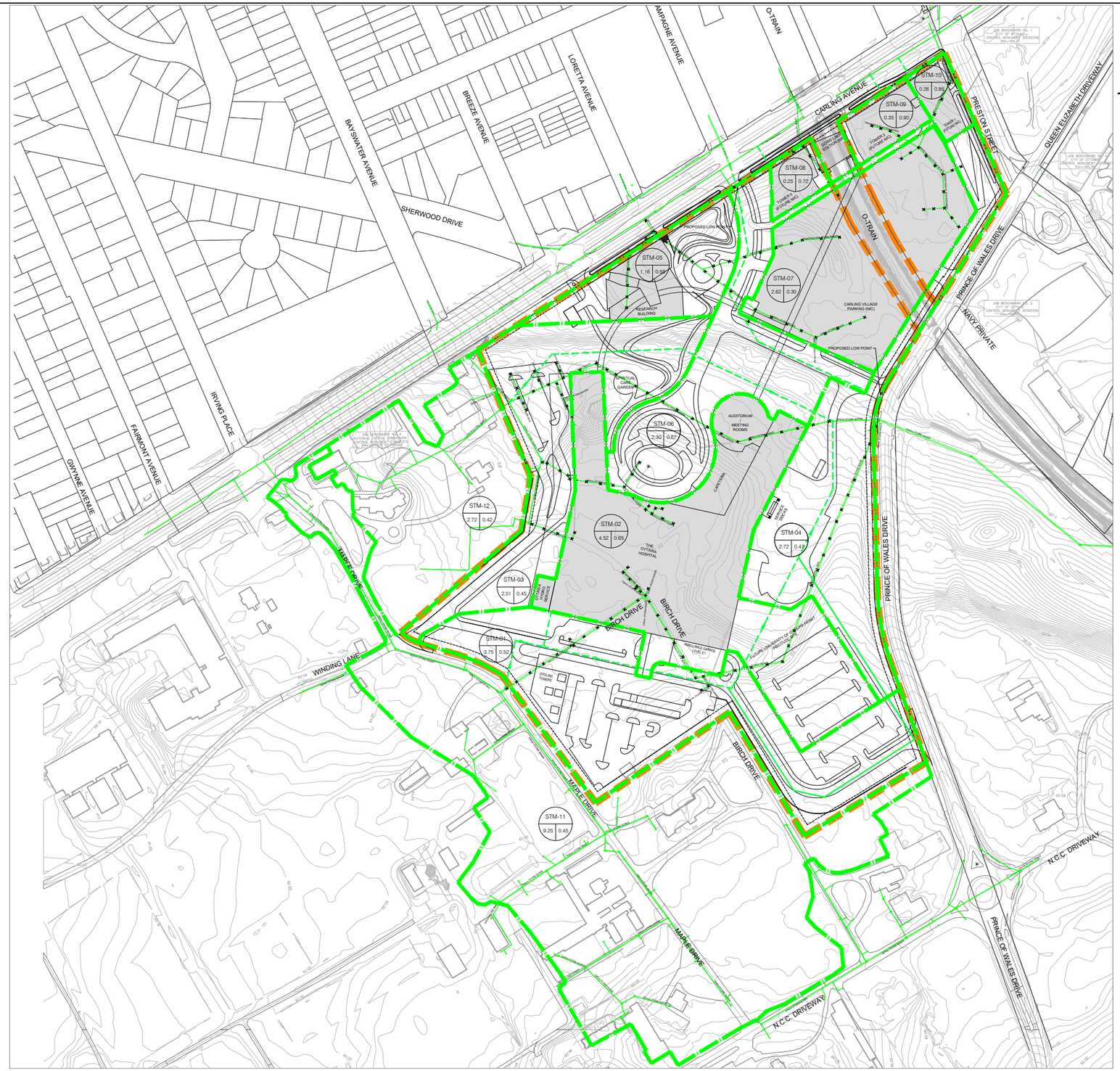


NOTES:

1. THE PROPOSED OVERLAND FLOW ROUTE WILL NEED TO BE FINALIZED DURING THE DESIGN PHASE. THE SITE WILL NEED TO BE GRADED TOWARDS THE TWO LOW POINTS.

LEGEND

- STUDY SITE BOUNDARY
- PROPOSED STORM SEWERSHED BOUNDRY
- EXISTING STORM SEWER TO BE REMOVED
- PROPOSED STORM SEWER
- FUTURE STORM SEWER
- MAJOR OVERLAND FLOW
- XXX-XX STORM SEWERSHED NAME
- XX.XX X.XX RUNOFF COEFFICIENT / AREA IN HECTARES

80m 40 20 0 40 80 160m

SCALE: 1:4000

PARSONS

# The New Civic Development

## Post Development Stormwater Drainage Areas

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 8-5


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PARSONS

**The New Civic Development**

PrD Dsed Green RDDf LDcatiDns

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 8-6

### 8.5.3 Quality Control

A quality control design will need to be completed during the design phase to ensure that 80% total suspended solid (TSS) removal. The design should adhere to the new Canadian ETV testing protocol land ETV verification protocol for oil and grit separators. Recent data demonstrates that oil and grit separator devices are not capable of providing 80% total suspended solid removal when targeting the ETV particle size distribution. A combination of oil and grit separators and low impact development measures will be required to achieve 80% total suspended solids removal.

### 8.5.4 Emergency Overland Flow Route

In existing conditions, the emergency overland flow route from the proposed site is north towards the Plouffe Park (easterly parcel) and the LRT Corridor (westerly parcel). The major system drainage areas within the vicinity of the development site are included in **Appendix H**.

## 8.6 Best Management Practices

Best management practices will be incorporated into the design to provide enhanced (80%) levels of quality treatment. During the preliminary and detailed design phase of the project the various treatment systems, including low impact developments, will be evaluated and the practices best suited for the site will be implemented. Below is a list and description of the various stormwater management quality treatment features that could be implemented at the site:

- Green Roofs;
- Rooftop Storage;
- Curbside Detention (i.e., Silva Cells);
- Curbside Infiltration Beds;
- Rain Gardens;
- Bio Infiltration Swales;
- Subsurface Storage & Cisterns;
- Permeable Pavement; and
- Storm Sewer System.

### 8.6.1 Green Roofs and Rooftop Storage

Green roofs and rooftop storage units (blue roofs) restrict and detain the precipitation that falls within the building footprints proving quality and quantity stormwater management treatment of the rainfall runoff.

### 8.6.2 Curbside Detention (Silva Cells)

When the rainwater hits the road rights-of-way it is collected in curbside underground “green” detention areas (i.e. green subsurface storage areas and Deep Root Silva Cells) rather than the typical underground catchbasins storm sewer system. These detention units serve to encourage infiltration while providing a water source for trees and plantings adjacent to the units and within the rights-of-way.

### 8.6.3 Curbside Infiltration Beds

Curbside infiltration beds can be utilized to capture runoff allowing for plant watering, storm water detention, and filtration purposes. These landscaped areas are slightly depressed from the curb height to permit infiltration and temporary storage of stormwater runoff beneath the proposed subsurface. Flows that exceed the bed’s capacity for infiltration overflow into the storm sewer via a raised landscaping catchbasin inlet within the infiltration bed.

### 8.6.4 Rain Gardens and Bio Infiltration Swales

Soft surface permeable areas can be utilized to capture runoff from the surrounding impervious areas, providing an area that is designed to withstand high moisture and high concentration of nutrients, such a Nitrogen and Phosphorus. Rain gardens and depressed landscaped areas and linear infiltration/bio swales are utilized to capture, treat, and infiltrate rainfall runoff.

### 8.6.5 Surface Storage & Cisterns

Subsurface storage and cisterns could be used to provide quantity treatment of the stormwater runoff. Runoff entering the storage system will most likely be filtered through the quality treatment train prior to entering the system. This will prevent clogging of the system. In addition, the subsurface storage and cisterns systems would be used to reduce the peak discharge of the runoff.

### 8.6.6 Permeable Pavement

Permeable pavements aid in runoff volume and a control of runoff rate in addition to pollution reduction. Permeable pavements allow the percolation and infiltration of stormwater runoff through the surface to natural layers of soil below. This infiltration allows for the rainwater to be naturally filtered by the soils and provide pollutant removal. This system allows the area to maintain its natural hydrology and biology of the watershed as well as improving the quality of the runoff as it passes through.

## 8.7 Stormwater Servicing

The minor system for the existing federal lands (STM11 and STM12) and a portion of the NCD (STM01, STM02, STM03, STM04) will outlet (by gravity) to the existing 1200mm diameter private stormwater sewer at Prince of Wales Drive that ultimately outlets to Dow's Lake.

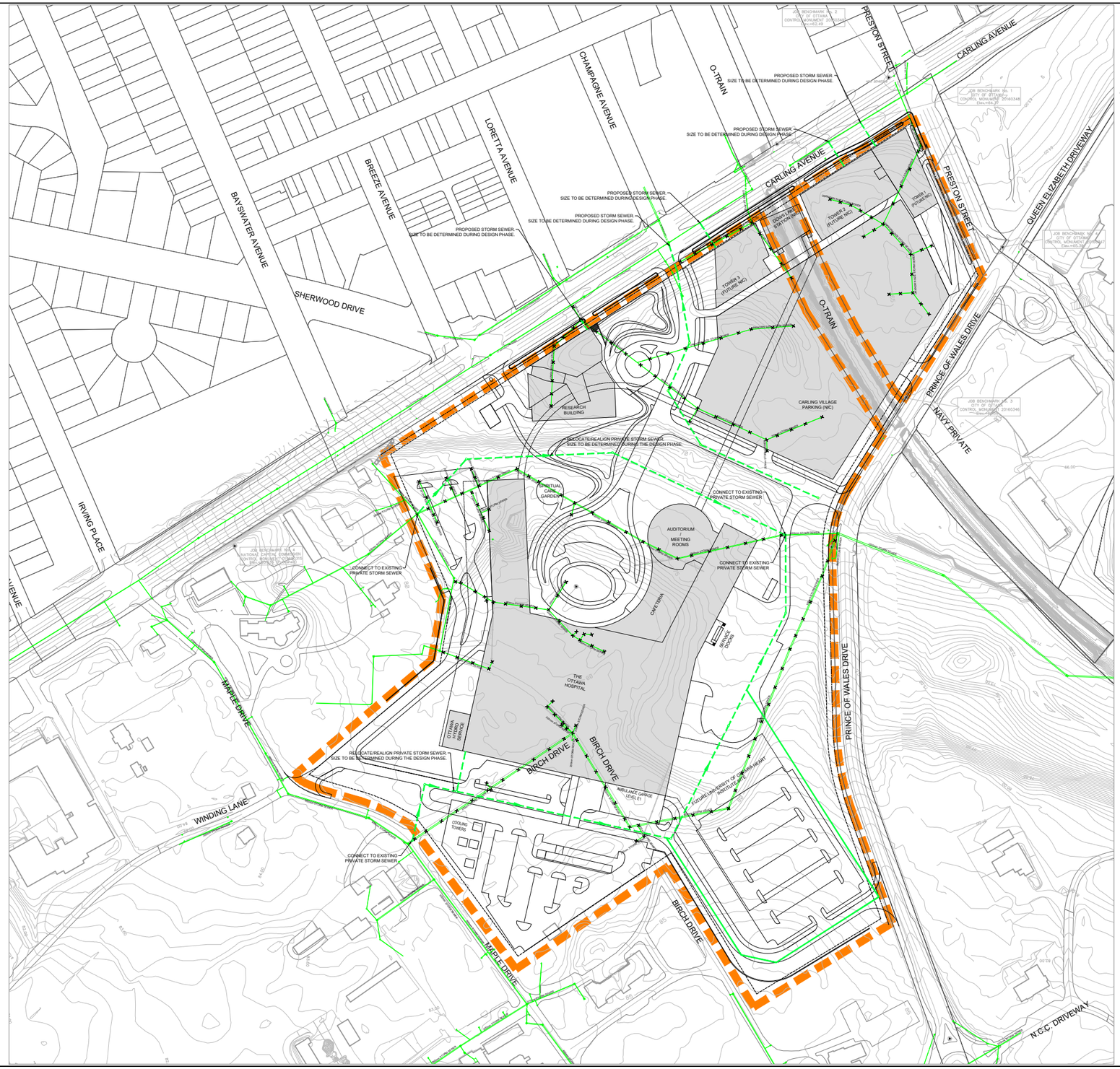
The minor system for a portion of the NCD (STM09 and STM10) is proposed to outlet (by gravity) to the existing 450mm diameter public stormwater sewer on Carling Avenue.

The minor system for a portion of the NCD (STM05, STM06, and STM07) is proposed to outlet (by gravity) to the existing 375mm diameter public stormwater sewer on Carling Avenue.

The minor system for a portion of the NCD (STM08) is proposed to outlet (by gravity) to the existing 300mm diameter public stormwater sewer on Carling Avenue.

The proposed minor system will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines* and in conjunction with the detailed stormwater management design and site grading. The pre-development drainage areas and outlets will need to be verified and refined during the design phase to align with the detailed site grading. The proposed stormwater flows into the existing infrastructure on Carling Avenue will need to be reviewed by the City of Ottawa to ensure that the existing system can accommodate the additional flows.

The proposed stormwater servicing approach for the NCD is illustrated in **Figure 8-7.** The stormwater sewers will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines*.




NOTES:

1. A POTENTIAL LOCATION FOR AN UNDERGROUND STORAGE TANK(S) IS ON THE SOUTH SIDE OF THE HOSPITAL BY THE LOADING ZONE.

LEGEND

- STUDY SITE BOUNDARY
- EXISTING STORM SEWER
- EXISTING STORM SEWER TO BE REMOVED
- PROPOSED STORM SEWER
- FUTURE STORM SEWER

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Stormwater Servicing

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 8-7

H:\SO\477458\1000\DWGS\01--Servicing\04--FIGURES.dwg Jul 27, 2021 - 11:51am

## 8.8 Stormwater Conclusion

The on-site stormwater management must be designed at attenuate the 2-year (Preston Trunk Outlet and Nepean Bay Trunk Outlet), 5-year (Dow's Law Outlet) and 100-year post development flows to the pre-development flow rates.

A high-level analysis was completed using the Rational Method to estimate volume of runoff generated during post-development conditions.

The pre-development release for the Dow's Lake Outlet (STM01, STM02, STM03, STM04, STM11, STM12) was estimated to be **2390.10L/s**. The storage volume required for the 100-year event based on the estimated release rate of 2390.10L/s was estimated to be **5400m³**. The estimated storage volume includes a portion of the federal lands to the west (approximately 12ha). A green roof is proposed on a portion of the proposed hospital building.

The pre-development release for the Preston Trunk Outlet (STM09, STM10) was estimated to be **145.56L/s**. The storage volume required for the 100-year event based on the estimated release rate of 145.56L/s was estimated to be **135m³**.

The pre-development release for the Nepean Bay Trunk Outlet (STM05, STM06, STM07, STM08) was estimated to be **466.45L/s**. The storage volume required for the 100-year event based on the estimated release rate of 466.45L/s was estimated to be **2555m³**. A green roof is proposed on the parking structure, a portion of the Research Building, and a portion of Carling Village Tower #3.

Underground storage will be required to control the development to the pre-development flow rates. An underground storage tank could be located on the south side of the hospital by the loading zone.

A quality control design will need to be completed during the design phase to ensure that 80% total suspended solid (TSS) removal.

A detailed stormwater management study will be required during the design phase once the development plan is finalized.

The minor system for the existing federal lands (STM11 and STM12) and a portion of the NCD (STM01, STM02, STM03, STM04) will outlet (by gravity) to the existing 1200mm diameter private stormwater sewer at Prince of Wales Drive that ultimately outlets to Dow's Lake.

The minor system for a portion of the NCD (STM09 and STM10) is proposed to outlet (by gravity) to the existing 450mm diameter public stormwater sewer on Carling Avenue.

The minor system for a portion of the NCD (STM05, STM06, and STM07) is proposed to outlet (by gravity) to the existing 375mm diameter public stormwater sewer on Carling Avenue.

The minor system for a portion of the NCD (STM08) is proposed to outlet (by gravity) to the existing 300mm diameter public stormwater sewer on Carling Avenue.

The proposed minor system will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines* and in conjunction with the stormwater management design and detailed site grading. The pre-development drainage areas and outlets will need to be verified and refined during the design phase to align with the detailed site grading. The proposed stormwater flows into the existing infrastructure on Carling Avenue will need to be reviewed by the City of Ottawa to ensure that the existing system has sufficient capacity. The proposed stormwater flows into the existing private infrastructure will need to be reviewed by PSPC to ensure the existing system has sufficient capacity.

# 9.0 CONNECTIONS TO EXISTING INFRASTRUCTURE

The proposed connections to the existing public infrastructure on Carling Avenue are illustrated in **Appendix J.** The connections will have to be investigated further during the design phase once the site plan is finalized the proposed/existing infrastructure sizes are verified. All existing underground infrastructure in Carling Avenue must be field verified to confirm the exact location. These connections will need to be review and approved by the City of Ottawa.

# 10.0 UTILITIES

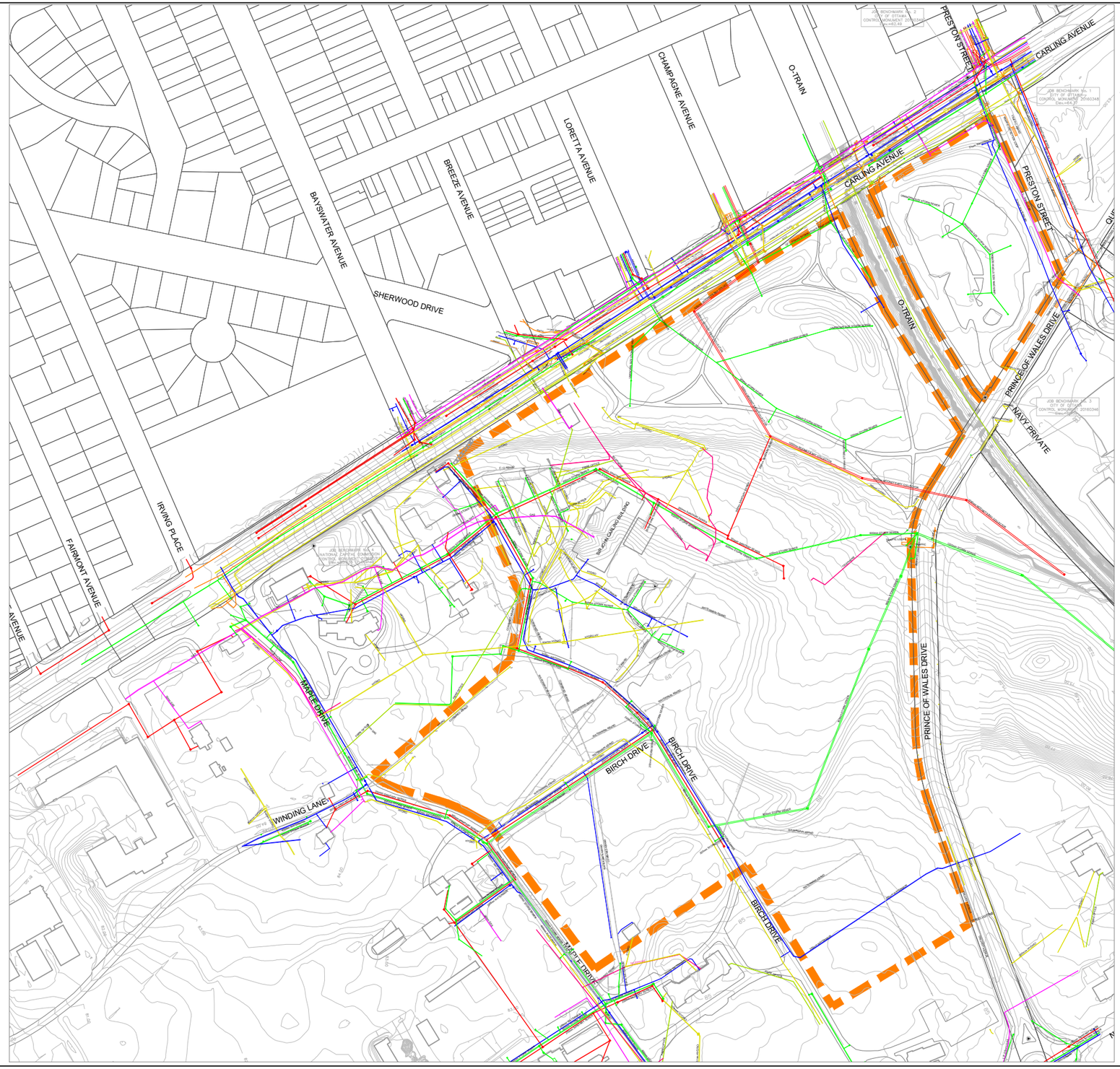
The existing underground infrastructure within the vicinity of the NCD is illustrated within **Figure 10-1**.. It should be noted that multiple sources of data, from the City of Ottawa and PSPC, were used in compiling the existing underground infrastructure figure.

Underground utility removals and relocations will be required to accommodate the NCD.

The location of the existing utilities is approximate only, the exact location will need to be determined by consulting the municipal authorities and utility companies concerned.

All municipal authorities and utility companies with underground infrastructure within the proposed Ottawa Hospital Site will need to review and approve all removals prior to commencement.

The Contractor shall prove the location of all underground utilities as well as approvals to remove underground utilities. The Contractor shall be responsible for adequate protection from damage to existing underground utilities that will remain in place.




NOTES:

1. 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 THE UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.

LEGEND

- STUDY SITE BOUNDARY
- BELL LINE
- GAS LINE
- HYDRO LINE
- ROGERS LINE
- SPRINT LINE
- STREET LIGHT DUCT
- TELUS LINE
- TRAFFIC DUCT
- STORM SEWER
- SANITARY SEWER
- WATERMAIN

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Existing Utility Infrastructure

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 10-1

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# 11.0 CONCLUSION

The proposed servicing (water, sanitary, and stormwater) for the NCD is illustrated in **Figure 11-1**.

## 11.1 Water

A preliminary water servicing analysis was previously completed based on the ultimate build out of the NCD. The previously estimated demands were provided to the City of Ottawa to develop boundary conditions at the two (2) connections points to the existing 406mm diameter public watermain on Carling Avenue. Revised boundary conditions will be provided by the City of Ottawa once further coordination with the design team and the City of Ottawa, and the completion of additional design analysis is completed to reduce the preliminary fire flow estimates.

The proposed distribution service is expected to loop around the NCD site with two (2) connection points to the existing 406mm diameter public watermain on Carling Avenue. The WaterCAD model will be revised once further coordination with the design team and the City of Ottawa and completion of additional design analysis is completed to reduce the preliminary fire flow estimates. Revised boundary conditions will be obtained from the City of Ottawa and a scenario will be completed for the ultimate build out of the NCD as well as the first phase of development which includes the parking garage building.

The high-level WaterCAD assessment will determine the watermain size required to service the land in accordance with the City of Ottawa's hydraulic objectives for minimum pressure (140Kpa or 20psi) under maximum day plus fire demand and minimum normal operating pressure (276Kpa or 40 psi) under peak hour demand. If the pressures are below the minimum requirements, a booster station would be required to ensure the minimum operating pressures can be achieved throughout the entire watermain loop.

Another water servicing option that could be considered and modelled, is if the two (2) proposed watermain connections to Carling Avenue for the hospital are located within the 2W pressure zone (west of Sherwood Drive) instead of the 1W pressure zone (east of Sherwood Drive).

Fire hydrants, serviced off the proposed watermain loop, will be required throughout the site. The location and spacing of the fire hydrant shall be in accordance with the *City of Ottawa Water Distribution Design Guidelines*.

In accordance with the *City of Ottawa Water Distribution Design Guidelines Technical Bulletin ISTB-2018-02*, the total maximum fire hydrant flow was estimated for the Research Building, Carling Village Tower #1, Carling Village Tower #2, and Carling Village Tower #3. A fire flow of 217L/s is available within the existing system for Carling Village Tower #1, Carling Village Tower #2, and Carling Village Tower #3. Additional fire protection measures will need to be implemented within the Research Building site to achieve a fire flow of 217L/s. Since these are City of Ottawa hydrants, a simulation was not completed to determine if these hydrants all remain above 20psi. A multiple flow hydrant analysis will be required to determine the maximum flow that can be drawn simultaneously from the existing City of Ottawa hydrants. A 150mm diameter watermain service, from the existing 400mm diameter public watermain on Carling Avenue, should be sufficient to service the four (4) buildings based on the estimated demands. The estimated building demands, fire flows, and service connection pipe sizes will need to be verified and finalized during preliminary design. Coordination with the City of Ottawa should be completed during preliminary design to obtain existing hydrant flow testing data.

Further analysis and detailed modeling will be required during preliminary design based on the final concept/land use plan for the NCD. Further analysis and detailed modeling will also be required for the relocation of PSPC water services.

The watermains will need to be designed in accordance with the *City of Ottawa Water Distribution Design Guidelines*.

## 11.2 Sanitary

The 150mm diameter sanitary service connection for the future Research Building and the 250mm diameter sanitary sewer for the PSPC lands are proposed to connect into the existing 300mm diameter public sanitary sewer on Carling Avenue, between Sherwood Drive and Loretta Avenue, that ultimately discharges into the public Mooney's Bay Collector at the intersection of Carling Avenue and Champagne Avenue. The proposed service connections have an estimated combined peak wet weather flow of (**19.98 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow, **Appendix G**.

The 150mm diameter sanitary service connection for the future Carling Village Tower #3 is proposed to connect into the existing 300mm diameter public combined sewer on Carling Avenue, between Champagne Avenue and the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor, that ultimately discharges into the public Mooney's Bay Collector at the intersection of Carling Avenue and Champagne Avenue. The proposed service connection has an estimated peak wet weather flow of (**4.06 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow.

The 300mm diameter sanitary service connection for the hospital is proposed to connect into the existing public Mooney's Bay Collector between Prince of Wales Drive and Carling Avenue. The proposed service connection has an estimated peak wet weather flow of (**34.24 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow.

The 150mm diameter sanitary service connections for the future Carling Village Tower #1 and Carling Village Tower #2 are proposed to connect into the existing 300mm diameter public sanitary sewer Carling Avenue, between the City of Ottawa's Light Rail Transit (LRT) Trillium Line Corridor and Preston Street, that ultimately discharges into the public Preston Trunk at the intersection of Carling Avenue and Preston Street. The proposed service connections have an estimated combined peak wet weather flow of (**10.05 L/s**). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow.

The total estimated peak wet weather flow to the public Mooney's Bay Collector is (**70.81 L/s**), (**10.63 L/s**) from the existing PSPC lands and (**47.66 L/s**) from the NCD (Hospital, Research Building, Carling Village Tower #3). It is assumed that the public Mooney's Bay Collector has sufficient capacity to accommodate this flow since the existing PSPC buildings discharge to the Mooney's Bay Collector and the New Civic Development will replace the existing Civic Campus (located at the intersection of Carling Avenue and Parkdale Avenue). The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow.

The total estimated peak wet weather flow to the Preston Trunk is (**10.05 L/s**) from the NCD (Carling Village #1 and Carling Village #2). The existing Civic Campus does not outlet to this sewer. The City of Ottawa confirmed that the existing system has sufficient capacity to accommodate the additional flow.

The sanitary sewers will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines*.

## 11.3 Stormwater

The on-site stormwater management must be designed at attenuate the 2-year (Preston Trunk Outlet and Nepean Bay Trunk Outlet), 5-year (Dow's Law Outlet) and 100-year post development flows to the pre-development flow rates.

A high-level analysis was completed using the Rational Method to estimate volume of runoff generated during post-development conditions.

The pre-development release for the Dow's Lake Outlet (STM01, STM02, STM03, STM04, STM11, STM12) was estimated to be **2390.10L/s**. The storage volume required for the 100-year event based on the estimated release rate of 2390.10L/s was estimated to be **5400m³**. The estimated storage volume includes a portion of the federal lands to the west (approximately 12ha). A green roof is proposed on a portion of the proposed hospital building.

The pre-development release for the Preston Trunk Outlet (STM09, STM10) was estimated to be **145.56L/s**. The storage volume required for the 100-year event based on the estimated release rate of 145.56L/s was estimated to be **135m³**.

The pre-development release for the Nepean Bay Trunk Outlet (STM05, STM06, STM07, STM08) was estimated to be **466.45L/s**. The storage volume required for the 100-year event based on the estimated release rate of 466.45L/s was estimated to be **2555m³**. A green roof is proposed on the parking structure, a portion of the Research Building, and a portion of Carling Village Tower #3.

Underground storage will be required to control the development to the pre-development flow rates. An underground storage tank could be located on the south side of the hospital by the loading zone.

A quality control design will need to be completed during the design phase to ensure that 80% total suspended solid (TSS) removal.

A detailed stormwater management study will be required during the design phase once the development plan is finalized.

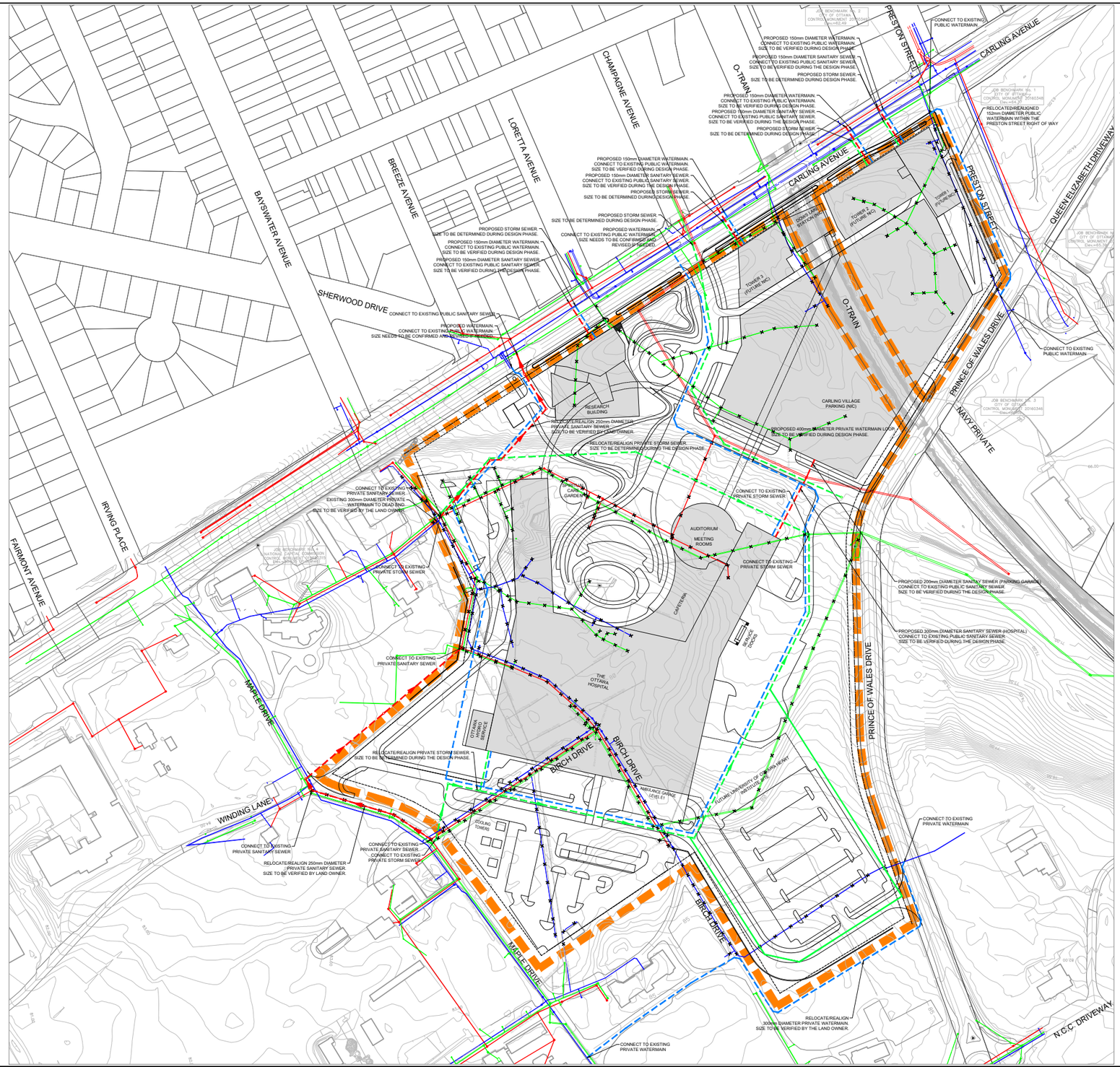
The minor system for the existing federal lands (STM11 and STM12) and a portion of the NCD (STM01, STM02, STM03, STM04) will outlet (by gravity) to the existing 1200mm diameter private stormwater sewer at Prince of Wales Drive that ultimately outlets to Dow's Lake.

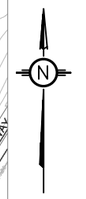
The minor system for a portion of the NCD (STM09 and STM10) is proposed to outlet (by gravity) to the existing 450mm diameter public stormwater sewer on Carling Avenue.

The minor system for a portion of the NCD (STM05, STM06, and STM07) is proposed to outlet (by gravity) to the existing 375mm diameter public stormwater sewer on Carling Avenue.

The minor system for a portion of the NCD (STM08) is proposed to outlet (by gravity) to the existing 300mm diameter public stormwater sewer on Carling Avenue.

The proposed minor system will need to be designed in accordance with the *City of Ottawa Sewer Design Guidelines* and in conjunction with the stormwater management design and detailed site grading. The pre-development drainage areas and outlets will need to be verified and refined during the design phase to align with the detailed site grading. The proposed stormwater flows into the existing infrastructure on Carling Avenue will need to be reviewed by the City of Ottawa to ensure that the existing system has sufficient capacity. The proposed stormwater flows into the existing private infrastructure will need to be reviewed by PSPC to ensure the existing system has sufficient capacity.




LEGEND

- STUDY SITE BOUNDARY
- EXISTING STORM SEWER
- EXISTING STORM SEWER TO BE REMOVED
- PROPOSED STORM SEWER
- FUTURE STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TO BE REMOVED
- PROPOSED SANITARY SEWER
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED/ABANDONED
- PROPOSED WATERMAIN

35m 0 70 140m

SCALE: 1:3500

PARSONS

# The New Civic Development

## Site Servicing

The Ottawa Hospital | L'Hôpital d'Ottawa

Figure 11-1

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# 12.0 CLOSURE

We trust that this report is sufficient for your requirements. Please contact the undersigned for any clarifications or additional information should the need arise.

Prepared by:

Sarah Mitchelson, P.Eng.

Reviewed by:

Kelly Paradis, P.Eng., PMP

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Appendix A:
List of Background Reports & Drawings

# Background Reports & Drawings

## City of Ottawa Information Request

An information request was sent to the City of Ottawa on February 6, 2020 and a response was received on March 4, 2020.

A list of the background drawings provided include the following:

- Carling Avenue Reconstruction & Widening from Bronson Avenue to Kirkwood Contract No. 56-28, 1956;
  - 1000p&p03.pdf
  - 1000p&p04.pdf
  - 1000p&p05.pdf
  - 1000p&p06.pdf
  - 1000p&p07.pdf
- Carling Avenue Storm and Sanitary Sewer and Convert Combined to Storm Sewer from Sherwood Drive to Champagne Street Contract No. 96C2929, 1996;
  - 2929p&p1.pdf
  - 2929p&p2.pdf
- Dow's Lake Visitor Parking Facility – Electrical, Light Standards & Irrigation Contract No. 6136, 1982;
  - 4434plan.pdf
- Mooney's Bay Sanitary Collector Sewer Phase 'A' Contract No. 65-180, 1965;
  - 6580p&p01.pdf
  - 6580p&p02.pdf
  - 6580p&p03.pdf
- Carling Avenue 42" Watermain from Loretta Avenue to East of Rochester Street Contract No. 6944, 1961;
  - 6944p&p1.pdf
- Preston Street Watermain from Carling Avenue to Dow's Lake Contract No. 3067, 1984;
  - 7232p&p.pdf
- Fire Sprinkler Systems for Buildings 76, 88, 91 & 91A Central Experimental Farm Ottawa New Water Service to Building #88 and Dry Pipe Sprinkler Connection to Building #91A Contract No. 653069, 1997;
  - 9086p&p01
- Dow's Lake Watermain Replacement Contract No. RD2800-64E, 2000;
  - 9580p&p01
- Carling Avenue Rehabilitation Watermain Irving Place/Maple Drive Contract No. ISB08-5037, 2008;
  - 14869p&p10.tif
- Central Experimental Farm Site Services Rehabilitation Phase 1A New Watermain and Storm Sewer Contract No. R.010222.002, 2008;
  - 15055p&p04.pdf
  - 15055p&p05.pdf
  - 15055p&p06.pdf
- Central Experimental Farm Site Services Rehabilitation Phase 1B Contract No. R.010223.002, 2009;
  - 15238p&p10.pdf
  - 15238plan01.pdf
  - 15238plan02.pdf
- Central Experimental Farm Site Service Reconstruction Phase 2 Contract No. R.010223.002, 2009;
  - 15395.tif
  - 15395p&p11.tif
  - 15395p&p12.tif
  - 15395p&p13.tif
  - 15395p&p14.tif

    - 15395p&p15.tif
    - 15395p&p16.tif
    - 15395p&p17.tif
    - 15395p&p20.tif
    - 15395p&p21.tif
    - 15395plan09.tif
    - 15395plan10.tif
- Loretta Avenue South Reconstruction Contract No. ISD16-5029, 2017;
    - 17416p&p20.pdf
- C.P.R Relocation Prescott Line Contract B2-Grade Separations and Approaches, 1964;
    - B12j-2.pdf
- Carling Avenue Reconstruction & Widening from Bronson Avenue to Kirkwood Avenue Contract No, 56-88, 1936;
    - B01931000-01.tif
    - B01931000-02.tif
    - B01931000-03.tif
    - B01931000-04.tif
    - B01931000-05.tif
- Proposed Conduit for Fire Cable Under CPR Tracks at Carling Avenue, 1957;
    - J-29-3.pdf
    - J-29-4.pdf
    - J-29-5.pdf
- Central Experimental Farm Site Service Reconstruction Phase 3, 2011;
    - key.pdf
    - p&pC-3.pdf
    - p&pC-4.pdf
    - p&pC-5.pdf
    - p&pC-6.pdf
    - p&pC-7.pdf
    - p&pC-8.pdf
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    - p&pC-14R.tif
    - p&pC-15R.tif
    - p&pC-16R.pdf
    - planC-2.pdf
    - planC-17R.pdf
    - planC-18R.pdf
    - planC-19R.pdf
    - planC-20R.pdf
    - planC-21R.pdf
    - planC-22R.pdf
- Water Distribution System Mapping 366-028, 2019; and
- Wastewater Collection System Mapping 366-028, 2019;

A list of the background reports provided include the following:

- City of Ottawa Report of Subsurface Investigation Carling Avenue from Sherwood Drive to Champagne Street Ottawa, Ontario prepared by John D. Patterson & Associates Limited Consulting Geotechnical & Environmental Engineers, December 15, 1995;
  - B-0298.pdf
- Transportation Department Test Laboratory Roan Plan and Borehole Log Carling Avenue from Bronson Avenue to Kirkwood Avenue, September 1992;
  - B-1772.pdf
- Geotechnical Investigation Carling Avenue Rehabilitation Kirkwood Avenue to Bronson Avenue Ottawa, Ontario prepared by Golder Associates Limited, March 17, 2007; and
  - B-2226.pdf
- Measurement of Sewage Flow from the Experimental Farm, February 1964.
  - R-0048.pdf

## Public Services and Procurement Canada (PSPC) Information Request

An information request was sent to Public Services and Procurement Canada (PSPC) and a response was received on May 20, 2020.

A list of the background drawings provided include the following:

- Sir John Carling Building – Annex Storm Sewer Relining Contract No. R.083619.002, 2017;
  - C-1-Plan-Relining.pdf
- Central Experimental Farm Site Services Reconstruction Phase 2 Contract No. R010223.002, 2009
  - CEF 2C – C9.pdf
  - CEF 2C – C12.pdf
  - CEF 2C – C13.pdf
  - CEF 2C – C14.pdf
  - CEF 2C – C15.pdf
  - CEF 2C – C16.pdf
  - CEF 2C – C17.pdf
- Central Experimental Farm Site Services Reconstruction Phase 3 Contract No. R010222.002, 2011
  - CEF_3-As Builts-C-14.pdf
  - CEF_3-As Builts-C-15.pdf

Appendix B:
City of Ottawa – Site Evalutation and Constraints

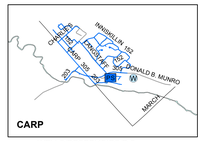
| | | Servicing Comments | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Option | Site | Street | Storm Mains | | | Sanitary Mains | | Water Mains | | | | | |
| | | | Sewer Size | Subwatershed | SWM Criteria | Sewer Size | Constraints | Pressure Zone | Size | Current Pressure (Psi) | Redundancy for Critical Customer (Requirement) | Redundant Feeds | Additional Comments |
| G | CEF - Carling East (AAFC) | Carling Ave. | 600mm-975mm | City Core [Rideau Valley Conservation] | 1. Maintain sewer capacity for new connections to Carling Ave<br>2. Onsite swm to contain 1:100 year onsite (major system control) | 225mm-600mm | 1. Partially separated.<br>2. MBC sewershed, basement flooding potential.<br>3. Maintain pre-development sanitary sewer flows for existing sewer connections or maintain sewer capacity new connections. Assess performance in wet weather.<br>4. Significant concerns related to basement flooding. | 2W | 406mm | 70-82 | No? | 406mm Carling Avenue, 200mm Gwynne Avenue | Depending on demand 200mm might not be sufficient to be a redundant feed |
| | | Prince of Wales Dr. | No Storm Main | | | No Sanitary Main | No existing SAN. | N/A | No Water Main | | | | |
| | | Proposed Site | Existing private sewers with outlet to Dow's Lake. | | 1. Depends on outlet. Need more information to comment.<br>1. Note: Dow's Lake connection in existing condition is via Private sewers. No comments provided on private sewers.<br>2. Maintain pre-development storm sewer flows for existing sewer connections<br>3. Onsite swm to contain 1:100 year onsite (major system control) | 1050mm Mooney's Bay Trunk Collector (North-Western corner of Site) | 1. Partially separated.<br>2. MBC sewershed, basement flooding potential.<br>3. Maintain pre-development sanitary sewer flows for existing sewer connections or maintain sewer capacity new connections. Assess performance in wet weather.<br>4. Significant concerns related to basement flooding. | | | | | | |
| I | Dow's Lake Parking (NCC) | Carling Ave. | 300mm | City Core East & Rideau Canal [Rideau Valley Conservation] | [Drains to Preston combined sewer, which goes to Booth Street sewer.]<br>1. Significant concerns due to connection to combined sewer, CSO risk, basement flooding risk<br>2. No increase in existing flows to combined sewer | 250mm | 1. Preston Street Trunk sewershed. CSO risk. Basement flooding risk.<br>2. Maintain pre-development sanitary sewer flows for existing sewer connections or maintain sewer capacity new connections. Assess performance in wet weather.<br>3. Significant concerns related to CSO and basement flooding risk. | 1W | 127mm | 62-78 | | 406mm Carling Avenue, Check Valve between ZW & SW, 406mm on Preston Street | |
| | | | | | | | | 1W | 406mm | | | | |
| | | Preston St. | No Storm Main | | Depends on outlet. More information required to comment. | 450mm | 1. This is a private sewer. No comments provided for private sewers.<br>2. Preston Street Trunk sewershed. CSO risk. Basement flooding risk.<br>3. Maintain pre-development sanitary sewer flows for existing sewer connections or maintain sewer capacity new connections. Assess performance in wet weather.<br>4. Significant concerns related to CSO and basement flooding risk. | 1W | 150mm | | | | |
| | | Prince of Wales Dr. | No Storm Main | | Depends on outlet. More information required to comment. | No Sanitary Main | Depends on outlet. Need more information to comment. | N/A | No Water Main | | | | |

**Notes:**

1. For Pinecrest Creek Criteria, please consult Planning and Growth Management Staff. Please see the "PINECREST CREEK/WESTBORO STORMWATER MANAGEMENT RETROFIT STUDY - FINAL REPORT" for more information
2. CCC refers to the Cave Creek Collector
3. MBC refers to the Mooney's Bay Collector
4. WNC refers to the West Nepean Collector
5. It is assumed that additional development criteria will apply including stormwater management criteria for most sites. The information above are preliminary comments on existing storm, sanitary, and water services only.
8. Additional comments will be required once additional details are available
9. Due to the critical nature of the proposed customer, no redundancy is a significant water servicing concern. [Column N]
11. Comments dated August 5, 2016 based on information provided (site locations and proposed connection points only)
12. Option A did not contain any information and a site location was not provided. No comment provided.
13. PSPC (PSPC) site not listed in table and proposed connections not provided. No comments provided.

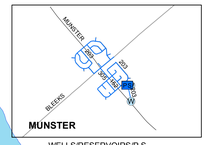
Appendix C:
Boundary Conditions & City of Ottawa Water Distribution System Facilities & Feedermains Map

# City of Ottawa - Water Distribution System
# Facilities & Feedermains

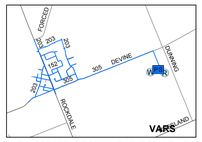



WELLS/RESERVOIRS/P.S


WELLS

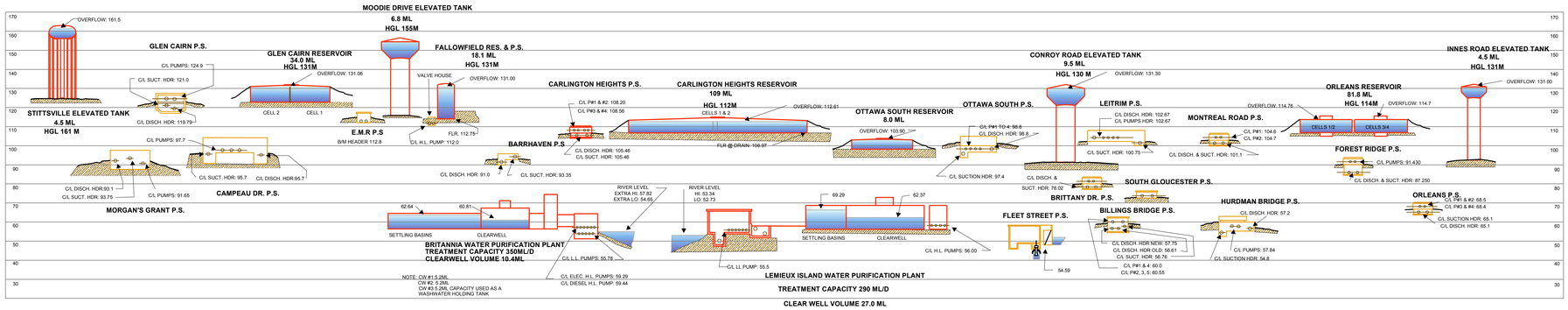



WELLS/RESERVOIRS/P.S




WELLS/RESERVOIRS/TREATMENT PLANT & P.S




## Legend

### Water System Structure

- Pump Station
- Backup Pump Station
- Water Treatment Plant
- Well
- Elevated Tank
- Reservoir

### WATERMAINS

**Priority, Internal Diameter**

- Backbone 1524mm - 1981mm
- Backbone 1067mm - 1372mm
- Backbone 610mm - 914mm
- Backbone 406mm - 508mm
- Backbone 152mm - 305mm
- Distribution 1676mm - 1981mm
- Distribution 1067mm - 1372mm
- Distribution 610mm - 914mm
- Distribution 406mm - 508mm
- Distribution 305mm - 381mm

### PRESSURE ZONES

- 1E
- 1W
- 2E
- 2W2C
- 3SW
- 3W
- EMR
- LEIT
- ME
- MG
- MONT
- SUC

N
W E
S

Ottawa

**Infrastructure Services & Community Sustainability**
**Infrastructure Services**

0 1,000 2,000 4,000 6,000

Meters

# FIGURE 1-1

DRAWN BY: D. HESS

DATE: 12 Sept 2016

Appendix D:
Water Calculations

# Table 1
# The New Civic Development for The Ottawa Hospital - Estimated Water Demands

| Area | Units | Population | Gross Floor Area (m2) | Site Area (ha) | Average Daily Demand (ADD) (L/s) | Maximum Daily Demand (MDD) (L/s) | Peak Hourly Demand (PHD) (L/s) | Fire Flow (FF) (L/s) | MDD + FF (L/s) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **Public Service & Procurement Canada Lands** | | | | | | | | | |
| Institutional | | | | 13.02 | 4.22 | 6.33 | 11.39 | 217 | 223.3 |
| **Hospital** | | | | | | | | | |
| Institutional | | | 441,289 | | 17.72 | 26.58 | 47.84 | 750 | 776.6 |
| Parking Garage | | | 25,682 | | 1.49 | 2.23 | 4.01 | 567 | 433.0 |
| **Research Building** | | | | | | | | | |
| Commercial | | | 63,000 | | 5.88 | 8.82 | 15.88 | 217 | 225.8 |
| **Carling Village Tower #3** | | | | | | | | | |
| Commercial | | | 28,424 | | 2.65 | 3.98 | 7.16 | 217 | 221.0 |
| **Carling Village Tower #2** | | | | | | | | | |
| Commercial | | | 43,118 | | 4.02 | 6.04 | 10.87 | 217 | 223.0 |
| **Carling Village Tower #1** | | | | | | | | | |
| Commercial | | | 27,275 | | 2.55 | 3.82 | 6.87 | 217 | 220.8 |

**Average Daily Demand**

Based on Ottawa Design Guidelines - Water Distribution, 2010 and MOE Design Guidelines for Drinking-Water Systems, 2008

| | | |
|---|---|---|
| Average Residential Daily Flow = | 350 | L/p/d |
| Institutional Flow = | 28,000 | L/gross ha/d |
| Commercial Flow = | 28,000 | L/gross ha/d |
| Light Industrial Flow = | 35,000 | L/gross ha/d |
| Heavy Industrial Flow = | 55,000 | L/gross ha/d |
| Hotel Daily Flow = | 225 | L/bed/d |
| Office/Warehouse Daily Flow = | 75 | L/person/d |
| Office/Warehouse Daily Flow = | 8.06 | L/m2/day |
| Restaurant (Ordinary not 24 Hours) = | 125 | L/seat/d |
| Restaurant (24 Hours) = | 200 | L/seat/d |
| Shopping Centres = | 2,500 | L/(1000$m^2$/d) |
| Amenity Area = | 5 | L/m2/d |

Medical Office Buildings, Dental Office and Medical Clinics

| | | |
|---|---|---|
| Doctors, Nurses & Medical Staff = | 275 | L/person/day |
| Office Staff = | 75 | L/person/day |
| Patients = | 25 | L/person/day |
| Hospitals - Including Laundry = | 1,400 | L/bed/day |
| Hospital - Average Water Use = | 2.2 | m3/m2/year |
| Nursing Homes & Rest Homes = | 450 | L/bed/day |

**Maximum Daily Demand**

| | |
|---|---|
| Residential = | 2.5 x Average Daily Demand |
| | 4.9 x Average Daily Demand ** |
| Industrial = | 1.5 x Average Daily Demand |
| Commercial = | 1.5 x Average Daily Demand |
| Institutional = | 1.5 x Average Daily Demand |

**Peak Hourly Demand**

| | |
|---|---|
| Residential = | 2.2 x Maximum Daily Demand |
| | 7.4 x Maximum Daily Demand ** |
| Industrial = | 1.8 x Maximum Daily Demand |
| Commercial = | 1.8 x Maximum Daily Demand |
| Institutional = | 1.8 x Maximum Daily Demand |

** Peaking factors as per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons

* (From *"The Ottawa Hospital - General Campus 5 Year Strategies Energy Management Plan 2014-2019"*)

# Table 2
# The New Civic Development for The Ottawa Hospital - Water Pressure

Hazen-Williams Head Loss Calculations: $hl = c*V^{1.85}L/(C^{1.85}D^{1.165})$

| Future Research Building Connection | Boundary Condition | Description | | | | | | | | Demand Results | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elevation at Boundary Condition (m) | Pipe Segment Length (m) | Diameter (mm) | Demand (L/s) | Hazen Williams Coefficient, C | Area ($m^2$) | Velocity (m/s) | Unit Conversion, K | Elevation at Building Connection (m) | Head loss (m) | Pressure (kPa) | Pressure (psi) |
| Peak Hour Demand | 107.1 | 31.0 | 150 | 15.88 | 150 | 0.0177 | 0.90 | 6.79 | 65.50 | 0.1469 | 406 | 59 |
| Average Daily Demand | 107.1 | 31.0 | 150 | 5.88 | 150 | 0.0177 | 0.33 | 6.79 | 65.50 | 0.0234 | 407 | 59 |
| Max Day + Fire Flow Demand | 108.6 | 31.0 | 150 | 225.82 | 150 | 0.0177 | 12.78 | 6.79 | 65.50 | 19.9621 | 227 | 33 |

| Carling Village Tower #1 Connection | Boundary Condition | Description | | | | | | | | Demand Results | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elevation at Boundary Condition (m) | Pipe Segment Length (m) | Diameter (mm) | Demand (L/s) | Hazen Williams Coefficient, C | Area ($m^2$) | Velocity (m/s) | Unit Conversion, K | Elevation at Building Connection (m) | Head loss (m) | Pressure (kPa) | Pressure (psi) |
| Peak Hour Demand | 107.1 | 31.0 | 150 | 6.87 | 150 | 0.0177 | 0.39 | 6.79 | 63.00 | 0.0312 | 431 | 63 |
| Average Daily Demand | 107.1 | 31.0 | 150 | 2.55 | 150 | 0.0177 | 0.14 | 6.79 | 63.00 | 0.0050 | 432 | 63 |
| Max Day + Fire Flow Demand | 108.0 | 31.0 | 150 | 220.82 | 150 | 0.0177 | 12.50 | 6.79 | 63.00 | 19.1518 | 253 | 37 |

| Carling Village Tower #2 Connection | Boundary Condition | Description | | | | | | | | Demand Results | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elevation at Boundary Condition (m) | Pipe Segment Length (m) | Diameter (mm) | Demand (L/s) | Hazen Williams Coefficient, C | Area ($m^2$) | Velocity (m/s) | Unit Conversion, K | Elevation at Building Connection (m) | Head loss (m) | Pressure (kPa) | Pressure (psi) |
| Peak Hour Demand | 107.1 | 31.0 | 150 | 10.87 | 150 | 0.0177 | 0.61 | 6.79 | 63.50 | 0.0729 | 426 | 62 |
| Average Daily Demand | 107.1 | 31.0 | 150 | 4.02 | 150 | 0.0177 | 0.23 | 6.79 | 63.50 | 0.0116 | 427 | 62 |
| Max Day + Fire Flow Demand | 108.1 | 31.0 | 150 | 223.04 | 150 | 0.0177 | 12.62 | 6.79 | 63.50 | 19.5092 | 246 | 36 |

| Carling Village Tower #3 Connection | Boundary Condition | Description | | | | | | | | Demand Results | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elevation at Boundary Condition (m) | Pipe Segment Length (m) | Diameter (mm) | Demand (L/s) | Hazen Williams Coefficient, C | Area ($m^2$) | Velocity (m/s) | Unit Conversion, K | Elevation at Building Connection (m) | Head loss (m) | Pressure (kPa) | Pressure (psi) |
| Peak Hour Demand | 107.1 | 31.0 | 150 | 15.88 | 150 | 0.0177 | 0.90 | 6.79 | 65.00 | 0.1469 | 411 | 60 |
| Average Daily Demand | 107.1 | 31.0 | 150 | 5.88 | 150 | 0.0177 | 0.33 | 6.79 | 65.00 | 0.0234 | 412 | 60 |
| Max Day + Fire Flow Demand | 108.4 | 31.0 | 150 | 220.98 | 150 | 0.0177 | 12.50 | 6.79 | 65.00 | 19.1776 | 237 | 34 |

# Table 3
## The New Civic Development for The Ottawa Hospital - Existing Fire Hydrants

| Future Research Building | | | | |
|---|---|---|---|---|
| **Existing Hydrant ID** | **Existing Hydrant Location** | **Distance to Building** | **Type of Hydrant** | **Maximum Fire Flow (L/min)** |
| 366028H328 | Corner of Loretta Ave. S and Carling Ave. | <=75m | AA | 5700 |
| 366028H029 | Carling Ave. (median) between Loretta Ave. S and Champagne Ave. S | <=75m | AA | 5700 |
| | | | **Total Maximum Fire Flow (L/min)** | **11400** |
| | | | **Total Maximum Fire Flow (L/s)** | **190** |

| Carling Village Tower #1 | | | | |
|---|---|---|---|---|
| **Existing Hydrant ID** | **Existing Hydrant Location** | **Distance to Building** | **Type of Hydrant** | **Maximum Fire Flow (L/min)** |
| 366028H219 | Preston St. near Carling Ave. | <=75m | AA | 5700 |
| 366028H032 | Carling Ave. (median) near Trillium Pathway | <=75m | AA | 5700 |
| 366028H031 | Carling Ave. (median) between Trillium Pathway and Champagne Ave. S | >75m and <=150m | AA | 3800 |
| 366028H041 | 785 Carling Ave. (median) | >75m and <=150m | AA | 3800 |
| | | | **Total Maximum Fire Flow (L/min)** | **19000** |
| | | | **Total Maximum Fire Flow (L/s)** | **317** |

| Carling Village Tower #2 | | | | |
|---|---|---|---|---|
| **Existing Hydrant ID** | **Existing Hydrant Location** | **Distance to Building** | **Type of Hydrant** | **Maximum Fire Flow (L/min)** |
| 366028H033 | 835 Carling Ave. | <=75m | AA | 5700 |
| 366028H032 | Carling Ave. (median) near Trillium Pathway | <=75m | AA | 5700 |
| 366028H031 | Carling Ave. (median) between Trillium Pathway and Champagne Ave. S | <=75m | AA | 5700 |
| | | | **Total Maximum Fire Flow (L/min)** | **17100** |
| | | | **Total Maximum Fire Flow (L/s)** | **285** |

| Carling Village Tower #3 | | | | |
|---|---|---|---|---|
| **Existing Hydrant ID** | **Existing Hydrant Location** | **Distance to Building** | **Type of Hydrant** | **Maximum Fire Flow (L/min)** |
| 366028H031 | Carling Ave. (median) between Trillium Pathway and Champagne Ave. S | <=75m | AA | 5700 |
| 366028H030 | Corner of Carling Ave. and Champagne Ave. S | <=75m | AA | 5700 |
| 366028H029 | Carling Ave. (median) between Loretta Ave. S and Champagne Ave. S | >75m and <=150m | AA | 3800 |
| | | | **Total Maximum Fire Flow (L/min)** | **15200** |
| | | | **Total Maximum Fire Flow (L/s)** | **253** |

# Table 4
# The New Civic Development for the Ottawa Hospital - Hospital Fire Demand Calculations

| Building | Type of Construction C | Total Floor Area (m2) A | Fire Flow (min. 2,000) (L/min) F | Adjusted (nearest 1,000) (L/min) | Occupancy Factor O | Reduction / Increase due to Occupancy | Fire Flow with Occupancy (min. 2,000) (L/min) | Sprinklers Factor S | Reduction due to Sprinklers (L/min) | Exposure Factor % E | Increase due to Exposure (L/min) | Fire Flow (L/min) | Roof Contribution (L/min) R | Required Fire Demand: Adjusted to the nearest 1000 (min. 2,000, max. 45,000) (L/min) F | Required Fire Demand: Minimum 33 (L/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| Hospital | 0.8 | 441,289 | 116,916 | 117,000 | -15% | -17,550 | 99,450 | 50% | 49,725 | 0% | 0 | 50,000 | 0 | 50,000 | 833 |
| | | | | | | | | | | | | Adjusted to the maximum | | 45,000 | 750 |
| | | | | | | | | | | | | | | | |

References

Reference: *Water Supply for Public Fire Protection , 1999 by Fire Underwriters Survey (FUS) and Ottawa Design Guidelines - Water Distribution, July 2010 and subsequent Technical Bulletins*

C Type of Construction

| | |
|---|---|
| Wood Frame | 1.5 |
| Ordinary Construction (joist masonry) | 1.0 |
| Non-Combustible Construction (unprotected metal structure, masonary non-combustible) | 0.8 |
| Fire resistive construction (= or > 3 hours) | 0.6 |

O Occupancy

| | |
|---|---|
| Non-Combustible | -25% |
| Limited Combustible | -15% |
| Combustible | 0% |
| Free Burning | 15% |
| Rapid Burning | 25% |
| Commercial | 0% |

A Total Floor Area (m2)

Basement excluded if at least 50% below grade

Fire-resistive Building Floor Area

Less than 1 hour rating

two largest adjoining floors

Additional floors (up to 8) at 50%

Fully protected, equal or more than 3 hours rating

(reinforced concrete, protected steel)

largest floor

Additional two adjoining floors at 25%

S Sprinklers

| | Complete coverage | Partial coverage |
|---|---|---|
| Cumulative, maximum 50% | | |
| Automatic Sprinklers NFPA Standards | 30% | 30% * x% |
| Standard Water Supply | 10% | 10% * x% |
| Full Supervision | 10% | 10% * x% |
| Residential Sprinklers | 30% | 30% * x% |

(x%: percentage of total protected floor area)

E Exposure

Cumulative , maximum 75%

Doesn't apply with fire-resistive construction

| Distance (m) | Exposure %* | North | East | South | West |
|---|---|---|---|---|---|
| 0-3 | 25% | | | | |
| 3.1-10 | 20% | | | | |
| 10.1-20 | 15% | | | | |
| 20.1-30 | 10% | | | | |
| 30.1-45 | 5% | | | | |

*Updated exposure % based on Table G5 of Tech Bulletin

F Fire Flow (L/Min)

220*C*(A^0.5)

2,000<F<45,000

FS Fire Wall Separation

Per Wall 1,000 L/min

R Roof

| | |
|---|---|
| Shake | 2,000 to 4,000 L/min |
| Wood | 2,000 to 4,000 L/min |

# Table 5
## The New Civic Development for the Ottawa Hospital - Parking Garage Fire Demand Calculations

| | | | | | | | | | | | | | | Required Fire Demand | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building | Type of Construction<br>C | Total Floor Area<br>(m2)<br>A | Fire Flow<br>(min. 2,000)<br>(L/min)<br>F | Adjusted (nearest 1,000)<br>(L/min) | Occupancy Factor<br>O | Reduction / Increase due to Occupancy | Fire Flow with Occupancy (min. 2,000)<br>(L/min) | Sprinklers Factor<br>S | Reduction due to Sprinklers<br>(L/min) | Exposure Factor<br>%<br>E | Increase due to Exposure<br>(L/min) | Fire Flow<br>(L/min) | Roof Contribution<br>(L/min)<br>R | Adjusted to the nearest 1000 (min. 2,000, max. 45,000)<br>(L/min)<br>F | Minimum 33<br>(L/s) |
| | | | | | | | | | | | | | | | |
| Parking Garage | 0.6 | 77,046 | 36,639 | 37,000 | 0% | 0 | 37,000 | 50% | 18,500 | 20% | 7,400 | 26,000 | 0 | 26,000 | 433 |
| | | | | | | | | | | | | | | | |

References

*Water Supply for Public Fire Protection , 1999 by Fire Underwriters Survey (FUS) and*

Reference: *Ottawa Design Guidelines - Water Distribution, July 2010 and subsequent Technical Bulletins*

C Type of Construction

| | |
|---|---|
| Wood Frame | 1.5 |
| Ordinary Construction (joist masonry) | 1.0 |
| Non-Combustible Construction (unprotected metal structure, masonary non-combustible) | 0.8 |
| Fire resistive construction (= or > 3 hours) | 0.6 |

A Total Floor Area (m2)

Basement excluded if at least 50% below grade

Fire-resistive Building Floor Area

Less than 1 hour rating

two largest adjoining floors

Additional floors (up to 8) at 50%

Fully protected, equal or more than 3 hours rating

(reinforced concrete, protected steel)

largest floor

Additional two adjoining floors at 25%

F Fire Flow (L/Min)

220*C*(A^0.5)

2,000<F<45,000

FS Fire Wall Separation

Per Wall 1,000 L/min

O Occupancy

| | |
|---|---|
| Non-Combustible | -25% |
| Limited Combustible | -15% |
| Combustible | 0% |
| Free Burning | 15% |
| Rapid Burning | 25% |
| Commercial | 0% |

S Sprinklers

Cumulative, maximum 50%

| | Complete coverage | Partial coverage |
|---|---|---|
| Automatic Sprinklers NFPA Standards | 30% | 30% * x% |
| Standard Water Supply | 10% | 10% * x% |
| Full Supervision | 10% | 10% * x% |
| Residential Sprinklers | 30% | 30% * x% |

(x%: percentage of total protected floor area)

E Exposure

Cumulative , maximum 75%

Doesn't apply with fire-resistive construction

| Distance (m) | Exposure %* | North | East | South | West |
|---|---|---|---|---|---|
| 0-3 | 25% | | | | |
| 3.1-10 | 20% | 6m | | | |
| 10.1-20 | 15% | | | | |
| 20.1-30 | 10% | | | | |
| 30.1-45 | 5% | | | | |

*Updated exposure % based on Table G5 of Tech Bulletin

R Roof

| | |
|---|---|
| Shake | 2,000 to 4,000 L/min |
| Wood | 2,000 to 4,000 L/min |

Appendix E:
WaterCAD Outputs& Schematics

Appendix F:
Sanitary Calculations

# TABLE 1: ESTIMATED PRE-DEVELOPMENT SANITARY DEMANDS

| Area | Commercial Space | | | | | | Hospital | | | | | | Institutional Space | | | | TOTAL | INFILTRATION | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Site Area (ha) | Building Gross Floor Area ($m^2$) | Commercial L/m2/day | Average Day (L/s) | Peak Factor | Peak Flow (L/s) | Site Area (ha) | Building Gross Floor Area ($m^2$) | Average Water Use (m3/m2/day) | Average Day Flow (L/s) | Peak Factor | Peak Flow (L/s) | Site Area (ha) | Institutional L/ha/day | Peak Factor | Peak Flow (L/s) | Peak Flow (L/s) | Site Area (ha) | Infiltration Allowance (L/s/ha) | Infiltration Flow (L/s) | Total Peak Flow (L/s) |
| **SA1 - PSPC Lands** | | | | | | | | | | | | | | | | | | | | | |
| Institutional | | | | | | | | | | | | | 31.20 | 28,000 | 1.50 | 15.17 | 15.17 | 31.20 | 0.33 | 10.30 | 25.46 |
| **SA2 - PSPC Lands** | | | | | | | | | | | | | | | | | | | | | |
| Institutional | | | | | | | | | | | | | 1.89 | 28000 | 1.50 | 0.92 | 0.92 | 1.89 | 0.33 | 0.62 | 1.54 |

**Average Daily Demands**

(Based on City of Ottawa *Sewer Design Guidelines 2012* and *MOE Water Design Guidelines*

| | | |
|---|---|---|
| Average Residential Daily Flow = | 280 | L/p/d |
| Institutional Flow = | 28,000 | L/gross ha/d |
| Commercial Flow = | 28,000 | L/gross ha/d |
| Light Industrial Flow = | 35,000 | L/gross ha/d |
| Heavy Industrial Flow = | 55,000 | L/gross ha/d |
| Hotel Daily Flow = | 225 | L/bed/d |
| Office/Warehouse Daily Flow = | 75 | L/person/d |
| Office/Warehouse Daily Flow = | 8.06 | L/m2/day |
| | 125 | L/seat/d |
| Restaurant (24 Hours) | 200 | L/seat/d |
| Shopping Centres = | 2,500 | L/(1000$m^2$/d) |
| Amenity Area = | 5 | L/m2/d |
| Medical Office Buildings, Dental Office and Medical Clinics | | |
| Doctors, Nurses & Medical Staff = | 275 | L/person/day |
| Office Staff = | 75 | L/person/day |
| Patients = | 25 | L/person/day |
| Hospitals - Including Laundry = | 1,400 | L/bed/day |
| 1.54 | 2.2 | m3/m2/year |
| Nursing Homes & Rest Homes = | 450 | L/bed/day |

**Peak Factors**

| | | | | |
|---|---|---|---|---|
| Commercial = | 1.5 | if commercial contribution > 20%, otherwise | 1.0 | |
| Institutional = | 1.5 | if institutional contribution > 20%, otherwise | 1.0 | |
| Industrial = | | per Appendix 4-B.0 Graph | | |
| Residential = | Harmon | 1 + (14/(4+(Capita/1000) ^ 0.5))*0.8 | | |
| | | Minimum = 2 | | |
| | | Maximum = 4 | | |

* (75L/person per 9.3m2 of floor space (OBC))

* (From "*The Ottawa Hospital - General Campus 5 Year Strategies Energy Management Plan 2014-2019*")

**Infiltration Allowance**

| | | |
|---|---|---|
| Infiltration allowance (dry) | 0.05 | L/s/ha |
| Infiltration allowance (wet)) | 0.28 | L/s/ha |
| Infiltration allowance (total) | 0.33 | L/s/ha |

**Population Densities**

| | | |
|---|---|---|
| Average Suburban Residential Dev. | 60 | p/ha |
| Single Family | 3.4 | p./unit |
| Semi-Detached | 2.7 | p./unit |
| Duplex | 2.3 | p./unit |
| Townhouse | 2.7 | p./unit |
| Apartment Average | 1.8 | p./unit |
| Bachelor | 1.4 | p./unit |
| 1 Bedroom | 1.4 | p./unit |
| 2 Bedrooms | 2.1 | p./unit |
| 3 Bedrooms | 3.1 | p./unit |
| Hotel Room, 18 m2 | 1 | p./unit |
| Restaurant, 1 m2 | 1 | p./unit |
| Office | 1 | p/25$m^2$ |

| | |
|---|---|
| **Design:** | **Project:** |
| SM | New Ottawa Hospital |
| **Check :** | **Location:** |
| KP | Ottawa, Ontario |
| **Project # :** | 477458 |
| **Date:** | February 2021 |
| **Sheet:** | 1 of 1 |

# TABLE 2: ESTIMATED POST DEVELOPMENT SANITARY DEMANDS

| Area | Commercial Space | | | | | | Hospital | | | | | | Parking Garage Rooftop Amenity | | | | | Institutional Space | | | | | TOTAL | INFILTRATION | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Site Area (ha) | Building Gross Floor Area ($m^2$) | Commercial L/m2/day | Average Day Flow (L/s) | Peak Factor | Peak Flow (L/s) | Site Area (ha) | Building Gross Floor Area ($m^2$) | Average Water Use (L/m2/day) | Average Day Flow (L/s) | Peak Factor | Peak Flow (L/s) | Site Area (ha) | Amenity Space L/m2/day | Average Day Flow (L/s) | Peak Factor | Peak Flow (L/s) | Site Area (ha) | Institutional L/ha/day | Average Day Flow (L/s) | Peak Factor | Peak Flow (L/s) | Peak Flow (L/s) | Site Area (ha) | Infiltration Allowance (L/s/ha) | Infiltration Flow (L/s) | Total Peak Flow (L/s) |
| **SA1 - Public Service & Procurement Canada Lands** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Institutional | | | | | | | | | | | | | | | | | | 13.02 | 28,000 | 4.22 | 1.50 | 6.33 | 6.33 | 13.02 | 0.33 | 4.30 | 10.63 |
| **SA2 - Hospital & Parking Structure** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Institutional | | | | | | | 18.01 | 441,290 | 3.50 | 17.88 | 1.50 | 26.81 | 2.57 | 5.00 | 1.49 | 1.00 | 1.49 | | | | | | 28.30 | 18.01 | 0.33 | 5.94 | 34.24 |
| **SA3 - Research Building** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Commercial | 1.61 | 63000 | 8.06 | 5.88 | 1.50 | 8.82 | | | | | | | | | | | | | | | | | 8.82 | 1.61 | 0.33 | 0.53 | 9.35 |
| **SA4 - Carling Village (Tower 3)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Commercial | 0.25 | 28430 | 8.06 | 2.65 | 1.50 | 3.98 | | | | | | | | | | | | | | | | | 3.98 | 0.25 | 0.33 | 0.08 | 4.06 |
| **SA5 - Carling Village (Tower 2)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Commercial | 0.35 | 43120 | 8.06 | 4.02 | 1.50 | 6.03 | | | | | | | | | | | | | | | | | 6.03 | 0.35 | 0.33 | 0.12 | 6.15 |
| **SA6 - Carling Village (Tower 1)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Commercial | 0.26 | 27280 | 8.06 | 2.55 | 1.50 | 3.82 | | | | | | | | | | | | | | | | | 3.82 | 0.26 | 0.33 | 0.09 | 3.91 |

**Average Daily Demands**

(Based on City of Ottawa *Sewer Design Guidelines 2012* and *MOE Water Design Guidelines*)

| | | |
|---|---|---|
| Average Residential Daily Flow = | 280 | L/p/d |
| Institutional Flow = | 28,000 | L/gross ha/d |
| Commercial Flow = | 28,000 | L/gross ha/d |
| Light Industrial Flow = | 35,000 | L/gross ha/d |
| Heavy Industrial Flow = | 55,000 | L/gross ha/d |
| Hotel Daily Flow = | 225 | L/bed/d |
| Office/Warehouse Daily Flow = | 75 | L/person/d |
| Office/Warehouse Daily Flow = | 8.06 | L/m2/day |
| | 125 | L/seat/d |
| Restaurant (24 Hours) | 200 | L/seat/d |
| Shopping Centres = | 2,500 | L/(1000$m^2$/d) |
| Amenity Area = | 5 | L/m2/d |
| Medical Office Buildings, Dental Office and Medical Clinics | | |
| Doctors, Nurses & Medical Staff = | 275 | L/person/day |
| Office Staff = | 75 | L/person/day |
| Patients = | 25 | L/person/day |
| Hospitals - Including Laundry = | 1,400 | L/bed/day |
| Hospital - Average Water Use = | 1.3 | m3/m2/year |
| Nursing Homes & Rest Homes = | 450 | L/bed/day |

**Peak Factors**

| | | | | | |
|---|---|---|---|---|---|
| Commercial = | 1.5 | if commercial contribution > 20%, otherwise | 1.0 | | |
| Institutional = | 1.5 | if institutional contribution > 20%, otherwise | 1.0 | | |
| Industrial = | | per Appendix 4-B.0 Graph | | | |
| Residential = | Harmon | 1 + (14/(4+(Capita/1000) ^ 0.5))*0.8 | | | |
| | | Minimum = 2 | | | |
| | | Maximum = 4 | | | |

* (75L/person per 9.3m2 of floor space (OBC))

* (From *2020 water records from the Civic Hospital*)

**Infiltration Allowance**

| | | |
|---|---|---|
| Infiltration allowance (dry) | 0.05 | L/s/ha |
| Infiltration allowance (wet)) | 0.28 | L/s/ha |
| Infiltration allowance (total) | 0.33 | L/s/ha |

**Population Densities**

| | | |
|---|---|---|
| Average Suburban Residential Dev. | 60 | p/ha |
| Single Family | 3.4 | p./unit |
| Semi-Detached | 2.7 | p./unit |
| Duplex | 2.3 | p./unit |
| Townhouse | 2.7 | p./unit |
| Apartment Average | 1.8 | p./unit |
| Bachelor | 1.4 | p./unit |
| 1 Bedroom | 1.4 | p./unit |
| 2 Bedrooms | 2.1 | p./unit |
| 3 Bedrooms | 3.1 | p./unit |
| Hotel Room, 18 m2 | 1 | p./unit |
| Restaurant, 1 m2 | 1 | p./unit |
| Office | 1 | p/25$m^2$ |

| | |
|---|---|
| **Design:** | **Project:** |
| SM | New Ottawa Hospital |
| **Check :** | **Location:** |
| KP | Ottawa, Ontario |
| **Project # :** | 477458 |
| **Date:** | July 2021 |
| **Sheet:** | 1 of 1 |

# TABLE 3: SANITARY SEWER COMPUTATIONS

| Drainage Area | From | To | Peak Flow Q (L/sec) | Sewer Data | | | | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Type of Pipe | Pipe Diameter nom. (mm) | Pipe Diameter actual (mm) | Slope* (%) | Length (m) | Capacity full (L/sec) | Velocity full (m/sec) | Velocity actual (m/sec) | Time of Flow (min) | Q(d) / Q(f) | |
| SA1 | PSPC Land | Carling Sanitary Sewer | 10.63 | PVC | 250 | 250 | 0.5 | 573.0 | 42.0 | 0.86 | 0.60 | 15.93 | 0.25 | Peak flow and sizing to be verified during the design phase |
| SA2 | Hospital | Mooney's Bay Sewer | 31.91 | PVC | 300 | 300 | 0.5 | 53.9 | 68.4 | 0.97 | 0.81 | 1.11 | 0.47 | Peak flow and sizing to be verified during the design phase |
| | Parking Garage | Mooney's Bay Sewer | 2.33 | PVC | 200 | 200 | 1.5 | 53.9 | 40.2 | 1.28 | 0.64 | 1.41 | 0.06 | Peak flow and sizing to be verified during the design phase |
| SA3 | Research Building | Carling Sanitary Sewer | 9.35 | PVC | 150 | 150 | 1.0 | 31.9 | 15.2 | 0.86 | 0.78 | 0.68 | 0.61 | Peak flow and sizing to be verified during the design phase |
| SA4 | Carling Village Tower | Carling Sanitary Sewer | 4.06 | PVC | 150 | 150 | 1.0 | 41.7 | 15.2 | 0.86 | 0.62 | 1.12 | 0.27 | Peak flow and sizing to be verified during the design phase |
| SA5 | Carling Village Tower | Carling Sanitary Sewer | 6.15 | PVC | 150 | 150 | 1.0 | 34.5 | 15.2 | 0.86 | 0.69 | 0.83 | 0.40 | Peak flow and sizing to be verified during the design phase |
| SA6 | Carling Village Tower | Carling Sanitary Sewer | 3.91 | PVC | 150 | 150 | 1.0 | 34.5 | 15.2 | 0.86 | 0.61 | 0.94 | 0.26 | Peak flow and sizing to be verified during the design phase |

Manning's n = 0.013

* Min slope for cleansing velocities is 0.32%

**Design:** SM
**Check:** KP
**Date:** July 2021

**Project Name:** New Ottawa Hospital
**Parsons Project #:** 477458
**Client:** GBA

Appendix G:
City of Ottawa Sanitary Modal Analysis

## Mitchelson, Sarah

**From:** Shillington, Jeffrey <jeff.shillington@ottawa.ca>
**Sent:** Wednesday, March 31, 2021 9:31 AM
**To:** Mitchelson, Sarah
**Cc:** Paradis, Kelly
**Subject:** [EXTERNAL] FW: New Ottawa Hospital - Sanitary Demands

HI Sarah,

Please see the analysis of the sanitary sewers below.

Let me know if you have any questions.

Jeff Shillington, P.Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

---

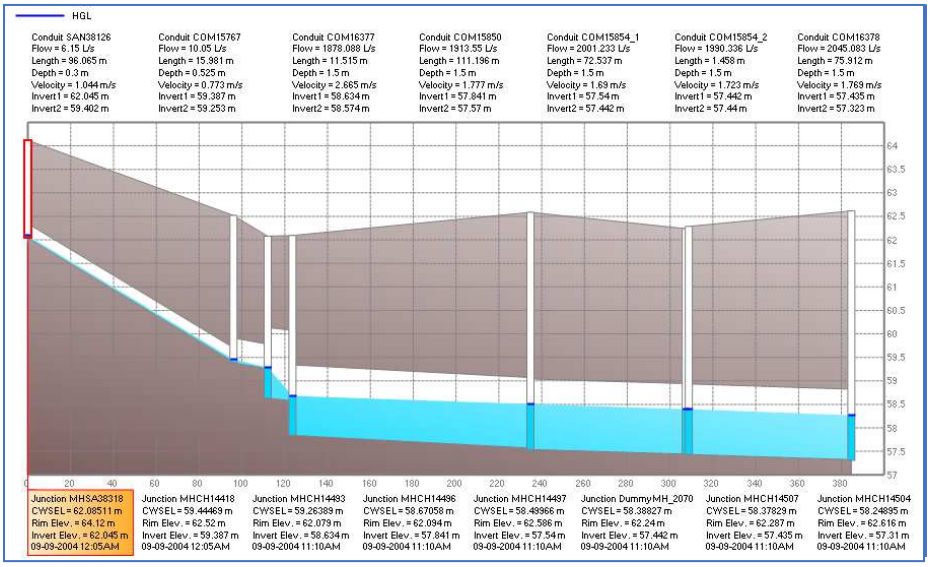
**From:** Tousignant, Eric <Eric.Tousignant@ottawa.ca>
**Sent:** March 19, 2021 3:20 PM
**To:** Shillington, Jeffrey <jeff.shillington@ottawa.ca>
**Subject:** RE: New Ottawa Hospital - Sanitary Demands

Hi Jeff

We completed our model analysis and have no issues with the proposed flows. Below is the summary from Nazrul

Eric

In worst case scenario, for Peak WWFs, the existing system can take additional flows from the proposed Hospital site and other sites. Figure below shows the HGL for various sites as per Parsons PWWFs.




From Hospital site to all along Mooney's Bay Sewer (PWWFs includes PSPC, research bld, Carling Village Tower 3 & Hospital sites)

PSPC and Research Bld Site to Mooney"s Bay Sewer (PWWFs includes PSPC, research bld, Carling Village Tower 3 & Hospital sites)

Carling Village Tower 1 & 2 Receiving System (PWWFs)

Please let me know if you need anything else.

Regards,
Nazrul

---

**From:** Shillington, Jeffrey <jeff.shillington@ottawa.ca>
**Sent:** March 12, 2021 4:38 PM
**To:** Tousignant, Eric <Eric.Tousignant@ottawa.ca>
**Subject:** FW: New Ottawa Hospital - Sanitary Demands

Hi Eric,

Can you please have a look at the information below and attachment provided by Parsons for the proposed New Ottawa Hospital and provide comments on each flow rate and outlet. Let me know if ou have any questions.

Let me know if you wish to discuss anything.

Regards,

Jeff Shillington, P.Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960

email: jeff.shillington@ottawa.ca

---

**From:** Mitchelson, Sarah <Sarah.Mitchelson@parsons.com>
**Sent:** March 05, 2021 4:54 PM
**To:** Shillington, Jeffrey <jeff.shillington@ottawa.ca>
**Cc:** Moore, Sean <Sean.Moore@ottawa.ca>; Paradis, Kelly <Kelly.Paradis@parsons.com>
**Subject:** New Ottawa Hospital - Sanitary Demands



Sensitive

Hi Jeff,

The estimated sanitary demands for the New Ottawa Hospital Campus are shown below.

| Building/Area | Average Dry Weather Flow Rate | Peak Dry Weather Flow Rate | Peak Wet Weather Flow Rate | |
|---|---|---|---|---|
| Research Building | 5.88 | 8.82 | 9.35 | 300mm Diameter Sa |
| Carling Village #1 | 2.55 | 3.82 | 3.90 | 300mm Diameter Sa |
| Carling Village #2 | 4.02 | 6.03 | 6.15 | 300mm Diameter Sa |
| Carling Village #3 | 2.65 | 3.98 | 4.06 | 300mm Diameter Comb |
| Hospital** | 27.22 | 40.83 | 46.77 | |
| PSPC Lands* | 4.22 | 6.33 | 10.63 | 300mm |

*Private services need to be relocated to accommodate the new hospital development and continue to service existing buildings on PSPC land. The demands for the PSPC lands were estimated since the Master Servicing Report could not be provided by PSPC due to COVID restrictions (only a hard copy exists in the their office).*
***The new hospital will replace the old Ottawa Hospital Civic Campus (located at Carling Avenue and Parkdale Avenue)*

Can the City please analysis the existing system with the above estimated demands to confirm if there is sufficient capacity and/or points of failure and concern?

We were previously informed by the City that pre-development sanitary flows should be maintained due to concerns with basement flooding. Based on the estimated demands for the proposed development, the pre-development sanitary flows will not be meet in certain areas.

It would be greatly appreciated if we could get a response by the end of next week (Friday March 12th).

Please advise if any other information is required or you would like to discuss further early next week.

Regards,
Sarah

SARAH MITCHELSON, P.ENG
Municipal Engineer
1223 Michael Street North, Suite 100, Ottawa, ON K1J 7T2

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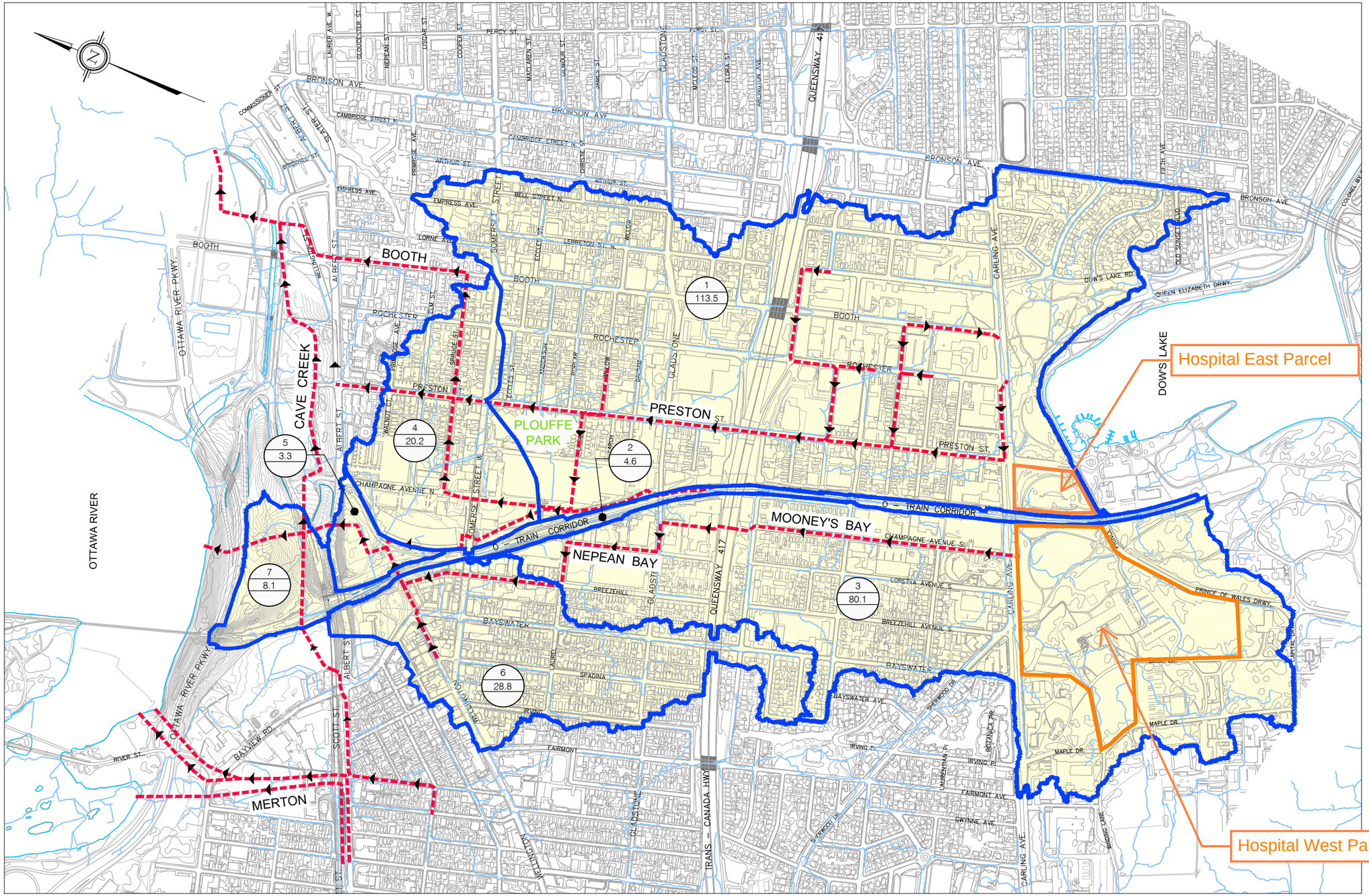
Appendix H:
Mooney's Bay Collector, Nepean Bay Trunk & Preston-Booth Trunk Drainage Areas

**THIS FIGURE IS TO SHOW THE MAJOR DRINAGE AREAS. THE MINOR SYSTEM MIGHT NOT DEPICT RECENT CITY OF OTTAWA SYSTEM UPGRADES.**




LEGEND :

- MAJOR SYSTEM TRIBUTARY DRAINAGE AREA (IBI) 258.6 a
- STORM TRUNK
- 1 / 113.50 — AREA ID / AREA ( a)

| AREA ID | MINOR FLOW RECIPIENT | MAJOR FLOW RECIPIENT |
|---|---|---|
| 1 | PRESTON NEPEAN BAY | PLOUFFE PARK |
| 2 | RAIL CORRIDOR | RAIL CORRIDOR |
| 3 | MOONEY'S BAY NEPEAN BAY | RAIL CORRIDOR |
| 4 | PRESTON NEPEAN BAY | AREA 5 |
| 5 | RAIL CORRIDOR (EX. COND.) | RAIL CORRIDOR (EX. COND.) |
| 6 | NEPEAN BAY | RAIL CORRIDOR |
| 7 | RAIL CORRIDOR | RAIL CORRIDOR |

J:\15197_ScottStCondo\5.9 Drawings\59civil\current\swm\15197-Swm-Figures.dwg Sheet Set: ####

Plot Style: ---- Plot Scale: 1:1 Plotted At: May. 14, 15 8:46 AM Printed By: DON SIURNA Last Saved By: SVUKIC Last Saved At: Jan. 11, 12

IBI GROUP

Scale: 1:10000

PrDect Title: LEBRETON MEWS

Dra ing Title: MAJOR SYSTEM DRAINAGE AREAS (IBI)

S eet ND.: FIGURE D2

Appendix I:
Stormwater Calculations

## TABLE 1 - PRE-DEVELOPMENT AVERAGE RUNOFF COEFFICIENTS

| Watershed Area No. | Impervious Areas (ha) | A * $C_{ASPH/ROOF}$ | Pervious Areas (ha) | A * $C_{GRASS}$ | Pervious Areas (ha) | A * $C_{FOREST}$ | Sum AC | Total Area (ha) | $C_{AVG\ (5yr)}$ | $C_{AVG(100yr)}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| STM01 | 3.27 | 2.95 | 7.96 | 1.59 | 1.02 | 0.41 | 4.94 | 12.25 | 0.40 | 0.50 |
| STM02 | 1.55 | 1.39 | 3.69 | 0.74 | 0.17 | 0.07 | 2.20 | 5.41 | 0.41 | 0.51 |
| STM03 | 0.04 | 0.04 | 0.32 | 0.06 | 0.22 | 0.09 | 0.19 | 0.59 | 0.33 | 0.41 |
| STM04 | 0.02 | 0.02 | 4.65 | 0.93 | 0.60 | 0.24 | 1.19 | 5.27 | 0.23 | 0.28 |
| STM05 | 0.54 | 0.49 | 4.08 | 0.82 | 0.86 | 0.34 | 1.64 | 5.48 | 0.30 | 0.38 |
| STM06 | 0.05 | 0.05 | 0.87 | 0.17 | 0.00 | 0.00 | 0.22 | 0.93 | 0.24 | 0.30 |
| STM07 | 0.02 | 0.02 | 0.43 | 0.09 | 0.01 | 0.00 | 0.11 | 0.46 | 0.24 | 0.29 |
| STM08 | 0.01 | 0.01 | 0.04 | 0.01 | 0.01 | 0.00 | 0.02 | 0.06 | 0.31 | 0.39 |
| STM09 | 0.94 | 0.85 | 0.52 | 0.10 | 0.06 | 0.02 | 0.98 | 1.52 | 0.64 | 0.80 |
| STM10 | 0.05 | 0.04 | 0.25 | 0.05 | 0.08 | 0.03 | 0.12 | 0.37 | 0.33 | 0.41 |
| **Total** | **6.50** | | **22.80** | | **3.02** | | **11.62** | **32.32** | | |

5-year Storm $C_{ASPH/ROOF/CONC}$ = 0.90 $C_{FOREST}$ = 0.40 $C_{GRASS}$ = 0.20
100-year Storm $C_{ASPH/ROOF/CONC}$ = 1.00 $C_{FOREST}$ = 0.50 $C_{GRASS}$ = 0.25

## TABLE 2 - AVERAGE RUNOFF CALCULATIONS BASED ON PRE-EXISTING CONDITIONS

| Area Description | Area (ha) | Time of Conc, Tc (min) | Minor Storm | | | | Major Storm | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $I_5$ (mm/hr) | $C_{AVG}$ | $Q_{AVG}$ (L/s) | | $I_{100}$ (mm/hr) | $C_{AVG}$ | $Q_{AVG}$ (L/sec) |
| STM01 | 12.249 | 10 | Storm = 5 yr | 104.19 | 0.40 | 1432.09 | Storm = 100 yr | 178.56 | 0.50 | 3067.78 |
| | | | *Discharges to 1200mm diameter storm sewer at Prince of Whales Drive* | | | | *Overland to Prince of Whales Drive and ultimately Plouffe Park* | | | |
| STM02 | 5.407 | 10 | Storm = 5 yr | 104.19 | 0.41 | 637.19 | Storm = 100 yr | 178.56 | 0.51 | 1364.96 |
| | | | *Discharges to 1200mm diameter storm sewer at Prince of Whales Drive* | | | | *Overland to Carling Avenue and ultimately LRT Corridor* | | | |
| STM03 | 0.587 | 10 | Storm = 2 yr | 76.81 | 0.33 | 41.06 | Storm = 100 yr | 178.56 | 0.41 | 119.32 |
| | | | *Overland to Carling Avenue storm sewers and ultimately Mooney's Bay Collector* | | | | *Overland to Carling Avenue and ultimately LRT Corridor* | | | |
| STM04 | 5.272 | 10 | Storm = 5 yr | 104.19 | 0.23 | 344.43 | Storm = 100 yr | 178.56 | 0.28 | 737.83 |
| | | | *Discharges to 1200mm diameter storm sewer at Prince of Whales Drive* | | | | *Overland to Prince of Whales Drive and ultimately Plouffe Park* | | | |
| STM05 | 5.475 | 10 | Storm = 2 yr | 76.81 | 0.30 | 351.07 | Storm = 100 yr | 178.56 | 0.38 | 1020.21 |
| | | | *Discharges to Carling Avenue storm sewers and ultimately Mooney's Bay Collector* | | | | *Overland to Carling Avenue and ultimately LRT Corridor* | | | |
| STM06 | 0.926 | 10 | Storm = 2 yr | 76.81 | 0.24 | 47.47 | Storm = 100 yr | 178.56 | 0.30 | 137.94 |
| | | | *Discharges to Carling Avenue storm sewers and ultimately Mooney's Bay Collector* | | | | *Overland to Carling Avenue and ultimately LRT Corridor* | | | |
| STM07 | 0.458 | 10 | Storm = 2 yr | 76.81 | 0.24 | 23.04 | Storm = 100 yr | 178.56 | 0.29 | 66.95 |
| | | | *Overland to LRT Corridor* | | | | *Overland to LRT Corridor* | | | |
| STM08 | 0.057 | 10 | Storm = 2 yr | 76.81 | 0.31 | 3.82 | Storm = 100 yr | 178.56 | 0.39 | 11.11 |
| | | | *Overland to LRT Corridor* | | | | *Overland to LRT Corridor* | | | |
| STM09 | 1.518 | 10 | Storm = 2 yr | 76.81 | 0.64 | 208.44 | Storm = 100 yr | 178.56 | 0.80 | 605.72 |
| | | | *Discharges to Preston Trunk* | | | | *Overland to Carling Avenue and ultimately Plouffe Park* | | | |
| STM10 | 0.369 | 10 | Storm = 2 yr | 76.81 | 0.33 | 25.96 | Storm = 100 yr | 178.56 | 0.41 | 75.45 |
| | | | *Overland to Carling Avenue storm sewers and ultimately Preston Trunk* | | | | *Overland to Carling Avenue and ultimately Plouffe Park* | | | |

Average Capture Rate is based on the 2-year and 5-year storms at $T_c$=10 mins

## TABLE 3 - ALLOWABLE RUNOFF CALCULATIONS BASED ON PRE-EXISTING CONDITIONS

| Area Description | Area (ha) | Time of Conc, Tc (min) | Minor Storm | | | | Major Storm | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $I_5$ (mm/hr) | $C_{AVG}$ | $Q_{ALLOWABLE}$ (L/s) | | $I_{100}$ (mm/hr) | $C_{AVG}$ | $Q_{ALLOWABLE}$ (L/s) |
| STM01 | 12.249 | 10 | Storm = 5 yr | 104.19 | 0.40 | 1419.20 | Storm = 100 yr | 178.56 | 0.45 | 2731.66 |
| STM02 | 5.407 | 10 | Storm = 5 yr | 104.19 | 0.40 | 626.47 | Storm = 100 yr | 178.56 | 0.45 | 1205.82 |
| STM03 | 0.587 | 10 | Storm = 2 yr | 76.81 | 0.33 | 41.06 | Storm = 100 yr | 178.56 | 0.45 | 130.91 |
| STM04 | 5.272 | 10 | Storm = 5 yr | 104.19 | 0.23 | 344.43 | Storm = 100 yr | 178.56 | 0.45 | 1175.71 |
| STM05 | 5.475 | 10 | Storm = 2 yr | 76.81 | 0.30 | 351.07 | Storm = 100 yr | 178.56 | 0.45 | 1220.99 |
| STM06 | 0.926 | 10 | Storm = 2 yr | 76.81 | 0.24 | 47.47 | Storm = 100 yr | 178.56 | 0.45 | 206.51 |
| STM07 | 0.458 | 10 | Storm = 2 yr | 76.81 | 0.24 | 23.04 | Storm = 100 yr | 178.56 | 0.45 | 102.14 |
| STM08 | 0.057 | 10 | Storm = 2 yr | 76.81 | 0.31 | 3.82 | Storm = 100 yr | 178.56 | 0.45 | 12.71 |
| STM09 | 1.518 | 10 | Storm = 2 yr | 76.81 | 0.40 | 129.65 | Storm = 100 yr | 178.56 | 0.45 | 338.53 |
| STM10 | 0.369 | 10 | Storm = 2 yr | 76.81 | 0.33 | 25.96 | Storm = 100 yr | 178.56 | 0.45 | 82.29 |
| | | | | | | **$Q_{ALLOWABLE}$ (L/s) Dow's Lake =** | **2390.10** | | | **$Q_{ALLOWABLE}$ (L/s) Plouffe Park =** | **4328.20** |
| | | | | | | **$Q_{ALLOWABLE}$ (L/s) Nepean Bay Trunk =** | **466.45** | | | **$Q_{ALLOWABLE}$ (L/s) LRT Corridor =** | **2879.07** |
| | | | | | | $Q_{ALLOWABLE}$ (L/s) Preston Trunk = | 155.61 | | | | |
| | | | | | | **$Q_{ALLOWABLE}$ (L/s) Preston Trunk (deduct additional proposed sanitary 10.05(L/s) =** | **145.56** | | | | |

Allowable Capture Rate is based on the 2-year and 5-year storms at $T_c$=10 mins

## TABLE 4 - POST DEVELOPMENT AVERAGE RUNOFF COEFFICIENTS

| Watershed Area No. | Impervious Areas (ha) | A * $C_{ASPH/ROOF}$ | Pervious Areas (ha) | A * $C_{GRASS}$ | Pervious Areas (ha) | A * $C_{FOREST}$ | Pervious Areas (ha) | A * $C_{GREENROOF}$ | Sum AC | Total Area (ha) | $C_{AVG\ (5yr)}$ | $C_{AVG(100yr)}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STM01 | 1.73 | 1.56 | 2.02 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 1.96 | 3.75 | 0.52 | 0.65 |
| STM02 | 2.62 | 2.36 | 0.00 | 0.00 | 0.00 | 0.00 | 1.90 | 1.71 | 4.07 | 4.52 | 0.90 | 1.00 |
| STM03 | 0.91 | 0.82 | 1.61 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 1.14 | 2.52 | 0.45 | 0.57 |
| STM04 | 1.05 | 0.95 | 1.67 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 1.28 | 2.72 | 0.47 | 0.59 |
| STM05 | 0.56 | 0.50 | 0.43 | 0.09 | 0.00 | 0.00 | 0.18 | 0.16 | 0.75 | 1.17 | 0.64 | 0.80 |
| STM06 | 1.55 | 1.39 | 0.76 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 1.54 | 2.30 | 0.67 | 0.84 |
| STM07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.63 | 2.37 | 2.37 | 2.63 | 0.90 | 1.00 |
| STM08 | 0.17 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.07 | 0.23 | 0.25 | 0.90 | 1.00 |
| STM09 | 0.35 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.32 | 0.35 | 0.90 | 1.00 |
| STM10 | 0.25 | 0.22 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 | 0.27 | 0.85 | 1.00 |
| STM 11 | 3.03 | 2.73 | 5.21 | 1.04 | 1.02 | 0.41 | 0.00 | 0.00 | 4.17 | 9.25 | 0.45 | 0.56 |
| STM 12 | 0.81 | 0.73 | 1.73 | 0.35 | 0.17 | 0.07 | 0.00 | 0.00 | 1.15 | 2.72 | 0.42 | 0.53 |
| **Total** | **13.03** | | **13.45** | | **1.19** | | **4.78** | | **19.20** | **32.45** | | |

5-year Storm $C_{ASPH/ROOF/CONC}$ = 0.90 $C_{GRASS}$ = 0.20 $C_{FOREST}$ = 0.40 $C_{GREENROOF}$ = 0.90
100-year Storm $C_{ASPH/ROOF/CONC}$ = 1.00 $C_{GRASS}$ = 0.25 $C_{FOREST}$ = 0.50 $C_{GREENROOF}$ = 1.00

## TABLE 5- TOTAL RUNOFF COEFFICIENT

$C_{AVG(5yr)}$ = Sum AC / Total Area = **19.20 / 32.45** = **0.59** $C_{AVG(100yr)}$ = **0.74**

# TABLE 6- SUMMARY OF POST-DEVELOPMENT RUNOFF

| Area No | Area (ha) | Storm = 2 yr | | | Storm = 5 yr | | | Storm = 100 yr | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I2 (mm/hr) | $C_{AVG(2yr)}$ | $Q_{GEN}$ (L/s) | $I_5$ (mm/hr) | $C_{AVG(5yr)}$ | $Q_{GEN}$ (L/s) | $I_{100}$ (mm/hr) | $C_{AVG(100yr)}$ | $Q_{GEN}$ (L/s) |
| STM01 | 3.75 | - | - | - | 104.19 | 0.52 | 568.19 | 178.56 | 0.65 | 1217.16 |
| STM02 | 4.52 | - | - | - | 104.19 | 0.90 | 1178.84 | 178.56 | 1.00 | 2244.69 |
| STM03 | 2.52 | - | - | - | 104.19 | 0.45 | 330.09 | 178.56 | 0.57 | 707.11 |
| STM04 | 2.72 | - | - | - | 104.19 | 0.47 | 371.22 | 178.56 | 0.59 | 795.22 |
| STM05 | 1.17 | 76.81 | 0.64 | 159.16 | - | - | - | 178.56 | 0.80 | 462.52 |
| STM06 | 2.30 | 76.81 | 0.67 | 329.71 | - | - | - | 178.56 | 0.84 | 958.16 |
| STM07 | 2.63 | 76.81 | 0.90 | 505.20 | - | - | - | 178.56 | 1.00 | 1305.02 |
| STM08 | 0.25 | 76.81 | 0.90 | 48.23 | - | - | - | 178.56 | 1.00 | 124.59 |
| STM09 | 0.35 | 76.81 | 0.90 | 67.83 | - | - | - | 178.56 | 1.00 | 175.23 |
| STM10 | 0.27 | 76.81 | 0.85 | 48.08 | - | - | - | 178.56 | 1.00 | 131.54 |
| STM 11 | 9.25 | - | - | - | 104.19 | 0.45 | 1209.04 | 178.56 | 0.56 | 2589.97 |
| STM 12 | 2.72 | - | - | - | 104.19 | 0.42 | 332.43 | 178.56 | 0.53 | 712.11 |
| **Total** | 32.45 | | | 1158.23 | | | 3989.82 | | | |
| | | **$Q_{GEN}$ (L/s) Nepean Bay Trunk =** | | **1042.31** | **$Q_{GEN}$ (L/s) Dow's Lake =** | | **3989.82** | | | |
| | | **$Q_{GEN}$ (L/s) Preston Trunk =** | | **115.92** | | | | | | |

$I_2 = 732.951 / (Tc + 6.199)^{0.810}$

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$

$I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

Time of concentration (min), Tc = 10 mins

# TABLE 7 - STORAGE VOLUMES (2-YEAR AND 100-YEAR STORM) WITH 20% STRESS FACTOR

## STORAGE REQUIREMENT FOR (STM05, STM06, STM07, STM08)

$C_{AVG}$ = 0.77 (2-year)
$C_{AVG}$ = 0.96 (100-year)
Time Interval = 5 (mins)
Drainage Area = 6.35 (hectares)

| | Release Rate = 466.5 (L/sec) | | | | | Release Rate = 466.5 (L/sec) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Return Period = 2 (years) | | | | | Return Period = 100 (years) | | | | |
| | IDF Parameters, A = 732.951 , B = 0.810 | | | | | IDF Parameters, A = 1735.688 , B = 0.820 | | | | |
| | $I = A/(T_c+C)B$ , C = 6.199 | | | | | $I = A/(Tc+C)B$ , C = 6.014 | | | | |
| Duration (min) | Rainfall Intensity, I (mm/hr) | Peak Flow (L/sec) | Release Rate (L/sec) | Storage Rate (L/sec) | Storage ($m^3$) | Rainfall Intensity, I (mm/hr) | Peak Flow (L/sec) | Release Rate (L/sec) | Storage Rate (L/sec) | Storage ($m^3$) |
| 0 | - | - | - | - | - | - | - | - | - | - |
| 5 | 103.6 | 1686.7 | 466.5 | 1220.2 | 366.1 | 242.7 | 4940.5 | 466.5 | 4474.1 | 1342.2 |
| 10 | 76.8 | 1250.8 | 466.5 | 784.3 | 470.6 | 178.6 | 3634.8 | 466.5 | 3168.3 | 1901.0 |
| 15 | 61.8 | 1005.9 | 466.5 | 539.4 | 485.5 | 142.9 | 2908.8 | 466.5 | 2442.3 | 2198.1 |
| 20 | 52.0 | 847.3 | 466.5 | 380.9 | 457.1 | 120.0 | 2441.7 | 466.5 | 1975.3 | 2370.4 |
| 25 | 45.2 | 735.5 | 466.5 | 269.1 | 403.6 | 103.8 | 2113.9 | 466.5 | 1647.5 | 2471.2 |
| 30 | 40.0 | 652.1 | 466.5 | 185.7 | 334.2 | 91.9 | 1870.1 | 466.5 | 1403.6 | 2526.6 |
| 35 | 36.1 | 587.2 | 466.5 | 120.8 | 253.6 | 82.6 | 1681.0 | 466.5 | 1214.5 | 2550.5 |
| 40 | 32.9 | 535.2 | 466.5 | 68.7 | 165.0 | 75.1 | 1529.7 | 466.5 | 1063.2 | 2551.7 |
| 45 | 30.2 | 492.4 | 466.5 | 26.0 | 70.2 | 69.1 | 1405.6 | 466.5 | 939.2 | 2535.7 |
| 50 | 28.0 | 456.6 | 466.5 | -9.8 | -29.4 | 64.0 | 1301.9 | 466.5 | 835.4 | 2506.2 |
| 55 | 26.2 | 426.2 | 466.5 | -40.3 | -132.9 | 59.6 | 1213.7 | 466.5 | 747.3 | 2466.0 |
| Max = | | | | | **485.5** | | | | | **2551.7** |

**Notes**

1 ) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc/60)^B$
3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontrolled Areas OR Pipe Outlet Capacity
4 ) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximum Storage = Max Storage Over Duration

# TABLE 8 - STORAGE VOLUMES (2-YEAR AND 100-YEAR STORM) WITH 20% STRESS FACTOR

## STORAGE REQUIREMENT FOR (STM09, STM10)

$C_{AVG}$ = 0.88 (2-year)
$C_{AVG}$ = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.618 (hectares)

| | 2-YEAR | | | | | 100-YEAR | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Release Rate = 145.6 (L/sec)<br>Return Period = 2 (years)<br>IDF Parameters, A = 732.951 , B = 0.810<br>$I = A/(T_c+C)B$ , C = 6.199 | | | | | Release Rate = 145.6 (L/sec)<br>Return Period = 100 (years)<br>IDF Parameters, A = 1735.688 , B = 0.820<br>$I = A/(Tc+C)B$ , C = 6.014 | | | | |
| Duration (min) | Rainfall Intensity, I (mm/hr) | Peak Flow (L/sec) | Release Rate (L/sec) | Storage Rate (L/sec) | Storage ($m^3$) | Rainfall Intensity, I (mm/hr) | Peak Flow (L/sec) | Release Rate (L/sec) | Storage Rate (L/sec) | Storage ($m^3$) |
| 0 | - | - | - | - | - | - | - | - | - | - |
| 5 | 103.6 | 187.6 | 145.6 | 42.0 | 12.6 | 242.7 | 500.4 | 145.6 | 354.8 | 106.4 |
| 10 | 76.8 | 139.1 | 145.6 | -6.5 | -3.9 | 178.6 | 368.1 | 145.6 | 222.6 | 133.5 |
| 15 | 61.8 | 111.9 | 145.6 | -33.7 | -30.3 | 142.9 | 294.6 | 145.6 | 149.0 | 134.1 |
| 20 | 52.0 | 94.2 | 145.6 | -51.3 | -61.6 | 120.0 | 247.3 | 145.6 | 101.7 | 122.1 |
| 25 | 45.2 | 81.8 | 145.6 | -63.8 | -95.6 | 103.8 | 214.1 | 145.6 | 68.5 | 102.8 |
| 30 | 40.0 | 72.5 | 145.6 | -73.0 | -131.5 | 91.9 | 189.4 | 145.6 | 43.8 | 78.9 |
| 35 | 36.1 | 65.3 | 145.6 | -80.3 | -168.5 | 82.6 | 170.2 | 145.6 | 24.7 | 51.8 |
| 40 | 32.9 | 59.5 | 145.6 | -86.0 | -206.5 | 75.1 | 154.9 | 145.6 | 9.4 | 22.5 |
| 45 | 30.2 | 54.8 | 145.6 | -90.8 | -245.1 | 69.1 | 142.4 | 145.6 | -3.2 | -8.7 |
| 50 | 28.0 | 50.8 | 145.6 | -94.8 | -284.3 | 64.0 | 131.9 | 145.6 | -13.7 | -41.1 |
| Max = | | | | | **12.6** | | | | | **134.1** |

**Notes**

1 ) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc/60)^B$
3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontrolled Areas OR Pipe Outlet Capacity
4 ) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximum Storage = Max Storage Over Duration

# TABLE 9 - STORAGE VOLUMES (2-YEAR AND 100-YEAR STORM) WITH 20% STRESS FACTOR

## STROAGE REQUIREMENT FOR (STM01, STM02, STM03, STM04, STM07, STM11, STM12)

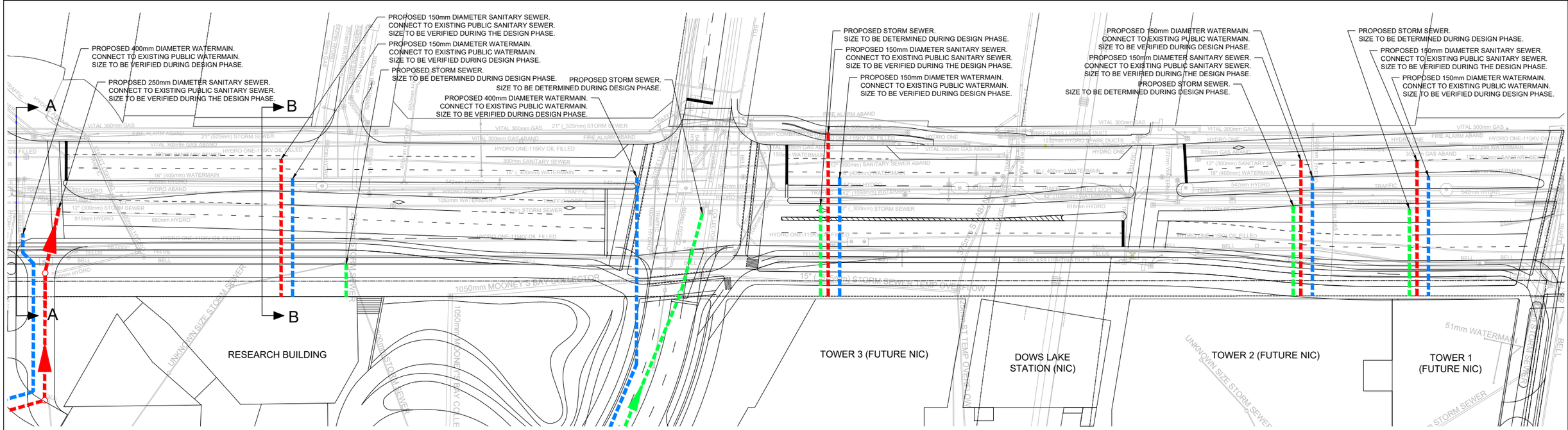
$C_{AVG}$ = 0.54 (5-year)
$C_{AVG}$ = 0.68 (100-year)
Time Interval = 5 (mins)
Drainage Area = 25.486 (hectares)

| | Release Rate = 2390.1 (L/sec) | | | | | Release Rate = 2390.1 (L/sec) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Return Period = 5 (years) | | | | | Return Period = 100 (years) | | | | |
| | IDF Parameters, A = 998.071 , B = 0.814 | | | | | IDF Parameters, A = 1735.688 , B = 0.820 | | | | |
| | $I = A/(T_c+C)B$ , C = 6.053 | | | | | $I = A/(Tc+C)B$ , C = 6.014 | | | | |
| Duration (min) | Rainfall Intensity, I (mm/hr) | Peak Flow (L/sec) | Release Rate (L/sec) | Storage Rate (L/sec) | Storage ($m^3$) | Rainfall Intensity, I (mm/hr) | Peak Flow (L/sec) | Release Rate (L/sec) | Storage Rate (L/sec) | Storage ($m^3$) |
| 0 | - | - | - | - | - | - | - | - | - | - |
| 5 | 141.2 | 6487.3 | 2390.1 | 4097.2 | 1229.2 | 242.7 | 13940.6 | 2390.1 | 11550.5 | 3465.2 |
| 10 | 104.2 | 4787.8 | 2390.1 | 2397.7 | 1438.6 | 178.6 | 10256.2 | 2390.1 | 7866.1 | 4719.7 |
| 15 | 83.6 | 3839.5 | 2390.1 | 1449.4 | 1304.5 | 142.9 | 8207.7 | 2390.1 | 5817.6 | 5235.8 |
| 20 | 70.3 | 3228.1 | 2390.1 | 838.0 | 1005.6 | 120.0 | 6889.8 | 2390.1 | 4499.7 | 5399.7 |
| 25 | 60.9 | 2798.2 | 2390.1 | 408.1 | 612.2 | 103.8 | 5964.9 | 2390.1 | 3574.8 | 5362.1 |
| 30 | 53.9 | 2478.0 | 2390.1 | 87.9 | 158.3 | 91.9 | 5276.8 | 2390.1 | 2886.7 | 5196.1 |
| 35 | 48.5 | 2229.4 | 2390.1 | -160.7 | -337.4 | 82.6 | 4743.2 | 2390.1 | 2353.1 | 4941.5 |
| 40 | 44.2 | 2030.3 | 2390.1 | -359.8 | -863.5 | 75.1 | 4316.3 | 2390.1 | 1926.2 | 4622.8 |
| 45 | 40.6 | 1866.9 | 2390.1 | -523.2 | -1412.6 | 69.1 | 3966.2 | 2390.1 | 1576.1 | 4255.4 |
| 50 | 37.7 | 1730.2 | 2390.1 | -659.9 | -1979.7 | 64.0 | 3673.5 | 2390.1 | 1283.4 | 3850.1 |
| 55 | 35.1 | 1614.0 | 2390.1 | -776.1 | -2561.3 | 59.6 | 3424.7 | 2390.1 | 1034.6 | 3414.2 |
| 60 | 32.9 | 1513.8 | 2390.1 | -876.3 | -3154.7 | 55.9 | 3210.5 | 2390.1 | 820.4 | 2953.5 |
| 65 | 31.0 | 1426.5 | 2390.1 | -963.6 | -3758.1 | 52.6 | 3024.0 | 2390.1 | 633.9 | 2472.0 |
| 70 | 29.4 | 1349.7 | 2390.1 | -1040.4 | -4369.8 | 49.8 | 2859.9 | 2390.1 | 469.8 | 1973.0 |
| 75 | 27.9 | 1281.5 | 2390.1 | -1108.6 | -4988.7 | 47.3 | 2714.3 | 2390.1 | 324.2 | 1458.9 |
| 80 | 26.6 | 1220.6 | 2390.1 | -1169.5 | -5613.8 | 45.0 | 2584.2 | 2390.1 | 194.1 | 931.8 |
| 85 | 25.4 | 1165.7 | 2390.1 | -1224.4 | -6244.4 | 43.0 | 2467.2 | 2390.1 | 77.1 | 393.3 |
| Max = | | | | | **1438.6** | | | | | **5399.7** |

**Notes**

1 ) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc/60)^B$
3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontrolled Areas OR Pipe Outlet Capacity
4 ) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximum Storage = Max Storage Over Duration

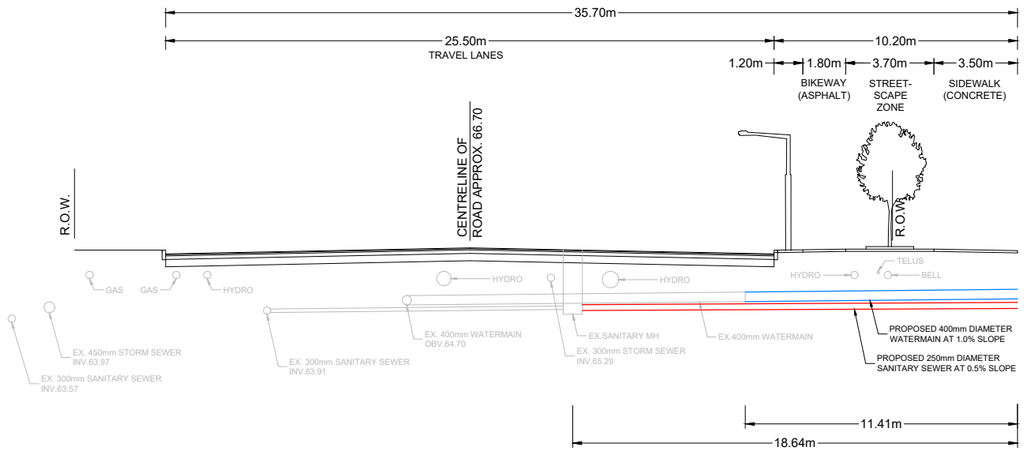
Appendix J:
Preliminary Connection Cross Sections



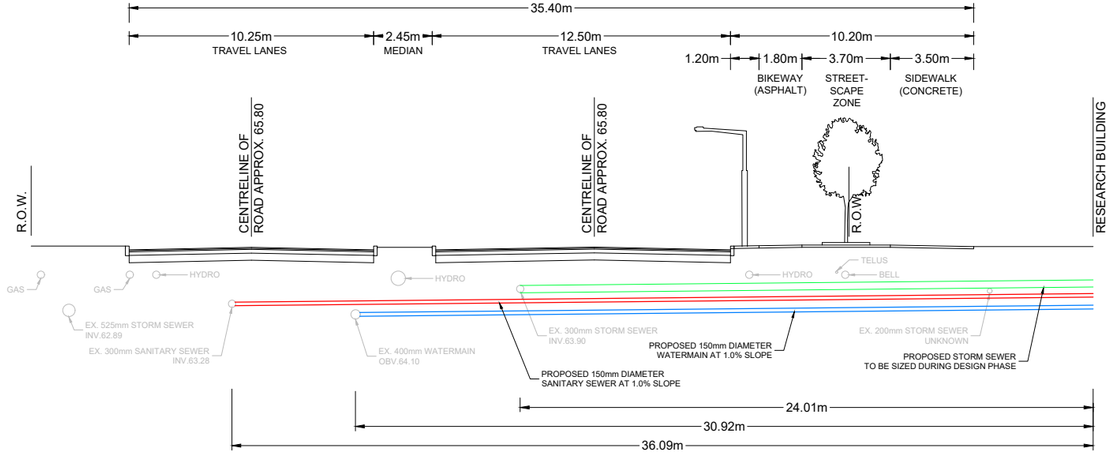

SCALE: 1:1000

NOTE:

1. ALL EXISTING UNDERGROUND INFRASTRUCTURE MUST BE FIELD VERIFIED TO CONFIRM EXACT ELEVATIONS.
2. ALL CONNECTIONS PIPE SIZES WILL NEED TO BE VERIFIED DURING THE DESIGN PHASE BASED ON THE FINAL CONCEPT PLAN FOR THE DEVELOPMENT.
3. ALL CONNECTIONS WILL NEED TO BE FURTHER INVESTIGATED AND DESIGN DURING THE DESIGN PHASE.




INTERSECTION CARLING AVENUE AND BREEZE AVENUE
CROSS SECTION A-A (35.70m) LOOKING EAST
N.T.S.




RESEARCH BUILDING
CROSS SECTION B-B (35.40m) LOOKING EAST
N.T.S.

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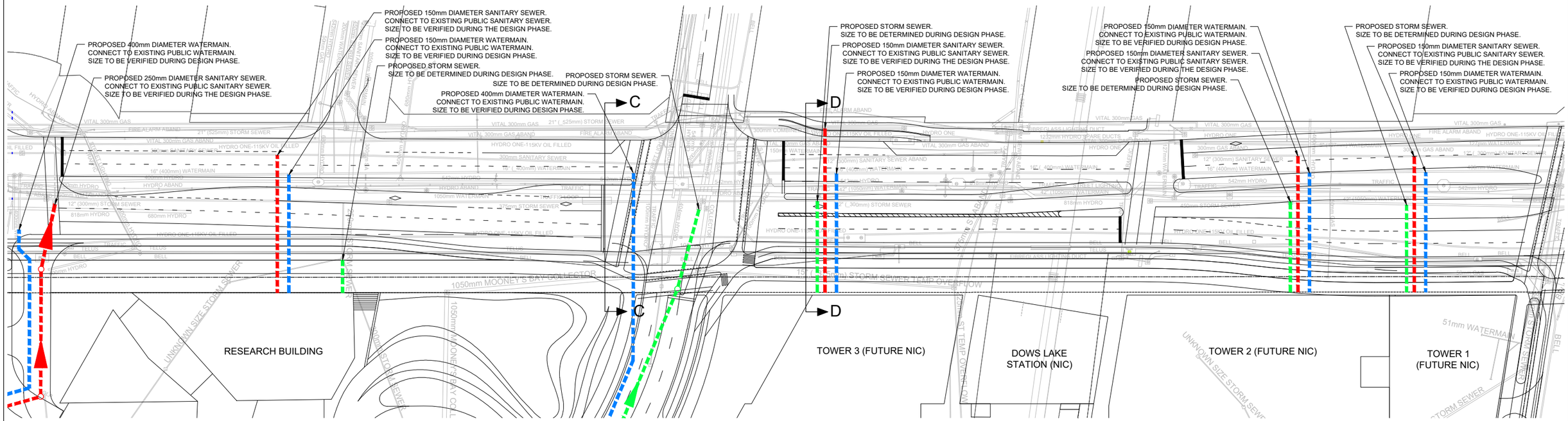
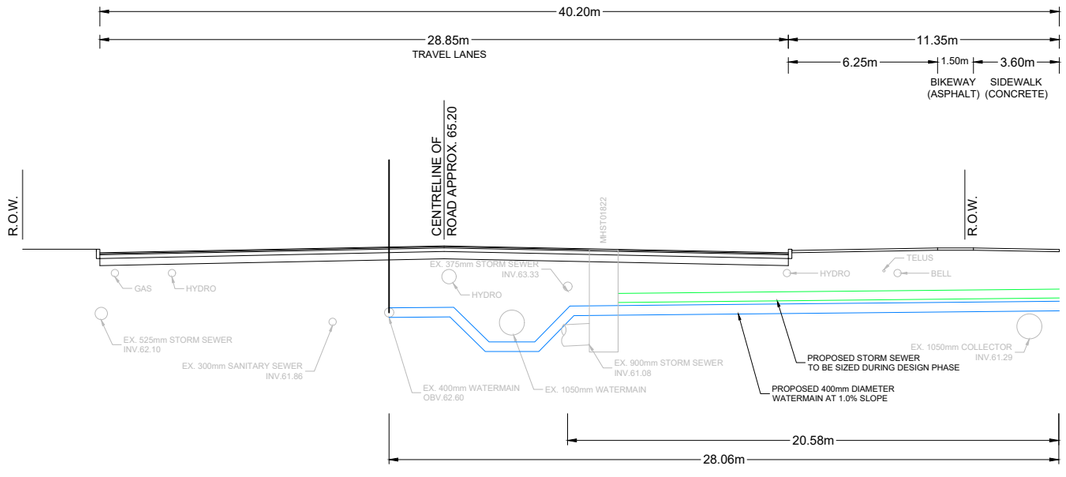
Figure J-1

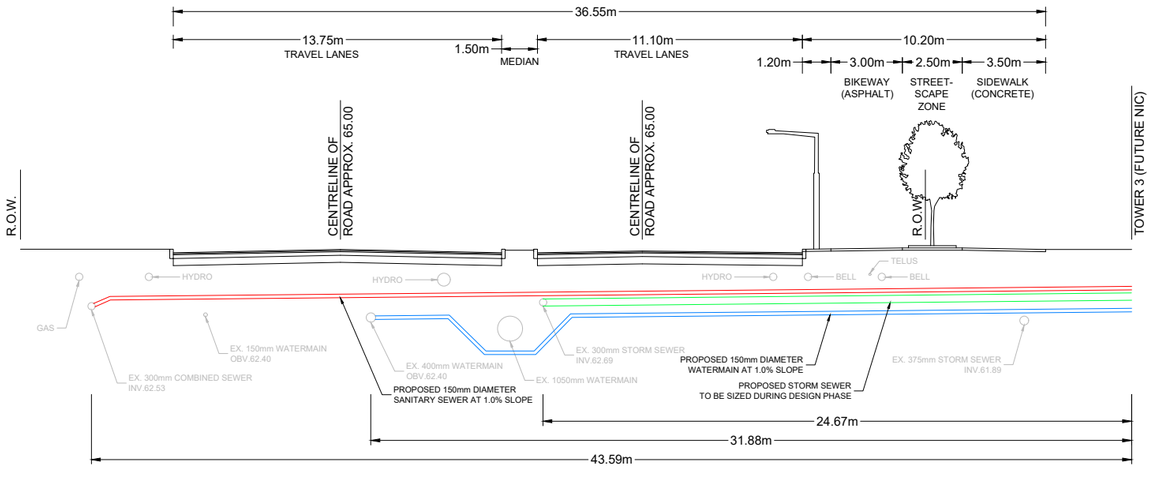



NOTE:

1. ALL EXISTING UNDERGROUND INFRASTRUCTURE MUST BE FIELD VERIFIED TO CONFIRM EXACT ELEVATIONS.
2. ALL CONNECTIONS PIPE SIZES WILL NEED TO BE VERIFIED DURING THE DESIGN PHASE BASED ON THE FINAL CONCEPT PLAN FOR THE DEVELOPMENT.
3. ALL CONNECTIONS WILL NEED TO BE FURTHER INVESTIGATED AND DESIGN DURING THE DESIGN PHASE.




INTERSECTION CARLING AVENUE AND CHAMPAGNE AVENUE
CROSS SECTION C-C (40.20m) LOOKING EAST
N.T.S.




TOWER 3 (FUTURE NIC)
CROSS SECTION D-D (36.55m) LOOKING EAST
N.T.S.

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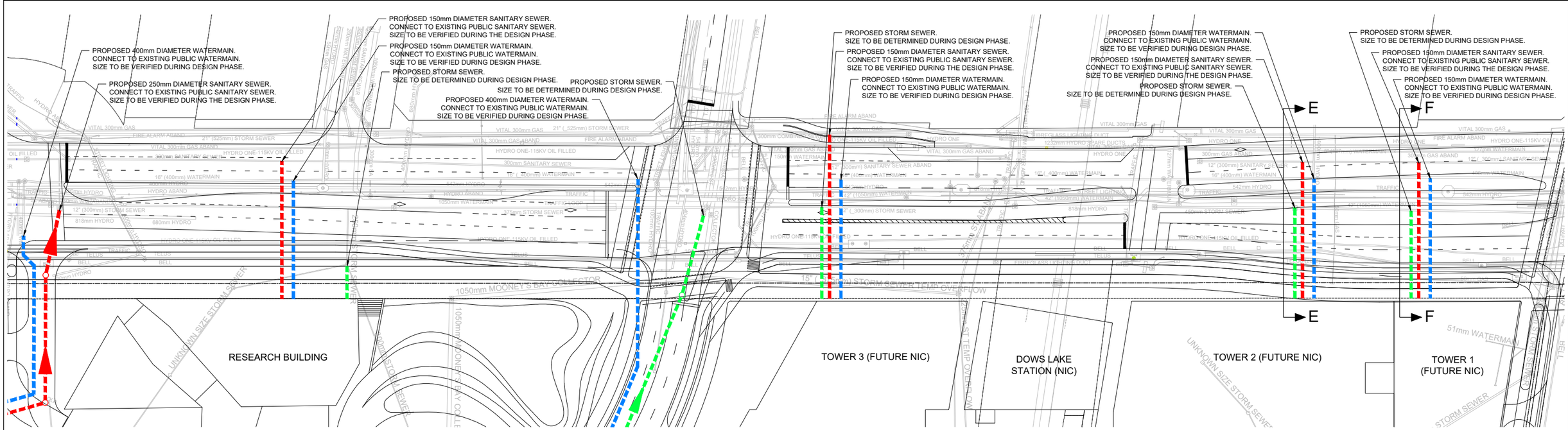
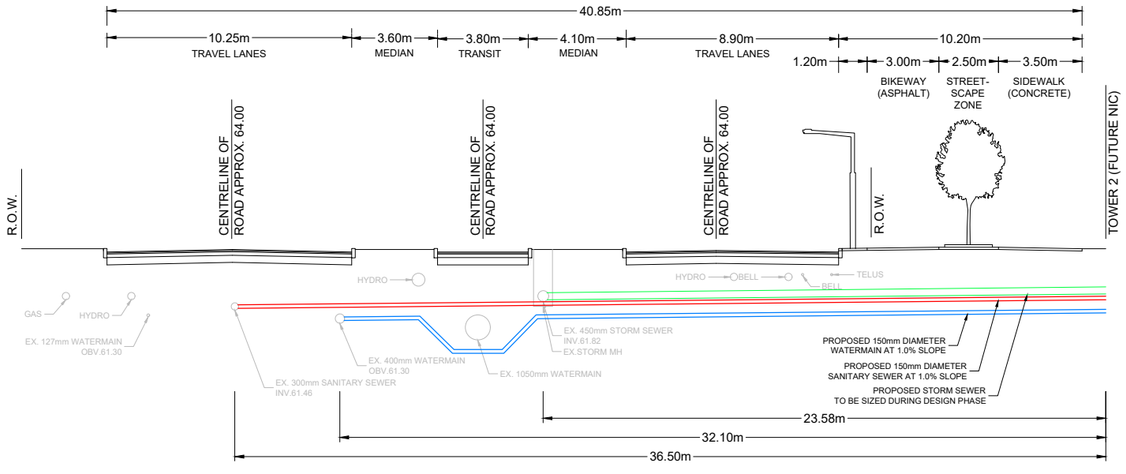
Figure J-2



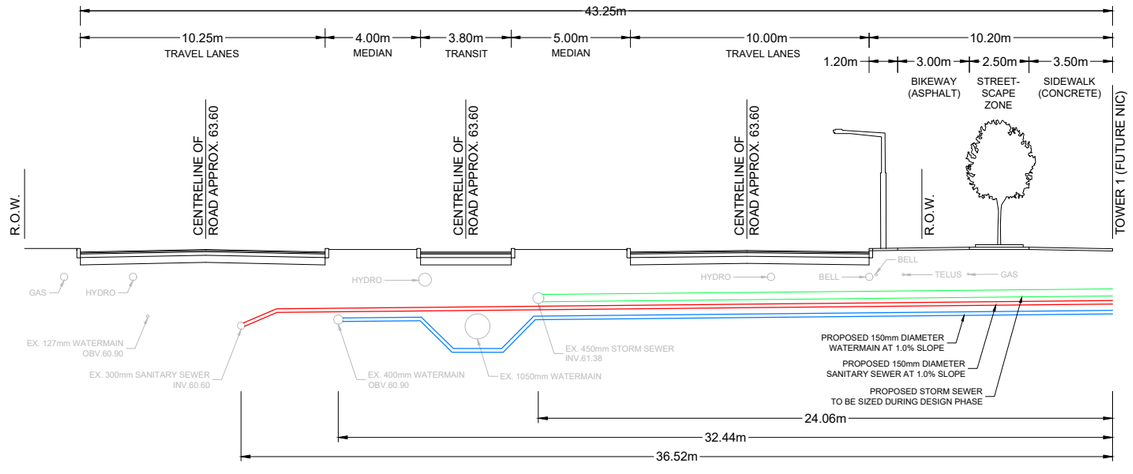

SCALE: 1:1000

NOTE:

1. ALL EXISTING UNDERGROUND INFRASTRUCTURE MUST BE FIELD VERIFIED TO CONFIRM EXACT ELEVATIONS.
2. ALL CONNECTIONS PIPE SIZES WILL NEED TO BE VERIFIED DURING THE DESIGN PHASE BASED ON THE FINAL CONCEPT PLAN FOR THE DEVELOPMENT.
3. ALL CONNECTIONS WILL NEED TO BE FURTHER INVESTIGATED AND DESIGN DURING THE DESIGN PHASE.




TOWER 2 (FUTURE NIC)
CROSS SECTION E-E (40.85m) LOOKING EAST
N.T.S.




TOWER 1 (FUTURE NIC)
CROSS SECTION F-F (43.25m) LOOKING EAST
N.T.S.

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Figure J-3