MORRISON HERSHFIELD

Site Servicing and Stormwater Management Design Brief

Carleton University, New Student Residence

1125 Colonel By Drive

Ottawa, Ontario

Presented to:

Diamond Schmitt Architects and KWC Architects in Joint Venture for the Carleton University New Student

Project: 190444600 December 13, 2019

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1 Introduction

1.1 Site Description and Proposed Development

This report describes the site servicing and stormwater management design and calculations pertaining to a proposed 9 storey residence building at Carleton University. The existing site houses an access road, parking lot and landscaped area with pedestrian pathways.

Proposed grading and servicing is shown on the drawings included in **Appendix A**.

The format of this report matches that of the development servicing study checklist found in Section 4 of the City of Ottawa's Servicing Study Guidelines for Development Applications. A completed copy of the checklist is provided in **Appendix H**.

1.1.1 Statement of Objectives and Servicing Criteria

The objective of this Site Servicing and Stormwater Management Report is to demonstrate that the proposed design meets the servicing requirements for the proposed development, while adhering to the appropriate regulatory requirements.

1.1.2 Location Map and Plan

The location of the site is illustrated in **Figure 1**. A detailed site layout is provided within the drawings in **Appendix A**.

Figure 1- Key Plan

The site is entirely within a property parcel (PIN 040870065) owned by Carleton University.

1.2 Background Documents

Existing conditions are shown on the Topographic and Legal Survey (**Appendix F**).

1.3 Consultation and Permits

1.3.1 Pre-consultation Meetings

A pre-consultation meeting was held with representatives of the City of Ottawa and the consultant design team on October 18th, 2018. The resulting comments that would affect this report are as follows:

- The capacity of the existing sanitary sewer network should be investigated, as some sanitary pipes on the campus are believed to have insufficient capacity
- A CCTV report is required to confirm that the existing sanitary sewers (local to the site) are in good condition to handle the proposed development
- The capacity of the existing storm sewer network should be investigated, as some storm pipes on the campus are believed to have insufficient capacity
- A CCTV report is required to confirm that the existing storm sewers (local to the site) is in good condition to handle the proposed development
- The City requires post-development flows from the site to be restricted to the 1:5 year pre-development level for all storm events up to and including 1:100 year storm. However, control to the 1:2 year pre-development level may be necessary due to limited capacity of the existing storm sewers
- Pre-development flow to be calculated using the smaller of a runoff coefficient of 0.5 or the actual existing runoff coefficient. Use either a T_c of 20 minutes or calculated the pre-development T_c but not less than 10 minutes
- Maximum ponding on the public and private roadways and parking lot surfaces during 1:100 year storm event = 350mm max.
- Consult with the RVCA regarding storm water quality control requirements/restrictions

The full comments regarding site-servicing and stormwater management-specific requirements can be found in **Appendix B**.

1.3.2 Adherence to Zoning and Related Requirements

The site is currently zoned I2 AF (1.5) – Major Institutional zone, Post-secondary educational facilities.

1.4 Available Existing Infrastructure

Sewer and watermain mapping collected from the City of Ottawa as well as Carleton University indicate that the following services exist in and surrounding the subject site.

<u>North</u>

- No watermains or sewers immediately north of the site

<u>East</u>

- 400mm diameter watermain (material unknown)
- 300mm diameter Conc. sanitary sewer
- 450mm diameter Conc. storm sewer

<u>South</u>

- 300mm diameter Conc. storm sewer

West

- 200mm diameter PVC sanitary sewer
- 150mm diameter PVC storm sewer
- 200mm diameter watermain (material unknown)

Within the site

- 200mm diameter Conc. sanitary sewer (flowing West to East)
- 300mm diameter Conc. sanitary sewer (flowing West to East)
- 200mm diameter watermain (material unknown)
- 200mm catchbasin leads (flowing North to South)

The existing utilities within the site will be relocated to the south and west of the proposed building. In addition, existing utilities along the east edge of the site will be relocated into Campus Avenue.

Existing utilities (and proposed relcoations) are shown in detail in Plan C001 found in **Appendix A.** CCTV inspections of existing storm and sanitary sewers have been carried out, and reports are provided in **Appendix G**.

2 Geotechnical Study

A Geotechnical Investigation was undertaken by WSP and is documented in Report No. 191-12948-00 dated November 18th, 2019.

Thirteen boreholes were drilled to a depths varying between 10m and 18.6m below the existing ground surface. The subsurface profile at the borehole locations within the pavement structure consist of a pavement structure underlain by a fill layer to approximately 1.4 to 2.4 m depth. The fill is variable in nature and consists of sand with varying amounts of gravel and of silt. The fill was underlain by approximately 2.5m deposits of sand and gravel underlain by 4.5m of glacial till. Bedrock depth vary between 10.5m – 11.8m below grade. A similar profile is shown where topsoil is present.

Based on available geological mapping, the subject site is located in an area where the bedrock consists of interbedded limestone and shale of the Verulam formation.

Groundwater was encountered at depths of 4.5-6.7 m below the existing ground surface.

The geotechnical report provides recommendations for excavation, backfill, pavement structure and pipe bedding and backfill.

3 Water Services

3.1 Design Criteria

The water service will be designed in accordance with the 2010 City of Ottawa Water Design Guidelines as well as MOE Design Guidelines for Drinking Water Systems. The proposed development lies within the City of Ottawa 1W pressure zone as shown by the Pressure Zone map in **Appendix C**

The required domestic water demand and pressure design parameters for the development has been calculated based in **Table 1**:

Table 1– Summary of Water Demand Parameters

Design Parameter	Value
Average Daily Demand	350 L/d/P[1]
Max. Daily Peaking Factor	2.95 x Average Daily[2]
Max. Hourly Peaking Factor	4.41 x Average Daily[2]
Minimum Watermain Size	200mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
Desired pressure range during normal operating conditions	350kPa and 480kPa
Min. pressure during normal operating conditions	275kPa
Max. pressure during normal operating conditions	552kPa
Min. pressure during maximum hourly demand	276kPa
Min. pressure during maximum daily demand + fire flow	140kPa

[1] Daily average based on Appendix 4-A from Water Supply Guidelines
[2] Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons

Table 2 summarizes the water demand/fire flow for the development based on the **Ottawa Design Guidelines (2010 incl. Technical Bulletins)** and the **Fire Underwriters Survey (1999)**:

Table 2– Summarization of Water Demand Calculations

Design Parameter	Water Demand (L/s)
Average Daily Demand	1.91 L/s (165 m²/d)
Maximum Daily Demand	5.64
Maximum Hourly Demand	8.43
Fire Flow	217.67
Total Max Daily Demand + Fire Flow	222.31
Maximum Hourly Demand	8.43

Domestic and fire flow calculations are provided in **Appendix C**. Supporting correspondence from the Architect is also provided in **Appendix C**.

3.2 Adequacy of Supply for Domestic and Fire Flows

The building will be serviced from the relocated 400 mm diameter watermain. The minimum pressure in this watermain under the Max Day Demand + fire, and Maximum Hourly scenarios will be determined once boundary conditions are received from the City of Ottawa.

It is anticipated that 250 mmm diameter service connections will be required to meet fire flow requirements (depending on the required fire pump capacity, to be determined by the Mechanical Engineer).

All relocated watermains will be sized on a like-for-like basis.

3.3 Check of High Pressures

The site is within Pressure Zone 1W, which operates at a maximum head of 115 m (City of Ottawa Water Master Plan, 2013). This would result in a maximum pressure above the finished floor elevation of approximately 483kPa, which falls under the maximum 552kPa defined in the guidelines.

3.4 Reliability Requirements

Because the average demand exceeds 50 m^3/d, dual service connections will be provided to the building. An isolation valve will be installed on the 400 mm watermain between the two service connections, to enable supply from either direction.

3.5 Summary and Conclusions

The proposed building will be serviced by dual 250 mm diameter water services connected to the relcoated 400mm diameter watermain east of the proposed building.

4 Sanitary Servicing

4.1 Background and Existing Infrastructure

The sanitary service will be designed in accordance with the 2012 Ottawa City Sewer Design Guidelines. The surrounding municipal sanitary services are described in detail in **Section 1.4**. The site is serviced by separated storm and sanitary sewers.

4.2 Review of Ground Water and Soil Conditions

Recommendations regarding the installation of piped services that are provided in the geotechnical report will be incorporated into the contract specifications.

Some of the proposed sewers are expected to be installed below the groundwater table, noted as 4.5m - 6.7m below existing grade. The pipe specified (PVC SDR35 in accordance with the appropriate City of Ottawa specifications and approved products listing), is required to be have joints capable of withstanding a minimum hydrostatic pressure of 345 kPa (50 psi) without leakage. This is equivalent to 35 m of hydrostatic head. As such, the proposed pipe is suitable for installation below the water table. To verify that the joints are sufficiently watertight, leakage tests will be specified for all sanitary sewers.

4.3 Proposed Servicing and Calculations

The proposed development will require a new 200mm diameter PVC sanitary service. The new 200mm diameter PVC sanitary service will extend from the east side of the building and connect to an existing 300mm diameter sanitary sewer east of the proposed building. The sanitary servicing design parameters are defined in **Table 3**.

Table 3– Summarization of Sanitary Servicing Design Parameters

Design Parameter	Value
Occupancy	471 persons
Per capita flow	400 l/c.d
Institutional Peaking Factor	1.5 if institutional contribution>20%,else 1.0
Infiltration and Inflow Allowance	0.33 L/ha/s
Sanitary Sewer Sizing Based on the Manning's Equation	$Q = \frac{1}{n}\pi A \mathrm{R}^{2/3} S^{1/2}$
Manning's Coefficient 'n'	0.013
Minimum Depth of Cover	2.5m from obvert of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
As per Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012 incl. all Tech. Bulletins as of November 2019	

The proposed building will produce a sanitary flow of 3.5 L/s as determined by the City of Ottawa 2012 Sewer Design Guidelines. The proposed 200mm PVC service lateral (at 1% slope) has a maximum capacity of 32.8 L/s. This is sufficient for the calculated sanitary flow.

The proposed relocated sewer on Campus Avenue has sufficient capacity accommodate this calculated flow. Full calculations can be found in **Appendix D**.

All other relocated sanitary sewers are sized on a like-for-like basis (diameter and slope).

4.4 Summary and Conclusions

In conclusion the proposed development meets all required servicing constraints and associated design criteria/requirements.

5 Storm Servicing and Stormwater Management

5.1 Background

The majority of the site presently drains to a network of catch basins. All storm water drained from the existing site flows into Network #1 (as defined by the Infrastructure Master Plan), which eventually discharges in the Rideau River at the east limit of Campus, near Bronson Avenue. There are currently no stormwater quantity control measures within the site.

As indicated in the Infrastructure Master Plan, Network #1 (which serves the project area) has pipes that are undersized for a 5-year storm event. This includes pipes within and downstream of the proposed site. The pipes within and downstream of the proposed site generally have sufficient (or near-sufficient) capacity for a 2-year storm event.

The majority of the University does not have a dual drainage system. Many existing catch basins and catch basin manholes are uncontrolled. Overland flow routes have not been engineered, for the most part, which has resulted in instances of surface flooding, often associated with high levels in the Rideau River. Accordingly, there is benefit to introducing flow control devices for the storm sewer system, during the implementation of new projects.

The Infrastructure Master Plan therefore recommends that all new buildings should be provided with storm water management quantity control to limit flows to be equal to or less than existing conditions.

The City of Ottawa's Sewer Design Guidelines require the 100-year post-development storm flow to be restricted to the 5-year pre-development run-off with an assumed pre-development coefficient no greater than 0.5.

5.2 Storm Servicing Strategy including Analysis of Existing Infrastructure

For the New Residence Building, it is proposed that the 100-year post-development flow be restricted to the 2-year pre-development run-off (calculated at a pre-development run-off coefficient of 0.5) to meet the capacity of downstream sewers. The 100-year flow will be detained on site. This will significantly reduce flows to the Network #1 storm sewers during storms exceeding the 2-year event, and will also reduce overland flows and associated flooding risks.

Quantity control meeting these requirements will be provided through the use of on-site detention and flow control devices. All quantity control requirements are currently proposed to be met through the use of underground storage tanks. During design development, opportunities to utilize low impact development technologies will be explored. These opportunities are anticipated to include:

- Possible implementation of a green roof on part of the proposed building.
- Use of permeable pavers.
- Use of reinforced grass in lieu of asphalt for part of fire route to Stormont-Dundas House.
- Design of stormwater tanks as retention rather than detention systems (i.e. to allow infiltration).
- Inclusion of bioretention within proposed terraced retaining walls between proposed building and Stormont-Dundas House.

5.3 Proposed Storm Servicing

Proposed storm servicing is indicated on Drawing C001 in **Appendix A**. The proposed pre-development and post-development catchment areas, runoff coefficients and catchment total areas are indicated on the Drainage Area Plans, also in **Appendix A**.

5.3.1 Design Criteria (Minor and Major Systems)

For the design of stormwater management (SWM), the City of Ottawa's criteria for a Commercial/ Institutional/ Industrial development in an existing area will be applied (Section 8.3.7.3 of the City of Ottawa Sewer Design Guidelines), except where modified as described in the following summary of the City's key SWM requirements:

- On-site SWM measures required to avoid impact on downstream system (i.e. existing storm sewers).
- Runoff to be controlled to the 2-year pre-development level. (This is more stringent than the City's requirement for control to the 5-year pre-development level, and will be applied due to the limited capacity of the receiving sewers, as designed above).
- Pre-development flow to be calculated using the smaller of a runoff coefficient of 0.5 or the actual existing runoff coefficient. Use either a T_c of 20 minutes or calculated the pre-development T_c but not less than 10 minutes.
- All flow depths must be controlled on-site (i.e. no spill to adjacent properties or rights-of-way for flows up to the 100-year event).

- The design should consider the 100-year return period event, address performance for specified historical storms, and be stress tested for Climate Change using design storms calculated on the basis of a 20% increase of the City's IDF curves for rainfall events. Any instances of severe flooding identified through the stress test must be rectified.

Key drainage design requirements from the City of Ottawa Sewer Design Guidelines include:

- The minor system (underground storm sewers) is designed to capture the 2-year event (minimum). Inlet Control Devices should be utilized to minimize surcharging during the 100-year event.

- The minor system is designed to convey the 2-year event, with the hydraulic grade line (HGL) below the crown of the pipe (except where impacted by boundary conditions – in which case the HGL shall not exceed 0.3m below the underside of the footings during the 100-year event).

- For events greater than the 100 year return period, spillage is directed to a public ROW and not to neighbouring private property.

- The site grading ensures that the property being developed is higher than the spill elevation of the adjacent municipal ROW. This is considered especially critical if underground parking is being proposed. The grading ensures sufficient positive drainage away from the building, with a minimum slope from the building to the street of 2% and building openings a minimum of 0.3m above the 100-year ponding level. If reduced lot grading is considered for an increase in travel time and infiltration, the 2% minimum grade is still maintained for at least 4m from the building.

- The maximum water depth on streets (public, private and parking lots), static or dynamic, is 350 mm.

- Where underground storage is utilized, the design must ensure that backwater from the downstream system does not impact the required storage.

In addition to the City of Ottawa's guidelines, requirements for storm water quality control will be considered. The Rideau Valley Conservation Authority (RVCA) has been contacted, but has not yet responded. It is anticipated that the RVCA will not require stormwater quality control for this site, because fewer than 6 parking spaces are proposed.

Stormwater Quantity Control

5.3.1.1 Runoff Coefficient and Peak Flows

Table 4 indicates the run-off coefficient for each catchment. The 100-year run-off coefficients include a 25% increase (to a maximum of 1.0) as required by the City of Ottawa Sewer Design Guidelines Section 5.4.5.2.1.

Table 4– Pre-development Run-off Coefficients

	Pre-Development Run-off Coefficients	
Storm Event	**2-Year Storm**	**100-Year Storm**
Site Area (in ha)	0.722	0.722
Run-off Coefficients	0.58	0.73

Intensity (i) is calculated using the formula:

$$i = \frac{A}{(T_d + C)^B}$$

Where A, B and C are all factors of the IDF Return Period, T_d being the time of concentration and A the drainage area (Detailed calculations provided in **Appendix E**).

Time of concentration is determined using the inlet time graph (Appendix 5D Ottawa City Sewer Design Guidelines) which results in a values less than 10 minutes. Therefore 10 minutes will be used to calculate peak flows. With the pre and post-development run-off coefficients and rainfall intensity, the peak flows for each drainage area can be calculated using the Rational Method. The results (using actual run-off coefficients) are summarized in **Table 5**.

Table 5– Pre-Development Peak Flows

	Pre-Development Peak Flows (actual run-off coefficients)	
Storm Event	**2-Year Storm**	**100-Year Storm**
Intensity (mm/hr)	76.8	178.6
Peak Flow (L/s)	89.5	260.2

Since the pre-development run-off coefficient exceeds 0.5, a value of 0.5 will be assumed for calculation of the allowable release rate. Considering time of concentration of 10 minutes, site area of 0.722 hectares and a 2 year storm, **the allowable release rate is 77.1 L/s**.

The project will result in an increase in impervious area. The post-development run-off coefficients are indicated in **Table 6**:

Table 6– Overall Post-Development Run-off Coefficients

	Overall Post-Development Run-off Coefficients	
Storm Event	**5-Year Storm**	**100-Year Storm**
Project Area (in ha)	0.722	0.722
Weighted Run-Off Coefficient	**0.90**	**1.00**

5.3.1.2 Stormwater Management Concept

Uncontrolled Drainage Areas (B1 and B2)

It is not feasible to capture run-off from the proposed sidewalks and paved entrance area along the east side of the site (Area B2). This run-off will be released uncontrolled to catchbasins on Campus Avenue.

In addition, due below-ground utilities, and the low elevation of Stormont-Dundas House, it is not feasible to provide stormwater detention storage for run-off from Area B1 (the proposed new fire route to Stormont-Dundas House, and the areas below the proposed terraced retaining wall). Run-off from Area B1 will be released uncontrolled to catchbasins.

Table 7– Post-Development Uncontrolled Release

	Post-Development Uncontrolled Release	
Storm Event	**5-Year Storm**	**100-Year Storm**
Drainage area (ha)	0.121	0.121
Run-off Coefficient	0.72	0.90
Peak Flow (L/s)	25.4	54.4

This leaves a remaining allowable release rate of **22.7 L/s**.

Controlled Drainage Areas BLDG, A1, A2, A3 and A4

The drainage from the roof (BLDG), paved area between the new building and Leeds House (A1 and A2), patio area (A3) and a landscaped area at the south-east of the proposed building (A4) will be captured and directed to an underground storage tank located below the proposed plaza south of the building. The building courtyard is included in the roof area, since the courtyard will be on a roof above the first storey and basement of the building.

The tank will outlet to a maintenance hole fitted with an Inlet Control Device (ICD). Downstream of the ICD the storm service will outlet to the proposed relocated storm sewer south of the building.

As indicated by the proposed storage calculations, the required underground storage for the southern tank is 198m³. This will be provided using a rectangular plastic geocellular stormwater storage tank. Assuming a void ratio of 0.97 (as per documentation for a typical tank in **Appendix E**), appropriate tank dimensions are 30.0m long by 4.2m wide by 1.8m tall.

Based on the orifice calculation, the outlet will require a 78mm diameter circular orifice plate, providing a maximum allowable release rate of 17.0 L/s during the 100-year event.

Controlled Drainage Areas A5

The drainage from the access road north of the building (A5) will be captured and directed to an underground storage tank located beneath the boulevard.

The tank will outlet to a maintenance hole fitted with an Inlet Control Device (ICD). Downstream of the ICD the storm service will outlet to the proposed relocated storm sewer south of the building.

As indicated by the proposed storage calculations, the required underground storage for the southern tank is 42m³. This will be provided using a rectangular plastic geocellular stormwater storage tank. Assuming a void ratio of 0.97 (as per documentation for a typical tank in **Appendix E**), appropriate tank dimensions are 12.0m long by 3.0m wide by 1.2m tall.

Based on the orifice calculation, the outlet will require an IPEX Tempest LMF 80 Vortex ICD, providing a maximum allowable release rate of 5.7 L/s during the 5-year event.

Summary

Table 8 summarizes the proposed release rates and confirms that the total release rate does not exceed the allowable release rate.

Table 8 – Post-Development Controlled Peak Flows

	Post-Development Controlled Peak Flows (L/s)
Allowable Release Rate	77.1
Release Rate from Uncontrolled Drainage Areas	54.4
Release Rate from Controlled Drainage Areas (South Tank)	17.0
Release Rate from Controlled Drainage Areas (North Tank)	5.7
Total Release Rate	77.1

5.3.1.3 Impact on Existing Stormwater Infrastructure

Overall run-off from the site to the storm sewers will be significantly reduced by the proposed development:

Table 9 – Pre-Development Peak Flows vs. Post-Development Controlled Peak Flows

	Pre-Development Peak Flow	Post-Development Controlled Peak Flow
Storm Event	**5-Year Storm**	**5-Year Storm**
Total run-off (L/s)	121.5	42.8

This shows a reduction in total run-off of 64.8% when compared to the uncontrolled pre-development peak flow.

Sewer Design Calculations are provided in **Appendix E**.

5.3.2 Storm Water Quality Control

As indicated in **Section 5.3.1** above, the RVCA considers run-off from building roof areas to be “clean”, and therefore not require quality control.

As there are fewer than 6 proposed parking spaces, quality control is not expected to be required for the exterior areas.

5.3.3 Pre-Consultation with the Ontario Ministry of the Environment and Conservation and Parks, and Conservation Authority

The Ministry of Environment, Conservation and Parks (MECP) has been contacted and has confirmed that no ECA is required for this site. Correspondence is provided in **Appendix B**.

5.3.4 Minor and Major Systems

The minor storm sewer system consists of the sewers described above. The major system consists of flow south through the campus to the Rideau River. To the extent possible, the site will be graded to direct run-off from storms in excess of the 100-year event to Campus Avenue, from where flow can continue south towards the river. Further discussion is provided in **Section 5.4** below.

5.3.5 Impacts to Receiving Watercourses

No negative impacts to receiving watercourses are anticipated.

5.3.6 100 Year Flood Levels and Major Flow Routing

The site is not within a 100-year floodplain.

5.4 Grading

The proposed grading plan is shown in Drawing C003 in **Appendix A**. The key objectives of the proposed grading are as follows:

- Provide step-free access to ground floor at all entrances
- Provide a slope away from the building for drainage (minimum 2% to the curb)
- Direct overland flow from Parking Lot 6 away from the building, and away from the existing depressed area along the north side of Stormont-Dundas House
- Minimize the area draining to catchbasins within the depressed area along the north side of Stormont-Dundas House
- Prevent overland flow on Campus Avenue from entering the proposed new fire route which slopes down to Stormont-Dundas House

- Direct flows in excess of the 100-year event towards Campus Avenue, to the extent possible.

Retaining walls are required to overcome the significant difference in grade between the site and Stormont-Dundas House. These walls should be designed by a structural engineer.

On the west side of the site, the proposed grades are high enough to enable the existing pedestrian tunnel to be extended into the basement of the building.

5.5 Fire Access Routes

Fire access to Leeds House and Stormont-Dundas House is currently provided by an access road and turnound within the site boundary.

Fire access to Leeds House will be maintained by providing a clear 6m-wide route through the proposed paved plaza between the new building and Leeds House, connecting to the existing fire route along the south side of Leeds House. Since the length of this route is less than 90m (the actual length is approximately 85m), no turnaround is required.

Fire access to Stormont-Dundas House will be maintained by constructing a new 6m-wide access route from Campus Avenue to within 15m of the existing building entrance and fire department connection.

5.6 Erosion and Sediment Control

As described in the servicing guidelines, an erosion and sediment control plan is required for implementation during the construction phase. To minimize the migration of sediments, items such as silt fencing and sediment capture devices for catch-basins downstream of the site and around the building are to be installed to capture and retain sediment. Additionally, all stockpiles are to be covered.

During construction, all erosion control features shall be maintained and repaired as necessary and adjacent roadways kept free of construction debris and sediment this responsibility falls under the prevue of the Contractor.

6 Conclusions

In conclusion the proposed development meets all required servicing constraints and associated design criteria/requirements as well as the additional City of Ottawa requirements identified in the pre-consultation phase. It is recommended that this report be submitted to the City of Ottawa in support of the application for site plan approval.

Sincerely,

Morrison Hershfield Limited

James Fookes, P.Eng., C.Eng.
Senior Municipal Engineer

Daniel Glauser, B.Eng.
Municipal Designer

7 Appendices

Appendix A Site Servicing, Grading and Erosion and Sediment Control, Catchments Plans and Details
Appendix B MECP, RVCA and City of Ottawa Specific Requirements Correspondence
Appendix C Water Demand and FUS Calculations
Appendix D Sanitary Flow Calculations
Appendix E Storm Sewer Design Calculations
Appendix F Topographic and Legal Survey
Appendix G Sewer CCTV Reports
Appendix H Site Servicing Checklist

Appendix A

Site Servicing, Grading and Erosion and Sediment Control, Catchments Plans and Details

INLET CONTROL DEVICE DATA TABLE - STMH401

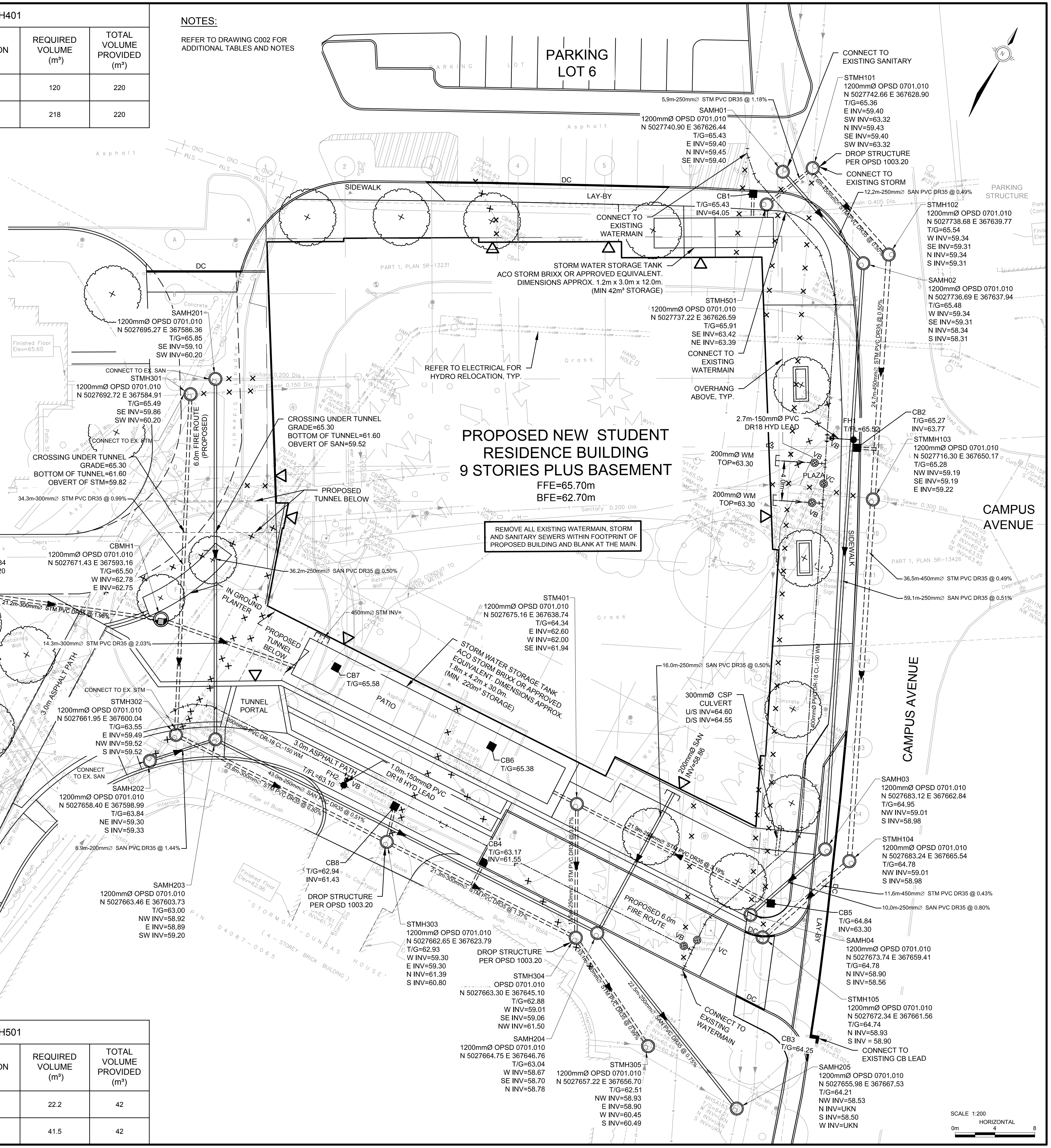
DESIGN EVENT	ICD TYPE	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	WATER ELEVATION (m)	REQUIRED VOLUME (m³)	TOTAL VOLUME PROVIDED (m³)
1:5 YR	78mmØ ORIFICE PLATE	250mmØ PVC	12.9	63.06	120	220
1:100 YR	78mmØ ORIFICE PLATE	250mmØ PVC	17.0	63.80	218	220

NOTES:

REFER TO DRAWING C002 FOR ADDITIONAL TABLES AND NOTES

LEGEND

- NEW STORM SEWER
- NEW SANITARY SEWER
- NEW WATERMAIN
- NEW MANHOLE
- NEW CATCH BASIN
- NEW WATER VALVE AND VALVE BOX
- NEW FIRE HYDRANT
- NEW ENTRANCE
- NEW FIRE DEPARTMENT CONNECTION
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- EXISTING HYDRO
- EXISTING CONDENSATE
- EXISTING STEAM
- EXISTING C-LOOP
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING LIGHT STANDARD
- EXISTING BOLLARDS
- EXISTING SIGN
- EXISTING WATERMAIN OR SEWER TO BE ABANDONED (REMOVE IF WITH EXCAVATION LIMITS)



INLET CONTROL DEVICE DATA TABLE - STMH501

DESIGN EVENT	ICD TYPE	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	WATER ELEVATION (m)	REQUIRED VOLUME (m³)	TOTAL VOLUME PROVIDED (m³)
1:5 YR	IPEX Tempest LMF 80	250mmØ PVC	4.5	64.16	22.2	42
1:100 YR	IPEX Tempest LMF 80	250mmØ PVC	5.7	64.65	41.5	42

MORRISON HERSHFIELD
200-2932 BASELINE ROAD, OTTAWA, ON K2H 1B1

KEY PLAN

ISSUED

No.	Date	Description
1	13/12/2019	ISSUED FOR SITE PLAN APPROVAL

Diamond Schmitt Architects
KWC Architects Inc.

CARLETON UNIVERSITY NEW STUDENT RESIDENCE

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE
OTTAWA ON
K1S 5B6

SITE SERVICING PLAN

Scale: 1:200
Project No: 1952
Date: 12/13/19

C001

NOTES:

GENERAL

1. COORDINATES ARE IN MTM ZONE 9 (76°30' WEST LONGITUDE) NAD-83 (ORIGINAL)
2. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA PRIOIR TO STARTING CONSTRUCTION
3. SERVICES ARE TO BE CONSTRUCTED TO 1.0m FROM FACE OF BUILDING.
4. REFER TO "SITE SERVICING AND STORMWATER MANAGEMENT DESIGN BRIEF" PREPARED BY MORRISON HERSHFIELD.
5. REFER TO GEOTECHNICAL INVESTIGATION REPORT (NOV 2019) PREPARED BY WSP FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT SHALL REVIEW EXCAVATIONS PRIOR TO THE PLACEMENT OF GRANULAR MATERIAL.
6. CONTRACTOR TO VERIFY ALL EXISTING UTILITY ELEVATIONS AT CONNECTION AND CROSSING LOCATIONS PRIOR TO CONSTRUCTION AND ADVISE THE ENGINEER OF ANY DISCREPANCIES.
7. UNLESS DIRECTED OTHERWISE ANY DAMAGED ASPHALT OR CURB (REGARDLESS OF WHETHER WITHIN OR EXTERNAL TO THE SITE) SHALL BE REINSTATED IN ACCORDANCE WITH CITY STD. DET. R10 AND S1.
8. UNLESS DIRECTED OTHERWISE THE CONTRACTOR SHALL REINSTATE ALL SIGNS, LIGHTING AND OTHER STREET FURNITURE DISTURBED BY THE WORK.
9. THE CONTRACTOR SHALL DEVELOP AND IMPLEMENT TRAFFIC MANAGEMENT PLANS FOR WORK IN RIGHT OF WAY IN ACCORDANCE WITH OTM BOOK 7.
10. CLAY SEALS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD DETAIL S8 AND SHALL BE INSTALLED AT 50m INTERVALS IN ALL PIPE TRENCHES. CLAY SEAL TO EXTEND FULL TRENCH WIDTH AND FROM BOTTOM OF TRENCH EXCAVATION TO UNDERSIDE OF ROAD STRUCTURE, WITH A MINIMUM THICKNESS OF 1m ALONG PIPE.
11. LOCATE AND CAP ALL EXISTING STORM, SANITARY AND WATER SERVICES AT THE PROPERTY LINE. ABANDON EXISTING SERVICES WITHIN THE R.O.W. PER STANDARD CITY OF OTTAWA DETAIL S11.4. (TYPICAL)

SEWERS

12. ALL STORM SEWERS, SANITARY SEWERS AND CATCH BASINS LEADS SHALL BE PVC DR 35 UNLESS OTHERWISE SPECIFIED.
13. REFER TO DETAIL ON DRAWING C002 FOR SEWER INSTALLATION.
14. MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES ON STORM SEWERS LESS THAN 900mm DIAMETER SHALL BE CONSTRUCTED WITH A 300mm SUMP. BENCHING SHALL BE INSTALLED IN MAINTENANCE HOLES ON STORM SEWERS 900mm AND ABOVE.
15. STORM SEWER MAINTENANCE HOLE COVERS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD DETAIL S24.1 ON FRAMES TO DETAIL S25.
16. CONTRACTOR SHALL MAINTAIN EXISTING SEWER FLOWS DURING CONSTRUCTION IN ACCORDANCE WITH CITY OF OTTAWA SPECIFICATIONS.
17. ALL MAINTENANCE HOLES, CATCHBASINS AND CLEANOUTS SHALL BE ADJUSTED TO POST-CONSTRUCTION GRADE.
18. CCTV INSPECTION OF ALL SEWERS SHALL BE COMPLETED AS PER CITY OF OTTAWA SPECIFICATIONS PRIOR TO THE INSTALLATION OF BASE COURSE ASPHALT.

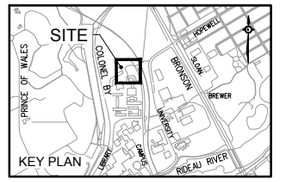
WATERMAINS

19. REFER TO DETAIL ON DRAWING C002 FOR WATERMAIN INSTALLATION.
20. ALL WATERMAIN MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE 2019 EDITION OF THE CITY OF OTTAWA STANDARD SPECIFICATIONS AND STANDARD DRAWINGS. PVC PIPE TO BE CLASS 150 DR18 TO LATEST EDITION OF A.W.W.A. SPECIFICATION C900 AND CSA B137.3 LATEST AMENDMENT WITH GASKETED BELL AND SPIGOT COUPLINGS.
21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A WATER PERMIT AS REQUIRED FROM THE CITY OF OTTAWA, AND COMPLYING WITH ALL CITY OF OTTAWA REQUIREMENTS. THE CITY MAY REQUIRE THAT CERTAIN ACTIVITIES (E.G. VALVE OPERATION, CONNECTION OF NEW WATER SERVICE TO EXISTING WATERMAIN, DISINFECTION) BE CARRIED OUT ONLY BY CITY FORCES.
22. ALL VALVES 300mm DIAMETER AND SMALLER SHALL INCLUDE A VALVE BOX AS PER W24.
23. THE NEW WATERMAIN IS TO BE INSTALLED WITH A MINIMUM OF 2.4m COVER (INCLUDING HYDRANT LEAD). WHERE 2.4m COVER IS NOT POSSIBLE, PROVIDE INSULATION IN ACCORDANCE WITH CITY OF OTTAWA STANDARD DETAILS W22 & W23.
24. THRUST RESTRAINT SHALL BE PROVIDED BY BOTH RESTRAINING/RETAINING RINGS AND THRUST BLOCKS AT ALL DEAD END CAPS, PLUGS, VALVES, BENDS AND REDUCERS AS PER CITY OF OTTAWA STANDARD DETAILS W25.3, W25.4, W25.5 AND W25.6. ALL TEMPORARY THRUST RESTRAINTS ARE THE RESPONSIBILITY OF THE CONTRACTOR.
25. TRACER WIRE SHALL BE PROVIDED FOR ALL NEW PVC WATERMAINS IN ACCORDANCE WITH THE SPECIFICATIONS AND CITY OF OTTAWA STANDARD DETAIL W36.
26. CATHODIC PROTECTION SHALL BE PROVIDED FOR ALL NEW WATERMAINS IN ACCORDANCE WITH THE SPECIFICATIONS AND CITY OF OTTAWA STANDARD DETAILS W39, W40, W41, W42 AND W47. CATHODIC PROTECTION OF EXISTING WATERMAINS SHALL ALSO BE PROVIDED AT CONNECTIONS BETWEEN EXISTING AND NEW WATERMAINS.
27. ADJUST ALL VALVE CHAMBERS, VALVE BOXES AND HYDRANTS TO FINISHED GRADE.

UTILITY NOTE

28. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWING, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM. THE CONTRACTOR WILL BE RESPONSIBLE FOR SUPPORTING AND PROTECTING ANY EXISTING UTILITIES, AS REQUIRED, IN ACCORDANCE WITH THE UTILITY OWNERS' REQUIREMENTS. CONTRACTOR IS REQUIRED TO OBTAIN LOCATES, IN ADVANCE OF EXCAVATION WORK, AND FORWARD COPIES OF THE LOCATES TO THE CONSULTANT AND THE OWNER PRIOR TO EXCAVATION.
29. ALL CROSSING OF EX. UTILITIES TO BE IN ACCORDANCE WITH CITY STD. DET. S10

MORRISON HERSHFIELD
200-2932 BASELINE ROAD, OTTAWA, ON K2H 1B1



ISSUED

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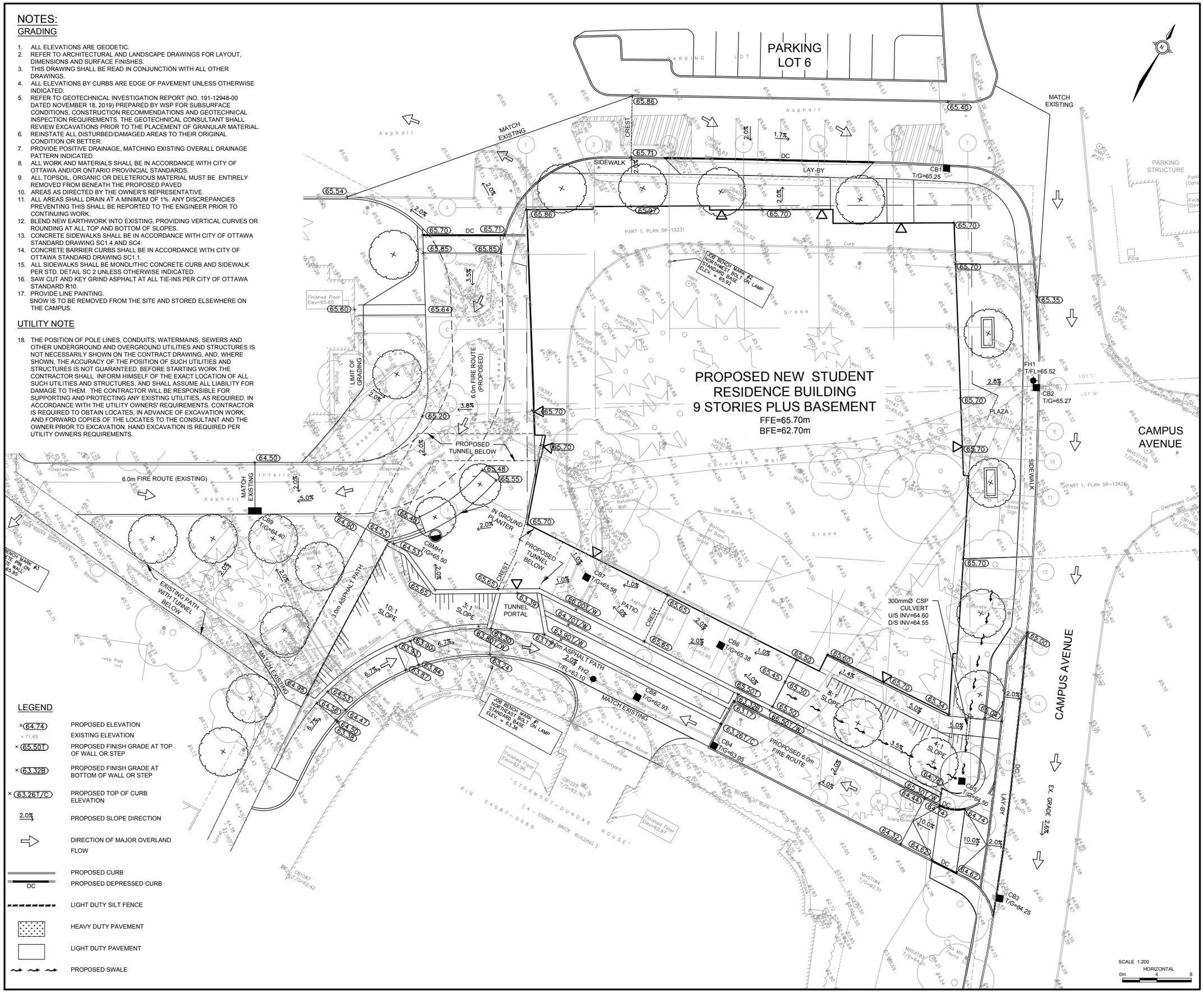
CARLETON UNIVERSITY NEW STUDENT RESIDENCE

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE
OTTAWA ON
K1S 5B6

SITE SERVICING NOTES AND SCHEDULES

Scale: AS INDICATED
Project No: 1952
Date: 12/13/19

C002



NOTES:

GRADING

1. ALL ELEVATIONS ARE GEODETIC.
2. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS FOR LAYOUT, DIMENSIONS AND SURFACE FINISHES.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS.
4. ALL ELEVATIONS BY CURBS ARE EDGE OF PAVEMENT UNLESS OTHERWISE INDICATED.
5. REFER TO GEOTECHNICAL INVESTIGATION REPORT (NO. 191-12948-00 DATED NOVEMBER 18, 2019) PREPARED BY WSP FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT SHALL REVIEW EXCAVATIONS PRIOR TO THE PLACEMENT OF GRANULAR MATERIAL.
6. REINSTATE ALL DISTURBED/DAMAGED AREAS TO THEIR ORIGINAL CONDITION OR BETTER.
7. PROVIDE POSITIVE DRAINAGE, MATCHING EXISTING OVERALL DRAINAGE PATTERN INDICATED.
8. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA AND/OR ONTARIO PROVINCIAL STANDARDS.
9. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED
10. AREAS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
11. ALL AREAS SHALL DRAIN AT A MINIMUM OF 1%. ANY DISCREPANCIES PREVENTING THIS SHALL BE REPORTED TO THE ENGINEER PRIOR TO CONTINUING WORK.
12. BLEND NEW EARTHWORK INTO EXISTING, PROVIDING VERTICAL CURVES OR ROUNDING AT ALL TOP AND BOTTOM OF SLOPES.
13. CONCRETE SIDEWALKS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD DRAWING SC1.4 AND SC4.
14. CONCRETE BARRIER CURBS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD DRAWING SC1.1.
15. ALL SIDEWALKS SHALL BE MONOLITHIC CONCRETE CURB AND SIDEWALK PER STD. DETAIL SC 2 UNLESS OTHERWISE INDICATED.
16. SAW CUT AND KEY GRIND ASPHALT AT ALL TIE-INS PER CITY OF OTTAWA STANDARD R10.
17. PROVIDE LINE PAINTING.
    SNOW IS TO BE REMOVED FROM THE SITE AND STORED ELSEWHERE ON THE CAMPUS.

UTILITY NOTE

18. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWING, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM. THE CONTRACTOR WILL BE RESPONSIBLE FOR SUPPORTING AND PROTECTING ANY EXISTING UTILITIES, AS REQUIRED, IN ACCORDANCE WITH THE UTILITY OWNERS' REQUIREMENTS. CONTRACTOR IS REQUIRED TO OBTAIN LOCATES, IN ADVANCE OF EXCAVATION WORK, AND FORWARD COPIES OF THE LOCATES TO THE CONSULTANT AND THE OWNER PRIOR TO EXCAVATION. HAND EXCAVATION IS REQUIRED PER UTILITY OWNERS REQUIREMENTS.

LEGEND

×64.74	PROPOSED ELEVATION
× 71.65	EXISTING ELEVATION
×65.50T	PROPOSED FINISH GRADE AT TOP OF WALL OR STEP
×63.32B	PROPOSED FINISH GRADE AT BOTTOM OF WALL OR STEP
×63.26T/C	PROPOSED TOP OF CURB ELEVATION
2.0%	PROPOSED SLOPE DIRECTION
⇨	DIRECTION OF MAJOR OVERLAND FLOW
	PROPOSED CURB
DC	PROPOSED DEPRESSED CURB
- - - -	LIGHT DUTY SILT FENCE
▨	HEAVY DUTY PAVEMENT
☐	LIGHT DUTY PAVEMENT
→ → →	PROPOSED SWALE

CONTRACTOR MUST CHECK & VERIFY ALL DIMENSIONS ON THE JOB.

DO NOT SCALE DRAWINGS.

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MORRISON HERSHFIELD
200-2932 BASELINE ROAD, OTTAWA, ON K2H 1B1

ISSUED

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J.G. FOOKES
100202820
Dec 13, 2019

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CARLETON UNIVERSITY NEW STUDENT RESIDENCE

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE
OTTAWA ON
K1S 5B6

GRADING PLAN

Scale: 1:200
Project No: 1952
Date: 12/13/19

C003

NOTES:
1. INSTALL AT ALL SITE ACCESS LOCATIONS.
2. TEMPORARY CONSTRUCTION ACCESS SHALL BE REMOVED ON COMPLETION OF THE WORK AND ALL DISTURBED AREAS SHALL BE RESTORED TO ORIGINAL OR BETTER CONDITION.

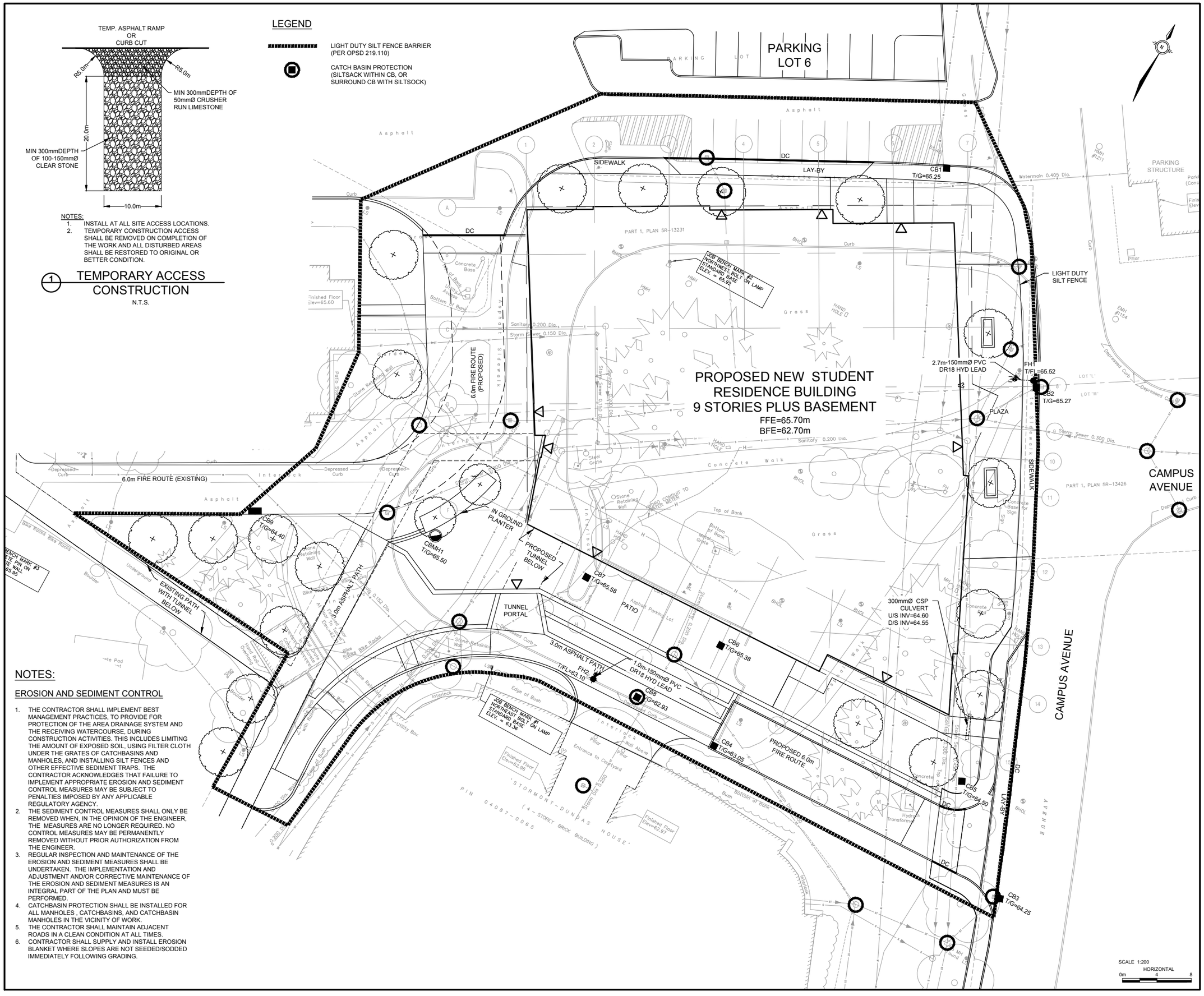
1 TEMPORARY ACCESS CONSTRUCTION

N.T.S.

LEGEND

LIGHT DUTY SILT FENCE BARRIER (PER OPSD 219.110)

CATCH BASIN PROTECTION (SILTSACK WITHIN CB, OR SURROUND CB WITH SILTSOCK)

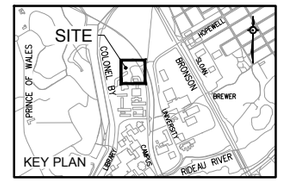


NOTES:

EROSION AND SEDIMENT CONTROL

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL, USING FILTER CLOTH UNDER THE GRATES OF CATCHBASINS AND MANHOLES, AND INSTALLING SILT FENCES AND OTHER EFFECTIVE SEDIMENT TRAPS. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
2. THE SEDIMENT CONTROL MEASURES SHALL ONLY BE REMOVED WHEN, IN THE OPINION OF THE ENGINEER, THE MEASURES ARE NO LONGER REQUIRED. NO CONTROL MEASURES MAY BE PERMANENTLY REMOVED WITHOUT PRIOR AUTHORIZATION FROM THE ENGINEER.
3. REGULAR INSPECTION AND MAINTENANCE OF THE EROSION AND SEDIMENT MEASURES SHALL BE UNDERTAKEN. THE IMPLEMENTATION AND ADJUSTMENT AND/OR CORRECTIVE MAINTENANCE OF THE EROSION AND SEDIMENT MEASURES IS AN INTEGRAL PART OF THE PLAN AND MUST BE PERFORMED.
4. CATCHBASIN PROTECTION SHALL BE INSTALLED FOR ALL MANHOLES , CATCHBASINS, AND CATCHBASIN MANHOLES IN THE VICINITY OF WORK.
5. THE CONTRACTOR SHALL MAINTAIN ADJACENT ROADS IN A CLEAN CONDITION AT ALL TIMES.
6. CONTRACTOR SHALL SUPPLY AND INSTALL EROSION BLANKET WHERE SLOPES ARE NOT SEEDED/SODDED IMMEDIATELY FOLLOWING GRADING.

MORRISON HERSHFIELD
200-2932 BASELINE ROAD, OTTAWA, ON K2H 1B1



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CARLETON UNIVERSITY NEW STUDENT RESIDENCE

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE
OTTAWA ON
K1S 5B6

EROSION AND SEDIMENT CONTROL PLAN

Scale: 1:200
Project No: 1952
Date: 12/13/19

C004

LEGEND

AREA ID — RUNOFF COEFFICIENT % — AREA ha

DRAINAGE AREA CHARACTERISTICS

CATCHMENTS AREAS

SITE OUTLINE

A1 0.30 | 0.17

A2 0.90 | 0.03

A3 0.30 | 0.113

A4 0.90 | 0.26

A5 0.54 | 0.13

A6 0.30 | 0.02

JOB BENCH MARK #1
NORTHEAST BOLT ON LAMP
STANDARD BASE
ELEV. = 63.36

JOB BENCH MARK #2
NORTHWEST BOLT ON LAMP
STANDARD BASE
ELEV. = 65.99

JOB BENCH MARK #3

CAMPUS AVENUE

"STORMONT-DUNDAS HOUSE"
(4 - STOREY BRICK BUILDING)
PIN 04087-0065

(6 - STOREY BRICK BUILDING)

SCALE 1:200
HORIZONTAL
0m 4 8

CONTRACTOR MUST CHECK & VERIFY ALL DIMENSIONS ON THE JOB.

DO NOT SCALE DRAWINGS.

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT.

MORRISON HERSHFIELD
200-2932 BASELINE ROAD, OTTAWA, ON K2H 1B1

KEY PLAN

ISSUED

No.	Date	Description
1	13/12/2019	ISSUED FOR SITE PLAN APPROVAL

LICENSED PROFESSIONAL ENGINEER
J.G FOOKES
100202020
Dec 13, 2019
PROVINCE OF ONTARIO

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CARLETON UNIVERSITY NEW STUDENT RESIDENCE

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE
OTTAWA ON
K1S 5B6

EXISTING CATCHMENTS

Scale: 1:200
Project No: 1952
Date: 12/13/19

C900

LEGEND

AREA ID
RUNOFF COEFFICIENT %
AREA ha

DRAINAGE AREA CHARACTERISTICS

CATCHMENTS AREAS

SITE OUTLINE

PARKING LOT 6

A5 0.90 0.10

CAMPUS AVENUE

PARKING STRUCTURE

CB1 T/G=65.25

DC

LAY-BY

SIDEWALK

CB2 T/G=65.27

B2 0.72 0.05

PROPOSED NEW STUDENT RESIDENCE BUILDING
9 STORIES PLUS BASEMENT
FFE=65.70m
BFE=62.70m

BLDG 0.90 0.26

6.0m FIRE ROUTE (PROPOSED)

300mmØ CSP CULVERT
U/S INV=64.60
D/S INV=64.55

A1 0.69 0.21

A2 0.90 0.01

A3 0.90 0.03

A4 0.30 0.03

PROPOSED TUNNEL BELOW

CB7 T/G=65.58

PATIO

CB6 T/G=65.38

CB5 T/G=64.50

CBMH1 T/G=65.50

B1 0.72 0.08

TUNNEL PORTAL

3.0m ASPHALT PATH

CB8 T/G=62.93

CB4 T/G=63.05

PROPOSED 6.0m FIRE ROUTE

CB3 T/G=64.25

6.0m FIRE ROUTE (EXISTING)

CB9 T/G=64.40

3.0m ASPHALT PATH

EXISTING PATH WITH TUNNEL BELOW

SCALE 1:200
HORIZONTAL
0m 4 8

CONTRACTOR MUST CHECK & VERIFY ALL DIMENSIONS ON THE JOB.

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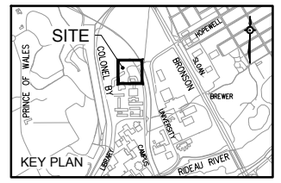
MORRISON HERSHFIELD
200-2932 BASELINE ROAD, OTTAWA, ON K2H 1B1



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J.G. FOOKES
100202820
Dec 13, 2019
PROVINCE OF ONTARIO

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CARLETON UNIVERSITY NEW STUDENT RESIDENCE

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OTTAWA ON
K1S 5B6

PROPOSED CATCHMENTS

Scale: 1:200
Project No: 1952
Date: 12/13/19

C901

Appendix B

MECP, RVCA and City of Ottawa Specific Requirements Correspondence

Date of Pre-Consultation: **November 13, 2019**

Site: **1125 Colonel By Drive / Carleton University Student Residence**

This site will use existing infrastructures own by the University.

Comments:

- Please investigate the capacity of the existing sanitary sewer network as some sanitary pipes do not have capacity
- A CCTV report is required to confirm that the existing sanitary sewer is in good condition to handle the proposed development
- Please investigate the capacity of the existing storm sewer.
- A CCTV report is required to confirm that the existing storm sewer is in good condition to handle the proposed development
- Please make sure that the outlet of the storm sewer is connected into a stormceptor otherwise installation of an onsite stormceptor is required to handle the quality of the stormflow.
- Please contact RVC to get the quality control criteria.

Servicing template and Guideline

Please find the Servicing Report Template & Study Guidelines" in the attachment and prepare the servicing study accordingly. For capacity issue, please see section 3.2.1 page 3-3 and follow this section. A completed checklist with corresponding references from the servicing study is mandatory for the completeness of the study. Please add a completed checklist in the report.

ServicingGuideli
nes_final_Dec...

Servicing Report
Template Final Versi

Required information for Water boundary conditions

Boundary conditions are required to confirm that the require fire flows can be achieved as well as availability of the domestic water pressure on the city street in front of the development. Please use Table 3-3 of the MOE Design Guidelines for Drinking-Water System to determine Maximum Day and Maximum Hour peaking factors for 0 to 500 persons and use Table 4.2 of the Ottawa Design Guidelines, Water Distribution for 501 to 3,000 persons.

1. Location of Service
2. A sketch of the proposed water service to the city watermain
3. Street Number & Name
4. Type of development and units
5. Amount of fire flow required ___l/s (Calculation as per the FUS Method).
6. Average daily demand: -l/s
7. Maximum daily demand: -l/s
8. Maximum hourly daily demand: -l/s

Please note proposed development will require 2 separate service connections from the city watermains if the basic day demand is greater than 50m^3/day to avoid the creation of a vulnerable service area. Two water meters will be required for two service connections and the service connections will have to be looped.

Utility conflict with the proposed servicing

- It is the consultant's sole responsibility to investigate the existing utilities in the proposed servicing area while preparing the Servicing and Grading Plans to avoid any conflict with the proposed services and will require a note stating this on the servicing plan.

SWM Criteria for the Catchment Area of the site being redeveloped: (Quantity control criteria)

- Allowable release rate will be pre-development rate 2 year for a local road, 5 year for Collectors.
- C Coefficient of runoff will need to be determined **as per existing conditions** but in no case more than 0.5
- TC =20 minutes or can be calculated,
- TC should not be less than 10 minutes, since the IDF curves become unrealistic less than 10min.
- Any storm events greater than 2 or 5 year, up to 100 year, and including 100-year storm event must be detained on site.

TECHNICAL BULLETIN PIEDTB-2016-01

Section 5.4.9.2,Page 5.31,

While rear yard grading will create low points and storage at each catch basin, the storage will not be considered in the available storage requirements. It will be assumed that all backyard flows in excess of the 2-year will flow towards the roads. Effective available storage will only be considered on streets and open space/park storage. Furthermore, there must be at least 30 cm of vertical clearance between the rear yard spill elevation and the ground elevation at the adjacent building envelope.

Major system storage in backyards is not to be included/accounted for in design computations, however the effect of flow attenuation can now be accounted for by assuming a constant slope ditch/swale draining to the street with the following geometry: a minimum slope of 1.5% and a minimum depth of 150 mm. The maximum allowable depth of a swale/ditch shall be 600 mm. The maximum side slope of swales/ditches shall be 3 horizontals to 1 vertical.

Section 8.3.11.6, Page 8.20:

Rear Yard storage cannot be accounted for in the water storage calculation. It should be assumed that all water in excess of the 2-year event will flow to the street. The maximum depth of flow depth in rear yards is 300 mm. Furthermore, there must be at least 30 cm of vertical clearance between the rear yard spill elevation and the ground elevation at the adjacent building envelope. See Section 5.4.9 for further information. Major system storage in backyards is not to be included/accounted for in design computations, however the effect of flow attenuation can now be accounted for by assuming a constant slope ditch/swale draining to the street.

Stormwater management criteria (Quality Control Issues)

Please note there will a section in the SWM report that will discuss about the quality control requirements for this site. It is consultant's responsibility to check with the Rideau Valley Conservation Authority (RVCA) for quality control issues and include this information in the SWM report under Quality Control Section. Please contact RVCA for further information.

Implementation considerations

- Accounting for external overland drainage
- Use of standard ICDs
- Requirement for ICD plans
- Requirement for plans showing 100-year and stress-test ponding limits
- Provide a foundation drain backwater valve installed as per Std Dwg S14.
- Provide a full port backwater valve, in the sanitary building drain, installed as per Std Dwg S14.1.

Studies required for Site Plan application

Studies Required:

- Serviceability Study
- Erosion and Sediment Control Plan, it can be combined with grading plan
- Stormwater Management Report
- Geotechnical Study
- Phase 2 Noise Control Detailed Study if the development occurs within 100m from the LRT line.
- ESA-Phase 1 Study needs to be prepared as per current MOE regulation not as per CSA standards
- ESA-Phase 2, Depend on the Phase I recommendation if required needs to be prepared as per current MOE regulation not as per CSA standard
- LRT _proximity study-Development Zone of influence – under Official Pan-under planning tag-please consult with the LRT office.

Plans Required:

a. Site Servicing Plan
b. Grade Control and Drainage Plan
c. Erosion and Sediment Control Plan
d. Pre-Development Drainage Area Plan
e. Post-Development Drainage Area Plan

MOECP application

- please consult with the local district office to verify an ECA is not required.

Relevant information

1. Servicing & site works shall be in accordance with the following documents:

    ⇨ Ottawa Sewer Design Guidelines (2012)
    ⇨ Ottawa Design Guidelines – Water Distribution (2010)

- ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
- ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (2004)
- ⇨ City of Ottawa Environmental Noise Control Guidelines (2006)
- ⇨ City of Ottawa Park and Pathway Development Manual (2012)
- ⇨ City of Ottawa Accessibility Design Standards (2012)
- ⇨ Ottawa Standard Tender Documents (2015)
- ⇨ Ontario Provincial Standards for Roads & Public Works (2015)

2. Record drawings and utility plans can be purchased from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

Regards,

Mark Fraser, P. Eng.
Project Manager
Development Review , Central Group

Planning, Infrastructure and Economic Development Department
Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. West / 110, avenue Laurier Ouest, Ottawa K1P 1J1
Tel. 613-580-2424 ext. 27791 , Fax. 613-560-6006 ,E-mail: Mark.Fraser@ottawa.ca

James Fookes

From: Daniel Glauser
Sent: Friday 06 December 2019 9:21 AM
To: Diamond, Emily (MECP)
Cc: James Fookes
Subject: RE: ECA requirements; Carleton University New Residence Building

Hi Emily,

With the stringent deadlines of this project I appreciate the quick response.

Kind Regards

Daniel Glauser
Municipal Designer - Infrastructure Ottawa
Office: 613 739 2910 Ext. 1022323
DGlauser@morrisonhershfield.com

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morrisonhershfield.com

From: Diamond, Emily (MECP) [mailto:Emily.Diamond@ontario.ca]
Sent: Friday, December 6, 2019 8:53 AM
To: Daniel Glauser <DGlauser@morrisonhershfield.com>
Subject: RE: ECA requirements; Carleton University New Residence Building

Hi Daniel,

From the information provided, the project would fall under the Ontario Regulation 525/98 exemption. Therefore an ECA would not be required for this project.

You may use this email as a record of pre-consultation.

Regards,

Emily Diamond
Environmental Officer
Ministry of the Environment, Conservation and Parks
Ottawa District Office
2430 Don Reid Drive
Ottawa, Ontario, K1H 1E1
Tel: 613-521-3450 ext 238
Fax: 613-521-5437
e-mail: emily.diamond@ontario.ca

From: Daniel Glauser <DGlauser@morrisonhershfield.com>
Sent: December 4, 2019 4:58 PM
To: Diamond, Emily (MECP) <Emily.Diamond@ontario.ca>
Cc: James Fookes <JFookes@morrisonhershfield.com>
Subject: ECA requirements; Carleton University New Residence Building

Hi Emily,

We are designing a new student residence on Carleton University Campus located on Campus Avenue (Link to Map location).
As a result of the Pre-consultation meeting process, the City of Ottawa has asked that:

*"**MOECP application***

- *please consult with the local district office to verify an ECA is not required."*

As identified in the attached GeoOttawa plan, the servicing is for a "single lot". Our intention is to connect to the existing private separated storm and sanitary sewer adjacent to Campus Avenue. The University neither services industrial land, nor is located on industrial land. Stormwater quantity control will be provided in accordance with City of Ottawa requirements.

We will also be relocating existing watermains, storm and sanitary sewers adjacent to the proposed building.

We've contacted the RVCA with regards to the requirements for the on-site quality control / treatment measures and are waiting on a response. If required we will provide quality control using an OGS and or LID measures.

We believe that this is considered an exemption under O.Reg. 525/98 and therefore requires no ECA application/approval. Could you confirm this?
I've attached a few plans showing the intended building as well as the site servicing.

Please don't hesitate to contact us if you have and questions or comments.

Kind Regards

Daniel Glauser
Municipal Designer - Infrastructure Ottawa
Office: 613 739 2910 Ext. 1022323
DGlauser@morrisonhershfield.com

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Appendix C

Water Demand and FUS Calculations

CU - New Flagship Residence Building - FUS Calculations

Project Name	CU - New Flagship Residence Building
Project Number	190444600
Site Address	1125 Colonel By Drive
Completed By	DG
Date	12-Sep-19

(Per Fire Underwriters Survey, Water Supply for Public Fire Protection, 1999)

1. Determine Estimated Fire Flow based on Building Floor Area

F= $220\ C\ \sqrt{A}$

F= Required flow in litres / minute
A= Total floor area in m^2
C= Coefficient related to Construction
= 1.5 for wood frame construction
= 1.0 for ordinary construction
= 0.8 for non-combustible construction
= 0.6 for fire-resistive construction

C= 0.8

Floor Areas

Floor	Area (m²)
Basement	1312
L1	2344
L2	1856
L3	1856
L4	1869
L5	1869
L6	1489
L7	1489
L8	1100
L9	1100
Total	16284

Area excl. basement at least 50% below grade = 14972 m^2

A= 14972 m^2

F= 21535.5 L/min

Round to nearest 1000 L/m, F = 22000.0 L/min

2. Adjust flow based on Fire hazard and contents

A	Non-combustible	-25%
B	Limited Combustible	-15%
C	Combustible	0%
D	Free Burning	15%
E	Rapid Burning	25%

Type of Construction (A,B,C,D)	B	
Adjustment Factor	-15%	
Flow From 1.	22000.0	L/min
Adjusted Flow	18700.0	L/min
Minimum Flow (2000 L/min)	18700.0	L/min
Flow	18700.0	L/min

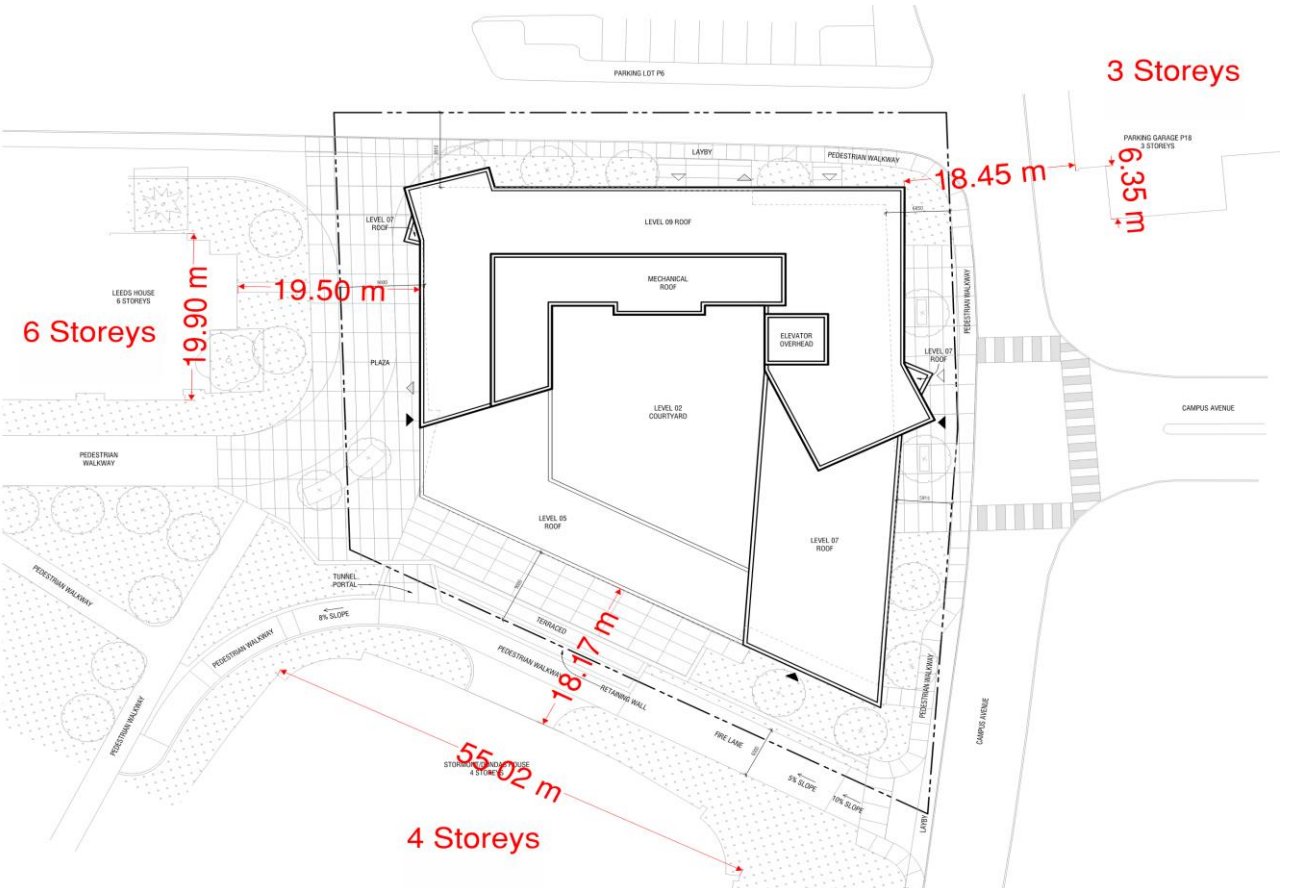
3. Reduce flow from No. 2. based on automatic sprinkler protection

Flow from 2.	18700.0	L/min
Complete Automatic Sprinkler Protection (yes/no)	Yes	
Reduction	30%	
Water supply is standard (yes/no)	Yes	
Additional Reduction	10%	
Sprinkler System is fully supervised (yes/no)	Yes	
Additional Reduction	10%	
Total Reduction	50%	
Flow after Sprinkler Reduction	9350.0	L/min

4. Adjacent Structures / Fire Separation with other buildings

Flow from 3.	9350.0	L/min

Figure 1: Adjacent Buildings



Exposure charge based on Table G5:

Side	Construction Type	Storeys	Length (m)	LH Factor
North	N/A	0	0	0
East	Fire resistive with unprotected openings	3	6	18
South	Fire resistive with unprotected openings	4	55	220
West	Fire resistive with unprotected openings	6	20	120

Side	Separation Distance (m)	Exposure Charge
North	>45	0
East	18.5	10%
South	18.2	15%
West	19.5	15%
	Cumulative Increase (Max 75%)	40%

Flow Increased for Adjacent Structures	13090.0	L/min
Maximum Permitted Flow (45 000 L/min)	13090.0	L/min
Minimum Permitted Flow (2 000 L/min)	13090.0	L/min
Required Fire Flow (rounded to nearest 1000 L/m)	13000.0	L/min
	216.67	L/s

CU - New Flagship Residence Building - Water Demand Calculations

Project Name	CU - New Flagship Residence Building
Project Number	190444600
Site Address	1125 Colonel By Drive
Completed By	DG

From City of Ottawa Water Distribution Systems Guidelines

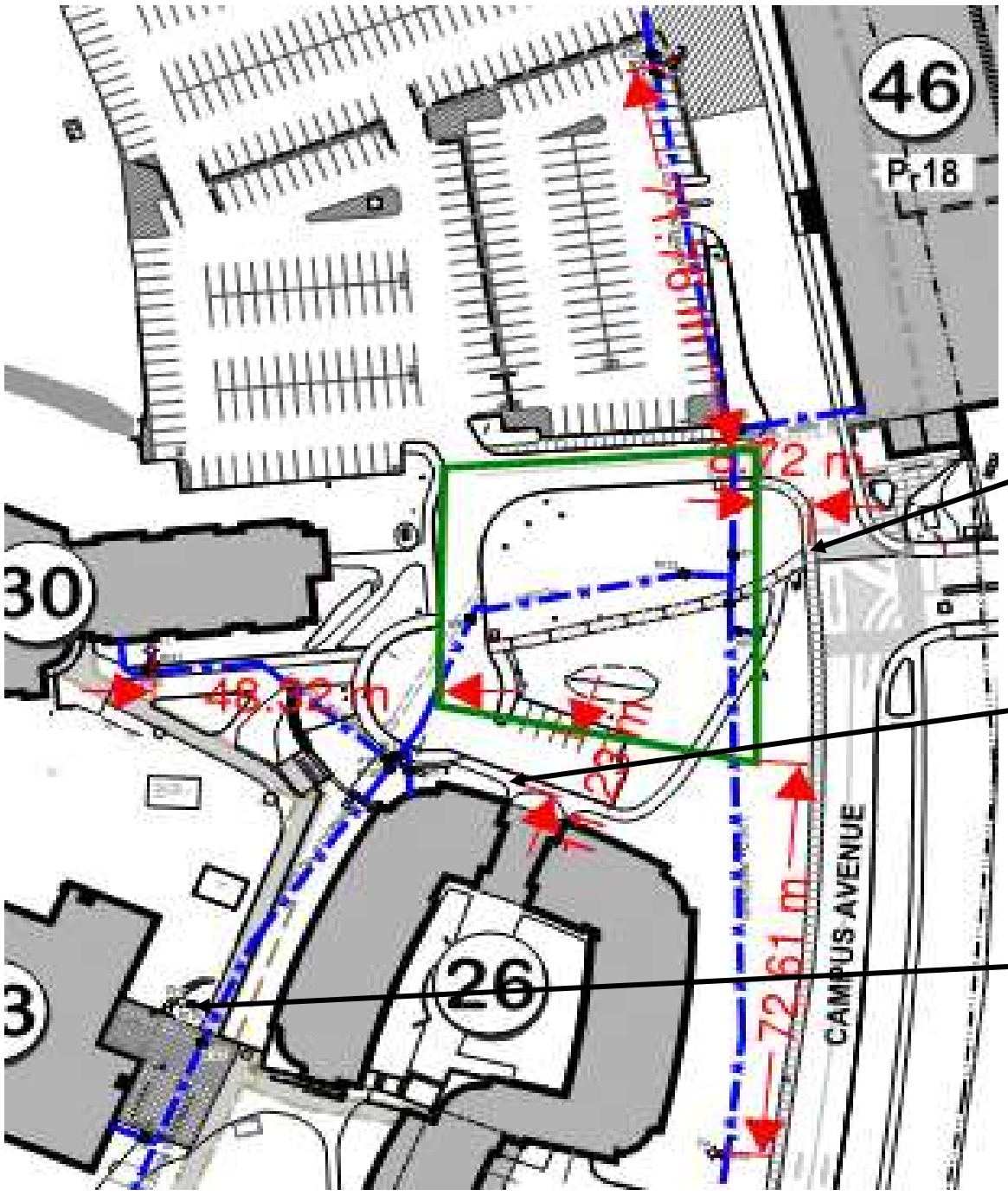
Occupancy Preliminary Design

	ea.		persons per unit	
Bachelor/Studio	0	ea	1.4	0
1 Bedroom	4	ea	1.4	5.6
2 Bedroom	12	ea	2.1	25.2
3 Bedroom	142	ea	3.1	440.2
				471

Building Occupancy	471	people	Posted per Preliminary Design
Residential	471	persons	
Per Capita Flow	350	l/per/d	City of Ottawa Water Design Guidelines Table 4.2 - residential
Daily average flow	164850	l/d	
Daily average flow	1.91	l/s	
Maximum Daily Demand Peak			
Peak Factor	2.96	x average day	MOE Design Guidelines for Drinking-Water System, Table 3-3
Peak Flow	5.64	l/s	
	89.46	GPM	
Maximum Hourly Demand Peak			
Peak Factor	4.42	x average day	MOE Design Guidelines for Drinking-Water System, Table 3-3
Peak Flow	8.43	l/s	
	133.55	GPM	
Total Max Daily water demand	5.64	l/s	
Total Max Hourly water demand	8.43	l/s	
Fire Demand (refer to FUS calc)	216.67	l/s	
Max Day plus Fire demand	222.31	l/s	

CU - New Flagship Residence Building - Water Demand Calculations

Key Plan showing distances to hydrants within 150m



Hydrant	Distance from building (m)	Class	Contribution to required fire flow (L/m)
1	9	AA*	5700
2	11	AA*	5700
3	48	AA*	5700
4	72	AA*	5700
5	73	AA*	5700

Available Flow 28500 L/min

Required Flow (FUS calc) 13000 L/min

*Hydrants not colour coded - class AA assumed.

James Fookes

From: Ran Zaig <rzaig@kwc-arch.ca>
Sent: Monday 09 December 2019 9:31 AM
To: James Fookes
Cc: Daniel Glauser; Nigel Tai; Jose Trinidad; Jessica Musialski
Subject: 2019-12-09_CU_NSRes - Information required for Fire Underwriters Survey Calculation
Attachments: Tech bulletin ISTB-2018-02_FUS extracts.pdf

Good morning James and Daniel,

Please see my reply below.

Regards,

Ran Zaig
Associate Partner, Architect
B.ARCH. l OAA l MRAIC l =^.^=

KWC architects
383 Parkdale Avenue, Suite 201, Ottawa, Ontario, K1Y 4R4
T: 613-238-2117; 223 **F:** 613-238-6595 **E:** rzaig@kwc-arch.com

---

From: James Fookes [mailto:JFookes@morrisonhershfield.com]
Sent: November-29-19 09:12 AM
To: Ran Zaig
Cc: Daniel Glauser
Subject: CU_NSRes - Information required for Fire Underwriters Survey Calculation

Hi Ran,

For Site Plan Control submission we are required to provide supporting correspondence for our assumptions with respect to the Fire Underwriters Survey fire flow calculations. These calculations are provided as part of the Site Servicing report, and are used by the City to verify that sufficient fire flow is available at hydrants in the vicinity of the building.

Could you please confirm the following.

1. GFA per floor and total GFA.***[KWC R.Z.]*** as previously provided via email form Nigel Tai 2019-11-29 (10:01)

2. Type of construction, based on the ISO classes and additional notes as follows. The ISO guide referenced here is attached as a PDF.***[KWC R.Z.]*** Using he definitions that are listed under item ***2. Classification of Basic Construction Type***, this building is proposed to be **Construction class 3 (Non-combustible).**

A. *Determine the type of construction.*

- Coefficient *C* in the FUS method is equivalent to coefficient *F* in the ISO method:

Correspondence between FUS and ISO construction coefficients

FUS type of construction	ISO class of construction	Coefficient *C*
Fire-resistive construction	Class 6 (fire resistive)	0.6
	Class 5 (modified fire resistive)	0.6
Non-combustible construction	Class 4 (masonry non-combustible)	0.8
	Class 3 (non-combustible)	0.8
Ordinary construction	Class 2 (joisted masonry)	1.0
Wood frame construction	Class 1 (frame)	1.5

However, the FUS definition of fire-resistive construction is more restrictive than those of ISO construction classes 5 and 6 (modified fire resistive and fire resistive). FUS requires structural members and floors in buildings of fire-resistive construction to have a fire-resistance rating of 3 hours or longer.

- With the exception of fire-resistive construction that is defined differently by FUS and ISO, practitioners can refer to the definitions of the ISO construction classes (and the supporting definitions of the types of materials and assemblies that make up the ISO construction classes) found in the current ISO guide [4] (see Annex i) to help select coefficient *C*.
- To identify the most appropriate type of construction for buildings of mixed construction, the rules included in the current ISO guide [4] can be followed (see Annex i). For a building to be assigned a given classification, the rules require ⅔ (67%) or more of the total wall area and ⅔ (67%) or more of the total floor and roof area of the building to be constructed according to the given construction class or a higher class.

3. Occupancy type based on the following classifications. Definitions are included in the attached PDF.***[KWC R.Z.]*** Based on the ***Occupancy Type Examples*** in the ISO document the propose building will be categorized ***Limited-Combustible (C-2)***

- The charge for occupancy class in the FUS method corresponds with the occupancy factor *O* in the ISO method (subtracting 1.00 from the ISO *O* factor values and converting to a percentage will yield the FUS charges):

Correspondence between FUS occupancy charges and ISO occupancy factors

FUS occupancy class	ISO occupancy combustibility class	Occupancy charge	Occupancy factor *O*
Non-combustible	C-1 (non-combustible)	–25%	0.75
Limited combustible	C-2 (limited combustibility)	–15%	0.85
Combustible	C-3 (combustible)	No charge	1.00
Free burning	C-4 (free burning)	+15%	1.15
Rapid burning	C-5 (rapid burning or flash burning)	+25%	1.25

4. Confirm that the building will be provided with complete automatic sprinkler protection.***[KWC R.Z.]*** Confirmed.

5. Confirm whether the sprinkler system is fully supervised. This requires a supervisory signal and water flow alarm to be transmitted to an approved monitoring location, meeting the NFPA requirements as follows:***[KWC R.Z.]*** Yes fully supervised sprinkler system will be provided.

- The FUS guide offers an additional credit of up to 10% for sprinkler systems that are considered "fully supervised", but the phrase is not clearly defined. In its *Life Safety Code* [10], the National Fire Protection Association (NFPA) describes "supervision" of sprinkler systems as requiring two types of signals:
  - a distinctive supervisory signal to indicate conditions that could impair the satisfactory operation of the sprinkler system (a fault alarm), which is to sound and be displayed, either at a location within the building that is constantly attended by qualified personnel (such as a security room), or at an approved remotely located receiving facility (such as a monitoring facility of the sprinkler system manufacturer); and
  - a water flow alarm to indicate that the sprinkler system has been activated, which is to be transmitted to an approved, proprietary alarm-receiving facility, a remote station, a central station or the fire department.

Thanks and regards,
James

James Fookes, P.Eng.
Department Manager, Municipal Infrastructure
jfookes@morrisonhershfield.com

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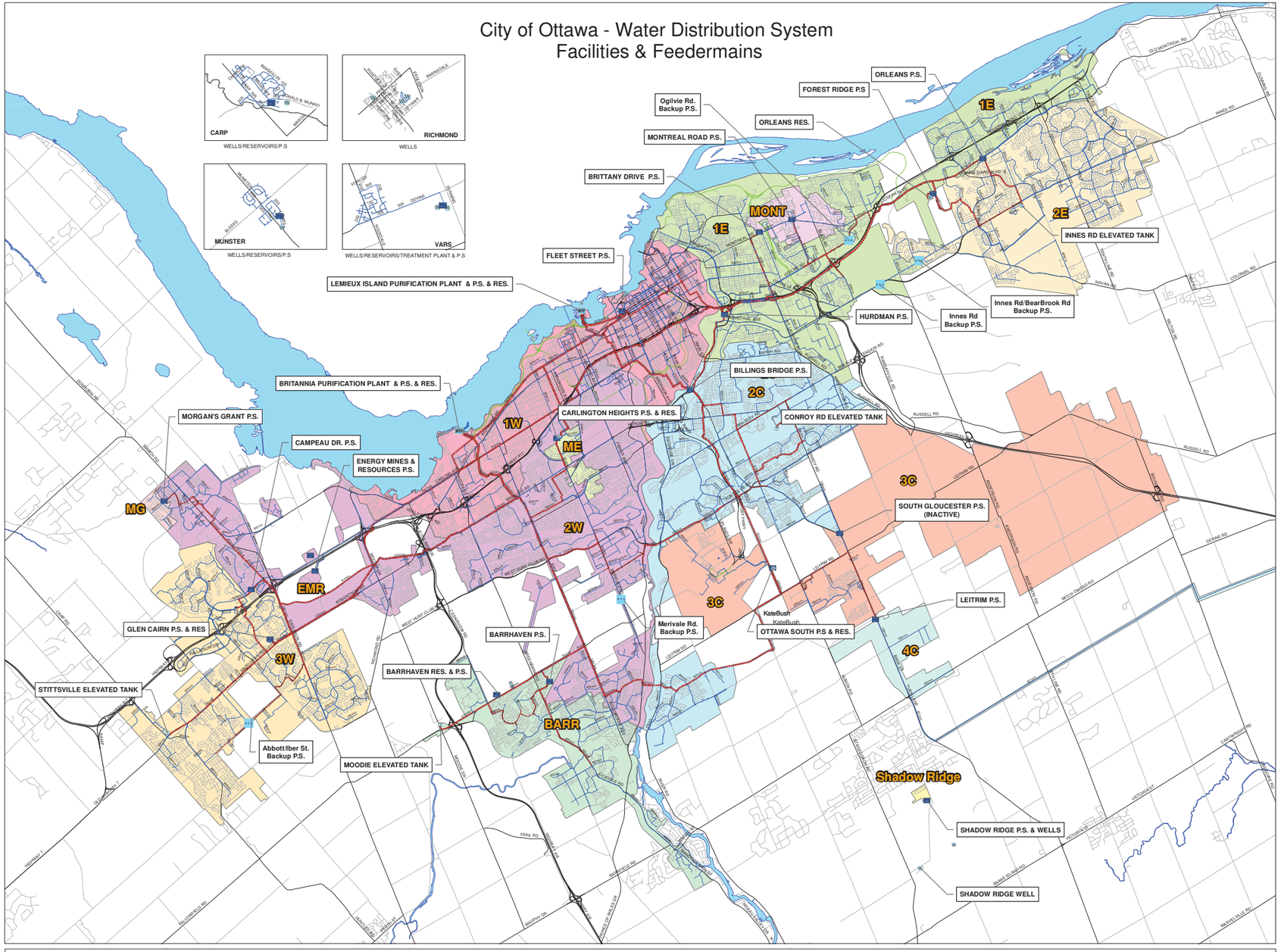
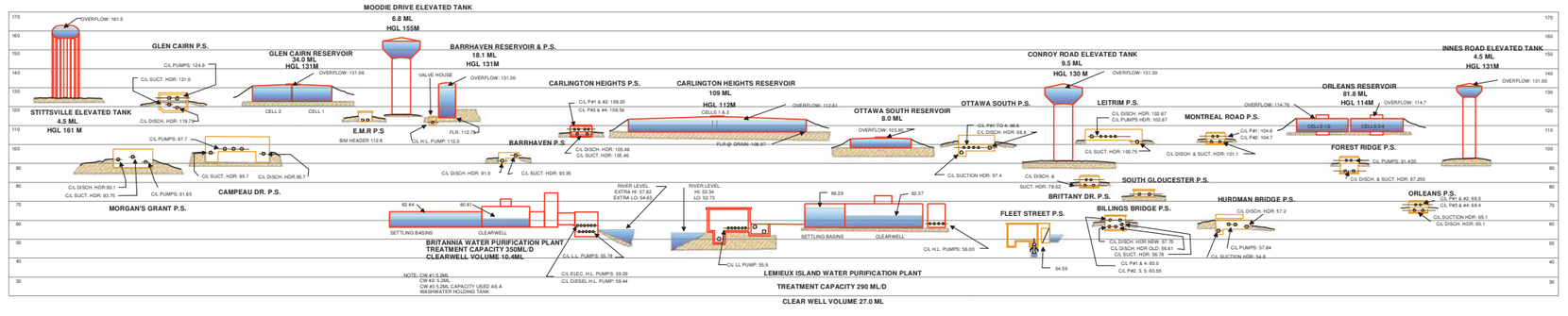
GROSS FLOOR AREA CALCULATIONS (GFA)		
Level	Area Type	Area
LEVEL 02	Gross Floor Area	1259.60 m²
LEVEL 03	Gross Floor Area	1260.42 m²
LEVEL 04	Gross Floor Area	1258.99 m²
LEVEL 05	Gross Floor Area	1258.99 m²
LEVEL 06	Gross Floor Area	929.16 m²
LEVEL 07	Gross Floor Area	999.85 m²
LEVEL 08	Gross Floor Area	637.87 m²
LEVEL 09	Gross Floor Area	429.77 m²
Total Area		8034.66 m²

GROSS FLOOR AREA CALCULATIONS (EXEMPT)		
Level	Area Type	Area
BASEMENT (TUNNEL LEVEL)	Exempt	1311.53 m²
LEVEL 01	Exempt	2343.95 m²
LEVEL 02	Exempt	596.79 m²
LEVEL 03	Exempt	595.97 m²
LEVEL 04	Exempt	610.06 m²
LEVEL 05	Exempt	610.07 m²
LEVEL 06	Exempt	559.54 m²
LEVEL 07	Exempt	488.84 m²
LEVEL 08	Exempt	462.10 m²
LEVEL 09	Exempt	670.21 m²
Total Area		8249.06 m²

GROSS FLOOR AREA CALCULATIONS (COMBINED TOTAL)		
Level	Area Type	Area
BASEMENT (TUNNEL LEVEL)	Exempt	1311.53 m²
LEVEL 01	Exempt	2343.95 m²
LEVEL 02	Exempt	596.79 m²
LEVEL 02	Gross Floor Area	1259.60 m²
LEVEL 03	Exempt	595.97 m²
LEVEL 03	Gross Floor Area	1260.42 m²
LEVEL 04	Exempt	610.06 m²
LEVEL 04	Gross Floor Area	1258.99 m²
LEVEL 05	Exempt	610.07 m²
LEVEL 05	Gross Floor Area	1258.99 m²
LEVEL 06	Exempt	559.54 m²
LEVEL 06	Gross Floor Area	929.16 m²
LEVEL 07	Exempt	488.84 m²
LEVEL 07	Gross Floor Area	999.85 m²
LEVEL 08	Exempt	462.10 m²
LEVEL 08	Gross Floor Area	637.87 m²
LEVEL 09	Exempt	670.21 m²
LEVEL 09	Gross Floor Area	429.77 m²
Total Area		16283.72 m²

City of Ottawa - Water Distribution System Facilities & Feedermains





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
- 2C
- 2E
- 2W
- 3C
- 3W
- 4C
- BARR
- EMR
- ME
- MG
- MONT
- SHAD

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: 31 July 2013

Appendix D

Sanitary Flow Calculations

CU - New Flagship Residence Building - Sanitary Flow Estimate

Occupancy Based Calculation

Occupancy	471	persons	(per Architectural correspondence)
Per Capita Flow	400	l/c.d	(Sewer Design Guidelines, Appendix 4-A)
Daily average flow	188 400	l/d	
	188.4	m^3/d	
Peak Factor	1.5		(Sewer Design Guidelines, Figure 4.3)
Peak Flow	3.27	l/s	
Site Area	0.8035	ha	
Infiltration allowance	0.33	l/s.gross ha	
Infiltration flow	0.265155	l/s	
Peak Flow	3.54	l/s	

Building Use Peak Flow

Gross Area	0.8035	ha
Institutional Average Flow	28 000	L/ha/d
Peaking Factor	1.5	
Peak Extraneous Flows	0.28	L/s/effective gross ha
Peak Flow	22 498	L/day
	0.26	L/sec

Peak flow occurs based on the occupancy-based estimate, so a peak sanitary flow of 3.5 L/sec will be used for design.

Designed: **D. Glauser**		Project: **CU - New Flagship Residence Building** **Proposed Servicing**	
Checked: **J. Fookes**	Date: **December 9, 2019**	Location: **1125 Colonel By Drive**	
Dwg Reference: **C-001**	File Ref: **190444600**		Sheet No.: **1 of 1**

Appendix E

Storm Sewer Design Calculations

1. Existing Conditions & Release Rate

Carleton University new Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

Existing Drainage Area Characteristics

Drainage Area	Area, A (ha)	Runoff Coefficient, R
A1	0.17	0.30
A2	0.032	0.90
A3	0.113	0.30
A4	0.256	0.90
A5	0.127	0.54
A6	0.024	0.30
Total	0.722	0.58

Asphalt Area:	R = 0.90
Grassy Area:	R = 0.30
Building Area:	R = 0.90
Gravel Area:	R = 0.50
Concrete Area:	R = 0.90

Existing Conditions

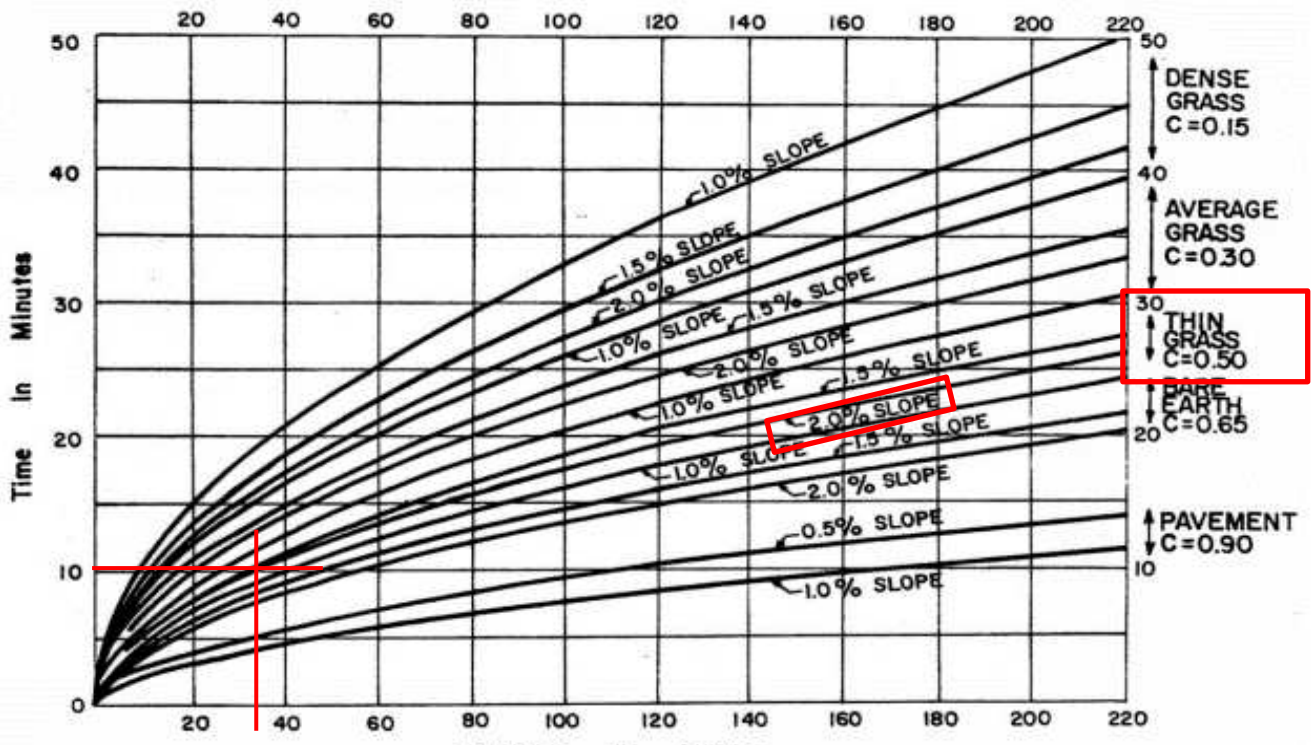
$Q = RAIN$ where Q = runoff rate (L/s)
R = runoff coefficient
i = rainfall intensity (mm/hr)
A = drainage area (ha)
N = 2.78

and $i = \frac{A}{(T_d + C)^B}$

Determinination of Time of Concentration, using Inlet Time Graph (City of Ottawa Sewer Design Guidelines, Appendix 5D):

Existing drainage area with longest flow path = A1
Approx. length of longest flow path (remote point to point of entry) = 35 m
Surface type = Thin grass
Approximate surface slope = >2%

RELATIONSHIP BETWEEN DISTANCE OF REMOTE POINT IN TRIBUTARY AREA TO POINT OF ENTRY TO SEWER AND TIME TAKEN FOR PARTICLE OF WATER TO TRAVEL THIS DISTANCE FOR VARIOUS SURFACE SLOPES AND IMPERVIOUSNESS



T_d = Time of Concentration = 10 (min)

Return Period (Years)	A	B	C	Intensity, I (mm/hr)	Area (ha)	Runoff Coefficient, R (Note 1)	Runoff Rate, Q (L/s)
2	732.951	0.81	6.199	76.8	0.722	0.58	89.5
5	998.071	0.814	6.053	104.2	0.722	0.58	121.5
100	1735.688	0.82	6.014	178.6	0.722	0.73	260.2

Note 1: For 100-year event, Runoff Coefficient is increased by 25% to a maximum of 1.0.

Allowable Release Rate

Criteria for calculation of allowable release rate:

Return Period	2	year (to suit capacity of downstream sewers)
Maximum Runoff Coefficient	0.5	
Time of Concentration	10	minutes

Return Period (Years)	A	B	C	Intensity, I (mm/hr)	Area (ha)	Runoff Coefficient, R	Runoff Rate, Q (L/s)
2	732.951	0.81	6.199	76.8	0.722	0.50	77.1

Allowable release rate from site in 100-year storm is 77.1 L/s

2. Proposed Uncontrolled Flow

Carleton University new Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

Summary of All Proposed Drainage Areas

Drainage Area	Area, A (ha)	Runoff Coefficient, R (5-year event)	Runoff Coefficient, R (100-year event, Note 1)
A1	0.176	0.67	0.84
A2	0.013	0.90	1.00
A3	0.025	0.90	1.00
A4	0.026	0.30	0.38
A5	0.102	0.90	1.00
B1	0.075	0.72	0.90
B2	0.046	0.72	0.90
BLDG	0.260	0.90	1.00
Total	0.723	0.79	0.92

(Refer to Proposed Storm Drainage Area Plan)

Proposed Uncontrolled Drainage Area Characteristics

Drainage Area	Area, A (ha)	Runoff Coefficient, R (5-year event)	Runoff Coefficient, R (100-year event, Note 1)
B1	0.075	0.72	0.91
B2	0.046	0.72	0.90
Total	0.121	0.72	0.90

(Refer to Proposed Storm Drainage Area Plan)

Note 1: For 100-year event, Runoff Coefficient is increased by 25% to a maximum of 1.0.

Runoff coefficients used in calculations:

Asphalt Area:	R = 0.90
Grassy Area:	R = 0.30
Building Area:	R = 0.90
Gravel Area:	R = 0.50
Permeable Pavers	R = 0.60
Concrete Area:	R = 0.90

Proposed Uncontrolled Runoff

Q = RAIN where Q = runoff rate (L/s)

R = runoff coefficient
i = rainfall intensity (mm/hr)
A = drainage area (ha)
N = 2.78

and $i = \frac{A}{(T_d + C)^B}$

T_d = Time of Concentration = 10 (min)

Return Period (Years)	A	B	C	Intensity, I (mm/hr)	Area (ha)	Runoff Coefficient, R	Runoff Rate, Q (L/s)
5	998.071	0.814	6.053	104.2	0.121	0.72	25.4
100	1735.688	0.82	6.014	178.6	0.121	0.90	54.4

Remaining Allowable Release Rate

Total Allowable Release Rate	77.1 (L/s)
Uncontrolled Runoff (100 year)	54.4 (L/s)
Remaining Allowable Release Rate	22.7 (L/s)

Runoff from remaining drainage areas in 100-year event will be controlled to 22.7 L/s

3a. Proposed Storage (South Tank)

Carleton University New Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

Proposed Controlled Drainage Area Characteristics

Drainage Area	Area, A (ha)	Runoff Coefficient, R (5-year event)	Runoff Coefficient, R (100-year event, Note 1)
BLDG	0.260	0.90	1.00
A1	0.176	0.67	0.84
A2	0.013	0.90	1.00
A3	0.025	0.90	1.00
A4	0.026	0.30	0.38
Total	0.500	0.79	0.91

(Refer to Proposed Storm Drainage Area Plan)

Note 1: For 100-year event, Runoff Coefficient is increased by 25% to a maximum of 1.0.

Allowable Release Rate from storage (100-year event) = 17.02 (L/s)

Average release rate for calculation of storage volume = 8.51 (L/s) (Conservatively estimated as 50% of allowable release rate)

Orifice Sizing

Q = CA(2gH)^0.5

C = 0.61

Design Flow Rate = 17.0 (L/s)

Proposed 100-year tank depth = 1.80 (m)

Proposed 100-year head above centreline of orifice = 1.74 (m)

Orifice Area = 4782 (mm2)

Orifice diameter = 78 (mm) (if <75mm then vortex ICD required)

Refer to Sheet 5a for detailed orifice calculations

Release Rates during 5-year event

Water depth during 5-year event = 0.99 (m) (based on result of Req. Storage Vol. calc below)

Proposed 5-year head above centreline of orifice = 0.92 (m)

Maximum release rate during 5-year event = 12.86 (L/s) (based on orifice calculation)

Average release rate during 5-year event = 6.43 (L/s) (Refer to attached calculation sheet)

Required Storage Volume (using Modified Rational Method)

Q = RAIN

Q = runoff rate (L/s)

R = runoff coefficient

i = rainfall intensity (mm/hr)

A = drainage area (ha)

N = 2.78

$$i = \frac{A}{(T_d + C)^B}$$

where i = Rainfall Intensity (mm/hr)

T_d = Time of Concentration (min)

	5-Year Event				100-Year Event			
Time, Td (min)	Intensity (mm/hr)	Peak Flow (L/s)	Average Release Rate (L/s)	Storage Volume (m^3)	Intensity (mm/hr)	Peak Flow (L/s)	Average Release Rate (L/s)	Storage Volume (m^3)
10	104.19	114.1	6.43	64.6	178.56	195.5	8.51	112.2
15	83.56	91.5	6.43	76.5	142.89	156.4	8.51	133.1
20	70.25	76.9	6.43	84.6	119.95	131.3	8.51	147.4
25	60.90	66.7	6.43	90.4	103.85	113.7	8.51	157.8
30	53.93	59.0	6.43	94.7	91.87	100.6	8.51	165.7
40	44.18	48.4	6.43	100.7	75.15	82.3	8.51	177.0
50	37.65	41.2	6.43	104.4	63.95	70.0	8.51	184.5
60	32.94	36.1	6.43	106.7	55.89	61.2	8.51	189.7
80	26.56	29.1	6.43	108.7	44.99	49.3	8.51	195.6
100	22.41	24.5	6.43	108.6	37.90	41.5	8.51	197.9
120	19.47	21.3	6.43	107.2	32.89	36.0	8.51	198.0
140	17.27	18.9	6.43	104.8	29.15	31.9	8.51	196.6
160	15.56	17.0	6.43	101.8	26.24	28.7	8.51	194.1
180	14.18	15.5	6.43	98.2	23.90	26.2	8.51	190.7

200	13.05	14.3	6.43	94.3	21.98	24.1	8.51	186.7
220	12.10	13.2	6.43	90.0	20.37	22.3	8.51	182.1
240	11.29	12.4	6.43	85.5	19.01	20.8	8.51	177.1
260	10.60	11.6	6.43	80.7	17.83	19.5	8.51	171.7
280	9.99	10.9	6.43	75.8	16.80	18.4	8.51	166.0
300	9.46	10.4	6.43	70.7	15.89	17.4	8.51	160.0
320	8.98	9.8	6.43	65.4	15.09	16.5	8.51	153.8
340	8.56	9.4	6.43	60.0	14.37	15.7	8.51	147.3

minimum time = time of concentration

Storage volume used	108.7	m^3	
Storage volume used	198.0	m^3	

A storage tank with a minimum volume of 198 m^3 is required.

4a. Tank Draindown Time (South Tank)

Carleton University new Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

Release Rate from Storage Tank

Equation 4.10 from MOE Stormwater Design Guidelines:

$$t = \frac{2A_P}{CA_P(2g)^{0.5}}\left({h_1}^{0.5} - {h_2}^{0.5}\right)$$

where:

Tank Volume	198.0	cu.m	
Water depth when full, h1	1.8	m	
Water depth when empty, h2	0.0	m	
Orifice coefficient, C	0.61		
Acceleration due to gravity, g	9.81	m/s²	
Tank Area, Ap	110.0	sq.m	(rectangular tank with vertical sides)

Incremental draindown calculation (100-year event), based on equivalent orifice to proposed ICD:

Water depth at start of step, h1 (m)	Water depth at end of step, h1 (m)	Duration of step, t (s)	Release rate (L/s)
1.80	1.75	320	17.2
1.75	1.70	324	17.0
1.70	1.65	329	16.7
1.65	1.60	334	16.5
1.60	1.55	339	16.2
1.55	1.50	345	16.0
1.50	1.45	351	15.7
1.45	1.40	357	15.4
1.40	1.35	363	15.1
1.35	1.30	370	14.9
1.30	1.25	377	14.6
1.25	1.20	385	14.3
1.20	1.15	393	14.0
1.15	1.10	401	13.7
1.10	1.05	411	13.4
1.05	1.00	421	13.1
1.00	0.95	431	12.8
0.95	0.90	443	12.4
0.90	0.85	455	12.1
0.85	0.80	469	11.7
0.80	0.75	484	11.4
0.75	0.70	500	11.0
0.70	0.65	518	10.6
0.65	0.60	539	10.2
0.60	0.55	562	9.8
0.55	0.50	588	9.4
0.50	0.45	618	8.9
0.45	0.40	653	8.4
0.40	0.35	696	7.9
0.35	0.30	747	7.4
0.30	0.25	813	6.8
0.25	0.20	899	6.1
0.20	0.15	1,020	5.4
0.15	0.10	1,210	4.5
0.10	0.05	1,577	3.5
0.05	0.00	3,808	1.4
	Total draindown duration	22,846	seconds
		6	hours

Average release rate (by water depth) 11.5 L/s

Incremental draindown calculation (5-year event), based on equivalent orifice to proposed ICD:

Water depth at start of step, h1 (m)	Water depth at end of step, h1 (m)	Duration of step, t (s)	Release rate (L/s)
0.99	0.94	433	12.7
0.94	0.89	445	12.4
0.89	0.84	458	12.0
0.84	0.79	472	11.7
0.79	0.74	487	11.3
0.74	0.69	504	10.9
0.69	0.64	522	10.5
0.64	0.59	543	10.1
0.59	0.54	566	9.7
0.54	0.49	593	9.3
0.49	0.44	625	8.8
0.44	0.39	661	8.3
0.39	0.34	705	7.8
0.34	0.29	759	7.2
0.29	0.24	828	6.6
0.24	0.19	920	6.0
0.19	0.14	1,051	5.2
0.14	0.09	1,263	4.4
0.09	0.04	1,703	3.2
	Total draindown duration	13,537	seconds
		4	hours

Average release rate (by water depth) **8.9 L/s**

5a. Orifice Plate Sizing (South Tank)

Carleton University new Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

ICD sizing - 100 year

100-yr elevation	63.80	m
Invert elevation	61.94	m
Outlet pipe dia	250	mm

Orifice Sizing:

100-yr depth	1.74	m (depth above centreline of orifice)
Design flow	17.0	l/s
Orifice area	4782	mm² (calculated by Orifice Equation: $Q=CA(2gh)^{0.5}$ where C=0.61)
Orifice diameter	78	mm (if less than 75mm then vortex ICD required)

ICD sizing - 5 year

5-yr elevation	63.06	m
Invert elevation	61.94	m
Outlet pipe dia	250	mm

Orifice Sizing:

5-yr depth	0.99	m (depth above centreline of orifice)
5-year flow	12.9	l/s
Orifice area	4782	mm² (calculated by Orifice Equation: $Q=CA(2gh)^{0.5}$ where C=0.61)
Orifice diameter	78	mm (if less than 75mm then vortex ICD required)

South Tank Outlet				
DESIGN EVENT	**DIAMETER OF OUTLET PIPE**	**ICD**	**DESIGN FLOW (l/s)**	**UPSTREAM HEAD (m)**
1:5 YR	250mm	78mm Circular Orifice Plate	12.9	0.99
1:100 YR	250mm	78mm Circular Orifice Plate	17.0	1.74

3b. Proposed Storage (North Tank)

Carleton University New Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

Proposed Controlled Drainage Area Characteristics

Drainage Area	Area, A (ha)	Runoff Coefficient, R (5-year event)	Runoff Coefficient, R (100-year event, Note 1)
A5	0.102	0.90	1.00
Total	0.102	0.90	1.00

(Refer to Proposed Storm Drainage Area Plan)

Note 1: For 100-year event, Runoff Coefficient is increased by 25% to a maximum of 1.0.

Allowable Release Rate from storage (100-year event) = 5.67 (L/s)

Average release rate for calculation of storage volume = 2.84 (L/s) (Conservatively estimated as 50% of allowable release rate)

Orifice Sizing

Q = CA(2gH)^0.5

C = 0.61

Design Flow Rate = 5.7 (L/s)

Proposed 100-year tank depth = 1.20 (m)

Proposed 100-year head above centreline of orifice = 1.14 (m)

Orifice Area = 1971 (mm2)

Orifice diameter = 50 (mm) (if <75mm then vortex ICD required)

Refer to Sheet 5 for Vortex ICD selection

Release Rates during 5-year event

Water depth during 5-year event = 0.64 (m) (based on result of Req. Storage Vol. calc below)

Proposed 5-year head above centreline of orifice = 0.58 (m)

Maximum release rate during 5-year event = 4.50 (L/s) (based on ICD performance, see Sheet 5)

Average release rate during 5-year event = 2.25 (L/s) (Refer to attached calculation sheet)

Required Storage Volume (using Modified Rational Method)

Q = RAIN

Q = runoff rate (L/s)

R = runoff coefficient

i = rainfall intensity (mm/hr)

A = drainage area (ha)

N = 2.78

$$i = \frac{A}{(T_d + C)^B}$$

where i = Rainfall Intensity (mm/hr)

T_d = Time of Concentration (min)

	5-Year Event				100-Year Event			
Time, Td (min)	Intensity (mm/hr)	Peak Flow (L/s)	Average Release Rate (L/s)	Storage Volume (m^3)	Intensity (mm/hr)	Peak Flow (L/s)	Average Release Rate (L/s)	Storage Volume (m^3)
10	104.19	26.6	2.25	14.6	178.56	45.6	2.84	25.6
15	83.56	21.3	2.25	17.2	142.89	36.5	2.84	30.3
20	70.25	17.9	2.25	18.8	119.95	30.6	2.84	33.3
25	60.90	15.5	2.25	19.9	103.85	26.5	2.84	35.5
30	53.93	13.8	2.25	20.7	91.87	23.4	2.84	37.1
40	44.18	11.3	2.25	21.7	75.15	19.2	2.84	39.2
50	37.65	9.6	2.25	22.1	63.95	16.3	2.84	40.5
60	32.94	8.4	2.25	22.2	55.89	14.3	2.84	41.1
80	26.56	6.8	2.25	21.7	44.99	11.5	2.84	41.5
100	22.41	5.7	2.25	20.8	37.90	9.7	2.84	41.0
120	19.47	5.0	2.25	19.6	32.89	8.4	2.84	40.0
140	17.27	4.4	2.25	18.1	29.15	7.4	2.84	38.7
160	15.56	4.0	2.25	16.5	26.24	6.7	2.84	37.1
180	14.18	3.6	2.25	14.8	23.90	6.1	2.84	35.2
200	13.05	3.3	2.25	13.0	21.98	5.6	2.84	33.3
220	12.10	3.1	2.25	11.1	20.37	5.2	2.84	31.2
240	11.29	2.9	2.25	9.1	19.01	4.9	2.84	29.0
260	10.60	2.7	2.25	7.1	17.83	4.5	2.84	26.7

280	9.99	2.5	2.25	5.0	16.80	4.3	2.84	24.4
300	9.46	2.4	2.25	2.9	15.89	4.1	2.84	21.9
320	8.98	2.3	2.25	0.8	15.09	3.9	2.84	19.5
340	8.56	2.2	2.25	-1.4	14.37	3.7	2.84	16.9

minimum time = time of concentration

Storage volume used	22.2 m^3	Storage volume used	41.5 m^3

A storage tank with a minimum volume of 41.5 m^3 is required.

4b. Tank Draindown Time (North Tank)

Carleton University new Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

Release Rate from Storage Tank

Equation 4.10 from MOE Stormwater Design Guidelines:

$$t = \frac{2A_P}{CA_P(2g)^{0.5}}\left({h_1}^{0.5} - {h_2}^{0.5}\right)$$

where:

Tank Volume	42.0	cu.m	
Water depth when full, h1	1.2	m	
Water depth when empty, h2	0.0	m	
Orifice coefficient, C	0.61		
Acceleration due to gravity, g	9.81	m/s²	
Tank Area, Ap	35.0	sq.m	(rectangular tank with vertical sides)

Incremental draindown calculation (100-year event), based on equivalent orifice to proposed ICD:

Water depth at start of step, h1 (m)	Water depth at end of step, h1 (m)	Duration of step, t (s)	Release rate (L/s)
1.20	1.15	303	5.8
1.15	1.10	310	5.6
1.10	1.05	317	5.5
1.05	1.00	325	5.4
1.00	0.95	333	5.3
0.95	0.90	342	5.1
0.90	0.85	351	5.0
0.85	0.80	362	4.8
0.80	0.75	373	4.7
0.75	0.70	386	4.5
0.70	0.65	400	4.4
0.65	0.60	416	4.2
0.60	0.55	434	4.0
0.55	0.50	454	3.9
0.50	0.45	477	3.7
0.45	0.40	504	3.5
0.40	0.35	537	3.3
0.35	0.30	577	3.0
0.30	0.25	627	2.8
0.25	0.20	694	2.5
0.20	0.15	788	2.2
0.15	0.10	934	1.9
0.10	0.05	1,218	1.4
	Total draindown duration	11,462	seconds
		3	hours

Average release rate (by water depth) 4.0 L/s

Incremental draindown calculation (5-year event), based on equivalent orifice to proposed ICD:

Water depth at start of step, h1 (m)	Water depth at end of step, h1 (m)	Duration of step, t (s)	Release rate (L/s)
0.64	0.59	173	10.1
0.59	0.54	180	9.7
0.54	0.49	189	9.3
0.49	0.44	199	8.8
0.44	0.39	210	8.3
0.39	0.34	224	7.8
0.34	0.29	242	7.2
0.29	0.24	263	6.6
0.24	0.19	293	6.0
0.19	0.14	334	5.2
0.14	0.09	402	4.4
0.09	0.04	542	3.2

Total draindown duration 3,251 seconds

1 hours

Average release rate (by water depth) 7.2 L/s

5b. Vortex ICD Sizing (North Tank)

Carleton University New Residence

Project No.	190444600
Date	12-Dec-19
Prepared By:	D Glauser
Checked By	J Fookes

ICD sizing - 100 year

100-yr elevation	64.65	m
Invert elevation	63.39	m
Outlet pipe dia	250	mm

Orifice Sizing:

100-yr depth	1.14	m (depth above centreline of orifice)
Design flow	5.7	l/s
Orifice area	1971	mm² (calculated by Orifice Equation: $Q=CA(2gh)^{0.5}$ where C=0.61)
Orifice diameter	50	mm (if less than 75mm then vortex ICD required)

ICD sizing - 5 year

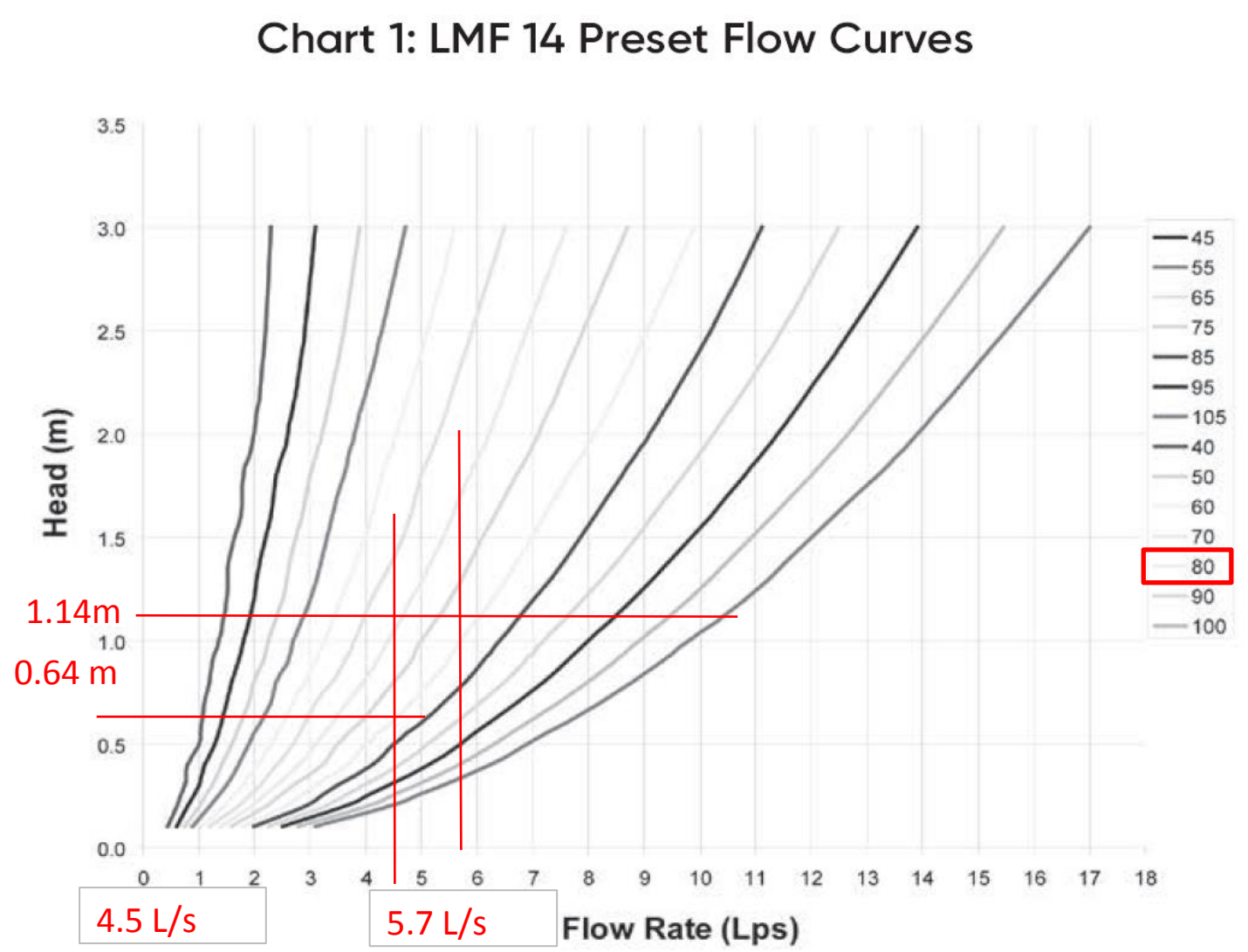
5-yr elevation	64.16	m
Invert elevation	63.39	m
Outlet pipe dia	250	mm

Orifice Sizing:

5-yr depth	0.64	m (depth above centreline of orifice)
Design flow	4.5	l/s

MHST1				
DESIGN EVENT	**DIAMETER OF OUTLET PIPE**	**ICD**	**DESIGN FLOW (l/s)**	**UPSTREAM HEAD (m)**
1:5 YR	250mm	IPEX Tempest LMF 80	4.5	0.64
1:100 YR	250mm	IPEX Tempest LMF 80	5.7	1.14

IPEX Tempest ICD Design Chart:



TEMPEST LMF ICD

6. PROPOSED STORM SEWER CALCULATION SHEET

Carleton University New Residence

LOCATION					INDIVIDUAL							CUMULATIVE		DESIGN					PROPOSED SEWER											
Description	From	Top of Cover	To	Top of Cover	Asphalt Area	Lawn Areas	Bldg. Area	Gravel Area	Conc. Area	Total	R*A*N	Area	R*A*N	Time of Conc.	Storm Event Return Period	Rainfall Intensity	Peak Flow		Length	Size	Area	Grade	Minimum Slope	Full Capacity	Full Velocity	Time of Flow	Reserve Capacity	Upstream Invert	Downstream Invert	Notes
		(m)		(m)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)		(ha)		(min.)	(year)	(mm/hr)	(L/s)	(m^3/s)	(m)	(mm)	(m^2)	(%)	(%)	(L/s)	(m/s)	(min)	(L/s)	(m)	(m)	
BLDG	BLDG		Storage				0.260			0.260	0.651	0.260	0.651	10.00	100.00	178.56	116.2	0.116	1.4	450	0.159	1.429	0.20	340.8	2.14	0.01	224.6	64.55	64.53	
A1	CB9		CBMH1		0.140			0.070		0.210	0.448	0.210	0.448	10.00	100.00	178.56	79.9	0.080	20	250	0.049	2.000	0.43	84.1	1.71	0.19	4.2	63.20	62.80	
A2	CBMH1		Storage		0.010					0.010	0.025	0.220	0.473	10.19	100.00	176.80	83.6	0.084	13.6	250	0.049	2.059	0.43	85.3	1.74	0.13	1.8	62.77	62.49	
A3	CB6+CB7		Storage		0.030					0.030	0.075	0.250	0.548	10.00	100.00	178.56	97.8	0.098												
A4	CB5		STMH401			0.030				0.030	0.025	0.280	0.025	10.00	100.00	178.56	4.5	0.004	21	250	0.049	3.333	0.43	108.6	2.21	0.16	104.1	63.30	62.60	
	STMH401		STMH304									0.790	1.223	10.16	2.00	76.20	93.2	0.093	13.4	250	0.049	3.284	0.43	107.8	2.20	0.10	14.5	61.94	61.50	
A5	CB1		Storage		0.100					0.100	0.278	0.100	0.278	10.00	100.00	178.56	49.6	0.050	3	250	0.049	2.000	0.43	84.1	1.71	0.03	34.5	63.90	63.84	
	Storage		STMH501							0.000	0.000	0.100	0.278	10.03	100.00	178.29	49.6	0.050	2	250	0.049	2.000	0.43	84.1	1.71	0.02	34.5	63.45	63.41	
	STMH501		STMH101							0.000	0.000	0.100	0.278	10.05	2.00	76.62	21.3	0.021	6	250	0.049	2.000	0.43	84.1	1.71	0.06	62.8	63.38	63.26	

Q = RAIN, where

Q = Peak flow (L/s)
R = Runoff coefficient
A = Area (ha)
I = Rainfall intensity (mm/hr)
N = 2.78

Asphalt Area:	R = 0.90
Grassy Area:	R = 0.30
Building Area:	R = 0.90
Gravel Area:	R = 0.50
Concrete Area:	R = 0.90

Mannings Roughness Coefficient = 0.013

Prepared By: Daniel Glauser

Checked by: James Fookes

Date: December 12, 2019

Project No. 190500700

StormBrixx® HD

StormBrixx® HD is ACO's heavy duty plastic geocellular surface water management system. It consists of a single, recyclable, polypropylene body that can be assembled in a variety of ways to form an open bonded structure.

50 YEARS DESIGN LIFE

SD

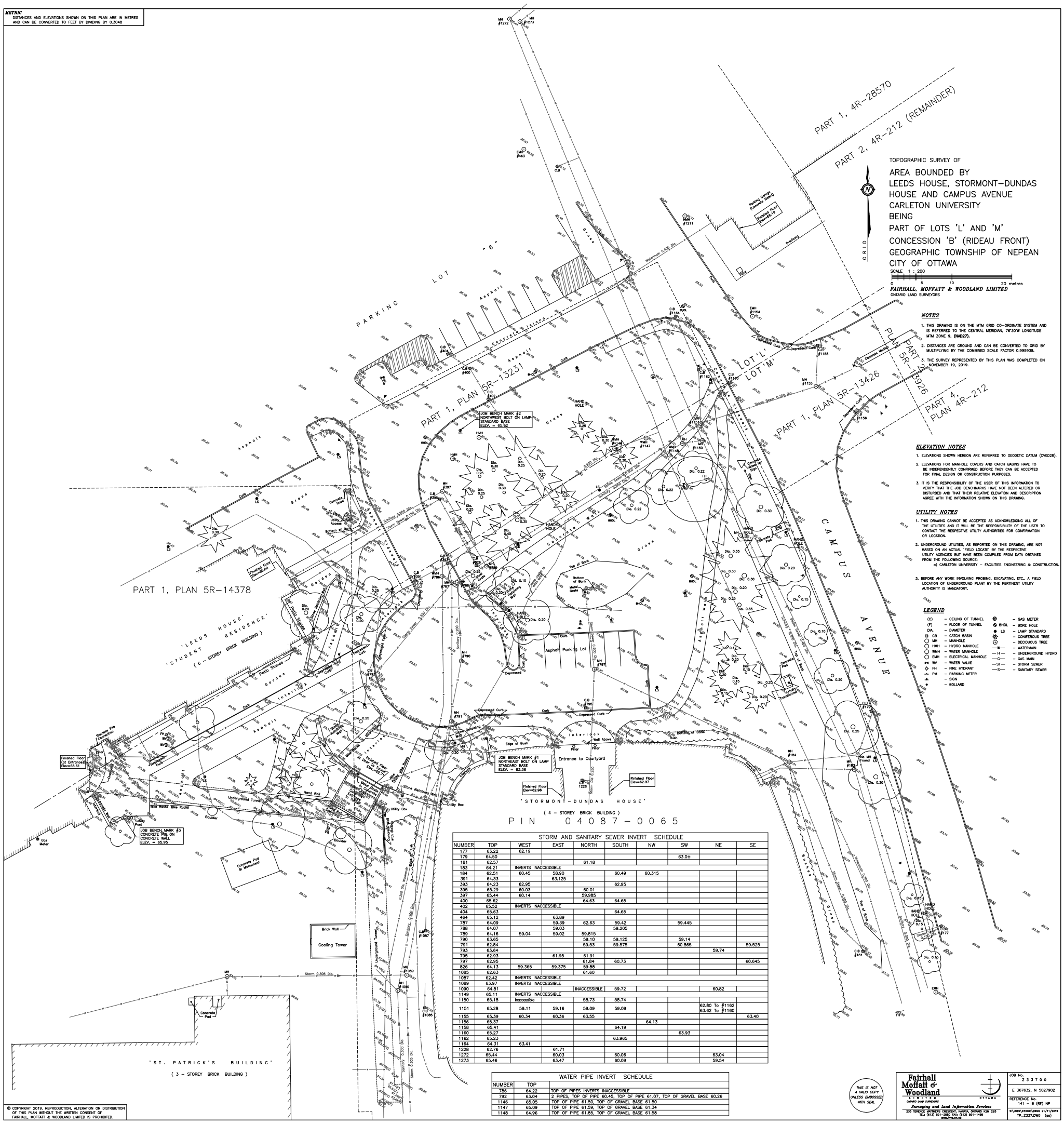
14.75' 4.5m Max depth to invert

1. 4.5 Half bodies per cubic metre
2. Functional design combined with an intelligent snap-lock system make for easy handling and rapid installation
3. High void ratio of 97% of total volume available for storage
4. Height of 1 layer: 24" (610mm)
5. Min. cover depth (see image above): 19.7" (0.5m)
6. StormBrixx® units can be cut in half to allow integration into the overall system
7. The open structure of StormBrixx® allows inspection cameras and cleaning devices to have free passage through the system

Appendix F

Topographic and Legal Survey

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



TOPOGRAPHIC SURVEY OF

AREA BOUNDED BY
LEEDS HOUSE, STORMONT–DUNDAS HOUSE AND CAMPUS AVENUE
CARLETON UNIVERSITY
BEING
PART OF LOTS 'L' AND 'M'
CONCESSION 'B' (RIDEAU FRONT)
GEOGRAPHIC TOWNSHIP OF NEPEAN
CITY OF OTTAWA

SCALE 1 : 200
0 5 10 20 metres

FAIRHALL, MOFFATT & WOODLAND LIMITED
ONTARIO LAND SURVEYORS

NOTES

1. THIS DRAWING IS ON THE MTM GRID CO-ORDINATE SYSTEM AND IS REFERRED TO THE CENTRAL MERIDIAN, 76°30'W LONGITUDE MTM ZONE 9, **(NAD27)**.
2. DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR 0.999939.
3. THE SURVEY REPRESENTED BY THIS PLAN WAS COMPLETED ON NOVEMBER 19, 2019.

ELEVATION NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM (CVGD28).
2. ELEVATIONS FOR MANHOLE COVERS AND CATCH BASINS HAVE TO BE INDEPENDENTLY CONFIRMED BEFORE THEY CAN BE ACCEPTED FOR FINAL DESIGN OR CONSTRUCTION PURPOSES.
3. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THEIR RELATIVE ELEVATION AND DESCRIPTION AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

UTILITY NOTES

1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ALL OF THE UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. UNDERGROUND UTILITIES, AS REPORTED ON THIS DRAWING, ARE NOT BASED ON AN ACTUAL "FIELD LOCATE" BY THE RESPECTIVE UTILITY AGENCIES BUT HAVE BEEN COMPILED FROM DATA OBTAINED FROM THE FOLLOWING SOURCE:
   a) CARLETON UNIVERSITY – FACILITIES ENGINEERING & CONSTRUCTION.
3. BEFORE ANY WORK INVOLVING PROBING, EXCAVATING, ETC., A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY.

LEGEND

(C)	– CEILING OF TUNNEL	Ⓜ	– GAS METER
(F)	– FLOOR OF TUNNEL	BHOL	– BORE HOLE
DIA.	– DIAMETER	LS	– LAMP STANDARD
CB	– CATCH BASIN		– CONIFEROUS TREE
MH	– MANHOLE		– DECIDUOUS TREE
HMH	– HYDRO MANHOLE	—W—	– WATERMAIN
WMH	– WATER MANHOLE	— H —	– UNDERGROUND HYDRO
EMH	– ELECTRICAL MANHOLE	—G—	– GAS MAIN
WV	– WATER VALVE	—ST—	– STORM SEWER
FH	– FIRE HYDRANT	—S—	– SANITARY SEWER
PM	– PARKING METER		
	– SIGN		
	– BOLLARD		

PIN 04087-0065

STORM AND SANITARY SEWER INVERT SCHEDULE

NUMBER	TOP	WEST	EAST	NORTH	SOUTH	NW	SW	NE	SE
177	63.22	62.19							
179	64.50						63.0±		
181	62.57			61.18					
183	64.21	INVERTS INACCESSIBLE							
184	62.51	60.45	58.90		60.49	60.315			
391	64.33		63.125						
393	64.23	62.95			62.95				
395	65.29	60.03		60.01					
397	65.44	60.14		59.985					
400	65.62			64.63	64.65				
402	65.52	INVERTS INACCESSIBLE							
404	65.63				64.65				
464	65.12		63.89						
787	64.09		59.39	62.63	59.42		59.445		
788	64.07		59.03		59.205				
789	64.16	59.04	59.02	59.815					
790	63.65			59.10	59.125		59.14		
791	62.84			59.53	59.575		60.865		59.525
793	63.64							59.74	
795	62.93		61.95	61.91					
797	62.95			61.84	60.73				60.645
826	64.13	59.365	59.375	59.88					
1085	62.63			61.60					
1087	62.42	INVERTS INACCESSIBLE							
1089	63.97	INVERTS INACCESSIBLE							
1090	64.81			INACCESSIBLE	59.72			60.82	
1149	65.11	INVERTS INACCESSIBLE							
1150	65.18	Inaccessible		58.73	58.74				
1151	65.28	59.11	59.16	59.09	59.09			62.80 To #1162 63.62 To #1160	
1155	65.39	60.34	60.36	63.55					63.40
1156	65.37					64.13			
1158	65.41				64.19				
1160	65.27						63.93		
1162	65.23				63.965				
1164	64.31	63.41							
1228	62.76		61.71						
1272	65.44		60.03		60.06			63.04	
1273	65.46		63.47		60.09			59.54	

WATER PIPE INVERT SCHEDULE

NUMBER	TOP	
786	64.22	TOP OF PIPES INVERTS INACCESSIBLE
792	63.04	2 PIPES, TOP OF PIPE 60.45, TOP OF PIPE 61.07, TOP OF GRAVEL BASE 60.26
1146	65.05	TOP OF PIPE 61.50, TOP OF GRAVEL BASE 61.50
1147	65.09	TOP OF PIPE 61.59, TOP OF GRAVEL BASE 61.34
1148	64.96	TOP OF PIPE 61.85, TOP OF GRAVEL BASE 61.58

THIS IS NOT A VALID COPY UNLESS EMBOSSED WITH SEAL

Fairhall Moffatt & Woodland
LIMITED
ONTARIO LAND SURVEYORS
OTTAWA
Surveying and Land Information Services
230 TERENCE MATTHEWS CRESCENT, KANATA, ONTARIO K2M 2B3
TEL: (613) 591-2580 FAX: (613) 591-1495
www.fmw.on.ca

JOB No. Z337700
E 367632, N 5027902
REFERENCE No. 141 – B (RF) NP
S:\JOBS\Z33700\DWGS 21/11/2019
TP_Z337.DWG (ss)

Appendix G

Sewer CCTV Reports

Ottawa (Head Office)
1800 Bantree Street
Ottawa, Ontario K1B 5L6
☎ 613.745.2444
613.745.9994
www.cwwcanada.com
1.866.695.0155

Montreal
2700 Sabourin Street
St-Laurent, Quebec H4S 1M2
☎ 514.738.2666
514.738.9762

CLEAN WATER WORKS INC.
INTEGRATED SEWER SOLUTIONS

Carleton UNIVERSITY

Carleton University

SEWER CCTV INSPECTION REPORT

Report ID
87830SA1

Sewer Use
Sanitary

Completion Date
November 18, 2019

Inspected Length
256.90 meters

Table of contents

1. Index of pipes

12 items

Inspected length : 256.90
Total length : 289.80

Pipe	Start/End	Direction	Road	Date	Inspected	Total	Page
BUILDING SAN 5	SAN 5 --> BUILDING	Against flow	Campus Avenue	14/11/2019 10:34 AM	43.5	43.5	5
BUILDING SAN 8	SAN 8 --> BUILDING	Against flow	Campus Avenue	18/11/2019 11:02 AM	0	0	7
LIMIT SAN 6	SAN 6 --> LIMIT	Against flow	Campus Avenue	14/11/2019 1:54 PM	50.5	50.5	9
SAN 1 SAN 2	SAN 2 --> SAN 1	Against flow	Campus Avenue	18/11/2019 3:13 PM	61.5	61.5	13
SAN 1 SAN 2	SAN 2 --> SAN 1	Against flow	Campus Avenue	13/11/2019 12:58 PM	14.7	14.7	11
SAN 2 SAN 3	SAN 2 --> SAN 3	Direction of flow	Campus Avenue	18/11/2019 2:45 PM	13.7	12	17
SAN 2 SAN 3	SAN 2 --> SAN 3	Direction of flow	Campus Avenue	13/11/2019 12:54 PM	10.7	12	15
SAN 3 SAN 4	SAN 3 --> SAN 4	Direction of flow	Campus Avenue	13/11/2019 1:26 PM	4.8	4.8	19
SAN 4 SAN 6	SAN 4 --> SAN 6	Direction of flow	Campus Avenue	14/11/2019 12:55 PM	39.8	39.8	21
SAN 5 SAN 4	SAN 5 --> SAN 4	Direction of flow	Campus Avenue	14/11/2019 10:13 AM	14.7	14.7	23
SAN 6 SAN 7	SAN 6 --> SAN 7	Direction of flow	Campus Avenue	14/11/2019 1:36 PM	3	3	25
SAN 7 SAN 8	SAN 7 --> SAN 8	Direction of flow	Campus Avenue	18/11/2019 10:11 AM	0	60	27

2. Structural rating

12 items

5 - Immediate Attention (1 of 12 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
8	5131	4	SAN 1 SAN 2	SAN 2 --> SAN 1	Against flow	Campus Avenue	11

4 - Poor (1 of 12 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
4	4100	4	BUILDING SAN 5	SAN 5 --> BUILDING	Against flow	Campus Avenue	5

2 - Good (1 of 12 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
2	2100	2	SAN 5 SAN 4	SAN 5 --> SAN 4	Direction of flow	Campus Avenue	23

0 - No Defects (9 of 12 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
0	0000	0	BUILDING SAN 8	SAN 8 --> BUILDING	Against flow	Campus Avenue	7
0	0000	0	LIMIT SAN 6	SAN 6 --> LIMIT	Against flow	Campus Avenue	9
0	0000	0	SAN 1 SAN 2	SAN 2 --> SAN 1	Against flow	Campus Avenue	13
0	0000	0	SAN 2 SAN 3	SAN 2 --> SAN 3	Direction of flow	Campus Avenue	17
0	0000	0	SAN 2 SAN 3	SAN 2 --> SAN 3	Direction of flow	Campus Avenue	15
0	0000	0	SAN 3 SAN 4	SAN 3 --> SAN 4	Direction of flow	Campus Avenue	19
0	0000	0	SAN 4 SAN 6	SAN 4 --> SAN 6	Direction of flow	Campus Avenue	21
0	0000	0	SAN 6 SAN 7	SAN 6 --> SAN 7	Direction of flow	Campus Avenue	25
0	0000	0	SAN 7 SAN 8	SAN 7 --> SAN 8	Direction of flow	Campus Avenue	27

3. O&M rating

12 items

5 - Immediate Attention (2 of 12 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
5	5100	5	5	SAN 1 SAN 2	SAN 2 --> SAN 1	Against flow	Campus Avenue	11
5	5100	5	0	SAN 7 SAN 8	SAN 7 --> SAN 8	Direction of flow	Campus Avenue	27

4 - Poor (1 of 12 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
4	4100	4	0	SAN 2 SAN 3	SAN 2 --> SAN 3	Direction of flow	Campus Avenue	15

2 - Good (1 of 12 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
2	2100	2	0	SAN 3 SAN 4	SAN 3 --> SAN 4	Direction of flow	Campus Avenue	19

0 - No Defects (8 of 12 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
0	0000	0	4	BUILDING SAN 5	SAN 5 --> BUILDING	Against flow	Campus Avenue	5
0	0000	0	0	BUILDING SAN 8	SAN 8 --> BUILDING	Against flow	Campus Avenue	7
0	0000	0	0	LIMIT SAN 6	SAN 6 --> LIMIT	Against flow	Campus Avenue	9
0	0000	0	0	SAN 1 SAN 2	SAN 2 --> SAN 1	Against flow	Campus Avenue	13
0	0000	0	0	SAN 2 SAN 3	SAN 2 --> SAN 3	Direction of flow	Campus Avenue	17
0	0000	0	0	SAN 4 SAN 6	SAN 4 --> SAN 6	Direction of flow	Campus Avenue	21
0	0000	0	2	SAN 5 SAN 4	SAN 5 --> SAN 4	Direction of flow	Campus Avenue	23
0	0000	0	0	SAN 6 SAN 7	SAN 6 --> SAN 7	Direction of flow	Campus Avenue	25

4. Pipe summary and condition details

Pipe identification

Pipe:	BUILDING SAN 5	**Direction of inspection:**	SAN 5 --> BUILDING
Direction of flow:	BUILDING --> SAN 5	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	43.5
Height:	200	**Total length:**	43.5
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 10:34 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	4	**Peak:**	0	**Peak:**	4
Quick rating:	4100	**Quick rating:**	0000	**Quick rating:**	4100
Score:	4	**Score:**	0	**Score:**	4
Index:	4	**Index:**	0	**Index:**	4

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

4. Pipe summary and condition details

Pipe identification

Pipe:	BUILDING SAN 8	**Direction of inspection:**	SAN 8 --> BUILDING
Direction of flow:	BUILDING --> SAN 8	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:				
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	0
Height:	200	**Total length:**	0
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Not Known	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	0	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 11:02 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

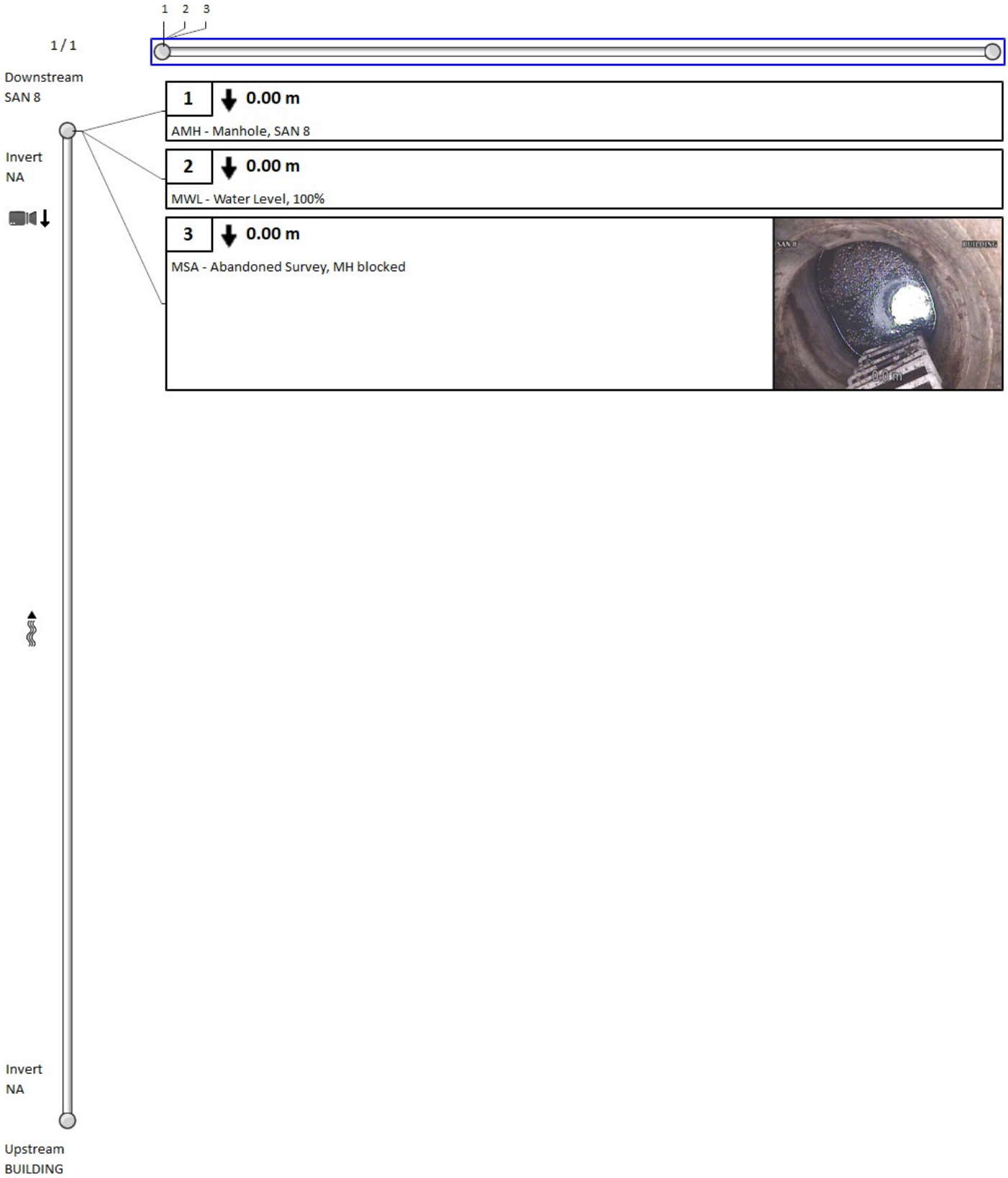
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	LIMIT SAN 6	**Direction of inspection:**	SAN 6 --> LIMIT
Direction of flow:	LIMIT --> SAN 6	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	50.5
Height:	200	**Total length:**	50.5
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 1:54 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

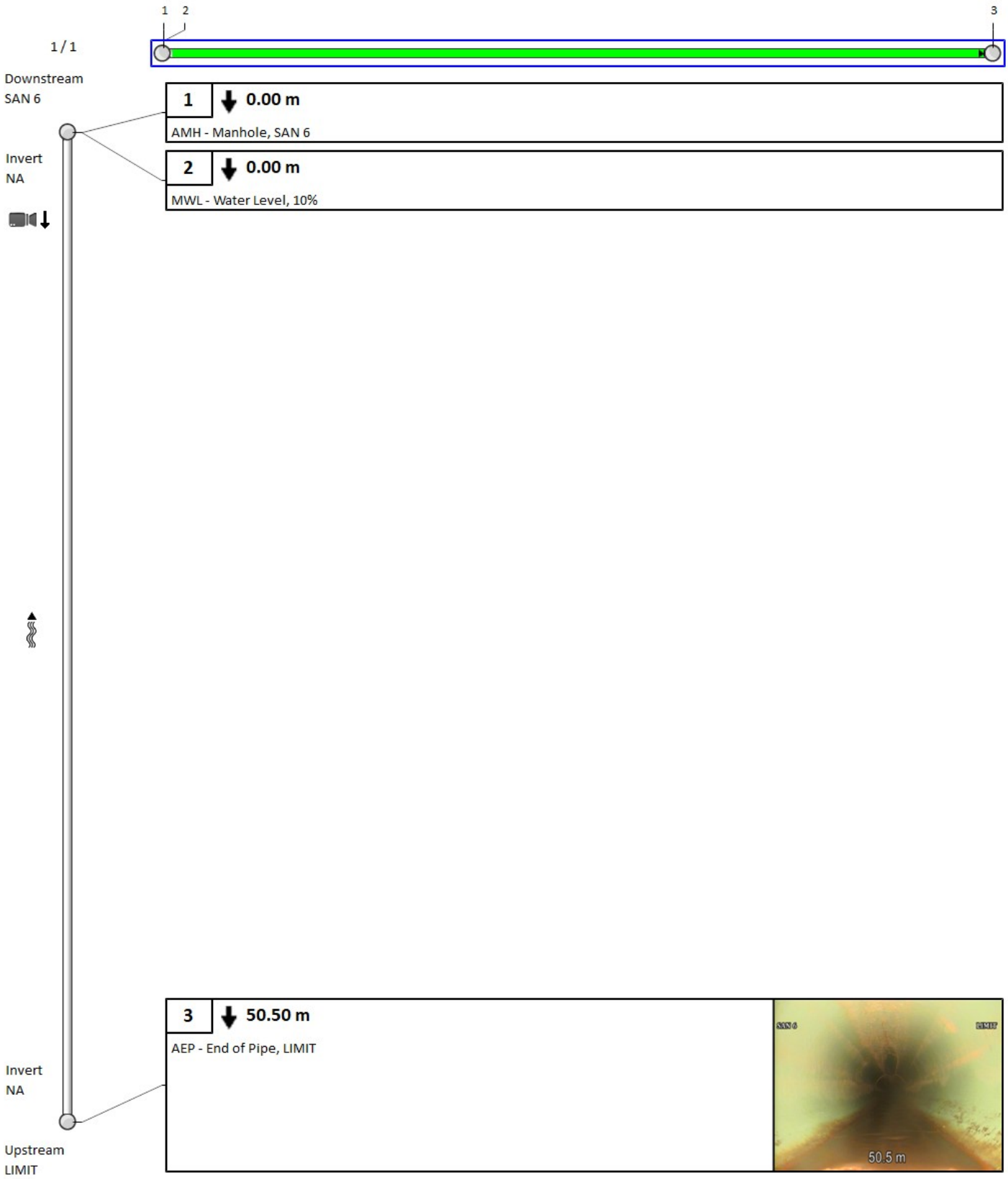
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 1 SAN 2	**Direction of inspection:**	SAN 2 --> SAN 1
Direction of flow:	SAN 1 --> SAN 2	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	14.7
Height:	200	**Total length:**	14.7
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 12:58 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	5	**Peak:**	5	**Peak:**	5
Quick rating:	5131	**Quick rating:**	5100	**Quick rating:**	5231
Score:	8	**Score:**	5	**Score:**	13
Index:	4	**Index:**	5	**Index:**	4.3

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

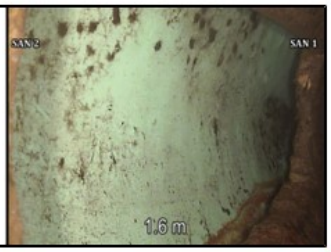
Downstream
SAN 2

Invert
NA

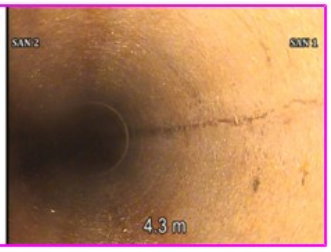
1 **0.00 m**
AMH - Manhole, SAN 2

2 **0.00 m**
MWL - Water Level, 10%

3 **1.60 m**
RPP - Repair Patch, from 10 o'clock to 11 o'clock, PVC patch



4 **4.30 m** 3
FL - Fracture Longitudinal, at 12 o'clock



5 **14.70 m** 5
OBR - Obstacle Rocks, from 12 o'clock to 12 o'clock, 90%

6 **14.70 m** 5
BVV - Broken Void Visible, from 11 o'clock to 1 o'clock

7 **14.70 m**
MSA - Abandoned Survey, Obstacle rocks

Invert
NA

Upstream
SAN 1

4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 1 SAN 2	**Direction of inspection:**	SAN 2 --> SAN 1
Direction of flow:	SAN 1 --> SAN 2	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	61.5
Height:	200	**Total length:**	61.5
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 3:13 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

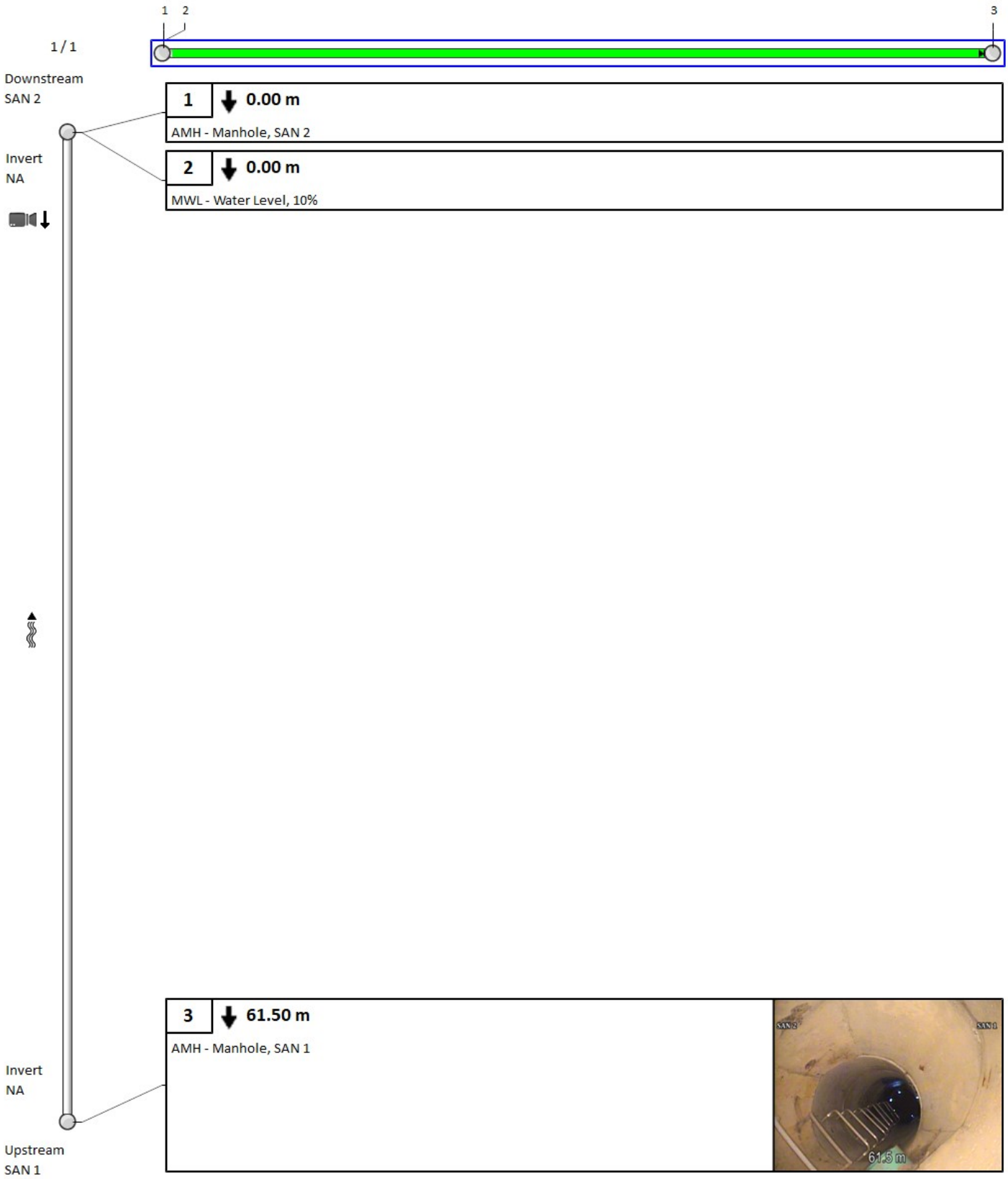
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 2 SAN 3	**Direction of inspection:**	SAN 2 --> SAN 3
Direction of flow:	SAN 2 --> SAN 3	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	10.7
Height:	200	**Total length:**	12
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 12:54 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	4	**Peak:**	4
Quick rating:	0000	**Quick rating:**	4100	**Quick rating:**	4100
Score:	0	**Score:**	4	**Score:**	4
Index:	0	**Index:**	4	**Index:**	4

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

Upstream
SAN 2

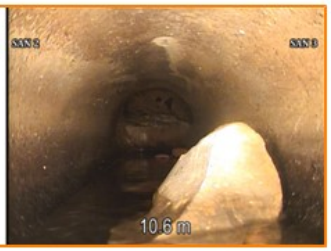
Invert
NA

1 **0.00 m**
AMH - Manhole, SAN 2

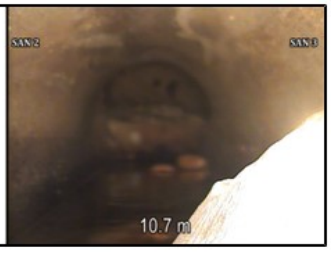
2 **0.00 m**
MWL - Water Level, 10%

3 **9.40 m**
MWL - Water Level, 15%

4 **10.60 m** **4**
OBR - Obstacle Rocks, from 5 o'clock to 6 o'clock, 25%



5 **10.70 m**
MSA - Abandoned Survey, Obstacle rock



Invert
NA

Downstream
SAN 3

4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 2 SAN 3	**Direction of inspection:**	SAN 2 --> SAN 3
Direction of flow:	SAN 2 --> SAN 3	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	13.7
Height:	200	**Total length:**	12
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 2:45 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

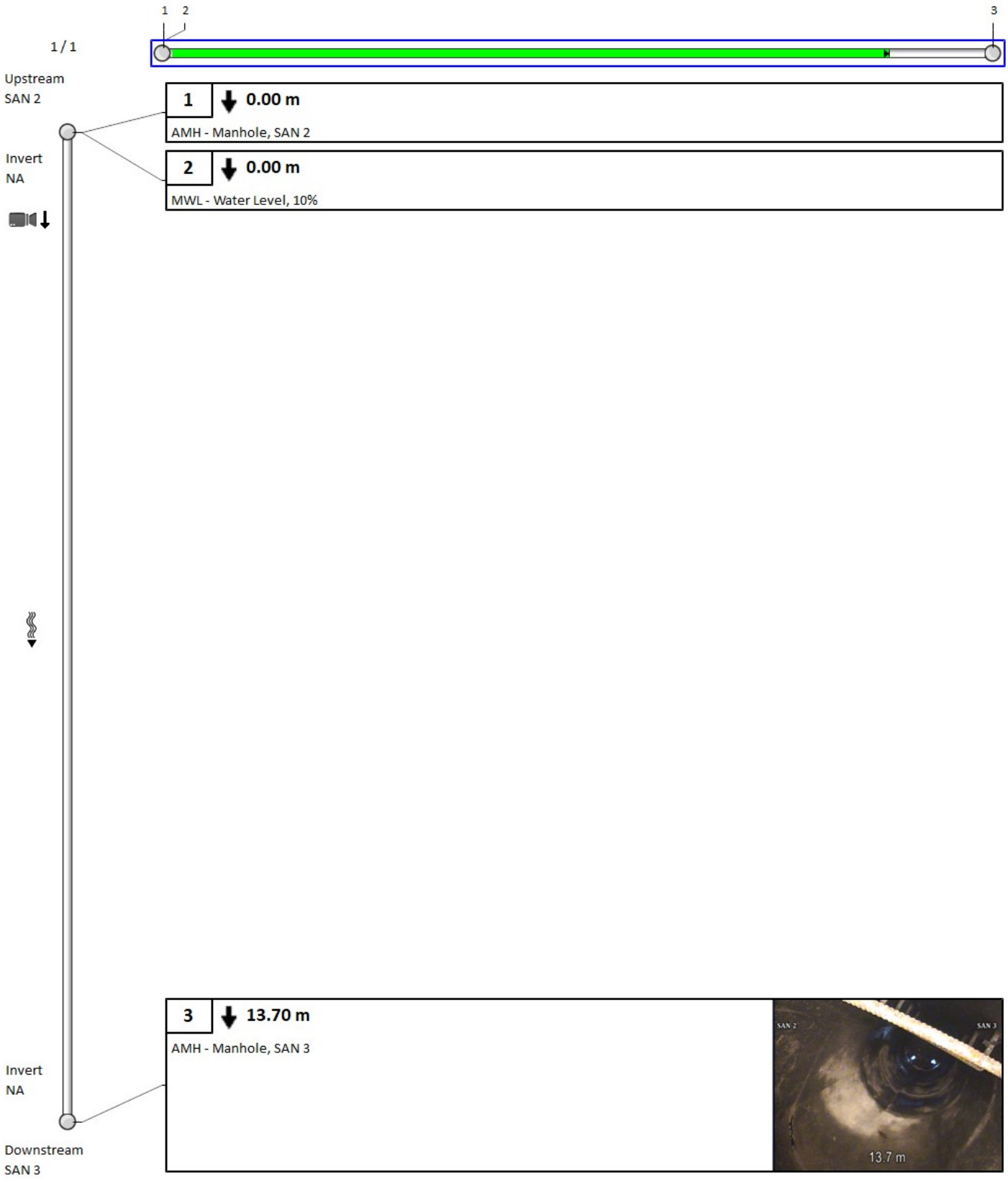
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 3 SAN 4	**Direction of inspection:**	SAN 3 --> SAN 4
Direction of flow:	SAN 3 --> SAN 4	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	4.8
Height:	200	**Total length:**	4.8
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 1:26 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

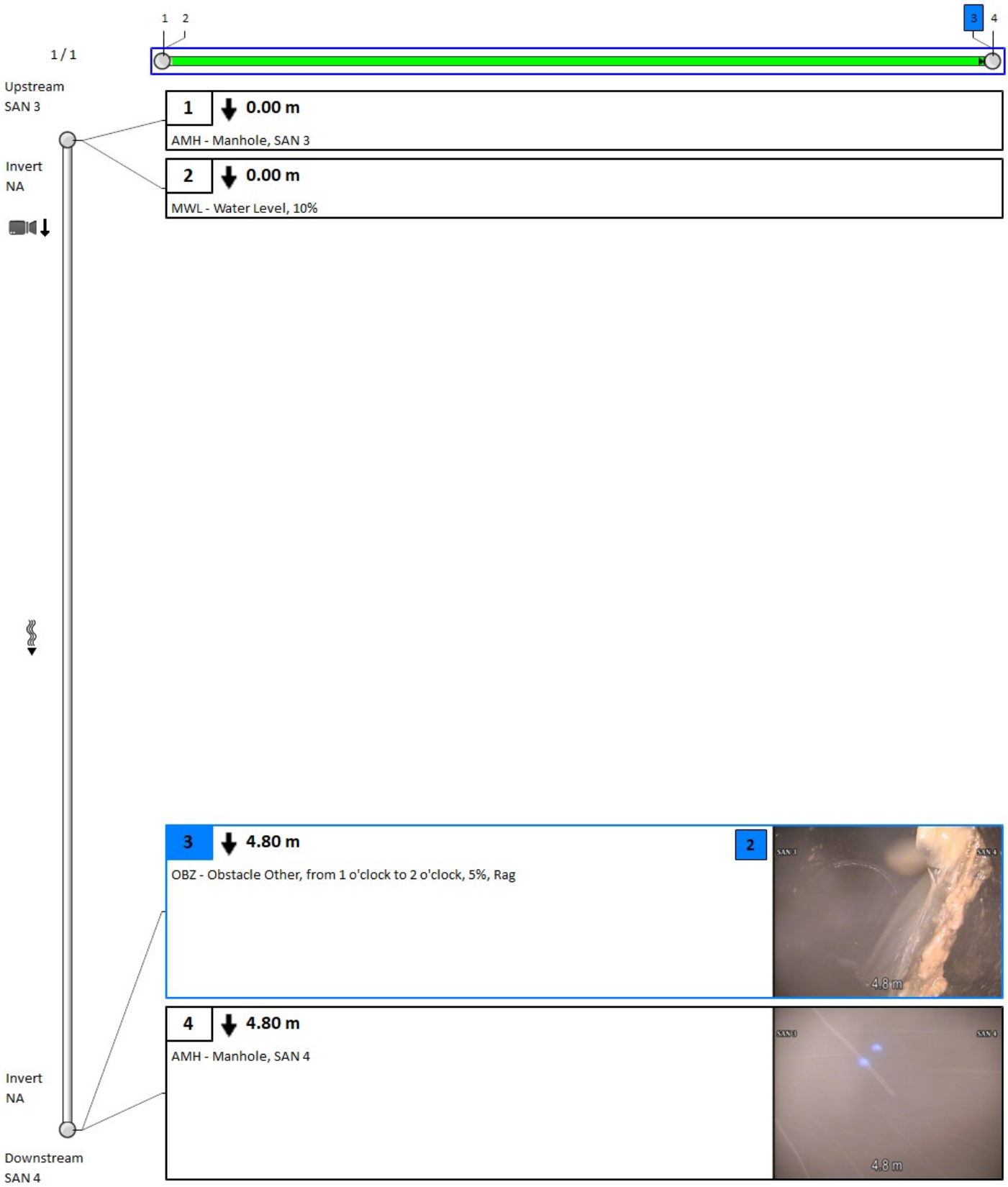
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	2	**Peak:**	2
Quick rating:	0000	**Quick rating:**	2100	**Quick rating:**	2100
Score:	0	**Score:**	2	**Score:**	2
Index:	0	**Index:**	2	**Index:**	2

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 4 SAN 6	**Direction of inspection:**	SAN 4 --> SAN 6
Direction of flow:	SAN 4 --> SAN 6	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	39.8
Height:	200	**Total length:**	39.8
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 12:55 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

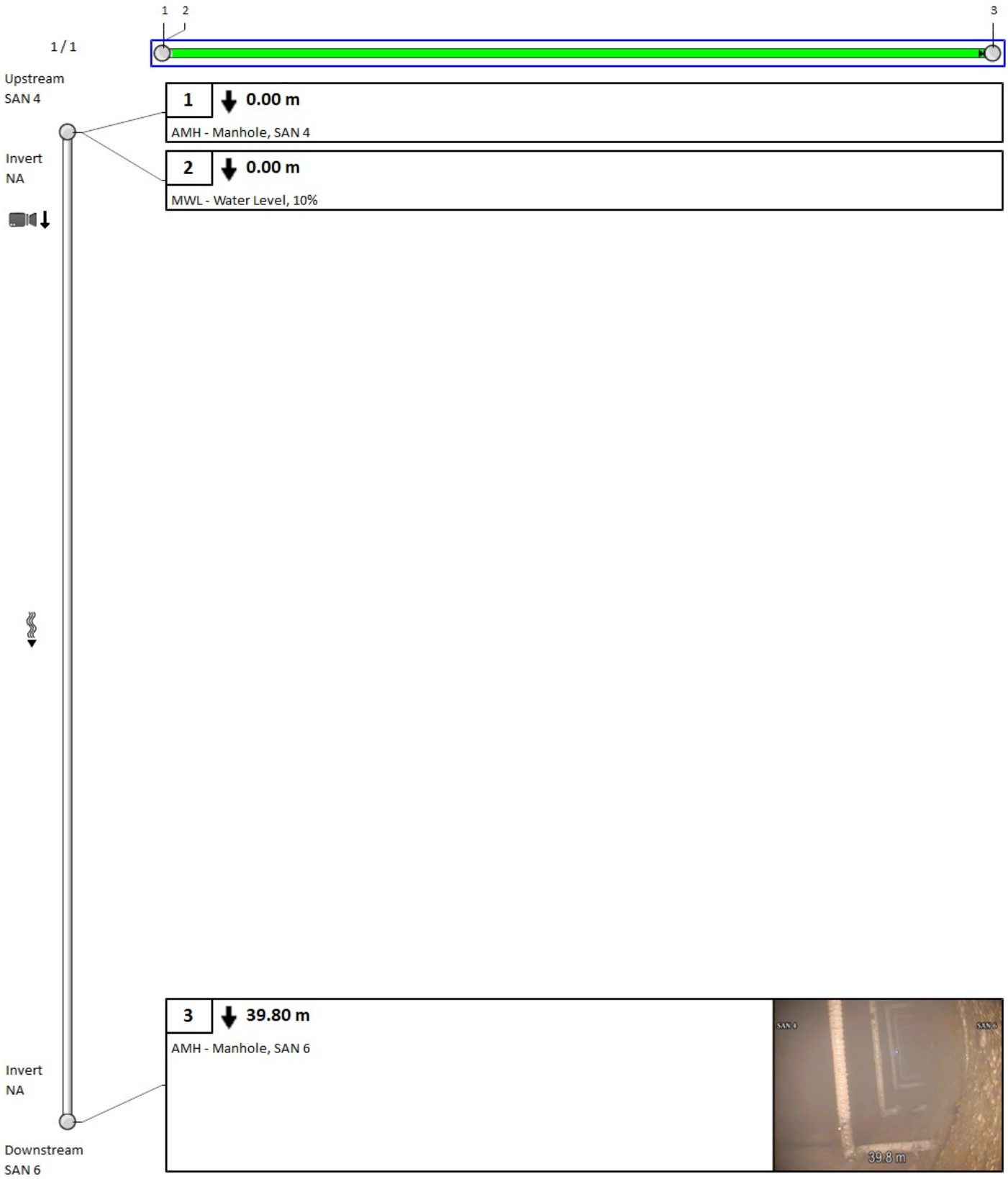
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 5 SAN 4	**Direction of inspection:**	SAN 5 --> SAN 4
Direction of flow:	SAN 5 --> SAN 4	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	14.7
Height:	200	**Total length:**	14.7
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Plastic/Steel Composite	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 10:13 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

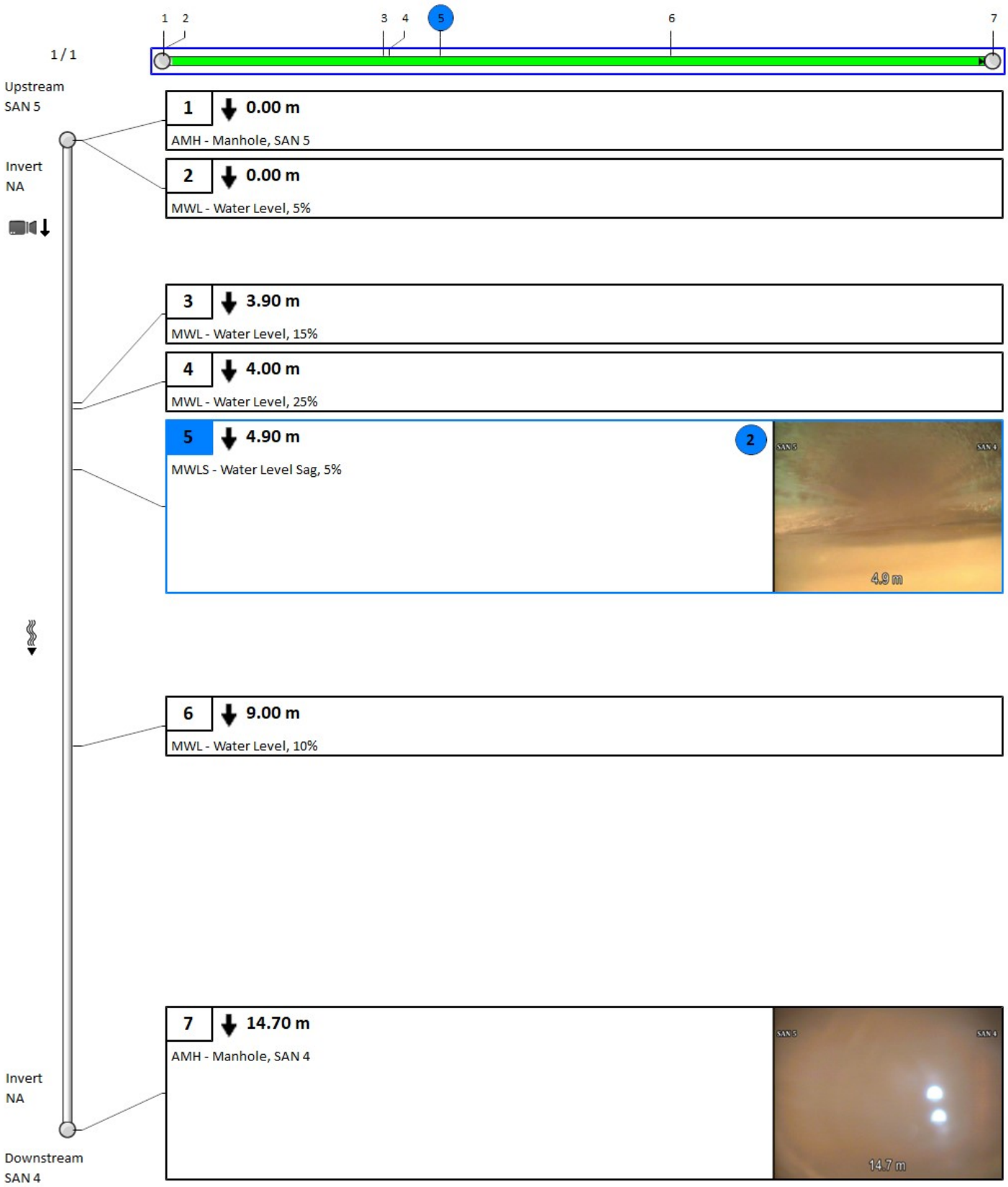
Structural rating		O&M rating		Overall rating	
Peak:	2	**Peak:**	0	**Peak:**	2
Quick rating:	2100	**Quick rating:**	0000	**Quick rating:**	2100
Score:	2	**Score:**	0	**Score:**	2
Index:	2	**Index:**	0	**Index:**	2

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 6 SAN 7	**Direction of inspection:**	SAN 6 --> SAN 7
Direction of flow:	SAN 6 --> SAN 7	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university			
Road segment:				

GPS Accuracy:
Corrdinate System:
Vertical Datum:

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	3
Height:	200	**Total length:**	3
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 1:36 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

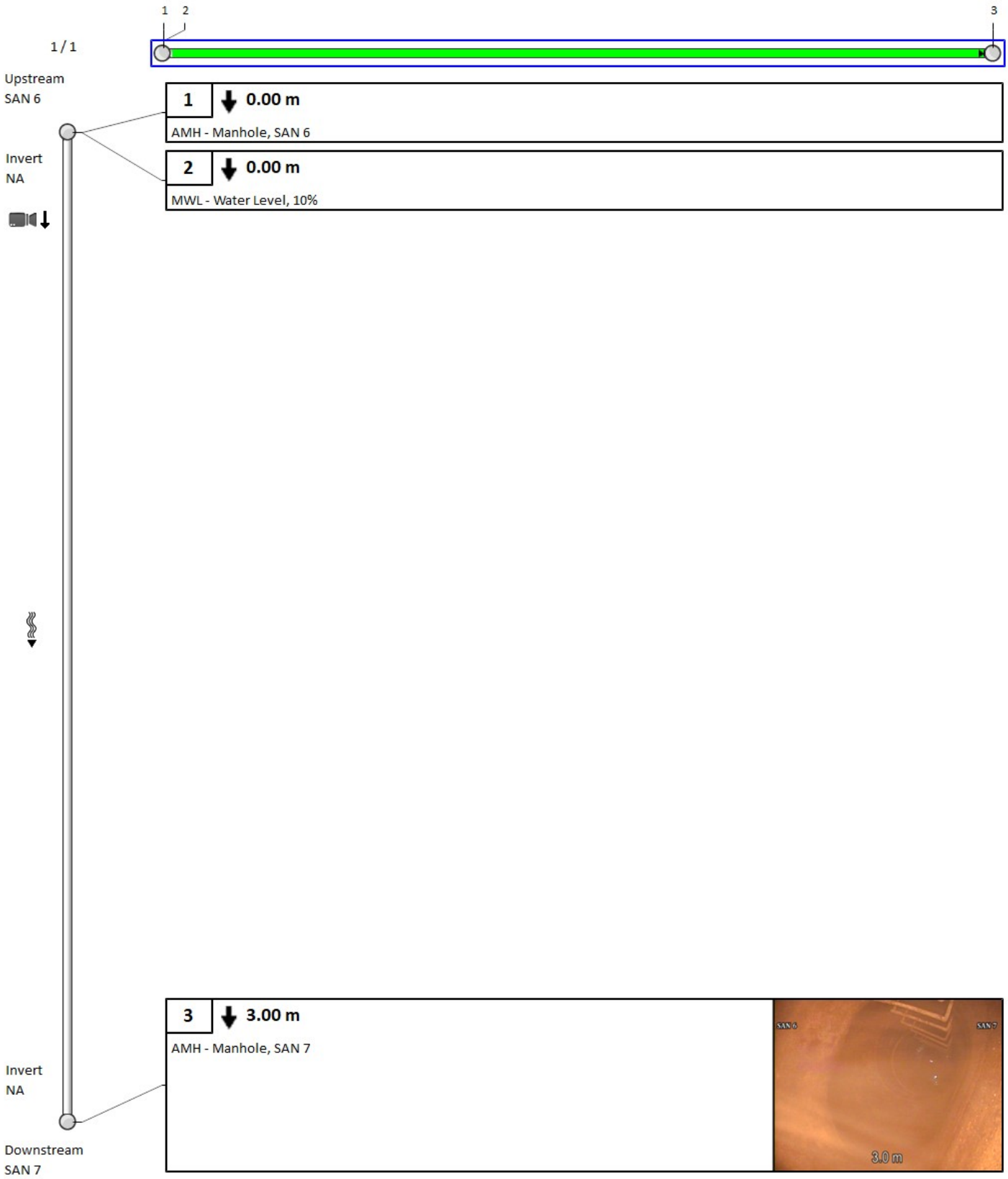
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	SAN 7 SAN 8	**Direction of inspection:**	SAN 7 --> SAN 8
Direction of flow:	SAN 7 --> SAN 8	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Sanitary	**Inspected length:**	0
Height:	450	**Total length:**	60
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 10:11 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

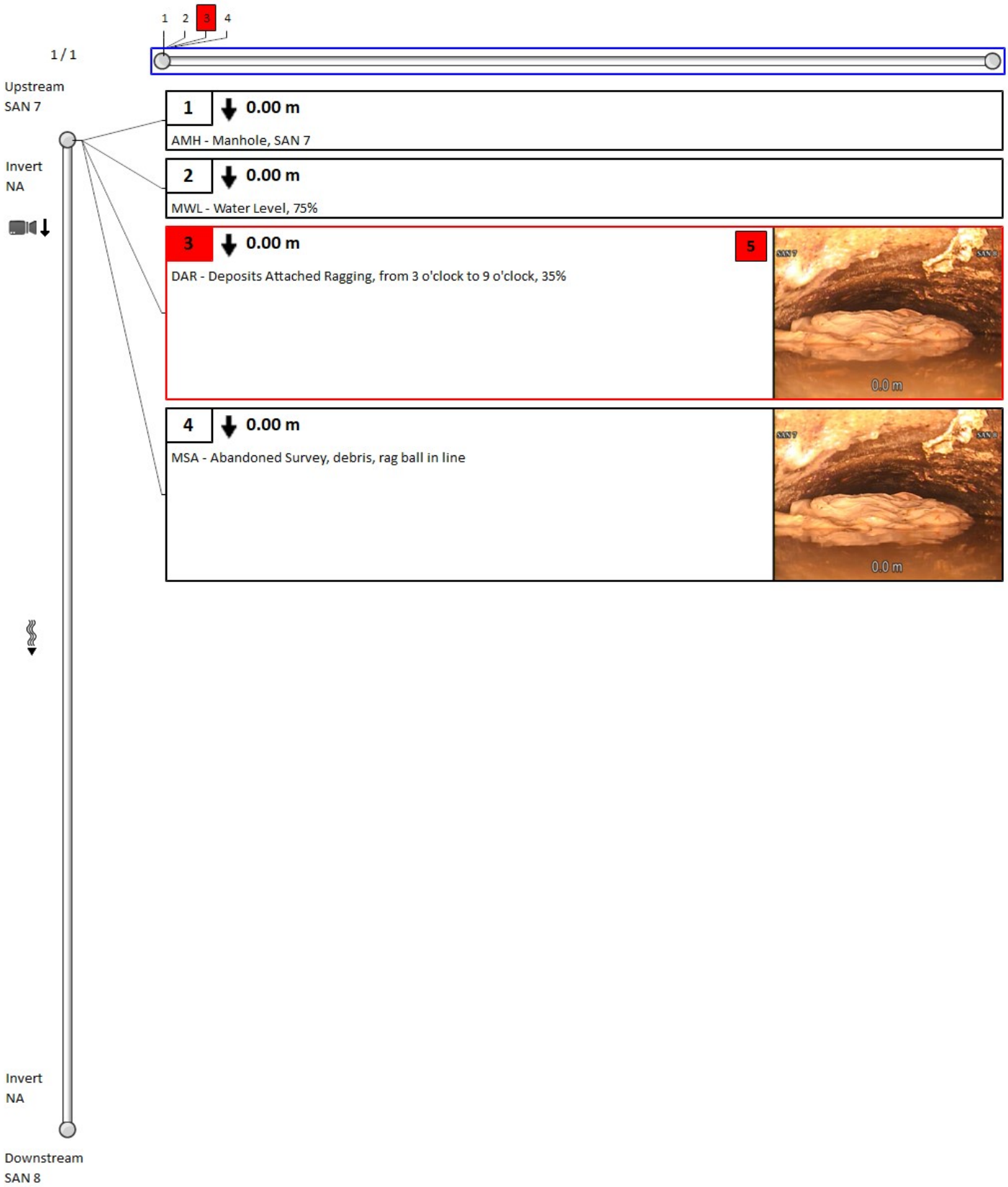
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	5	**Peak:**	5
Quick rating:	0000	**Quick rating:**	5100	**Quick rating:**	5100
Score:	0	**Score:**	5	**Score:**	5
Index:	0	**Index:**	5	**Index:**	5

Additional information

Other information

REPORT ID:	87830SA1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



0 5 10 20 30 40 50
SCALE 1:600 (METRIC)

Include CCTV to upstream manhole on storm and sanitary sewer

LIMIT

0.405 Dia. WATERMAIN

CAMPUS AVENUE

30

23

26

SCULPUTRE ON CONCRETE PAD

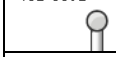
Gas Meter

CB1 CB2 CB3 CB4 CB5 CB6 CB7 CB8

SAN1 SAN2 SAN3 SAN4 SAN5 SAN6 SAN7 SAN8

STM1 STM2 STM3 STM4 STM5 STM6 STM8 STM9 STM10

Vision Report© Legend

	The numbers sequentially indicate each observation that was picked up throughout the inspection period. This will allow you to sift through the pages and view the accompanying description and photos in each section. Note that when a pipe section contains too many observations, Vision© Report must hide secondary observations in order to optimize the display.*
60	A number with neither a square nor circle indicates a general observation.
	A circled number indicates a structural anomaly. The color of the circle indicates the severity of the anomaly on a scale of 1 to 5, 5 being the most severe: green=1, blue=2, magenta=3, orange=4 and red=5.
	A number in a square indicates an operation and maintenance anomaly. The color of the square indicates the severity of the anomaly on a scale of 1 to 5, 5 being the most severe: green=1, blue=2, magenta=3, orange=4 and red=5.
◀ 3 / 31 ▶	Indicates the current page number of the inspection report.
	The blue square indicates a section of the pipe; this section is covered in detail on the current page of the report.
	The green line indicates the inspected part of the pipe. The remaining white line indicates the uninspected part of the pipe.
	Indicates the hold points on the camera during an inspection.
	Indicates the hold points on the camera during the reverse inspection.
	Indicates that a reverse inspection was carried out, however the camera did not reach the initial inspection hold point. (the hold point of the initial inspection)
	Indicates that a reverse inspection was carried out and that it has joined (has arrived at) the initial inspection hold point.
 401-059B	Identifies the start manhole number. Note that this manhole is not necessarily the upstream manhole of the pipe.
 401-631	Identifies the end manhole number. Note that this manhole is not necessarily the downstream manhole of the pipe.
 ou	A downward arrow indicates that the inspection was carried out in the direction of the current, whereas an upward arrow indicates an inspection against the current. Note that the manhole located on the upper left of the page is always the start manhole, but not necessarily the upstream manhole of the pipe.
	This camera followed by a downward arrow is located on the upper left of the vertical pipe; it indicates that an inspection was done from this manhole.
	When the second camera appears on the bottom left page it means that a reverse inspection was carried out. Information about the reverse inspection is included in the report, thereby combining both inspections.
Invert 3.40	The measurement shown under the word <Invert> indicates the measurements between the frame and the pipe captured during the inspection. This measurement is available at the top left for the start manhole and the bottom left for the end manhole. If the invert was not measured during the inspection, an <NA> mark will be displayed.
 1 AMH - R	The downward bold arrow to the right of the observation number indicates that this observation was captured during the initial inspection.
 14 MSA - I	The blank arrow pointing upwards and located to the right of the observation number indicates that this observation was taken during the reverse inspection period, thereby confirming that this report combined both inspections.
18.40 m	Located to the right of the observation number is a number identifying the observation distance in relation to the start of the pipe.
SRV - Armature visib	A full description of the observation code according to the protocol used.

*Any hidden observations are readily accessible from the database as well as in other CTSpec report templates.

** CTSpec inc. reserves the right to modify, eliminate or add to the product features described in this pamphlet without notice.

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CLEAN WATER WORKS INC.

INTEGRATED SEWER SOLUTIONS

Carleton UNIVERSITY

Carleton University

SEWER CCTV INSPECTION REPORT

Report ID
87830ST1

Sewer Use
Storm

Completion Date
November 18, 2019

Inspected Length
415.50 meters

THE WAY IS CLEAR™

Table of contents

1. Index of pipes

22 items

Inspected length : 415.50
Total length : 402.10

Pipe	Start/End	Direction	Road	Date	Inspected	Total	Page
CB 1 STM 2	STM 2 --> CB 1	Against flow	Campus Avenue	13/11/2019 10:03 AM	11.3	11.3	5
CB 2 STM 8	CB 2 --> STM 8	Direction of flow	Campus Avenue	13/11/2019 1:59 PM	3	3	7
CB 3 CB 2	CB 2 --> CB 3	Against flow	Campus Avenue	13/11/2019 2:26 PM	5.5	5.5	9
CB 4 MAIN	CB 4 --> MAIN	Direction of flow	Campus Avenue	14/11/2019 9:26 AM	9.8	9.8	11
CB 5 CB 4	CB 5 --> CB 4	Direction of flow	Campus Avenue	14/11/2019 9:16 AM	6.3	6.3	13
CB 6 CB 5	CB 6 --> CB 5	Direction of flow	Campus Avenue	14/11/2019 8:53 AM	4.6	4.6	15
CB 7 STM 8	CB 7 --> STM 8	Direction of flow	Campus Avenue	18/11/2019 3:33 PM	20.9	21	17
CB 8 STM 5	STM 5 --> CB 8	Against flow	Campus Avenue	14/11/2019 2:30 PM	8.5	8.5	19
LIMIT STM 5	STM 5 --> LIMIT	Against flow	Campus Avenue	14/11/2019 3:57 PM	49.9	49.9	21
STM 1 STM 2	STM 2 --> STM 1	Against flow	Campus Avenue	13/11/2019 10:23 AM	34.3	34.3	23
STM 2 STM 3	STM 2 --> STM 3	Direction of flow	Campus Avenue	13/11/2019 3:34 PM	29.4	29.4	25
STM 3 STM 4	STM 3 --> STM 4	Direction of flow	Campus Avenue	18/11/2019 1:57 PM	11.4	11.4	27
STM 3 STM 12	STM 3 --> STM 4	Direction of flow	Campus Avenue	14/11/2019 4:26 PM	2.8	10	29
STM 5 STM 4	STM 5 --> STM 4	Direction of flow	Campus Avenue	14/11/2019 3:34 PM	60.3	60	31
STM 6 STM 5	STM 5 --> STM 6	Against flow	Campus Avenue	14/11/2019 2:17 PM	20.7	20.7	34
STM 7 STM 5	STM 7 --> STM 5	Direction of flow	Campus Avenue	13/11/2019 2:10 PM	36.3	44	36
STM 7 STM 5	STM 7 --> STM 5	Direction of flow	Campus Avenue	18/11/2019 12:57 PM	44.9	44	39
STM 8 STM 7	STM 8 --> STM 7	Direction of flow	Campus Avenue	13/11/2019 2:03 PM	4.7	4.7	41
STM 9 STM 8	STM 9 --> STM 8	Direction of flow	Campus Avenue	13/11/2019 11:43 AM	18.7	18.7	43
STM 10 STM 9	STM 9 --> STM 10	Against flow	Campus Avenue	18/11/2019 2:19 PM	1.9	1.9	45
STM 11 BUILDING	STM 11 --> BUILDING	Against flow	Campus Avenue	14/11/2019 11:32 AM	18.2	35	47
STM 11 STM 7	STM 11 --> STM 7	Direction of flow	Campus Avenue	14/11/2019 11:23 AM	12.1	12.1	49

2. Structural rating

22 items

4 - Poor (1 of 22 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
25	4137	3.1	STM 3 STM 4	STM 3 --> STM 4	Direction of flow	Campus Avenue	27

3 - Fair (7 of 22 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
89	3D21	3	STM 7 STM 5	STM 7 --> STM 5	Direction of flow	Campus Avenue	39
66	3C00	3	STM 7 STM 5	STM 7 --> STM 5	Direction of flow	Campus Avenue	36
49	3B11	2.9	STM 5 STM 4	STM 5 --> STM 4	Direction of flow	Campus Avenue	31
27	3900	3	CB 7 STM 8	CB 7 --> STM 8	Direction of flow	Campus Avenue	17
24	3800	3	STM 6 STM 5	STM 5 --> STM 6	Against flow	Campus Avenue	34
21	3700	3	STM 9 STM 8	STM 9 --> STM 8	Direction of flow	Campus Avenue	43
3	3100	3	STM 8 STM 7	STM 8 --> STM 7	Direction of flow	Campus Avenue	41

2 - Good (1 of 22 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
2	2100	2	STM 11 STM 7	STM 11 --> STM 7	Direction of flow	Campus Avenue	49

0 - No Defects (13 of 22 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
0	0000	0	CB 1 STM 2	STM 2 --> CB 1	Against flow	Campus Avenue	5
0	0000	0	CB 2 STM 8	CB 2 --> STM 8	Direction of flow	Campus Avenue	7
0	0000	0	CB 3 CB 2	CB 2 --> CB 3	Against flow	Campus Avenue	9
0	0000	0	CB 4 MAIN	CB 4 --> MAIN	Direction of flow	Campus Avenue	11
0	0000	0	CB 5 CB 4	CB 5 --> CB 4	Direction of flow	Campus Avenue	13
0	0000	0	CB 6 CB 5	CB 6 --> CB 5	Direction of flow	Campus Avenue	15
0	0000	0	CB 8 STM 5	STM 5 --> CB 8	Against flow	Campus Avenue	19
0	0000	0	LIMIT STM 5	STM 5 --> LIMIT	Against flow	Campus Avenue	21
0	0000	0	STM 1 STM 2	STM 2 --> STM 1	Against flow	Campus Avenue	23
0	0000	0	STM 2 STM 3	STM 2 --> STM 3	Direction of flow	Campus Avenue	25
0	0000	0	STM 3 STM 12	STM 3 --> STM 4	Direction of flow	Campus Avenue	29
0	0000	0	STM 10 STM 9	STM 9 --> STM 10	Against flow	Campus Avenue	45
0	0000	0	STM 11 BUILDING	STM 11 --> BUILDING	Against flow	Campus Avenue	47

3. O&M rating

22 items

5 - Immediate Attention (1 of 22 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
5	5100	5	0	STM 11 BUILDING	STM 11 --> BUILDING	Against flow	Campus Avenue	47

4 - Poor (3 of 22 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
8	4200	4	0	CB 6 CB 5	CB 6 --> CB 5	Direction of flow	Campus Avenue	15
6	4121	3	0	CB 4 MAIN	CB 4 --> MAIN	Direction of flow	Campus Avenue	11
6	4121	3	4	STM 3 STM 4	STM 3 --> STM 4	Direction of flow	Campus Avenue	27

2 - Good (4 of 22 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
2	2100	2	0	STM 3 STM 12	STM 3 --> STM 4	Direction of flow	Campus Avenue	29
2	2100	2	3	STM 5 STM 4	STM 5 --> STM 4	Direction of flow	Campus Avenue	31
2	2100	2	3	STM 7 STM 5	STM 7 --> STM 5	Direction of flow	Campus Avenue	36
2	2100	2	0	STM 10 STM 9	STM 9 --> STM 10	Against flow	Campus Avenue	45

0 - No Defects (14 of 22 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
0	0000	0	0	CB 1 STM 2	STM 2 --> CB 1	Against flow	Campus Avenue	5
0	0000	0	0	CB 2 STM 8	CB 2 --> STM 8	Direction of flow	Campus Avenue	7
0	0000	0	0	CB 3 CB 2	CB 2 --> CB 3	Against flow	Campus Avenue	9
0	0000	0	0	CB 5 CB 4	CB 5 --> CB 4	Direction of flow	Campus Avenue	13
0	0000	0	3	CB 7 STM 8	CB 7 --> STM 8	Direction of flow	Campus Avenue	17
0	0000	0	0	CB 8 STM 5	STM 5 --> CB 8	Against flow	Campus Avenue	19
0	0000	0	0	LIMIT STM 5	STM 5 --> LIMIT	Against flow	Campus Avenue	21
0	0000	0	0	STM 1 STM 2	STM 2 --> STM 1	Against flow	Campus Avenue	23
0	0000	0	0	STM 2 STM 3	STM 2 --> STM 3	Direction of flow	Campus Avenue	25
0	0000	0	3	STM 6 STM 5	STM 5 --> STM 6	Against flow	Campus Avenue	34
0	0000	0	3	STM 7 STM 5	STM 7 --> STM 5	Direction of flow	Campus Avenue	39
0	0000	0	3	STM 8 STM 7	STM 8 --> STM 7	Direction of flow	Campus Avenue	41
0	0000	0	3	STM 9 STM 8	STM 9 --> STM 8	Direction of flow	Campus Avenue	43
0	0000	0	2	STM 11 STM 7	STM 11 --> STM 7	Direction of flow	Campus Avenue	49

4. Pipe summary and condition details

Pipe identification

Pipe:	CB 1 STM 2	**Direction of inspection:**	STM 2 --> CB 1
Direction of flow:	CB 1 --> STM 2	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	11.3
Height:	200	**Total length:**	11.3
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 10:03 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

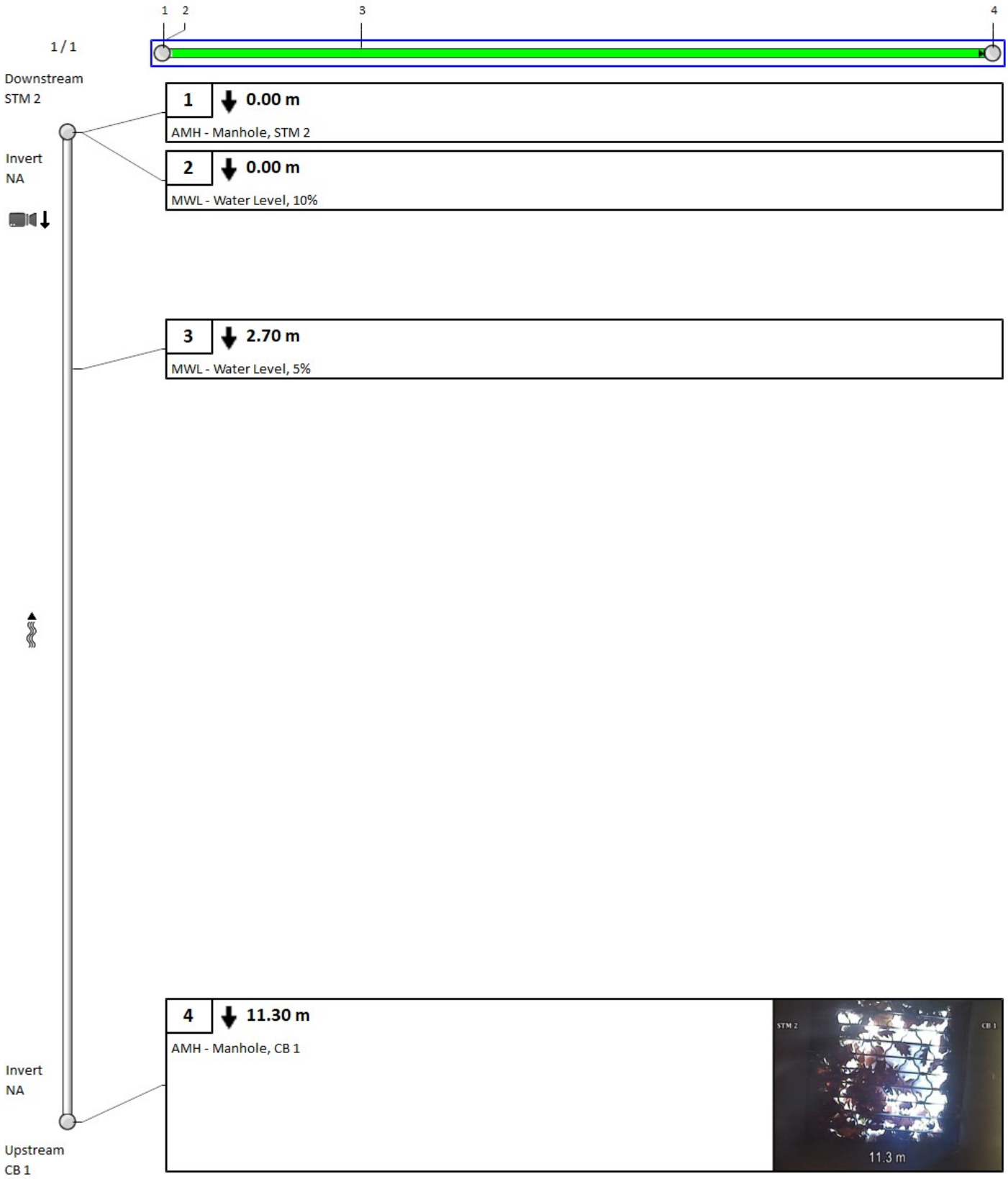
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	CB 2 STM 8	**Direction of inspection:**	CB 2 --> STM 8
Direction of flow:	CB 2 --> STM 8	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	3
Height:	250	**Total length:**	3
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 1:59 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

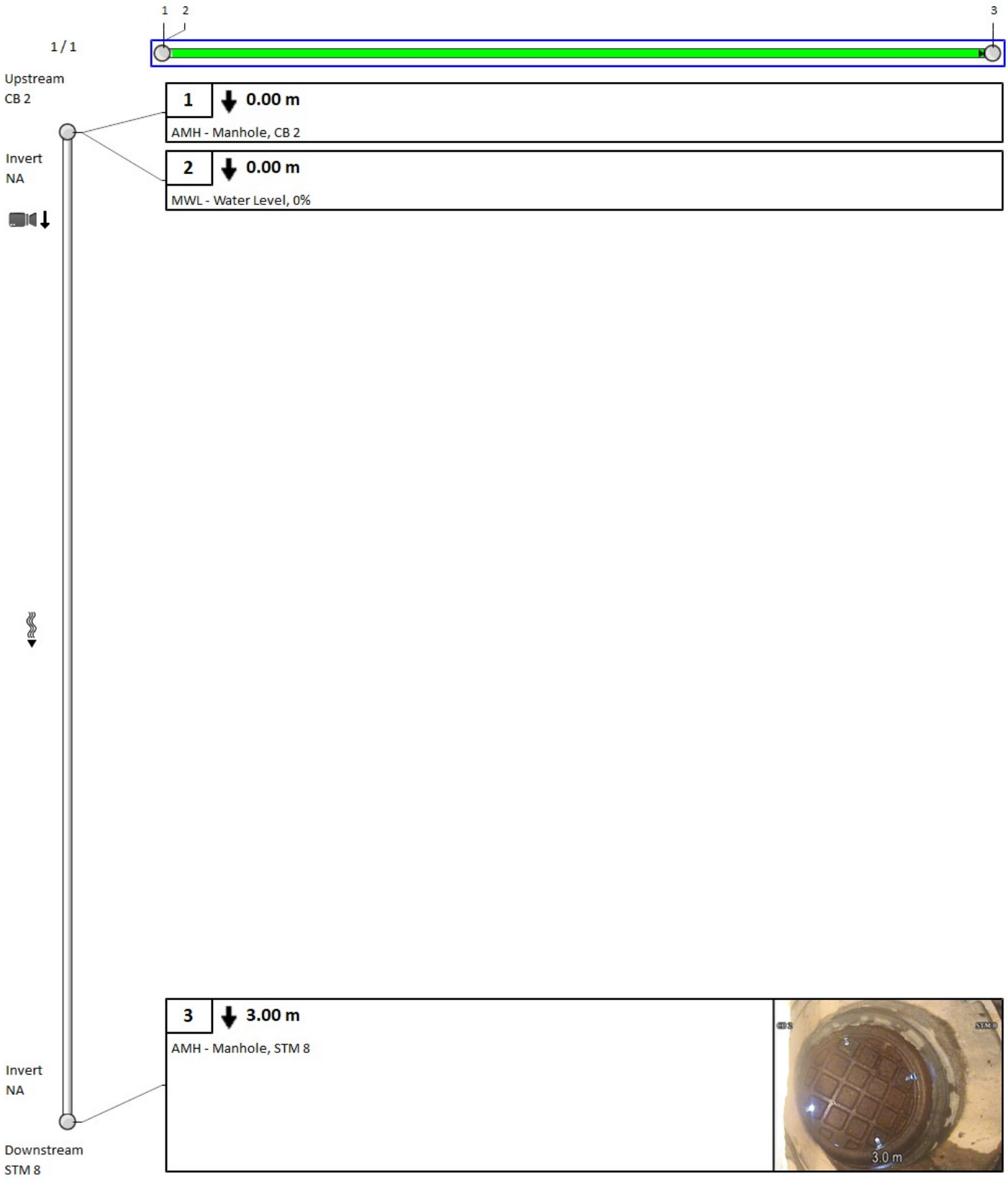
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	CB 3 CB 2	**Direction of inspection:**	CB 2 --> CB 3
Direction of flow:	CB 3 --> CB 2	**Direction:**	Against flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:	Parking Lot			
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	5.5
Height:	250	**Total length:**	5.5
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1.5	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 2:26 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

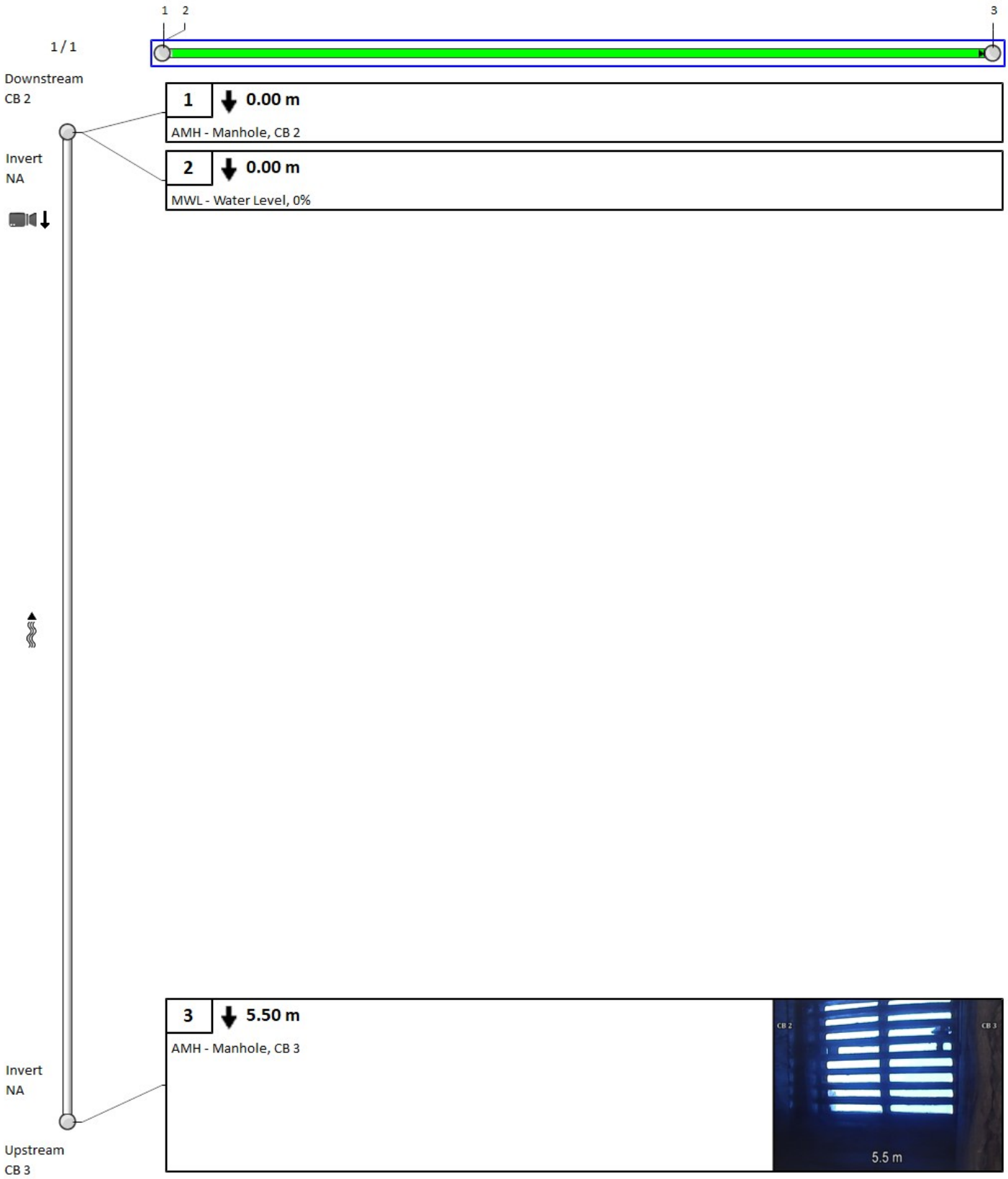
Additional information

Broken Lid at upstream CB

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	CB 4 MAIN	**Direction of inspection:**	CB 4 --> MAIN
Direction of flow:	CB 4 --> MAIN	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:				
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	9.8
Height:	200	**Total length:**	9.8
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 9:26 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

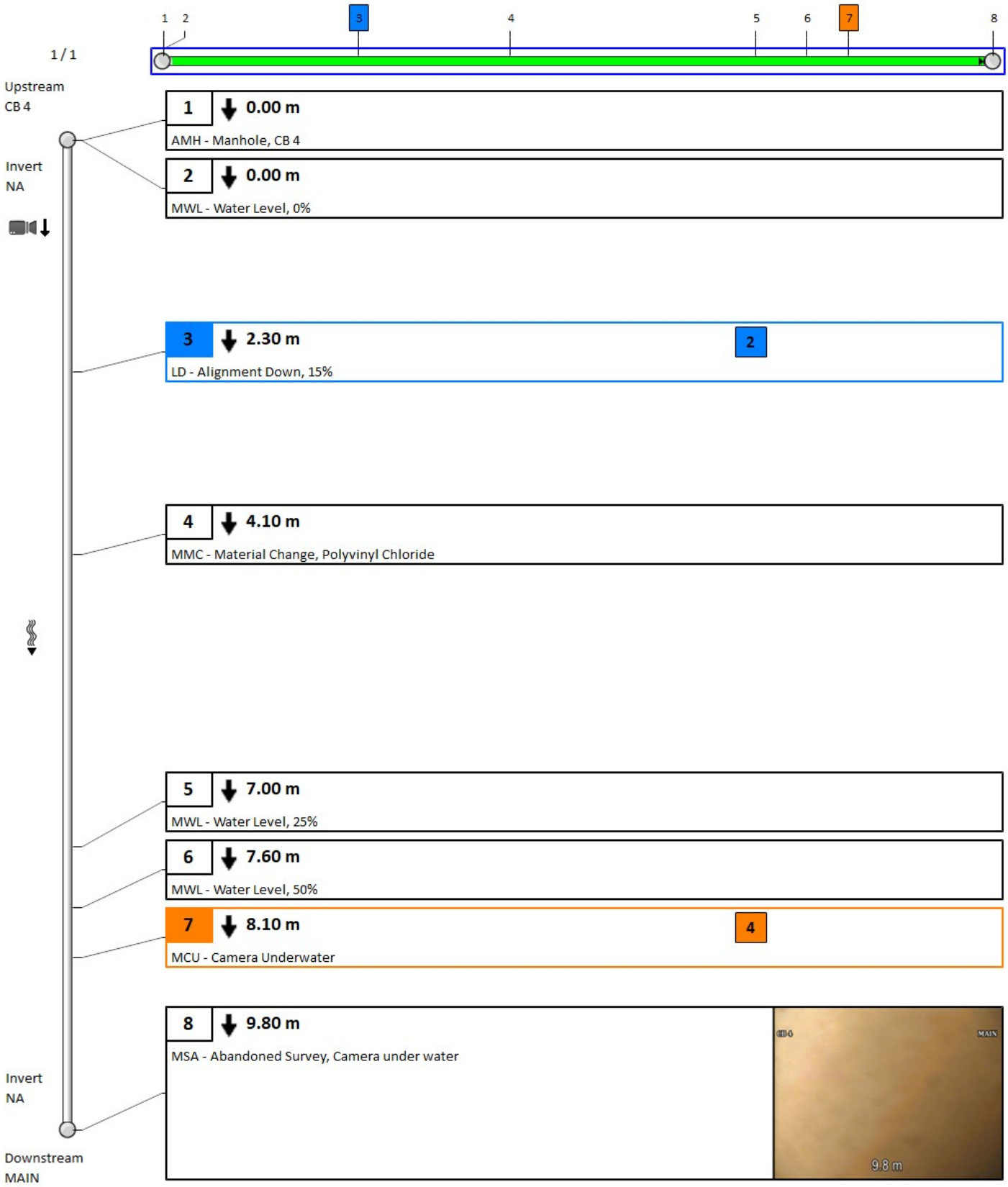
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	4	**Peak:**	4
Quick rating:	0000	**Quick rating:**	4121	**Quick rating:**	4121
Score:	0	**Score:**	6	**Score:**	6
Index:	0	**Index:**	3	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	CB 5 CB 4	**Direction of inspection:**	CB 5 --> CB 4
Direction of flow:	CB 5 --> CB 4	**Direction:**	Direction of flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:				
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	6.3
Height:	200	**Total length:**	6.3
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 9:16 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

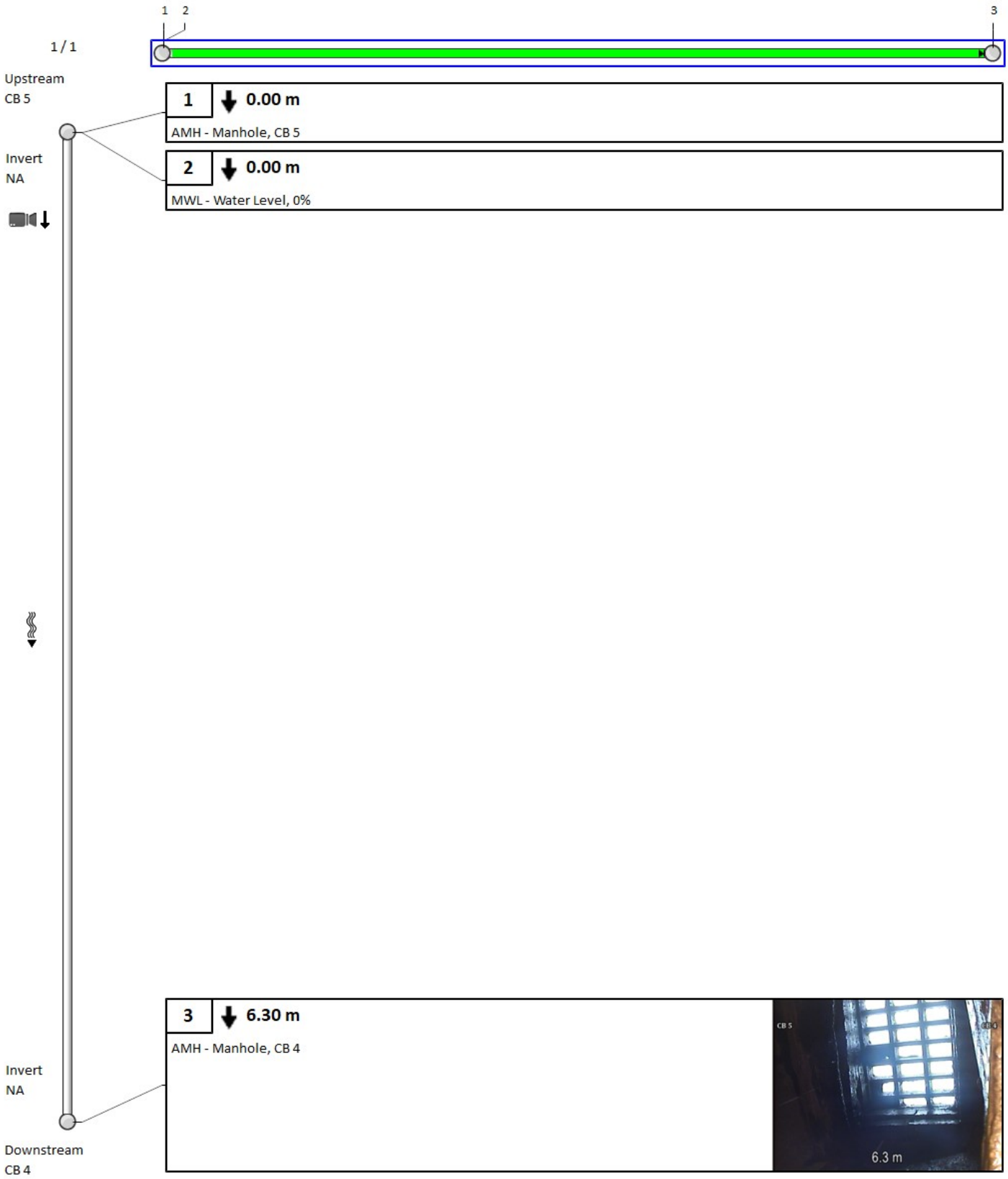
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	CB 6 CB 5	**Direction of inspection:**	CB 6 --> CB 5
Direction of flow:	CB 6 --> CB 5	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	4.6
Height:	200	**Total length:**	4.6
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 8:53 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	4	**Peak:**	4
Quick rating:	0000	**Quick rating:**	4200	**Quick rating:**	4200
Score:	0	**Score:**	8	**Score:**	8
Index:	0	**Index:**	4	**Index:**	4

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

4. Pipe summary and condition details

Pipe identification

Pipe:	CB 7 STM 8	**Direction of inspection:**	CB 7 --> STM 8
Direction of flow:	CB 7 --> STM 8	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	20.9
Height:	200	**Total length:**	21
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 3:33 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	0	**Peak:**	3
Quick rating:	3900	**Quick rating:**	0000	**Quick rating:**	3900
Score:	27	**Score:**	0	**Score:**	27
Index:	3	**Index:**	0	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

Upstream
CB 7

Invert
NA

1 **0.00 m**
AMH - Manhole, CB 7

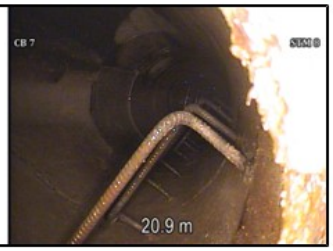
2 **0.00 m**
MWL - Water Level, 5%

3 **6.50 m** **3**
(S01) FL - Fracture Longitudinal, at joint, at 12 o'clock

4 **14.00 m**
MWL - Water Level, 15%

5 **20.90 m** **3**
(F01) FL - Fracture Longitudinal, at joint, at 12 o'clock

6 **20.90 m**
AMH - Manhole, STM 8



Invert
NA

Downstream
STM 8

4. Pipe summary and condition details

Pipe identification

Pipe:	CB 8 STM 5	**Direction of inspection:**	STM 5 --> CB 8
Direction of flow:	CB 8 --> STM 5	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	8.5
Height:	200	**Total length:**	8.5
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 2:30 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

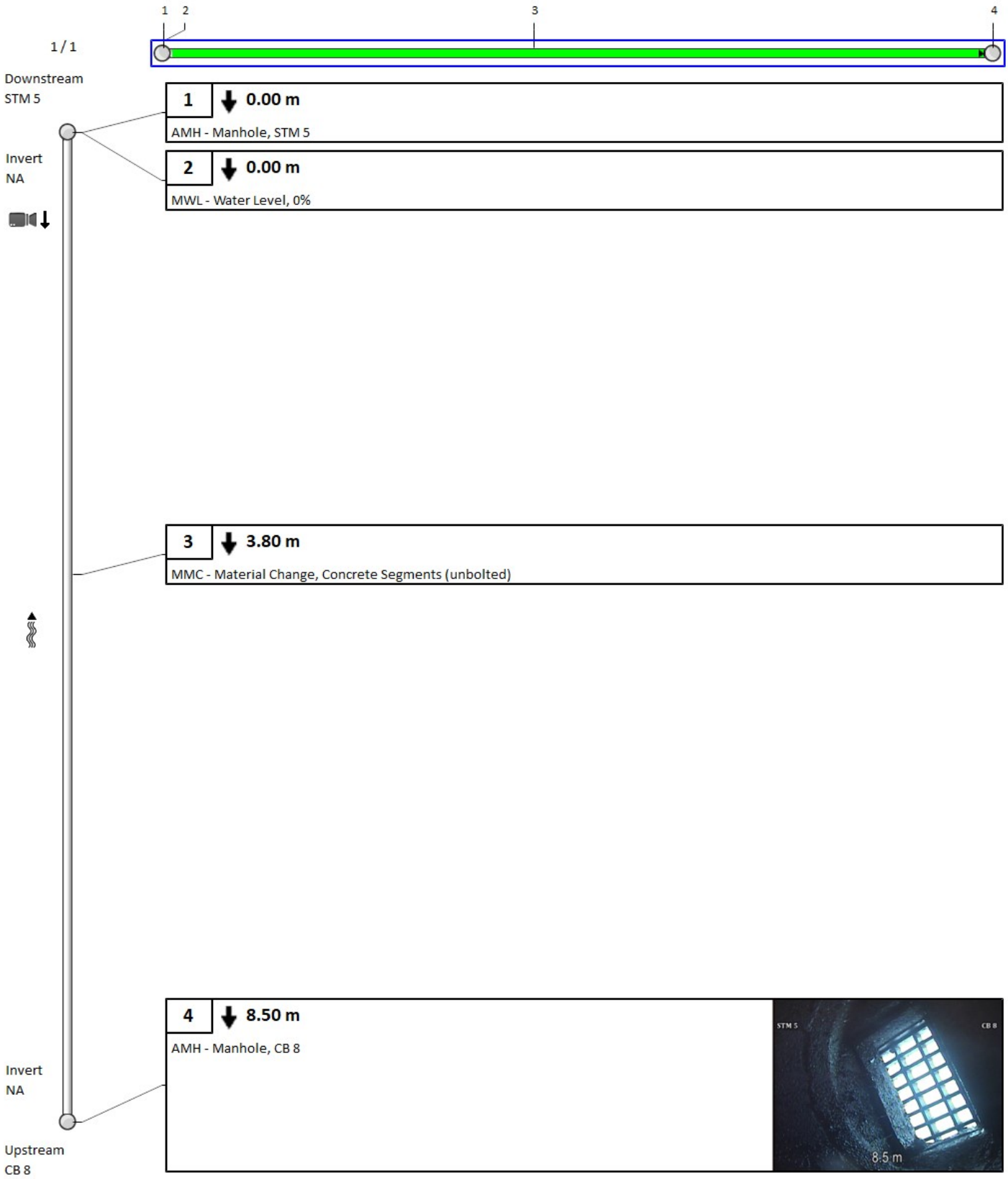
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	LIMIT STM 5	**Direction of inspection:**	STM 5 --> LIMIT
Direction of flow:	LIMIT --> STM 5	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	49.9
Height:	450	**Total length:**	49.9
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 3:57 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

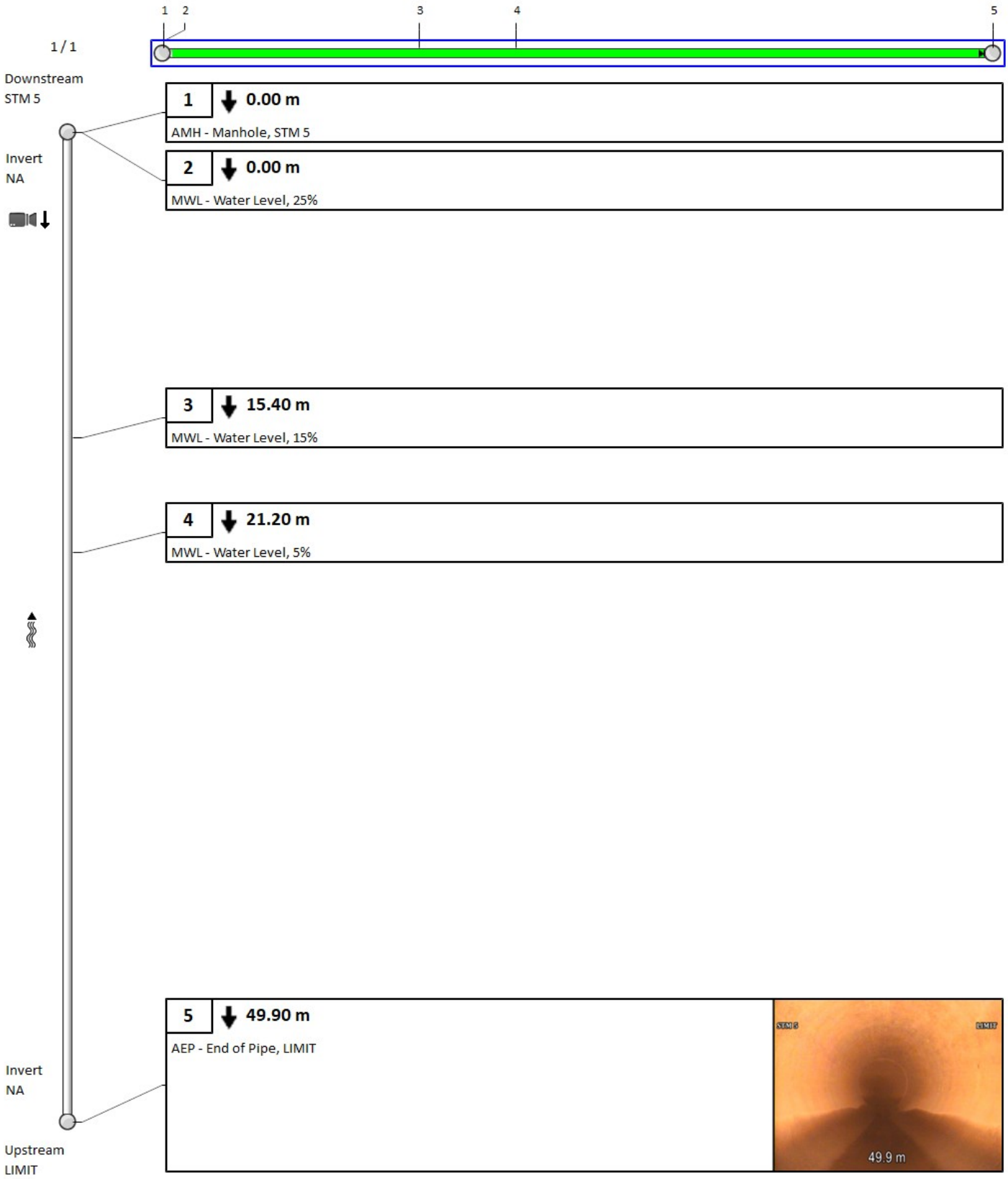
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 1 STM 2	**Direction of inspection:**	STM 2 --> STM 1
Direction of flow:	STM 1 --> STM 2	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	34.3
Height:	250	**Total length:**	34.3
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 10:23 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

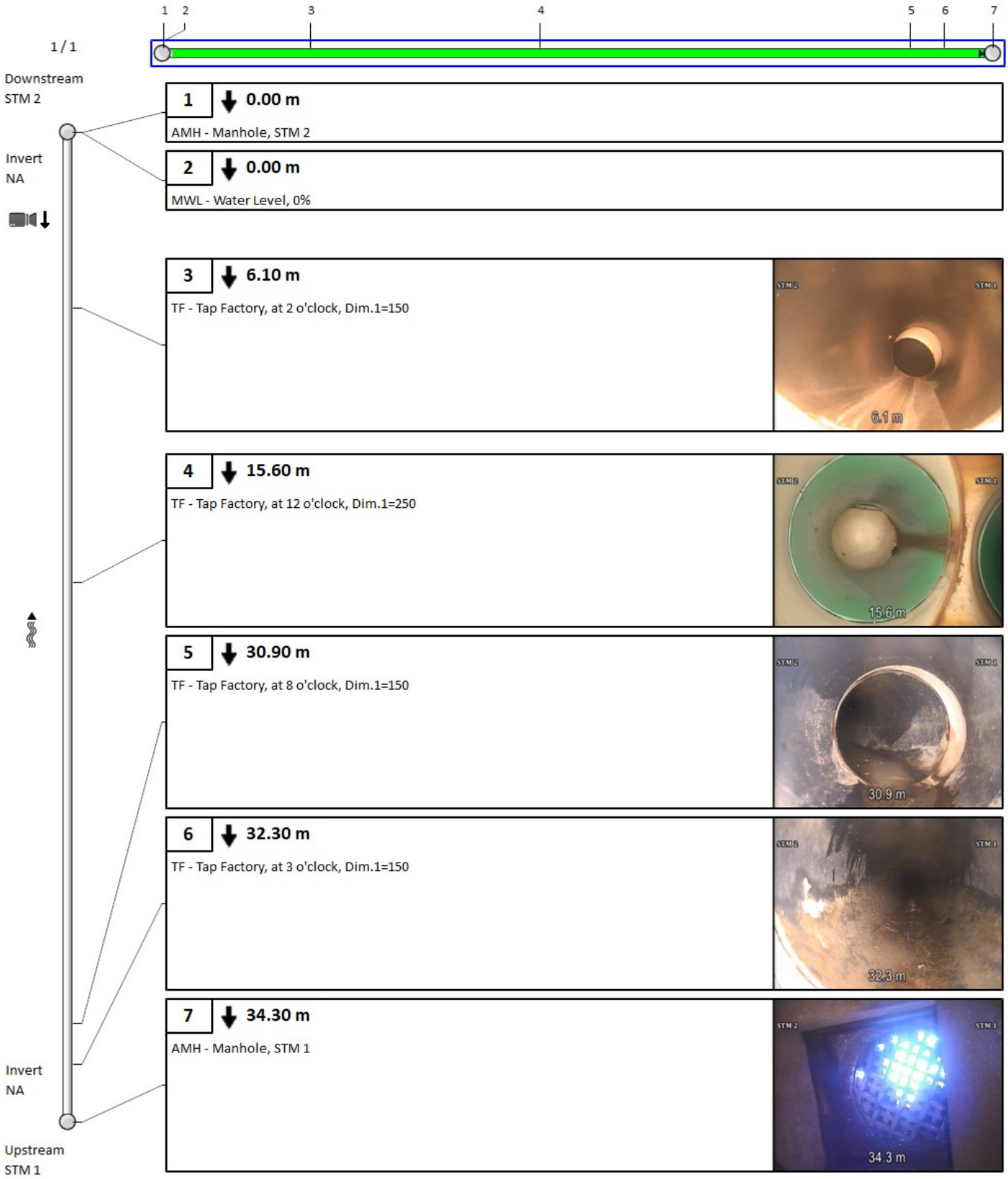
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 2 STM 3	**Direction of inspection:**	STM 2 --> STM 3
Direction of flow:	STM 2 --> STM 3	**Direction:**	Direction of flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:	Parking Lot			
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	29.4
Height:	300	**Total length:**	29.4
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	3	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 3:34 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

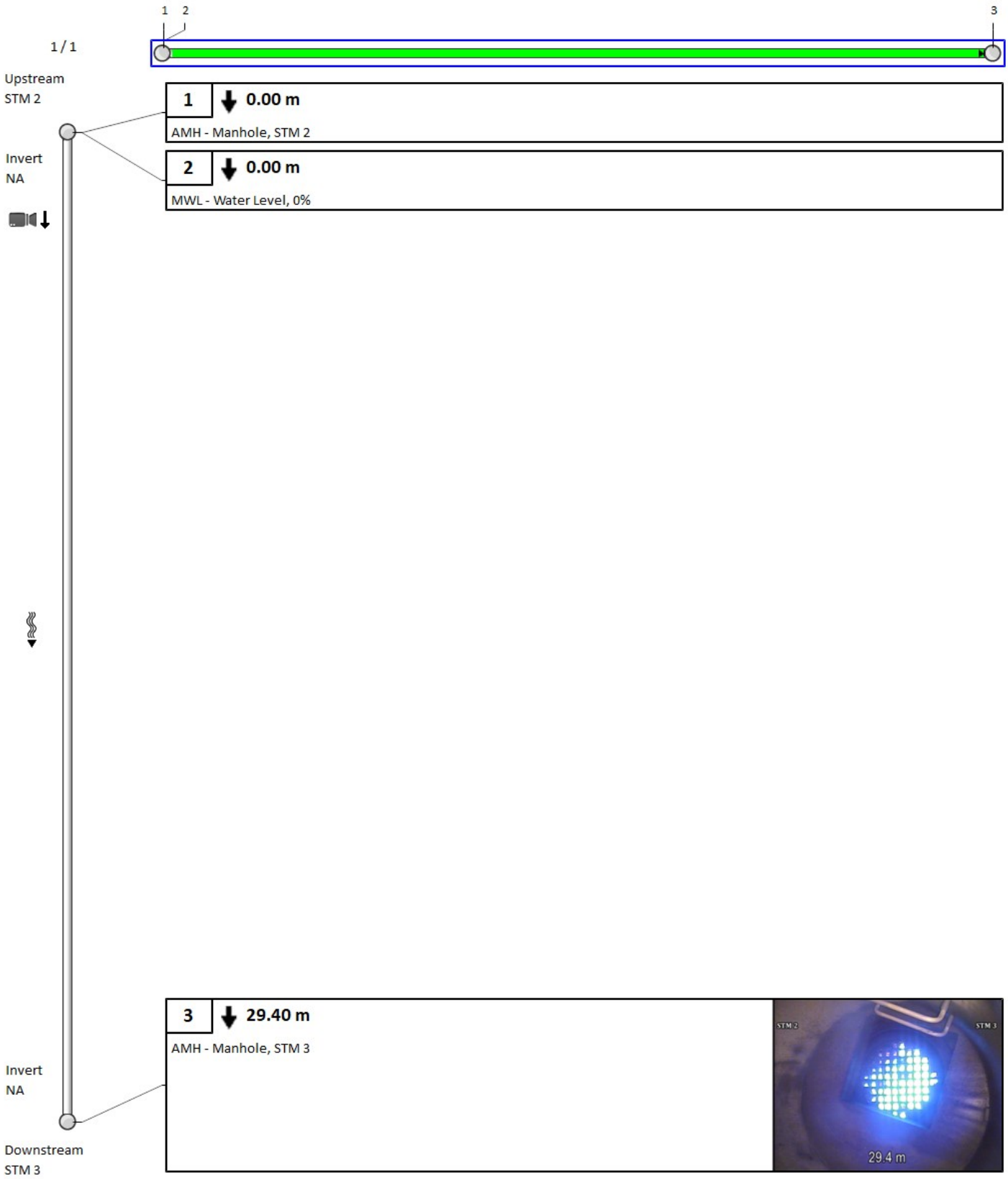
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	0	**Peak:**	0
Quick rating:	0000	**Quick rating:**	0000	**Quick rating:**	0000
Score:	0	**Score:**	0	**Score:**	0
Index:	0	**Index:**	0	**Index:**	0

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 3 STM 4	**Direction of inspection:**	STM 3 --> STM 4
Direction of flow:	STM 3 --> STM 4	**Direction:**	Direction of flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:	Parking Lot			
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	11.4
Height:	450	**Total length:**	11.4
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 1:57 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	4	**Peak:**	4	**Peak:**	4
Quick rating:	4137	**Quick rating:**	4121	**Quick rating:**	4237
Score:	25	**Score:**	6	**Score:**	31
Index:	3.1	**Index:**	3	**Index:**	3.1

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

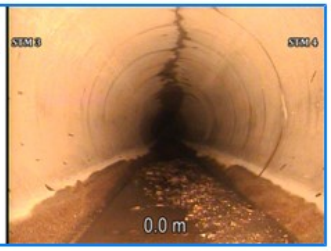
Upstream
STM 3

Invert
NA

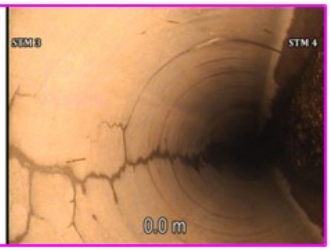
1 **0.00 m**
AMH - Manhole, STM 3

2 **0.00 m**
MWL - Water Level, 15%

3 **0.00 m** **2**
DSF - Deposits Settled Fine, from 5 o'clock to 7 o'clock, 5%

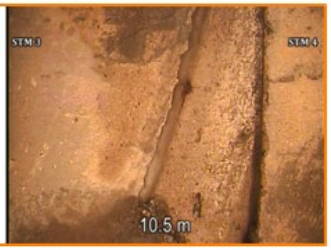


4 **0.00 m** **3**
(S01) FL - Fracture Longitudinal, at joint, at 12 o'clock



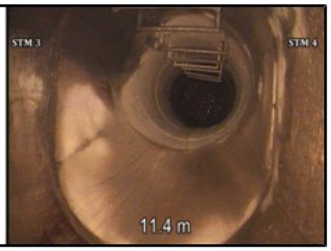
5 **10.00 m** **4**
LL - Alignment Left, 25%

6 **10.50 m** **4**
B - Broken, from 12 o'clock to 2 o'clock



7 **10.60 m** **3**
(F01) FL - Fracture Longitudinal, at joint, at 12 o'clock

8 **11.40 m**
AMH - Manhole, STM 4



Invert
NA

Downstream
STM 4

4. Pipe summary and condition details

Pipe identification

Pipe:	STM 3 STM 12	**Direction of inspection:**	STM 3 --> STM 4
Direction of flow:	STM 3 --> STM 4	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	2.8
Height:	450	**Total length:**	10
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:		**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 4:26 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	2	**Peak:**	2
Quick rating:	0000	**Quick rating:**	2100	**Quick rating:**	2100
Score:	0	**Score:**	2	**Score:**	2
Index:	0	**Index:**	2	**Index:**	2

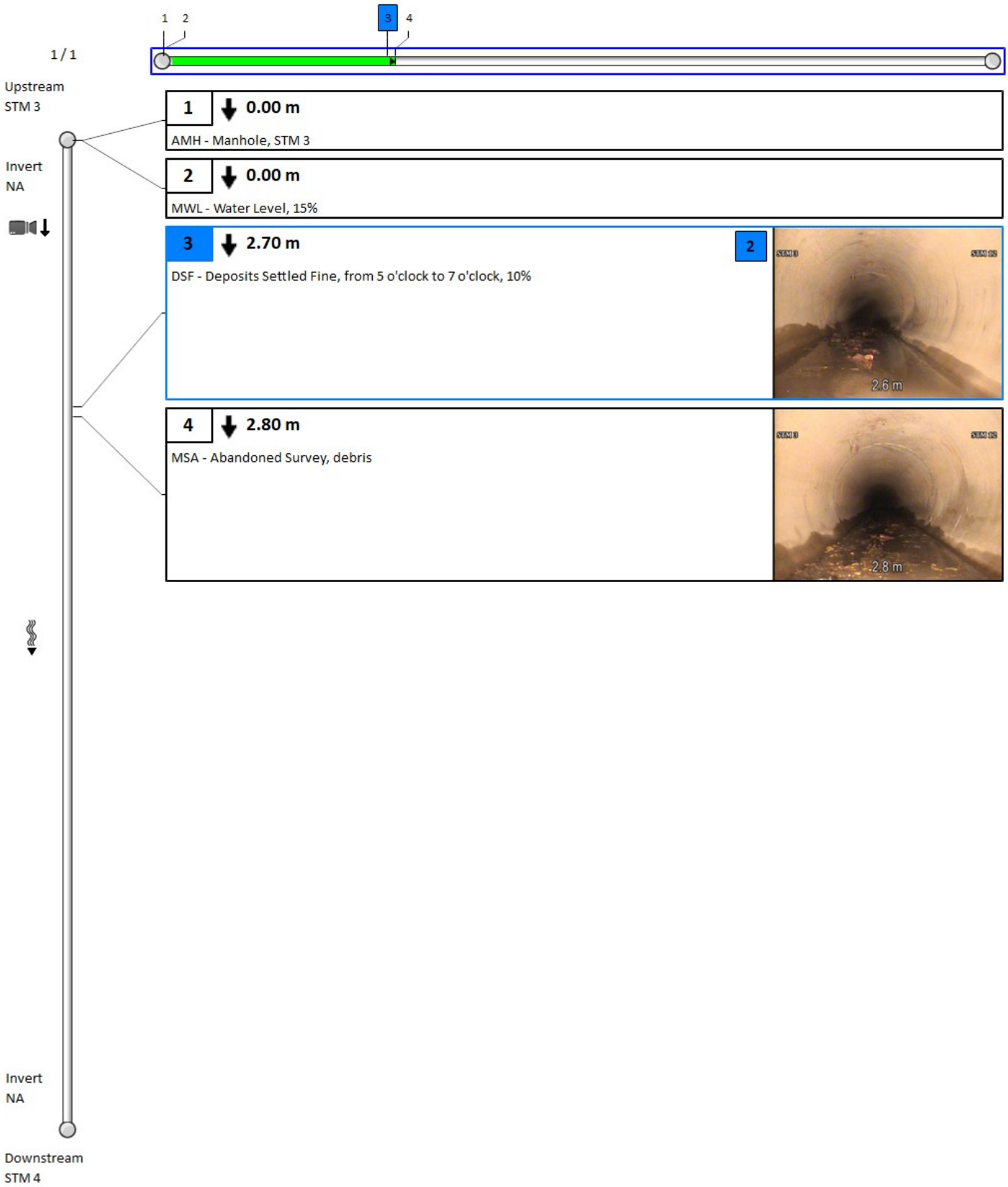
Additional information

Incorrect struction ID. Correction structure ID STM 3 to STM 4

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 5 STM 4	**Direction of inspection:**	STM 5 --> STM 4
Direction of flow:	STM 5 --> STM 4	**Direction:**	Direction of flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:	Light Highway			
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	60.3
Height:	450	**Total length:**	60
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 3:34 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	2	**Peak:**	3
Quick rating:	3B11	**Quick rating:**	2100	**Quick rating:**	3B21
Score:	49	**Score:**	2	**Score:**	51
Index:	2.9	**Index:**	2	**Index:**	2.8

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

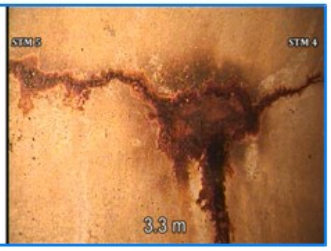
Upstream
STM 5

Invert
NA

1 **0.00 m**
AMH - Manhole, STM 5

2 **0.00 m**
MWL - Water Level, 5%

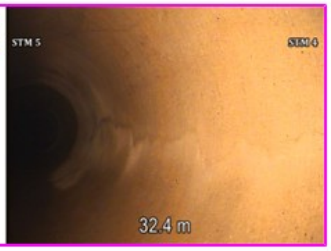
3 **2.40 m** **2**
DSGV - Deposits Settled Gravel, from 5 o'clock to 7 o'clock, 10%



4 **3.30 m** **3**
FL - Fracture Longitudinal, at 11 o'clock

5 **10.90 m** **3**
FL - Fracture Longitudinal, at 12 o'clock

6 **32.40 m** **3**
(S01) FL - Fracture Longitudinal, at joint, at 12 o'clock



7 **37.70 m** **3**
(F01) FL - Fracture Longitudinal, at joint, at 12 o'clock

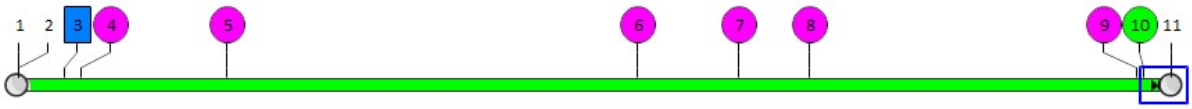
8 **41.40 m** **3**
(S02) FL - Fracture Longitudinal, at joint, at 12 o'clock

Invert
NA

9 **58.50 m** **3**
(F02) FL - Fracture Longitudinal, at joint, at 12 o'clock

Downstream
STM 4

4. Pipe summary and condition details



◀ 2 / 2

Upstream
STM 5

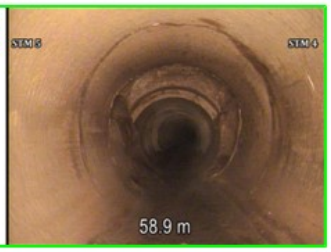
Invert
NA

Invert
NA

Downstream
STM 4

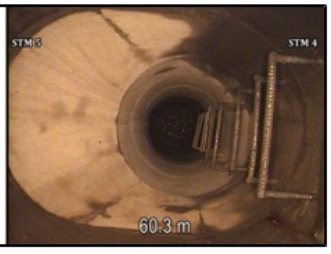
10 **58.90 m** **1**

CC - Crack Circumferential, from 7 o'clock to 4 o'clock



11 **60.30 m**

AMH - Manhole, STM 4



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 6 STM 5	**Direction of inspection:**	STM 5 --> STM 6
Direction of flow:	STM 6 --> STM 5	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	20.7
Height:	200	**Total length:**	20.7
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 2:17 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	0	**Peak:**	3
Quick rating:	3800	**Quick rating:**	0000	**Quick rating:**	3800
Score:	24	**Score:**	0	**Score:**	24
Index:	3	**Index:**	0	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

4. Pipe summary and condition details

Pipe identification

Pipe:	STM 7 STM 5	**Direction of inspection:**	STM 7 --> STM 5
Direction of flow:	STM 7 --> STM 5	**Direction:**	Direction of flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:	Parking Lot			
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	36.3
Height:	300	**Total length:**	44
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 2:10 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	2	**Peak:**	3
Quick rating:	3C00	**Quick rating:**	2100	**Quick rating:**	3C21
Score:	66	**Score:**	2	**Score:**	68
Index:	3	**Index:**	2	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

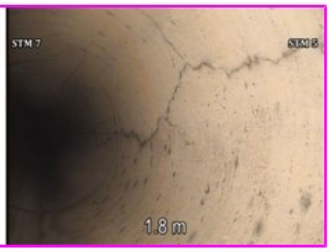
Upstream
STM 7

Invert
NA

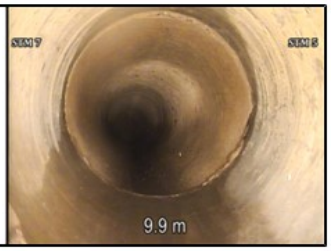
1 **0.00 m**
AMH - Manhole, STM 7

2 **0.00 m**
MWL - Water Level, 5%

3 **1.80 m** 3
(S01) FL - Fracture Longitudinal, at joint, at 12 o'clock



4 **9.90 m**
TB - Tap Break-in, at 9 o'clock, Dim.1=200



5 **23.00 m**
MWL - Water Level, 25%

6 **26.20 m**
MWL - Water Level, 35%

7 **30.50 m**
MWL - Water Level, 25%

8 **33.10 m**
MWL - Water Level, 15%

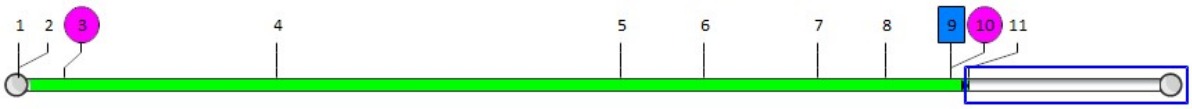
9 **35.60 m** 2
DSGV - Deposits Settled Gravel, from 5 o'clock to 7 o'clock, 10%

10 **35.60 m** 3
(F01) FL - Fracture Longitudinal, at joint, at 12 o'clock

Invert
NA

Downstream
STM 5

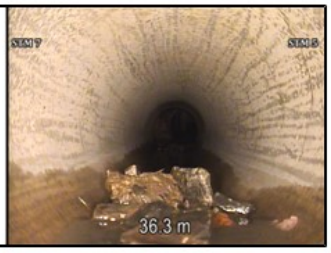
4. Pipe summary and condition details



◀ 2 / 2

Upstream
STM 7

Invert
NA

11	36.30 m
MSA - Abandoned Survey, debris, rocks in line	

Invert
NA

Downstream
STM 5

4. Pipe summary and condition details

Pipe identification

Pipe:	STM 7 STM 5	**Direction of inspection:**	STM 7 --> STM 5
Direction of flow:	STM 7 --> STM 5	**Direction:**	Direction of flow

Pipe location

Road:	Campus Avenue		UPSTREAM	DOWNSTREAM
Crossroad:		**Easting (X):**		**Easting (X):**
Drainage Area:		**Northing (Y):**		**Northing (Y):**
City:	Ottawa	**Elevation (Z):**		**Elevation (Z):**
Location:	Parking Lot			
Owner:	Carleton university			**GPS Accuracy:**
Road segment:				**Corrdinate System:**
				Vertical Datum:

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	44.9
Height:	300	**Total length:**	44
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 12:57 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	0	**Peak:**	3
Quick rating:	3D21	**Quick rating:**	0000	**Quick rating:**	3D21
Score:	89	**Score:**	0	**Score:**	89
Index:	3	**Index:**	0	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

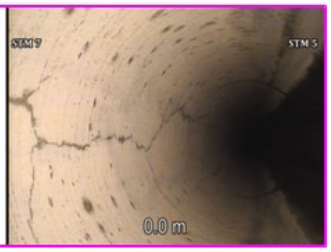
Upstream
STM 7

Invert
NA

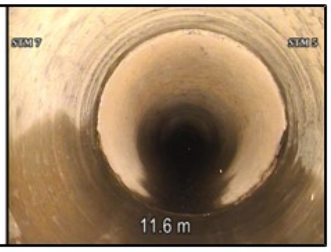
1 **0.00 m**
AMH - Manhole, STM 7

2 **0.00 m**
MWL - Water Level, 5%

3 **0.00 m** 3
(S01) FL - Fracture Longitudinal, at joint, at 12 o'clock



4 **11.60 m**
TB - Tap Break-in, at 10 o'clock, Dim.1=250

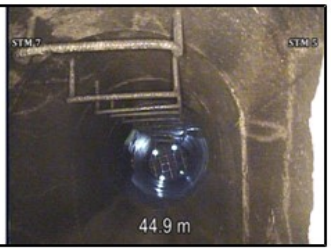


5 **28.60 m**
MWL - Water Level, 25%

6 **44.60 m** 3
(F01) FL - Fracture Longitudinal, at joint, at 12 o'clock

7 **44.90 m** 2
FC - Fracture Circumferential, from 7 o'clock to 5 o'clock

8 **44.90 m**
AMH - Manhole, STM 5



Invert
NA

Downstream
STM 5

4. Pipe summary and condition details

Pipe identification

Pipe:	STM 8 STM 7	**Direction of inspection:**	STM 8 --> STM 7
Direction of flow:	STM 8 --> STM 7	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	4.7
Height:	300	**Total length:**	4.7
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	1	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 2:03 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	0	**Peak:**	3
Quick rating:	3100	**Quick rating:**	0000	**Quick rating:**	3100
Score:	3	**Score:**	0	**Score:**	3
Index:	3	**Index:**	0	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

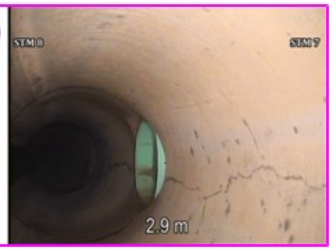
Upstream
STM 8

Invert
NA

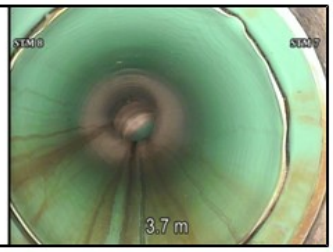
1 **0.00 m**
AMH - Manhole, STM 8

2 **0.00 m**
MWL - Water Level, 5%

3 **2.90 m** 3
(S01) FL - Fracture Longitudinal, at joint, at 12 o'clock



4 **3.70 m**
TB - Tap Break-in, at 12 o'clock, Dim.1=200



5 **4.70 m** 3
(F01) FL - Fracture Longitudinal, at joint, at 12 o'clock

6 **4.70 m**
AMH - Manhole, STM 7

Invert
NA

Downstream
STM 7

4. Pipe summary and condition details

Pipe identification

Pipe:	STM 9 STM 8	**Direction of inspection:**	STM 9 --> STM 8
Direction of flow:	STM 9 --> STM 8	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	18.7
Height:	300	**Total length:**	18.7
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Concrete Segments (unbolted)	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	2	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	13/11/2019 11:43 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

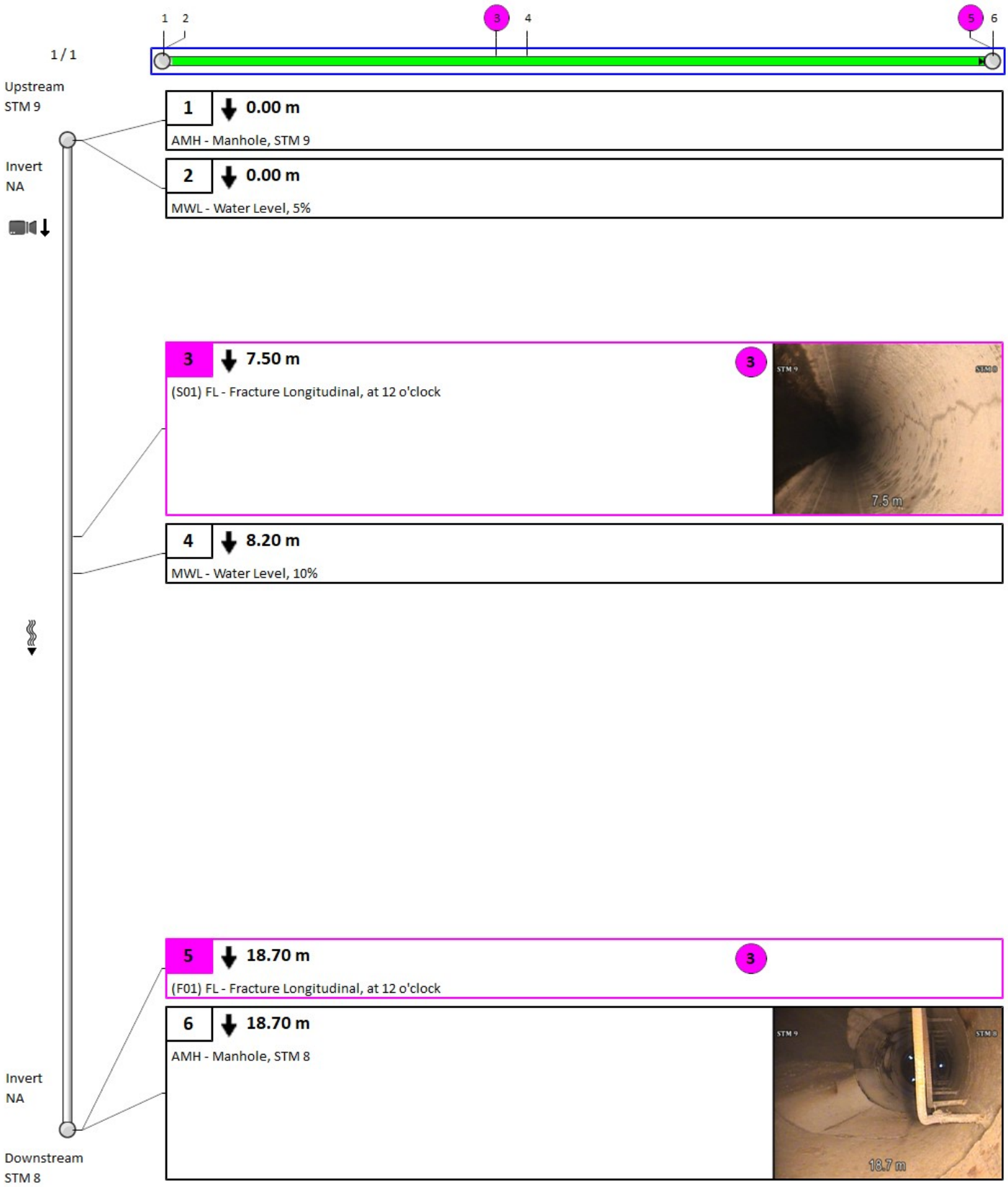
Structural rating		O&M rating		Overall rating	
Peak:	3	**Peak:**	0	**Peak:**	3
Quick rating:	3700	**Quick rating:**	0000	**Quick rating:**	3700
Score:	21	**Score:**	0	**Score:**	21
Index:	3	**Index:**	0	**Index:**	3

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 10 STM 9	**Direction of inspection:**	STM 9 --> STM 10
Direction of flow:	STM 10 --> STM 9	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Parking Lot			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	1.9
Height:	200	**Total length:**	1.9
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:		**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	18/11/2019 2:19 PM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	2	**Peak:**	2
Quick rating:	0000	**Quick rating:**	2100	**Quick rating:**	2100
Score:	0	**Score:**	2	**Score:**	2
Index:	0	**Index:**	2	**Index:**	2

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details

1 / 1

Downstream
STM 9

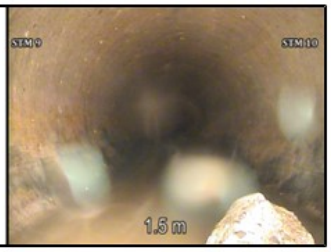
Invert
NA

1 **0.00 m**
AMH - Manhole, STM 9

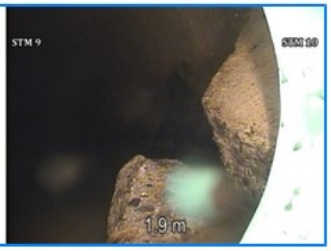
2 **0.00 m**
MWL - Water Level, 10%

3 **1.50 m**
MMC - Material Change, Concrete Segments (unbolted)

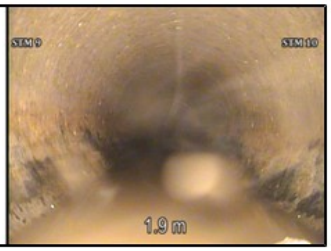
4 **1.50 m**
MSC - Shape or Size Change, Dim.1=300



5 **1.90 m** 2
OBR - Obstacle Rocks, from 4 o'clock to 6 o'clock, 10%



6 **1.90 m**
MSA - Abandoned Survey, Size change from 200 to 300, obstacle rocks



Invert
NA

Upstream
STM 10

4. Pipe summary and condition details

Pipe identification

Pipe:	STM 11 BUILDING	**Direction of inspection:**	STM 11 --> BUILDING
Direction of flow:	BUILDING --> STM 11	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	18.2
Height:	150	**Total length:**	35
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 11:32 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

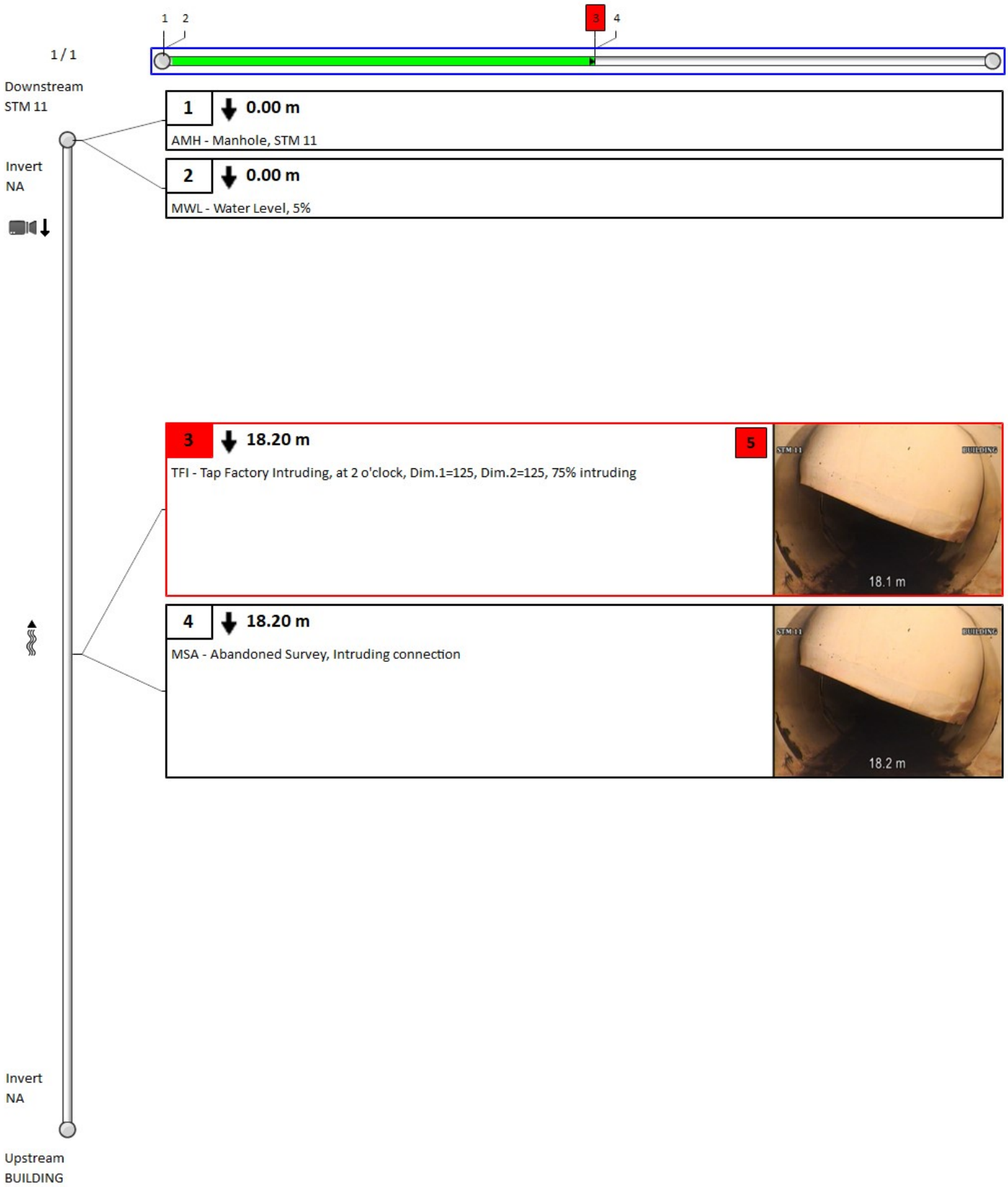
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	5	**Peak:**	5
Quick rating:	0000	**Quick rating:**	5100	**Quick rating:**	5100
Score:	0	**Score:**	5	**Score:**	5
Index:	0	**Index:**	5	**Index:**	5

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



4. Pipe summary and condition details

Pipe identification

Pipe:	STM 11 STM 7	**Direction of inspection:**	STM 11 --> STM 7
Direction of flow:	STM 11 --> STM 7	**Direction:**	Direction of flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Campus Avenue	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:	Light Highway			
Owner:	Carleton university	**GPS Accuracy:**		
Road segment:		**Corrdinate System:**		
		Vertical Datum:		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	12.1
Height:	150	**Total length:**	12.1
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	14/11/2019 11:23 AM	**Location details:**	
Project Number:	Carleton University	**Surveyed by:**	Jonathan Larocque
Customer:	Carleton University-87830	**Certificate #:**	U06180703002189
PO number:		**Pre-Cleaning:**	Jetting
Work order:	87830	**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Snow	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

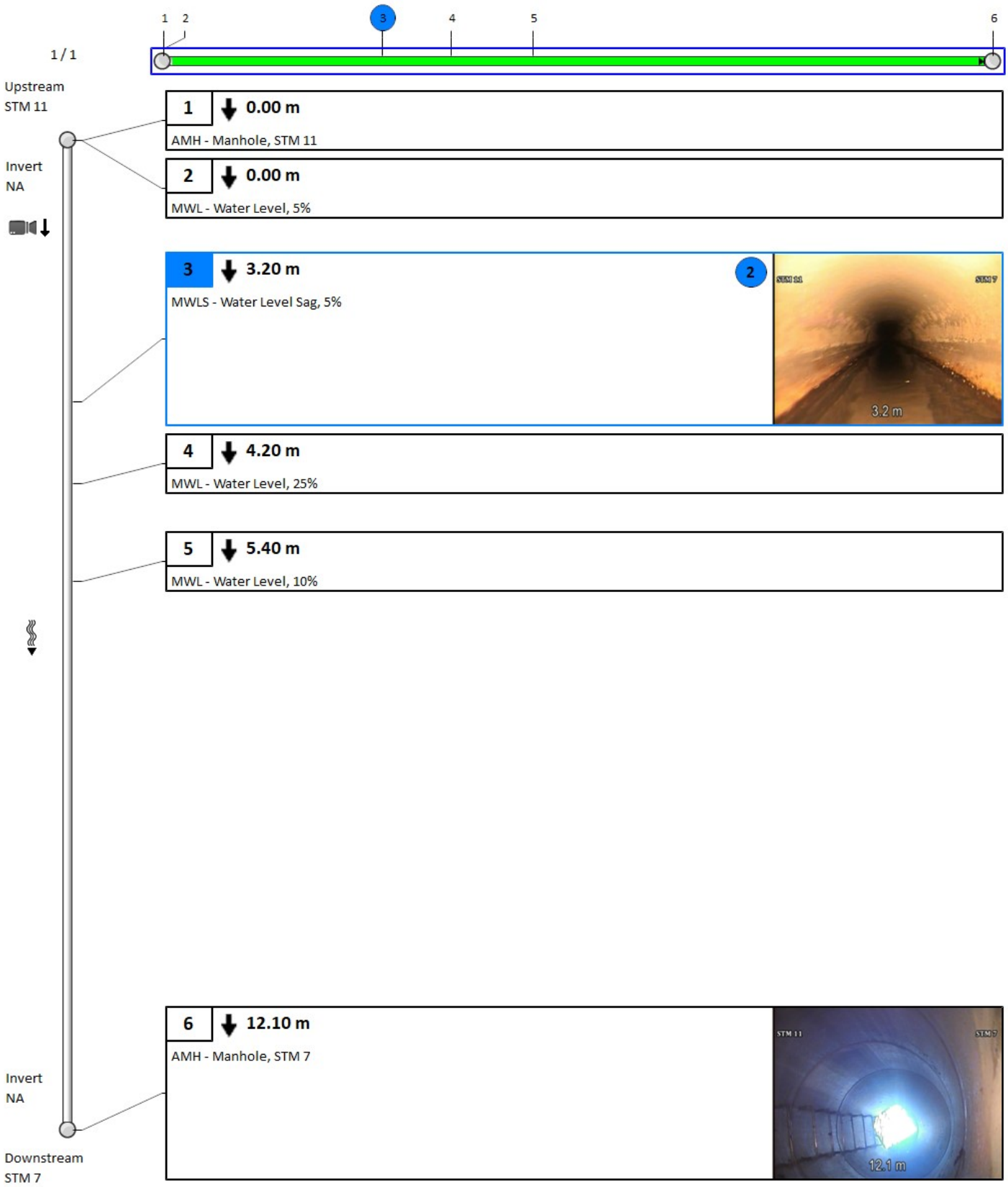
Structural rating		O&M rating		Overall rating	
Peak:	2	**Peak:**	0	**Peak:**	2
Quick rating:	2100	**Quick rating:**	0000	**Quick rating:**	2100
Score:	2	**Score:**	0	**Score:**	2
Index:	2	**Index:**	0	**Index:**	2

Additional information

Other information

REPORT ID:	87830ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



0 5 10 20 30 40 50
SCALE 1:600 (METRIC)

Include CCTV to upstream manhole on storm and sanitary sewer

LIMIT

0.405 Dia. WATERMAIN

CAMPUS AVENUE

30

23

26

SCULPUTRE ON CONCRETE PAD

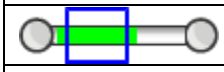
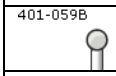
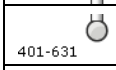
Gas Meter

CB1 CB2 CB3 CB4 CB5 CB6 CB7 CB8

SAN1 SAN2 SAN3 SAN4 SAN5 SAN6 SAN7 SAN8

STM1 STM2 STM3 STM4 STM5 STM6 STM8 STM9 STM10

Vision Report© Legend

	The numbers sequentially indicate each observation that was picked up throughout the inspection period. This will allow you to sift through the pages and view the accompanying description and photos in each section. Note that when a pipe section contains too many observations, Vision© Report must hide secondary observations in order to optimize the display.*
60	A number with neither a square nor circle indicates a general observation.
	A circled number indicates a structural anomaly. The color of the circle indicates the severity of the anomaly on a scale of 1 to 5, 5 being the most severe: green=1, blue=2, magenta=3, orange=4 and red=5.
	A number in a square indicates an operation and maintenance anomaly. The color of the square indicates the severity of the anomaly on a scale of 1 to 5, 5 being the most severe: green=1, blue=2, magenta=3, orange=4 and red=5.
◀ 3 / 31 ▶	Indicates the current page number of the inspection report.
	The blue square indicates a section of the pipe; this section is covered in detail on the current page of the report.
	The green line indicates the inspected part of the pipe. The remaining white line indicates the uninspected part of the pipe.
	Indicates the hold points on the camera during an inspection.
	Indicates the hold points on the camera during the reverse inspection.
	Indicates that a reverse inspection was carried out, however the camera did not reach the initial inspection hold point. (the hold point of the initial inspection)
	Indicates that a reverse inspection was carried out and that it has joined (has arrived at) the initial inspection hold point.
	Identifies the start manhole number. Note that this manhole is not necessarily the upstream manhole of the pipe.
	Identifies the end manhole number. Note that this manhole is not necessarily the downstream manhole of the pipe.
	A downward arrow indicates that the inspection was carried out in the direction of the current, whereas an upward arrow indicates an inspection against the current. Note that the manhole located on the upper left of the page is always the start manhole, but not necessarily the upstream manhole of the pipe.
	This camera followed by a downward arrow is located on the upper left of the vertical pipe; it indicates that an inspection was done from this manhole.
	When the second camera appears on the bottom left page it means that a reverse inspection was carried out. Information about the reverse inspection is included in the report, thereby combining both inspections.
Invert 3.40	The measurement shown under the word <Invert> indicates the measurements between the frame and the pipe captured during the inspection. This measurement is available at the top left for the start manhole and the bottom left for the end manhole. If the invert was not measured during the inspection, an <NA> mark will be displayed.
	The downward bold arrow to the right of the observation number indicates that this observation was captured during the initial inspection.
	The blank arrow pointing upwards and located to the right of the observation number indicates that this observation was taken during the reverse inspection period, thereby confirming that this report combined both inspections.
18.40 m	Located to the right of the observation number is a number identifying the observation distance in relation to the start of the pipe.
SRV - Armature visib	A full description of the observation code according to the protocol used.

*Any hidden observations are readily accessible from the database as well as in other CTSpec report templates.

** CTSpec inc. reserves the right to modify, eliminate or add to the product features described in this pamphlet without notice.

Appendix H

Site Servicing Checklist

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

N/A ☐ Executive Summary (for larger reports only).

☒ Date and revision number of the report.

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

☒ Plan showing the site and location of all existing services.

☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.

☒ Statement of objectives and servicing criteria.

☒ Identification of existing and proposed infrastructure available in the immediate area.

N/A ☐ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

N/A ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

☒ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

☒ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

N/A ☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☒ Address reliability requirements such as appropriate location of shut-off valves

N/A ☐ Check on the necessity of a pressure zone boundary modification.

To Follow ☐ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

☒ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

N/A ☐ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

N/A ☐ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

☒ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

☒ Confirm consistency with Master Servicing Study and/or justifications for deviations.

☒ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

☒ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

☒ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.

☒ Description of proposed sewer network including sewers, pumping stations, and forcemains.

N/A ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).

N/A ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.

N/A ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.

N/A ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

☒ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

☒ Analysis of available capacity in existing public infrastructure.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

N/A ☐ Set-back from private sewage disposal systems.

N/A ☐ Watercourse and hazard lands setbacks.

RVCA to follow ☒ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

N/A ☐ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

	☒	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
N/A	☐	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
	☒	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.
N/A	☐	Any proposed diversion of drainage catchment areas from one outlet to another.
	☒	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
N/A	☐	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.
N/A	☐	Identification of potential impacts to receiving watercourses
N/A	☐	Identification of municipal drains and related approval requirements.
	☒	Descriptions of how the conveyance and storage capacity will be achieved for the development.
	☒	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.
N/A	☐	Inclusion of hydraulic analysis including hydraulic grade line elevations.
	☒	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
N/A	☐	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
N/A	☐	Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

N/A ☐ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

N/A ☐ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

N/A ☐ Changes to Municipal Drains.

☐ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

☐ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario