PARSONS

Site Servicing and Stormwater Management Report
473 Albert Street
Ottawa, Ontario
December 5, 2019

Prepared for :

InterRent No. 3 Limited Partnership

Submitted to :

City of Ottawa

Parsons Project # 477234

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1.0 INTRODUCTION

1.1 Site Description and Proposed Development

InterRent No. 3 Limited Partnership (InterRent) has retained Parsons Inc. to prepare a *Site Servicing and Stormwater Management Report* in support of the conversion of an existing high-rise office building into a mixed-use building consisting of residential, office and restaurant uses at 473 Albert Street. Figure 1 shows the site location.

There is an existing access driveway from Albert Street at the west side of the property that is covered by the building. The driveway leads to a ramp for the existing two level underground parking garage as well as to a small open area behind the building, historically used as parking. The existing driving access to the surface parking at the back of the building will be converted to pedestrian only access. This open area behind the building will be converted to amenity space including a terrace for the restaurant, bicycle parking, etc. The access to the underground parking garage will remain. The parking garage will provide 47 vehicle parking spaces. There will also be at least 63 bicycle parking spots divided between interior and exterior spaces.

The proposed building breakdown is listed in the table below.

Table 1: Proposed Building Breakdown

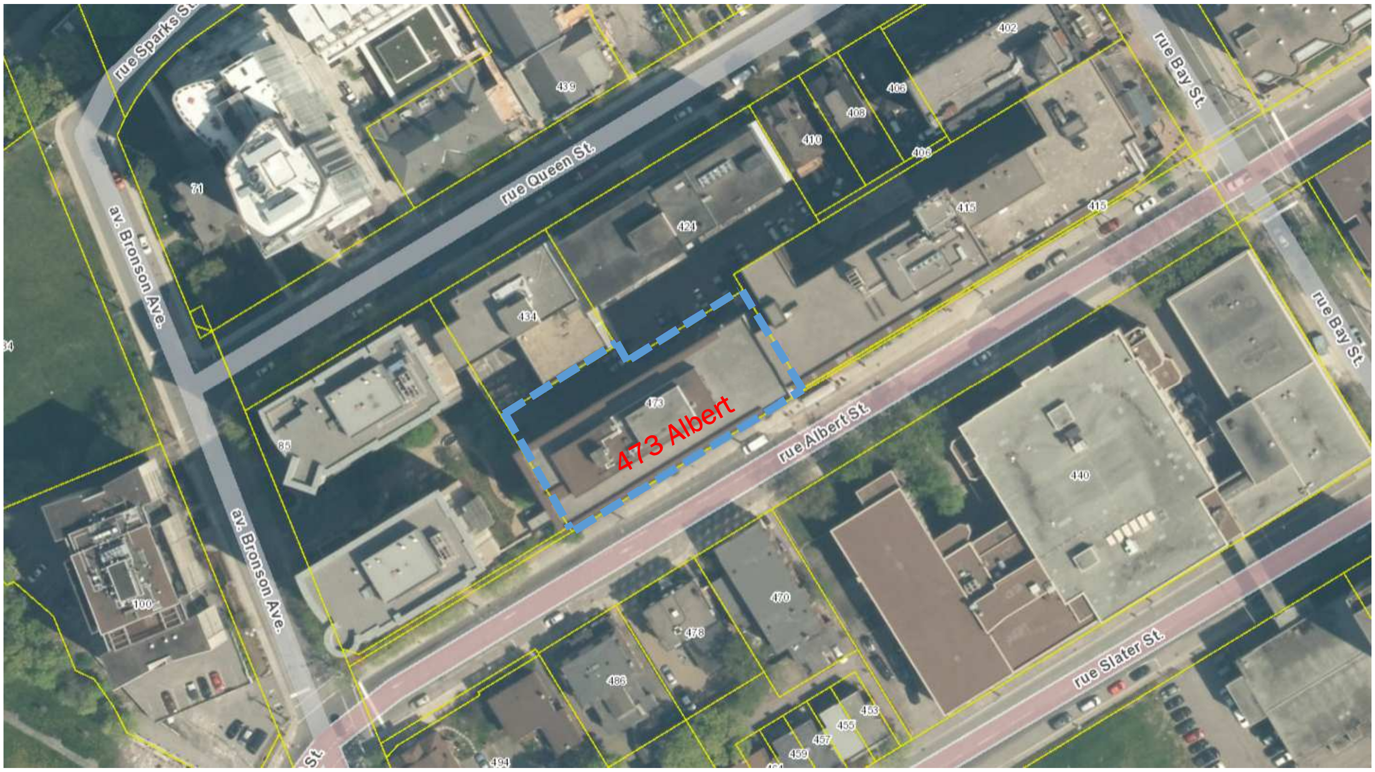
	473 ALBERT STREET (12 STOREYS)
Gross Floor Area	13,980.26 m^2
Gross Leasable Area	11,378.15 m^2
Office Area	*1,363.15 m^2*
Restaurant Area	*385.00 m^2*
Residential Area	*9,630.00 m^2*

The existing parcel is roughly 0.17 ha in size with a zoning of Residential Fifth Density Zone. The site ground elevation varies between approximately 74.00 m and 73.2 m and generally slopes to the southwest.

The 472 Albert Street property is surrounded by the features described below.

- North: High rise buildings (residential apartments and office space) facing Queen Street
- East: Albert at Bay Suite Hotel
- South: low rise residential buildings
- West: The Gardens Condo Development

Figure 1: 473 Albert Street, Ottawa Key Plan



1.2 Guidelines and Background Documents

The 473 Albert Street design is in accordance with the documents below.

- *Ottawa Design Guidelines – Water Distribution,*1st Edition, July 2010 (OWG and technical bulletins)
  - *Technical Bulletin ISD-2010-2*, December 15, 2010
  - *Technical Bulletin ISDTB-2014-02*, May 27, 2014
  - *Technical Bulletin ISTB-2018-02*, March 21, 2018
- *Sewer Design Guidelines*, City of Ottawa, 2nd Edition, October 2012 (OSG and technical bulletins)
  - *Technical Bulletin ISDTB-2012-6,* October 31, 2012
  - *Technical Bulletin ISDTB-2014-01,* February 5, 2014
  - *Technical Bulletin PIEDTB-2016-01,* September 6, 2016
  - *Technical Bulletin ISTB-2018-01,* March 21, 2018
- *Water Supply for Public Fire Protection*, Fire Underwrites Survey, 1999 (FUS)
- *City of Ottawa Park and Pathway Development Manual (2012)*
- *City of Ottawa Accessibility Design Standards (2012)*
- *Ottawa Standard Tender Documents (2019)*
- *Ontario Provincial Standards for Roads & Public Works (2019)*

1.3 Existing Infrastructure

The site is currently developed and serviced by municipal infrastructure. The exiting municipal infrastructure surrounding the property is shown in Figure 2.

The existing municipal infrastructure on Albert Street consists of:

- A 152 mm UCI watermain (1933) (abandoned)
- A 203 mm UCI watermain (1933)

- A 300 mm CONC combined sewer (1935)

The building currently has a water service, a storm service and a sanitary service. The storm and sanitary services both drain to the City's combined sewer. The water service is supplied by the 203 mm diameter City watermain.

There is planned road, water and sewer renewal works identified for Slater Street, Albert Street and Bronson Avenue in the next 3 – 5 years. This work will likely include separation of the existing combined sewer and upgrades to the watermain network.

Figure 2: Existing Municipal Infrastructure Surrounding the Site

1.4 Consultation and Permits

The City of Ottawa and agencies were consulted for this project. A summary of the consultations is provided below; copies of the correspondences and/or minutes are provided in Appendix A.

CONSULTATIONS

City of Ottawa

The City of Ottawa provided the following criteria for the proposed development:

- The allowable release rate (storm and sanitary) will be the 2-year pre-development rate;
- Runoff coefficient will need to be determined based on existing conditions but be no more than 0.4;
- Time of concentration should be 20 minutes, or can be calculated, but should not be less than 10 minutes;
- Any storm events greater than 2-year, up to 100-year, and including the 100-year storm event must be detained on site;
- Two separate sewer laterals will be required;

- Foundation drains are to be independently connected to the sewer, unless being pumped with appropriate back up power, sufficient sized pump and backflow prevention.
- Roof drains are to be connected downstream of any incorporated ICD within the stormwater system or pumped with the lateral being appropriately sized;
- Surface water to be retained on property and conveyed to ROW, approved on-site storage or directly to City infrastructure;
- A second drinking water service to be provided where the average daily demand exceeds 50 m^3/day;
- FUS fire flow criteria to be used unless a low-rise building, where OBC requirements may be applicable;
- Above and below ground storage is permitted although uses ½ peak flow rate or is modeled; and
- There must be at least 15 cm of vertical clearance between the spill elevation and the ground elevation at the building envelope that is in proximity of the flow route or ponding area.

Rideau Valley Conservation Authority (RVCA)

Parsons contacted the RVCA who indicated that no additional water quality protections will be required as the site will remain rooftop drainage and the existing surface parking will be converted to open amenity space. The communication with the RVCA is included in **Appendix A**.

Ministry of the Environment, Conservation and Parks (MECP)

An Environmental Compliance Approval (ECA) is required for this site as the municipal infrastructure in the area is not fully separated, the building service laterals will drain to a combined sewer.

PERMITS AND APPROVALS

The City of Ottawa and the various agencies consulted require the approvals and permits listed below. The City of Ottawa Development Servicing Study Checklist is included in **Appendix B**.

City of Ottawa

- Road Cut Permit
- Commence Work Order
- Water permit
- Water Data Card
- Flow Control Roof Drainage Declaration

Ontario Ministry of the Environment, Conservation and Parks

- Environmental Compliance Approval

2.0 WATER SERVICING

2.1 Proposed Water Servicing

The proposed drinking water servicing approach includes providing two 152 mm diameter water services. The existing 152 mm diameter service from the City's 203 mm diameter watermain will be maintained. A second 152 mm diameter water service will be provided to the City's 203 mm diameter watermain. A new 203 mm water valve will be installed on the main line separating the two water services.

Drawing C101, in **Appendix C,** shows the existing and proposed water distribution network.

2.2 Design Criteria

The proposed water servicing network has been designed in general conformance with OWG and FUS as amended by the City of Ottawa by its technical bulletins.

The system pressure criteria under normal and various operating conditions are listed in the table below.

Table 2: Water System Pressure – Criteria

OPERATING CONDITIONS	PRESSURE CRITERIA	
	KPa	psi
Average Daily Demand		
minimum to maximum	276-552	40-80
Desirable range	350-480	50-70
Peak Hourly Demand		
minimum to maximum	276-552	40-80
Desirable range	350-480	50-70
Maximum Daily Demand + Fire Flow		
minimum	140	20

The City of Ottawa provided the watermain boundary conditions for the existing 203 mm diameter watermain, as shown in the table below. A copy of the correspondence is in Appendix D. The City noted that the watermains on Bronson, Albert and surrounding streets are planned to be upgraded but the planned sizes are not known yet so boundary conditions for these future conditions are not known at this time.

Table 3: 203mm Diameter Watermain Boundary Conditions

MINIMUM HGL	MAXIMUM HGL	MAXIMUM DAY + FIRE FLOW
106 m	115.5 m	87.8m
46 psi	60 psi	20 psi
318 KPa	411 KPa	140 KPa

*The available fire flow = 115 L/s assuming a residual of 20 psi and a ground elevation of 73.5 m.

The boundary conditions provided demonstrate that the available pressure ranges from approximately 46 psi to 60 psi during normal operating conditions but is limited during fire flow conditions.

The fire flow was calculated using the FUS with the following parameters:

Type of construction: non-combustible construction

Occupancy Type: limited combustible

Sprinkler Protection: fully monitored, automatic sprinkler system from standard water supply

The OWG requires that “Service areas with a basic day demand greater than 50 m^3/day (about 50 homes) shall be connected with a minimum of two watermains, separated by an isolation valve, to avoid the creation of a vulnerable service area. Individual residential facilities with a basic day demand greater than 50 m^3/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid the creation of a vulnerable service area.” Therefore, a new 152 mm water service will be provided to the building, connected to the existing 203 mm watermain on Albert Street to provide redundancy to the existing 152 mm water service. An isolation valve will be installed on the City’s 203 mm watermain to separate the two services.

The new water service will be installed with a minimum cover of 2.4 m where possible. Should there be less than 2.4 m cover or separation from an open structure, the pipes will be insulated as per City Standard Drawings W22 and W23.

2.3 Calculations and Simulation Results

The table below summarizes the anticipated maximum water demand for the proposed building conversion. Detailed calculations for the water demand and fire flow are in Appendix E.

Table 4: Water Demand Rates

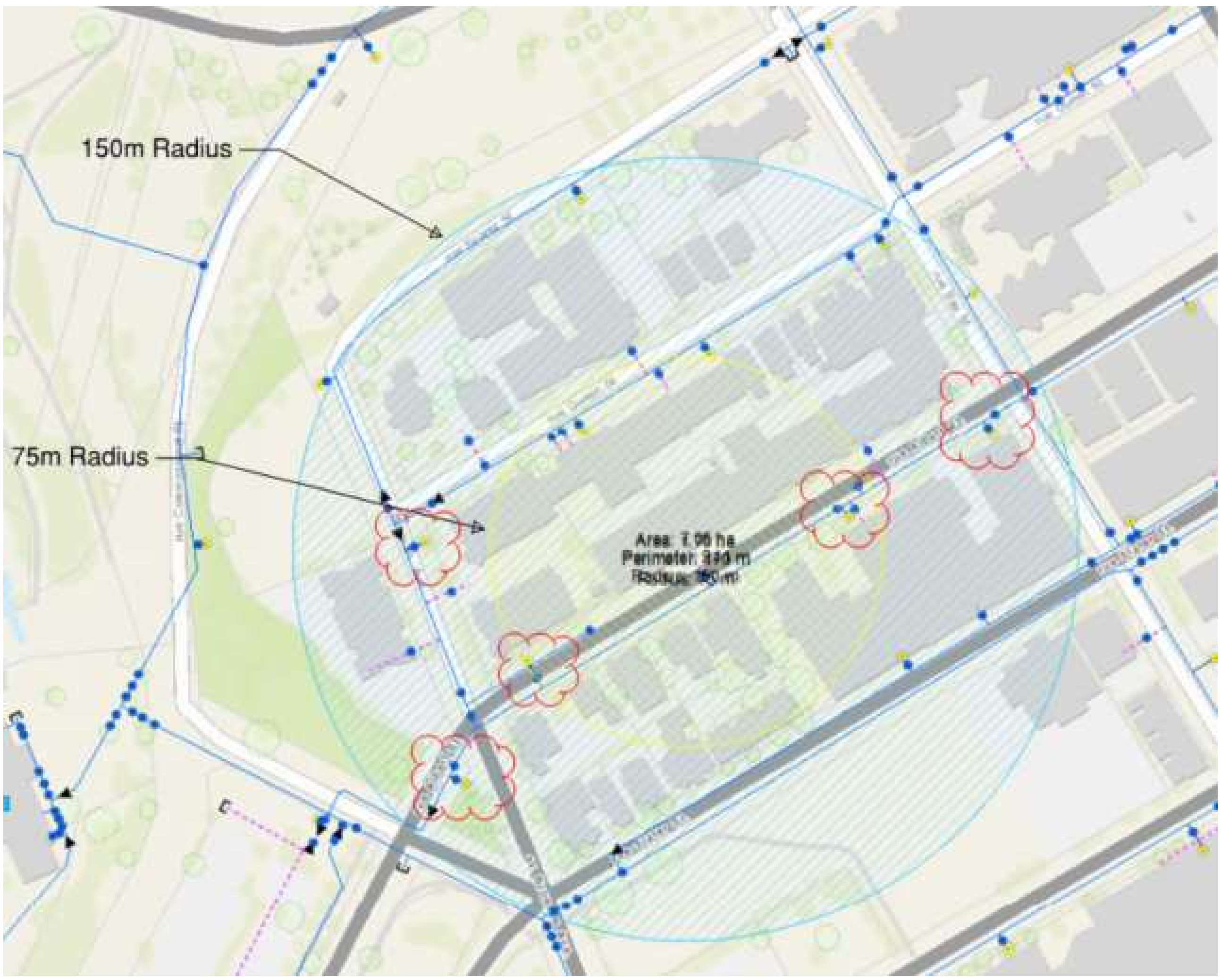
BUILDING	AVERAGE DAY DEMAND (ADD) L/s	MAX DAILY DEMAND (MDD) L/s	PEAK HOURLY DEMAND (PHD) L/s	FIRE FLOW DEMAND (FF) L/s	MDD+FF L/s
473 Albert	1.61	5.71	8.90	350	355.71

High pressure is not an issue on this site as the boundary conditions are below 80 psi. Therefore, pressure reducing valves will not be required.

The required fire flow can be provided by five (5) nearby hydrants at the following locations:

- Two hydrants on Albert Street (within 75 m of the building)
- Two hydrants on Albert Street and one hydrant on Bronson, just north of Albert (within 150 m of the building)

Figure 3: Existing Hydrants



There are 5 fire hydrants within the vicinity of the site, 2 hydrants are within 75m and 3 hydrants within 150m. According to Table 18.5.4.3 in Appendix I of ISTB-2018-02, the available fire flow from the existing hydrants surrounding the building is 22,800 L/min (380 L/s). Based on the estimated available fire flow the existing hydrants can meet the required fire flow demands of the building.

2.4 Summary and Conclusions

A second 152 mm water service will be provided from the existing 203 mm watermain on Albert Street.

The water pressures, under average day demand, peak hour demand, are within the allowable pressure range specified by the City of Ottawa.

As per Table 18.5.4.3 of ISTB-2018-02, the surrounding hydrants can meet the required fire flow demands of the proposed building.

The proposed water service is shown on Drawing C101 in Appendix C.

3.0 SANITARY SERVICING

3.1 Proposed Sanitary Servicing

The existing sanitary service was inspected by Clean Water Works. The internal plumbing was noted to be 150 mm diameter cast iron pipe. The service lateral to the sewer in the road is a 203 mm diameter transite pipe. The pipe was inspected before and after flushing. No deficiencies were noted. Therefore, the existing sanitary service will be maintained. It is likely that this service will be replaced to the property line/building face as part of the City's planned sewer and water upgrades in the next few years. The CCTV reports are included in Appendix F.

3.2 Design Criteria

The proposed sanitary sewer flow has been designed in general conformance with the *OSG* and its technical bulletins.

The sanitary design flow rate is the peak flow plus the peak extraneous flow. The table below presents the values for the average flow, peak factor and peak extraneous flows used in the sanitary servicing calculations for the residential development.

Table 5: Sanitary Design Flows Criteria

DEVELOPMENT TYPE	AVERAGE SANITARY FLOW	UNIT	PEAK FACTOR	PEAK EXTRANEOUS FLOW
Residential	280	L/c/d	Harmon Equation	0.33 L/s/gross ha
Office	75	L/p/d	1.5	
Restaurant	125	L/seat/d	1.5	

3.3 Calculations and Results

The sanitary design flows and sewer pipe design spreadsheets, included in Appendix G, shows the flows from the proposed converted building as well as the estimated existing flows. The sanitary flows increased due to the proposed residential use of the building. The increase in the sanitary flows will be considered as part of the total allowable release rate from the site to the combined sewer. The existing sanitary service is sufficient to accommodate the proposed sanitary flows.

There will be additional sanitary flows from the parking garage sump which will collect the stormwater any other drainage collected within the garage from snow melt off cars, etc. The discharge rate from the sump pump is not known at this time but is expected to be negligible compared to the sanitary flows from the domestic use.

3.4 Summary and Conclusions

The existing 203 mm diameter sanitary lateral will be maintained for the proposed development.

4.0 STORM SERVICING AND STORMWATER MANAGEMENT

4.1 Existing Storm Servicing

The existing site has a parking drain at the northwest corner of the site which drains into the underground parking garage and is directed to the building's existing services. The site generally drains northeast to southwest with the existing driveway access draining towards the City right-of-way. The topography differs with the northeastern parking portion and driveway access being fairly flat with slopes less than 2% and the northwestern parking portion being sloped around 4%.

The existing storm service was inspected by Clean Water Works. The internal plumbing was noted to be 100 mm and 152 mm diameter cast iron. The storm service lateral to the City sewer is a 203 mm diameter transite pipe. No deficiencies were noted. Therefore, the existing storm service will be maintained. It is likely that this service will be replaced to the property line/building face as part of the City's planned sewer and water upgrades in the next few years.

The site existing drainage area is shown on Figure A: Pre-development Drainage Plan in Appendix H.

4.2 Proposed Storm Servicing

The storm system will maintain the existing parking drain and reuse the existing storm lateral that connects to the 300 mm diameter combined sewer on Albert Street. The existing sump pumps will be retained and will continue pumping drainage from the parking and perimeters drains.

The extended mechanical penthouse on the top floor (13th level) of the building will be equipped with a combination of controlled roof drains and uncontrolled roof drains (where storage is not available). The roof space on the 12th level will be used for amenity space and therefore will be equipped with uncontrolled roof drains. The controlled roof drains will drain directly to the existing storm service. The uncontrolled roof drains and the existing parking drain will drain to a stormwater storage tank, to be located within the underground parking garage. Drawing C102, in Appendix C depicts the roof drains and their associated catchment areas.

The design approach for the stormwater management is to ensure that the post-development peak flows do not exceed the existing 2-year pre-development release rate flow.

Drawing C101, in Appendix C depicts the boundaries of the post-development drainage areas.

4.3 Design Criteria

The proposed storm sewer system has been designed in general conformance with the *OSG* and its technical bulletins, plus more specific requirements from the City of Ottawa.

The criteria below were provided in part by the City of Ottawa and RVCA. These agencies correspondence are located in Appendix A.

The design criteria for the site includes the following:

i. Stormwater management for the site shall be based on the 2-year storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997;
ii. The pre-development runoff coefficient or a maximum equivalent 'C' of 0.4, whichever is less (8.3.7.3);
iii. A calculated time of concentration (Cannot be less than 10 minutes);
iv. Flows to the storm sewer in excess of the 2-year storm release rate, up to and including the 100-year storm event, must be detained on site;
v. The Rational Method is used to calculate the allowable peak flow to discharge into the receiving combined sewer systems and the runoff volume to be retained on site;
vi. IDF curve equations used with the Rational formula:
    a. 2-year $=732.951/(Tc+6.199)^{0.810}$

b. 100-year = $1735.688/(Tc+6.014)^{0.820}$

The Rational Method uses runoff coefficients for various surfaces. The table below shows the runoff coefficients chosen in this study. The runoff coefficient for a 100-year storm event is increased by 25% per the OSG.

Table 6: Rational Method Runoff Coefficients

SURFACE	5-YEAR COEFFICIENT	100-YEAR COEFFICIENT
Asphalt/Building/Concrete	0.90	1.00

4.4 Allowable Release Rate

The allowable release rate for the 0.16 ha site developed was calculated using the rational method formula based on the 2-year flow and the existing runoff coefficient of 0.4.

$$Q = 2.78\, CiA$$

where

Q = Flow rate (L/s)

C = Runoff coefficient

i = Rainfall intensity (mm/hr)

A = Area (ha)

The resultant allowable release rate is 14.0 L/s.

The allowable release rate is a combination of the sanitary and storm flows as the flows are conveyed to a combined sewer. As a result, the allowable release rate for the storm flows is decreased by the equivalent amount of sanitary flows that are additional compared to the flows associated with the existing usage. The existing building usage results in an estimated sanitary flow of 1.34 L/s. The proposed building usage results in an estimated sanitary flow of 3.73 L/s. This represents an increase of 2.39 L/s in the sanitary flows. Therefore, the allowable storm release rate is decreased by 2.39 L/s to a total of 11.6 L/s.

4.5 Storm Sewer Design

Calculations showing the storm sewer design are included in Appendix I. The storm sewer design spreadsheet is based on the Rational Method and Manning formula and was used to calculate the design flow and required pipe size. Ottawa IDF information for the 2-year design storm was used to calculate the peak flows.

Drawing C101, in Appendix C shows the drainage areas.

4.6 Stormwater Management

The on-site storm water management has been designed to attenuate the 2-year and 100-year post-development flow rates to the allowable post-development flow rates as shown in Appendix J.

DRAINAGE AREA WS-01 (CONTROLLED ROOF DRAINS)

A portion of the expanded mechanical penthouse roof will provide stormwater storage through the use of controlled roof drains, Watts Adjustable Accutrol roof drains. The drainage area per roof drain is shown in the table below. The roof drains are shown on Drawing C102, in Appendix C.

Table 7: Roof Drain Controlled Flows and Storage

Roof Drain Number	Controlled Flow (L/s)		Max Ponding Depth (mm)		Storage Volume (m^3)	
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	1:5 Year	1:100 Year
CFRD 1	0.15	0.38	11.7	30.5	0.044	0.115
CFRD 2	0.13	0.34	10.6	27.4	0.048	0.126
CFRD 3	0.14	0.38	11.7	30.3	0.044	0.115
CFRD 4	0.13	0.33	10.4	26.9	0.049	0.128
CFRD 5	0.06	0.15	4.8	12.3	0.070	0.183
CFRD 6	0.14	0.37	11.4	29.7	0.045	0.118
CFRD 7	0.06	0.15	4.7	12.1	0.070	0.183
CFRD 8	0.06	0.15	4.9	12.5	0.070	0.182
CFRD 9	0.13	0.34	10.6	27.4	0.048	0.126
CFRD 10	0.06	0.14	4.5	11.5	0.071	0.185
CFRD 11	0.14	0.38	11.7	30.4	0.044	0.115
CFRD 12	0.10	0.25	7.7	19.9	0.059	0.154
Total	1.30	3.36				

The controlled flow from these sub-catchment areas will be 1.3 L/s for the 2-year event and 3.4 L/s for the 100-year event. The controlled roof drains will be connected directly to the storm service, inside the building.

DRAINAGE AREA WS-02 (UNCONTROLLED ROOF DRAINS)

The remaining portions of the mechanical penthouse, as well as the roof on the amenity floor, will drain through uncontrolled roof drains. These flows will be directed to the stormwater storage tank within the underground parking garage.

DRAINAGE AREA WS-03 (GROUND LEVEL AMENITY SPACE BEHIND THE BUILDING)

The post-development flow for this sub-catchment area will be collected using the existing parking drain. The flows will be directed to the stormwater storage tank within the underground parking garage.

The flows from Drainage Areas WS-02 and WS-03 will be directed to the stormwater storage tank. The stormwater storage tank will be pumped to the existing storm service at a maximum allowable flow rate of 8.2 L/s. The required storage volume of the storage tank is 43.1 m^3.

4.7 Stormwater Quality

The RVCA has indicated that onsite water quality treatment will not be required as the stormwater is all captured on the roof or in the open space behind the building, there are no surface parking areas and driving isles.

4.8 Major Overland Flow

The major overland flow route generally flows to the southwest with most of the site exiting to the City right-of-way.

4.9 Summary and Conclusions

The existing storm service will be maintained and will convey the flows from the controlled roof drains as well as the pumped flows from the stormwater storage tank.

5.0 SEDIMENT AND EROSION CONTROL

To mitigate the impacts due to erosion and sedimentation during construction, erosion and sediment control measures shall be installed and maintained throughout the duration of construction. Measures shall only be removed once the construction activities are complete, and the site has stabilized.

The measures will include:

- Siltsack® shall be installed between the frame and cover of existing and new catchbasins and maintenance holes, to minimize sediments entering the storm drainage system. These shall remain in place until construction is complete.

6.0 CONCLUSIONS

This report outlines the proposed servicing and stormwater management design for the conversion of the existing building at 473 Albert Street, Ottawa, ON.

The proposed drinking water system will include the use of the existing 152 mm diameter water service as well as the construction of a second 152 mm diameter water service and the installation of a new line valve on the City watermain between these two connections.

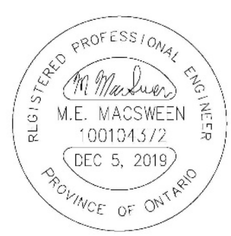
The proposed sanitary sewer system will consist of the reuse of the existing sanitary service to convey flows to the existing combined sewer.

Stormwater runoff from the site will include a combination of controlled roof drains as well as uncontrolled roof drains and the ground level amenity space behind the building. The uncontrolled flows will be directed to a stormwater storage tank to be located within the underground parking garage. The flows in the stormwater storage tank will be pumped to the existing storm service at a maximum allowable rate of 8.8 L/s.

Prepared by:

Mathew Theiner, P.Eng., ing.

Reviewed by:



Meghan MacSween, M.Eng., P.Eng.

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APPENDIX A | CORRESPONDENCE

473 Albert: Preconsultation Meeting
Conversion of existing high-rise office building into a mixed-use building (~126 dwelling units, office and restaurant uses)

Christopher Moise (Design) Comments:

- Consider fenestration / cladding / treatment at grade
- Consider location of loading area
- Re-consider 'dog area' at grade in rear yard
- Building & Façade
    - Clarify 'brutalist' characterization
    - How is the building 'residential' from the exterior
    - Consider balconies (juliette or otherwise)
    - Appropriateness of exposing concrete (especially as an <u>improvement)</u>
- UDRP for DPA not required

John Bernier (File Lead, Planner)

- Height limit is 37 metres: is 'amenity penthouse' a projection (**if no=Variance**)
- Restaurant terrace (outdoor comm. patio) is prohibited – (**MV or Minor ZBA**)
- Minor variances required for **existing** building setbacks
- Loading space (in ROW) not functional
    - Make reference to 'Downtown Moves'
        - Which considers 2 loading spaces
        - Considers tree plantings
        - 'DM' implementation **to be determined**
        - **J. Bernier to provide timeline for DM**
- Encroachment agreement for (**new**) canopy – must be reviewed
- Dog Run – is there a more appropriate use for those lands?
- <u>**Complex Site Plan Application:**</u>
    - <u>**Timeline: +4 months**</u>
    - <u>**ZBA v. MV different timelines**</u>
    - <u>**MV only after conclusion of first round of circulation/issue resolution**</u>

E. Johnson (CLV Group)

- Existing encroachment agreement

Wally Dubyk (Transportation)

- 1.25 metre right-of-way protection to be conveyed
- RE: **TIA Screening:** 2 triggers for step 2 guidelines
- Multimodal service must be analyzed
- Must address reduction of parking spaces on site

- Must review docking/ROW layby
- **C. Gordon (Applicants Transportation Consultant, In Response):**
    - Initial morning trip generation (ex. Office vs. residential), 200 v. ~80
    - Prefer to avoid **full TIA** process: proposes Supplement to 'Step 1'
- **Dubyk: Supplement to Step 1 as alternate 'works'**
- **Must submit a Construction Management Plan**

Shawn Wessel (Infrastructure)

- ECA required (combined sewer dates to 1935)
- Services on site, require CCTV Report
- SWM increase, SWM guidelines have changed
    - Rear yard may increase release rate
- Roof Drains: must see existing drain detail
- **Wind Study Required**
- Record of Site Condition Required
- Enbridge requires new pressure relief valve (to be shown on plans)
- Noise Study Req'd: Height and location of building
    - Must include stationary noise sources
    - Must include amenity areas
    - Fenestration – reference FDC Rating
- **Road & Sewer & Water Renewal Planned for Albert (likely sewer separation)**
- Contact RVCA RE: restrictions
- Existing restaurant: sanitary needs grease trap
- Oil & grit separator: TBD for parking garage
- S.W. to provide **boundary conditions** for SWM Consultant
- Fire hydrant analysis – Secondary water service required
- Trees: confirm appropriate species (in ROW) given services
- Must confirm if services **in surcharge condition**

Pre-Consul Meeting Notes to the File Lead – John Bernier **August 22, 2019**
Re: 473 Albert St. – Commercial Bld Re-Use

<u>Infrastructure:</u>

A 152 mm dia. UCI Watermain (c. 1933) is available on the North side of Albert St.

A 203 mm dia. UCI Watermain (c. 1933) is available on the South side of Albert St.

A 300 mm dia. Conc. Combined Sewer (c. 1935) is available on Albert St., which is conveyed to the Booth St. Trunk and then onto the Interceptor Sewer.

The following apply to this site and any development within a <u>combined sewer</u> area:

- **<u>Total</u>** (San & Stm) allowable release rate will be 2-year pre-development rate.
- Coefficient (C) of runoff will need to be determined **as per existing conditions** but in no case more than 0.4
- TC = 20 minutes or can be calculated
  TC should be not be less than 10 minutes, since IDF curves become unrealistic at less than 10 min.
- Any storm events greater than 2 year, up to 100 year, and including 100-year storm event must be detained on site.
- Two separate sewer laterals (one for sanitary and other for storm) will be required.

An MECP ECA will be required.

Please have applicant provide one copy of the following for our review:

MECP ECA Application Form - Direct Submission tied to SPC
Fees - Certified Cheque made out to “Ministry of Finance”
Proof of Applicant’s Identification (if no Certificate of Incorporation)
Certificate of Incorporation (if Applicable)
NAICS Code (If Applicable)
Plan & Profile
Grading and Servicing Plans
Survey Plan
Pipe Data Form
Draft ECA (City of Ottawa Expanded Works Form)
Source Protection Policy Screening & Significant Threat Report
Sewer Drainage Area Plan
SWM Report
Services Report
Geotechnical Report & any other supportive documentation
Correspondence: City of Ottawa including ROW, Water Resources Dept., ISD etc., MNR, Conservation Authority & MECP.

Please note that once the review has been completed and the Sr. Engineer is satisfied and ready to sign off on the application, after the PM recommendations 3 final bound copies including 3 flash drives will be required to accompany the applications with MECP and for City of Ottawa records.

Footer of ECA Application should have reference #: 8551E (2019/05)

Please also note:

Foundation drains are to be independently connected to sewermain (separated or combined) unless being pumped with appropriate back up power, sufficient sized pump and back flow prevention. Water Resources Dept. to comment if connection is to a combined sewer.

Roof drains are to be connected downstream of any incorporated ICD within the SWM system or pumped with the lateral being appropriately sized.

RVCA:
Applicant to contact Rideau Valley Conservation Authority (RVCA) for possible restrictions due to quality control. Provide correspondence in Report.

Grease trap required for restaurant if not already installed.

Trees – please ensure proposed trees do not conflict with existing or proposed services. Deep root plantings not permitted. Services to be outside critical root zone (CRZ).

Surface water to be retained on property and conveyed to ROW, approved on-site storage or directly to City infrastructure. Refer to calculated allowable release rate and this sites SWM.

Existing or proposed canopy at front of building:
Please provide details on how this canopy will drain and if applicable, connect to City infrastructure. Show DS location on plans and speak to this in the SWM Report.

Provide roof plan showing drain and scupper locations including control information.

Provide all control information including manufacturing specifications in the SWM Report.

Water Supply Redundancy – Fire Flow:

Applicant to ensure that a second service with an inline valve chamber be provided where the average daily demand exceeds 50 m^3 / day (0.5787 l/s per day)
FUS Fire Flow Criteria to be used unless a low-rise building, where OBC requirements may be applicable.

Where underground storage (UG) and surface ponding are being considered:

Show all ponding for 5 and 100 year events

Above and below ground storage is permitted although uses ½ Peak Flow Rate or is modeled. Please confirm that this has been accounted for and/or revise.

Rationale:

The Modified Rational Method for storage computation in the Sewer Design Guidelines was originally intended to be used for above ground storage (i.e. parking lot) where the change in head over the orifice varied from 1.5 m to 1.2 m (assuming a 1.2 m deep CB and a max ponding depth of 0.3 m). This change in head was small and hence the release rate fluctuated little, therefore there was no need to use an average release rate.

When underground storage is used, the release rate fluctuates from a maximum peak flow based on maximum head down to a release rate of zero. This difference is large and has a significant impact on storage requirements. We therefore require that an average release rate be used to estimate the required volume. Alternatively, the consultant may choose to use a submersible pump in the design to ensure a constant release rate.

In the event that there is a disagreement from the designer regarding the required storage, The City will require that the designer demonstrate their rationale utilizing dynamic modelling, that will then be reviewed by City modellers in the Water Resources Group.

Note that the above will added to upcoming revised Sewer Design Guidelines to account for underground storage, which is now widely used.

Further to above, what will be the actual underground storage provided during the major (100 year) and minor (2 year) storm events?

Please provide information on UG storage pipe. Provide required cover over pipe and details, chart of storage values, capacity etc. How will this pipe be cleaned of sediment and debris?

Note - There must be at least 15cm of vertical clearance between the spill elevation and the ground elevation at the building envelope that is in proximity of the flow route or ponding area. The exception in this case would be at reverse sloped loading dock locations. At these locations, a minimum of 15cm of vertical clearance must be provided below loading dock openings. Ensure to provide discussion in report and ensure grading plan matches if applicable.

Provide information on type of underground storage system including product name and model, number of chambers, chamber configuration, confirm invert of chamber system, top of chamber system, required cover over system and details, interior bottom slope (for self-cleansing), chart of storage values, length, width and height, capacity, entry ports (maintenance) etc.

Provide a cross section of underground chamber system showing invert and obvert/top, major and minor HWLs, top of ground, system volume provided during major and minor events. UG storage to provide actual 2 and 100 year event storage requirements.

In regard to all proposed UG storage, ground water levels (and in particular HGW levels) will need to be reviewed to ensure that the proposed system does not become surcharged and thereby ineffective.

Modeling can be provided to ensure capacity for both storm and sanitary sewers for the proposed development by City's Water Distribution Dept. – Modeling Group, through Infrastructure PM and upon request.

For proposed depressed driveways or developments with private lanes, parking areas or with entrances etc. lower than roadway…

S18.pdf S18.1.pdf

Other:

Due to more sensitive use, a Record of Site Condition (RSC) is required. Ensure Phase I, and if applicable, Phase II ESA's speak to required RSC.

Environmental Noise Study is required due to Albert St. and within 100m proximity of Slater and Bronson Avenues.

Stationary Noise Study – consultant to speak to this in their report as per City NCG and NPC 300 Guidelines. Particularly regarding roof top units and amenity spaces.

Shadow Study required for this proposal.

Wind Study is required for this proposal.

Capital Projects:
Road, Water and Sewer renewal projects listed for Slater, Albert and Bronson in the next 3-5 years.

Environmental Source Information (Re: Phase I ESA):

City of Ottawa - Historical Land Use Inventory (HLUI) - Required

Rationale:

The HLUI database is currently undergoing an update. The updated HLUI will include additional sources beyond those included in the current database, making the inclusion of this record search even more important.
Although a municipal historic land use database is not specifically listed as required environmental record in O. Reg 153/04, Schedule D, Part II states the following:

The following are the specific objectives of a records review:

1. To obtain and review records that relate to the Phase I (One) property and to the current and past uses of and activities at or affecting the Phase I (One) property in order to determine if an area of potential environmental concern exists and to interpret any area of potential environmental concern.

2. To obtain and review records that relate to properties in the Phase I (One) study area other than the Phase I (One) property, in order to determine if an area of potential environmental concern exists and to interpret any area of potential environmental concern.

It is therefore reasonable to request that the HLUI search be included in the Phase I ESA to meet the above objectives.
Please submit.

Existing buildings require a CCTV inspection and report to ensure existing services to be re-used are in good working order and meet current minimum size requirements. Located services to be placed on site servicing plans.

CCTV Scan
Guideline.pdf

All existing reports and plans will need to be revised if older than 2 years and must reflect current City Standards, Guidelines, By-laws and Policies.

Please refer to City of Ottawa website portal **for "Guide to preparing Studies and Plans"** at https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans.

Please ensure you are using the current guidelines, bylaws and standards including materials of construction, disinfection and all relevant reference to OPSS/D and AWWA guidelines - all current and as amended, such as:

City of Ottawa Sewer Design Guidelines (**CoOSDG**) complete with ISTDB 2012-01, 2014-01, 2016-01 & 2018-01 technical bulletin updates as well as current Sewer, Landscape & Road Standard Detail Drawings as well as Material Specifications (MS Docs).
Sewer Connection (2003-513) & Sewer Use (2003-514) By-Laws.

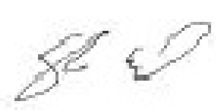
City of Ottawa Water Distribution Design Guidelines (**CoOWDDG**) complete with ISTDB 2010-02, 2014-02 & 2018-02 technical bulletin updates as well as current Watermain/ Services Material Specifications (MS Docs) as well as Water and Road Standard Detail Drawings.
FUS Fire Flow standards
Water (2018-167) By-Law

Ensure to include version date and add "(as amended)" when referencing all standards, detail drwaings, by-Laws and guidelines.

Please also note:
Regarding provided Information, please be advised that it is the responsibility of the applicant and their representatives/consultants to verify information provided by the City of Ottawa. Please contact City View and Release Info Centre at Ext. 44455

Contact me at 613-580-2424, Ext. # 33017 or e-mail shawn.wessel@ottawa.ca if you have any questions.

Sincerely,



Shawn Wessel, A.Sc.T., rcji
Project Manager
Development Review, Central Branch


INTERCEPTOR SEWER
rue Slater St.

MacSween, Meghan

From: Eric Lalande <eric.lalande@rvca.ca>
Sent: Tuesday, November 05, 2019 9:52 AM
To: MacSween, Meghan
Subject: [EXTERNAL] RE: 473 Albert Street, Ottawa

Hi Meghan,

The RVCA will not require any additional water quality protections as the site will remain rooftop along with the conversion of parking spaces to open area.

Thank you,

Eric Lalande, MCIP, RPP
Planner, Rideau Valley Conservation Authority
613-692-3571 x1137

From: MacSween, Meghan <Meghan.Macsween@parsons.com>
Sent: Tuesday, October 29, 2019 11:29 AM
To: Eric Lalande <eric.lalande@rvca.ca>
Subject: 473 Albert Street, Ottawa

Hi Eric,

We would like to request any RVCA requirements or comments related to proposed work at 473 Albert Street in Ottawa.

We are working for the owner of this building (CLV Group) towards a Site Plan Approval from the City of Ottawa, to convert the existing building from office use to mixed-use (residential, office and restaurant). The existing building footprint will remain the same. As you can see from the existing aerial below, the building covers the majority of the property. Currently there is a driving aisle on the west side of the property, which is covered by the building, see picture below, that allows access to an underground parking garage as well as a small open area at the back of the property that has been used for parking a few cars in the past.

The proposed works include renovations inside the building and reuse of the existing underground parking garage. However, the vehicle access to the back of the property will be eliminated and replaced with pedestrian only access. The ground level at the back of the building will consist of amenity space including a restaurant terrace, bicycle storage and a basketball court – there will be no vehicle parking. I've attached a very preliminary site plan so you can see the building footprint and the amenity space behind the building. There will be a separate sanitary and storm outlet to the existing combined sewer in Albert Street. We are awaiting CCTV results to confirm if we'll be reusing existing service laterals or constructing new ones.

Please feel free to contact me if you have any questions or concerns.

Thanks,

Meghan

Meghan MacSween, M.Eng., P.Eng.
Municipal Engineer
1223 Michael St. North, Suite 100, Ottawa, ON K1J 7T2
meghan.macsween@parsons.com – P: +1 613.691.1540 M: +1 343.997.3895

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APPENDIX B | SERVICING CHECKLIST

Development Servicing Study Checklist

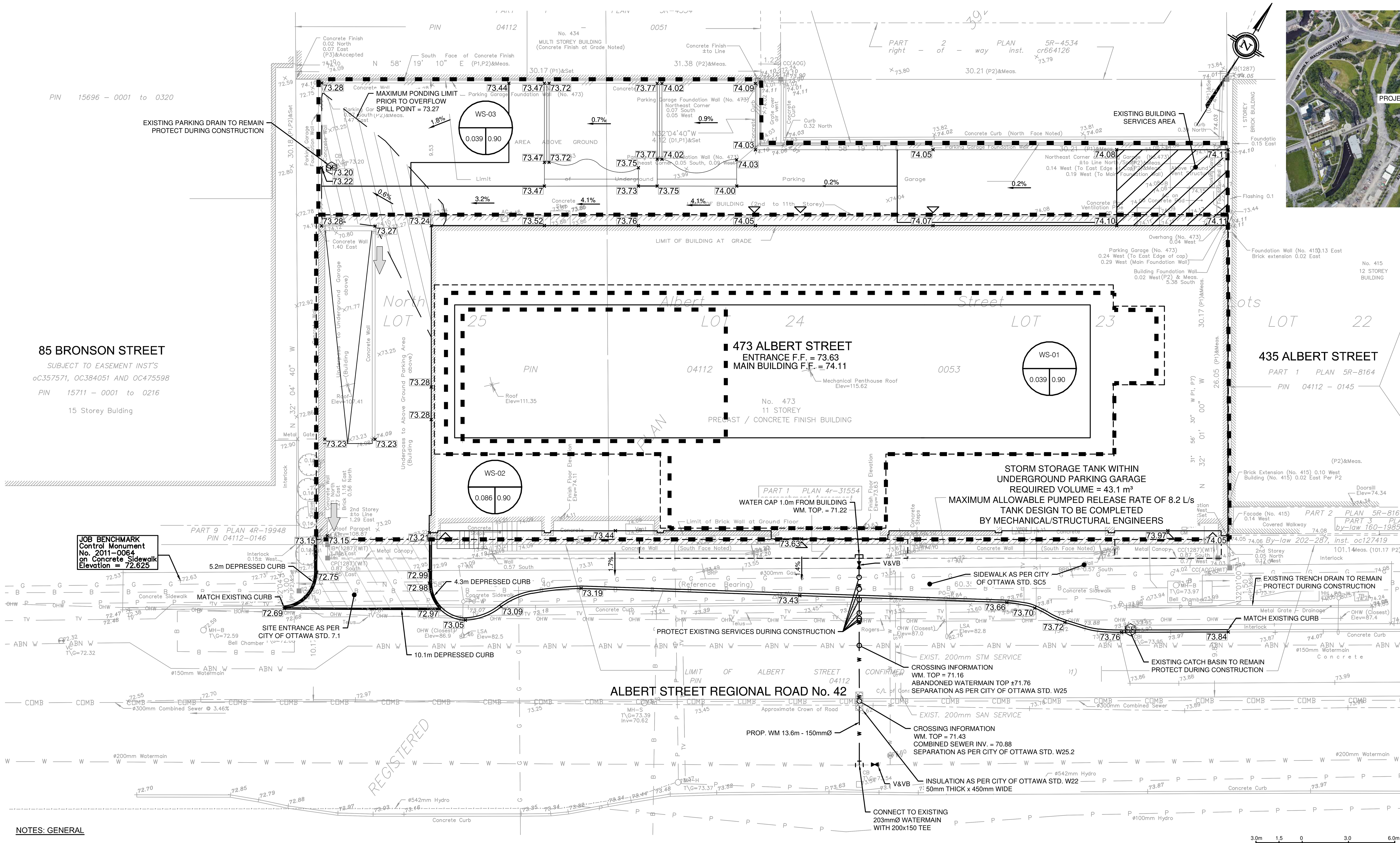
	1 General Content	Comments
NA	Executive Summary (for larger reports only).	
Y	Date and revision number of the report.	Title page
Y	Location map and plan showing municipal address, boundary, and layout of proposed development.	Figure 1 and Drawing C101
Y	Plan showing the site and location of all existing services.	Drawing C101 and Figure 2
NA	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.	
Y	Summary of Pre-consultation Meetings with City and other approval agencies.	Section 1.4
NA	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.	
Y	Statement of objectives and servicing criteria.	Section 2.2/3.2/4.3
Y	Identification of existing and proposed infrastructure available in the immediate area.	Section 1.3
NA	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).	
Y	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed storm water management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Drawing C101
NA	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.	
Y	Proposed phasing of the development, if applicable	Section 1.1
NA	Reference to geotechnical studies and recommendations concerning servicing.	
	All preliminary and formal site plans submissions should have the following information:	
Y	● Metric Scale	Drawings
Y	● North arrow (including construction North)	Drawings
Y	● Key Plan	Drawings
Y	● Name and contact information of applicant and property owner	Drawings
Y	● Property limits including bearing and dimensions	Drawings
Y	● Existing and proposed structures and parking areas	Drawings
Y	● Easement, road widening and right-of-way	Drawings
Y	● Adjacent street names	Drawings
	2 Development Servicing Report : Water	**Comments**
NA	Confirm consistency with Master Servicing Study, if available.	
Y	Availability of public infrastructure to services proposed development.	Section 2.0
Y	Identification of system constraints.	Section 2.2
Y	Identification of boundary conditions.	Section 2.2
Y	Confirmation of adequate domestic supply and pressure	Section 2.2
Y	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.	Section 2.2

Development Servicing Study Checklist		
NA	Provided a check of high pressure. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	
NA	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	
Y	Address reliability requirements such as appropriate location of shut-off valves.	Section 2.2
NA	Check on the necessity of a pressure zone boundary modification.	
NA	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 expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Section 2.2
Y	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.	Section 2.1
NA	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.	
Y	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 2.2
Y	Provision of model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Appendix D
3 Development Servicing Report: Wastewater		**Comments**
Y	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitoring Flow data from relatively new infrastructure cannot be used to justify capacity requirements for	Section 3.0
NA	Confirm consistency with Master Servicing Study and/or justification for deviations.	
NA	Consideration of local conditions that may contribute to extraneous flow that are higher than the recommended flow in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	
Y	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 3.1
NA	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).	
Y	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Appendix F
NA	Description of proposed sewer network including sewers, pumping stations, and forcemains.	
NA	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitation imposed on the development in order to preserve the physical condition of watercourse, vegetation, soil cover, as	
NA	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to services development.	
NA	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	

Development Servicing Study Checklist		
NA	Identification and implementation of the emergency overflow from sanitary pumping station in relation to the hydraulic grade line to protect against basement flooding.	
NA	Special considerations such as contamination, corrosive environment etc.	
4 Development Servicing Report: Stormwater Checklist		**Comments**
Y	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 4.1
	Analysis of available capacity in existing public infrastructure.	
Y	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage patterns.	Figure A and Figure B in Appendix G
Y	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm event ranging from the 2 or 5 years event (dependent on the receiving sewer design) to 100 years return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatershed, taking into account long-term cumulative effects.	Section 4.3
NA	Water Quality control objectives (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	
Y	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 4.6
NA	Set-back from private sewage disposal systems.	
NA	Watercourse and hazard lands setbacks.	
Y	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Appendix A
NA	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	
Y	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 years return period) and major events (1:100 years return period).	Section 4.6
NA	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	
Y	Calculate pre and post development peak flow rates including a descriptions of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Section 4.6, Appendix I
NA	Any proposed diversion of drainage catchment areas from one outlet to another.	
Y	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Drawing C101
NA	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.	
NA	Identification of potential impacts to receiving watercourses.	
NA	Identification of municipal drains and related approvals requirements.	
Y	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Sections 4.6
Y	100 years flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Section 4.7
NA	Inclusion of hydraulic analysis including hydraulic grade line elevations.	

Development Servicing Study Checklist		
Y	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 5.0
NA	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.	
NA	Identification of fill constraints related to floodplain and geotechnical investigation.	
5 Approval and Permit Requirements: Checklist		**Comments**
NA	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 Approvals under Lakes and Rivers Improvements Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvements Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvements Act is not required, except in cases of dams as defined in the Act.	
NA	Application for Certificate of Approvals (CofA) under the Ontario Water Resources Act.	
NA	Change to Municipal Drains	
NA	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	
6 Conclusion Checklist		**Comments**
Y	Clearly stated conclusion and recommendations.	Section 6.0
Y	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.	Appendix A
Y	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Report

APPENDIX C | DRAWINGS C101, C102 AND C103



KEY PLAN

NOTES: GENERAL

1. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
2. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
3. JOB BENCH MARK - REFER TO SURVEY BY AOV LTD. CONFIRM WITH CONTRACT ADMINISTRATOR PRIOR TO UTILIZATION OF BENCH MARK.
4. ALL GROUND SURFACES SHALL BE EVENLY GRADED WITHOUT PONDING AREAS AND WITHOUT LOW POINTS EXCEPT WHERE APPROVED SWALE OR CATCH BASIN OUTLETS ARE PROVIDED.
5. STRIP AND REMOVE ALL TOPSOIL FROM IMPROVED AREAS.
6. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
7. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT. PAVEMENT REINSTATEMENT SHALL BE WITH STEP JOINTS OF 500mm WIDTH MINIMUM IN ACCORDANCE WITH D2 ON DRAWING C103.
8. CURBS TO BE CONCRETE BARRIER, CONSTRUCTED AS PER CITY OF OTTAWA DETAIL SC1.1. ELEVATIONS AT CURB INDICATE THE GRADE AT THE FINISHED ROAD SURFACE UNLESS NOTED OTHERWISE.
9. RESTORE PAVEMENT STRUCTURE AND SURFACES ON EXISTING ROADS TO A CONDITION AT LEAST EQUAL TO ORIGINAL AND TO THE SATISFACTION OF THE MUNICIPAL AUTHORITIES.
10. ALL MATERIAL SUPPLIED AND PLACED FOR PARKING LOT AND ACCESS ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. CONSTRUCTION TO OPSS 206, 310 & 314. MATERIALS TO OPSS 1001, 1003 & 1010.
11. ABUTTING PROPERTY GRADE TO BE MATCHED.
12. OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS FROM THE MUNICIPAL AUTHORITIES PRIOR TO COMMENCING CONSTRUCTION.
13. MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING THE EXECUTION OF ALL WORKS.
14. FILTER FABRIC TO BE INSTALLED AND MAINTAINED BETWEEN THE FRAME AND COVER OF ALL CATCHBASINS AND CATCHBASIN MANHOLES DURING THE CONSTRUCTION PERIOD TO MINIMIZE SEDIMENTS ENTERING THE STORM SEWER SYSTEM. ALL GRASSED AREAS MUST BE COMPLETED PRIOR TO THE REMOVAL OF THE FILTER FABRIC IN THE CATCH BASINS.
15. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE DIRECTED FROM THE ENGINEER. EXCAVATE AND REMOVE ALL ORGANIC MATERIAL AND DEBRIS LOCATED WITHIN THE PROPOSED BUILDING, PARKING AND ROADWAY LOCATIONS. ANY CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
16. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS BUT NOT LIMITED TO; ROAD CUT PERMITS, SEWER PERMITS, WATER PERMIT, ETC.
17. AT PROPOSED UTILITY CONNECTION POINTS AND CROSSINGS (I.E. STORM SEWER, SANITARY SEWER, WATER, ETC.) THE CONTRACTOR SHALL DETERMINE THE PRECISE LOCATION AND DEPTH AND SIZE OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES.
18. REFER TO ARCHITECT AND LANDSCAPE ARCHITECTS DRAWINGS FOR BUILDING, LANDSCAPE, AND HARD SURFACE AREAS AND DIMENSIONS.

EROSION AND SEDIMENT CONTROL MEASURES:

- CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURE MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
- SEDIMENT AND EROSION CONTROL PLAN OBJECTIVES:
- PREVENT SOIL EROSION. THIS CAN RESULT FROM STREAMING RAIN WATER OR WIND EROSION DURING CONSTRUCTION,
- PREVENT SEDIMENT DEPOSITS IN THE SEWER PIPES AND NEARBY COLLECTING STREAMS (AS APPLICABLE),
- PREVENT AIR POLLUTION FROM PARTICULATE MATTER AND DUST.

1. PRIOR TO START OF CONSTRUCTION:

PRIOR TO THE REMOVAL OF ANY VEGETATIVE COVER, MOVING OF SOIL AND CONSTRUCTION:

- INSTALL FILTER CLOTH ON DOWNSTREAM MANHOLE COVERS.
- INSTALL SILTSACK FILTERS IN ALL CONCRETE CATCH BASINS STRUCTURES.
- INSPECT MEASURES IMMEDIATELY AFTER INSTALLATION.
- THE CONTRACTOR MUST SET UP THE MEASURES INDICATED ON THE PLAN, INSPECT THEM FREQUENTLY AND CLEAN AND REPAIR OR REPLACE THE DETERIORATED STRUCTURES. AT THE END OF THE CONSTRUCTION PERIOD, THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF THE TEMPORARY STRUCTURES AND RECONDITIONING THE AFFECTED AREAS

2. DURING CONSTRUCTION:

- SEDIMENT AND EROSION CONTROL MEASURES TO BE CONSTRUCTED AS PER OPSS 805.
- WHEN SEDIMENT AND EROSION CONTROL MEASURES MUST BE REMOVED TO COMPLETE A PORTION OF THE WORK, THE SAME MEASURES MUST BE REINSTATED UPON THE WORK'S COMPLETION.
- WORK TO BE DONE IN THE VICINITY OF MAJOR WATERWAYS TO BE CARRIED OUT FROM JULY AND SEPTEMBER ONLY.
- MINIMIZE THE EXTENT OF DISTURBED AREAS AND THE DURATION OF EXPOSURE.
- PROTECT DISTURBED AREAS FROM RUNOFF.
- PROVIDE TEMPORARY COVER SUCH AS SEEDING OR MULCHING IF DISTURBED AREA WILL NOT BE REHABILITATED SHORTLY.
- INSPECT STRAW BALE FLOW CHECK DAMS, SILT FENCES, SILT SACKS, AND CATCH BASIN SUMPS REGULARLY AND AFTER EVERY MAJOR STORM EVENT. CLEAN AND REPAIR WHEN NECESSARY.
- PLAN TO BE REVIEWED AND REVISED AS REQUIRED DURING CONSTRUCTION.
- EROSION CONTROL FENCING TO BE ALSO INSTALLED AROUND THE BASE OF ALL STOCKPILES.
- DO NOT LOCATE TOPSOIL PILES AND EXCAVATION MATERIAL CLOSER THAN 2.5m FROM ANY PAVED SURFACE, OR ONE WHICH IS TO BE PAVED BEFORE THE PILE IS REMOVED. ALL TOPSOIL PILES ARE TO BE SEEDED IF THEY ARE TO REMAIN ON SITE LONG ENOUGH FOR SEEDS TO GROW (LONGER THAN 30 DAYS). WHEN STORING SOIL ON SITE IN PILES THE CONTRACTOR MUST COVER EACH PILE WITH TARPS, STRAW OR A GEOTEXTILE FABRIC TO AVOID FINE PARTICLE TRANSPORT BY WIND AND/OR STREAMING RAIN WATER.
- CONTROL WIND-BLOWN DUST OFF SITE TO ACCEPTABLE LEVELS BY SEEDING TOPSOIL PILES AND OTHER AREAS TEMPORARILY (PROVIDE WATERING AS REQUIRED). FOR DUST CONTROL, CONTRACTOR TO APPLY CALCIUM CHLORIDE (TYPE I – OPSS 2501 AND CAN/CGSB-15-1) AND WATER WITH EQUIPMENT APPROVED BY THE OWNER'S REPRESENTATIVE AT RATE IN ACCORDANCE TO OPSS 506 WHEN DIRECTED BY OWNER'S REPRESENTATIVE.
- ALL EROSION CONTROL STRUCTURE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN DESTABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER. SEDIMENT CAPTURE SILT SACKS MUST BE MAINTAINED AND CANNOT BE REMOVED UNTIL ALL LANDSCAPING AREAS ARE COMPLETED.
- NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVES BY THIS CONSULTING ENGINEER AND THE TOWN DEPARTMENT OF PUBLIC WORKS.
- CONTRACTOR RESPONSIBLE FOR MUNICIPAL ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENT FROM VEHICULAR TRACKING ETC. AT THE END OF EACH WORK DAY.
- DURING WET CONDITIONS, TIRES OF ALL VEHICLES/EQUIPMENT LEAVING THE SITE ARE TO BE SCRAPED.
- ANY MUD/MATERIAL TRACKED ONTO THE ROAD SHALL BE REMOVED IMMEDIATELY BY HAND OR RUBBER TIRE LOADER.
- TAKE ALL NECESSARY STEPS TO PREVENT BUILDING MATERIAL, CONSTRUCTION DEBRIS OR WASTE BEING SPILLED OR TRACKED ONTO ABUTTING PROPERTIES OR PUBLIC STREETS DURING CONSTRUCTION AND PROCEED IMMEDIATELY TO CLEAN UP ANY AREAS SO AFFECTED.
- PROVIDE GRAVEL ENTRANCE WHEREVER EQUIPMENT LEAVES THE SITE TO PROVIDE MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 10m LONG, 4m WIDE, AND 0.15m DEEP AND SHALL CONSIST OF COARSE MATERIAL. MAINTAIN GRAVEL ENTRANCE IN CLEAN CONDITION.

3. AFTER CONSTRUCTION:

- PROVIDE PERMANENT COVER CONSISTING OF TOPSOIL AND SEED TO DISTURBED AREAS.
- ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE REMOVED BY THE CONTRACTOR FOLLOWING THE COMPLETION OF WORK AND AFTER DISTURBED AREAS HAVE BEEN REHABILITATED AND STABILIZED, THIS INCLUDES REMOVE STRAW BALE FLOW CHECK DAMS, SILT FENCES AND FILTER CLOTHS ON CATCH BASINS AND MANHOLE COVERS.
- INSPECT AND CLEAN CATCH BASIN SUMPS AND STORM SEWERS.

NOTES: WATERMAIN

19. SUPPLY AND INSTALL ALL WATERMAIN AND APPURTENANCES IN ACCORDANCE WITH MOST CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS.
20. ALL WATER MAIN TO BE INSTALLED AT MINIMUM COVER OF 2.4m BELOW FINISHED GRADE. WHERE REQUIRED, PROVIDE INSULATION IN ACCORDANCE WITH CITY OF OTTAWA STANDARDS W22 AND W23.
21. WATER MAIN BEDDING AS PER CITY OF OTTAWA STANDARD W17.
22. CONCRETE THRUST BLOCKS AND RESTRAINING AS PER DETAILS ON DRAWING C103.
23. CATHODIC PROTECTION REQUIRED FOR ALL IRON FITTINGS AS PER DETAILS ON DRAWING C103.
24. IF WATER MAIN MUST BE DEFLECTED TO MEET ALIGNMENT, ENSURE THAT THE AMOUNT OF DEFLECTION USED IS LESS THAN HALF THAT RECOMMENDED BY THE MANUFACTURER.
25. EXCAVATION, INSTALLATION, AND BACKFILL BY CONTRACTOR. CONNECTIONS AND SHUT-OFFS AT THE MAIN BY CITY.

LEGEND:

————	EXISTING PROPERTY LINE
Concrete Curb	EXISTING CONCRETE CURB
	PROPOSED CONCRETE CURB
	PROPOSED DEPRESSED CURB
	PROPOSED BUILDING OR STRUCTURE
— W — W —	EXISTING WATERMAIN
— ABN W —	EXISTING ABANDONED WATERMAIN
VC	EXISTING V&VB
	EXISTING CURBSTOP
	EXISTING FIRE HYDRANT
— W — W —	PROPOSED WATERMAIN
	PROPOSED V&VB
	PROPOSED FIRE HYDRANT
— G — G —	EXISTING UNDERGROUND GAS
— B — B —	EXISTING UNDERGROUND BELL
— P — P —	EXISTING UNDERGROUND POWER
— OHW — OHW —	EXISTING OVERHEAD WIRES
— TV —	EXISTING UNDERGROUND COMMUNICATIONS
— COMB —	EXISTING COMBINED SEWER AND MANHOLE
— S — S —	EXISTING SANITARY SEWER
— S — S —	PROPOSED SANITARY SEWER AND MANHOLE
— ST — ST —	EXISTING STORM SEWER
— ST — ST —	PROPOSED STORM SEWER AND MANHOLE
	PROPOSED CATCH BASIN
	PROPOSED PIPE INSULATION
113.45	EXISTING GRADE
114.40	PROPOSED GRADE
0.7%	PROPOSED SLOPE
SS	SILT SACKS IN CATCH BASIN GRATE PER DETAIL D1
	PROPOSED MAXIMUM PONDING LIMIT PRIOR TO OVERFLOW
	PROPOSED MAJOR OVERLAND FLOW
	PROPOSED WATERSHED BOUNDARY
WS-03	WATERSHED AREA NO.
0.90	RUNOFF COEFFICIENT
0.039	AREA (IN HECTARES)

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Ottawa, Ontario K2P 1Z2
613-806-7816

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MEP engineers | ingénieur MEP

PARSONS
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Tel: 613-738-4160 Fax: 613-739-7105

general notes | note générale

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2. DO NOT SCALE THE DRAWINGS.
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nord du projet / project north — nord actuel / true north

no	revisions	date
1	ISSUED FOR SITE PLAN APPLICATION	12/05/2019

stamp | timbre

REGISTERED PROFESSIONAL ENGINEER
M.E. MACSWEEN
100104372
DEC 5, 2019
PROVINCE OF ONTARIO

architect | architecte

linebox STUDIO

project title

473 ALBERT

PROPOSED MIXED-USE RENOVATION

473 ALBERT STREET | OTTAWA | ONTARIO | CANADA

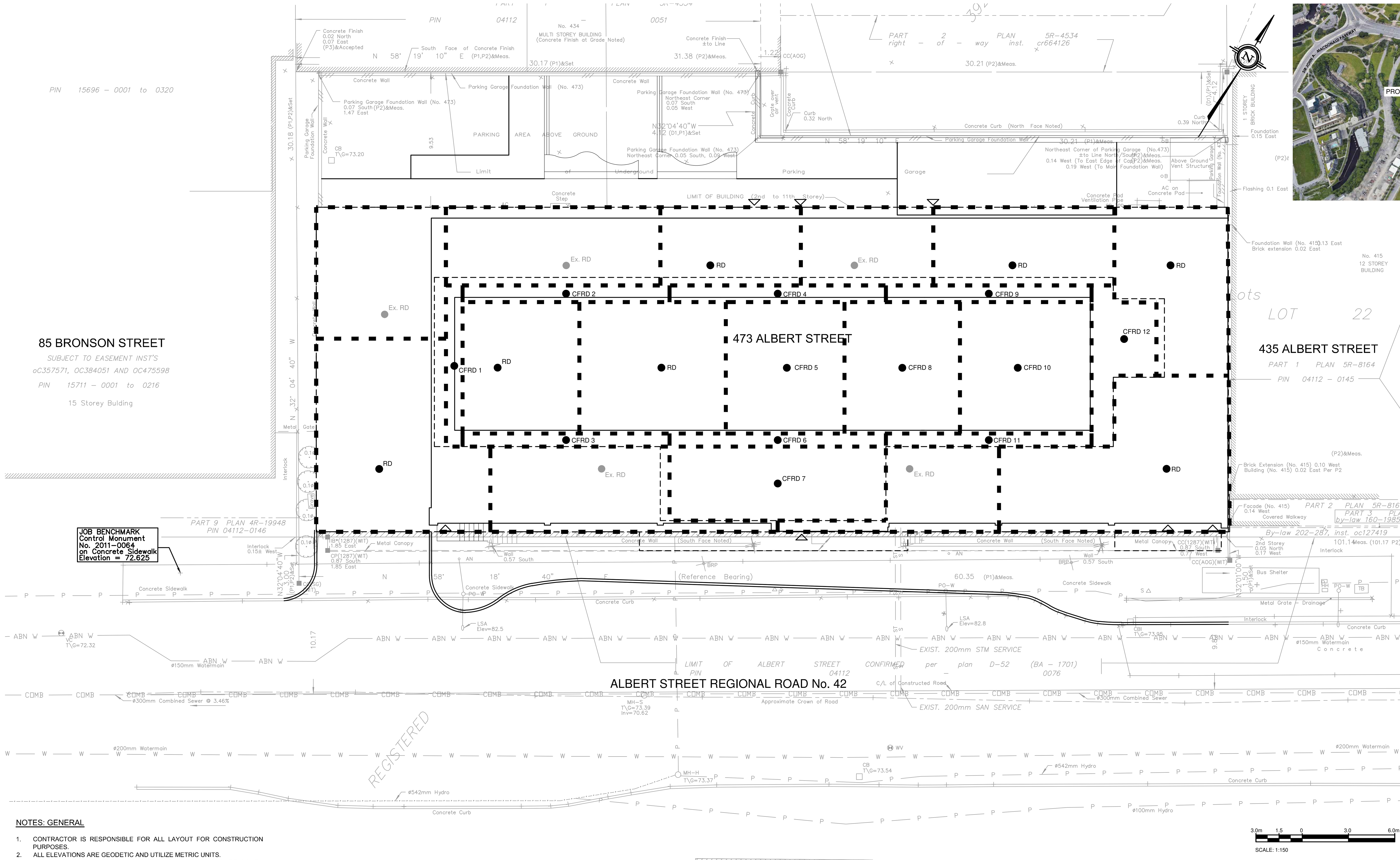
drawing title | titre du dessin

SITE SERVICING AND GRADING PLAN

project number | numero du projet	477234
drawn | dessiné	SS
checked | verifié	MM / MT
date | date	11/29/19
scale | échelle	As indicated

drawing number | numéro du dessin

C-101



KEY PLAN

NOTES: GENERAL

1. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
2. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
3. JOB BENCH MARK - REFER TO SURVEY BY AOV LTD. CONFIRM WITH CONTRACT ADMINISTRATOR PRIOR TO UTILIZATION OF BENCH MARK.
4. ALL GROUND SURFACES SHALL BE EVENLY GRADED WITHOUT PONDING AREAS AND WITHOUT LOW POINTS EXCEPT WHERE APPROVED SWALE OR CATCH BASIN OUTLETS ARE PROVIDED.
5. STRIP AND REMOVE ALL TOPSOIL FROM IMPROVED AREAS.
6. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
7. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT. PAVEMENT REINSTATEMENT SHALL BE WITH STEP JOINTS OF 500mm WIDTH MINIMUM IN ACCORDANCE WITH D2 ON DRAWING C103.
8. CURBS TO BE CONCRETE BARRIER, CONSTRUCTED AS PER CITY OF OTTAWA DETAIL SC1.1. ELEVATIONS AT CURB INDICATE THE GRADE AT THE FINISHED ROAD SURFACE UNLESS NOTED OTHERWISE.
9. RESTORE PAVEMENT STRUCTURE AND SURFACES ON EXISTING ROADS TO A CONDITION AT LEAST EQUAL TO ORIGINAL AND TO THE SATISFACTION OF THE MUNICIPAL AUTHORITIES.
10. ALL MATERIAL SUPPLIED AND PLACED FOR PARKING LOT AND ACCESS ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. CONSTRUCTION TO OPSS 206, 310 & 314. MATERIALS TO OPSS 1001, 1003 & 1010.
11. ABUTTING PROPERTY GRADE TO BE MATCHED.
12. OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS FROM THE MUNICIPAL AUTHORITIES PRIOR TO COMMENCING CONSTRUCTION.
13. MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING THE EXECUTION OF ALL WORKS.
14. FILTER FABRIC TO BE INSTALLED AND MAINTAINED BETWEEN THE FRAME AND COVER OF ALL CATCHBASINS AND CATCHBASIN MANHOLES DURING THE CONSTRUCTION PERIOD TO MINIMIZE SEDIMENTS ENTERING THE STORM SEWER SYSTEM. ALL GRASSED AREAS MUST BE COMPLETED PRIOR TO THE REMOVAL OF THE FILTER FABRIC IN THE CATCH BASINS.
15. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE DIRECTED FROM THE ENGINEER. EXCAVATE AND REMOVE ALL ORGANIC MATERIAL AND DEBRIS LOCATED WITHIN THE PROPOSED BUILDING, PARKING AND ROADWAY LOCATIONS. ANY CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
16. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS BUT NOT LIMITED TO; ROAD CUT PERMITS, SEWER PERMITS, WATER PERMIT, ETC.
17. AT PROPOSED UTILITY CONNECTION POINTS AND CROSSINGS (I.E. STORM SEWER, SANITARY SEWER, WATER, ETC.) THE CONTRACTOR SHALL DETERMINE THE PRECISE LOCATION AND DEPTH AND SIZE OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES.
18. REFER TO ARCHITECT AND LANDSCAPE ARCHITECTS DRAWINGS FOR BUILDING, LANDSCAPE, AND HARD SURFACE AREAS AND DIMENSIONS.

LEGEND:

	EXISTING PROPERTY LINE
Concrete Curb	EXISTING CONCRETE CURB
	PROPOSED CONCRETE CURB
	PROPOSED DEPRESSED CURB
	PROPOSED BUILDING OR STRUCTURE
W — W	EXISTING WATERMAIN
ABN W	EXISTING ABANDONED WATERMAIN
VC	EXISTING V&VB
	EXISTING CURBSTOP
	EXISTING FIRE HYDRANT
G — G	EXISTING UNDERGROUND GAS
B — B	EXISTING UNDERGROUND BELL
P — P	EXISTING UNDERGROUND POWER
OHW — OHW	EXISTING OVERHEAD WIRES
TV	EXISTING UNDERGROUND COMMUNICATIONS
COMB	EXISTING COMBINED SEWER AND MANHOLE
S — S	EXISTING SANITARY SEWER
ST — ST	EXISTING STORM SEWER
	EXISTING ROOF DRAIN
RD	PROPOSED ROOF DRAIN
CFRD 1	PROPOSED CONTROLLED FLOW ROOF DRAIN
	PROPOSED WATERSHED BOUNDARY

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(6 1 3) 5 9 1 - 1 5 3 3
structural engineers | ingénieur structure

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t 613 230 1186 smithandandersen.com
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nord du projet
project north

nord actuel
true north

no	revisions	date
1	ISSUED FOR SITE PLAN APPLICATION	12/05/2019

stamp | timbre

REGISTERED PROFESSIONAL ENGINEER
M.E. MACSWEEN
100104372
DEC 5, 2019
PROVINCE OF ONTARIO

architect | architecte

linebox STUDIO

project title

473 ALBERT

PROPOSED MIXED-USE RENOVATION

473 ALBERT STREET | OTTAWA | ONTARIO | CANADA

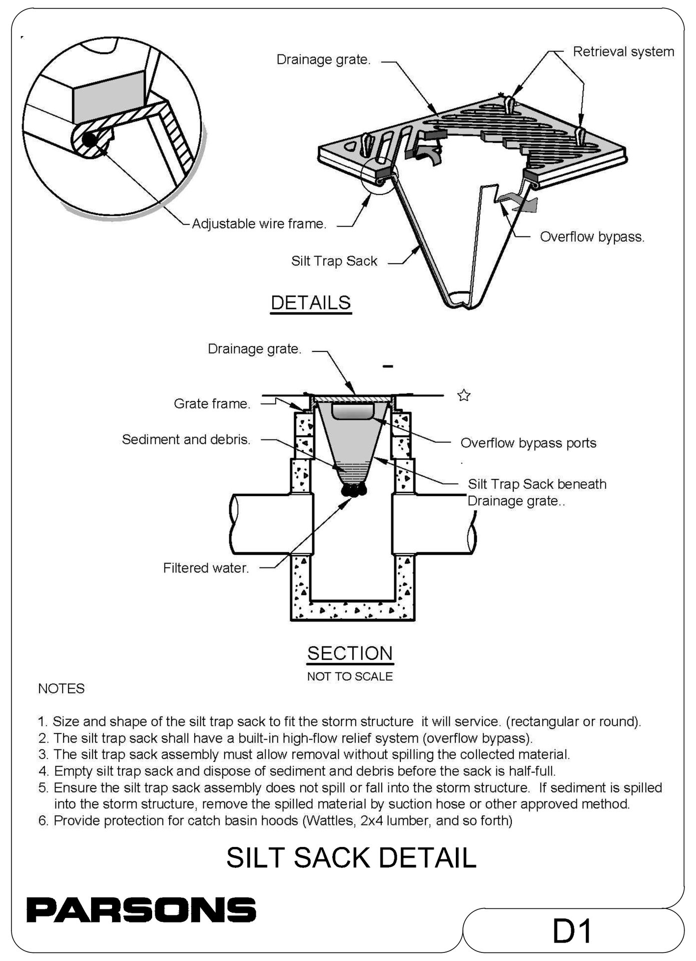
drawing title | titre du dessin

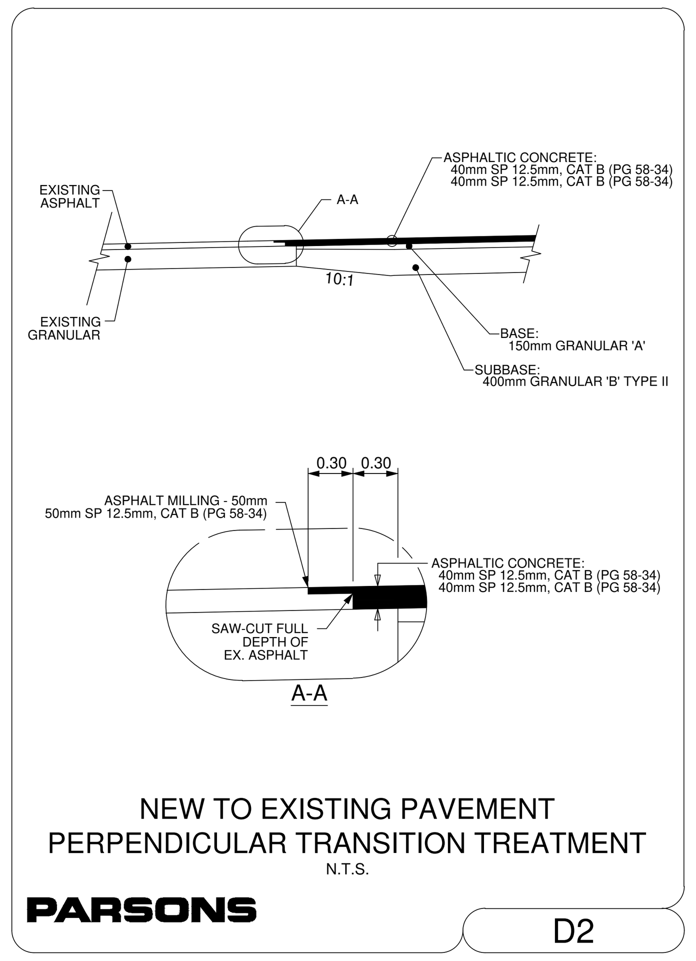
ROOF DRAIN PLAN

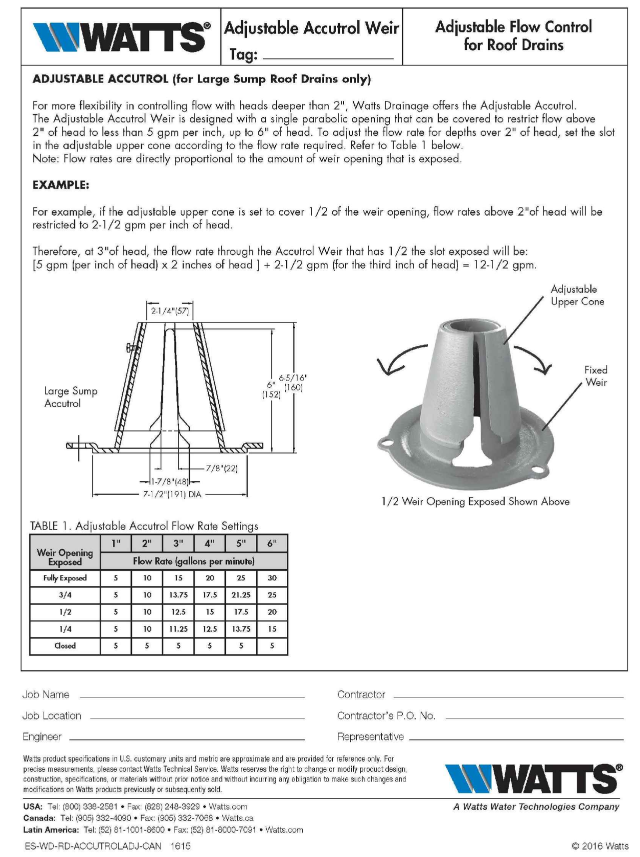
project number | numero du projet	477234
drawn | dessiné	SS
checked | verifié	MM / MT
date | date	29/11/19
scale | échelle	As indicated

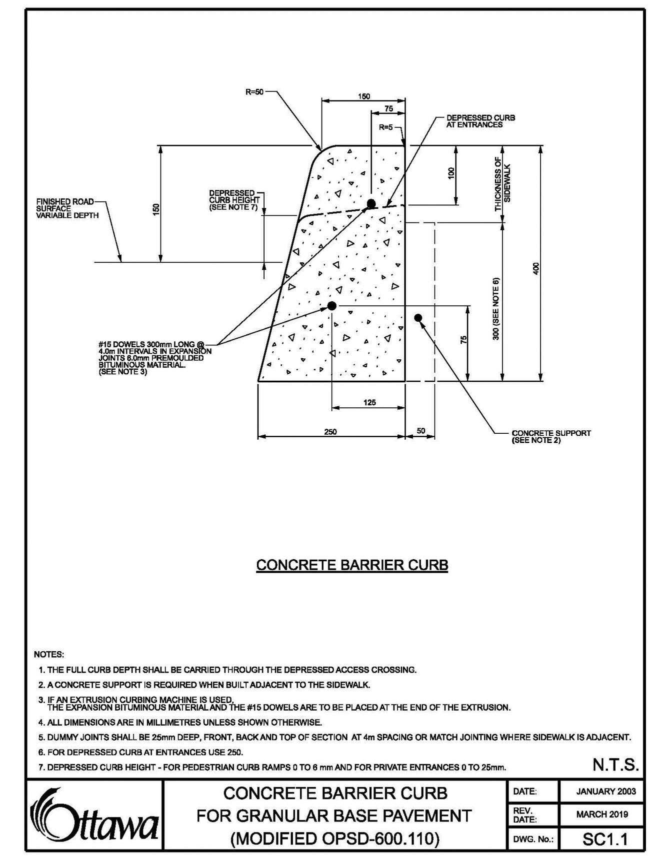
drawing number | numéro du dessin

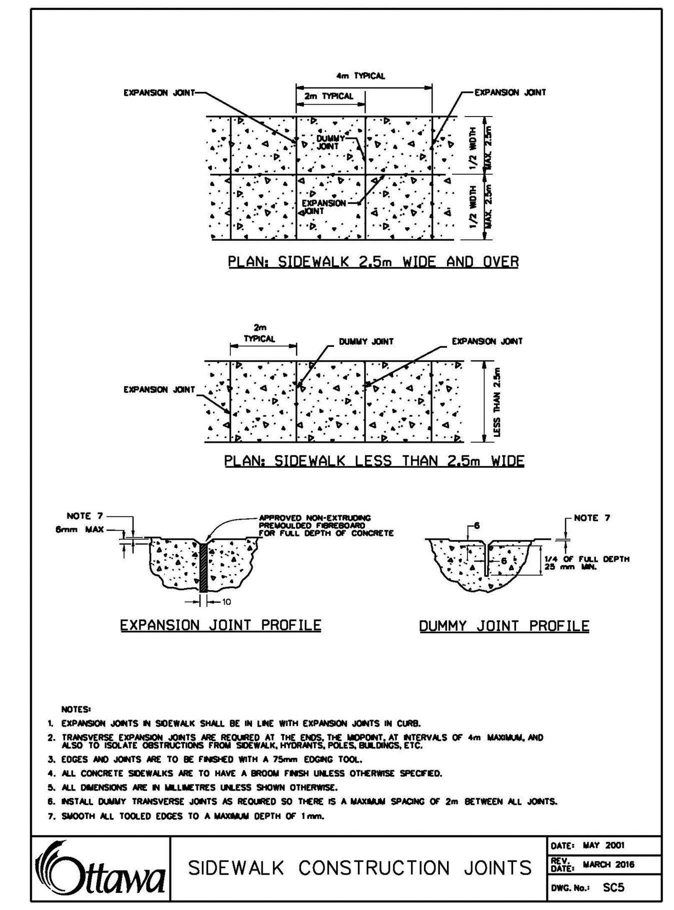
C-102

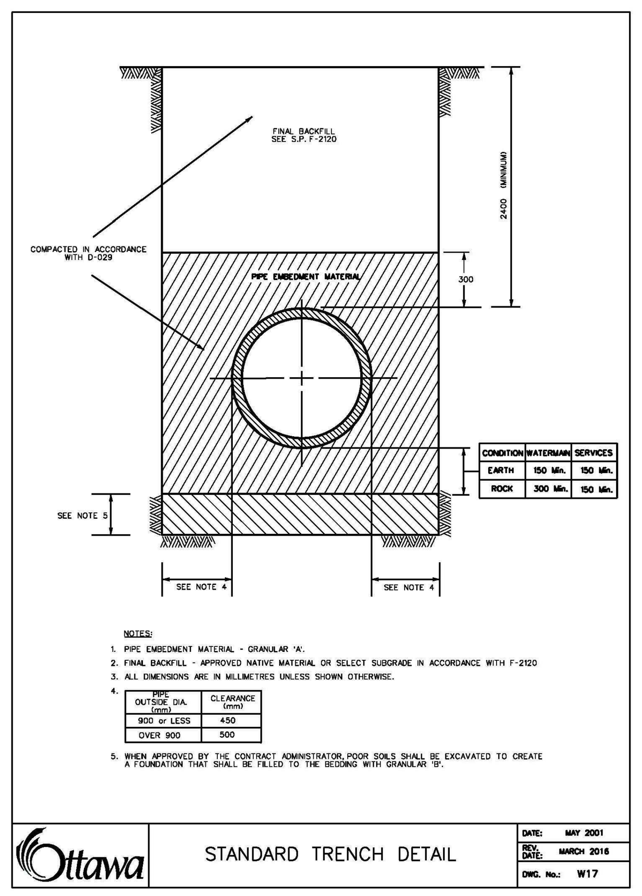


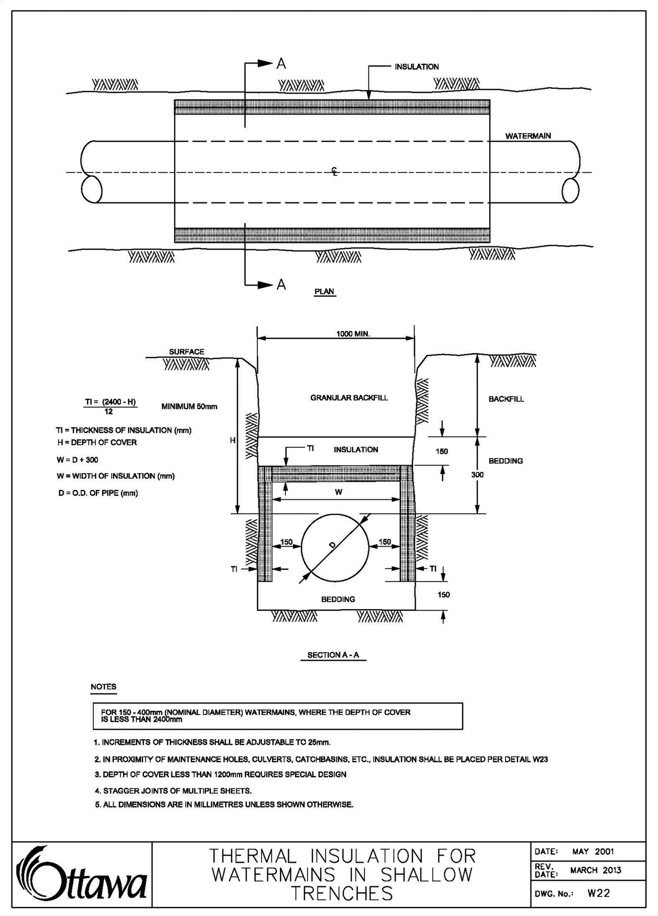


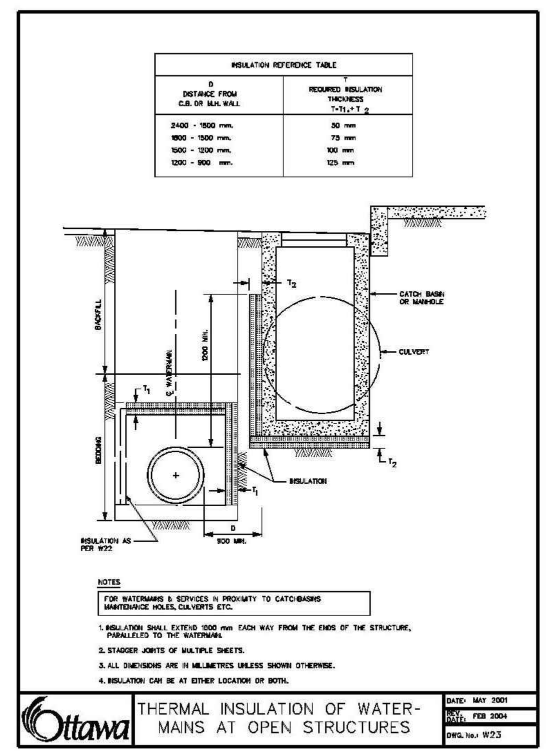


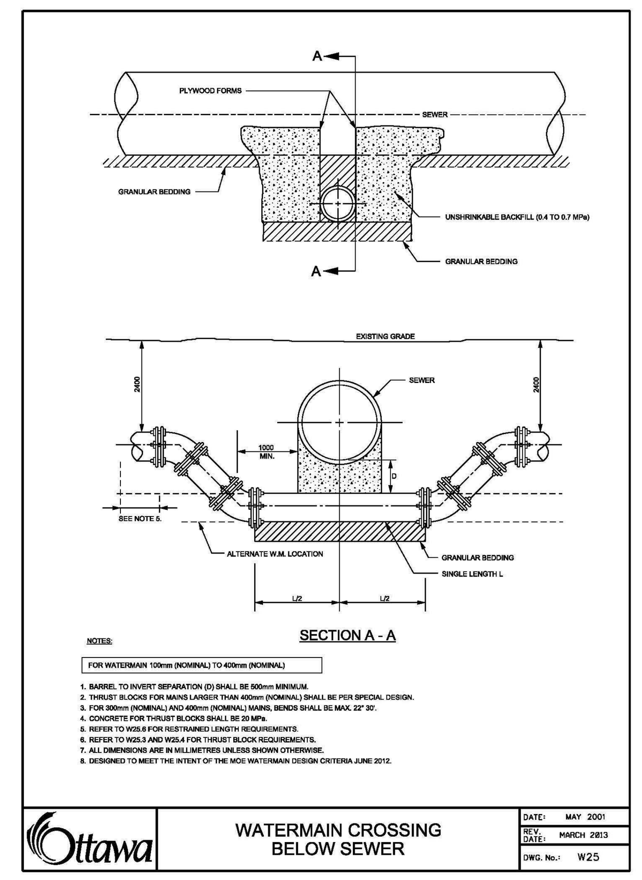


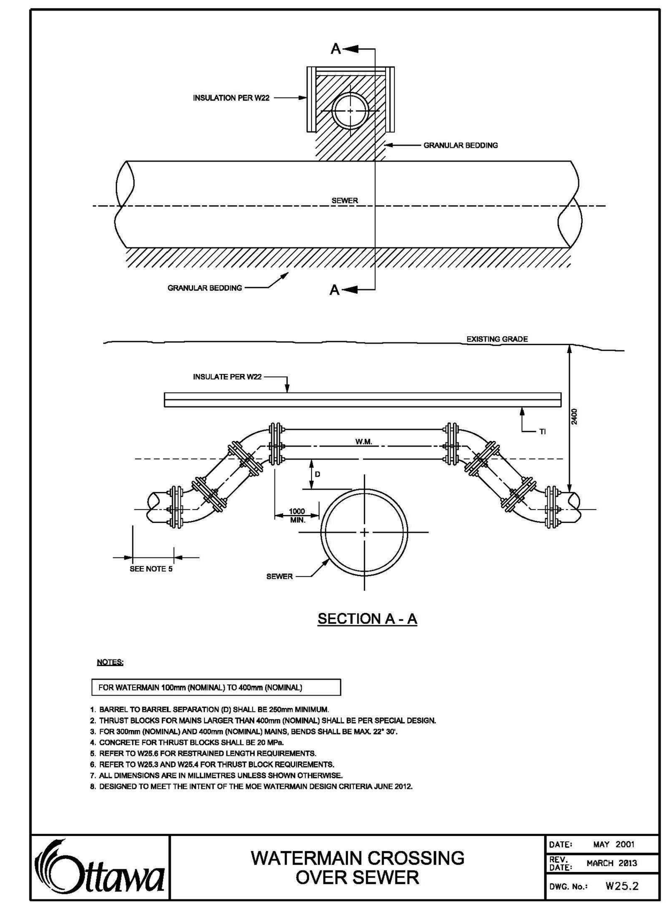


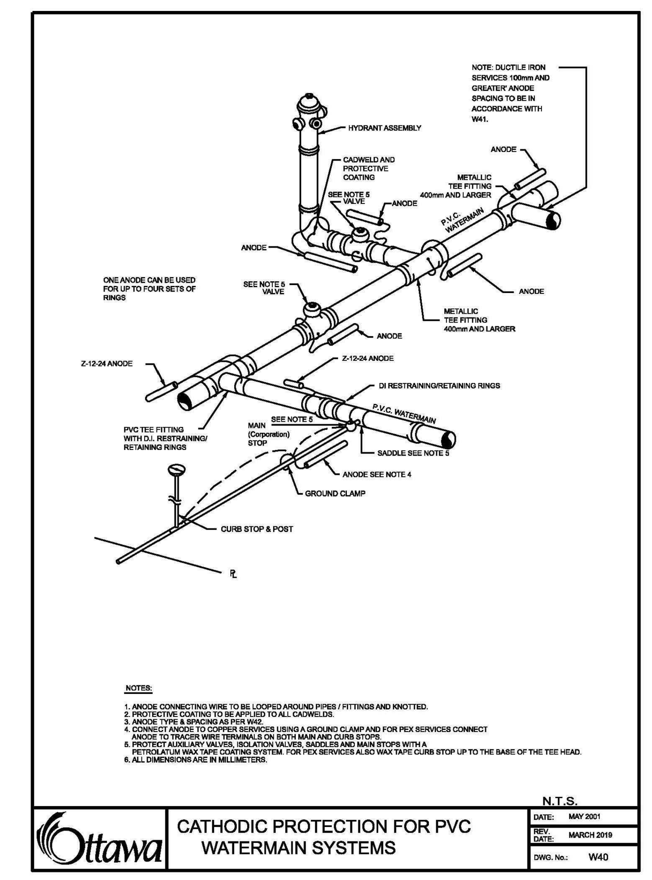


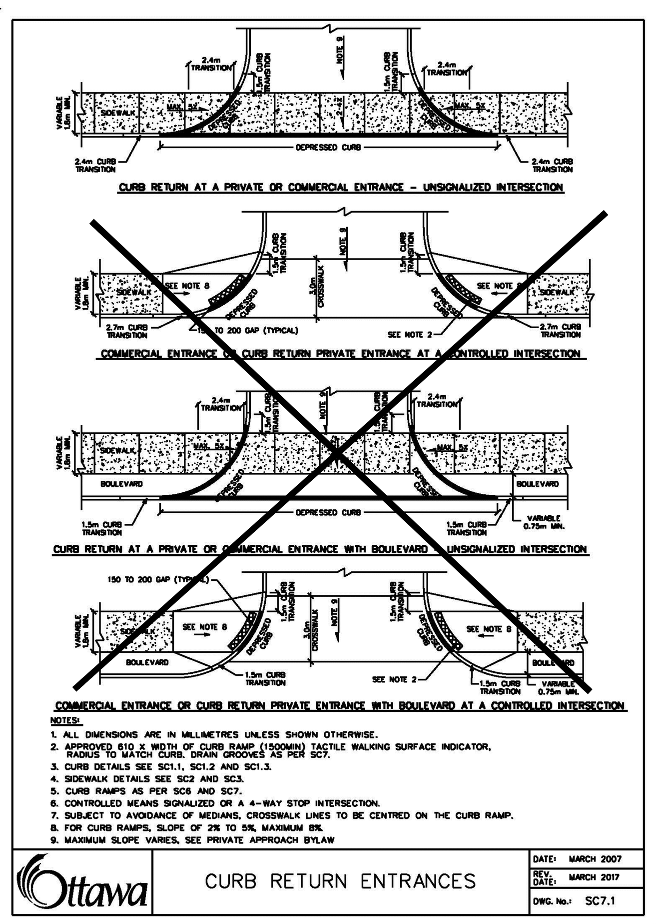


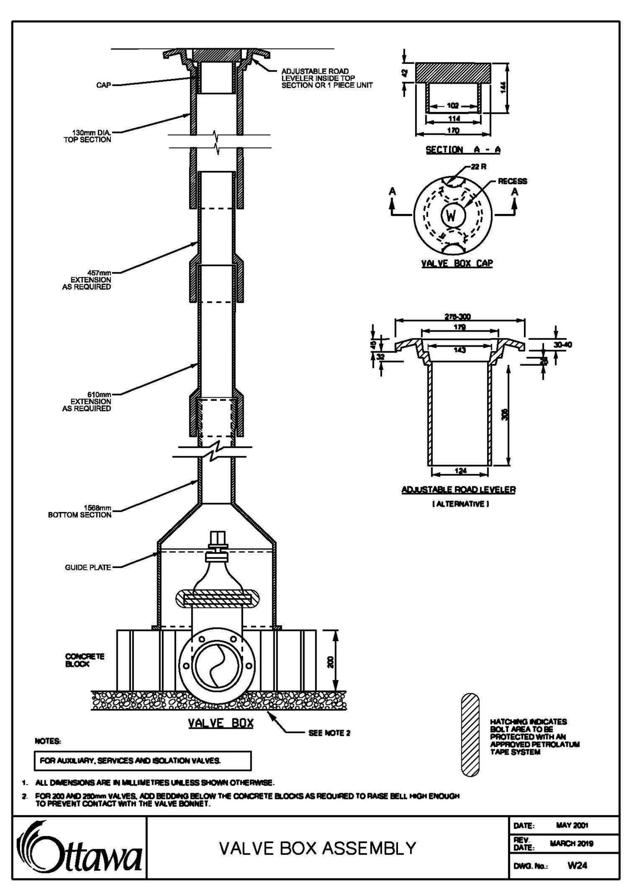


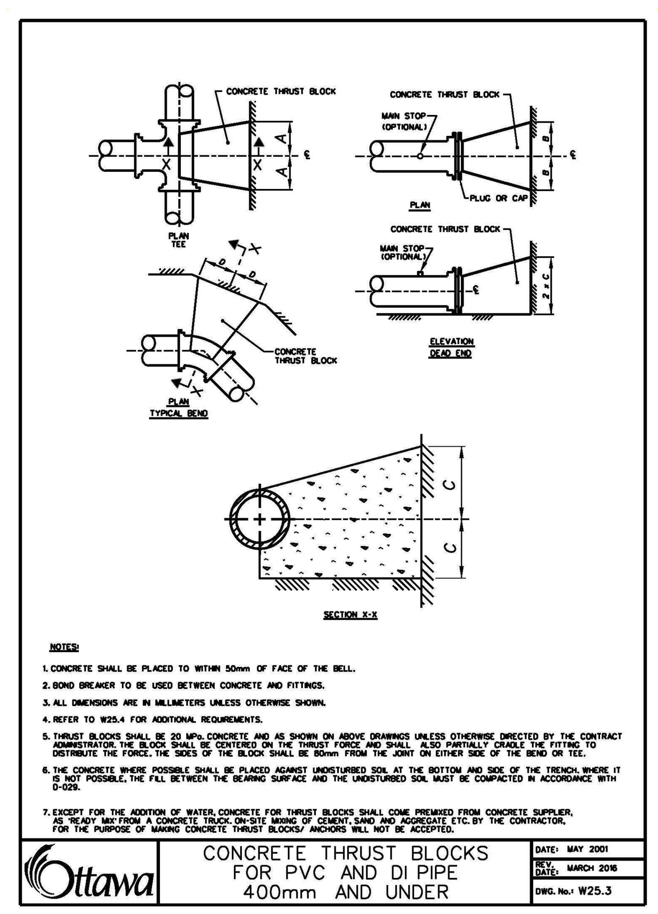


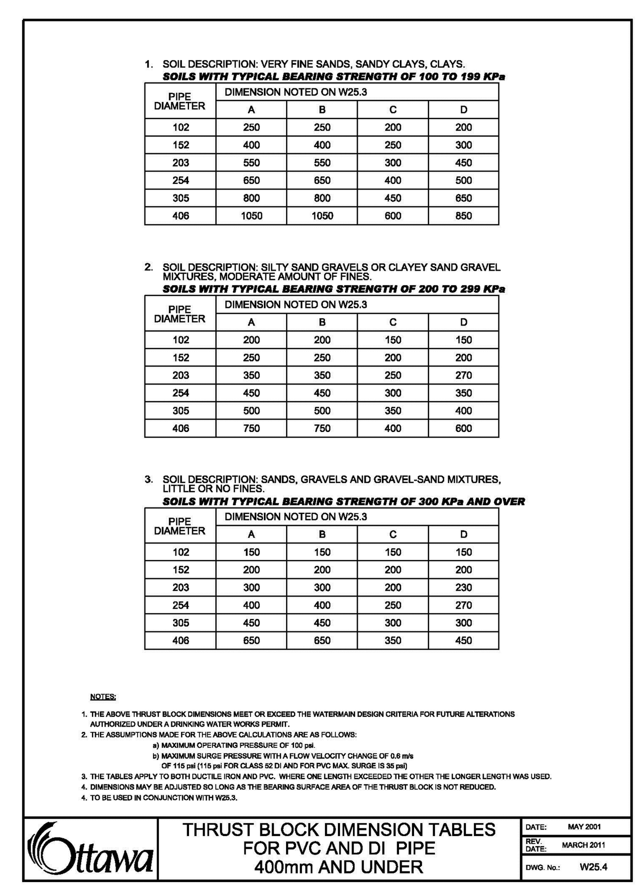


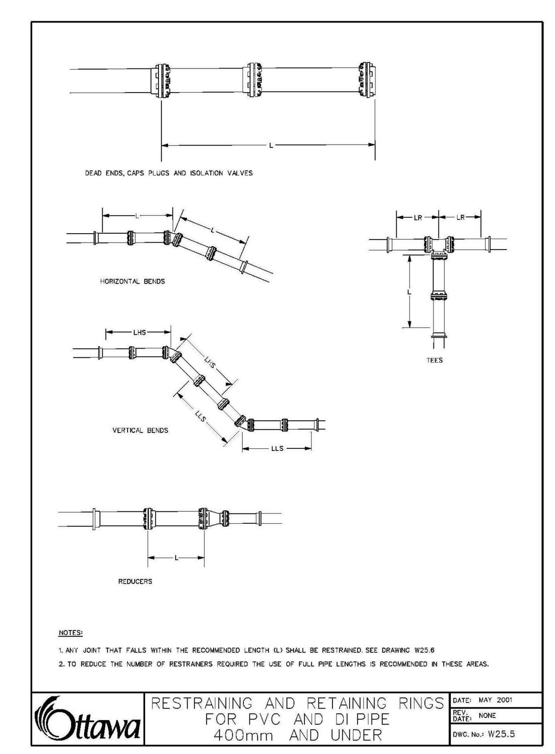


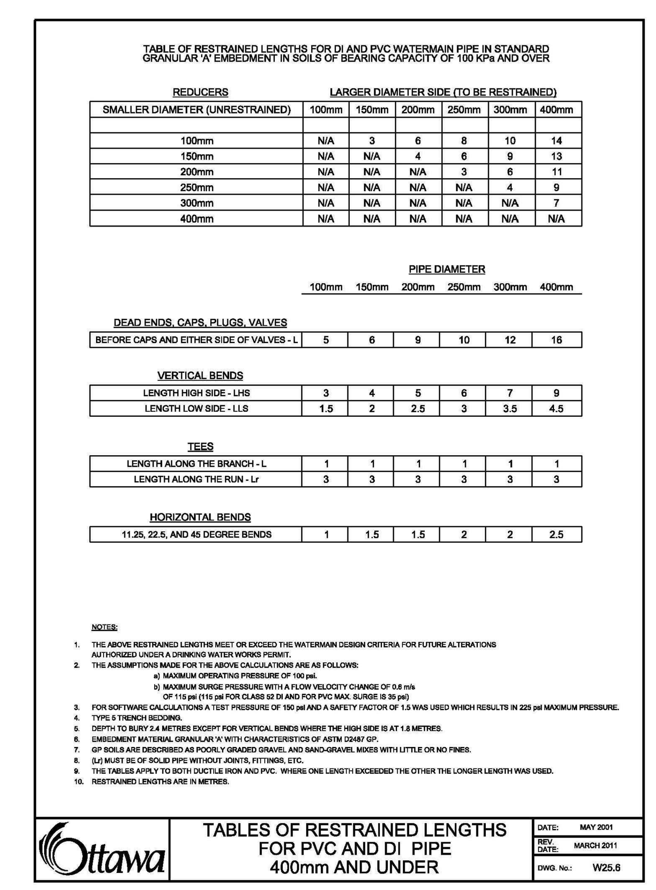












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nord du projet / project north — nord actuel / true north

no	revisions	date
1	ISSUED FOR SITE PLAN APPLICATION	12/05/2019

stamp | timbre

REGISTERED PROFESSIONAL ENGINEER
M.E. MACSWEEN
100104372
DEC 5, 2019
PROVINCE OF ONTARIO

architect | architecte

linebox STUDIO

project title

473 ALBERT

PROPOSED MIXED-USE RENOVATION
473 ALBERT STREET | OTTAWA | ONTARIO | CANADA

drawing title | titre du dessin

DETAILS PLAN

project number | numero du projet	477234
drawn | dessiné	SS
checked | verifié	MM / MT
date | date	29/11/19
scale | échelle	As indicated

drawing number | numéro du dessin

C-103

APPENDIX D | BOUNDARY CONDITIONS

Theiner, Mathew

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: Thursday, November 21, 2019 8:52 AM
To: MacSween, Meghan
Cc: Deiaco, Simon; Theiner, Mathew
Subject: [EXTERNAL] RE: 473 Albert Street - Boundary Condition Request
Attachments: 473 Albert Nov 2019.pdf

Good morning Ms. MacSween / Mr. Theiner

As discussed, the existing 152mm on Albert will be abandoned and the existing 203mm will be replaced by a new 203mm PVC in the near future. We can provide boundary conditions for future conditions but we are still waiting to hear back on the planned watermain sizes for Bronson, Albert and surrounding streets.

The following are boundary conditions, HGL, for hydraulic analysis at 473 Albert (zone 1W) assumed to be connected to the 203 mm on Albert (see attached PDF for location).

Minimum HGL = 106.0 m

Maximum HGL = 115.5 m

Available fire flow = 115 L/s assuming a residual of 20 psi and a ground elevation of 73.5 m

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

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

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals

Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
Planning, Infrastructure and Economic Development Department | Direction générale de la planification de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1
(613) 580 2424 Ext. | Poste 33017
Int. Mail Code | Code de Courrier Interne 01-14
shawn.wessel@ottawa.ca

From: MacSween, Meghan <Meghan.Macsween@parsons.com>
Sent: November 13, 2019 1:29 PM
To: Wessel, Shawn <shawn.wessel@ottawa.ca>
Cc: Deiaco, Simon <Simon.Deiaco@ottawa.ca>; Theiner, Mathew <Mathew.Theiner@parsons.com>
Subject: RE: 473 Albert Street - Boundary Condition Request

Hi Shawn,

Thanks for the heads up, we'll await confirmation. If the 152mm watermain is out of service we will have to connect to the 203 mm diameter watermain and install a valve to separate the two services.

I am going to be out of the office for the next two weeks, can I ask that you include Mathew Theiner, cc'd, on any communication as he will be taking over in my absence.

Thanks,

Meghan

Meghan MacSween, M.Eng., P.Eng.
Municipal Engineer
1223 Michael St. North, Suite 100, Ottawa, ON K1J 7T2
meghan.macsween@parsons.com – P: +1 613.691.1540 M: +1 343.997.3895

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Parsons PLUS
envision more

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: Wednesday, November 13, 2019 10:52 AM
To: MacSween, Meghan <Meghan.Macsween@parsons.com>
Cc: Deiaco, Simon <Simon.Deiaco@ottawa.ca>
Subject: [EXTERNAL] 473 Albert Street - Boundary Condition Request

Good morning Ms. Macsween.

Further to your request, the Water Distribution Dept. has sent the following message:

The 152mm watermain on Albert that they're proposing to connect to seems to be out of service according to GIS. I'm just waiting to hear back from Distribution to find out if this is just temporary or permanent.

I will get back to you once I hear from our colleagues regarding this matter.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
Planning, Infrastructure and Economic Development Department | Direction générale de la planification de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1
(613) 580 2424 Ext. | Poste 33017
Int. Mail Code | Code de Courrier Interne 01-14
shawn.wessel@ottawa.ca

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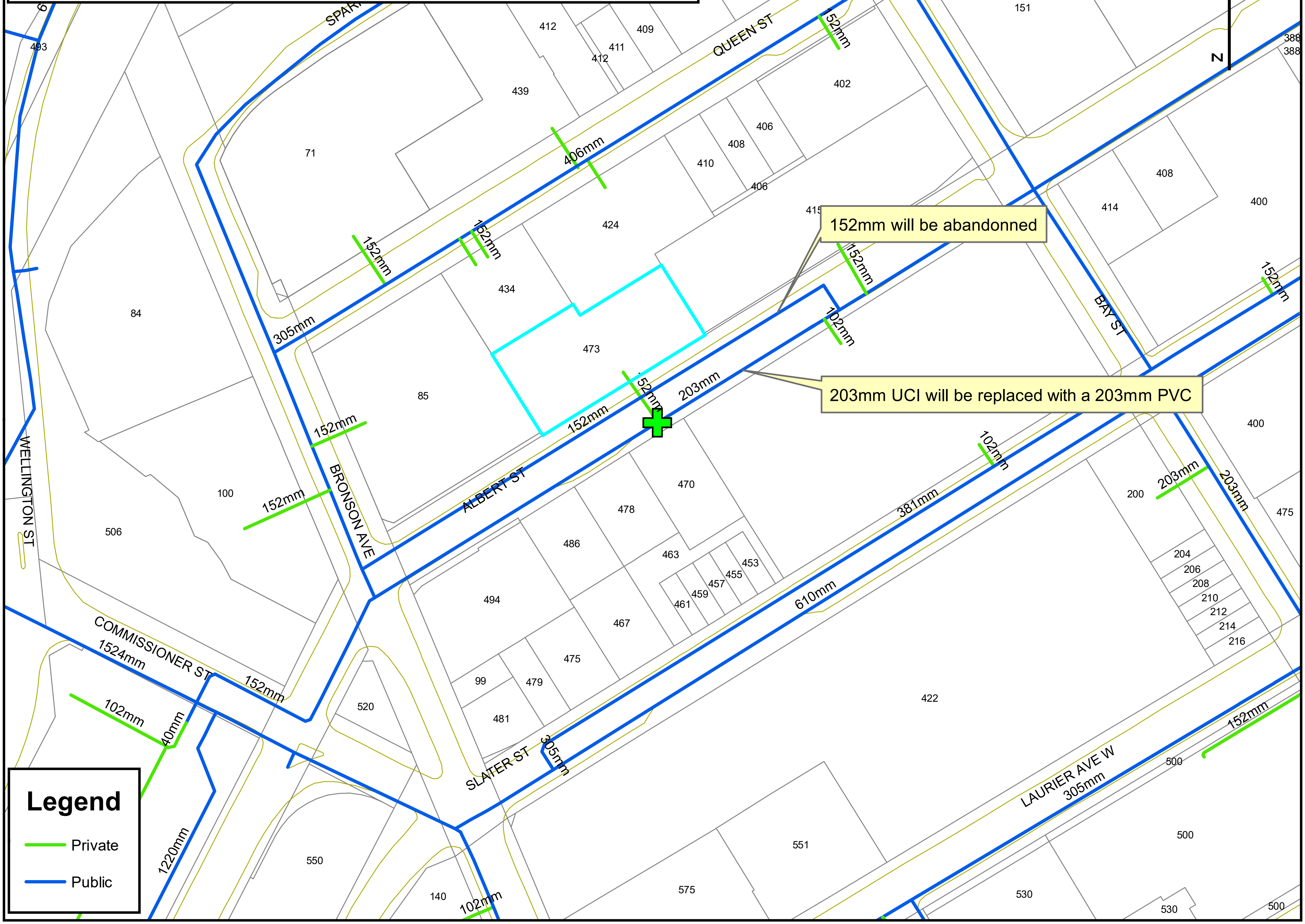
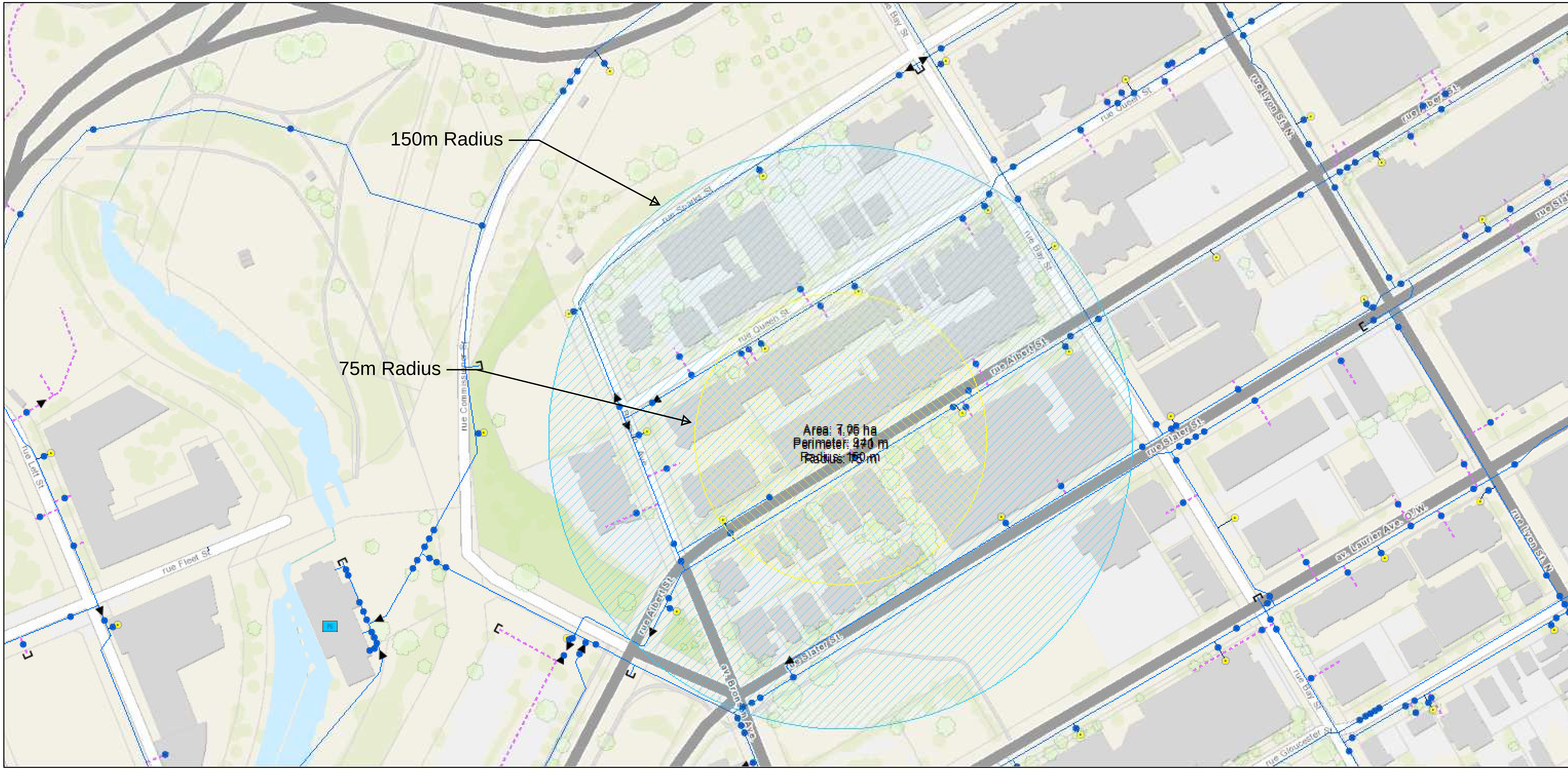
Boundary Condition for 473 Albert





November 27, 2019

1:2,839

0	0.0325	0.065	0.13 mi
0	0.05	0.1	0.2 km

City of Ottawa

Valves / Vannes

- Valve / Vanne
- TVS, A, D

Water Fittings / Raccords de conduite d'eau

- Cap / bouchon
- Reducer / réducteur
- Hydrants / Bornes-fontaines

- Hydrant Laterals / Branchements de borne-fontaine

Water Mains / Conduites d'eau principales

- Private / Branchement privé
- Public / Branchement public

Misc. Water Structures / Structures d'aqueduc - divers

- Pumping Station / Station de pompage des eaux
- Well Supply / Alimentation par puits
- Elevated Tank / Château d'eau
- In Ground Tank / Réservoir souterrain
- Water Treatment Plant / Usine d'épuration des eaux

APPENDIX E | WATER DEMAND

Table1 : Water Demand for 473 Albert Street

Building	Units	Population	Gross Floor Area (m2)	Average Daily Demand (ADD)*	Maximum Daily Demand (MDD)**	Peak Hourly Demand (PHD)**	Fire Flow (FF)	MDD + FF
				L/s	4.9*ADD 1.5*ADD (non-residential) L/s	7.4*ADD 1.8*MDD (non-residential) L/s	L/s	L/s
473 Albert Street				**1.61**	**5.71**	**8.90**	**350**	**355.7**
Residential	*144*	*239*		*0.97*	*4.75*	*7.18*		
Office			*1363*	*0.05*	*0.07*	*0.13*		
Restaurant			*385*	*0.56*	*0.84*	*1.50*		
12th floor			*579*	*0.03*	*0.05*	*0.09*		

Average Daily Demands

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

Average Residential Daily Flow =	350	L/p/d	
Shopping Centres =	2,500	L/(1000m2/d)	
Restaurant (Ordinary not 24h)	125	L/seat/d	
Office Daily Flow =	75	L/empl/d	75L/9.3m2/d 1 seat per 9.3m2
Amenity Area Flow =	5	L/m2/d	

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

Table 2: Fire Flow Calculations

Building	Type of Construction C	Total Floor Area m^2 A	Fire Flow (min. 2,000) L/min F	Adjusted (nearest 1,000) L/min	Occupancy Factor O	Reduction / Increase due to Occupancy	Fire Flow with Occupancy (min. 2,000) L/min	Sprinklers Factor S	Reduction due to Sprinklers L/min	Exposure Factor % E	Increase due to Exposure L/min	Fire Flow L/min	Roof Contribution L/min R	Required Fire Flow: Adjusted to the nearest 1000 (min. 2,000, max. 45,000) L/min F	Required Fire Flow: minimum 33 L/s
473 Albert Street	0.8	13,980	20,810	21,000	-15%	-3,150	17,850	50%	8,925	70%	12,495	21,000	0	21,000	350
Outline of Procedure P. 20	A	B/C	D 1	D 2	E 2	E 2	E 2	F 3	F 3	G	G	H			

Reference:

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

C Type of Construction

Wood Frame	1.5
Ordinary Construction (joist masonry)	1
Non-Combustible Construction (unprotected metal structure, masonry non-combustible)	0.8
Fire resistive construction (= or > 3 hours)	0.7

A Total Floor Area (m^2)
First Floor
Basement excluded if at least 50% below grade

Fire-resistive Building Floor Area
Less than 1 hour rating
two largest adjoining floors
Additional floors (up to 8) at 50%
Fully protected, equal or more than 3 hours rating
(reinforced concrete, protected steel)
largest floor
Additional two adjoining floors at 25%

F
Fire Flow (L/Min)
220*C*(A^0.5)
2,000<F<45,000

FS Fire Wall Separation
Per Wall 1,000 L/min

O

O Occupancy

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

S Sprinklers

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

(x%: percentage of total protected floor area)

E Exposure
Cumulative , maximum 75%

Distance (m)	*	E	W	N	S
0-3	25%	0			
3.1-10	20%			9	
10.1-20	15%		16.7		
20.1-30	10%				20.7
30.1-45	5%				

R Roof

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

APPENDIX F | 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

InterRent No.3 Limited Partnership

473 Albert St.
Ottawa, Ontario
Job No.: 87892

Drain Use
Sanitary

Inspection Date
November 21st 2019

DRAIN CCTV INSPECTION REPORT

1800 Bantree Street
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CLEAN WATER WORKS

InterRent No. 3 Limited Partnership

473 Albert Street
Ottawa, Ontario
Job No.: 88792

Inspection Date

November 21st 2019

Inspection Notes:

Water main was verbally confirmed as 6 inch plastic by David Seaman on site with Evan Johnson.

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CLEAN WATER WORKS

MINI CAMERA CCTV INSPECTION REPORT

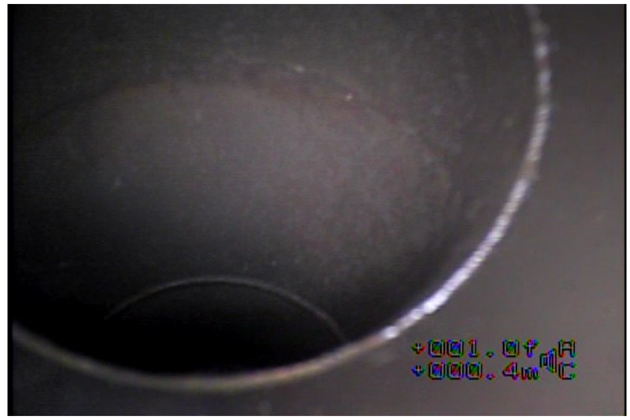
CUSTOMER:	InterRent No. 3 Limited Partnership	**START OF INSPECTION:**	BASEMENT MECH ROOM
JOB NO.:	87892	**END OF INSPECTION:**	CITY MAIN LINE
		SEWER USE:	SANITARY
LOCATION:	473 ALBERT STREET OTTAWA, ONTARIO	**PIPE DIAMETER(S):**	150MM / 200MM
		PIPE MATERIAL(S):	CAST IRON / TRANSITE
		DIRECTION OF FLOW:	DOWNSTREAM
DATE:	NOVEMBER 21ST 2019	**VIDEO FILENAME:**	Video #1
OPERATOR:	DAVID S.	**REPORT NUMBER:**	**1 of 2**

DISTANCE (M)	CODE	INSPECTION COMMENTS
0.0	START	START OF INSPECTION – BASEMENT MECH ROOM
1.0	LBD	LINE BENDS DOWN
2.4	LBS	LINE BENDS STRAIGHT
2.4	DC	DIAMETER CHANGE: 150MM – 200MM
3.8	LBR	LINE BENDS RIGHT
3.8	MC	MATERIAL CHANGE: CAST IRON – TRANSITE
13.4	END	END OF INSPECTION – CITY MAIN LINE

CODE	DESCRIPTION
AIF	ACTIVE INFILTRATION
BKJ	BROKEN JOINT
BSG	START OF SAG
BWV	BACKWATER VALVE
C/O	CLEANOUT
CAL	CALCITE
CFL	COLLAPSE
CRC	CIRCULAR CRACK
DC	DIAMETER CHANGE
DEB	DEBRIS
DEF	PIPE DEFORMATION
EIF	EVIDENCE OF INFILTRATION
ESG	END OF SAG
EXG	EXPOSED GASKET
EXR	EXPOSED REBAR
F/D	FLOOR DRAIN
FRC	FRACTURE
GRS	GREASE
HOLE	HOLE IN PIPE
LBD	LINE BENDS DOWN
LBL	LINE BENDS LEFT
LBR	LINE BENDS RIGHT
LBS	LINE BENDS STRAIGHT
LGC	LONGITUDINAL CRACK
MAIN	MAIN SEWER IN BUILDING
MC	MATERIAL CHANGE
MH	MANHOLE
MSP	MISSING PIPE PIECE
OBS	OBSTRUCTION IN PIPE
OFJ	OFFSET JOINT
OPJ	OPEN JOINT
PFL	PARTIAL COLLAPSE
PSC	PROTRUDING CONNECTION
PUN	PUNCTURE
RTS	ROOTS
SC	SERVICE CONNECTION
WYE	WYE CONNECTION

COMMENTS:
Before Flushing
No deficiencies noted

Video #1



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CLEAN WATER WORKS

MINI CAMERA CCTV INSPECTION REPORT

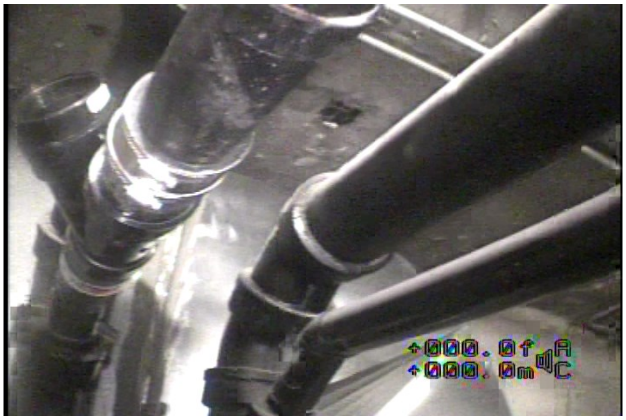
CUSTOMER:	InterRent No. 3 Limited Partnership	**START OF INSPECTION:**	BASEMENT MECH ROOM
JOB NO.:	87892	**END OF INSPECTION:**	CITY MAIN LINE
		SEWER USE:	SANITARY
LOCATION:	473 ALBERT STREET OTTAWA, ONTARIO	**PIPE DIAMETER(S):**	150MM / 200MM
		PIPE MATERIAL(S):	CAST IRON / TRANSITE
		DIRECTION OF FLOW:	DOWNSTREAM
DATE:	NOVEMBER 21ST 2019	**VIDEO FILENAME:**	Video #2
OPERATOR:	DAVID S.	**REPORT NUMBER:**	**2 of 2**

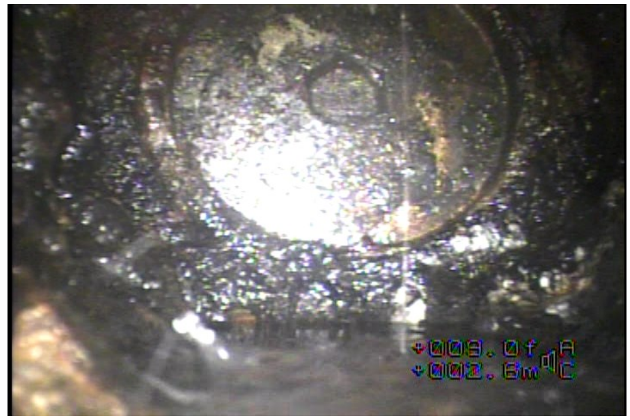
DISTANCE (M)	CODE	INSPECTION COMMENTS
0.0	START	START OF INSPECTION – BASEMENT MECH ROOM
1.0	LBD	LINE BENDS DOWN
2.4	LBS	LINE BENDS STRAIGHT
2.4	DC	DIAMETER CHANGE: 150MM – 200MM
3.8	LBR	LINE BENDS RIGHT
3.8	MC	MATERIAL CHANGE: CAST IRON – TRANSITE
13.4	END	END OF INSPECTION – CITY MAIN LINE

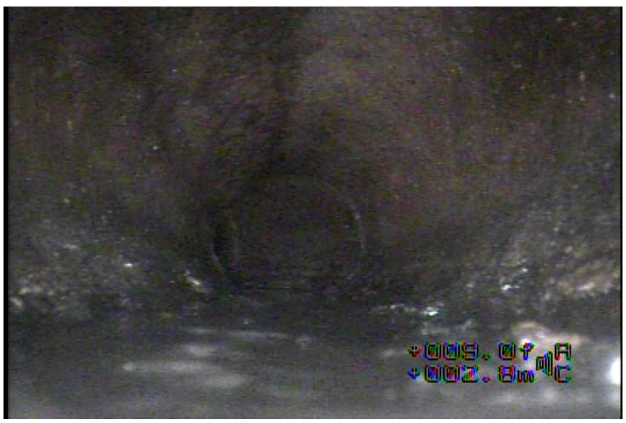
CODE	DESCRIPTION
AIF	ACTIVE INFILTRATION
BKJ	BROKEN JOINT
BSG	START OF SAG
BWV	BACKWATER VALVE
C/O	CLEANOUT
CAL	CALCITE
CFL	COLLAPSE
CRC	CIRCULAR CRACK
DC	DIAMETER CHANGE
DEB	DEBRIS
DEF	PIPE DEFORMATION
EIF	EVIDENCE OF INFILTRATION
ESG	END OF SAG
EXG	EXPOSED GASKET
EXR	EXPOSED REBAR
F/D	FLOOR DRAIN
FRC	FRACTURE
GRS	GREASE
HOLE	HOLE IN PIPE
LBD	LINE BENDS DOWN
LBL	LINE BENDS LEFT
LBR	LINE BENDS RIGHT
LBS	LINE BENDS STRAIGHT
LGC	LONGITUDINAL CRACK
MAIN	MAIN SEWER IN BUILDING
MC	MATERIAL CHANGE
MH	MANHOLE
MSP	MISSING PIPE PIECE
OBS	OBSTRUCTION IN PIPE
OFJ	OFFSET JOINT
OPJ	OPEN JOINT
PFL	PARTIAL COLLAPSE
PSC	PROTRUDING CONNECTION
PUN	PUNCTURE
RTS	ROOTS
SC	SERVICE CONNECTION
WYE	WYE CONNECTION

COMMENTS:
After Flushing
No deficiencies noted

Video #2


000.0f A
000.0m C


009.0f A
002.8m C


009.0f A
002.8m C


014.5f A
004.4m C


041.0f A
012.4m C


043.5f A
013.2m C

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CLEAN WATER WORKS INC.

INTEGRATED SEWER SOLUTIONS

InterRent No.3 Limited Partnership

473 Albert St.
Ottawa, Ontario
Job No.: 87892

Drain Use
Storm

Inspection Date
November 14th 2019

DRAIN CCTV INSPECTION REPORT

1800 Bantree Street
Ottawa, Ontario K1B 5L6
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613.745.9994
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1.866.695.0155

CLEAN WATER WORKS

MINI CAMERA CCTV INSPECTION REPORT

CUSTOMER:	InterRent No. 3 Limited Partnership	**START OF INSPECTION:**	CLEANOUT
JOB NO.:	87892	**END OF INSPECTION:**	MAIN LINE
		SEWER USE:	STORM
LOCATION:	473 ALBERT OTTAWA, ONTARIO	**PIPE DIAMETER(S):**	100MM / 150MM / 200MM
		PIPE MATERIAL(S):	CAST IRON / TRANSITE
		DIRECTION OF FLOW:	DOWNSTREAM
DATE:	NOVEMBER 14TH 2019	**VIDEO FILENAME:**	Video #1
OPERATOR:	TREVOR F.	**REPORT NUMBER:**	**1 of 1**

DISTANCE (M)	CODE	INSPECTION COMMENTS
0.0	C/O	START OF INSPECTION – CLEANOUT
2.8	LBR	LINE BENDS RIGHT
2.8	DC	DIAMETER CHANGE: 100MM – 150MM
4.8	LBD	LINE BENDS DOWN
6.0	LBS	LINE BENDS STRAIGHT
7.4	LBR	LINE BENDS RIGHT
8.2	LBL	LINE BENDS LEFT
8.2	DC	DIAMETER CHANGE: 150MM – 200MM
8.2	MC	MATERIAL CHANGE: CAST IRON – TRANSITE
17.8	END	END OF INSPECTION – MAIN LINE

CODE	DESCRIPTION
AIF	ACTIVE INFILTRATION
BKJ	BROKEN JOINT
BSG	START OF SAG
BWV	BACKWATER VALVE
C/O	CLEANOUT
CAL	CALCITE
CFL	COLLAPSE
CRC	CIRCULAR CRACK
DC	DIAMETER CHANGE
DEB	DEBRIS
DEF	PIPE DEFORMATION
EIF	EVIDENCE OF INFILTRATION
ESG	END OF SAG
EXG	EXPOSED GASKET
EXR	EXPOSED REBAR
F/D	FLOOR DRAIN
FRC	FRACTURE
GRS	GREASE
HOLE	HOLE IN PIPE
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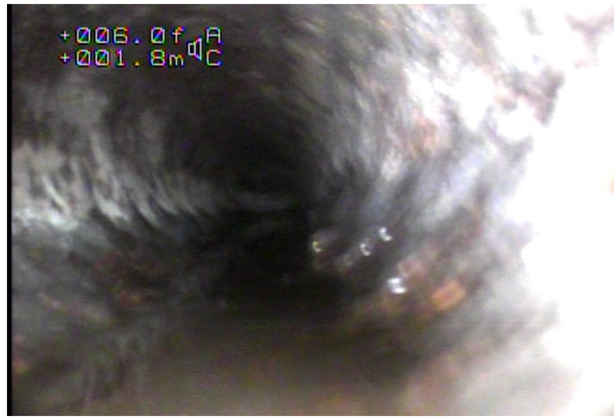
LBL	LINE BENDS LEFT
LBR	LINE BENDS RIGHT
LBS	LINE BENDS STRAIGHT
LGC	LONGITUDINAL CRACK
MAIN	MAIN SEWER IN BUILDING
MC	MATERIAL CHANGE
MH	MANHOLE
MSP	MISSING PIPE PIECE
OBS	OBSTRUCTION IN PIPE
OFJ	OFFSET JOINT
OPJ	OPEN JOINT
PFL	PARTIAL COLLAPSE
PSC	PROTRUDING CONNECTION
PUN	PUNCTURE
RTS	ROOTS
SC	SERVICE CONNECTION
WYE	WYE CONNECTION

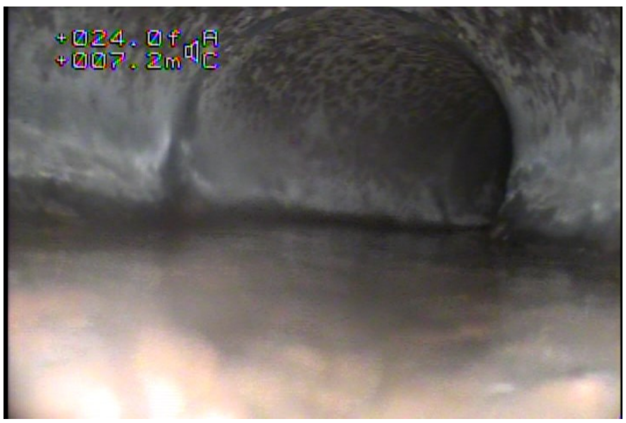
COMMENTS:
No deficiencies noted

Video #1

002.0f
000.6m



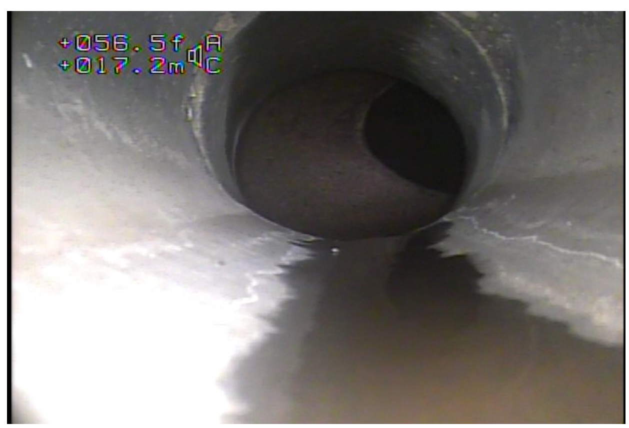
006.0f
001.8m



024.0f
007.2m

030.5f
009.2m

044.5f
013.4m



056.5f
017.2m

APPENDIX G | SANITARY FLOWS AND SEWER DESIGN SHEET

Table 1: SANITARY DESIGN FLOWS

Area	RESTAURANT									ROOFTOP AMENITY SPACE				RESIDENTIAL				TOTAL	INFILTRATION			Total
	Restaurant Area (m^2)	Seats assumed 1 seat per m^2	Flow/seat L/seat/d	Peak Factor	Peak Flow (L/s)	Office Area (m^2)	Capita ($1/25m^2$)	Peak Factor	Peak Flow (L/s)	Area (m^2)	Amenity Space L/m2/d	Peak Factor	Peak Flow (L/s)	Number of units	Capita	Peak Factor	Peak Flow (L/s)	Peak Flow (L/s)	Site Areas (ha)	Infiltration Allowance (L/s/ha)	Infilt. Flow (L/s)	Total Peak Flow (L/s)
Proposed Building																			0.20	0.33	0.07	0.07
Restaurant	385	385	125	1.5	0.84													0.84				0.84
Office						1,363	55	1.5	0.07									0.07				0.07
Residential														144	239	3.5	2.71	2.71				2.71
Amenity Space										579	5	1.5	0.1					0.05				0.05
																					Total	**3.73**
Existing Building																			0.20	0.33	0.07	0.07
Office						12,647	506	1	0.44									0.44				0.44
Restaurant	385	385	125	1.5	0.84													0.84				0.84
																					Total	**1.34**

Design:	Benoit Villeneuve	**Project:**	473 Albert St. Ottawa, Ontario
Check :	Meghan MacSwee	**Location:**	473 Albert St. Ottawa, Ontario
		Project # :	477234
		Date:	November, 2019
		Sheet:	1 of 1

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

Average Residential Daily Flow =	280	L/p/d
Institutional Flow =	28,000	L/ha/d
Commercial Flow =	28,000	L/ha/d
Light Industrial Flow =	35,000	L/ha/d
Heavy Industrial Flow =	55,000	L/ha/d
Hotel Daily Flow =	225	L/bed/d
Office/Warehouse Daily Flow =	75	L/empl/d
Restaurant (Ordinary not 24h)	125	L/seat/d
Shopping Centres =	2,500	L/($1000m^2$/d)
Amenity Area =	5	L/m2/d

Peak Factors

Commercial =	1.5	if commercial contribution > 20%, otherwis	1.0
Institutional =	1.5	if institutional contribution > 20%, otherwis	1.0
Industrial =		per Appendix 4-B.0 Graph	
Residential :		Harmon Equ 1 + (14/(4+(Capita/1000) ^ 0.5))*8	
		min = 2 max = 4	

Infiltration allowance (dry weather)	0.05	L/s/ha
Infiltration allowance (wet weather)	0.28	L/s/ha
I/I (total)	0.33	L/s/ha

Population Densities

Average suburban residential dev.	60	p/ha
Single family	3.4	p./unit
Semi-detached	2.7	p./unit
Duplex	2.3	p./unit
Townhouse	2.7	p./unit
Appartment average	1.8	p./unit
Bachelor	1.4	p./unit
1 Bedroom	1.4	p./unit
2 Bedrooms	2.1	p./unit
Hotel room, 18 m2	1	p./unit
Restaurant, 1 m2	1	p./unit
Office	1	$p/25m^2$

Table 2: SANITARY SEWER COMPUTATIONS

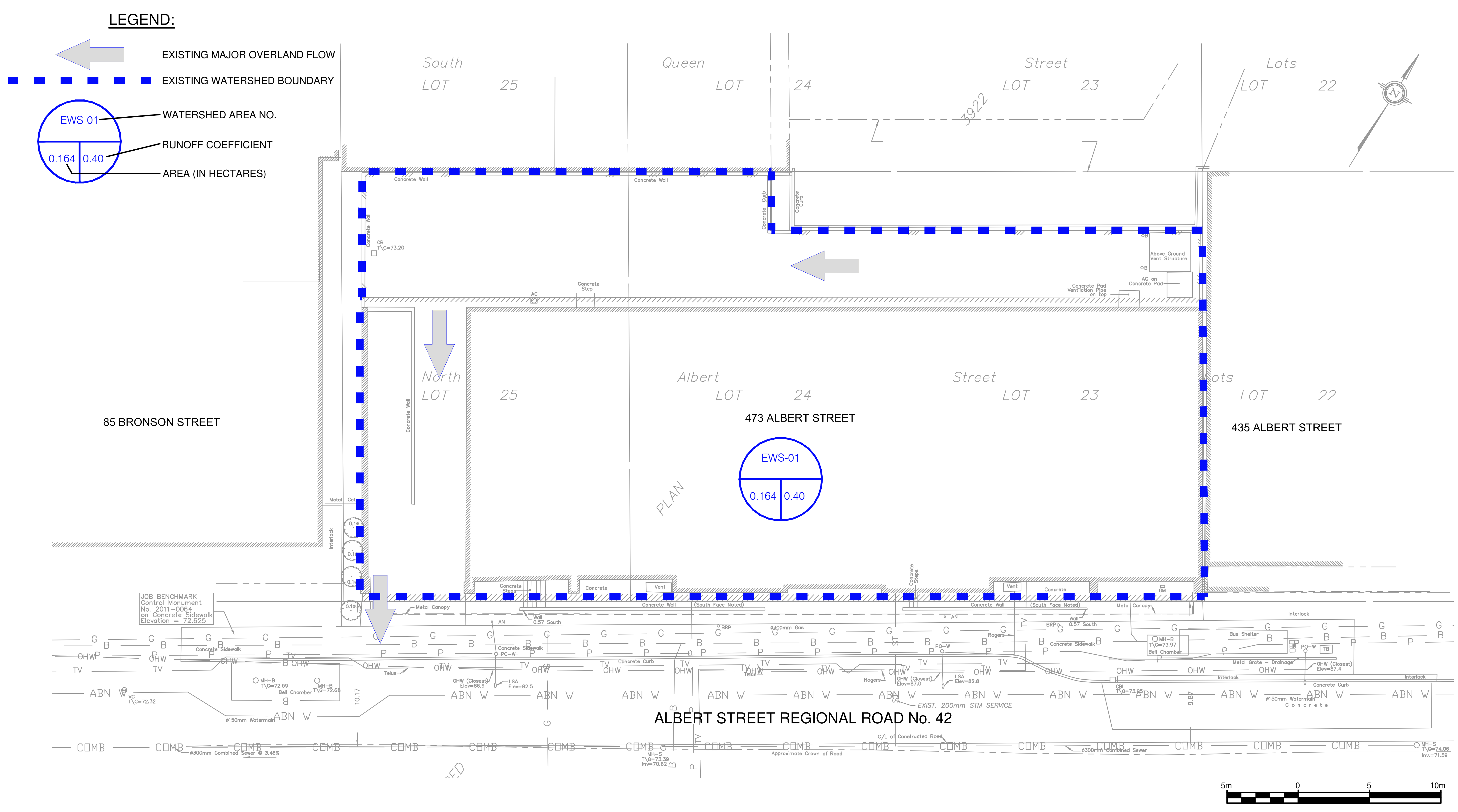
Drainage Area	From	To	Peak Flow Q (L/sec)	Sewer Data: Type of Pipe	Pipe Dia. nom. (mm)	Pipe Dia. actual (mm)	Slope* (%)	Length (m)	Capacity full (L/sec)	Velocity full (m/sec)	Velocity actual (m/sec)	Time of Flow (min)	Q(d) / Q(f)	REMARKS
473 Albert Street	Building	Combined Sewer	3.73	Transite	200	200	1.5	13.4	40.1	1.28	0.71	0.31	0.09	

Manning's n = **0.013**

* Min slope for cleansing velocities is 0.8%.
Estimated invert at building wall = 71.4 m
Top of combined sewer at connection point is +/-71.2m

Design:	Mathew Theiner	**Project Name:**	473 Albert St.
Check:	Meghan MacSween	**Parsons Project #:**	477234
Date:	November, 2019	**Client:**	InterRent

APPENDIX H | PRE-DEVELOPMENT DRAINAGE PLAN



PARSONS

473 ALBERT STREET
OTTAWA, ON

PRE DRAINAGE PLAN

December, 2019
477234
FIGURE A

APPENDIX I | STORM SEWER DESIGN SHEET

STORM SEWER COMPUTATION FORM

Rational Method

Q = 2.78*A*I*R

Q = Flow (L/sec)
A = Area (ha)
I = Rainfall Intensity (mm/h)
R = Ave. Runoff Coefficient

Ottawa IDF Curve - 5-y

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

Minimum Time of Conc. Tc = **10 min**

Manning's n = **0.013**

Drainage Area	From	To	Area (ha)	Runoff Parameters: Runoff Coeff. R	Indiv. 2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall Intensity (mm/hr)	Roof Flow Q (L/sec)	Peak Flow Q (L/sec)	Pipe Dia. nom. (mm)	Pipe Dia. actual (mm)	Slope (%)	Length (m)	Capacity full (L/sec)	Velocity full (m/sec)	Velocity actual (m/sec)	Time of Flow (min)	Q(d) / Q(f)	REMARKS
473 Albert Street	Building	Sewer	0.160	0.90	0.40	0.40	10.00	104.19		11.60	200	200	1.12	17.8	34.77	1.11	0.84	0.27	0.33	

Note:
Allowable release rate

Design: M. Theiner
Check: M. MacSween
Date: November, 2019

Project: 473 Albert Street

APPENDIX J | STORMWATER MANAGEMENT CALCULATIONS

TABLE I - ALLOWABLE RUNOFF CALCULATIONS BASED ON PRE-EXISTING CONDITIONS

Area Description	Area (ha)	Time of Conc, Tc (min)	Minor Storm				Storm = 100 yr		
				I_2 (mm/hr)	C_{AVG}	Q_{ALLOW} (L/s)	I_{100} (mm/hr)	C_{AVG}	Q_{ALLOW} (L/sec)
EWS-A	0.164	10	Storm = 2 yr	76.81	0.40	14.0	178.56	0.90	73.2
Deduct additional proposed sanitary flows (3.73L/s-1.34L/s=2.39 L/s) due to combined sewer						**11.6**			

Allowable Capture Rate is based on the 2-year storm at T_c=10 mins, and a C_{avg} of 0.40

2-year Storm	$C_{ASPH/ROOF/CONC}$ =	0.90	C_{GRASS} =	0.20
100-year Storm	$C_{ASPH/ROOF/CONC}$ =	1.00	C_{GRASS} =	0.25

TABLE II- POST-DEVELOPMENT AVERAGE RUNOFF COEFFICIENTS

Watershed Area No.	Impervious Areas (m^2)	A * $C_{ASPH/ROOF}$	Pervious Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	$C_{AVG\ (5yr)}$	$C_{AVG(100yr)}$
WS-01*	387.86	349	0.00	0	349	388	0.90	1.00
WS-02	857.92	772	0.00	0	772	858	0.90	1.00
WS-03	392.80	354	0.00	0	354	393	0.90	1.00
Total	1639		0		1475	1639		
Total Controlled	388		0		349	388		

* Controlled roof top area

TABLE III- TOTAL RUNOFF COEFFICIENT FOR CONTROLLED AREAS

$$C_{AVG(5yr)} = \frac{\text{Sum AC}}{\text{Total Area}} = \frac{349}{388} = 0.90$$

$C_{AVG(100yr)}$ = 1.00

Runoff coefficient for controlled areas (WS-02, WS-03, WS-05, & WS-06) are listed in Table IV

TABLE IV- SUMMARY OF POST-DEVELOPMENT RUNOFF

Area No	Area (ha)	Storm = 2 yr				Storm = 100 yr			
		I_2 (mm/hr)	$C_{AVG(2yr)}$	Q_{GEN} (L/s)	Q_{CONT} (L/s)	I_{100} (mm/hr)	$C_{AVG(100yr)}$	Q_{GEN} (L/s)	Q_{CONT} (L/s)
WS-01*	0.039	76.81	0.90	7.5	1.3	178.56	1.00	19.3	3.4
WS-02	0.086	76.81	0.90	16.5	10.3	178.56	1.00	42.6	8.2
WS-03	0.039	76.81	0.90	7.5		178.56	1.00	19.5	
Total	0.164			31.5	**11.6**			81.3	**11.6**

* Controlled roof top area

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

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

Time of concentration (min), Tc = 10 mins

Table V - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 1

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.001 (hectares)
11.28 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-year					100-year				
	Release Rate = **0.15** (L/sec) per drain					Release Rate = **0.38** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					$I = A/(Tc+C)B$, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.15	0.15	0.044	242.7	0.8	0.38	0.38	0.115
10	76.8	0.2	0.15	0.07	0.043	178.6	0.6	0.38	0.18	0.109
15	61.8	0.2	0.15	0.03	0.026	142.9	0.4	0.38	0.07	0.063
20	52.0	0.1	0.15	0.00	0.002	120.0	0.4	0.38	0.00	-0.003
25	45.2	0.1	0.15	-0.02	-0.027	103.8	0.3	0.38	-0.05	-0.079
30	40.0	0.1	0.15	-0.03	-0.058	91.9	0.3	0.38	-0.09	-0.163
35	36.1	0.1	0.15	-0.04	-0.092	82.6	0.3	0.38	-0.12	-0.251
40	32.9	0.1	0.15	-0.05	-0.126	75.1	0.2	0.38	-0.14	-0.343
45	30.2	0.1	0.15	-0.06	-0.162	69.1	0.2	0.38	-0.16	-0.437
50	28.0	0.1	0.15	-0.07	-0.199	64.0	0.2	0.38	-0.18	-0.534
55	26.2	0.1	0.15	-0.07	-0.236	59.6	0.2	0.38	-0.19	-0.632
60	24.6	0.1	0.15	-0.08	-0.274	55.9	0.2	0.38	-0.20	-0.732
65	23.2	0.1	0.15	-0.08	-0.312	52.6	0.2	0.38	-0.21	-0.832
70	21.9	0.1	0.15	-0.08	-0.351	49.8	0.2	0.38	-0.22	-0.934
75	20.8	0.1	0.15	-0.09	-0.390	47.3	0.1	0.38	-0.23	-1.036
80	19.8	0.1	0.15	-0.09	-0.429	45.0	0.1	0.38	-0.24	-1.140
85	18.9	0.1	0.15	-0.09	-0.469	43.0	0.1	0.38	-0.24	-1.243
90	18.1	0.1	0.15	-0.09	-0.509	41.1	0.1	0.38	-0.25	-1.348
95	17.4	0.0	0.15	-0.10	-0.548	39.4	0.1	0.38	-0.25	-1.453
100	16.7	0.0	0.15	-0.10	-0.589	37.9	0.1	0.38	-0.26	-1.558
105	16.1	0.0	0.15	-0.10	-0.629	36.5	0.1	0.38	-0.26	-1.664
110	15.6	0.0	0.15	-0.10	-0.669	35.2	0.1	0.38	-0.27	-1.770
115	15.0	0.0	0.15	-0.10	-0.710	34.0	0.1	0.38	-0.27	-1.876
120	14.6	0.0	0.15	-0.10	-0.751	32.9	0.1	0.38	-0.28	-1.982
Max Storage (m^3)=					**0.044**					**0.115**
Average Ponding Depth (mm)					**3.9**					**10.2**
Maximum Ponding Depth (mm)					**11.7**					**30.5**

Notes

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

Table VI - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 2

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.001 (hectares)
14.47 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.13** (L/sec) per drain					Release Rate = **0.34** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					$I = A/(Tc+C)B$, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.13	0.16	0.048	242.7	0.8	0.34	0.42	0.126
10	76.8	0.2	0.13	0.09	0.051	178.6	0.6	0.34	0.22	0.132
15	61.8	0.2	0.13	0.04	0.039	142.9	0.4	0.34	0.11	0.098
20	52.0	0.1	0.13	0.02	0.018	120.0	0.4	0.34	0.04	0.044
25	45.2	0.1	0.13	0.00	-0.006	103.8	0.3	0.34	-0.01	-0.021
30	40.0	0.1	0.13	-0.02	-0.033	91.9	0.3	0.34	-0.05	-0.093
35	36.1	0.1	0.13	-0.03	-0.062	82.6	0.3	0.34	-0.08	-0.169
40	32.9	0.1	0.13	-0.04	-0.093	75.1	0.2	0.34	-0.10	-0.250
45	30.2	0.1	0.13	-0.05	-0.125	69.1	0.2	0.34	-0.12	-0.332
50	28.0	0.1	0.13	-0.05	-0.157	64.0	0.2	0.34	-0.14	-0.417
55	26.2	0.1	0.13	-0.06	-0.190	59.6	0.2	0.34	-0.15	-0.504
60	24.6	0.1	0.13	-0.06	-0.224	55.9	0.2	0.34	-0.16	-0.592
65	23.2	0.1	0.13	-0.07	-0.258	52.6	0.2	0.34	-0.17	-0.681
70	21.9	0.1	0.13	-0.07	-0.292	49.8	0.2	0.34	-0.18	-0.771
75	20.8	0.1	0.13	-0.07	-0.327	47.3	0.1	0.34	-0.19	-0.861
80	19.8	0.1	0.13	-0.08	-0.362	45.0	0.1	0.34	-0.20	-0.953
85	18.9	0.1	0.13	-0.08	-0.398	43.0	0.1	0.34	-0.20	-1.045
90	18.1	0.1	0.13	-0.08	-0.433	41.1	0.1	0.34	-0.21	-1.138
95	17.4	0.0	0.13	-0.08	-0.469	39.4	0.1	0.34	-0.22	-1.231
100	16.7	0.0	0.13	-0.08	-0.505	37.9	0.1	0.34	-0.22	-1.325
105	16.1	0.0	0.13	-0.09	-0.541	36.5	0.1	0.34	-0.23	-1.419
110	15.6	0.0	0.13	-0.09	-0.578	35.2	0.1	0.34	-0.23	-1.513
115	15.0	0.0	0.13	-0.09	-0.614	34.0	0.1	0.34	-0.23	-1.608
120	14.6	0.0	0.13	-0.09	-0.651	32.9	0.1	0.34	-0.24	-1.702
Max Storage (m^3)=					**0.051**					**0.132**
Average Ponding Depth (mm)					**3.5**					**9.1**
Maximum Ponding Depth (mm)					**10.6**					**27.4**

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

Table VII - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 3

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.001 (hectares)
11.40 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-year					100-year				
	Release Rate = **0.14** (L/sec) per drain					Release Rate = **0.38** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.14	0.15	0.044	242.7	0.8	0.38	0.38	0.115
10	76.8	0.2	0.14	0.07	0.043	178.6	0.6	0.38	0.18	0.110
15	61.8	0.2	0.14	0.03	0.027	142.9	0.4	0.38	0.07	0.064
20	52.0	0.1	0.14	0.00	0.003	120.0	0.4	0.38	0.00	0.000
25	45.2	0.1	0.14	-0.02	-0.026	103.8	0.3	0.38	-0.05	-0.076
30	40.0	0.1	0.14	-0.03	-0.057	91.9	0.3	0.38	-0.09	-0.159
35	36.1	0.1	0.14	-0.04	-0.090	82.6	0.3	0.38	-0.12	-0.247
40	32.9	0.1	0.14	-0.05	-0.124	75.1	0.2	0.38	-0.14	-0.338
45	30.2	0.1	0.14	-0.06	-0.160	69.1	0.2	0.38	-0.16	-0.432
50	28.0	0.1	0.14	-0.07	-0.196	64.0	0.2	0.38	-0.18	-0.528
55	26.2	0.1	0.14	-0.07	-0.233	59.6	0.2	0.38	-0.19	-0.625
60	24.6	0.1	0.14	-0.08	-0.271	55.9	0.2	0.38	-0.20	-0.724
65	23.2	0.1	0.14	-0.08	-0.309	52.6	0.2	0.38	-0.21	-0.824
70	21.9	0.1	0.14	-0.08	-0.347	49.8	0.2	0.38	-0.22	-0.925
75	20.8	0.1	0.14	-0.09	-0.386	47.3	0.1	0.38	-0.23	-1.027
80	19.8	0.1	0.14	-0.09	-0.425	45.0	0.1	0.38	-0.24	-1.129
85	18.9	0.1	0.14	-0.09	-0.465	43.0	0.1	0.38	-0.24	-1.233
90	18.1	0.1	0.14	-0.09	-0.504	41.1	0.1	0.38	-0.25	-1.336
95	17.4	0.0	0.14	-0.10	-0.544	39.4	0.1	0.38	-0.25	-1.440
100	16.7	0.0	0.14	-0.10	-0.584	37.9	0.1	0.38	-0.26	-1.545
105	16.1	0.0	0.14	-0.10	-0.624	36.5	0.1	0.38	-0.26	-1.650
110	15.6	0.0	0.14	-0.10	-0.664	35.2	0.1	0.38	-0.27	-1.755
115	15.0	0.0	0.14	-0.10	-0.704	34.0	0.1	0.38	-0.27	-1.861
120	14.6	0.0	0.14	-0.10	-0.745	32.9	0.1	0.38	-0.27	-1.967
Max Storage (m^3)=					**0.044**					**0.115**
Average Ponding Depth (mm)					**3.9**					**10.1**
Maximum Ponding Depth (mm)					**11.7**					**30.3**

Notes

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

Table VIII - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 4

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.002 (hectares)
15.13 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.13** (L/sec) per drain					Release Rate = **0.33** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					$I = A/(Tc+C)B$, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.13	0.16	0.049	242.7	0.8	0.33	0.43	0.128
10	76.8	0.2	0.13	0.09	0.053	178.6	0.6	0.33	0.23	0.136
15	61.8	0.2	0.13	0.05	0.041	142.9	0.4	0.33	0.11	0.103
20	52.0	0.1	0.13	0.02	0.021	120.0	0.4	0.33	0.04	0.051
25	45.2	0.1	0.13	0.00	-0.003	103.8	0.3	0.33	-0.01	-0.012
30	40.0	0.1	0.13	-0.02	-0.029	91.9	0.3	0.33	-0.05	-0.082
35	36.1	0.1	0.13	-0.03	-0.058	82.6	0.3	0.33	-0.07	-0.157
40	32.9	0.1	0.13	-0.04	-0.087	75.1	0.2	0.33	-0.10	-0.235
45	30.2	0.1	0.13	-0.04	-0.118	69.1	0.2	0.33	-0.12	-0.316
50	28.0	0.1	0.13	-0.05	-0.150	64.0	0.2	0.33	-0.13	-0.399
55	26.2	0.1	0.13	-0.06	-0.183	59.6	0.2	0.33	-0.15	-0.484
60	24.6	0.1	0.13	-0.06	-0.216	55.9	0.2	0.33	-0.16	-0.570
65	23.2	0.1	0.13	-0.06	-0.249	52.6	0.2	0.33	-0.17	-0.657
70	21.9	0.1	0.13	-0.07	-0.283	49.8	0.2	0.33	-0.18	-0.746
75	20.8	0.1	0.13	-0.07	-0.317	47.3	0.1	0.33	-0.19	-0.835
80	19.8	0.1	0.13	-0.07	-0.351	45.0	0.1	0.33	-0.19	-0.924
85	18.9	0.1	0.13	-0.08	-0.386	43.0	0.1	0.33	-0.20	-1.015
90	18.1	0.1	0.13	-0.08	-0.421	41.1	0.1	0.33	-0.20	-1.106
95	17.4	0.0	0.13	-0.08	-0.456	39.4	0.1	0.33	-0.21	-1.197
100	16.7	0.0	0.13	-0.08	-0.491	37.9	0.1	0.33	-0.21	-1.289
105	16.1	0.0	0.13	-0.08	-0.527	36.5	0.1	0.33	-0.22	-1.381
110	15.6	0.0	0.13	-0.09	-0.563	35.2	0.1	0.33	-0.22	-1.474
115	15.0	0.0	0.13	-0.09	-0.598	34.0	0.1	0.33	-0.23	-1.566
120	14.6	0.0	0.13	-0.09	-0.634	32.9	0.1	0.33	-0.23	-1.660
Max Storage (m^3)=					**0.053**					**0.136**
Average Ponding Depth (mm)					**3.5**					**9.0**
Maximum Ponding Depth (mm)					**10.4**					**26.9**

Notes

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

Table IX - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 5

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.007 (hectares)
65.57 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = 0.06 (L/sec) per drain					Release Rate = 0.15 (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.06	0.23	0.070	242.7	0.8	0.15	0.61	0.183
10	76.8	0.2	0.06	0.16	0.094	178.6	0.6	0.15	0.41	0.245
15	61.8	0.2	0.06	0.11	0.103	142.9	0.4	0.15	0.30	0.266
20	52.0	0.1	0.06	0.09	0.105	120.0	0.4	0.15	0.22	0.269
25	45.2	0.1	0.06	0.07	0.102	103.8	0.3	0.15	0.17	0.260
30	40.0	0.1	0.06	0.05	0.097	91.9	0.3	0.15	0.14	0.244
35	36.1	0.1	0.06	0.04	0.089	82.6	0.3	0.15	0.11	0.224
40	32.9	0.1	0.06	0.03	0.080	75.1	0.2	0.15	0.08	0.200
45	30.2	0.1	0.06	0.03	0.070	69.1	0.2	0.15	0.06	0.174
50	28.0	0.1	0.06	0.02	0.059	64.0	0.2	0.15	0.05	0.145
55	26.2	0.1	0.06	0.01	0.048	59.6	0.2	0.15	0.03	0.115
60	24.6	0.1	0.06	0.01	0.036	55.9	0.2	0.15	0.02	0.083
65	23.2	0.1	0.06	0.01	0.023	52.6	0.2	0.15	0.01	0.050
70	21.9	0.1	0.06	0.00	0.010	49.8	0.2	0.15	0.00	0.016
75	20.8	0.1	0.06	0.00	-0.003	47.3	0.1	0.15	0.00	-0.018
80	19.8	0.1	0.06	0.00	-0.016	45.0	0.1	0.15	-0.01	-0.053
85	18.9	0.1	0.06	-0.01	-0.030	43.0	0.1	0.15	-0.02	-0.089
90	18.1	0.1	0.06	-0.01	-0.044	41.1	0.1	0.15	-0.02	-0.126
95	17.4	0.0	0.06	-0.01	-0.058	39.4	0.1	0.15	-0.03	-0.163
100	16.7	0.0	0.06	-0.01	-0.073	37.9	0.1	0.15	-0.03	-0.200
105	16.1	0.0	0.06	-0.01	-0.087	36.5	0.1	0.15	-0.04	-0.238
110	15.6	0.0	0.06	-0.02	-0.102	35.2	0.1	0.15	-0.04	-0.276
115	15.0	0.0	0.06	-0.02	-0.117	34.0	0.1	0.15	-0.05	-0.314
120	14.6	0.0	0.06	-0.02	-0.132	32.9	0.1	0.15	-0.05	-0.353
Max Storage (m^3)=					**0.105**					**0.269**
Average Ponding Depth (mm)					**1.6**					**4.1**
Maximum Ponding Depth (mm)					**4.8**					**12.3**

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

Table X - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 6

C_{AVG} = 0.90 (2-year)

C_{AVG} = 1.00 (100-year)

Time Interval = 5 (mins)

Drainage Area = 0.001 (hectares)

11.92 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = 0.14 (L/sec) per drain					Release Rate = 0.37 (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.14	0.15	0.045	242.7	0.8	0.37	0.39	0.118
10	76.8	0.2	0.14	0.08	0.045	178.6	0.6	0.37	0.19	0.115
15	61.8	0.2	0.14	0.03	0.030	142.9	0.4	0.37	0.08	0.072
20	52.0	0.1	0.14	0.01	0.007	120.0	0.4	0.37	0.01	0.010
25	45.2	0.1	0.14	-0.01	-0.021	103.8	0.3	0.37	-0.04	-0.063
30	40.0	0.1	0.14	-0.03	-0.051	91.9	0.3	0.37	-0.08	-0.143
35	36.1	0.1	0.14	-0.04	-0.083	82.6	0.3	0.37	-0.11	-0.228
40	32.9	0.1	0.14	-0.05	-0.116	75.1	0.2	0.37	-0.13	-0.316
45	30.2	0.1	0.14	-0.06	-0.151	69.1	0.2	0.37	-0.15	-0.408
50	28.0	0.1	0.14	-0.06	-0.186	64.0	0.2	0.37	-0.17	-0.501
55	26.2	0.1	0.14	-0.07	-0.222	59.6	0.2	0.37	-0.18	-0.596
60	24.6	0.1	0.14	-0.07	-0.259	55.9	0.2	0.37	-0.19	-0.692
65	23.2	0.1	0.14	-0.08	-0.296	52.6	0.2	0.37	-0.20	-0.789
70	21.9	0.1	0.14	-0.08	-0.334	49.8	0.2	0.37	-0.21	-0.887
75	20.8	0.1	0.14	-0.08	-0.371	47.3	0.1	0.37	-0.22	-0.987
80	19.8	0.1	0.14	-0.09	-0.409	45.0	0.1	0.37	-0.23	-1.086
85	18.9	0.1	0.14	-0.09	-0.448	43.0	0.1	0.37	-0.23	-1.187
90	18.1	0.1	0.14	-0.09	-0.486	41.1	0.1	0.37	-0.24	-1.288
95	17.4	0.0	0.14	-0.09	-0.525	39.4	0.1	0.37	-0.24	-1.389
100	16.7	0.0	0.14	-0.09	-0.564	37.9	0.1	0.37	-0.25	-1.491
105	16.1	0.0	0.14	-0.10	-0.603	36.5	0.1	0.37	-0.25	-1.594
110	15.6	0.0	0.14	-0.10	-0.642	35.2	0.1	0.37	-0.26	-1.696
115	15.0	0.0	0.14	-0.10	-0.682	34.0	0.1	0.37	-0.26	-1.799
120	14.6	0.0	0.14	-0.10	-0.721	32.9	0.1	0.37	-0.26	-1.903
Max Storage (m^3)=					**0.045**					**0.118**
Average Ponding Depth (mm)					**3.8**					**9.9**
Maximum Ponding Depth (mm)					**11.4**					**29.7**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc/60)^B$

3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontroled Areas OR Pipe Outlet Capacity

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

Table XI - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 7

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.007 (hectares)
67.33 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.06** (L/sec) per drain					Release Rate = **0.15** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					$I = A/(Tc+C)B$, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.06	0.23	0.070	242.7	0.8	0.15	0.61	0.183
10	76.8	0.2	0.06	0.16	0.095	178.6	0.6	0.15	0.41	0.246
15	61.8	0.2	0.06	0.12	0.104	142.9	0.4	0.15	0.30	0.268
20	52.0	0.1	0.06	0.09	0.106	120.0	0.4	0.15	0.23	0.272
25	45.2	0.1	0.06	0.07	0.104	103.8	0.3	0.15	0.18	0.264
30	40.0	0.1	0.06	0.05	0.098	91.9	0.3	0.15	0.14	0.249
35	36.1	0.1	0.06	0.04	0.091	82.6	0.3	0.15	0.11	0.229
40	32.9	0.1	0.06	0.03	0.082	75.1	0.2	0.15	0.09	0.206
45	30.2	0.1	0.06	0.03	0.073	69.1	0.2	0.15	0.07	0.180
50	28.0	0.1	0.06	0.02	0.062	64.0	0.2	0.15	0.05	0.152
55	26.2	0.1	0.06	0.02	0.051	59.6	0.2	0.15	0.04	0.123
60	24.6	0.1	0.06	0.01	0.039	55.9	0.2	0.15	0.03	0.092
65	23.2	0.1	0.06	0.01	0.027	52.6	0.2	0.15	0.02	0.060
70	21.9	0.1	0.06	0.00	0.014	49.8	0.2	0.15	0.01	0.027
75	20.8	0.1	0.06	0.00	0.001	47.3	0.1	0.15	0.00	-0.007
80	19.8	0.1	0.06	0.00	-0.012	45.0	0.1	0.15	-0.01	-0.042
85	18.9	0.1	0.06	0.00	-0.025	43.0	0.1	0.15	-0.02	-0.077
90	18.1	0.1	0.06	-0.01	-0.039	41.1	0.1	0.15	-0.02	-0.113
95	17.4	0.0	0.06	-0.01	-0.053	39.4	0.1	0.15	-0.03	-0.149
100	16.7	0.0	0.06	-0.01	-0.067	37.9	0.1	0.15	-0.03	-0.185
105	16.1	0.0	0.06	-0.01	-0.081	36.5	0.1	0.15	-0.04	-0.223
110	15.6	0.0	0.06	-0.01	-0.096	35.2	0.1	0.15	-0.04	-0.260
115	15.0	0.0	0.06	-0.02	-0.110	34.0	0.1	0.15	-0.04	-0.298
120	14.6	0.0	0.06	-0.02	-0.125	32.9	0.1	0.15	-0.05	-0.336
Max Storage (m^3)=					**0.106**					**0.272**
Average Ponding Depth (mm)					**1.6**					**4.0**
Maximum Ponding Depth (mm)					**4.7**					**12.1**

Notes

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

Table XII - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 8

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.006 (hectares)
63.86 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.06** (L/sec) per drain					Release Rate = **0.15** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.06	0.23	0.070	242.7	0.8	0.15	0.61	0.182
10	76.8	0.2	0.06	0.16	0.094	178.6	0.6	0.15	0.41	0.243
15	61.8	0.2	0.06	0.11	0.103	142.9	0.4	0.15	0.29	0.264
20	52.0	0.1	0.06	0.09	0.104	120.0	0.4	0.15	0.22	0.266
25	45.2	0.1	0.06	0.07	0.101	103.8	0.3	0.15	0.17	0.256
30	40.0	0.1	0.06	0.05	0.095	91.9	0.3	0.15	0.13	0.240
35	36.1	0.1	0.06	0.04	0.087	82.6	0.3	0.15	0.10	0.219
40	32.9	0.1	0.06	0.03	0.078	75.1	0.2	0.15	0.08	0.194
45	30.2	0.1	0.06	0.02	0.067	69.1	0.2	0.15	0.06	0.167
50	28.0	0.1	0.06	0.02	0.056	64.0	0.2	0.15	0.05	0.138
55	26.2	0.1	0.06	0.01	0.045	59.6	0.2	0.15	0.03	0.107
60	24.6	0.1	0.06	0.01	0.032	55.9	0.2	0.15	0.02	0.074
65	23.2	0.1	0.06	0.00	0.019	52.6	0.2	0.15	0.01	0.041
70	21.9	0.1	0.06	0.00	0.006	49.8	0.2	0.15	0.00	0.006
75	20.8	0.1	0.06	0.00	-0.007	47.3	0.1	0.15	-0.01	-0.029
80	19.8	0.1	0.06	0.00	-0.021	45.0	0.1	0.15	-0.01	-0.065
85	18.9	0.1	0.06	-0.01	-0.035	43.0	0.1	0.15	-0.02	-0.102
90	18.1	0.1	0.06	-0.01	-0.049	41.1	0.1	0.15	-0.03	-0.139
95	17.4	0.0	0.06	-0.01	-0.064	39.4	0.1	0.15	-0.03	-0.177
100	16.7	0.0	0.06	-0.01	-0.078	37.9	0.1	0.15	-0.04	-0.215
105	16.1	0.0	0.06	-0.01	-0.093	36.5	0.1	0.15	-0.04	-0.253
110	15.6	0.0	0.06	-0.02	-0.108	35.2	0.1	0.15	-0.04	-0.292
115	15.0	0.0	0.06	-0.02	-0.123	34.0	0.1	0.15	-0.05	-0.331
120	14.6	0.0	0.06	-0.02	-0.138	32.9	0.1	0.15	-0.05	-0.371
Max Storage (m^3)=					**0.104**					**0.266**
Average Ponding Depth (mm)					**1.6**					**4.2**
Maximum Ponding Depth (mm)					**4.9**					**12.5**

Notes

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

Table XIII - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 9

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.001 (hectares)
14.38 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.13** (L/sec) per drain					Release Rate = **0.34** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.13	0.16	0.048	242.7	0.8	0.34	0.42	0.126
10	76.8	0.2	0.13	0.08	0.051	178.6	0.6	0.34	0.22	0.132
15	61.8	0.2	0.13	0.04	0.038	142.9	0.4	0.34	0.11	0.097
20	52.0	0.1	0.13	0.02	0.018	120.0	0.4	0.34	0.04	0.043
25	45.2	0.1	0.13	0.00	-0.007	103.8	0.3	0.34	-0.01	-0.022
30	40.0	0.1	0.13	-0.02	-0.034	91.9	0.3	0.34	-0.05	-0.094
35	36.1	0.1	0.13	-0.03	-0.063	82.6	0.3	0.34	-0.08	-0.171
40	32.9	0.1	0.13	-0.04	-0.094	75.1	0.2	0.34	-0.10	-0.252
45	30.2	0.1	0.13	-0.05	-0.125	69.1	0.2	0.34	-0.12	-0.335
50	28.0	0.1	0.13	-0.05	-0.158	64.0	0.2	0.34	-0.14	-0.420
55	26.2	0.1	0.13	-0.06	-0.191	59.6	0.2	0.34	-0.15	-0.507
60	24.6	0.1	0.13	-0.06	-0.225	55.9	0.2	0.34	-0.17	-0.595
65	23.2	0.1	0.13	-0.07	-0.259	52.6	0.2	0.34	-0.18	-0.684
70	21.9	0.1	0.13	-0.07	-0.294	49.8	0.2	0.34	-0.18	-0.774
75	20.8	0.1	0.13	-0.07	-0.329	47.3	0.1	0.34	-0.19	-0.865
80	19.8	0.1	0.13	-0.08	-0.364	45.0	0.1	0.34	-0.20	-0.957
85	18.9	0.1	0.13	-0.08	-0.399	43.0	0.1	0.34	-0.21	-1.049
90	18.1	0.1	0.13	-0.08	-0.435	41.1	0.1	0.34	-0.21	-1.142
95	17.4	0.0	0.13	-0.08	-0.471	39.4	0.1	0.34	-0.22	-1.236
100	16.7	0.0	0.13	-0.08	-0.507	37.9	0.1	0.34	-0.22	-1.329
105	16.1	0.0	0.13	-0.09	-0.543	36.5	0.1	0.34	-0.23	-1.424
110	15.6	0.0	0.13	-0.09	-0.580	35.2	0.1	0.34	-0.23	-1.518
115	15.0	0.0	0.13	-0.09	-0.616	34.0	0.1	0.34	-0.23	-1.613
120	14.6	0.0	0.13	-0.09	-0.653	32.9	0.1	0.34	-0.24	-1.708
Max Storage (m^3)=					**0.051**					**0.132**
Average Ponding Depth (mm)					**3.5**					**9.1**
Maximum Ponding Depth (mm)					**10.6**					**27.4**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc/60)^B$

3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontroled Areas OR Pipe Outlet Capacity

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

Table XIV - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 10

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.007 (hectares)
72.78 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = 0.06 (L/sec) per drain					Release Rate = 0.14 (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.06	0.24	0.071	242.7	0.8	0.14	0.62	0.185
10	76.8	0.2	0.06	0.16	0.097	178.6	0.6	0.14	0.42	0.250
15	61.8	0.2	0.06	0.12	0.107	142.9	0.4	0.14	0.31	0.275
20	52.0	0.1	0.06	0.09	0.109	120.0	0.4	0.14	0.23	0.280
25	45.2	0.1	0.06	0.07	0.108	103.8	0.3	0.14	0.18	0.274
30	40.0	0.1	0.06	0.06	0.103	91.9	0.3	0.14	0.15	0.262
35	36.1	0.1	0.06	0.05	0.097	82.6	0.3	0.14	0.12	0.244
40	32.9	0.1	0.06	0.04	0.089	75.1	0.2	0.14	0.09	0.223
45	30.2	0.1	0.06	0.03	0.080	69.1	0.2	0.14	0.07	0.199
50	28.0	0.1	0.06	0.02	0.070	64.0	0.2	0.14	0.06	0.174
55	26.2	0.1	0.06	0.02	0.060	59.6	0.2	0.14	0.04	0.146
60	24.6	0.1	0.06	0.01	0.049	55.9	0.2	0.14	0.03	0.117
65	23.2	0.1	0.06	0.01	0.038	52.6	0.2	0.14	0.02	0.087
70	21.9	0.1	0.06	0.01	0.026	49.8	0.2	0.14	0.01	0.056
75	20.8	0.1	0.06	0.00	0.014	47.3	0.1	0.14	0.01	0.025
80	19.8	0.1	0.06	0.00	0.002	45.0	0.1	0.14	0.00	-0.008
85	18.9	0.1	0.06	0.00	-0.011	43.0	0.1	0.14	-0.01	-0.041
90	18.1	0.1	0.06	0.00	-0.024	41.1	0.1	0.14	-0.01	-0.074
95	17.4	0.0	0.06	-0.01	-0.037	39.4	0.1	0.14	-0.02	-0.108
100	16.7	0.0	0.06	-0.01	-0.050	37.9	0.1	0.14	-0.02	-0.143
105	16.1	0.0	0.06	-0.01	-0.064	36.5	0.1	0.14	-0.03	-0.178
110	15.6	0.0	0.06	-0.01	-0.077	35.2	0.1	0.14	-0.03	-0.213
115	15.0	0.0	0.06	-0.01	-0.091	34.0	0.1	0.14	-0.04	-0.249
120	14.6	0.0	0.06	-0.01	-0.105	32.9	0.1	0.14	-0.04	-0.285
Max Storage (m^3)=					**0.109**					**0.280**
Average Ponding Depth (mm)					**1.5**					**3.8**
Maximum Ponding Depth (mm)					**4.5**					**11.5**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc/60)^B$

3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontroled Areas OR Pipe Outlet Capacity

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

Table XV - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 11

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.001 (hectares)
11.33 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.14** (L/sec) per drain					Release Rate = **0.38** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.14	0.15	0.044	242.7	0.8	0.38	0.38	0.115
10	76.8	0.2	0.14	0.07	0.043	178.6	0.6	0.38	0.18	0.109
15	61.8	0.2	0.14	0.03	0.027	142.9	0.4	0.38	0.07	0.063
20	52.0	0.1	0.14	0.00	0.003	120.0	0.4	0.38	0.00	-0.002
25	45.2	0.1	0.14	-0.02	-0.026	103.8	0.3	0.38	-0.05	-0.078
30	40.0	0.1	0.14	-0.03	-0.057	91.9	0.3	0.38	-0.09	-0.161
35	36.1	0.1	0.14	-0.04	-0.090	82.6	0.3	0.38	-0.12	-0.249
40	32.9	0.1	0.14	-0.05	-0.125	75.1	0.2	0.38	-0.14	-0.341
45	30.2	0.1	0.14	-0.06	-0.160	69.1	0.2	0.38	-0.16	-0.435
50	28.0	0.1	0.14	-0.07	-0.197	64.0	0.2	0.38	-0.18	-0.531
55	26.2	0.1	0.14	-0.07	-0.234	59.6	0.2	0.38	-0.19	-0.629
60	24.6	0.1	0.14	-0.08	-0.271	55.9	0.2	0.38	-0.20	-0.728
65	23.2	0.1	0.14	-0.08	-0.309	52.6	0.2	0.38	-0.21	-0.829
70	21.9	0.1	0.14	-0.08	-0.348	49.8	0.2	0.38	-0.22	-0.930
75	20.8	0.1	0.14	-0.09	-0.387	47.3	0.1	0.38	-0.23	-1.032
80	19.8	0.1	0.14	-0.09	-0.426	45.0	0.1	0.38	-0.24	-1.135
85	18.9	0.1	0.14	-0.09	-0.465	43.0	0.1	0.38	-0.24	-1.239
90	18.1	0.1	0.14	-0.09	-0.505	41.1	0.1	0.38	-0.25	-1.343
95	17.4	0.0	0.14	-0.10	-0.544	39.4	0.1	0.38	-0.25	-1.447
100	16.7	0.0	0.14	-0.10	-0.584	37.9	0.1	0.38	-0.26	-1.552
105	16.1	0.0	0.14	-0.10	-0.624	36.5	0.1	0.38	-0.26	-1.657
110	15.6	0.0	0.14	-0.10	-0.665	35.2	0.1	0.38	-0.27	-1.763
115	15.0	0.0	0.14	-0.10	-0.705	34.0	0.1	0.38	-0.27	-1.869
120	14.6	0.0	0.14	-0.10	-0.745	32.9	0.1	0.38	-0.27	-1.976
Max Storage (m^3)=					**0.044**					**0.115**
Average Ponding Depth (mm)					**3.9**					**10.1**
Maximum Ponding Depth (mm)					**11.7**					**30.4**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc/60)^B$

3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontroled Areas OR Pipe Outlet Capacity

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

Table XVI - Storage Volumes (2-Year and 100-Year Storm Events)

Storage Requirement for CFRD 12

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.003 (hectares)
28.40 (sqm)

Watts Adjustable Accutrol Weir Roof Drain

	2-Year					100-Year				
	Release Rate = **0.10** (L/sec) per drain					Release Rate = **0.25** (L/sec) per drain				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	103.6	0.3	0.10	0.20	0.059	242.7	0.8	0.25	0.51	0.154
10	76.8	0.2	0.10	0.12	0.073	178.6	0.6	0.25	0.31	0.188
15	61.8	0.2	0.10	0.08	0.071	142.9	0.4	0.25	0.20	0.182
20	52.0	0.1	0.10	0.05	0.062	120.0	0.4	0.25	0.13	0.156
25	45.2	0.1	0.10	0.03	0.048	103.8	0.3	0.25	0.08	0.119
30	40.0	0.1	0.10	0.02	0.032	91.9	0.3	0.25	0.04	0.076
35	36.1	0.1	0.10	0.01	0.014	82.6	0.3	0.25	0.01	0.027
40	32.9	0.1	0.10	0.00	-0.006	75.1	0.2	0.25	-0.01	-0.025
45	30.2	0.1	0.10	-0.01	-0.027	69.1	0.2	0.25	-0.03	-0.079
50	28.0	0.1	0.10	-0.02	-0.048	64.0	0.2	0.25	-0.05	-0.136
55	26.2	0.1	0.10	-0.02	-0.071	59.6	0.2	0.25	-0.06	-0.195
60	24.6	0.1	0.10	-0.03	-0.093	55.9	0.2	0.25	-0.07	-0.254
65	23.2	0.1	0.10	-0.03	-0.117	52.6	0.2	0.25	-0.08	-0.315
70	21.9	0.1	0.10	-0.03	-0.140	49.8	0.2	0.25	-0.09	-0.377
75	20.8	0.1	0.10	-0.04	-0.164	47.3	0.1	0.25	-0.10	-0.440
80	19.8	0.1	0.10	-0.04	-0.188	45.0	0.1	0.25	-0.10	-0.503
85	18.9	0.1	0.10	-0.04	-0.213	43.0	0.1	0.25	-0.11	-0.567
90	18.1	0.1	0.10	-0.04	-0.238	41.1	0.1	0.25	-0.12	-0.632
95	17.4	0.0	0.10	-0.05	-0.263	39.4	0.1	0.25	-0.12	-0.697
100	16.7	0.0	0.10	-0.05	-0.288	37.9	0.1	0.25	-0.13	-0.762
105	16.1	0.0	0.10	-0.05	-0.313	36.5	0.1	0.25	-0.13	-0.828
110	15.6	0.0	0.10	-0.05	-0.338	35.2	0.1	0.25	-0.14	-0.895
115	15.0	0.0	0.10	-0.05	-0.364	34.0	0.1	0.25	-0.14	-0.961
120	14.6	0.0	0.10	-0.05	-0.390	32.9	0.1	0.25	-0.14	-1.028
Max Storage (m^3)=					**0.073**					**0.188**
Average Ponding Depth (mm)					**2.6**					**6.6**
Maximum Ponding Depth (mm)					**7.7**					**19.9**

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

Total **1.30** **3.36**

Table XVII - Storage Volumes (5-Year and 100-Year Storm Events)

Storage Requirement for Uncontrolled Roof Drains and Ground Level Amenity Space Behind Building

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.125 (hectares)

	Release Rate = **10.3** (L/sec)					Release Rate = **8.2** (L/sec)				
	Return Period = 2 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951, B = 0.810					IDF Parameters, A = 1735.688, B = 0.820				
	$I = A/(T_c+C)B$, C = 6.199					I = A/(Tc+C)B, C = 6.014				
Duration (min)	**Rainfall Intensity, I (mm/hr)**	**Peak Flow (L/sec)**	**Release Rate (L/sec)**	**Storage Rate (L/sec)**	**Storage (m^3)**	**Rainfall Intensity, I (mm/hr)**	**Peak Flow (L/sec)**	**Release Rate (L/sec)**	**Storage Rate (L/sec)**	**Storage (m^3)**
0	-	-	-	-	-	-	-	-	-	-
5	103.6	32.4	10.3	22.1	6.6	242.7	84.4	8.2	76.2	22.9
10	76.8	24.0	10.3	13.7	8.2	178.6	62.1	8.2	53.9	32.3
15	61.8	19.3	10.3	9.0	8.1	142.9	49.7	8.2	41.5	37.3
20	52.0	16.3	10.3	6.0	7.2	120.0	41.7	8.2	33.5	40.2
25	45.2	14.1	10.3	3.8	5.8	103.8	36.1	8.2	27.9	41.9
30	40.0	12.5	10.3	2.2	4.0	91.9	31.9	8.2	23.7	42.7
35	36.1	11.3	10.3	1.0	2.1	82.6	28.7	8.2	20.5	43.1
40	32.9	10.3	10.3	0.0	0.0	75.1	26.1	8.2	17.9	43.0
45	30.2	9.5	10.3	-0.8	-2.3	69.1	24.0	8.2	15.8	42.7
50	28.0	8.8	10.3	-1.5	-4.6	64.0	22.2	8.2	14.0	42.1
55	26.2	8.2	10.3	-2.1	-7.0	59.6	20.7	8.2	12.5	41.4
60	24.6	7.7	10.3	-2.6	-9.4	55.9	19.4	8.2	11.2	40.4
65	23.2	7.2	10.3	-3.1	-11.9	52.6	18.3	8.2	10.1	39.4
70	21.9	6.9	10.3	-3.4	-14.5	49.8	17.3	8.2	9.1	38.3
75	20.8	6.5	10.3	-3.8	-17.0	47.3	16.4	8.2	8.2	37.0
80	19.8	6.2	10.3	-4.1	-19.7	45.0	15.6	8.2	7.4	35.7
85	18.9	5.9	10.3	-4.4	-22.3	43.0	14.9	8.2	6.7	34.3
90	18.1	5.7	10.3	-4.6	-25.0	41.1	14.3	8.2	6.1	32.9
95	17.4	5.4	10.3	-4.9	-27.6	39.4	13.7	8.2	5.5	31.4
100	16.7	5.2	10.3	-5.1	-30.4	37.9	13.2	8.2	5.0	29.9
105	16.1	5.0	10.3	-5.3	-33.1	36.5	12.7	8.2	4.5	28.3
110	15.6	4.9	10.3	-5.4	-35.8	35.2	12.2	8.2	4.0	26.7
115	15.0	4.7	10.3	-5.6	-38.6	34.0	11.8	8.2	3.6	25.0
120	14.6	4.6	10.3	-5.7	-41.4	32.9	11.4	8.2	3.2	23.3
Max =					**8.2**					**43.1**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc/60)^B$

3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontroled Areas OR Pipe Outlet Capacity

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration