

QUEENSWOOD UNITED CHURCH

360 KENNEDY LANE EAST STORMWATER MANAGEMENT REPORT

NOVEMBER 30, 2021





360 KENNEDY LANE EAST

STORMWATER MANAGEMENT REPORT

QUEENSWOOD UNITED CURCH

1ST SUBMISSION

PROJECT NO.: 211-12127-00
CLIENT REF:
DATE: NOVEMBER 30, 2021

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REVISION HISTORY

FIRST ISSUE

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November 30th, 2021

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November 30th, 2021

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CONTRIBUTORS

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1 INTRODUCTION

1.1 SCOPE

WSP Canada Inc. was retained by Queenswood United Church to prepare a Stormwater Management (SWM) report for the proposed development at 360 Kennedy Lane in Ottawa, Ontario. This SWM report examines the potential water quality and quantity impacts of the proposed residential development and summarizes how each will be addressed in accordance with applicable guidelines.

1.2 SITE LOCATION

The site of the proposed development is located at 360 Kennedy Lane East, Ottawa, Ontario. The subject site is bounded by Queenwood United Church to the north, Queenwood Ridge Park to the east and south, and residential homes along Mountainside Crescent to the west. The site is accessed via Kennedy Lane East on the north-east end of the property. The site location is shown in Figure 1.

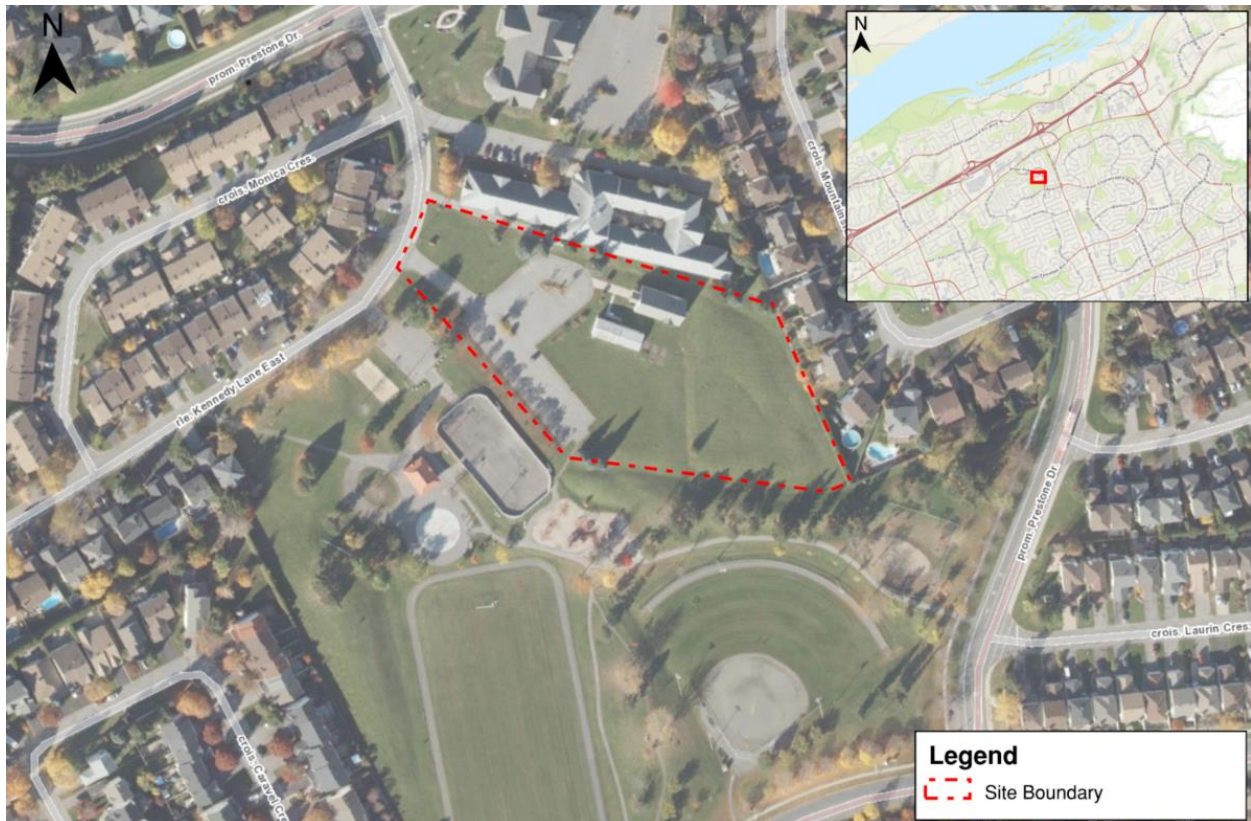


Figure 1: Site Location

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- Collect and review background information
- Determine the site-specific stormwater management requirements to ensure that the proposals are in conformance with the applicable Provincial, Municipal and Conservation Authority stormwater management and development guidelines.
- Evaluate various stormwater management practices that meet the applicable SWM and development requirements and recommend a preferred strategy.
- Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities.

1.4 DESIGN CRITERIA

Design criteria were obtained through the Site Plan Pre-Application Consultation Notes provided by the City of Ottawa on May 19th, 2021 (pre consultation notes in **Appendix A**). Criteria for 360 Kennedy Lane East are as follows:

- **Stormwater Quantity**- control the 100-year post-development flows to the pre-development levels for the 5-year storm events. Allowable runoff coefficient (C) shall be the lesser of the pre-development conditions to a maximum of 0.5.
- **Storm Quality**- enhanced level of protection per the Rideau Valley Conservation Authority (RVCA) is required (80% TSS Removal).

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The subject site is a 1.22 ha parcel of land comprised of primarily landscaped grass area, with an impervious paved parking area and two small building structures. Vehicular access to the site is via an entrance off of Kennedy Lane East. Existing drainage patterns for the site were determined using topographic survey information and aerial imagery. Under pre-development conditions the entire 1.22 ha site ultimately discharges to the 900 mm concrete storm sewer on Kennedy Lane East. The pre-development imperviousness and runoff coefficient was determined using the PCSWMM area weighting tool. The existing conditions drainage area and runoff coefficient is summarized in Table 1, existing conditions drainage mosaic and land use figure are shown in Exhibit 1 and Exhibit 2 found in **Appendix B**.

Table 1: Existing Drainage Areas

AREA ID	AREA (HA)	IMPERVIOUS AREA (HA)	IMPERVIOUSNESS (%)	RUNOFF COEFFICIENT
EX-001	1.22	0.34	28	0.37

2.2 RAINFALL INFORMATION

The rainfall intensity is calculated in accordance with Section 5.4.2 of the Ottawa Sewer Design Guidelines (October, 2012):

Where;

$$i = \left[\frac{A}{(Td + C)^B} \right]$$

- A, B, C = regression constants for each return period (defined in section 5.4.2)
- i = rainfall intensity (mm/hour)
- Td = storm duration (minutes)

The IDF parameters/regression constants are per the Ottawa Sewer Design Guidelines (October, 2012).

2.3 ALLOWABLE FLOW RATES

As noted in section 1.4, relevant policies from the OSDG for a re-development and the Site Plan Pre-Application Consultation notes require the 100-year post-development discharge rate from the site be controlled to the pre-development levels for the 5-year storm event, where pre-development conditions are analyzed using the lesser of the actual runoff coefficient and a runoff coefficient of 0.5. As previously discussed, under existing conditions the subject site has a runoff coefficient on 0.37 and therefore the actual runoff coefficient was used for existing conditions analysis.

PCSWMM was used to evaluate pre-development peak flow rates. Detailed model output can be found in **Appendix C**.

Table 2: Pre-Development Peak Flow Rate

AREA ID	PEAK FLOW RATE (m ³ /s)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
EX-001	0.08	0.12	0.16	0.22	0.26	0.31

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed Kennedy Lane E project is a residential development in Ottawa. Post development conditions drainage areas and runoff coefficients are shown in on Exhibit 3 in **Appendix B** and summarized in Table 3.

The proposed development includes the construction of 84 stacked residential units on the approximately 1.22 ha parcel of land. Vehicular access to the site will be via the one existing entrance off of Kennedy Lane E. Similar to existing conditions, all stormwater runoff will ultimately discharge via one outlet to the 900 mm concrete sewer on Kennedy Lane E.

An estimated area breakdown for the new layout is provided in Table 3.

Table 3: Area Breakdown

CATCHMENT ID	AREA (ha)	% COVERAGE OF PROJECT AREA	RUNOFF COEFFICIENT
Controlled Drainage Areas			
S-001	0.082	6.7%	0.83
S-002	0.047	3.8%	0.84
S-003	0.077	6.3%	0.72
S-004	0.036	2.9%	0.78
S-005	0.028	2.3%	0.70
S-006	0.062	5.1%	0.71
S-007	0.123	10.0%	0.66
S-008	0.126	10.3%	0.74
S-009	0.105	8.6%	0.77
S-010	0.114	9.3%	0.49
S-011	0.098	8.0%	0.53
S-012	0.051	4.2%	0.83
S-013	0.079	6.5%	0.84
S-014	0.113	9.2%	0.40
Un-Controlled Drainage Areas			
S-015	0.056	4.6%	0.40
S-016	0.006	0.5%	0.20
S-017	0.021	1.7%	0.83
TOTAL PROJECT AREA	1.22	100%	0.66

3.2 WATER QUANTITY

As noted previously, it is required that the 100-year post-development discharge rate from the site not exceed the 5-year pre-development level. As shown in Table 2, this means the 100-year post development flow must be controlled to 0.12 m³/s or less.

Proposed features to achieve these targets include;

- Surface storage with inlet control devices (ICDs) (HYDROVEX VHV or equivalent)
- Stormtech (or equivalent) subsurface storage chambers with ICDs on outlets (HYDROVEX VHV or equivalent).

PCSWMM software was used to model the behaviour of the proposed SWM system. Storage areas were defined using storage nodes with the appropriate stage-storage relationships. Outflow controls from each storage node were defined using the appropriate Hydrovex VHV head-discharge curve at catchbasin lead pipes. Specified Hydrovex models are shown in Table 4.

Table 4: Catchbasin Outflow Control

LOCATION	ICD
CB01	150-VHV-2
CB04	200-VHV-2
CB06	75-VHV-1
Tank A	75-VHV-1
Tank B	75-VHV-1
Tank C	75-VHV-1
Tank D	75-VHV-1
Tank F	75-VHV-1
Tank G	75-VHV-1

A summary of modeling results is provided in Table 5 and detailed modelling output is included in **Appendix C**.

Table 5: Summary of PCSWMM Modelling Results

	RETURN PERIOD					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Peak Discharge Rate (m ³ /s)	0.044	0.067	0.081	0.097	0.11	0.12
Storage Utilized in Tank A (m ³)	12.90	18.72	22.64	27.73	31.67	35.76
Storage Utilized in Tank B (m ³)	9.71	14.72	18.13	22.69	26.21	29.81
Storage Utilized in Tank C (m ³)	35.34	52.71	65.69	83.17	96.63	110.60
Storage Utilized in Tank D (m ³)	16.61*	24.21*	29.37*	36.23*	41.50*	43.69*
Storage Utilized in Tank F (m ³)	42.78	62.69	76.24	94.23	108	122.20
Storage Utilized in Tank G (m ³)	15.95	23.72	29.00	35.98	41.34	46.87

*Includes surface storage – maximum underground storage 42 m³

To avoid risk of flooding to the proposed homes, surface ponding has only been proposed where sufficient freeboard is provided between the 100-year ponding elevation and the finish floor elevation of surrounding homes, all other storage will be provided via underground storage as summarized in Table 5. To determine peak surface ponding depths at catchbasin locations, reference has been made to model output at each respective storage node where surface storage is utilized. Ponding depths have been simulated in the model by routing runoff from the contributing sub-catchment area to a storage node defined with a stage-storage relationship describing the ponding volume available on the surface (based on proposed grading), and with outflow controlled by a stage-discharge rating curve based on a standard 600 mm square CB grate (per City of Ottawa standards) with a Hydrovex VHV ICD on the CB lead.

As shown in Table 6, the model results provide maximum ponding elevation and volume at each location, maximum anticipated extents of ponding are shown on the Civil Grading Plan C04.

Table 6: Summary of Surface Ponding Analysis

AREA ID	LOCATION	INVERT (M)	100-YEAR ELEV. (M)	HEAD (M)	Q ₁₀₀ (L/SEC)	MAX VOLUME (M ³)
S-009	CB07	85.27	87.53	2.26	5.3	1.69
S-010	CB01	84.21	87.15	2.94	35.6	1.29
S-011	CB04	84.11	87.15	3.04	61.3	1.21
S-012	CB06	85.32	87.72	2.40	5.3	12.33

3.3 WATER QUALITY

As outlined in Section 1.4, it is required that post development runoff be treated to achieve 80% TSS removal.

Proposed features to achieve these targets include;

- Suitably sized oil and grit separator (OGS) unit (FDC-3HC or equivalent)
- Stormtech Isolator Row Plus
- Grass swales

As noted previously, a single outlet location into the Kennedy Lane East sewer is proposed. A suitably sized OGS unit is proposed to achieve a minimum 80% TSS removal. Hydro First Defense (FDC-3HC, or equivalent) is proposed to meet the requirements, details on the proposed unit can be found in **Appendix D**.

The majority of roadway and parking lot runoff will be routed to one of six proposed underground Stormtech (or equivalent) storage units. The units are proposed to include a Stormtech Isolator Row Plus filtration devices to further improve the water quality through a treatment train approach. ETV Canada testing on Stormtech Isolator Row Plus units verified the filtration device is capable of achieving an average 82% TSS removal.

It is assumed that the runoff from pervious rear yard areas will be free of typical sediment-generating activities and therefore runoff will leave them effectively unchanged and can be considered clean for the purposes of water quality assessment. Additionally, it should be noted that runoff from the rear yards along the property line of the site will be captured and conveyed towards the outlet (and OGS) via grass swales. Grass swales are vegetated open channels that convey, treat and attenuate stormwater runoff.

4 CONCLUSIONS

A stormwater management report has been prepared to support the proposed development at 360 Kennedy Lane East in the City of Ottawa. The key points are summarized below.

WATER QUALITY

An OGS unit (Hydro First Defense FD-3HC, or equivalent) is proposed at the outlet to the Kennedy Lane East Sewer meet MOE Enhanced treatment standards (80% TSS removal). In addition, the enhanced grass swales will provide additional quality control.

WATER QUANTITY

Runoff will be controlled on the surface using ICDs on catch basin lead pipes and the outlet of the proposed underground chambers.

APPENDIX

A

PRE-CONSULTATION
MEETING MINUTES
AND TECHNICAL
COMMENTS

Site Plan Pre- Application Consultation Notes

Date: Wednesday, May 19, 2021

Site Location: 360 Kennedy Lane E

Type of Development: Residential (townhomes, stacked, singles, apartments), Office Space, Commercial, Retail, Institutional, Industrial, Other: N/A

Infrastructure

Water

Existing public services:

- Kennedy Lane E – 203mm DI



Watermain Frontage Fees to be paid (\$190.00 per metre) on Woodroffe Avenue Yes No

Boundary conditions:

Civil consultant must request boundary conditions from the City's assigned Project Manager prior to first submission.

- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:
 - Location of service(s)
 - Type of development and the amount of fire flow required (as per FUS, 1999)
 - Average daily demand: ___ L/s
 - Maximum daily demand: ___ L/s
 - Maximum hourly daily demand: ___ L/s
- Fire protection (Fire demand, Hydrant Locations)
- Please submit sanitary demands with the water boundary conditions

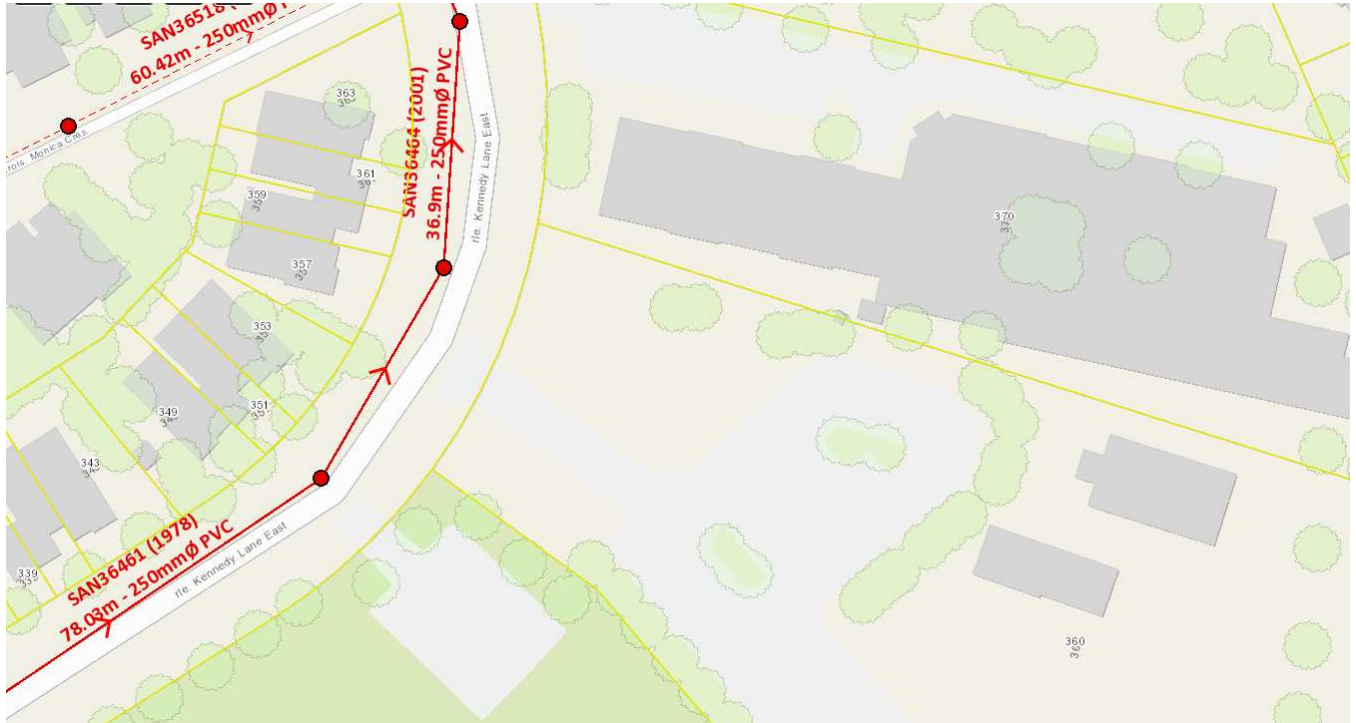
General comments

- Service areas with a basic demand greater than 50 m³/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.
- A District Metering Area Chamber (DMA) is required for new services 150mm or greater in diameter.

Sanitary Sewer

Existing public services:

- Kennedy Lane E – 250mm PVC



Is a monitoring manhole required on private property? Yes No

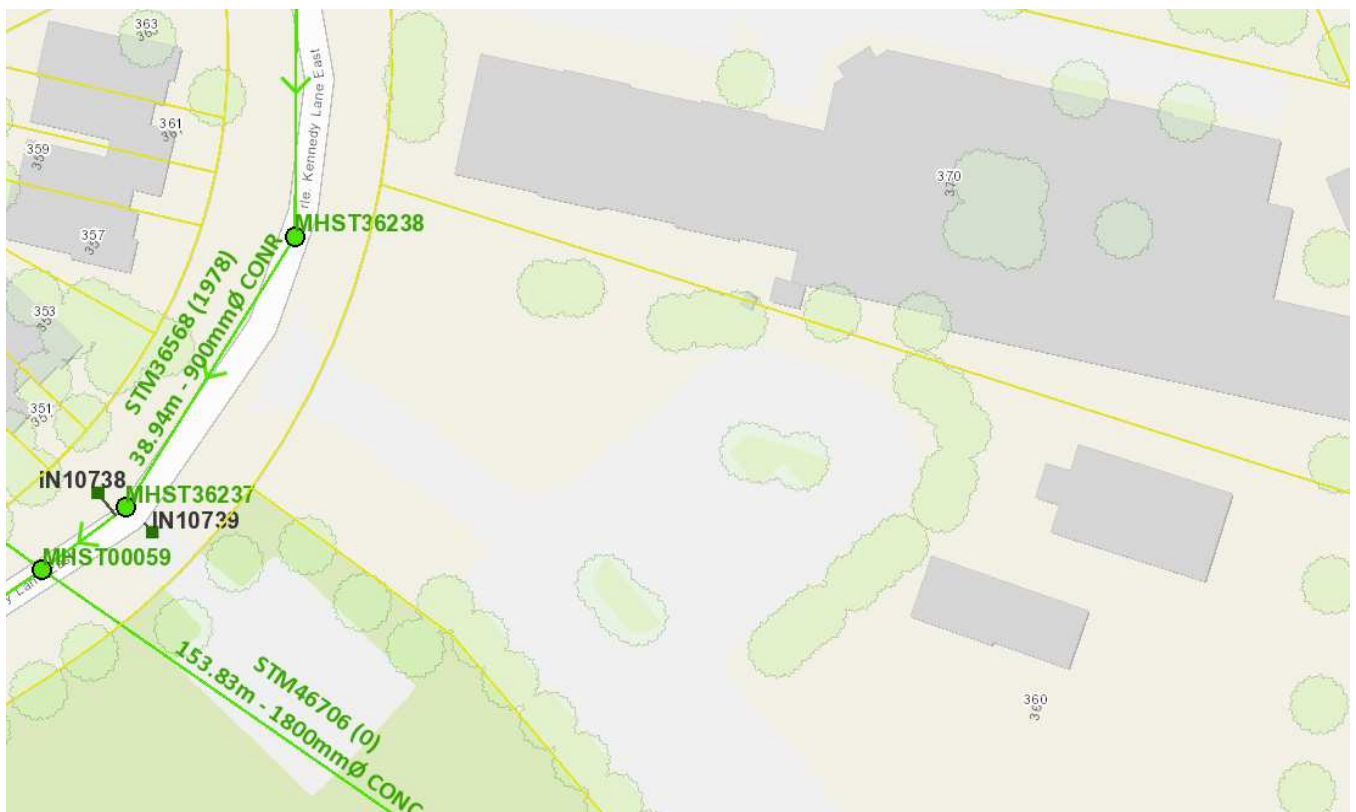
General comments

- Please submit sanitary demands with the water boundary conditions
- For infill developments within older neighbourhoods there is not an allotment for the sanitary capacity. As part of the rezoning application the consultant is required to demonstrate that there is sufficient capacity in the pipe network and system for the proposed sanitary demands.

Storm Sewer

Existing public services:

- Kennedy Lane E – 900mm Conc R



Stormwater Management

Quality Control:

- Rideau Valley Conservation Authority to confirm quality control requirements.

Quantity Control:

- LID features are strongly encouraged as the development is going from mostly pervious to impervious.
- Time of concentration (Tc): Tc = pre-development; maximum Tc = 10 min
- Allowable run-off coefficient: 0.5
- Allowable flowrate: Allowable flowrate: Control the 100-year storm events to the 5-year storm event.

Ministry of Environment, Conservation and Parks (MECEP)

All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

- a. Consultants are required to determine if an approval for sewage works under Section 53 of OWRA is required.
- b. ECA applications are required to be submitted online through the MECP portal. A business account required to submit ECA application. For more information visit <https://www.ontario.ca/page/environmental-compliance-approval>
- c. If the consultant determines the site does not meet the definition of industrial site the consultant may request the MECP to exempt the works. The following information must be provided to the City Project Manager:
 - (i) is designed to service one lot or parcel of land;
 - (ii) discharges into a storm sewer that is not a combined sewer;
 - (iii) does not service industrial land or a structure located on industrial land; and
 - (iv) is not located on industrial land.

NOTE: Site Plan Approval, or Draft Approval, is required before any Ministry of the Environment and Climate Change (MOECC) application is sent

General Service Design Comments

- Existing sewers or watermains that are not reused must be decommissioned as per City Standards.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.

Other

Capital Works Projects within proximity to application? Yes No

References and Resources

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.
- All required plans & reports are to be provided in *.pdf format (at application submission and for any, and all, re-submissions)
- Please find relevant City of Ottawa Links to Preparing Studies and Plans below:
<https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#standards-policies-and-guidelines>
- To request City of Ottawa plan(s) or report information please contact the City of Ottawa Information Centre:
InformationCentre@ottawa.ca <<mailto:InformationCentre@ottawa.ca>>
(613) 580-2424 ext. 44455
- geoOttawa
<http://maps.ottawa.ca/geoOttawa/>

SITE PLAN APPLICATION – Municipal servicing

For information on preparing required studies and plans refer to:

<http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans>

S/A	Number of copies	ENGINEERING		S/A	Number of copies
S		1. Site Servicing Plan	2. Site Servicing Report	S	
S		3. Grade Control and Drainage Plan	4. Geotechnical Study Alternatively, existing report with memo providing recommendations for works based on current geotechnical guidelines.	S	
		5. Composite Utility Plan	6. Groundwater Impact Study		
		7. Servicing Options Report	8. Wellhead Protection Study		
		9. Community Transportation Study and/or Transportation Impact Study / Brief	10. Erosion and Sediment Control Plan / Brief	S	
S		11. Storm water Management Report	12. Hydro-geological and Terrain Analysis		
		13. Water main Analysis	14. Noise / Vibration Study	S	
		15. Roadway Modification Design Plan	16. Confederation Line Proximity Study		

It is important to note that the need for additional studies and plans may result during application review. If following the submission of your application, it is determined that material that is not identified in this checklist is required to achieve complete application status, in accordance with the Planning Act and Official Plan requirements, City Planning will notify you of outstanding material required within the required 30 day period. Mandatory pre-application consultation will not shorten the City's standard processing timelines, or guarantee that an application will be approved. It is intended to help educate and inform the applicant about submission requirements as well as municipal processes, policies, and key issues in advance of submitting a formal development application. This list is valid for one year following the meeting date. If the application is not submitted within this timeframe the applicant must again pre-consult with the City.

Notes:

4. Geotechnical Study / Slope Stability Study – required as per Official Plan section 4.8.3. All site plan applications need to demonstrate the soils are suitable for development. A Slope Stability Study may be required with unique circumstances (Schedule K or topography may define slope stability concerns).

10. Erosion and Sediment Control Plan – required with all site plan applications as per Official Plan section 4.7.3.

11. Stormwater Management Report/Brief - required with all site plan applications as per Official Plan section 4.7.6.

REZONING APPLICATION – Municipal servicing

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<http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans>

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S		11. Storm water Management Report	12. Hydro-geological and Terrain Analysis		
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APPENDIX

B EXHIBITS

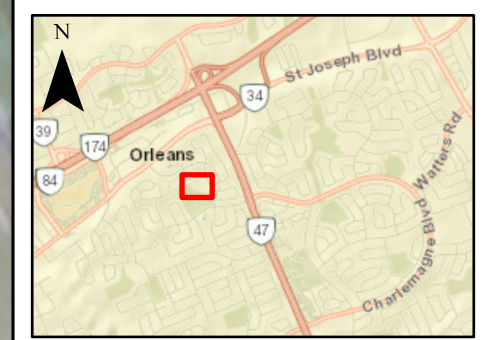




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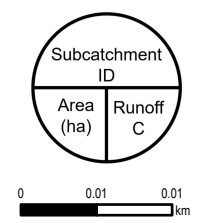
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**EXHIBIT 1
 EXISTING CONDITIONS
 DRAINAGE MOSAIC**



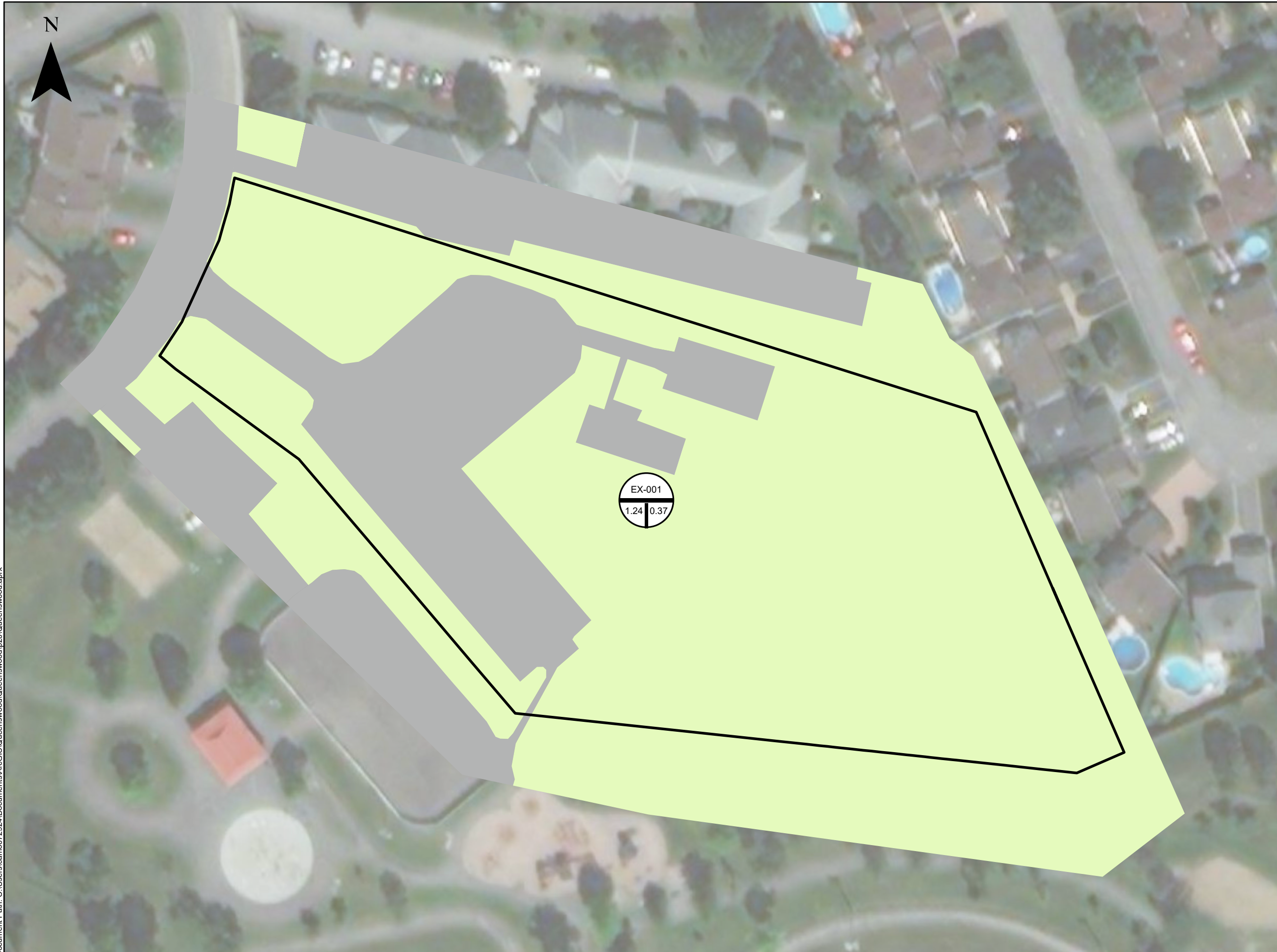
LEGEND

- - - - - Existing Swale
- Existing Storm
- - - - - Drainage Area

EX-001	
1.24	0.37



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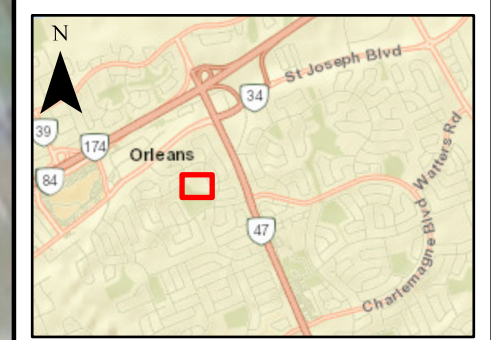
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360 KENNEDY LANE EAST
DEVELOPMENT

TITLE
**EXHIBIT 2
EXISTING CONDITIONS
LAND USE**

**EXHIBIT 2
EXISTING CONDITIONS
LAND USE**



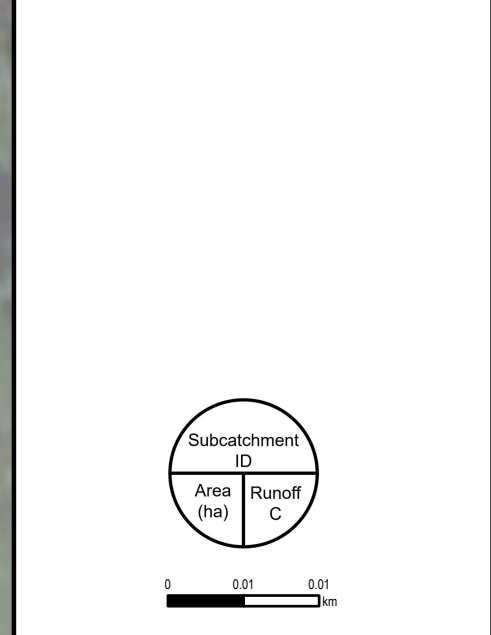
LEGEND

Drainage Area

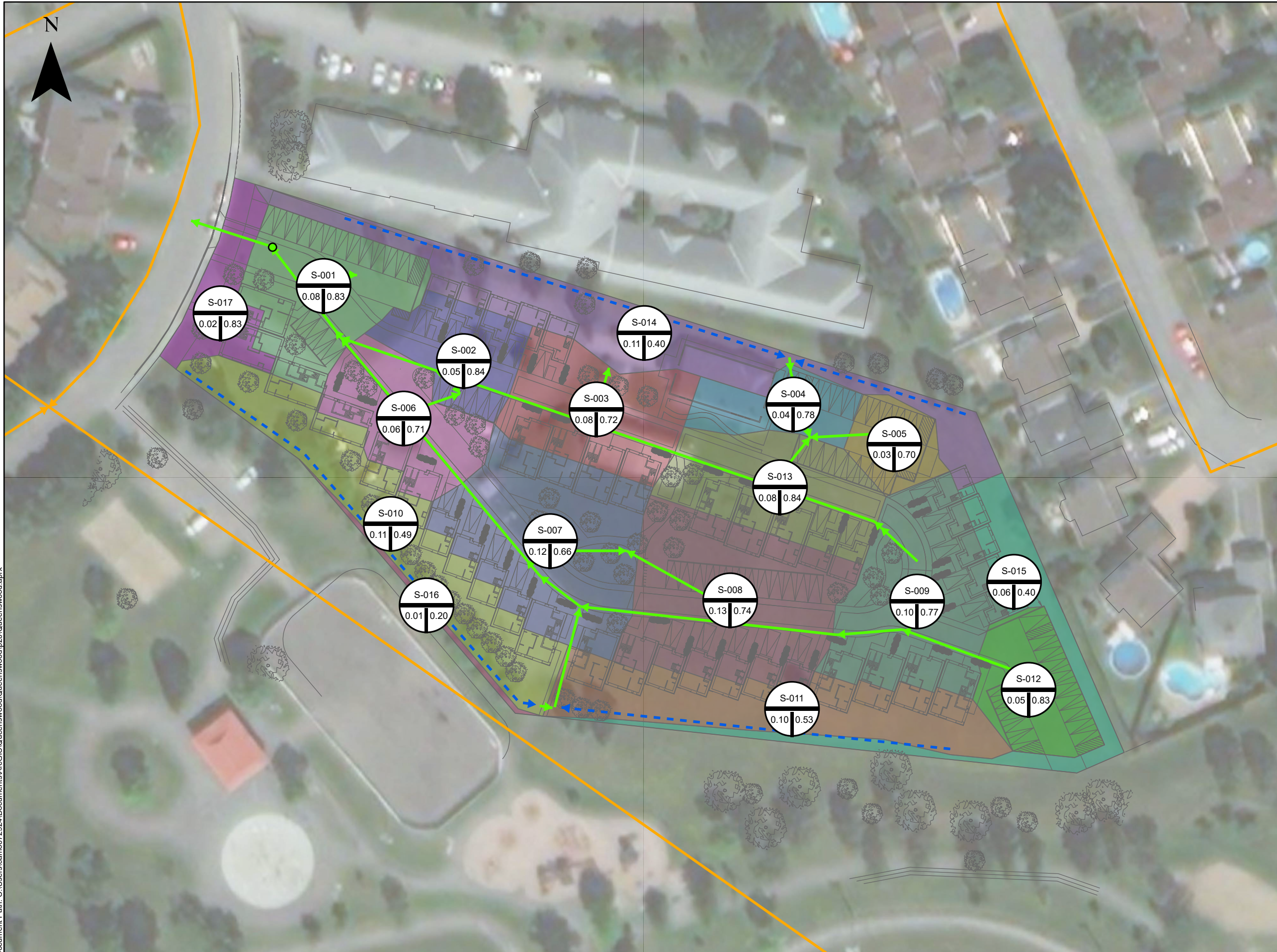
Land Use

Impervious

Pervious



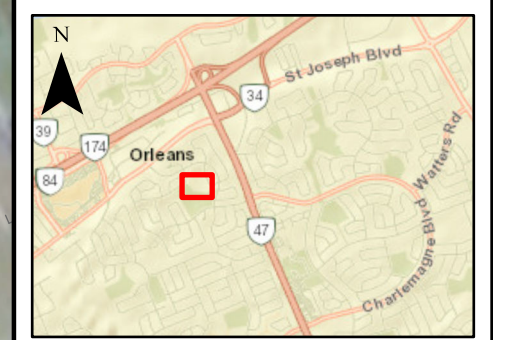
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360 KENNEDY LANE EAST DEVELOPMENT

TITLE
**EXHIBIT 3
 PROPOSED CONDITIONS
 DRAINAGE MOSAIC**

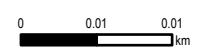
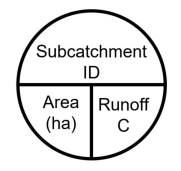


LEGEND

- OGS
- Proposed Storm
- Proposed Swale
- Existing Storm

Drainage Areas

 S-001	 S-007
 S-002	 S-008
 S-003	 S-009
 S-004	 S-010
 S-005	 S-011
 S-006	 S-012
	 S-013
	 S-014
	 S-015
	 S-016
	 S-017



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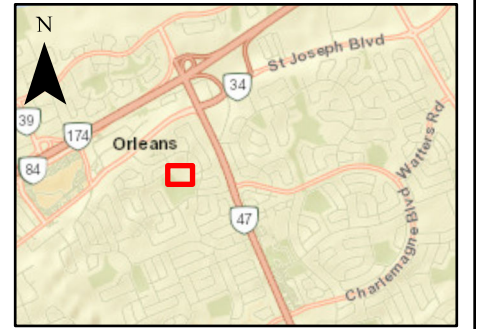
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QUEENSWOOD UNITED CHURCH

PROJECT
360 KENNEDY LANE EAST DEVELOPMENT

TITLE
**EXHIBIT 4
PROPOSED CONDITIONS
LAND USE**



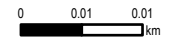
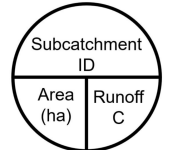
LEGEND

Drainage Areas

Land Use

Impervious

Pervious



DRAWN BY MO

November 2021

NAD 1983 MTM 9

1:622

CHECKED BY AH



APPENDIX

C CALCULATIONS & PCSWMM OUTPUT

5-Year Pre-Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

```

*****
Element Count
*****
Number of rain gages ..... 16
Number of subcatchments ... 2
Number of nodes ..... 1
Number of links ..... 0
Number of pollutants ..... 0
Number of land uses ..... 0
    
```

 Rainage Summary

Name	Data Source	Data Type	Recording Interval
100yr_3hr_Chicago	100yr_3hr_Chicago	INTENSITY	10 min.
100yr_3hr_Chicago_Climate_Change	100yr_3hr_Chicago_Increase_20percent	INTENSITY	10 min.
100yr_6hr_Chicago	100yr_6hr_Chicago	INTENSITY	10 min.
100yr_6hr_Chicago_Climate_Change	100yr_6hr_Chicago_Increase_20percent	INTENSITY	10 min.
10yr_3hr_Chicago	10yr_3hr_Chicago	INTENSITY	10 min.
10yr_6hr_Chicago	10yr_6hr_Chicago	INTENSITY	10 min.
25mm_3hr_Chicago	25mm_3hr_Chicago	INTENSITY	10 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_3hr_Chicago	25yr_3hr_Chicago	INTENSITY	10 min.
25yr_6hr_Chicago	25yr_6hr_Chicago	INTENSITY	10 min.
2yr_3hr_Chicago	2yr_3hr_Chicago	INTENSITY	10 min.
2yr_6hr_Chicago	2yr_6hr_Chicago	INTENSITY	10 min.
50yr_3hr_Chicago	50yr_3hr_Chicago	INTENSITY	10 min.
50yr_6hr_Chicago	50yr_6hr_Chicago	INTENSITY	10 min.
5yr_3hr_Chicago	5yr_3hr_Chicago	INTENSITY	10 min.
5yr_6hr_Chicago	5yr_6hr_Chicago	INTENSITY	10 min.

 Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1_1	0.51	68.63	6.56	7.7320	5yr_3hr_Chicago	OF1
S1_2	0.72	60.33	43.95	3.4980	5yr_3hr_Chicago	OF1

 Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	83.72	0.00	0.0	

 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

 Analysis Options

```

Flow Units ..... CMS
Process Models:
Rainfall/Runoff ..... YES
RDII ..... NO
Snowmelt ..... NO
Groundwater ..... NO
Flow Routing ..... NO
Water Quality ..... NO
Infiltration Method ..... HORTON
Starting Date ..... 11/10/2013 00:00:00
Ending Date ..... 11/10/2013 06:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:05:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
    
```

```

*****
Runoff Quantity Continuity          Volume          Depth
*****                              hectare-m       mm
*****                              -----
    
```

```

Total Precipitation ..... 0.053 42.514
Evaporation Loss ..... 0.000 0.000
Infiltration Loss ..... 0.035 28.029
Surface Runoff ..... 0.018 14.194
Final Storage ..... 0.001 0.449
Continuity Error (%) ..... -0.373
    
```

```

*****
Volume          Volume
Flow Routing Continuity          hectare-m       10^6 ltr
*****
Dry Weather Inflow ..... 0.000 0.000
Wet Weather Inflow ..... 0.018 0.176
Groundwater Inflow ..... 0.000 0.000
RDII Inflow ..... 0.000 0.000
External Inflow ..... 0.000 0.000
External Outflow ..... 0.018 0.176
Flooding Loss ..... 0.000 0.000
Evaporation Loss ..... 0.000 0.000
Exfiltration Loss ..... 0.000 0.000
Initial Stored Volume ..... 0.000 0.000
Final Stored Volume ..... 0.000 0.000
Continuity Error (%) ..... 0.000
    
```

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1_1	42.51	0.00	0.00	36.36	6.17	0.03	0.02	0.145
S1_2	42.51	0.00	0.00	22.11	19.90	0.14	0.10	0.468

Analysis begun on: Mon Nov 29 16:03:21 2021
 Analysis ended on: Mon Nov 29 16:03:21 2021
 Total elapsed time: < 1 sec

based on results found at every computational time step,
not just on results from each reporting time step.

Analysis Options

Flow Units CMS
Process Models:
Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed YES
Water Quality NO
Infiltration Method HORTON
Flow Routing Method DYNWAVE
Starting Date 11/10/2013 00:00:00
Ending Date 11/10/2013 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step 1.00 sec
Variable Time Step YES
Maximum Trials 20
Number of Threads 2
Head Tolerance 0.001500 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
-----	-----	-----
Total Precipitation	0.089	71.677
Evaporation Loss	0.000	0.000
Infiltration Loss	0.017	13.640
Surface Runoff	0.071	57.651
Final Storage	0.001	1.100
Continuity Error (%)	-0.995	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
-----	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.071	0.714
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.051	0.511
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.020	0.199
Continuity Error (%)	0.646	

Highest Continuity Errors

Node TankC (1.66%)
Node TankF (1.22%)
Node CB04 (-1.21%)

Time-Step Critical Elements

Link C1_1 (65.91%)

Highest Flow Instability Indexes

Link ICD_CB01 (32)
Link ICD_CB04 (12)

Routing Time Step Summary

Minimum Time Step : 0.50 sec
Average Time Step : 0.84 sec
Maximum Time Step : 1.00 sec
Percent in Steady State : -0.00
Average Iterations per Step : 2.10
Percent Not Converging : 0.02

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S-001	71.68	0.00	0.00	4.32	66.49	0.05	0.04	0.928
S-002	71.68	0.00	0.00	3.43	67.29	0.03	0.02	0.939
S-003	71.68	0.00	0.00	9.24	61.92	0.05	0.04	0.864
S-004	71.68	0.00	0.00	3.16	67.56	0.02	0.02	0.943
S-005	71.68	0.00	0.00	6.23	64.81	0.02	0.01	0.904
S-006	71.68	0.00	0.00	11.00	60.30	0.04	0.03	0.841
S-007	71.68	0.00	0.00	9.27	61.84	0.08	0.06	0.863
S-008	71.68	0.00	0.00	9.50	61.61	0.08	0.06	0.859
S-009	71.68	0.00	0.00	7.09	63.91	0.07	0.05	0.892
S-010	71.68	0.00	0.00	25.49	45.96	0.05	0.04	0.641
S-011	71.68	0.00	0.00	23.03	48.42	0.05	0.04	0.676
S-012	71.68	0.00	0.00	3.65	67.15	0.03	0.02	0.937
S-013	71.68	0.00	0.00	2.88	67.82	0.05	0.04	0.946
S-014	71.68	0.00	0.00	30.71	40.84	0.05	0.03	0.570
S-015	71.68	0.00	0.00	30.78	43.05	0.02	0.03	0.601
S-016	71.68	0.00	0.00	41.22	34.75	0.00	0.00	0.485
S-017	71.68	0.00	0.00	17.11	54.53	0.02	0.02	0.761

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB010	JUNCTION	0.70	1.54	85.64	0 01:33	1.54
CB011	JUNCTION	0.87	1.45	85.54	0 01:45	1.45
CB012	JUNCTION	0.69	1.32	85.22	0 01:41	1.32
CB014	JUNCTION	1.15	1.58	85.83	0 02:22	1.58
CB02	JUNCTION	0.82	1.39	85.54	0 01:45	1.39
CB03	JUNCTION	1.11	1.48	86.63	0 02:32	1.48
CB05	JUNCTION	1.10	1.53	86.72	0 01:10	1.53
CB08	JUNCTION	1.12	1.53	85.83	0 02:22	1.53
CB09	JUNCTION	0.94	1.33	85.83	0 02:22	1.33
J1	JUNCTION	0.08	0.25	83.98	0 01:12	0.24
J2	JUNCTION	0.09	0.24	83.90	0 01:12	0.23
J3	JUNCTION	0.08	0.17	83.68	0 01:13	0.17
J4	JUNCTION	0.06	0.08	83.90	0 01:47	0.08
J5	JUNCTION	0.07	0.10	83.80	0 01:45	0.10
STMH101	JUNCTION	0.05	0.10	82.97	0 01:13	0.10
STMH102	JUNCTION	0.08	0.17	83.70	0 01:13	0.16
STMH103	JUNCTION	0.07	0.25	83.99	0 01:12	0.24
STMH104	JUNCTION	0.05	0.23	84.07	0 01:11	0.23
STMH105	JUNCTION	0.03	0.06	84.18	0 01:39	0.06
STMH106	JUNCTION	0.03	0.06	84.26	0 01:23	0.06
STMH107	JUNCTION	0.03	0.06	84.41	0 01:23	0.06
STMH108	JUNCTION	0.04	0.06	83.96	0 01:34	0.06
STMH109	JUNCTION	0.03	0.05	84.19	0 01:34	0.05
OF1	OUTFALL	0.05	0.10	82.30	0 01:13	0.10
CB01	STORAGE	0.33	2.94	87.15	0 01:11	2.89
CB04	STORAGE	0.40	3.04	87.15	0 01:11	2.99
CB06	STORAGE	1.03	3.27	87.72	0 01:22	3.27
TankA	STORAGE	0.83	1.49	85.22	0 01:41	1.49
TankB	STORAGE	0.80	1.66	85.64	0 01:34	1.66
TankC	STORAGE	1.24	1.68	85.83	0 02:22	1.68
TankD_CB07	STORAGE	1.17	3.37	87.53	0 01:34	3.36
TankF	STORAGE	1.23	1.63	86.63	0 02:32	1.63
TankG	STORAGE	0.97	1.56	85.54	0 01:45	1.56

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow 10^6 ltr	Total Inflow 10^6 ltr	Flow Balance Error Percent
CB010	JUNCTION	0.037	0.037	0 01:10	0.0476	0.0475	-0.068
CB011	JUNCTION	0.023	0.023	0 01:10	0.0319	0.0319	1.101
CB012	JUNCTION	0.040	0.040	0 01:10	0.0548	0.0548	0.022
CB014	JUNCTION	0.013	0.013	0 01:10	0.018	0.018	2.083
CB02	JUNCTION	0.029	0.029	0 01:10	0.0372	0.0372	0.952
CB03	JUNCTION	0.058	0.058	0 01:10	0.0758	0.0758	0.474
CB05	JUNCTION	0.060	0.060	0 01:10	0.0776	0.0776	0.774

CB02	4.95	4.95	5.04	0.01	0.01
CB08	4.96	4.96	5.02	0.15	0.15
CB09	4.93	4.93	5.02	0.01	0.01
ICD_010	3.79	3.79	4.09	0.02	0.02
ICD_03	4.96	4.96	5.03	0.13	0.13
ICD_05	4.97	4.97	5.03	0.20	0.20

Analysis begun on: Mon Nov 29 16:04:59 2021
Analysis ended on: Mon Nov 29 16:05:00 2021
Total elapsed time: 00:00:01

APPENDIX

D SUPPORTING DOCUMENTS



Hydro First Defense® - HC

Net Annual Water Quality Worksheet

Rev. 9.9



Project Name: **360 Kennedy Lane** Report Date: **3/22/2021** Paste
 Street: - City: **Ottawa**
 Province: **ON** Country: **Canada**
 Designer: **Meaghan O'Neill** email: **Meaghan.Oneill@wsp.com**

Treatment Parameters:

Structure ID: OGS
 TSS Goal: 80 % Removal
 TSS Particle Size: Fine
 Area: 1.2 ha
 Percent Impervious: 65%
 Rational C value: 0.64 Calc. Cn
 Rainfall Station: Ottawa, ON MAP
 Peak Storm Flow: - L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	81.7%	97.6%
FD-4HC	86.2%	99.5%
FD-5HC	90.1%	99.9%
FD-6HC	92.3%	100.0%
FD-8HC	95.2%	99.9%

Model Specification:

Model: **FD-3HC**
 Diameter: 900 mm
 Peak Flow Capacity: 425.00 L/s
 Sediment Storage: 0.31 m³
 Oil Storage: 473.00 L

Installation Configuration:

Placement: Online
 Outlet Pipe Size: mm OK
 Inlet Pipe 1 Size: mm OK
 Inlet Pipe 2 Size: mm OK
 Inlet Pipe 3 Size: mm OK
 Rim Level: m Calc Invs.
 Outlet Pipe Invert: m
 Invert Pipe 1: m OK!
 Invert Pipe 2: m
 Invert Pipe 3: m

Designer Notes:

Net Annual Removal Model: FD-3HC

Intensity ⁽¹⁾	Fraction of Rainfall ⁽¹⁾	FD-3HC Removal Efficiency ⁽²⁾	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.1%	98.0%	0.1%
1.00	14.1%	91.9%	13.0%
1.50	14.2%	88.5%	12.6%
2.00	14.1%	86.1%	12.2%
2.50	4.2%	84.4%	3.5%
3.00	1.5%	82.9%	1.2%
3.50	8.5%	81.8%	7.0%
4.00	5.4%	80.7%	4.4%
4.50	1.2%	79.9%	0.9%
5.00	5.5%	79.1%	4.4%
6.00	4.3%	77.8%	3.4%
7.00	4.5%	76.7%	3.5%
8.00	3.1%	75.7%	2.3%
9.00	2.3%	74.9%	1.7%
10.00	2.6%	74.2%	1.9%
20.00	9.2%	69.5%	6.4%
30.00	2.6%	67.0%	1.8%
40.00	1.2%	65.2%	0.8%
50.00	0.5%	63.8%	0.3%
100.00	0.7%	59.9%	0.4%
150.00	0.1%	57.6%	0.0%
200.00	0.0%	56.1%	0.0%

Total Net Annual Removal Efficiency: 81.7%

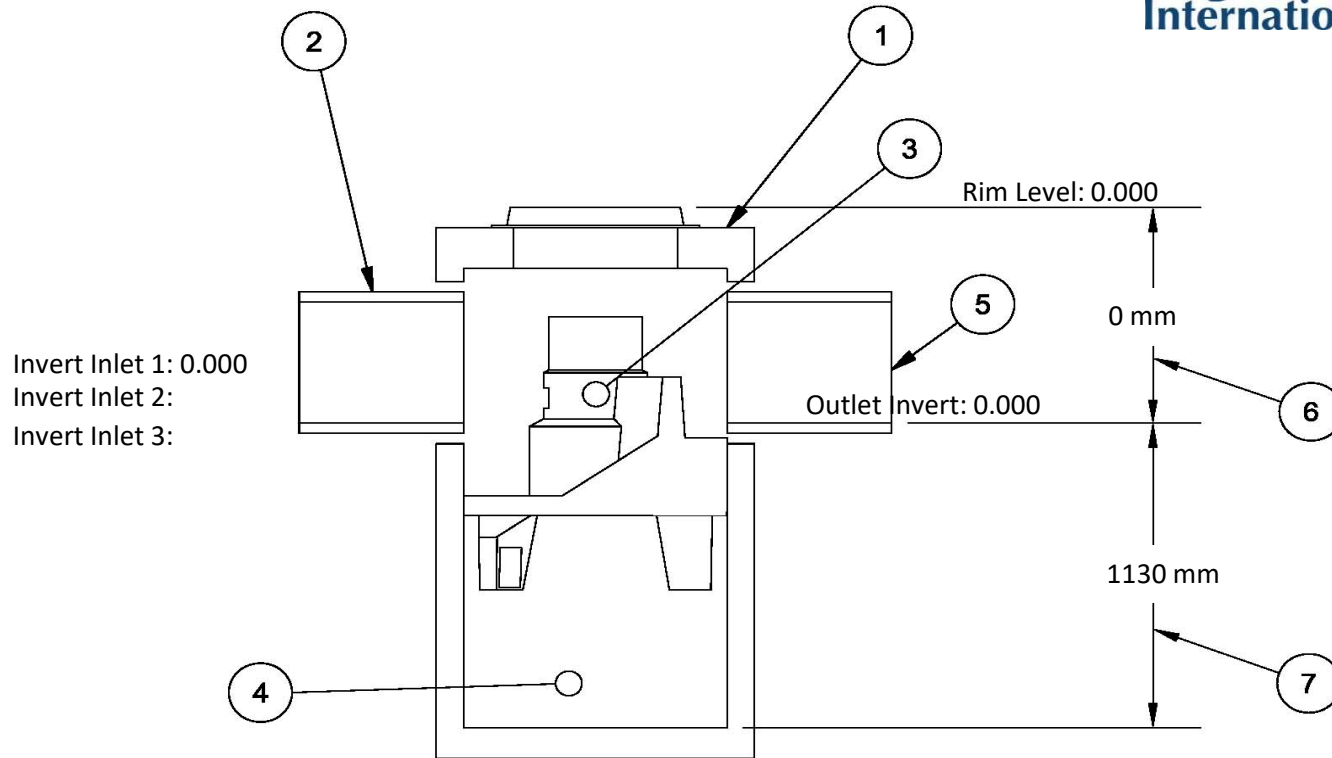
Total Annual Runoff Volume Treated: 97.6%

1. Rainfall Data: 1960:2007, HLY03, Ottawa, ONT, 6105976 & 6105978.

2. Based on third party verified data and approximating the removal of a PSD similar to the STC Fine distribution

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Hydro First Defense® - HC



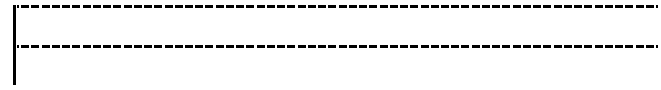
All drawing elevations are metres.

FD-3HC Specification

1	Vortex Chamber Diameter	900 mm
2	Inlet Pipe Diameter	0 mm
3	Oil Storage Capacity	473.00 L
4	Min. Provided Sediment Storage Capacity	0.31 m ³
5	Outlet Pipe Diameter	0 mm
6	Height(Final Grade to Outlet Invert)	0 mm

Notes:

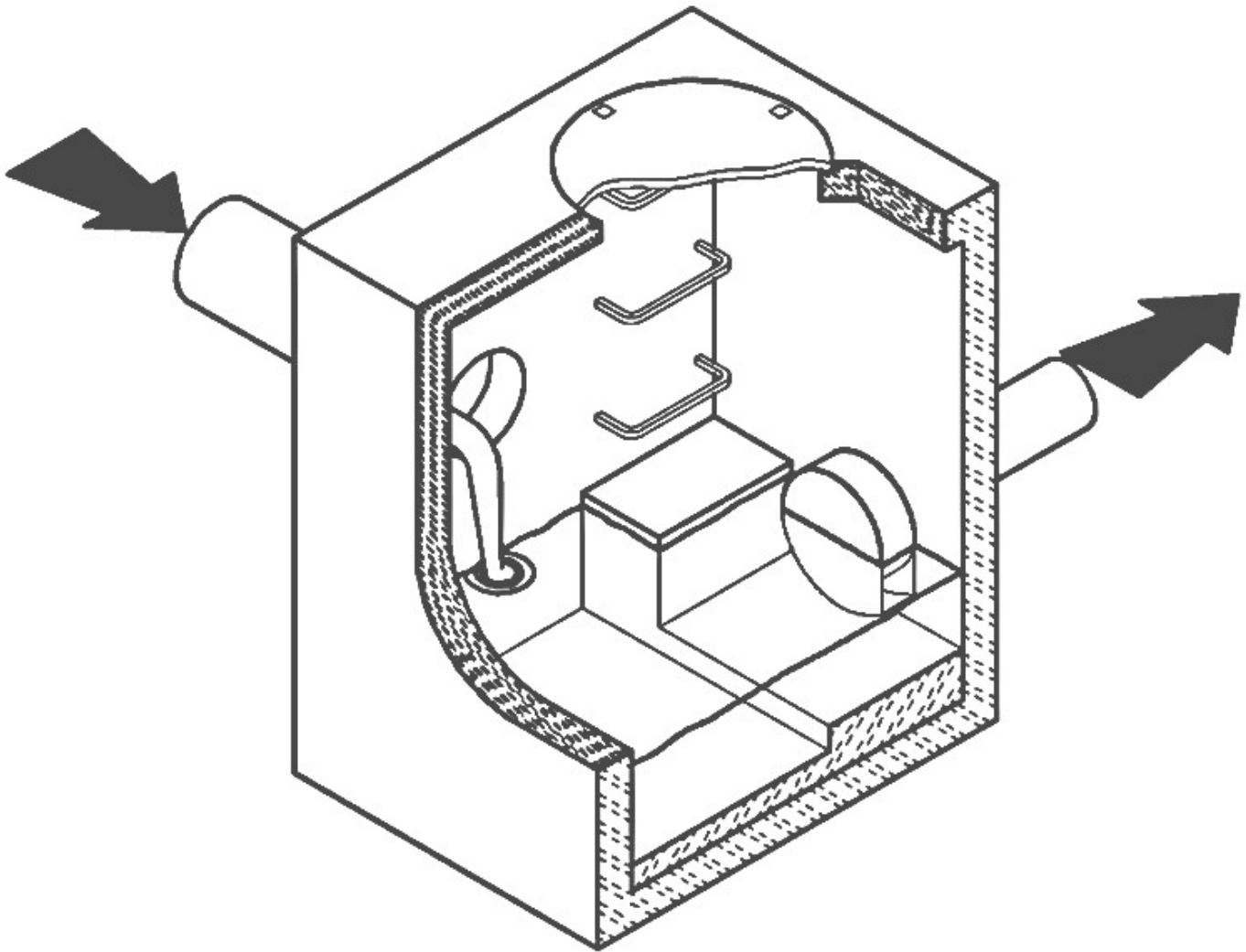
7	Sump Depth(Outlet Invert to Sump)	1130 mm
	Total Depth	1130 mm



CSO/STORMWATER MANAGEMENT



HYDROVEX[®] VHV / SVHV
Vertical Vortex Flow Regulator



JOHN MEUNIER

HYDROVEX® VHV / SVHV VERTICAL VORTEX FLOW REGULATOR

APPLICATIONS

One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm, uncontrolled flows may overload the drainage system and cause flooding. Due to increased velocities, sewer pipe wear is increased dramatically and results in network deterioration. In a combined sewer system, the wastewater treatment plant may also experience significant increases in flows during storms, thereby losing its treatment efficiency.

A simple means of controlling excessive water runoff is by controlling excessive flows at their origin (manholes). **John Meunier Inc.** manufactures the **HYDROVEX® VHV / SVHV** line of vortex flow regulators to control stormwater flows in sewer networks, as well as manholes.

The vortex flow regulator design is based on the fluid mechanics principle of the forced vortex. This grants flow regulation without any moving parts, thus reducing maintenance. The operation of the regulator, depending on the upstream head and discharge, switches between orifice flow (gravity flow) and vortex flow. Although the concept is quite simple, over 12 years of research have been carried out in order to get a high performance.

The **HYDROVEX® VHV / SVHV** Vertical Vortex Flow Regulators (refer to **Figure 1**) are manufactured entirely of stainless steel, and consist of a hollow body (1) (in which flow control takes place) and an outlet orifice (7). Two rubber "O" rings (3) seal and retain the unit inside the outlet pipe. Two stainless steel retaining rings (4) are welded on the outlet sleeve to ensure that there is no shifting of the "O" rings during installation and use.

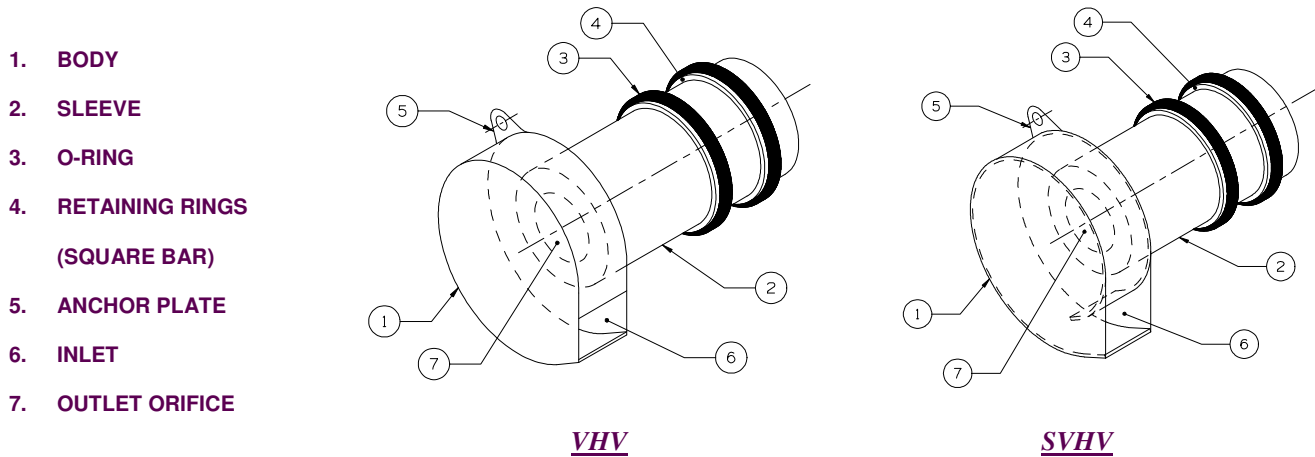


FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTEX FLOW REGULATORS

ADVANTAGES

- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Having no moving parts, they require minimal maintenance.
- The geometry of the **HYDROVEX® VHV / SVHV** flow regulators allows a control equal to an orifice plate, having a cross section area 4 to 6 times smaller. This decreases the chance of blockage of the regulator, due to sediments and debris found in stormwater flows. **Figure 2** illustrates the comparison between a regulator model 100 SVHV-2 and an equivalent orifice plate. One can see that for the same height of water, the regulator controls a flow approximately four times smaller than an equivalent orifice plate.
- Installation of the **HYDROVEX® VHV / SVHV** flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no special tools or equipment and may be carried out by any contractor.
- Installation may be carried out in existing structures.

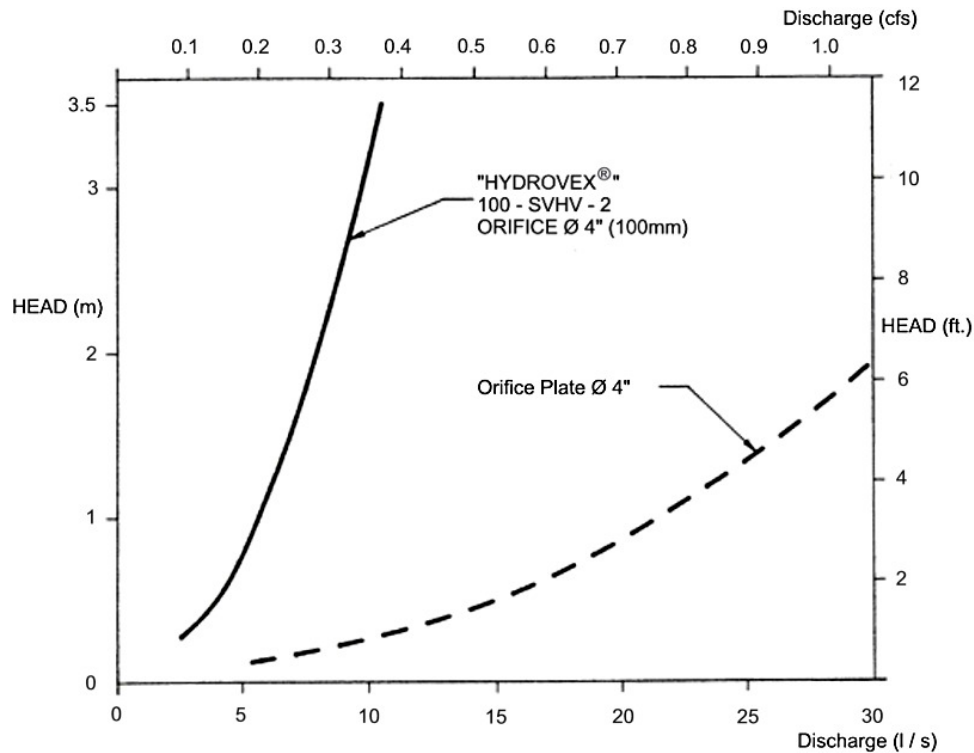


FIGURE 2: DISCHARGE CURVE SHOWING A HYDROVEX® FLOW REGULATOR VS AN ORIFICE PLATE

SELECTION

Selection of a **VHV** or **SVHV** regulator can be easily made using the selection charts found at the back of this brochure (see **Figure 3**). These charts are a graphical representation of the maximum upstream water pressure (head) and the maximum discharge at the manhole outlet. The maximum design head is the difference between the maximum upstream water level and the invert of the outlet pipe. All selections should be verified by John Meunier Inc. personnel prior to fabrication.

Example:

- ✓ Maximum design head 2m (6.56 ft.)
- ✓ Maximum discharge 6 L/s (0.2 cfs)
- ✓ Using **Figure 3** - VHV model required is a **75 VHV-1**

INSTALLATION REQUIREMENTS

All **HYDROVEX®** **VHV** / **SVHV** flow regulators can be installed in circular or square manholes. **Figure 4** gives the various minimum dimensions required for a given regulator. *It is imperative to respect the minimum clearances shown to ensure easy installation and proper functioning of the regulator.*

SPECIFICATIONS

In order to specify a **HYDROVEX**[®] regulator, the following parameters must be defined:

- The model number (ex: 75-VHV-1)
- The diameter and type of outlet pipe (ex: 6" diam. SDR 35)
- The desired discharge (ex: 6 l/s or 0.21 CFS)
- The upstream head (ex: 2 m or 6.56 ft.) *
- The manhole diameter (ex: 36" diam.)
- The minimum clearance "H" (ex: 10 inches)
- The material type (ex: 304 s/s, 11 Ga. standard)

* *Upstream head is defined as the difference in elevation between the maximum upstream water level and the invert of the outlet pipe where the **HYDROVEX**[®] flow regulator is to be installed.*

PLEASE NOTE THAT WHEN REQUESTING A PROPOSAL, WE SIMPLY REQUIRE THAT YOU PROVIDE US WITH THE FOLLOWING:

- *project design flow rate*
- *pressure head*
- *chamber's outlet pipe diameter and type*



Typical VHV model in factory

OPTIONS



FV – SVHV (mounted on sliding plate)



VHV-1-O (standard model with odour control inlet)



FV – VHV-O (mounted on sliding plate with odour control inlet)



VHV with Gooseneck assembly in existing chamber without minimum release at the bottom



VHV with air vent for minimal slopes



VHV Vertical Vortex Flow Regulator

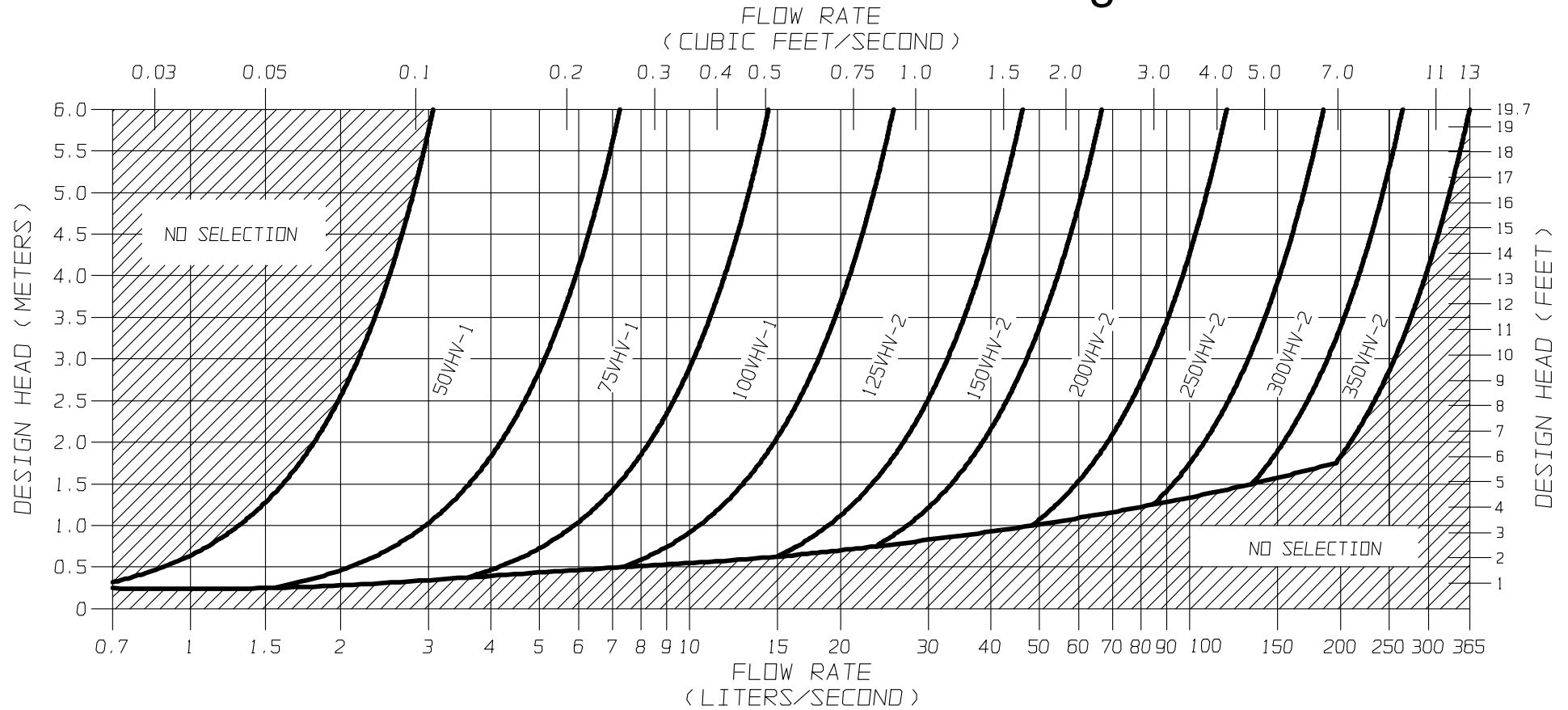


FIGURE 3 - VHV

JOHN MEUNIER



SVHV Vertical Vortex Flow Regulator

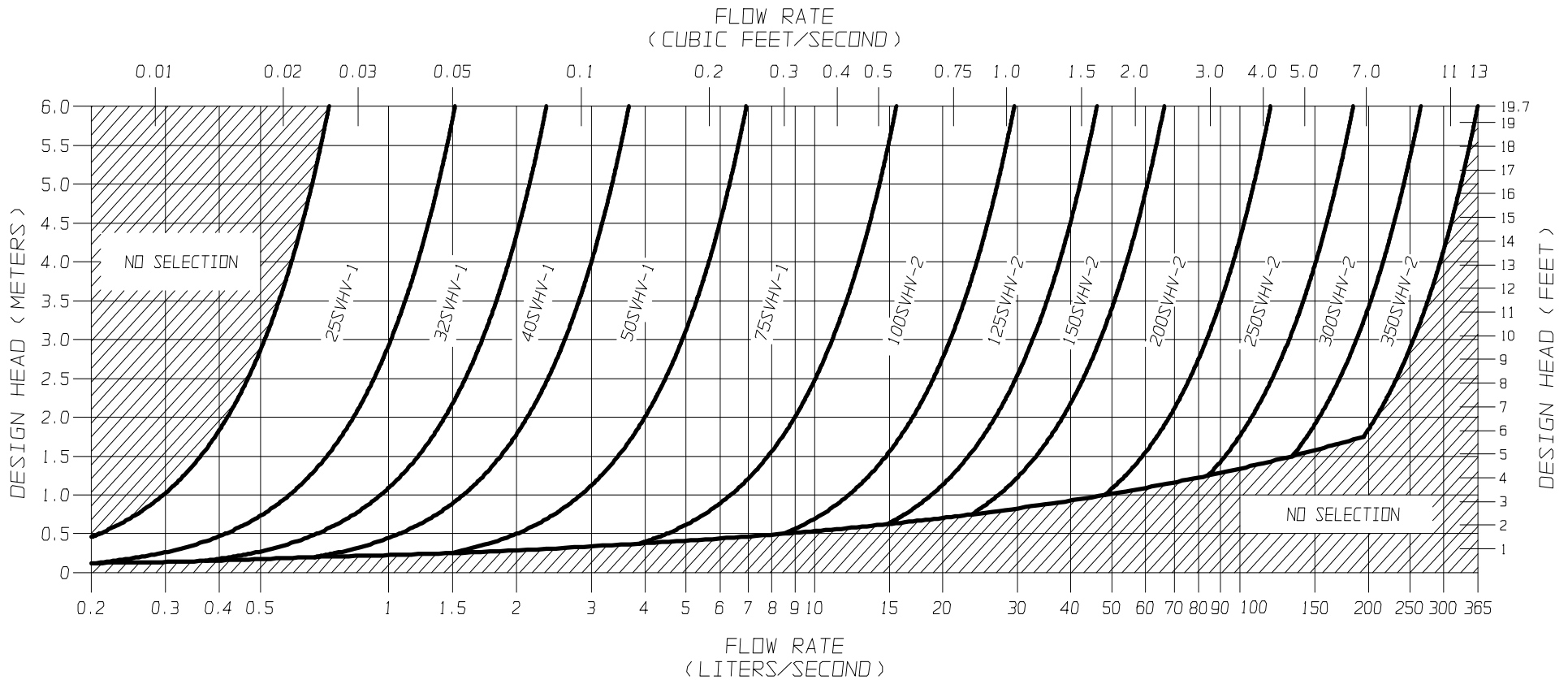
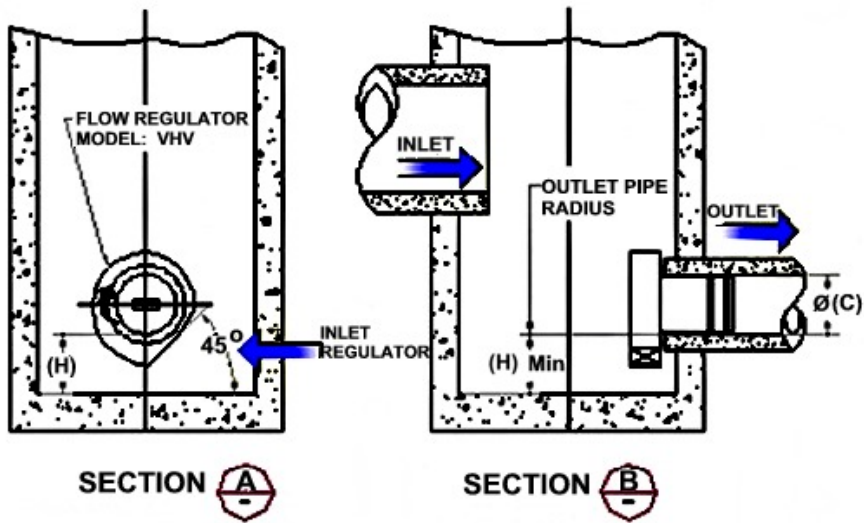
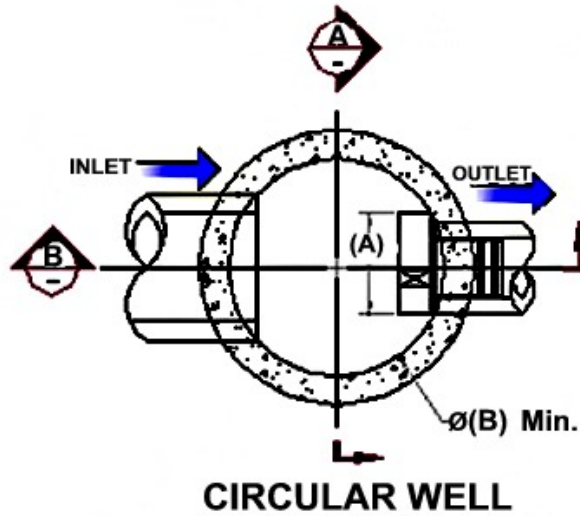


FIGURE 3 - SVHV

JOHN MEUNIER

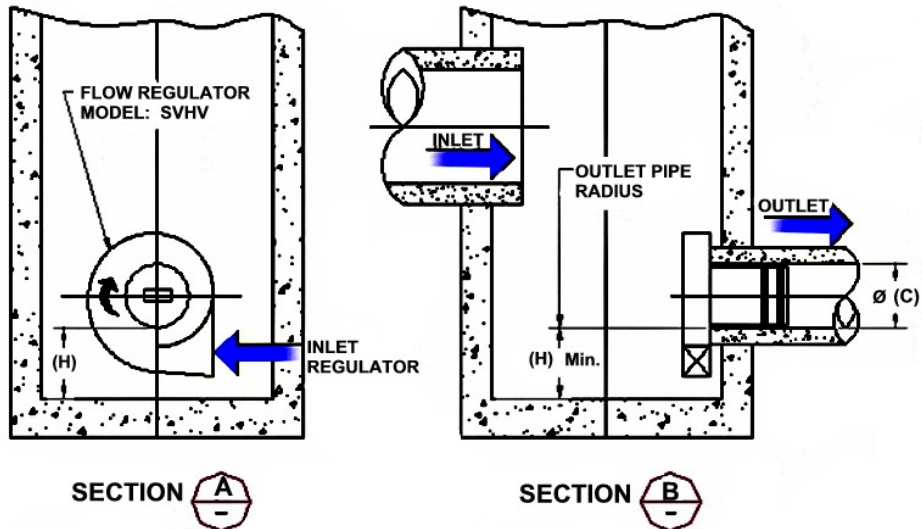
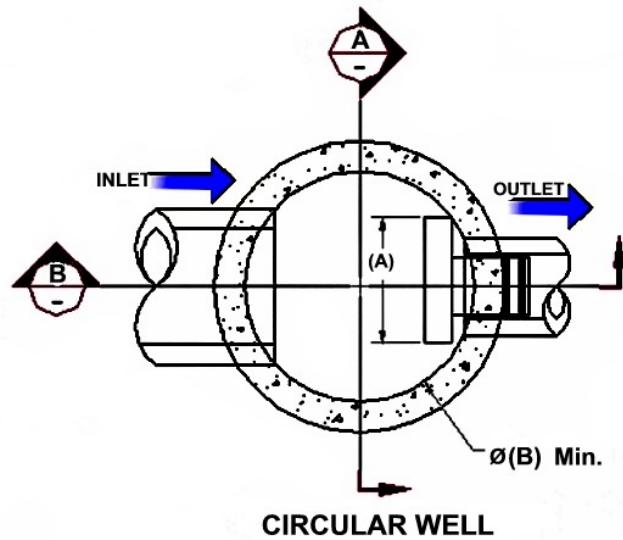
**FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL VHV)**

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	900	36	150	6	200	8
125VHV-2	275	11	900	36	150	6	200	8
150VHV-2	350	14	900	36	150	6	225	9
200VHV-2	450	18	1200	48	200	8	300	12
250VHV-2	575	23	1200	48	250	10	350	14
300VHV-2	675	27	1600	64	250	10	400	16
350VHV-2	800	32	1800	72	300	12	500	20



FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL SVHV)

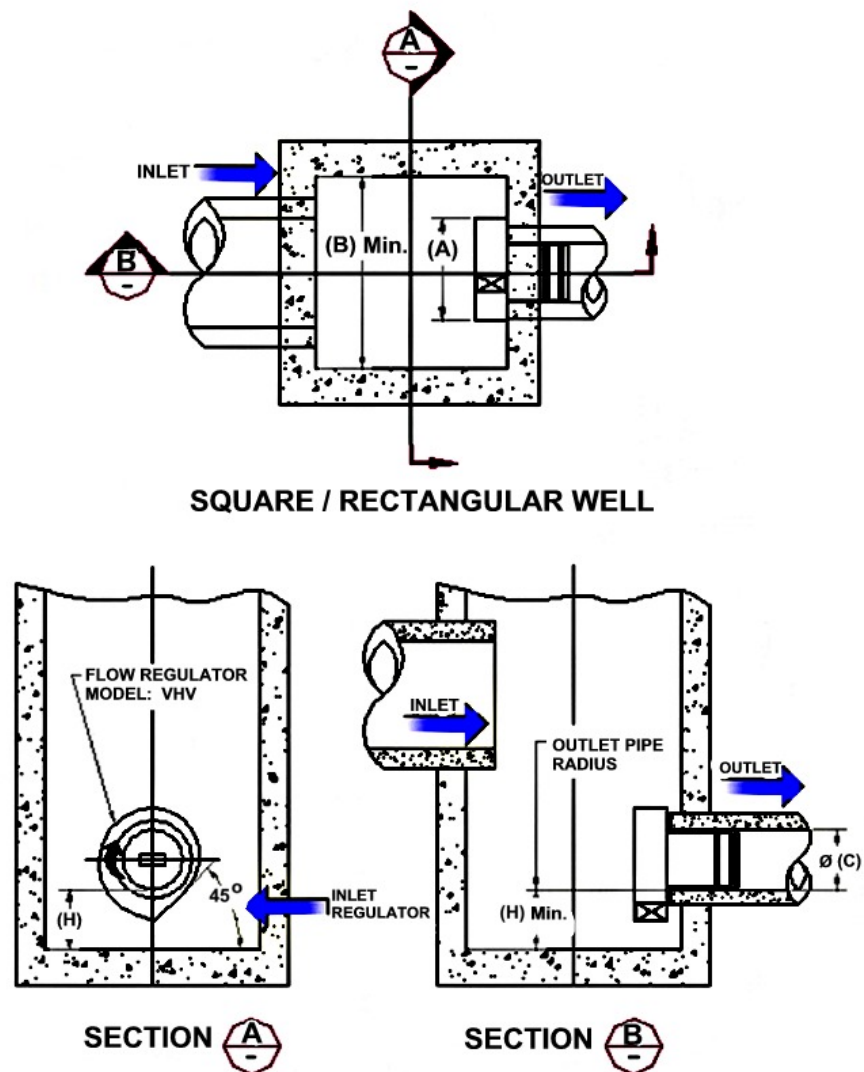
Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	900	36	150	6	275	11
100 SVHV-2	275	11	900	36	150	6	250	10
125 SVHV-2	350	14	900	36	150	6	300	12
150 SVHV-2	425	17	1200	48	150	6	350	14
200 SVHV-2	575	23	1600	64	200	8	450	18
250 SVHV-2	700	28	1800	72	250	10	550	22
300 SVHV-2	850	34	2400	96	250	10	650	26
350 SVHV-2	1000	40	2400	96	250	10	700	28



**FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL VHV)**

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	600	24	150	6	200	8
125VHV-2	275	11	600	24	150	6	200	8
150VHV-2	350	14	600	24	150	6	225	9
200VHV-2	450	18	900	36	200	8	300	12
250VHV-2	575	23	900	36	250	10	350	14
300VHV-2	675	27	1200	48	250	10	400	16
350VHV-2	800	32	1200	48	300	12	500	20

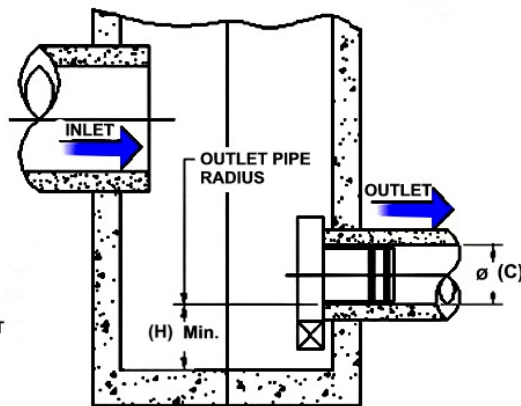
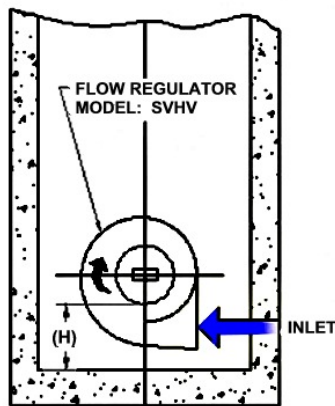
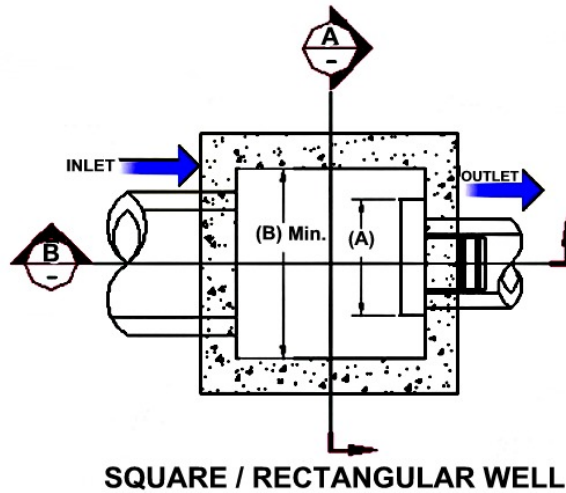
NOTE: *In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.*



FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL SVHV)

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	600	24	150	6	275	11
100 SVHV-2	275	11	600	24	150	6	250	10
125 SVHV-2	350	14	600	24	150	6	300	12
150 SVHV-2	425	17	600	24	150	6	350	14
200 SVHV-2	575	23	900	36	200	8	450	18
250 SVHV-2	700	28	900	36	250	10	550	22
300 SVHV-2	850	34	1200	48	250	10	650	26
350 SVHV-2	1000	40	1200	48	250	10	700	28

NOTE: *In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.*



INSTALLATION

The installation of a **HYDROVEX**[®] regulator may be undertaken once the manhole and piping is in place. Installation consists of simply fitting the regulator into the outlet pipe of the manhole. **John Meunier Inc.** recommends the use of a lubricant on the outlet pipe, in order to facilitate the insertion and orientation of the flow controller.

MAINTENANCE

HYDROVEX[®] regulators are manufactured in such a way as to be maintenance free; however, a periodic inspection (every 3-6 months) is suggested in order to ensure that neither the inlet nor the outlet has become blocked with debris. The manhole should undergo periodically, particularly after major storms, inspection and cleaning as established by the municipality

GUARANTY

The **HYDROVEX**[®] line of **VHV / SVHV** regulators are guaranteed against both design and manufacturing defects for a period of 5 years. Should a unit be defective, **John Meunier Inc.** is solely responsible for either modification or replacement of the unit.

John Meunier Inc.

ISO 9001 : 2008

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