Stormwater Management Report

VED Homes Subdivision

Township of Wellington North

November 2, 2022

Project Reference Number 22-087

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
85 McINTYRE DRIVE, KITCHENER, ONTARIO N2R 1H6
TELEPHONE (519) 748-1199 FAX (519) 748-6100

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Introduction

This report provides details on the stormwater management design for the proposed residential development on Township of Wellington North, Ontario.

Background Information

The subject property includes residential blocks on Township of Wellington North. The 0.985 ha property is located on the south side of Domville Street and west side of Conestoga Street. The site is currently undeveloped. The proposed development will consist of multi-unit residential buildings. The subject property is bounded by residential buildings to the north and east, residential buildings to the south, and residential lots of Catchet Development to the west. The Catchet Development is comprised of single detached dwellings, street townhouses, park and a SWM block. The site location is shown below.

Figure 1- Site Location

Geotechnical Information

There is no Geotechnical report specifically prepared for VED Homes Development. The geotechnical report prepared by Moto Engineering for Catchet Development located west of VED Homes Development gives some ideas about the general geological information of the surrounding area. The Moto Engineering indicates that the existing soils of Catchet Development consist mostly of silty, sand, and sandy silt expanding to approximately 1.5 to 4.6m and followed by clayey silt to 7.9 to 9.8m with occasional sand and gravel with corresponding hydraulic conductivity of 10^{-3}cm/s to 10^{-6} cm/s, or percolation time between 8min to 50min/cm.

The groundwater elevations vary from 454.0 m a.s.l. to 455.0 m a.s.l. throughout the VED Homes Development.

Existing Site Drainage Conditions

The existing drainage is from the north towards south to the existing ditch located at the center of Catchet Development site. There is an existing 1050 mm diameter storm pipe from Walton Street and 450mm diameter culvert both draining into the existing ditch and then discharging to the existing 900mm diameter culvert under Preston Street.

Proposed Site Drainage Conditions

The proposed development consists of townhouse blocks including 35 new residential units. The post development runoff from the entire site will be directed to Catchet Development located west of the VED Homes Development. The storm sewer system of Catchet Development has been sized for external lands including VED Homes lands. The backyard of blocks 1 and 2 will drain overland towards the catchment areas of Catchet Development. The roofs and front areas of blocks 1, 2, and 3 as well as Adelaide Street will drain to proposed catchbasin CB1 and catchbasin manhole CBMH1 at Adelaide Street. The runoffs in excess of the capacity of the 375 mm storm sewer outlet at CBMH1 will be diverted over the Adelaide Street and drain into catchbasin DCB1 at the proposed driveway. The grading of roofs, front areas of the Condo blocks, and driveway will direct the stormwater to catchbasin DCB1. The backyards of the east Condo block and block 3 will also drain to the catchbasin DCB1.The catchbasin DCB1 will discharge into the proposed underground chamber located east of the driveway. The underground chambers comprise of 60 chambers and are equipped with a 200 mm control pipe for quantity control of the outflow to the manhole MH2. The southwest, south, and southeast landscapes as well as proposed parking area will finally drain to the existing manhole MH7B.

The overall site peak flows in post development condition have been attenuated to less than peak flows in predevelopment condition considered in Cachet Development stormwater management design.

Stormwater Management Design Criteria

A stormwater management plan has been prepared for the proposed development.
The stormwater management plan considers quantity control of stormwater runoff from the entire site. One central quality and quantity SWM pond for the Catchet Development area and the external drainage areas, including VED Homes Development, is proposed. No additional quality control is required for VED Homes Development.

The design criteria for the stormwater plan area is:

To provide Quantity control of runoff resulting from the 5 year to 100 year storm events to less than the predevelopment runoff considered in Catchet Development design.

The storm sewers have been sized to convey the 5 year storm event. The storm design sheet is included in Appendix B.

Stormwater Management Plan

The stormwater management plan that has been prepared for the proposed development considers quantity control of stormwater runoff from the entire site.

Stormwater quantity control will be achieved using underground chambers equipped with control pipe. The stormwater management plan for the proposed development is presented here.

Quantity Control

The proposed stormwater management will result in a reduction in peak flows of predevelopment condition considered in Catchet Development design. The installed control pipe on the underground chamber outlet restricts the outflow to MH7 at Catchet Development.

A central quality SWM pond for the Catchet Development area and the external drainage areas including VED Homes Development is proposed. No additional quality control is required for VED Homes Development.

Stormwater Modeling

The MIDUSS Model was used to model the 5 year and 100 year storm events to demonstrate the level of quantity control provided by the proposed stormwater management design.

For a proper comparison of predevelopment and post development conditions, the design storm hyetographs were based on IDF curve information obtained from the Catchet Development stormwater management report, with the a, b, and c parameters outlined as follows:

$$i_{5yr} = \frac{1497.99}{(t_d+12.041)^{0.858}} \qquad i_{100yr} = \frac{4641.755}{(t_d+21.19)^{0.942}}$$

Stormwater Model Input Parameters

Table 1 shows the catchment area input parameters into the model under proposed conditions. Drainage catchment areas for the existing and proposed conditions are shown in Appendix A.

Table 1: Model Input Parameters

Catchment	Description	Area (ha)	Percent Impervious (%)	Overland Slope (%)	Flow Length (m)
Existing Conditions					
101	South catchment	0.433	40	3.1	70.0
102	North catchment	0.552	40	1.9	75.0
Proposed Conditions					
201	North backyard	0.150	3	6.0	21
202	Blocks 1 to 3 roofs and front areas	0.175	88	4.8	11
203	Adelaide Street Extension	0.134	79	2.0	20
204	Access driveway	0.083	95	0.5	70
205	Block 3 and southeast Condo block backyards	0.066	3	2.6	45
206	Condo Block west backyard	0.058	3	16.0	6
207	Condo Block south backyard	0.088	3	12.0	12
208	Condo Block roofs and front areas	0.196	77	4.0	18

Stormwater Model Results

Table 2 shows the predevelopment and post development peak flows to the Catchet Development. The overall site peak flow in post development condition has been reduced to less than peak flows of predevelopment condition to Catchet Development. The MIDUSS output files are included in Appendix C. Table 3 shows water level and storage of the underground chamber.

Table 2: MIDUSS Model Results Summary

Design Storm	Existing condition Total runoff directed to Catchet Development based on Catchet stormwater management report (m^3/sec)	Proposed Condition Total runoff directed to Catchet Development (m^3/sec)
5 year	0.108	0.089
100 year	0.212	0.209

Table 3: Underground Chamber Water Level and Storage

Design Storm	Max. Water Level (m)	Storage (m^3)
5 year	455.01	62.71
100 year	455.46	122.38

During the 5-year storm event, the total peak flow to Catchet Development is 0.089 m^3/sec, which is less than the peak flow of 0.108 m^3/sec under existing conditions. During the 100-year storm event, the total peak flow to Catchet Development is 0.209 m^3/sec, which is less than the peak flow of 0.212 m^3/sec under the existing condition. The proposed storm sewer system demonstrates sufficient capacity to service the proposed development and convey the 5 year and 100 year storm events.

Maintenance Protocol for Stormwater Management

Review and monitoring should be made after every significant storm to ensure proper functioning of the SWM system (average is about four inspections per year). The stormwater management plan consists of several components. Each component, its primary function, and required maintenance is summarized in Table 4.

Table 4: Maintenance Protocol for Stormwater Management

SWM Component	Function	Maintenance Activity	Maintenance Frequency
Roof Drainage System	Convey roof water to the street and driveway	• Ensure roof eaves are kept clear of debris	• As required
Catchbasins and Catchbasin Manholes	Allow surface water entry into storm sewers	• Ensure grates are free of debris • Clean sumps once sediment depth reaches 50% of depth	• As required • Annually
Underground Chamber	Provide ponding area during rainfall events	• Maintain parking and driveway areas to be free of trash and debris • Sweep up sand and salt that may be applied • Maintain chambers' inlets and outlets to be free of trash and debris	• As required • As required in spring and winter thaw periods • As required
Sheet flow from street and driveway	Convey stormwater runoff from driveway, street, and rooftops	• Maintain street and driveway to be free of trash and debris • Sweep up sand and salt that may be applied	• As required • As required in spring and winter thaw periods

Conclusions

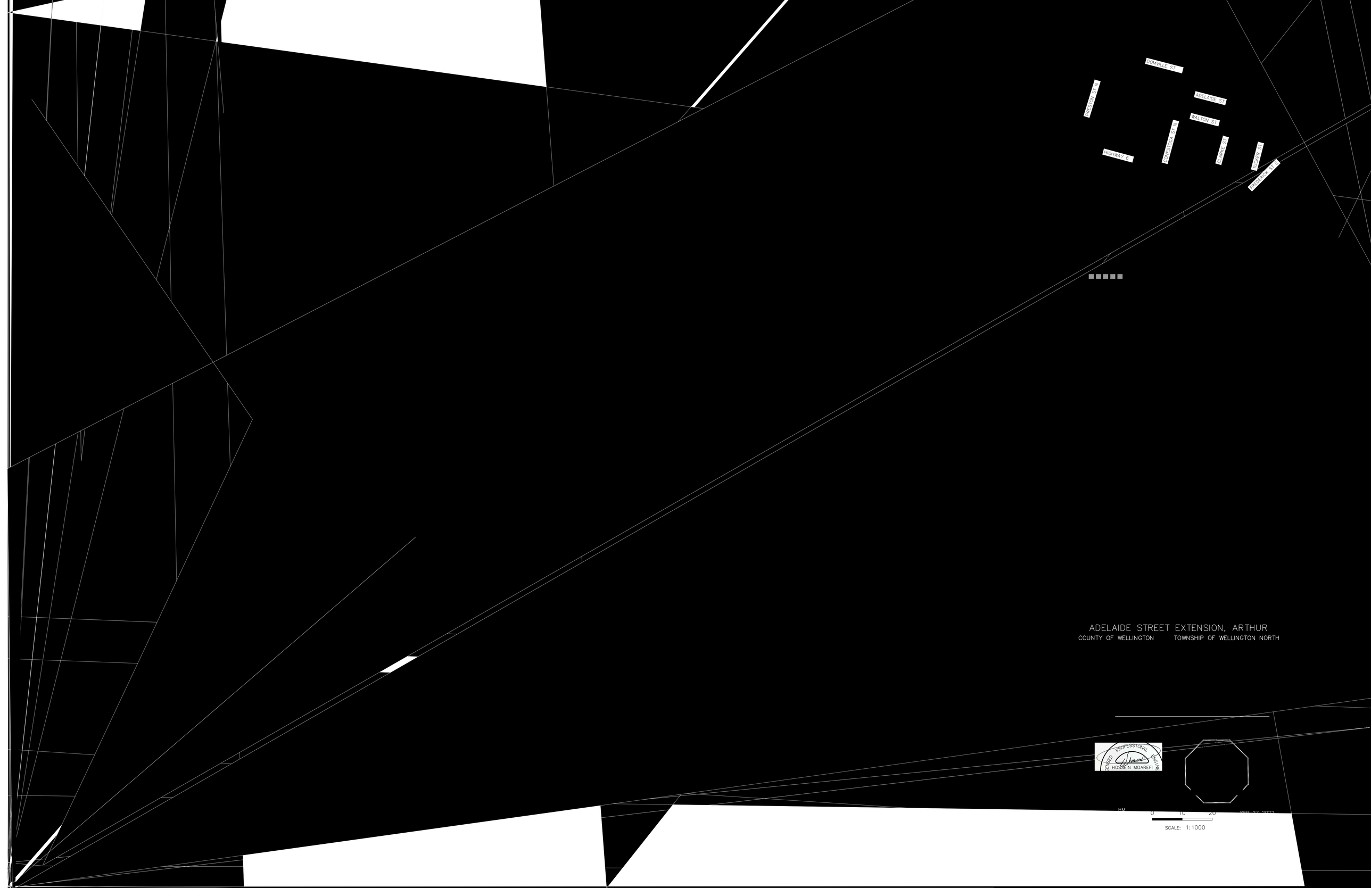
In summary, the overall site peak flow from pre-development conditions to post development has been reduced and proposed development will not result in an increase in peak discharge rates to the storm sewer system of Catchet Development.

Hossein Moarefi, P.Eng.

K. Smart Associates Limited

Appendix A

Drainage Catchment Areas for Existing and Proposed Conditions



ADELAIDE STREET EXTENSION, ARTHUR

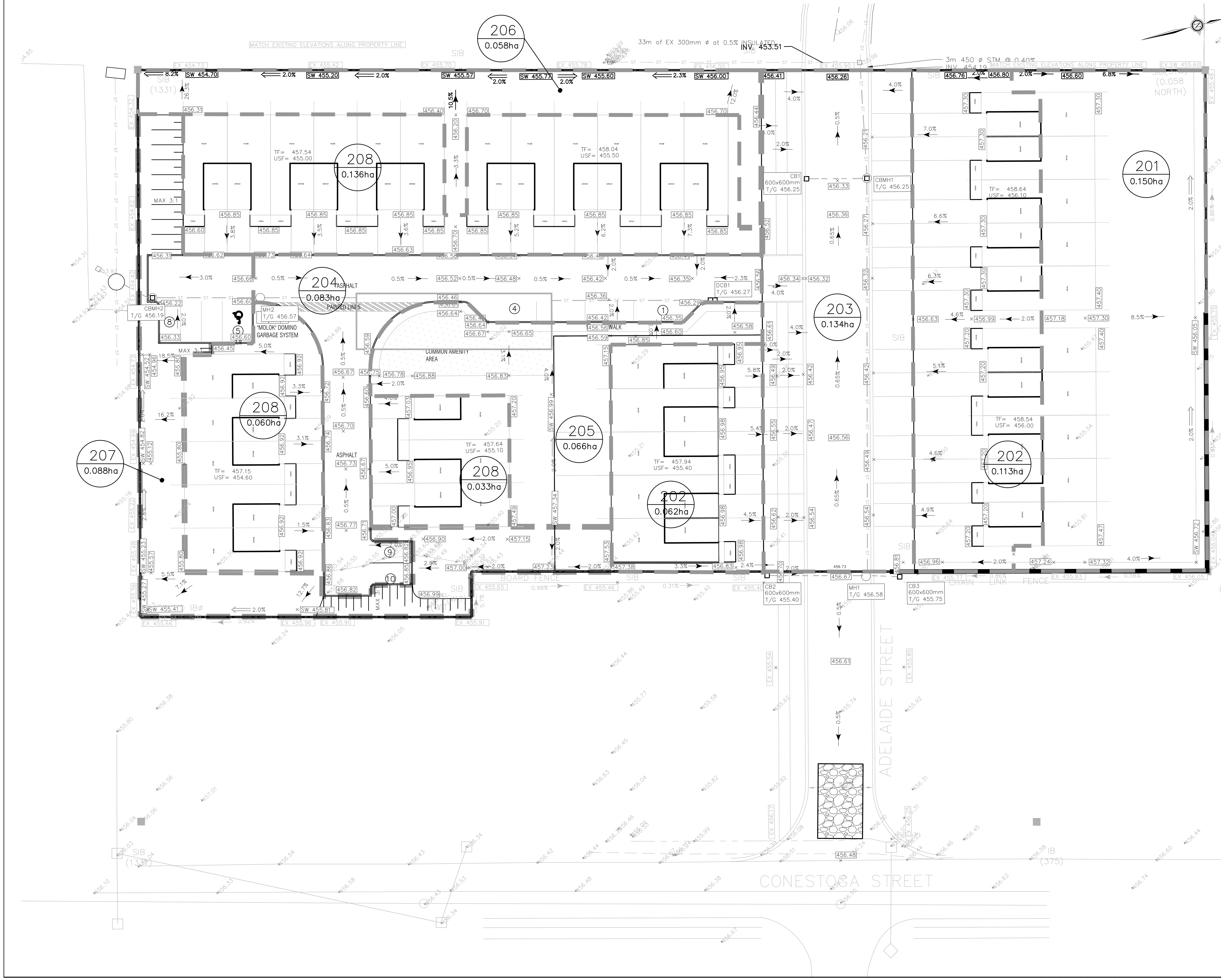
COUNTY OF WELLINGTON TOWNSHIP OF WELLINGTON NORTH

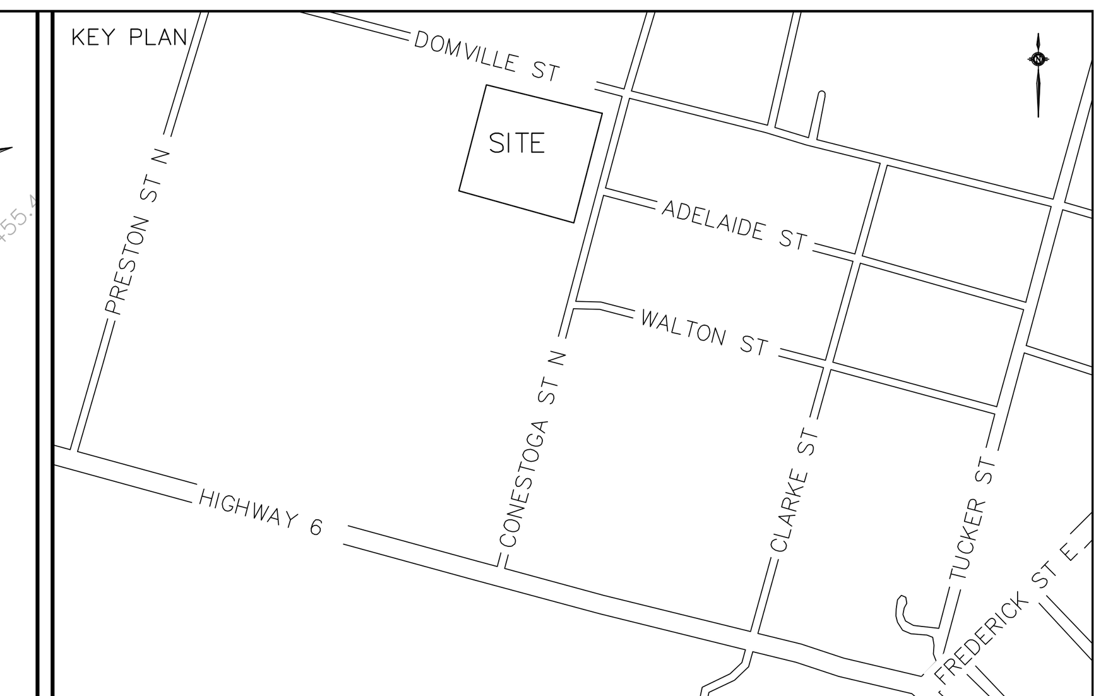
REGISTERED PROFESSIONAL ENGINEER
HOSSEIN MOAREFI

HM SEP 27 2022

0 10 20

SCALE: 1:1000





NOTES:

200 / 0.000ha — PROPOSED CATCHMENT AREA I.D. / CATCHMENT AREA

CATCHMENT AREA BOUNDARY

No.	REVISIONS	BY	DATE
	CONSTRUCTION		
	TENDER		
	ISSUE FOR APPROVALS		
	ISSUE BLOCK		

VED HOMES SUBDIVISION

ADELAIDE STREET EXTENSION, ARTHUR

COUNTY OF WELLINGTON   TOWNSHIP OF WELLINGTON NORTH

PROPOSED STORM
CATCHMENT PLAN

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER   SUDBURY

LICENSED PROFESSIONAL ENGINEER HOSSEIN MOAREFI 100162491 SEP 27/22 PROVINCE OF ONTARIO

CERTIFIED ENGINEERING TECHNOLOGIST OACETT ONTARIO KEVIN DEATH No 050753

DESIGNED BY: HM	0 5 10	DATE: JULY 2022
CHECKED BY: KD	SCALE: 1:250	SHEET
DRAWN BY: CN		1 OF 1
CHECKED BY: KD	REVISION No.	
FILE No. 22-087		

S:\2022\22-087\Drafting\22-087 VED Homes, Arthur - KSA SEPT 20, 2022 NEW TOPO.dwg 2. PROPOSED CATCHMENT 1-Nov-22 1:19:33 PM

Appendix B

Storm Design Sheet

VED Homes Subdivision, Township of Wellington North
STORM SEWER DESIGN SHEET

K. Smart Associates Limited	
Project Number	22-087
Designed By	Hosein Moarefi, P. Eng.
Checked By	Sandra Swanton, P. Eng.
Date	Nov-22

IDF Parameters - City of Greater Sudbury
5 Year Storm Event

A	*1497.99*
B	*12.041*
C	*0.858*

Rational Formula: Q=CIA/360
Q: peak flow (m^3/sec)
C: runoff coeficient
I: rainfall intensity (mm/hr)
A: area(ha)

Total time= Tc+pipe travel time (minute)
Tc: inlet time before pipe (minute)
pipe travel time= pipe length/60V (minute)
V: pipe velocity (m/sec)

Manning Equation:Qcap= (D/1000)^2.667*(S/100)^0.5/(3.211*n) (m^3/sec)
D: pipe size (mm)
S: slope of pipe (%)
n: roughness coeficient

1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Catchment	**From**	**To**	**Area (ha)**	**C**	**AC**	**Total AC**	**Tc (minutes)**	**Rain (mm/hr)**	**Q design (cms)**	**Design Pipe Size**	**Qcap (cms)**	**Velocity (m/sec)**	**Mannings 'n'**	**Pipe Slope (%)**	**Pipe Length (meters)**	**PipeTravel Time (minutes)**	**Total Time (minutes)**	**Q/Qcap (%)**
Blocks 1,2 and part of Adelaide Street		CBMH1	0.175	0.84	0.147	0.147	10.00	105.443	**0.043**									
Block 3 and part of Adelaide Street	CB1	CBMH1	0.112	0.85	0.095	0.095	10.00	105.443	**0.028**	250	**0.096**	1.952	0.013	2.6	7.2	0.061	10.06	29.1%
Blocks 1,2,3 and Adelaide Street	CBMH1	EX. CBMH19	0.287	0.85	0.244	0.244	10.06	105.191	**0.071**	375	**0.111**	1.003	0.013	0.4	16.9	0.281	10.34	64.3%
Condo Block, driveway, and overland flow from CBMH1		DCB1[1]					10.00	105.443	**0.082**									
	DCB1	Underground chambers					10.00	105.443	**0.082**	375	**0.124**	1.122	0.013	0.5	21	0.312	10.31	66.2%
	Underground chambers	MH2[2]					10.00	105.443	**0.023**	300	**0.137**	1.933	0.013	2	12.3	0.106	10.11	16.8%
West and south backyards, and east landscape	MH2	CBMH2					10.11	105.009	**0.023**	300	**0.153**	2.162	0.013	2.5	13.2	0.102	10.21	15.1%
Small parking lot and end of the driveway		CBMH2	0.017	0.90	0.015	0.015	10.00	105.443	**0.004**									
South Condo block backyards and the condo block east landscape		CBMH2	0.075	0.30	0.023	0.023	10.00	105.443	**0.007**									
	CBMH2	EX. CBMH					10.21	104.597	**0.034**	300	**0.244**	3.458	0.013	6.4	3.6	0.017	10.23	13.9%
Notes:																		
1	Taken from MIDUSS model																	
2	Outflow restricted by outlet of the underground chamber during 5 year event taken from MIDUSS model																	

Appendix C

Miduss Output Files

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"      1500.000   Max. Hydrograph"
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"             1   Chicago storm"
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"        12.041   Constant B"
"         0.858   Exponent C"
"         0.400   Fraction R"
"       180.000   Duration"
"         1.000   Time step multiplier"
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"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           101   South catchment"
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"         0.433   Total Area"
"        70.000   Flow length"
"         3.100   Overland Slope"
"         0.260   Pervious Area"
"        70.000   Pervious length"
"         3.100   Pervious slope"
"         0.173   Impervious Area"
"        70.000   Impervious length"
"         3.100   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.270   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.876   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.048     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           0.260      0.173      0.433      hectare"
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"              Rainfall volume        128.27     85.51      213.78     c.m"
"              Rainfall losses        36.053     6.101      24.072     mm"
"              Runoff depth           13.319     43.271     25.300     mm"
"              Runoff volume          34.60      74.94      109.55     c.m"
"              Runoff coefficient     0.270      0.876      0.512      "
"              Maximum flow           0.009      0.047      0.048      c.m/sec"
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"         0.552   Total Area"
"        75.000   Flow length"
"         1.900   Overland Slope"
"         0.331   Pervious Area"
"        75.000   Pervious length"
"         1.900   Pervious slope"
"         0.221   Impervious Area"
"        75.000   Impervious length"
"         1.900   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.270   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.876   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.061     0.048     0.000     0.000 c.m/sec"
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"            6   Combine "
"            1   Node #"
"                Catchet"
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"             Hydrograph volume           249.221    c.m"
"                    0.061     0.108     0.108     0.108"
" 38          START/RE-START TOTALS 102"
"            3   Runoff Totals on EXIT"
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"             Total Impervious area                      0.394    hectare"
"             Total % impervious                        40.000"
" 19          EXIT"
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"         0.433   Total Area"
"        70.000   Flow length"
"         3.100   Overland Slope"
"         0.260   Pervious Area"
"        70.000   Pervious length"
"         3.100   Pervious slope"
"         0.173   Impervious Area"
"        70.000   Impervious length"
"         3.100   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
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"         0.100   Pervious Ia/S coefficient"
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"                      0.096     0.000     0.000     0.000 c.m/sec"
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"              Time to Centroid       116.418    88.196     100.201    minutes"
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"              Rainfall volume        244.59     163.06     407.66     c.m"
"              Rainfall losses        51.150     7.022      33.499     mm"
"              Runoff depth           42.997     87.125     60.648     mm"
"              Runoff volume          111.71     150.90     262.61     c.m"
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"                      0.096     0.096     0.000     0.000"
" 33           CATCHMENT 102"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           102   Noerth catchment"
"        40.000   % Impervious"
"         0.552   Total Area"
"        75.000   Flow length"
"         1.900   Overland Slope"
"         0.331   Pervious Area"
"        75.000   Pervious length"
"         1.900   Pervious slope"
"         0.221   Impervious Area"
"        75.000   Impervious length"
"         1.900   Impervious slope"
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"        75.000   Pervious SCS Curve No."
"         0.458   Pervious Runoff coefficient"
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"         0.518   Impervious Initial abstraction"
"                      0.116     0.096     0.000     0.000 c.m/sec"
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"              Time to Centroid       120.881    88.962     102.599    minutes"
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"              Rainfall volume        311.81     207.88     519.69     c.m"
"              Rainfall losses        51.074     7.537      33.659     mm"
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"             Runoff volume          142.66     191.24     333.89     c.m"
"             Runoff coefficient     0.458      0.920      0.642      "
"             Maximum flow           0.048      0.107      0.116      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.116     0.212     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.116     0.212     0.212     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Catchet"
"             Maximum flow                  0.212    c.m/sec"
"             Hydrograph volume           596.499    c.m"
"                    0.116     0.212     0.212     0.212"
" 38          START/RE-START TOTALS 102"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                       0.985    hectare"
"             Total Impervious area                      0.394    hectare"
"             Total % impervious                        40.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                                  February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:                            C:\Users\hmoarefi\Desktop"
"                Output filename: VED Homes -5 Year-Post development- Run 8.out"
"                Licensee name:                                    Sandra Swanton"
"                Company                                K. Smart Associates Limited"
"                Date & Time last used:                     2022-11-02 at 8:41:27 AM"
" 81          ADD COMMENT================================================="
"            1  Lines of comment"
"               VED Homes Development - 5 Year - Post development-Run 8"
" 31          TIME PARAMETERS"
"         5.000   Time Step"
"       180.000   Max. Storm length"
"      1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"             1   Chicago storm"
"      1497.990   Coefficient A"
"        12.041   Constant B"
"         0.858   Exponent C"
"         0.400   Fraction R"
"       180.000   Duration"
"         1.000   Time step multiplier"
"               Maximum intensity           131.488    mm/hr"
"               Total depth                  49.372    mm"
"             4   5hyd   Hydrograph extension used in this file"
" 33           CATCHMENT 201"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           201   North backyard"
"         3.000   % Impervious"
"         0.150   Total Area"
"        21.000   Flow length"
"         6.000   Overland Slope"
"         0.146   Pervious Area"
"        21.000   Pervious length"
"         6.000   Pervious slope"
"         0.005   Impervious Area"
"        21.000   Impervious length"
"         6.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.269   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.874   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                       0.009     0.000     0.000     0.000 c.m/sec"
"              Catchment 201          Pervious   Impervious Total Area "
"              Surface Area           0.146      0.005      0.150      hectare"
"              Time of concentration  11.119     1.175      10.212     minutes"
"              Time to Centroid       113.122    88.255     110.853    minutes"
"              Rainfall depth         49.372     49.372     49.372     mm"
"              Rainfall volume        71.84      2.22       74.06      c.m"
"              Rainfall losses        36.074     6.219      35.179     mm"
"              Runoff depth           13.297     43.153     14.193     mm"
"              Runoff volume          19.35      1.94       21.29      c.m"
"              Runoff coefficient     0.269      0.874      0.287      "
"              Maximum flow           0.008      0.001      0.009      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                       0.009     0.009     0.000     0.000"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                       0.009     0.009     0.009     0.000"
" 40           HYDROGRAPH   Combine    4"
"             6   Combine "
"             4   Node #"
"                 North to Catchet"
"              Maximum flow                  0.009    c.m/sec"
"              Hydrograph volume            21.290    c.m"
"                       0.009     0.009     0.009     0.009"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                       0.009     0.000     0.009     0.009"
" 33           CATCHMENT 202"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           202   Blocks 1 to 3 roofs and front areas"
"        88.000   % Impervious"
"         0.175   Total Area"
"        11.000   Flow length"
"         4.800   Overland Slope"
"         0.021   Pervious Area"
"        11.000   Pervious length"
"         4.800   Pervious slope"
"         0.154   Impervious Area"
"        11.000   Impervious length"
"         4.800   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.269   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.855   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.047     0.000     0.009     0.009 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.021      0.154      0.175      hectare"
"             Time of concentration  8.066      0.852      1.149      minutes"
"             Time to Centroid       109.460    87.896     88.783     minutes"
"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        10.37      76.03      86.40      c.m"
"             Rainfall losses        36.091     7.147      10.620     mm"
"             Runoff depth           13.280     42.225     38.752     mm"
"             Runoff volume          2.79       65.03      67.82      c.m"
"             Runoff coefficient     0.269      0.855      0.785      "
"             Maximum flow           0.001      0.047      0.047      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.047     0.047     0.009     0.009"
" 33          CATCHMENT 203"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         203   Adelaide Street Extension"
"       79.000   % Impervious"
"        0.134   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.028   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.106   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.269   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.882   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.032     0.047     0.009     0.009 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.028      0.106      0.134      hectare"
"             Time of concentration  15.013     1.587      2.595      minutes"
"             Time to Centroid       117.894    88.804     90.988     minutes"
```

```
"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        13.89      52.26      66.16      c.m"
"             Rainfall losses        36.081     5.844      12.194     mm"
"             Runoff depth           13.291     43.527     37.178     mm"
"             Runoff volume          3.74       46.08      49.82      c.m"
"             Runoff coefficient     0.269      0.882      0.753      "
"             Maximum flow           0.001      0.032      0.032      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.032     0.079     0.009     0.009"
" 56          DIVERSION"
"         203   Node number"
"       0.111   Overflow threshold"
"       1.000   Required diverted fraction"
"           0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.000    c.m/sec"
"             Volume of diverted flow       0.000    c.m"
"             DIV00203.5hyd"
"             Major flow at 203"
"                    0.032     0.079     0.079     0.009 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Adelaide Street"
"             Maximum flow                 0.079    c.m/sec"
"             Hydrograph volume            117.633    c.m"
"                    0.032     0.079     0.079     0.079"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.032     0.000     0.079     0.079"
" 33          CATCHMENT 204"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         204   Access dirveway"
"       95.000   % Impervious"
"        0.083   Total Area"
"       70.000   Flow length"
"        0.500   Overland Slope"
"        0.004   Pervious Area"
"       70.000   Pervious length"
"        0.500   Pervious slope"
"        0.079   Impervious Area"
"       70.000   Impervious length"
"        0.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.270   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.888   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.022     0.000     0.079     0.079 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.079      0.083      hectare"
"             Time of concentration  48.255     5.100      5.780      minutes"
"             Time to Centroid       158.298    93.992     95.005     minutes"
"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        2.05       38.93      40.98      c.m"
"             Rainfall losses        36.049     5.543      7.069      mm"
"             Runoff depth           13.323     43.828     42.303     mm"
"             Runoff volume          0.55       34.56      35.11      c.m"
"             Runoff coefficient     0.270      0.888      0.857      "
"             Maximum flow           0.000      0.022      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.022     0.022     0.079     0.079"
" 33          CATCHMENT 205"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         205   Block 3 and southeast Condo Block backyard"
"        3.000   % Impervious"
"        0.066   Total Area"
"       45.000   Flow length"
"        2.600   Overland Slope"
"        0.064   Pervious Area"
"       45.000   Pervious length"
"        2.600   Pervious slope"
"        0.002   Impervious Area"
"       45.000   Impervious length"
"        2.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.270   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.879   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.003     0.022     0.079     0.079 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.064      0.002      0.066      hectare"
"             Time of concentration  22.574     2.386      20.724     minutes"
"             Time to Centroid       127.085    90.025     123.689    minutes"
```

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"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        31.61      0.98       32.59      c.m"
"             Rainfall losses        36.065     5.964      35.162     mm"
"             Runoff depth           13.306     43.407     14.209     mm"
"             Runoff volume          8.52       0.86       9.38       c.m"
"             Runoff coefficient     0.270      0.879      0.288      "
"             Maximum flow           0.003      0.001      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.003     0.024     0.079     0.079"
" 33          CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Condo Block roofs and front areas"
"       77.000   % Impervious"
"        0.196   Total Area"
"       18.000   Flow length"
"        4.000   Overland Slope"
"        0.045   Pervious Area"
"       18.000   Pervious length"
"        4.000   Pervious slope"
"        0.151   Impervious Area"
"       18.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.269   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.875   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.046     0.024     0.079     0.079 c.m/sec"
"             Catchment 208          Pervious   Impervious Total Area "
"             Surface Area           0.045      0.151      0.196      hectare"
"             Time of concentration  11.448     1.210      2.072      minutes"
"             Time to Centroid       113.524    88.310     90.432     minutes"
"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        22.26      74.51      96.77      c.m"
"             Rainfall losses        36.074     6.150      13.033     mm"
"             Runoff depth           13.298     43.221     36.339     mm"
"             Runoff volume          5.99       65.23      71.22      c.m"
"             Runoff coefficient     0.269      0.875      0.736      "
"             Maximum flow           0.002      0.046      0.046      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.046     0.065     0.079     0.079"
```

```
" 47          FILEI_O Read/Open DIV00203.5hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV00203.5hyd"
"             Major flow at 203"
"             Total volume                  0.000    c.m"
"             Maximum flow                  0.000    c.m/sec"
"                  0.000     0.065     0.079     0.079 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.000     0.065     0.079     0.079"
" 54          POND DESIGN"
"        0.065   Current peak flow    c.m/sec"
"        0.260   Target outflow    c.m/sec"
"        115.7   Hydrograph volume    c.m"
"          22.   Number of stages"
"      454.640   Minimum water level    metre"
"      455.650   Maximum water level    metre"
"      454.640   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                454.640     0.000     4.430"
"                454.688  1.01E-05     8.870"
"                454.736  1.01E-05    13.300"
"                454.784   0.00025    22.230"
"                454.832   0.00204    31.080"
"                454.880   0.00528    39.830"
"                454.929   0.00967    48.470"
"                454.977   0.01458    56.960"
"                455.025   0.01964    65.290"
"                455.073   0.02446    73.460"
"                455.121   0.02884    81.420"
"                455.169   0.03277    89.140"
"                455.217   0.03631    96.610"
"                455.265   0.03955   103.710"
"                455.313   0.04254   105.440"
"                455.361   0.04534   111.550"
"                455.410   0.04803   116.670"
"                455.458   0.05053   122.010"
"                455.506   0.05290   126.660"
"                455.554   0.05518   131.090"
"                455.602   0.05737   135.530"
"                455.650   0.05947   139.960"
"           1.   OUTFLOW PIPE"
"               Upstream Downstr'm      Pipe      Pipe   Manning     Entry"
"                 invert    invert    Length  Diameter       'n'   loss Ke"
"                454.760   454.750     0.600     0.200     0.015     0.500"
"             Peak outflow                  0.018    c.m/sec"
"             Maximum level               455.010    metre"
"             Maximum storage              62.712    c.m"
"             Centroidal lag                3.297   hours"
"                  0.000     0.065     0.018     0.079 c.m/sec"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                MH7"
"             Maximum flow                  0.018    c.m/sec"
"             Hydrograph volume           101.184    c.m"
"                  0.000     0.065     0.018     0.018"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.000     0.000     0.018     0.018"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Condo Block west backyard"
"        3.000   % Impervious"
"        0.058   Total Area"
"        6.000   Flow length"
"       16.000   Overland Slope"
"        0.056   Pervious Area"
"        6.000   Pervious length"
"       16.000   Pervious slope"
"        0.002   Impervious Area"
"        6.000   Impervious length"
"       16.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.790   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.005     0.000     0.018     0.018 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.056      0.002      0.058      hectare"
"             Time of concentration  3.907      0.413      3.613      minutes"
"             Time to Centroid       104.554    87.667     103.132    minutes"
"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        27.78      0.86       28.64      c.m"
"             Rainfall losses        36.261     10.382     35.485     mm"
"             Runoff depth           13.111     38.990     13.887     mm"
"             Runoff volume          7.38       0.68       8.05       c.m"
"             Runoff coefficient     0.266      0.790      0.281      "
"             Maximum flow           0.004      0.001      0.005      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.005     0.005     0.018     0.018"
" 33          CATCHMENT 207"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          207   Condo Block south backyard"
"        3.000   % Impervious"
"        0.088   Total Area"
"       12.000   Flow length"
"       12.000   Overland Slope"
"        0.085   Pervious Area"
"       12.000   Pervious length"
"       12.000   Pervious slope"
"        0.003   Impervious Area"
"       12.000   Impervious length"
"       12.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.267   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.837   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.006     0.005     0.018     0.018 c.m/sec"
"             Catchment 207          Pervious   Impervious Total Area "
"             Surface Area           0.085      0.003      0.088      hectare"
"             Time of concentration  6.455      0.682      5.945      minutes"
"             Time to Centroid       107.632    87.994     105.896    minutes"
"             Rainfall depth         49.372     49.372     49.372     mm"
"             Rainfall volume        42.14      1.30       43.45      c.m"
"             Rainfall losses        36.186     8.028      35.341     mm"
"             Runoff depth           13.186     41.344     14.030     mm"
"             Runoff volume          11.26      1.09       12.35      c.m"
"             Runoff coefficient     0.267      0.837      0.284      "
"             Maximum flow           0.006      0.001      0.006      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.006     0.010     0.018     0.018"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.006     0.010     0.010     0.018"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Overland to Catchet site"
"             Maximum flow                  0.010    c.m/sec"
"             Hydrograph volume            20.401    c.m"
"                    0.006     0.010     0.010     0.010"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Adelaide Street"
"             Maximum flow                  0.079    c.m/sec"
"             Hydrograph volume           117.633    c.m"
"                    0.006     0.079     0.010     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.006     0.079     0.079     0.000"
" 40          HYDROGRAPH   Combine    5"
"            6   Combine "
"            5   Node #"
"                Total flow to Catchet"
"             Maximum flow                  0.079    c.m/sec"
"             Hydrograph volume           117.633    c.m"
"                    0.006     0.079     0.079     0.079"
" 40          HYDROGRAPH   Confluence    2"
"            7   Confluence "
"            2   Node #"
"                Overland to Catchet site"
"             Maximum flow                  0.010    c.m/sec"
"             Hydrograph volume            20.401    c.m"
"                    0.006     0.010     0.079     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.006     0.010     0.010     0.000"
" 40          HYDROGRAPH   Combine    5"
"            6   Combine "
"            5   Node #"
"                Total flow to Catchet"
"             Maximum flow                  0.085    c.m/sec"
"             Hydrograph volume           138.035    c.m"
"                    0.006     0.010     0.010     0.085"
" 40          HYDROGRAPH   Confluence    3"
"            7   Confluence "
"            3   Node #"
"                MH7"
"             Maximum flow                  0.018    c.m/sec"
"             Hydrograph volume           101.184    c.m"
"                    0.006     0.018     0.010     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.006     0.018     0.018     0.000"
" 40          HYDROGRAPH   Combine    5"
"            6   Combine "
"            5   Node #"
```

```
"               Total flow to Catchet"
"            Maximum flow                  0.086    c.m/sec"
"            Hydrograph volume           239.219    c.m"
"                    0.006     0.018     0.018     0.086"
" 40         HYDROGRAPH   Confluence    4"
"           7   Confluence "
"           4   Node #"
"               North to Catchet"
"            Maximum flow                  0.009    c.m/sec"
"            Hydrograph volume            21.290    c.m"
"                    0.006     0.009     0.018     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.006     0.009     0.009     0.000"
" 40         HYDROGRAPH   Combine    5"
"           6   Combine "
"           5   Node #"
"               Total flow to Catchet"
"            Maximum flow                  0.089    c.m/sec"
"            Hydrograph volume           260.508    c.m"
"                    0.006     0.009     0.009     0.089"
" 38         START/RE-START TOTALS 4"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      0.950    hectare"
"            Total Impervious area                     0.500    hectare"
"            Total % impervious                       52.683"
" 19         EXIT"
```

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"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                               February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                          C:\Users\hmoarefi\Desktop"
" 81          ADD COMMENT================================================="
"           1  Lines of comment"
"              VED Homes Development - 100 Year - Post development-Run 8"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"             1   Chicago storm"
"     4641.755   Coefficient A"
"       21.190   Constant B"
"        0.942   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"              Maximum intensity           214.190    mm/hr"
"              Total depth                  94.147    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           201   North backyard"
"        3.000   % Impervious"
"        0.150   Total Area"
"       21.000   Flow length"
"        6.000   Overland Slope"
"        0.146   Pervious Area"
"       21.000   Pervious length"
"        6.000   Pervious slope"
"        0.005   Impervious Area"
"       21.000   Impervious length"
"        6.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.454   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.909   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.035     0.000     0.000     0.000 c.m/sec"
"              Catchment 201          Pervious   Impervious Total Area "
"              Surface Area           0.146      0.005      0.150      hectare"
"              Time of concentration  7.004      0.955      6.651      minutes"
"              Time to Centroid       103.642    86.253     102.628    minutes"
"              Rainfall depth         94.147     94.147     94.147     mm"
"              Rainfall volume        136.98     4.24       141.22     c.m"
"              Rainfall losses        51.414     8.583      50.129     mm"
"              Runoff depth           42.733     85.564     44.018     mm"
"              Runoff volume          62.18      3.85       66.03      c.m"
"              Runoff coefficient     0.454      0.909      0.468      "
"              Maximum flow           0.034      0.002      0.035      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.035     0.035     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                      0.035     0.035     0.035     0.000"
" 40          HYDROGRAPH   Combine    4"
"             6   Combine "
"             4   Node #"
"                 North to Catchet"
"              Maximum flow                 0.035    c.m/sec"
"              Hydrograph volume            66.027    c.m"
"                      0.035     0.035     0.035     0.035"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                      0.035     0.000     0.035     0.035"
" 33          CATCHMENT 202"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           202   Blocks 1 to 3 roofs and front areas"
"        88.000   % Impervious"
"         0.175   Total Area"
"        11.000   Flow length"
"         4.800   Overland Slope"
"         0.021   Pervious Area"
"        11.000   Pervious length"
"         4.800   Pervious slope"
"         0.154   Impervious Area"
"        11.000   Impervious length"
"         4.800   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.455   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.880   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
```

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"        0.518   Impervious Initial abstraction"
"                    0.082     0.000     0.035     0.035 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.021      0.154      0.175      hectare"
"             Time of concentration  5.081      0.693      0.982      minutes"
"             Time to Centroid       101.229    86.192     87.182     minutes"
"             Rainfall depth         94.147     94.147     94.147     mm"
"             Rainfall volume        19.77      144.99     164.76     c.m"
"             Rainfall losses        51.307     11.257     16.063     mm"
"             Runoff depth           42.840     82.890     78.084     mm"
"             Runoff volume          9.00       127.65     136.65     c.m"
"             Runoff coefficient     0.455      0.880      0.829      "
"             Maximum flow           0.005      0.079      0.082      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.082     0.082     0.035     0.035"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Adelaide Street Extension"
"       79.000   % Impervious"
"        0.134   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.028   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.106   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.456   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.926   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.057     0.082     0.035     0.035 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.028      0.106      0.134      hectare"
"             Time of concentration  9.457      1.290      2.235      minutes"
"             Time to Centroid       106.528    86.678     88.974     minutes"
"             Rainfall depth         94.147     94.147     94.147     mm"
"             Rainfall volume        26.49      99.66      126.16     c.m"
"             Rainfall losses        51.263     6.993      16.290     mm"
"             Runoff depth           42.884     87.154     77.857     mm"
"             Runoff volume          12.07      92.26      104.33     c.m"
"             Runoff coefficient     0.456      0.926      0.827      "
"             Maximum flow           0.006      0.055      0.057      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.057     0.139     0.035     0.035"
" 56          DIVERSION"
"           203   Node number"
"         0.111   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.028    c.m/sec"
"             Volume of diverted flow       8.529    c.m"
"             DIV00203.100hyd"
"             Major flow at 203"
"                    0.057     0.139     0.111     0.035 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Adelaide Street"
"             Maximum flow                 0.111    c.m/sec"
"             Hydrograph volume            232.447    c.m"
"                    0.057     0.139     0.111     0.111"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.057     0.000     0.111     0.111"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Access dirveway"
"       95.000   % Impervious"
"        0.083   Total Area"
"       70.000   Flow length"
"        0.500   Overland Slope"
"        0.004   Pervious Area"
"       70.000   Pervious length"
"        0.500   Pervious slope"
"        0.079   Impervious Area"
"       70.000   Impervious length"
"        0.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.458   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.932   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
```

```
"        0.518   Impervious Initial abstraction"
"                     0.038     0.000     0.111     0.111 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.079      0.083      hectare"
"             Time of concentration  30.397     4.146      4.807      minutes"
"             Time to Centroid       132.069    90.667     91.711     minutes"
"             Rainfall depth         94.147     94.147     94.147     mm"
"             Rainfall volume        3.91       74.23      78.14      c.m"
"             Rainfall losses        51.064     6.417      8.650      mm"
"             Runoff depth           43.083     87.730     85.497     mm"
"             Runoff volume          1.79       69.17      70.96      c.m"
"             Runoff coefficient     0.458      0.932      0.908      "
"             Maximum flow           0.000      0.038      0.038      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.038     0.038     0.111     0.111"
" 33          CATCHMENT 205"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         205   Block 3 and southeast Condo Block backyard"
"       3.000   % Impervious"
"       0.066   Total Area"
"      45.000   Flow length"
"       2.600   Overland Slope"
"       0.064   Pervious Area"
"      45.000   Pervious length"
"       2.600   Pervious slope"
"       0.002   Impervious Area"
"      45.000   Impervious length"
"       2.600   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious SCS Curve No."
"       0.457   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.467   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.929   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                     0.012     0.038     0.111     0.111 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.064      0.002      0.066      hectare"
"             Time of concentration  14.220     1.940      13.494     minutes"
"             Time to Centroid       112.337    87.533     110.871    minutes"
"             Rainfall depth         94.147     94.147     94.147     mm"
"             Rainfall volume        60.27      1.86       62.14      c.m"
"             Rainfall losses        51.108     6.685      49.776     mm"
"             Runoff depth           43.039     87.462     44.371     mm"
"             Runoff volume          27.55      1.73       29.29      c.m"
"             Runoff coefficient     0.457      0.929      0.471      "
"             Maximum flow           0.012      0.001      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.012     0.046     0.111     0.111"
" 33          CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Condo Block roofs and front areas"
"      77.000   % Impervious"
"       0.196   Total Area"
"      18.000   Flow length"
"       4.000   Overland Slope"
"       0.045   Pervious Area"
"      18.000   Pervious length"
"       4.000   Pervious slope"
"       0.151   Impervious Area"
"      18.000   Impervious length"
"       4.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious SCS Curve No."
"       0.455   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.467   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.911   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                     0.083     0.046     0.111     0.111 c.m/sec"
"             Catchment 208          Pervious   Impervious Total Area "
"             Surface Area           0.045      0.151      0.196      hectare"
"             Time of concentration  7.211      0.984      1.792      minutes"
"             Time to Centroid       103.878    86.281     88.565     minutes"
"             Rainfall depth         94.147     94.147     94.147     mm"
"             Rainfall volume        42.44      142.09     184.53     c.m"
"             Rainfall losses        51.313     8.380      18.254     mm"
"             Runoff depth           42.834     85.767     75.893     mm"
"             Runoff volume          19.31      129.44     148.75     c.m"
"             Runoff coefficient     0.455      0.911      0.806      "
"             Maximum flow           0.011      0.079      0.083      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.083     0.122     0.111     0.111"
" 47          FILEI_O Read/Open DIV00203.100hyd"
"           1   1=read/open; 2=write/save"
"           2   1=rainfall; 2=hydrograph"
"           1   1=runoff; 2=inflow; 3=outflow; 4=junction"
```

```
"             DIV00203.100hyd"
"             Major flow at 203"
"             Total volume                  8.529    c.m"
"             Maximum flow                  0.028    c.m/sec"
"                  0.028     0.122     0.111     0.111 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.028     0.150     0.111     0.111"
" 54          POND DESIGN"
"        0.150   Current peak flow    c.m/sec"
"        0.260   Target outflow    c.m/sec"
"        257.5   Hydrograph volume    c.m"
"          22.   Number of stages"
"      454.640   Minimum water level    metre"
"      455.650   Maximum water level    metre"
"      454.640   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                454.640     0.000     4.430"
"                454.688  1.01E-05     8.870"
"                454.736  1.01E-05    13.300"
"                454.784   0.00025    22.230"
"                454.832   0.00204    31.080"
"                454.880   0.00528    39.830"
"                454.929   0.00967    48.470"
"                454.977   0.01458    56.960"
"                455.025   0.01964    65.290"
"                455.073   0.02446    73.460"
"                455.121   0.02884    81.420"
"                455.169   0.03277    89.140"
"                455.217   0.03631    96.610"
"                455.265   0.03955   103.710"
"                455.313   0.04254   105.440"
"                455.361   0.04534   111.550"
"                455.410   0.04803   116.670"
"                455.458   0.05053   122.010"
"                455.506   0.05290   126.660"
"                455.554   0.05518   131.090"
"                455.602   0.05737   135.530"
"                455.650   0.05947   139.960"
"           1.   OUTFLOW PIPE"
"               Upstream Downstr'm      Pipe      Pipe   Manning     Entry"
"                 invert    invert    Length  Diameter       'n'   loss Ke"
"                454.760   454.750     0.600     0.200     0.015     0.500"
"             Peak outflow                  0.051    c.m/sec"
"             Maximum level               455.462    metre"
"             Maximum storage             122.381    c.m"
"             Centroidal lag                2.571   hours"
"                  0.028     0.150     0.051     0.111 c.m/sec"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                MH7"
"             Maximum flow                  0.051    c.m/sec"
"             Hydrograph volume           242.636    c.m"
"                    0.028     0.150     0.051     0.051"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.028     0.000     0.051     0.051"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Condo Block west backyard"
"        3.000   % Impervious"
"        0.058   Total Area"
"        6.000   Flow length"
"       16.000   Overland Slope"
"        0.056   Pervious Area"
"        6.000   Pervious length"
"       16.000   Pervious slope"
"        0.002   Impervious Area"
"        6.000   Impervious length"
"       16.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.448   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.815   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.014     0.000     0.051     0.051 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.056      0.002      0.058      hectare"
"             Time of concentration  2.461      0.336      2.348      minutes"
"             Time to Centroid       97.960     85.456     97.294     minutes"
"             Rainfall depth         94.147     94.147     94.147     mm"
"             Rainfall volume        52.97      1.64       54.61      c.m"
"             Rainfall losses        51.939     17.397     50.903     mm"
"             Runoff depth           42.208     76.750     43.244     mm"
"             Runoff volume          23.75      1.34       25.08      c.m"
"             Runoff coefficient     0.448      0.815      0.459      "
"             Maximum flow           0.013      0.001      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.014     0.014     0.051     0.051"
" 33          CATCHMENT 207"
```

```
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Condo Block south backyard"
"       3.000   % Impervious"
"       0.088   Total Area"
"      12.000   Flow length"
"      12.000   Overland Slope"
"       0.085   Pervious Area"
"      12.000   Pervious length"
"      12.000   Pervious slope"
"       0.003   Impervious Area"
"      12.000   Impervious length"
"      12.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious SCS Curve No."
"       0.452   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.467   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.854   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.022     0.014     0.051     0.051 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.085      0.003      0.088      hectare"
"            Time of concentration  4.067      0.555      3.873      minutes"
"            Time to Centroid       100.031    86.113     99.263     minutes"
"            Rainfall depth         94.147     94.147     94.147     mm"
"            Rainfall volume        80.36      2.49       82.85      c.m"
"            Rainfall losses        51.597     13.750     50.462     mm"
"            Runoff depth           42.550     80.397     43.685     mm"
"            Runoff volume          36.32      2.12       38.44      c.m"
"            Runoff coefficient     0.452      0.854      0.464      "
"            Maximum flow           0.021      0.001      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.022     0.036     0.051     0.051"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.022     0.036     0.036     0.051"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Overland to Catchet site"
"            Maximum flow                0.036    c.m/sec"
"            Hydrograph volume           63.524    c.m"
"                   0.022     0.036     0.036     0.036"
" 40          HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               Adelaide Street"
"            Maximum flow                  0.111    c.m/sec"
"            Hydrograph volume           232.447    c.m"
"                   0.022     0.111     0.036     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.022     0.111     0.111     0.000"
" 40          HYDROGRAPH   Combine    5"
"           6   Combine "
"           5   Node #"
"               Total flow to Catchet"
"            Maximum flow                  0.111    c.m/sec"
"            Hydrograph volume           232.447    c.m"
"                   0.022     0.111     0.111     0.111"
" 40          HYDROGRAPH   Confluence    2"
"           7   Confluence "
"           2   Node #"
"               Overland to Catchet site"
"            Maximum flow                  0.036    c.m/sec"
"            Hydrograph volume            63.524    c.m"
"                   0.022     0.036     0.111     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.022     0.036     0.036     0.000"
" 40          HYDROGRAPH   Combine    5"
"           6   Combine "
"           5   Node #"
"               Total flow to Catchet"
"            Maximum flow                  0.140    c.m/sec"
"            Hydrograph volume           295.972    c.m"
"                   0.022     0.036     0.036     0.140"
" 40          HYDROGRAPH   Confluence    3"
"           7   Confluence "
"           3   Node #"
"               MH7"
"            Maximum flow                  0.051    c.m/sec"
"            Hydrograph volume           242.636    c.m"
"                   0.022     0.051     0.036     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.022     0.051     0.051     0.000"
" 40          HYDROGRAPH   Combine    5"
"           6   Combine "
"           5   Node #"
"               Total flow to Catchet"
"            Maximum flow                  0.176    c.m/sec"
"            Hydrograph volume           538.608    c.m"
"                   0.022     0.051     0.051     0.176"
```

```
" 40          HYDROGRAPH   Confluence    4"
"            7   Confluence "
"            4   Node #"
"                North to Catchet"
"             Maximum flow                  0.035    c.m/sec"
"             Hydrograph volume            66.027    c.m"
"                     0.022     0.035     0.051     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.022     0.035     0.035     0.000"
" 40          HYDROGRAPH   Combine    5"
"            6   Combine "
"            5   Node #"
"                Total flow to Catchet"
"             Maximum flow                  0.209    c.m/sec"
"             Hydrograph volume           604.635    c.m"
"                     0.022     0.035     0.035     0.209"
" 38          START/RE-START TOTALS 4"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.950    hectare"
"             Total Impervious area                     0.500    hectare"
"             Total % impervious                       52.683"
" 19          EXIT"
```

Appendix D

Underground Chamber Storage and Specifications

Project: **Vedd Homes - 60 chambers**

Chamber Model - SC-740
Units - **Metric** (Click Here for Imperial)

Number of chambers - 60
Voids in the stone (porosity) - 40 %
Base of Stone Elevation - 454.59 m
Amount of Stone Above Chambers - 152 mm
Amount of Stone Below Chambers - 152 mm

☑ Include Perimeter Stone in Calculations

218.24 sq.meters Min. Area - 188.399 sq.meters

StormTech SC-740 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	2.22	2.22	139.965	455.65
1041	0.00	0.00	2.22	2.22	137.748	455.63
1016	0.00	0.00	2.22	2.22	135.531	455.60
991	0.00	0.00	2.22	2.22	133.314	455.58
965	0.00	0.00	2.22	2.22	131.097	455.55
940	0.00	0.00	2.22	2.22	128.879	455.53
914	0.00	0.09	2.18	2.27	126.662	455.50
889	0.00	0.28	2.11	2.38	124.389	455.48
864	0.01	0.48	2.03	2.50	122.006	455.45
838	0.02	1.03	1.81	2.83	119.501	455.43
813	0.02	1.36	1.67	3.03	116.668	455.40
787	0.03	1.62	1.57	3.19	113.634	455.38
762	0.03	1.83	1.49	3.31	110.447	455.35
737	0.03	2.01	1.41	3.42	107.135	455.32
711	0.04	2.15	1.36	3.51	103.714	455.30
686	0.04	2.30	1.30	3.60	100.207	455.27
660	0.04	2.47	1.23	3.70	96.608	455.25
635	0.04	2.59	1.18	3.77	92.909	455.22
610	0.04	2.69	1.14	3.83	89.137	455.20
584	0.05	2.79	1.10	3.89	85.307	455.17
559	0.05	2.89	1.06	3.95	81.415	455.15
533	0.05	2.98	1.03	4.00	77.466	455.12
508	0.05	3.06	0.99	4.06	73.462	455.10
483	0.05	3.15	0.96	4.11	69.407	455.07
457	0.05	3.22	0.93	4.15	65.298	455.05
432	0.05	3.29	0.90	4.19	61.151	455.02
406	0.06	3.36	0.87	4.23	56.963	454.99
381	0.06	3.41	0.85	4.27	52.732	454.97
356	0.06	3.47	0.83	4.30	48.466	454.94
330	0.06	3.53	0.81	4.33	44.164	454.92
305	0.06	3.58	0.79	4.36	39.832	454.89
279	0.06	3.62	0.77	4.39	35.469	454.87
254	0.06	3.66	0.75	4.41	31.078	454.84
229	0.06	3.70	0.74	4.44	26.665	454.82
203	0.06	3.74	0.72	4.46	22.229	454.79
178	0.06	3.75	0.72	4.47	17.771	454.77
152	0.00	0.00	2.22	2.22	13.303	454.74
127	0.00	0.00	2.22	2.22	11.086	454.72
102	0.00	0.00	2.22	2.22	8.869	454.69
76	0.00	0.00	2.22	2.22	6.652	454.66
51	0.00	0.00	2.22	2.22	4.434	454.64
25	0.00	0.00	2.22	2.22	2.217	454.61

StormTech SC-740 Chamber

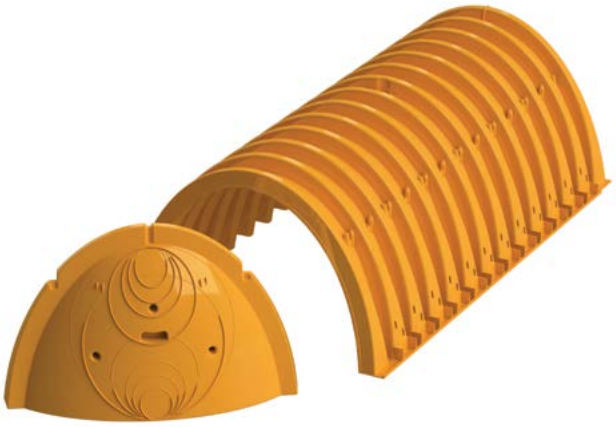
Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

StormTech SC-740 Chamber (not to scale)

Nominal Specifications

Size (Lx W x H)	85.4” x 51.0” x 30.0” (2,170 x 1,295 x 762 mm)
Chamber Storage	45.9 ft³ (1.30 m³)
Min. Installed Storage*	74.9 ft³ (2.12 m³)
Weight	74.0 lbs (33.6 kg)

*Assumes 6” (150 mm) stone above, below and between chambers and 40% stone porosity.

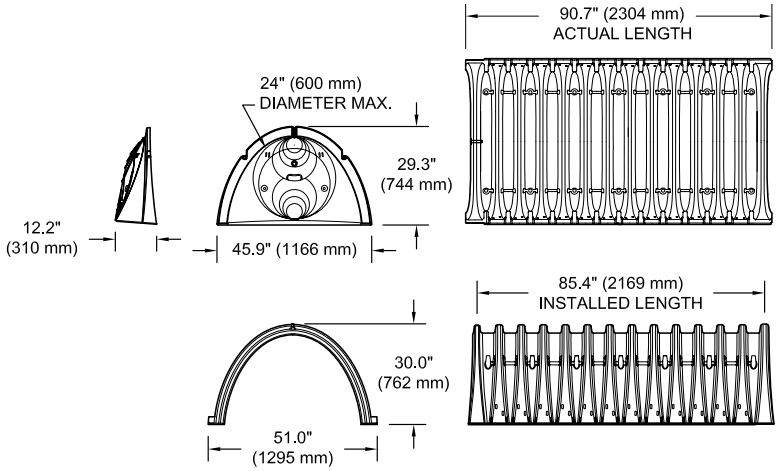


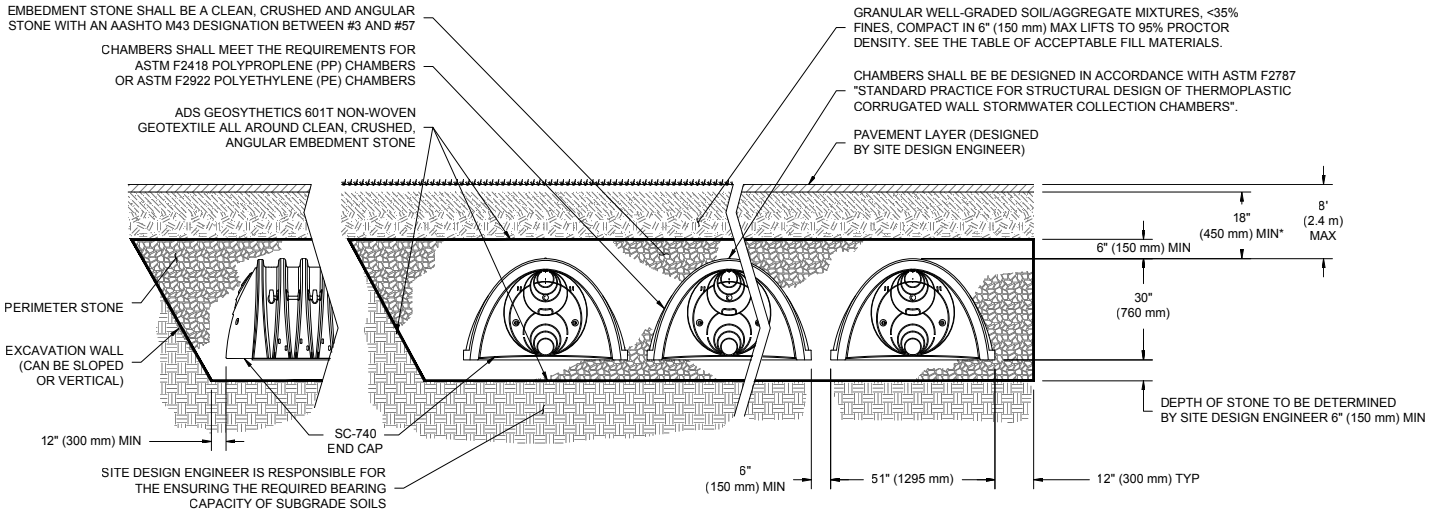
Shipping

30 chambers/pallet

60 end caps/pallet

12 pallets/truck





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

The installed chamber system shall provide the load factors specified in the aashto lrfd bridge design specifications section 12.12 for earth and live loads, with consideration for impact and multiple vehicle presences.

SC-740 Cumulative Storage Volumes per chamber
Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System in. (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	45.90 (1.300)	72.64 (2.057)
39 (991)	45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (940)	45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1.269)	62.97 (1.783)
31 (787)	44.01 (1.246)	w61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1.365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	1.85 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37.47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	0 (0)	6.76 (0.191)
5 (127)	0 (0)	5.63 (0.160)
4 (102)	0 (0)	4.51 (0.128)
3 (76)	0 (0)	3.38 (0.096)
2 (51)	0 (0)	2.25 (0.064)
1 (25)	0 (0)	1.13 (0.032)

Stone Cover

Stone Foundation

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber

ft³ (m³)	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

TONS (yds³)	Stone Foundation Depth		
	6	12	16
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

Volume Excavation Per Chamber

yd³ (m³)	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.