BUCHANAN APARTMENT BUILDING
5640 STANLEY AVENUE, NIAGARA FALLS

STORM WATER MANAGEMENT DESIGN BRIEF
NEW DEVELOPMENT DRAINAGE SYSTEM

REV 0 – July 05, 2023

PREPARED BY:

HALLEX ENGINEERING LTD.

HALLEX PROJECT #221014

HALLEX NIAGARA
4999 VICTORIA AVENUE
NIAGARA FALLS, ON L2E 4C9

HALLEX HAMILTON
745 SOUTH SERVICE ROAD, UNIT 205
STONEY CREEK, ON L8E 5Z2

TABLE OF CONTENTS

1. PRE-DEVELOPMENT CONDITIONS

1.1 LOCATION

The proposed Buchanan apartment building development is located at 5640 Stanley Avenue, which is at the southeast corner of the Stanley Avenue and North Street intersection and at the at the southwest corner of the Buchanan Avenue and North Street intersection in the City of Niagara Falls, ON.

1.2 DRAINAGE PATTERN

The current drainage path for the site consists partly of overland sheet flow to the existing 525mm municipal storm sewer at Buchanan Avenue, partly of overland sheet flow to the existing 900mm municipal storm sewer at North Street and partly of overland sheet flow to the existing 2400mm municipal storm sewer at Stanley Avenue. The municipal storm sewer at Buchanan Avenue drains to the municipal storm sewer at North Street which in turn drains to the municipal storm sewer at Stanley Avenue. The proposed stormwater management controls will ensure the storm flows are controlled to the pre-development flow rate to the existing municipal storm sewer at Stanley Avenue.

2. PROPOSED WORK

2.1 GRADING

The objective of the design is to utilize the existing natural slope and achieve the minimum and maximum slopes in the grading of the granular/asphalt surfaces. This will ensure the surface not only drains as per the design but is not too steep. The grading of the site also ensures that the storm water flow will mostly drain through the onsite drainage system for storm water quantity and quality controls. The proposed drainage system onsite has been designed according to the five-year storm event as per the City of Niagara Falls intensity-duration-frequency curve.

2.2 DRAINAGE

The proposed design requires 143.6 metres of storm sewer piping, five parking structure drains, ten Zurn ZCF121 Control-Flo roof drains and a Hydroguard HG4 oil and grit separator.

3. DESIGN CONSIDERATIONS

3.1 PRE-DEVELOPMENT SITE DRAINAGE

3.1.1 Peak Runoff

The total drainage area for the development is 0.418 hectares with an existing runoff coefficient of 0.79 based on the existing roof, asphalt and grass surfaces.

The time of concentration is determined to be 10 minutes to the start of the existing drainage system as required by the City of Niagara Falls municipal standards.

Using the Rational Method, the peak flow rates are $Q = \frac{CiA}{360}$

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Stanley Avenue	0.418	10
5-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.418	0.79	84	77.0

Therefore, the total pre-development flow for the subject site is 77.0L/s for the five-year storm.

3.1.2 Quantity

There is no known storm quantity control measure in place for the pre-development condition.

3.1.3 Quality

There is no known storm quality control measure in place for the pre-development condition.

3.2 POST-DEVELOPMENT SITE DRAINAGE

3.2.1 Peak Runoff

The proposed Buchanan apartment building development consists of the demolition of the existing buildings and parking areas and the construction of a new apartment building, asphalt laneway & parking areas, underground parking garage and grass areas. The resulting runoff coefficient in the post-development condition of the site is 0.80.

The proposed development will drain through the proposed onsite storm drainage system and shall discharge to the existing 2400mm municipal storm sewer at Stanley Avenue as per the existing site condition. Part of the site will continue to drain directly to Buchanan, North Street and Stanley Avenue via sheet flow similar to the pre-development condition.

The site's storm sewer pipes are designed according to the 5-year minor storm. Utilizing the minimum recommended time of concentration of 10 minutes, the time for storm water to flow from the farthest drainage area to the municipal storm sewer at Stanley Avenue, as outlined in Exhibit #1, is calculated to be 11.64 minutes.

Using the Rational Method, the peak flow rates are as follows:

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Stanley Avenue	0.083	10
Prop. Sewer	Sewer	Stanley Avenue	0.335	10
5-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.083	0.45	84	8.6
Prop. Sewer	0.335	0.89	84	69.4
TOTAL	0.418	0.80	84	78.0

Therefore, the total post-development flow for the subject site is 78.0L/s for the five-year storm. The flows and other design information are contained in Exhibit #1 for the five -year storm at the end of the design brief.

3.2.2 Quantity

The post-development storm water runoff to the existing 2400mm municipal storm sewer at Stanley Avenue is slightly higher than the pre-development runoff. As such, storm water detention is required to ensure that the existing municipal sewer does not surcharge as a result of the proposed development.

Stormwater quantity controls for the site will be achieved by utilizing ten Zurn ZCF121 Control-Flo roof drains. The Control-Flo roof drains will ensure the post-development runoff is controlled to the pre-development runoff rate for the five-year storm event. The resulting 24m^3 volume generated from the five-year storm will be contained on the roof of the apartment building.

The following table summarizes the pre-development / allowable flow rates, the post-development uncontrolled flow rates and the post-development controlled flow rates for the subject site:

	Pre- Development / Allowable Flow Rate (L/s)	Post- Development Uncontrolled Flow Rate (L/s)	Post- Development Controlled Flow Rate (L/s)
5-year Storm			
Area.1	77.0	8.6	8.6
Prop. Sewer		69.4	49.7
TOTAL	77.0	78.0	58.3

The roof drain sizing, controlled flow rates, typical ponding depths and subsequent storage volumes for the detained flows are shown on Exhibit #2 for the five-year storm at the end of the design brief.

3.2.3 Quality

The storm water collected in the proposed development passes through a Hydroguard HG4, which achieves a total suspended solids removal of at least 87%. This value is greater than the required 'Normal' treatment of 70% as indicated in the MOE Stormwater Management Planning and Design Manual, dated March 2003 (refer to Chapter 3: Environmental Design Criteria, Section 3.3.1.1. Level of Protection). The design calculations from the manufacturer as well as the drawings for the unit are included in Appendix 'A' of this report.

3.2.4 Maintenance Recommendations

The storm sewer system includes pipes, drains and the oil/grit separator. It is important to regularly inspect the elements to ensure that storm water is flowing as originally designed. Debris and sediment commonly clog the system and reduce the overall effectiveness.

The following maintenance and inspection tasks should be done:

1. Inspect the inlet pipes and outlet pipes for structural integrity. (Annually) Check inlet/ outlet pipes for structural integrity to ensure they aren't crumbling or broken.
2. Conduct routine inspections for trash or other debris that may be blocking the inlet and outlet pipes. (Monthly and after rain events) Remove all trash and debris.
3. Inspect and clean the storm sewer system (Every 5 years or as needed). Catchbasins to be inspected annually and debris removed when the debris reaches a depth of ½ from the bottom of the sump to the bottom of the pipe.
4. Inspect for sediment accumulation at pipes (Semi-annually and after rain events). It is important to clean out sediment that might be restricting water flow.
5. Do not dump any materials in the storm sewer system.
6. Inspect the Hydroguard Oil/Grit Separator (Annually). Procedures for inspection are provided in the Hydroguard Owner's Manual. A vacuum truck is to be used for maintenance of the Hydroguard.

4. CONCLUSION

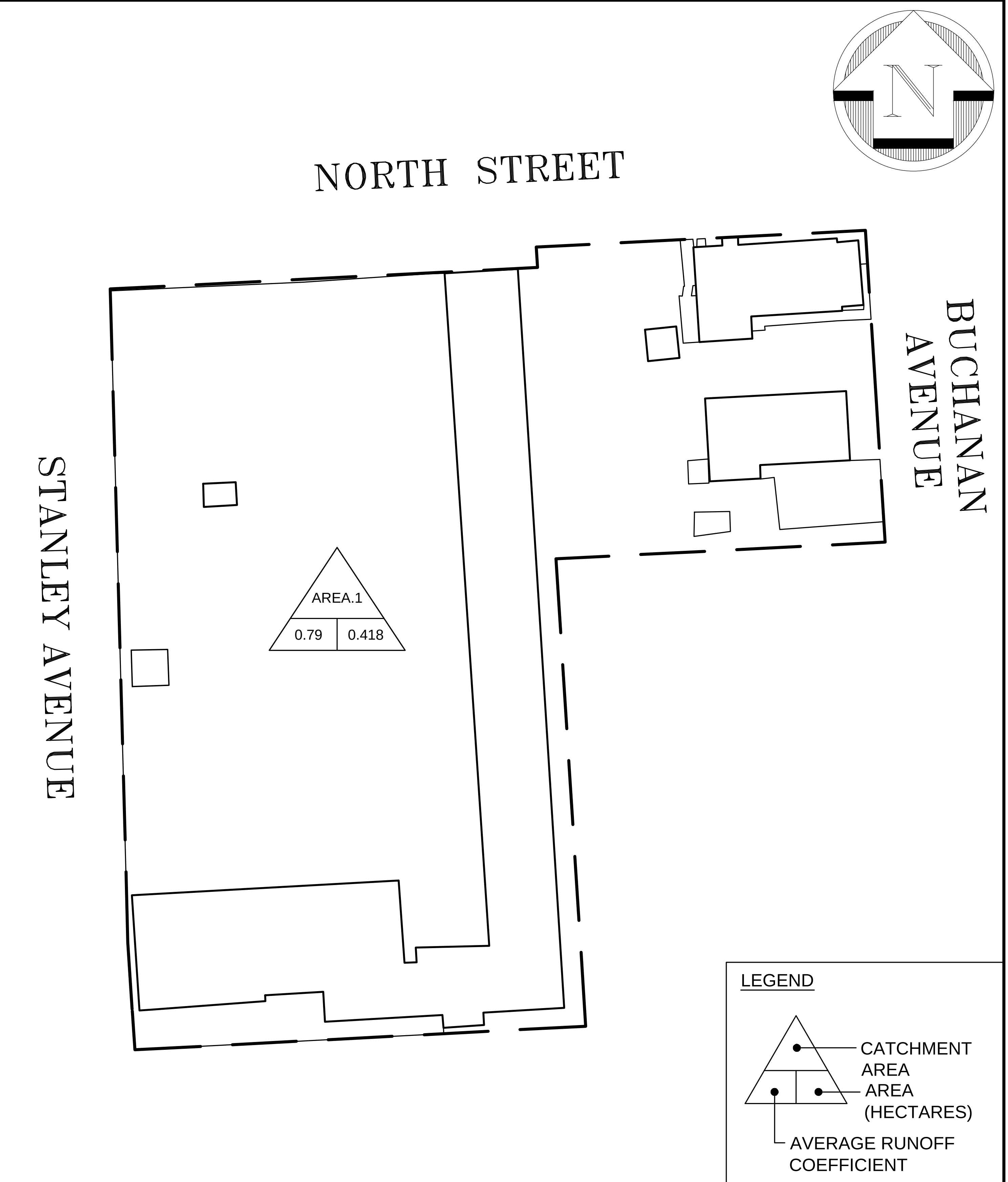
The aforementioned calculations and recommendations for the storm drainage system are based on the current design for the site as of writing this report.

We trust this report meets your approval. Please contact the undersigned should you have any questions or comments.

Yours truly,
HALLEX ENGINEERING LTD

Jim Halucha P.Eng
Civil/Structural Engineer

Jonathan Skinner, C.E.T., B.Tech
Civil Technologist



HALLEX ENGINEERING LTD.
4999 Victoria Avenue, Niagara Falls, ON L2E 4C9 Tel: 905-357-4015 Fax: 905-353-1105
745 South Service Rd. Unit 205, Stoney Creek, ON L8E 5Z2 Tel: 905-561-4016 Fax: 905-561-1105

PROJECT: BUCHANAN APARTMENT BUILDING 5640 STANLEY AVENUE, NIAGARA FALLS

SHEET TITLE: PRE-DEVELOPMENT CATCHMENT AREAS

DATE: 07/05/2023

JOB No.: 221014

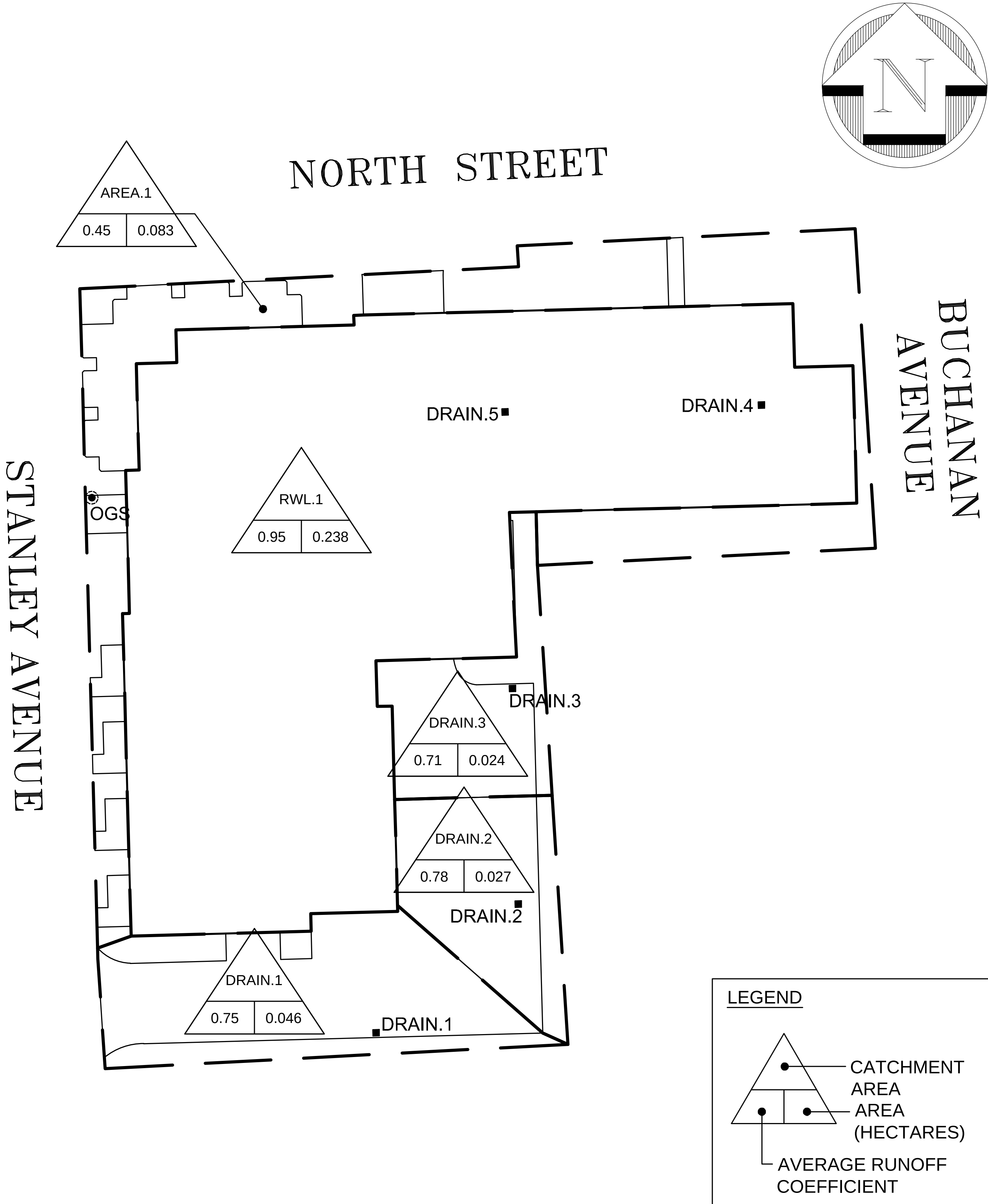
SCALE: 1:500

DR. BY: JS

CH. BY: JH

DWG. CSK1

REV. 0



HALLEX ENGINEERING LTD.

4999 Victoria Avenue, Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105

745 South Service Rd. Unit 205, Stoney Creek, ON L8E 5Z2
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT:
BUCHANAN APARTMENT BUILDING
5640 STANLEY AVENUE, NIAGARA FALLS

SHEET TITLE:
POST-DEVELOPMENT CATCHMENT AREAS

DATE: 07/05/2023
JOB No.: 221014
SCALE: 1:500
DR. BY: JS
CH. BY: JH
DWG. CSK2
REV. 0

HALLEX ENGINEERING LTD.

Buchanan Apartment Building
Exhibit #1 - 5 Year Post - Development Calculations

MUNICIPALITY: **Niagara Falls**

Rainfall Intensity Values = A= 719.500, B= 6.340, C= 0.769

manning's n = 0.013 PVC Pipe; 0.013 Conc Pipe; 0.024 Corr. Stl Pipe; 0.035 Grass Swale

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre- ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up- stream	Down- stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
1	**Area 1**	**Street**	**N/A**	**0.083**	**0.083**	**10.00**	**N/A**	**84**	**23191**	**746.1**	**0.0086**	**0.0086**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Paved	-	-	-	0.025	-	-	-	-	18149.2	453.7	-	-	-	-	-	-	-	-
Grass	-	-	-	0.058	-	-	-	-	5041.4	292.4	-	-	-	-	-	-	-	-
2	**Drain. 1**	**Drain. 2**	**25.7**	**0.046**	**0.046**	**10.00**	**0.42**	**84**	**23191**	**690.7**	**0.0080**	**0.0080**	**0.0100**	**0.0328**	**1.0440**	**0.200**	**183.83**	**183.57**
Paved	-	-	-	0.035	-	-	-	-	18149.2	635.2	-	-	-	-	-	-	-	-
Grass	-	-	-	0.011	-	-	-	-	5041.4	55.5	-	-	-	-	-	-	-	-
3	**Drain. 2**	**Drain. 3**	**20.5**	**0.027**	**0.073**	**10.42**	**0.33**	**82**	**22743**	**1107.0**	**0.0128**	**0.0128**	**0.0100**	**0.0328**	**1.0440**	**0.200**	**183.57**	**183.36**
Paved	-	-	-	0.022	-	-	-	-	17798.6	391.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.005	-	-	-	-	4944.0	24.7	-	-	-	-	-	-	-	-
4	**Drain. 3**	**Pipe. 1**	**19.2**	**0.024**	**0.097**	**10.75**	**0.31**	**81**	**22404**	**1439.1**	**0.0167**	**0.0167**	**0.0100**	**0.0328**	**1.0440**	**0.200**	**183.36**	**183.16**
Paved	-	-	-	0.017	-	-	-	-	17533.8	298.1	-	-	-	-	-	-	-	-
Grass	-	-	-	0.007	-	-	-	-	4870.5	34.1	-	-	-	-	-	-	-	-
5	**Drain. 4**	**Drain. 5**	**24.4**	**0.000**	**0.000**	**10.00**	**0.39**	**84**	**0**	**0.0**	**0.0000**	**0.0000**	**0.0100**	**0.0328**	**1.0440**	**0.200**	**183.49**	**183.24**
Hide	-	-	-	0.000	-	-	-	-	0.0	0.0	-	-	-	-	-	-	-	-
6	**Drain. 5**	**Pipe. 1**	**7.1**	**0.000**	**0.000**	**10.39**	**0.12**	**83**	**0**	**0.0**	**0.0000**	**0.0000**	**0.0100**	**0.0328**	**1.0440**	**0.200**	**183.24**	**183.16**
Hide	-	-	-	0.000	-	-	-	-	0.0	0.0	-	-	-	-	-	-	-	-
7	**RWL. 1**	**Pipe. 1**	**N/A**	**0.238**	**0.238**	**10.00**	**N/A**	**84**	**19157**	**4559.5**	**0.0528**	**0.0331**	**0.0100**	**N/A**	**N/A**	**0.300**	**N/A**	**N/A**
Roof	-	-	-	0.238	-	-	-	-	19157.5	4559.5	-	-	-	-	-	-	-	-
8	**Pipe. 1**	**OGS**	**38.9**	**0.000**	**0.335**	**11.06**	**0.48**	**80**	**0**	**5998.6**	**0.0694**	**0.0497**	**0.0100**	**0.0967**	**1.3680**	**0.300**	**183.11**	**182.72**
9	**OGS**	**Street**	**7.8**	**0.000**	**0.335**	**11.54**	**0.10**	**78**	**0**	**5998.6**	**0.0694**	**0.0497**	**0.0100**	**0.0967**	**1.3680**	**0.300**	**182.66**	**182.58**

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

Buchanan Apartment Building
Exhibit #2 - 5 Year Orifice Plate and Storage Volume Calcs

Site Data

Roof Discharge	Total Flow (m^3/s)	Description
Control Flow Discharge	0.00038	Flow per 25.4mm in head per ZCF121 roof drain
5 year Roof Flow	0.0528	Un-controlled flow rate

Required Storage

Roof Discharge	Required Storage Volume*	Roof Ponding (100 year storm)			ZCF121 Flow Rate
		Area	Depth	Allowable Volume	
	(m^3)	(m^2)	(m)	(m^3)	(m^3/s)
Roof Drain a	2	83.5	0.055	2.30	0.00083
Roof Drain b	2	87.9	0.055	2.42	0.00083
Roof Drain c	2	87.9	0.055	2.42	0.00083
Roof Drain d	2	87.9	0.055	2.42	0.00083
Roof Drain e	3	92.5	0.070	3.24	0.00106
Roof Drain f	2	76.2	0.060	2.29	0.00091
Roof Drain g	2	77.3	0.055	2.13	0.00083
Roof Drain h	3	105.7	0.060	3.17	0.00091
Roof Drain i	3	105.8	0.060	3.17	0.00091
Roof Drain j	3	102.5	0.065	3.33	0.00098
Total	24			26.89	0.00890

* Calculated using using SWMM 5.1 modelling software

Total Storage = 26.9 m^3 Required Storage Achieved

APPENDIX ‘A’

Hydroguard HG4

Sizing Calculations and Schematic

Hydroworks

Hydroworks Sizing Summary

Buchanan Apartment Building Development
5640 Stanley Ave, Niagara Falls

07-05-2023

Recommended Size: Hydroguard HG 4

A Hydroguard HG 4 is recommended to provide 80.0 % annual TSS removal based on a drainage area of 0.335 (ha) with an imperviousness of 89.1 % and St. Catherines A, Ontario rainfall for the Hydroworks standard particle size distribution.

The recommended Hydroguard HG 4 treats 97 % of the annual runoff and provides 87 % annual TSS removal for the St. Catherines A rainfall records and Hydroworks standard particle size distribution.

The Hydroguard has a headloss coefficient (K) of 1.6. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .1 (m3/s) for the given 300 (mm) pipe diameter at 1% slope. The headloss was calculated to be 153 (mm) based on a flow depth of 300 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the Hydroguard .

TSS Removal Sizing Summary

Hydroworks Hydrodynamic Separator Sizing Program - Hydroguard

File   Product   Units   CAD   Video   Help

General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

Site Parameters
Area (ha): 0.335
Imperviousness (%): 89.1

Units
☐ U.S.
☑ Metric

Rainfall Station
St. Catherines A — Ontario
1971 To 2005 — Rainfall Timestep = 60 min.

Project Title (2 lines): Buchanan Apartment Building Development
5640 Stanley Ave. Niagara Falls

Outlet Pipe
Diam. (mm): 300   Slope (%): 1
Peak Design Flow (m3/s):

ETV Lab Testing Results   ☐ Post Treatment Recharge

Hydroguard Annual Sizing Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
HG 4	.023	.097	97 %	87 %
HG 5	.029	.097	98 %	92 %
HG 6	.035	.097	98 %	94 %
Unavailable	.041	.097	99 %	96 %
HG 8	.049	.097	99 %	97 %
Unavailable	.057	.097	99 %	98 %
HG 10	.065	.097	100 %	99 %
HG 12	.082	.097	100 %	99 %

Particle Size Distribution

Size (um)	%	SG
20	35	2.65
35	10	2.65
63	5	2.65
88	10	2.65
125	15	2.65
200	15	2.65
325	5	2.65
750	5	2.65

Note: Results vary significantly based on particle size distribution

Simulate

TSS Particle Size Distribution

Hydroworks Hydrodynamic Separator Sizing Program - Hydroguard

File   Product   Units   CAD   Video   Help

General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

TSS Particle Size Distribution

Size (um)	%	SG
20	35	2.65
35	10	2.65
63	5	2.65
88	10	2.65
125	15	2.65
200	15	2.65
325	5	2.65
750	5	2.65
*		

Notes:

1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

TSS Distributions

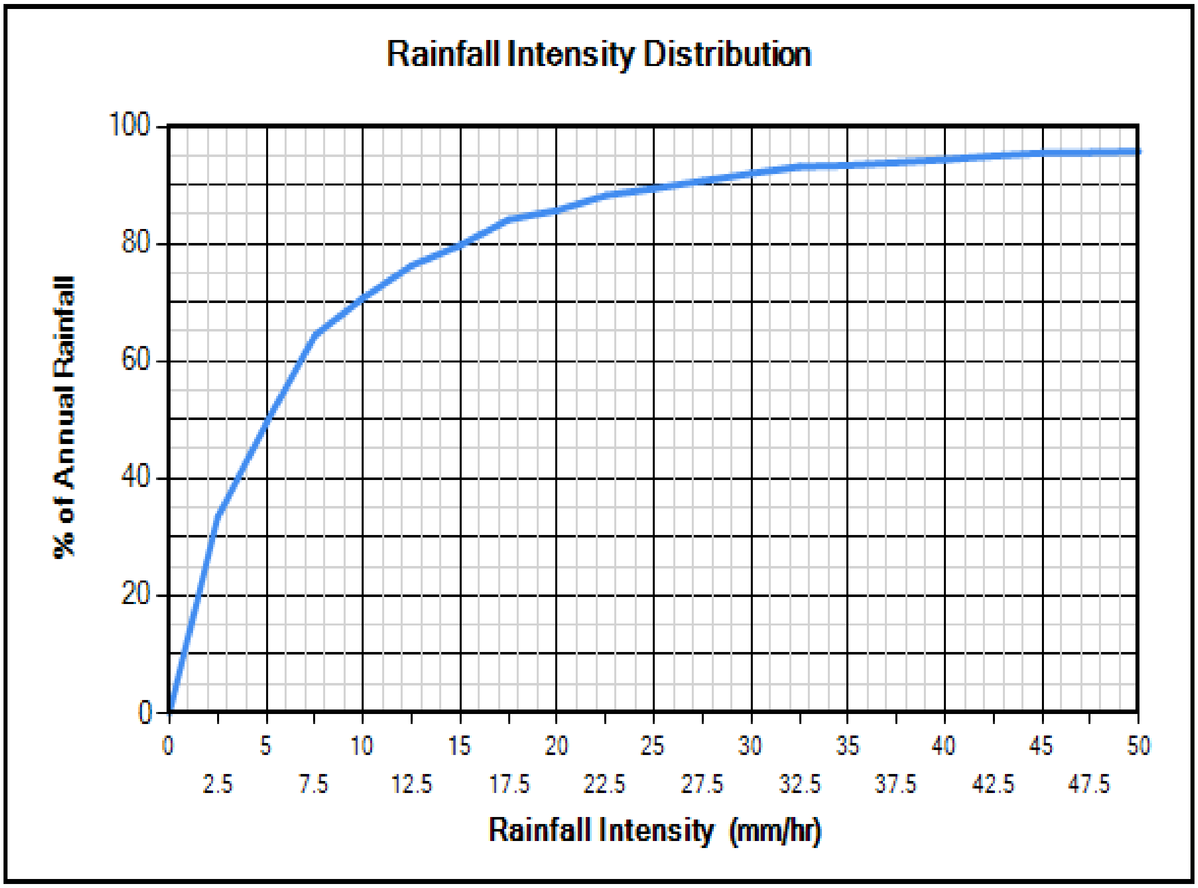
- (•) Standard Design
- ( ) ETV Canada
- ( ) OK110
- ( ) Toronto
- ( ) Ontario Fine
- ( ) Calgary Forebay
- ( ) Kitchener
- ( ) User Defined

Clear

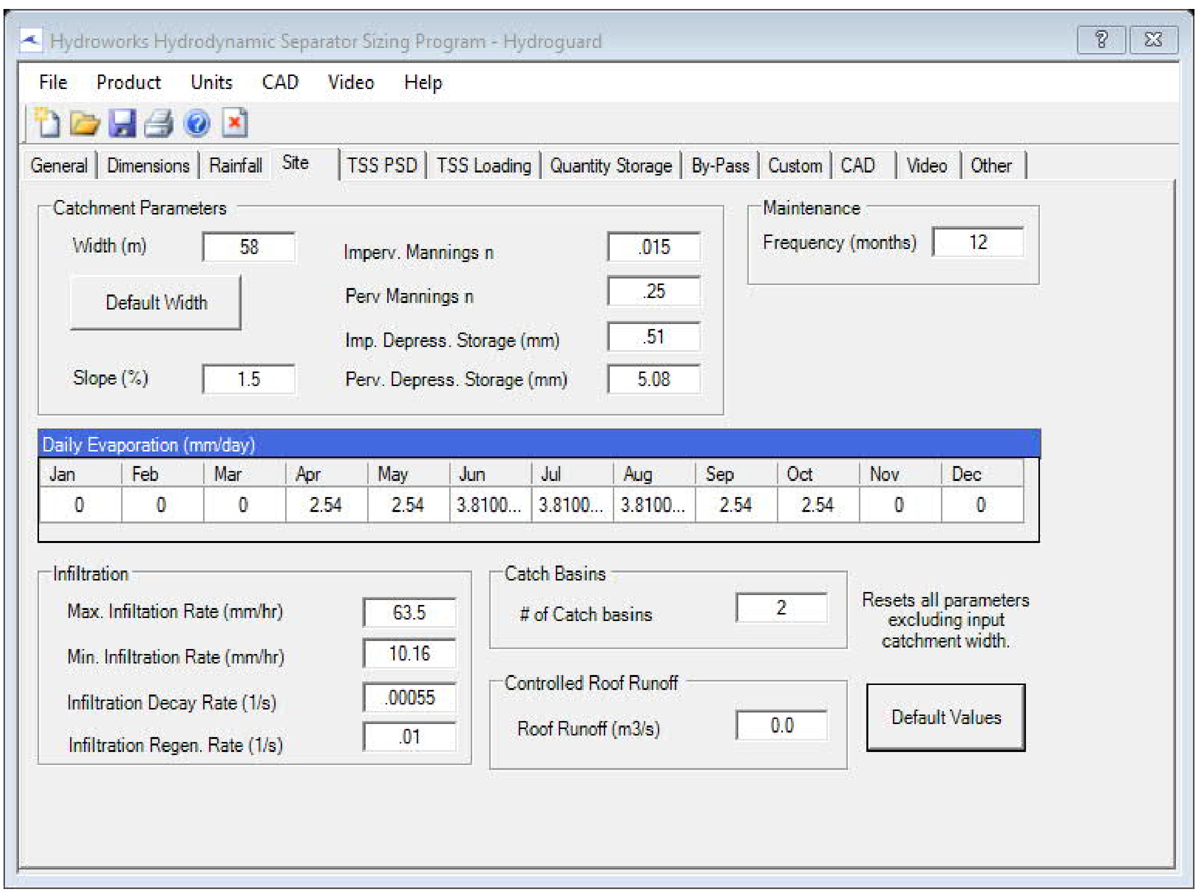
You must select a particle size distribution for TSS to simulate TSS removal

Water Temp (C): 20

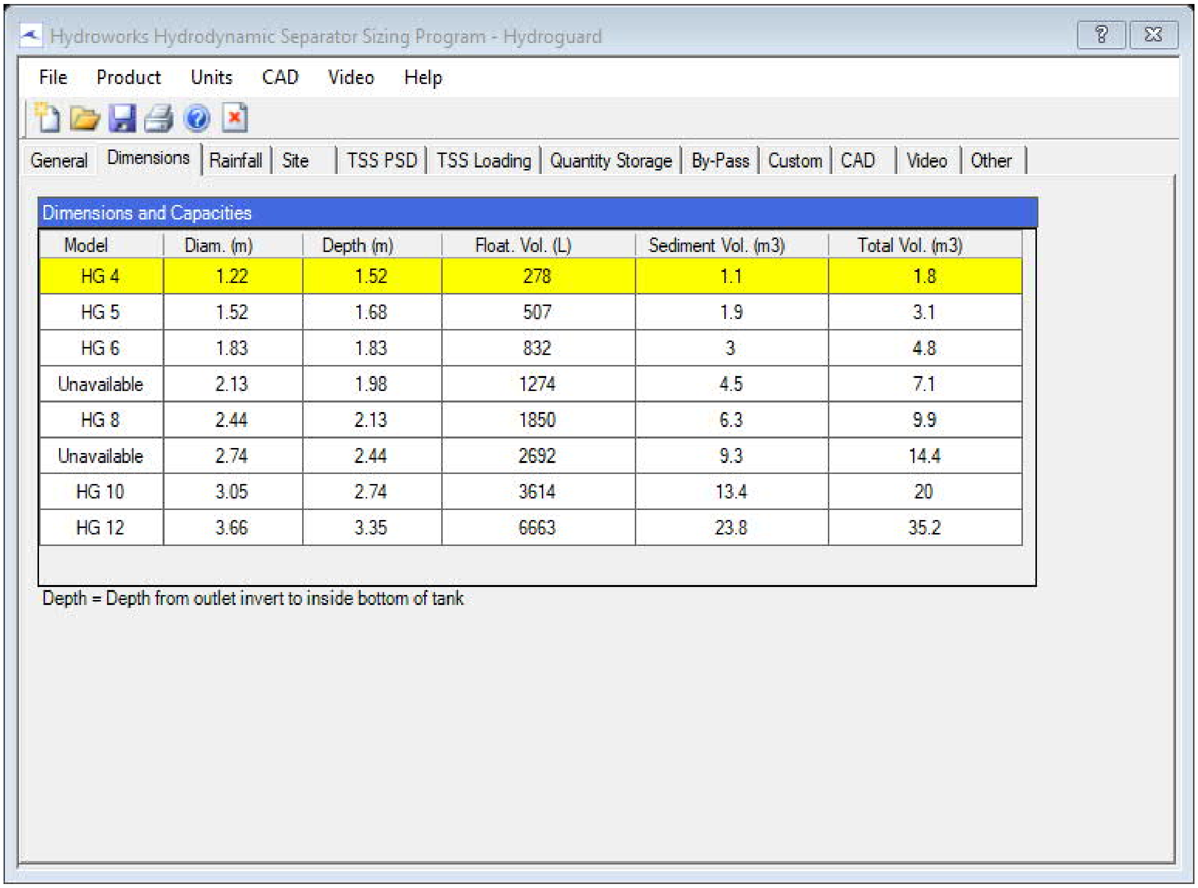
Rainfall Station - St. Catherines A, Ontario(1971 To 2005)



Site Physical Characteristics



Dimensions And Capacities

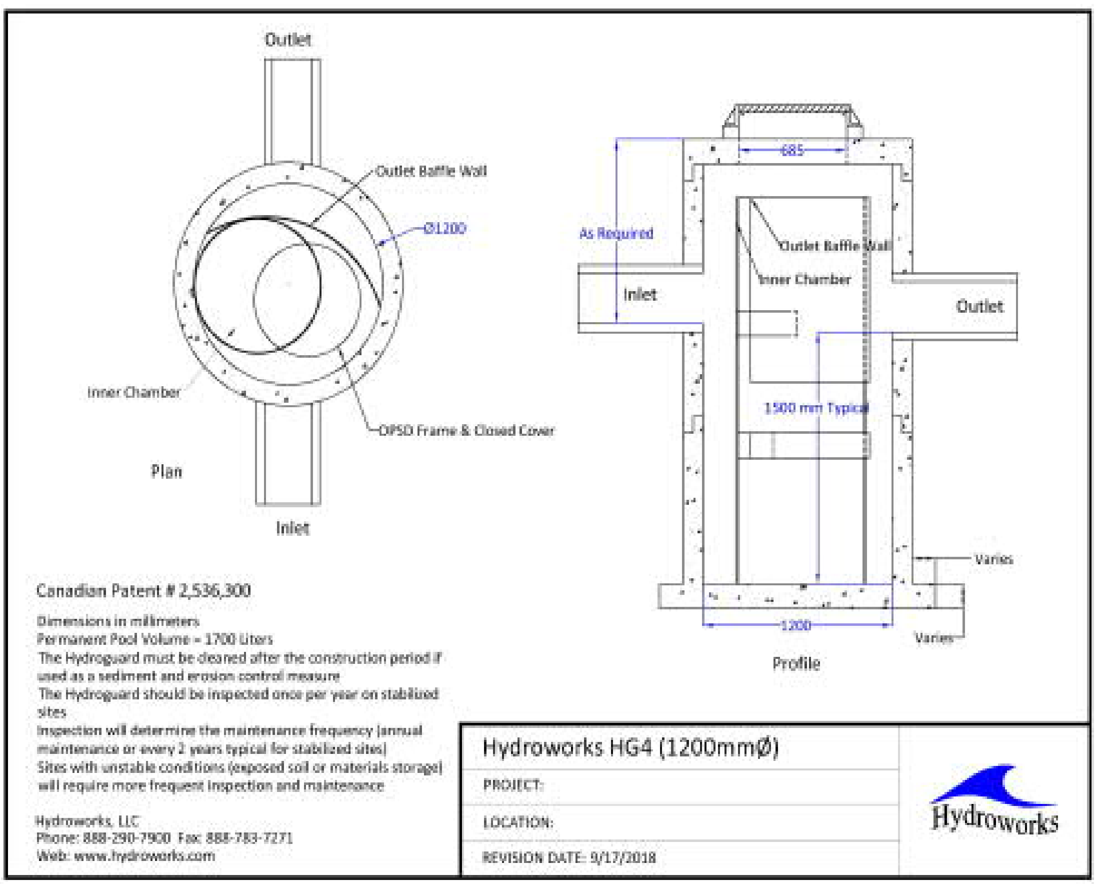


Dimensions and Capacities

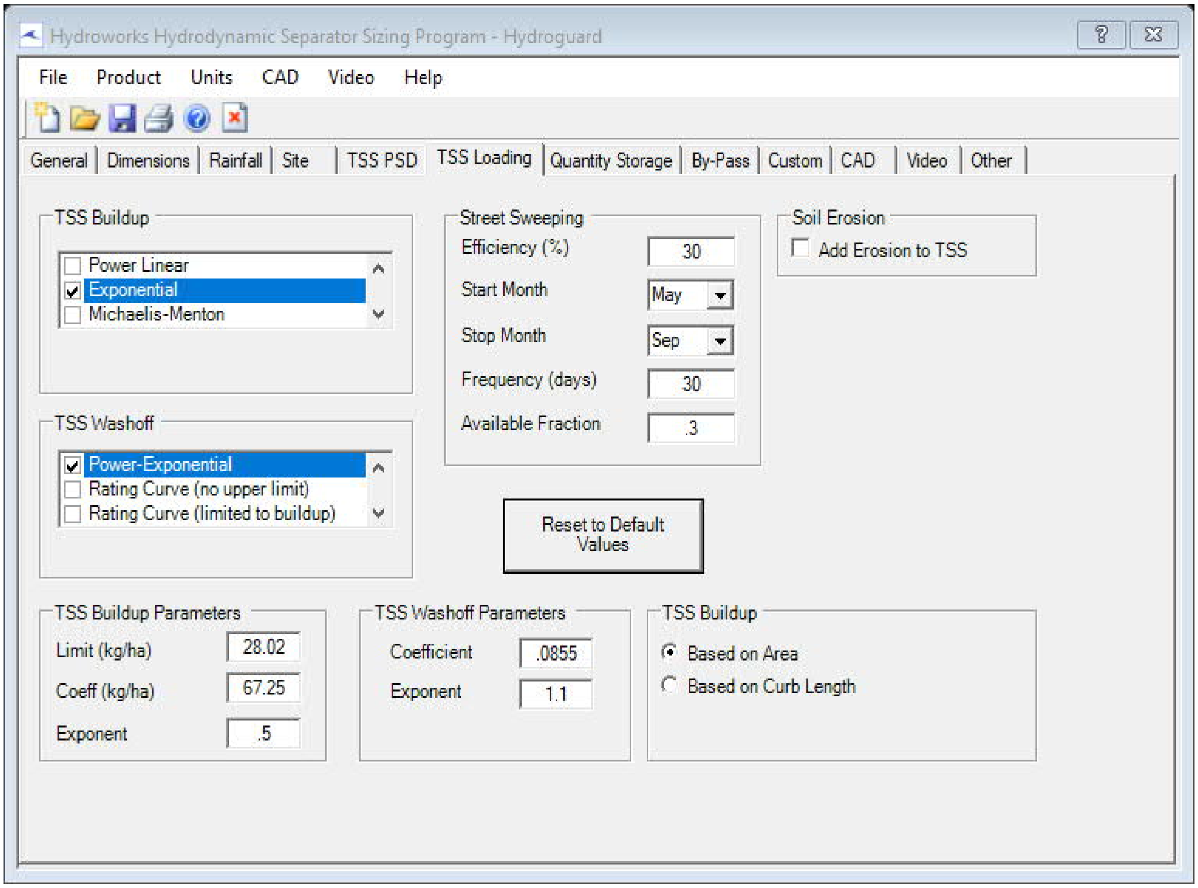
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HG 4	1.22	1.52	278	1.1	1.8
HG 5	1.52	1.68	507	1.9	3.1
HG 6	1.83	1.83	832	3	4.8
Unavailable	2.13	1.98	1274	4.5	7.1
HG 8	2.44	2.13	1850	6.3	9.9
Unavailable	2.74	2.44	2692	9.3	14.4
HG 10	3.05	2.74	3614	13.4	20
HG 12	3.66	3.35	6663	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

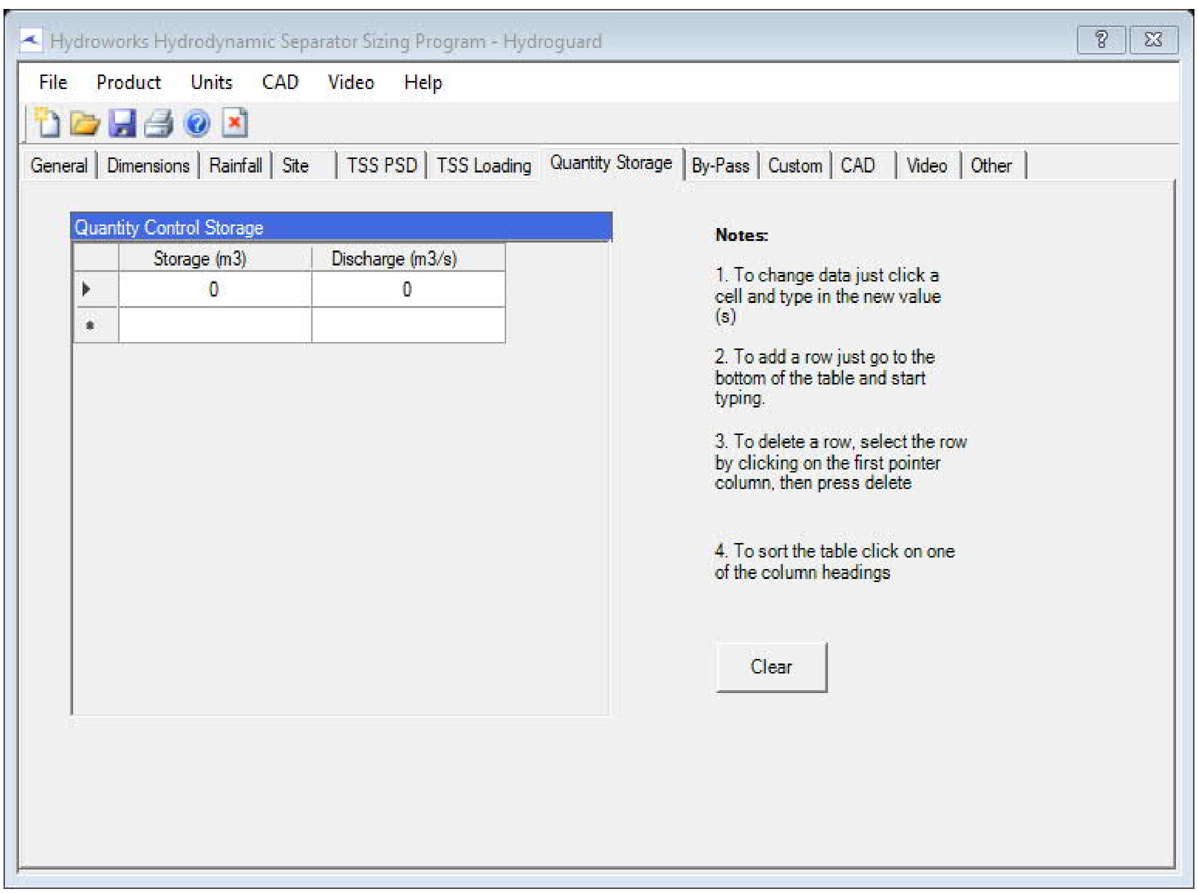
Generic HG 4 CAD Drawing



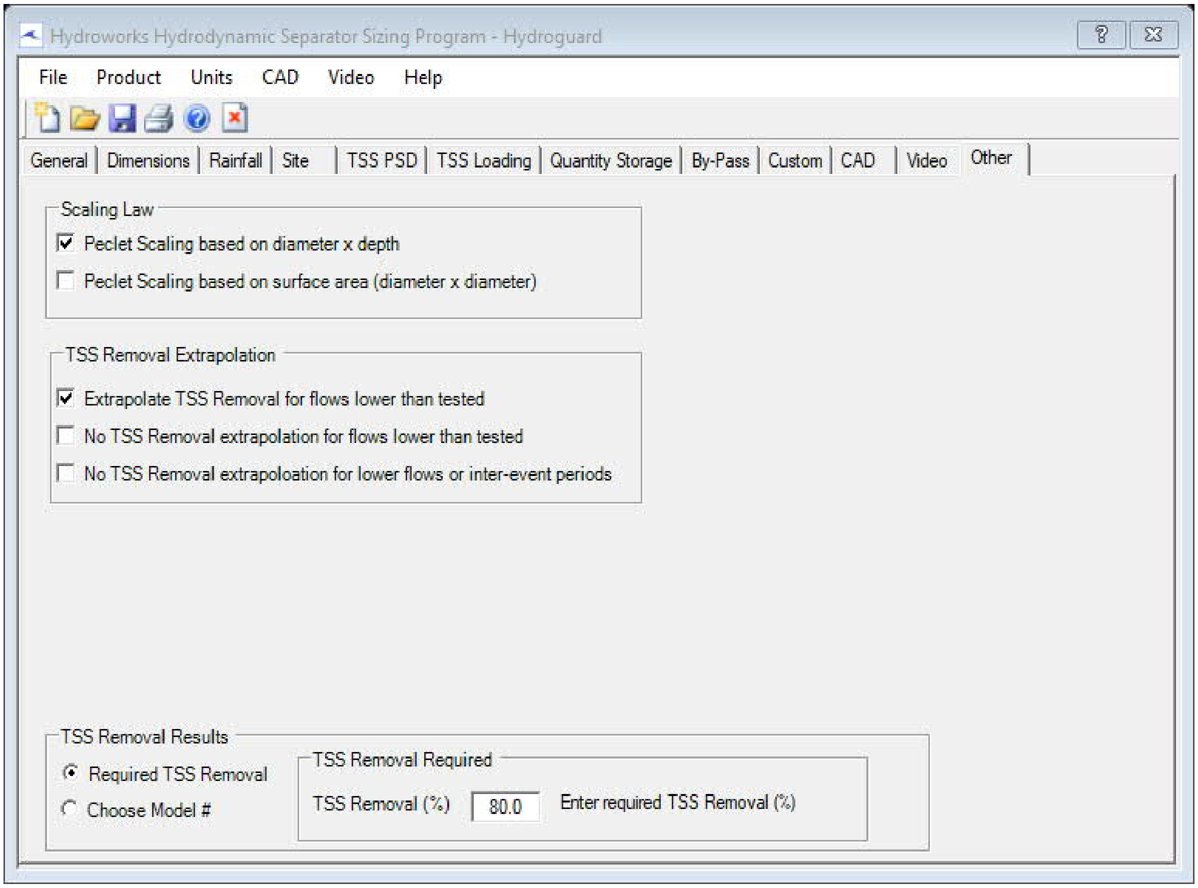
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

Hydroworks Sizing Program - Version 5.6

1-800-290-7900
www.hydroworks.com