PROPOSED DEL DEGAN WINERY
17945 LOYALIST PARKWAY, ROSEHALL,
PRINCE EDWARD COUNTY, ON

STORM WATER MANAGEMENT DESIGN BRIEF
NEW DEVELOPMENT DRAINAGE SYSTEM

REV 3 – August 26, 2024

PREPARED BY:

HALLEX ENGINEERING LTD.

HALLEX PROJECT #220526

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

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

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1. PRE-DEVELOPMENT CONDITIONS

1.1 LOCATION

The proposed Del Degan Winery development is located at 17945 Loyalist Parkway, Rosehall, which is south of the Greer Road and Loyalist Parkway intersection in the County of Prince Edward, ON.

1.2 DRAINAGE PATTERN

The current drainage path for the site consists of overland sheet flow to Hubbs Creek. As such, the proposed stormwater management controls will ensure the storm flows are controlled to the pre-development flow rate to Hubbs Creek.

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 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 and one-hundred-year storm events as per the City of Belleville intensity-duration-frequency curve.

2.2 DRAINAGE

The proposed design requires 283.0 meters of flat bottom swale, a Hydrodome HD8 oil and grit separator and a combined fire/ stormwater management pond.

3. DESIGN CONSIDERATIONS

3.1 PRE-DEVELOPMENT SITE DRAINAGE

3.1.1 Peak Runoff

The total drainage area for the development is 21.748 hectares with an existing runoff coefficient of 0.26 based on the existing roof, asphalt, and agricultural field / grass surfaces. Due to the significant size of the drainage area, the airport formula is used to determine the time of concentration as per the following formula:

Airport Formula

Tc= (3.26* (1.1-C) *(L^0.5))/(Sw^0.33)

Tc= Time of Concentration (minutes)
L= Watershed Length (metres)
C=Runoff Coefficient (Dimensionless)
Sw = Watershed Slope % (m/m)

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

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Hubbs Creek	21.748	284.02
5-year Storm	**A,ha**	**C**	**i,mm/h**	**Q, L/s**
Area.1	21.748	0.26	10	146.6
100-year Storm	**A,ha**	**C**	**i,mm/h**	**Q, L/s**
Area.1	21.748	0.26	16	242.7

Therefore, the total pre-development for the subject site is 146.6 L/s for the five-year storm and 242.7 L/s for the one-hundred-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 Del Degan Winery development consists of the construction of three new buildings, asphalt laneway & parking areas and grass areas. The resulting runoff coefficient in the post-development condition of the site is 0.29.

The proposed development will drain through the proposed onsite storm drainage system and shall discharge to the existing ditch which eventually drains to the Hubbs Creek watercourse.

The proposed drainage system is designed according to the 5-year minor storm and the 100-year major storm. Utilizing the airport formula, the time for storm water to flow from the farthest drainage area to Hubbs Creek, as outlined in Exhibit #1, is calculated to be 279.37 minutes.

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

Subcatchment	**Description**	**Draining to**	**Area, ha**	**Tc, min**
Pond	Sheet Flow	Swale	4.258	147.52
Swale	Channel Flow	Area.1	2.618	201.48
Area.1	Sheet / Channel	Hubbs Creek	14.872	279.37
5-year Storm	**A,ha**	**C**	***i*,mm/h**	**Cumulative Q, L/s**
Pond	4.258	0.38	15	67.9
Swale	2.618	0.26	12	90.4
Area.1	14.872	0.27	10	197.3
TOTAL	**21.748**	**0.29**		
100-year Storm	**A,ha**	**C**	***i*,mm/h**	**Cumulative Q, L/s**
Pond	4.258	0.38	25	112.4
Swale	2.618	0.26	20	149.7
Area.1	14.872	0.27	16	326.7
TOTAL	**21.748**	**0.39**		

Therefore, the total post-development flow for the subject site is 197.3 L/s for the five-year storm and 326.7 L/s for the one-hundred-year storm. The flows and other design information are contained in Exhibit #1 for the five -year storm and Exhibit #2 for the one-hundred-year storm at the end of the design brief.

3.2.2 Quantity

The post-development storm water runoff to Hubbs Creek is higher than the pre-development runoff. As such, storm water detention is required to ensure that the existing watercourse does not surcharge as a result of the proposed development.

Stormwater quantity controls for the site will be achieved by utilizing a 100mm diameter orifice pipe at the combined fire / stormwater management pond outlet. The orifice pipe will ensure the post-development runoff is controlled to the pre-development runoff rate for the five and one-hundred-year storm events. The resulting 512m^3 volume generated from the five-year storm and 828m^3 volume generated from the one-hundred-year storm will be contained within the proposed fire / stormwater management pond.

The storage volume for the five and one-hundred-year storms are calculated using EPA SWMM v5.1 software (Refer to Appendix ‘A’ for EPA SWMM v5.1 – Output Files)

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

	Pre- Development (L/s)	**Post- Development Uncontrolled Flow Rate (L/s)**	**Post- Development Controlled Flow Rate (L/s)**
5-year Storm			
TOTAL	146.6	197.3	144.1
100-year Storm			
TOTAL	242.7	326.7	233.1

The orifice pipe sizing and subsequent storage volume for the detained flow are indicated in Exhibit #3 for the five -year storm and Exhibit #4 for the one-hundred-year storm at the end of the design brief.

The proposed combined fire / stormwater management pond has also been designed with a permanent pool volume to provide fire flow storage on-site. The calculations provided in the "Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code" by Office of the Fire Marshal were used for the fire flow analysis. As such, the proposed winery volume is used in the fire flow calculations. The minimum fire protection water supply shall not be less than what is needed to provide the minimum flow rate for a duration of 30 minutes as per the Office of the Fire Marshal Guidelines. Therefore, the flow rate for fire protection is determined to be 9000 L/min with a minimum fire flow storage of 270.0 m^3 and a calculated fire flow storage requirement of 439.5 m^3.

The proposed combined fire / stormwater management pond has a total permanent pool volume of 471.34 m^3 considering the reduction in storage volume from the 600mm ice depth allowance and the 200mm clearance from the dry hydrant intake pipe to the bottom of the pond.

The fire pond storage volume and sizing calculations are indicated in Exhibit #5.

3.2.3 Quality

The storm water collected in the proposed development passes through a HydroDome HD8, which achieves a total suspended solids removal of at least 84%. This value is greater than the required 'Enhanced' treatment of 80% 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 'B' of this report.

Additionally, the combined fire / stormwater management pond will aid to further improve the water quality from the site due to the permanent pool volume and the rip-rap at the spillway inlets to the pond.

3.2.4 Maintenance Recommendations

The storm sewer system includes swales and a combined fire / stormwater management pond. 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 culverts for structural integrity. (Annually) Check culvert 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 culvert pipes, swales and combined fire / stormwater management pond. (Monthly and after rain events) Remove all trash and debris.
3. Conduct routine inspections for erosion of the combined fire / stormwater management pond and swales. (Annually and after rain events). Any erosion shall be corrected by sodding the area. There may be a need to provide further erosion control (ie rip-rap) to prevent the re-occurrence of erosion.
4. If there is a visible accumulation of sediment in the bottom of the pond or around the high-water line of the pond, then removal of sediment accumulation is required.
5. Conduct routine maintenance of swales and pond including grass cutting.
6. The frequency of grass cutting correlates on the surrounding land uses, and ultimately local municipal by - laws. Grass cutting should be done as infrequently as possible recognizing the aesthetic concerns of nearby residents. Grass around wet facilities should not be cut to the edge of the permanent pool.
7. As a safety precaution, grass cutting should be done parallel to the shoreline with grass clippings being ejected upland to reduce the potential for organic loadings to the pond.
8. 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.
9. Do not dump any materials in the storm system.
10. Inspect the Hydrodome Oil/Grit Separator (Annually). Procedures for inspection are provided in the Hydrodome Owner's Manual. A vacuum truck is to be used for maintenance of the Hydrodome.

4. CONCLUSION

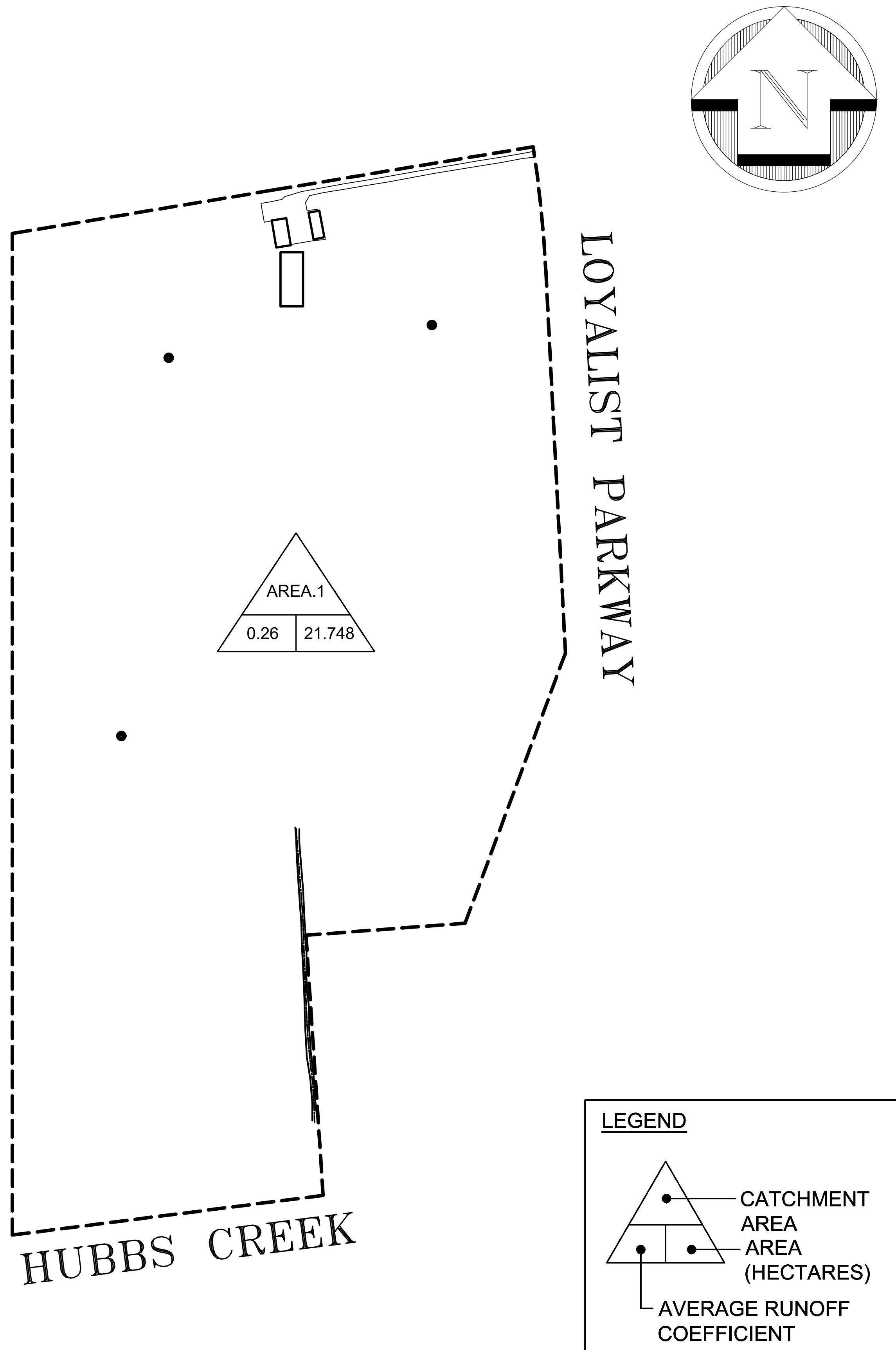
The aforementioned calculations and recommendations for the storm drainage system are based on the current design for the site as of writing this report.

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

Mustafa Abdullaiev, B.Eng
Civil Designer



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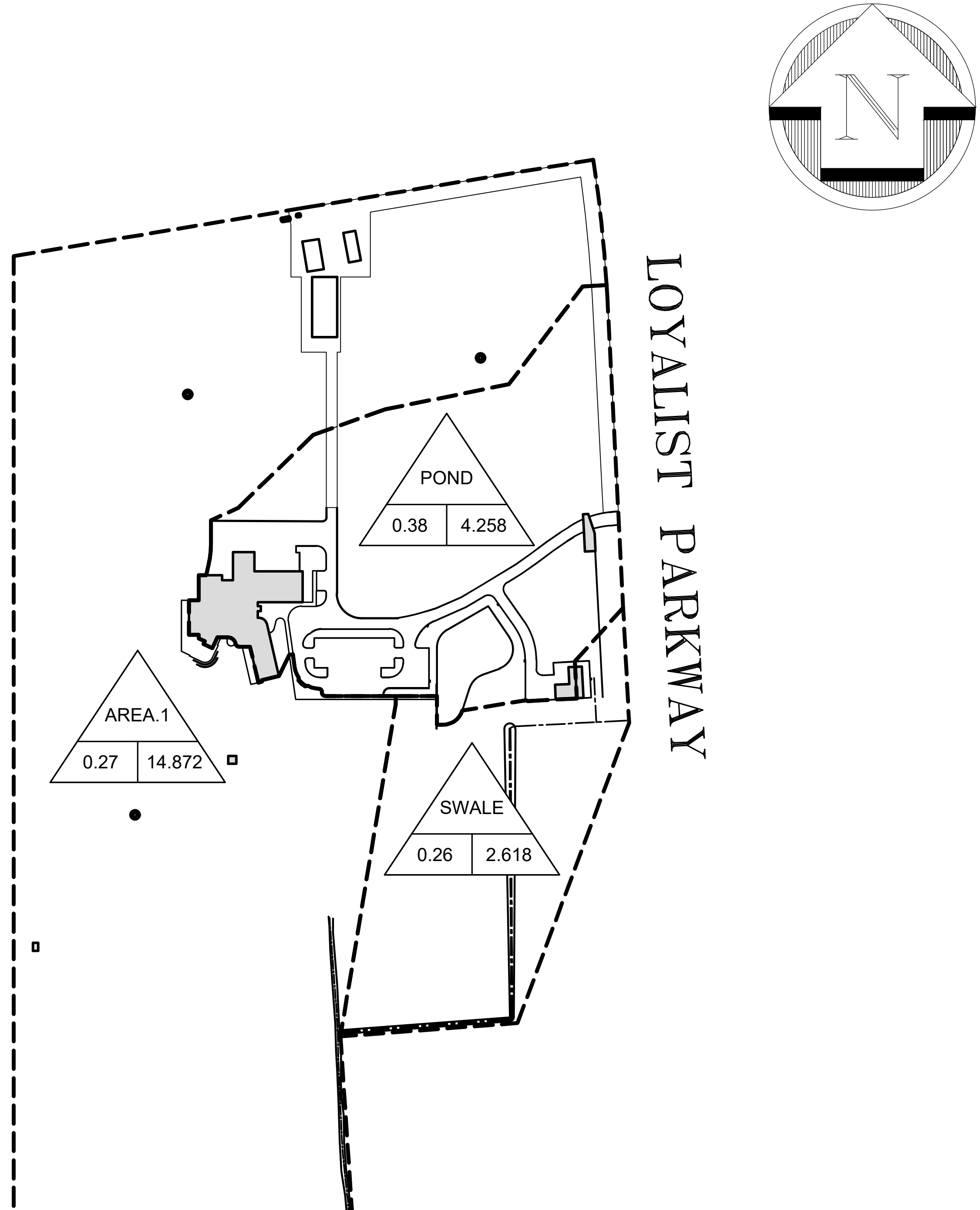
PROJECT:
DEL DEGAN WINERY
17945 LOYALIST PKWY, ROSEHALL, PEC, ON

SHEET TITLE:
PRE-DEVELOPMENT CATCHMENT AREAS

DATE: 2024/08/26
SCALE: 1:4000
DR. BY: JS/MA
CH. BY: JH
JOB No.: 220526
DWG. CSK1
REV. 3



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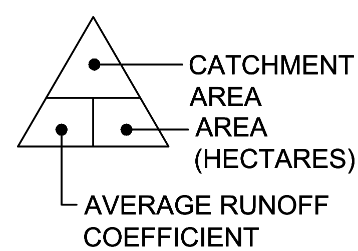

HALLEX ENGINEERING LTD.	PROJECT: DEL DEGAN WINERY 17945 LOYALIST PKWY, ROSEHALL, PEC, ON	DATE: 2024/08/26	JOB No.: 220526	
		SCALE: 1:4000	DWG.	REV.
	SHEET TITLE: POST-DEVELOPMENT CATCHMENT AREAS	DR. BY: MA	CSK2	3
		CH. BY: JS/JH		

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MUNICIPALITY: **Belleville**

Del Degan Winery
Exhibit #1 - 5 Year Post - Development Calculations

2024-08-26
Job: 220526

Rainfall Intensity Values = A= 28.200, B= -0.699, C= 0.000

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	**Pond 1**	**OGS**	**4.0**	**4.258**	**4.258**	**147.52**	**0.08**	**15**	**9924**	**5866.2**	**0.0679**	**0.0147**	**0.0200**	**0.0073**	**0.9301**	**0.100**	**87.40**	**87.32**
Roof	-	-	-	0.295	-	-	-	-	3428.3	1011.3	-	-	-	-	-	-	-	-
Paved	-	-	-	0.070	-	-	-	-	3428.3	240.0	-	-	-	-	-	-	-	-
Grass	-	-	-	3.020	-	-	-	-	902.2	2724.6	-	-	-	-	-	-	-	-
2	**OGS**	**Swale 1**	**26.8**	**0.000**	**4.258**	**147.60**	**0.24**	**15**	**0**	**5866.2**	**0.0679**	**0.0147**	**0.0200**	**0.1368**	**1.9347**	**0.300**	**87.26**	**86.72**
3	**Swale 1**	**Area 1**	**283**	**2.618**	**6.876**	**201.48**	**11.44**	**12**	**7981**	**7809.3**	**0.0904**	**0.0372**	**0.0063**	**0.0413**	**0.4126**	**0.100**	**86.72**	**84.93**
Roof	-	-	-	0.008	-	-	-	-	2757.1	22.1	-	-	-	-	-	-	-	-
Paved	-	-	-	0.008	-	-	-	-	2757.1	22.1	-	-	-	-	-	-	-	-
Grass	-	-	-	2.591	-	-	-	-	725.5	1879.9	-	-	-	-	-	-	-	-
4	**Area 1**	**Chnnl**	**N/A**	**14.872**	**21.748**	**279.37**	**N/A**	**10**	**6351**	**17045.0**	**0.1973**	**0.1441**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Roof	-	-	-	0.092	-	-	-	-	2194.0	201.8	-	-	-	-	-	-	-	-
Paved	-	-	-	0.082	-	-	-	-	2194.0	179.9	-	-	-	-	-	-	-	-
Gravel	-	-	-	0.455	-	-	-	-	1385.7	630.5	-	-	-	-	-	-	-	-
Grass	-	-	-	14.243	-	-	-	-	577.4	8223.5	-	-	-	-	-	-	-	-

* Swale/Ditch geometry based on the following assumptions: trapezoidal channel, grassed lined (n = 0.035), 2.5:1 sideslopes, 0.75 m bottom width.
* Grassed swale Flow Velocity for Water Quality Enhancement to be maximum 0.5 m/s for the 4 hour 25mm Chicago Storm.

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.95
Gravel Surface	C =	0.60
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

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Del Degan Winery
Exhibit #2 - 100 Year Post - Development Calculations

MUNICIPALITY: **Belleville**

Rainfall Intensity Values = A= 46.700, B= -0.699, C= 0.000

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	**Pond 1**	**OGS**	**4.0**	**4.258**	**4.258**	**147.52**	**0.08**	**25**	**16434**	**9714.5**	**0.1124**	**0.0189**	**0.0200**	**0.0073**	**0.9301**	**0.100**	**87.40**	**87.32**
Roof	-	-	-	0.295	-	-	-	-	5677.3	1674.8	-	-	-	-	-	-	-	-
Paved	-	-	-	0.070	-	-	-	-	5677.3	397.4	-	-	-	-	-	-	-	-
Grass	-	-	-	3.020	-	-	-	-	1494.0	4512.0	-	-	-	-	-	-	-	-
2	**OGS**	**Swale 1**	**26.8**	**0.000**	**4.258**	**147.60**	**0.24**	**25**	**0**	**9714.5**	**0.1124**	**0.0189**	**0.0200**	**0.1368**	**1.9347**	**0.300**	**87.26**	**86.72**
3	**Swale 1**	**Area 1**	**283**	**2.618**	**6.876**	**201.48**	**10.34**	**20**	**13217**	**12932.5**	**0.1497**	**0.0561**	**0.0063**	**0.0575**	**0.4563**	**0.120**	**86.72**	**84.93**
Roof	-	-	-	0.008	-	-	-	-	4565.8	36.5	-	-	-	-	-	-	-	-
Paved	-	-	-	0.008	-	-	-	-	4565.8	36.5	-	-	-	-	-	-	-	-
Grass	-	-	-	2.591	-	-	-	-	1201.5	3113.2	-	-	-	-	-	-	-	-
4	**Area 1**	**Chnnl**	**N/A**	**14.872**	**21.748**	**279.37**	**N/A**	**16**	**10518**	**28227.1**	**0.3267**	**0.2331**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Roof	-	-	-	0.092	-	-	-	-	3633.3	334.3	-	-	-	-	-	-	-	-
Paved	-	-	-	0.082	-	-	-	-	3633.3	297.9	-	-	-	-	-	-	-	-
Gravel	-	-	-	0.455	-	-	-	-	2294.7	1044.1	-	-	-	-	-	-	-	-
Grass	-	-	-	14.243	-	-	-	-	956.1	13618.3	-	-	-	-	-	-	-	-

* Swale/Ditch geometry based on the following assumptions: trapezoidal channel, grassed lined (n = 0.035), 2.5:1 sideslopes, 0.75 m bottom width.
* Grassed swale Flow Velocity for Water Quality Enhancement to be maximum 0.5 m/s for the 4 hour 25mm Chicago Storm.

Run-off Coefficients Used:

Roof Structure C = 0.95
Paved Surface C = 0.95
Gravel Surface C = 0.60
Grass Surface C = 0.25

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

Del Degan Winery
Exhibit #3 - 5 Year Orifice Plate and Storage Volume Calcs

2024-08-26
Job: 220526

Site Data

Site Discharge	Flow	Adj. Flow (w/o Surface Runoff)	Total Storm Volume
	(m^3/s)	(m^3/s)	(m^3)
Pre - Develop.	0.1466	0.0172	
Post - Develop.	0.1973	0.0679	512.0

Control Node Data

Outlet Pipe	Storm Control Node	Outlet Pipe Size	Outlet Invert Elev.	Elev. @ Orifice
		(m)	(m)	(m)
1	Pond 1	0.100	87.40	87.45

* Volume calculated using SWMM 5.1 modelling software in accordance with the flow rate for actual size of the orifice.

Head Height 0.28 m **Storm Retention Elev. Check** **87.73 m**

Pond Storage

Pond Sections	Pond Dimensions		Storage Volume
	Depth	Avg Area	
	(m)	(m)	(m^3)
Pond	0.330	1587.20	523.78
Total			**523.78**

Total Storage = 523.8 m^3 **Required Storage Achieved**

Orifice Diameter Calculation (A=Q/(Cd*sqrt(2*g*h)))

Coefficient of Discharge	Cd =	0.8	(tube)	0.62	Sharp Orifice coefficient of discharge
Allowable Flow Rate	Q =	0.0172	m^3/s	0.80	Tube coefficient of discharge
Force of Gravity	g =	9.81	m/s/s		
Head Height	h =	0.28	m		
Dia of Max. Orifice	dia =	108.01	mm	Use -	100 mm

Flow Rate for Actual Size of Hole (Q=Cd*A*sqrt(2*g*h))

Area of Orifice	A =	0.0079	m^2
Flow Rate through Orifice	Q =	0.0147	m^3/s

Del Degan Winery
Exhibit #4 - 100 Year Orifice Plate and Storage Volume Calcs

Site Data

Site Discharge	Flow	Adj. Flow (w/o Surface Runoff)	Total Storm Volume
	(m^3/s)	(m^3/s)	(m^3)
Pre - Develop.	0.2427	0.0284	
Post - Develop.	0.3267	0.1124	828.0

Control Node Data

Outlet Pipe	Storm Control Node	Outlet Pipe Size	Outlet Invert Elev.	Elev. @ Orifice
		(m)	(m)	(m)
1	Pond 1	0.100	87.40	87.45

* Volume calculated using SWMM 5.1 modelling software in accordance with the flow rate for actual size of the orifice.

Head Height 0.46 m

Storm Retention Elev. Check **87.91 m**

Pond Storage

Pond Sections	Pond Dimensions: Depth	Pond Dimensions: Avg Area	Storage Volume
	(m)	(m)	(m^3)
Pond	0.510	1628.30	830.43
Total			**830.43**

Total Storage = 830.4 m^3 **Required Storage Achieved**

Orifice Diameter Calculation (A=Q/(Cd*sqrt(2*g*h)))

Coefficient of Discharge	Cd =	0.8	(tube)	0.62	Sharp Orifice coefficient of discharge
Allowable Flow Rate	Q =	0.0284	m^3/s	0.80	Tube coefficient of discharge
Force of Gravity	g =	9.81	m/s/s		
Head Height	h =	0.46	m		
Dia of Max. Orifice	dia =	122.77	mm	Use -	100 mm

Flow Rate for Actual Size of Hole (Q=Cd*A*sqrt(2*g*h))

Area of Orifice	A =	0.0079	m^2
Flow Rate through Orifice	Q =	0.0189	m^3/s

Del Degan Winery
Exhibit #5: Fire Pond Volume Calculations

Required Minimum Water Supply Flow Rate for Fire Protection
(As required determined by the Office of the Fire Marshal Guideline - OFM-TG-03-1999)

Prop. Building Area	2,947	m^2
Prop. Building Height	7.85	m
Prop. Building Volume	23,134	m^3
Total Volume	**23,134**	**m^3**
Water Supply Coefficient (K)	19	F-3 Occupancy as per OBC matrix provided by Giannone Petricone Associates Inc.
Spatial Coefficient (S)	1	
Total Minimum Water Supply	439,545	L

The calculated Q is greater than 270,000 L therefore the required minimum water supply for fire protection is 9000 L/min (as per Table 2 in the Office of the Fire Marshal Guideline).

Fire Pond Sizing

Minimum Storage Required 439.5 m^3

Side Slopes	2.5	:1
Water Depth	1.2	m
Intake Pipe Offset from Pond Bottom	0.2	m
Ice Depth Allowance	0.6	m
D = Water Depth Above Intake Pipe	0.4	m
A_{ice} = Pond Area @ Ice Depth	1,258.8	m^2
A_{pipe} = Pond Area @ Intake Pipe	1,097.9	m^2

$V = (A_{pipe} * D) + ((A_{ice} - A_{pipe}) * D/2)$

Total Volume = 471.34 m^3 Required Storage Achieved

APPENDIX 'A'

EPA SWMM v5.1

Output File

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

Del Degan Winery, 5yr Storm

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

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
1	3hrChicago5yr_R0.46	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
Del_Degan_Winery	4.26	195.00	38.00	1.0000	1	SWM_Pond

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Swale	OUTFALL	100.00	0.00	0.0	
SWM_Pond	STORAGE	101.00	1.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
Pond_Outlet	SWM_Pond	Swale	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

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

****
Analysis Options
****
Flow Units .... LPS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO
  Snowmelt .... NO
  Groundwater .... NO
  Flow Routing .... YES
  Ponding Allowed .... NO
  Water Quality .... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Surcharge Method .... EXTRAN
Starting Date 08/08/2014 00:00:00
Ending Date 08/08/2014 06:00:00

```
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:05:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 01:00:00
  Routing Time Step ........ 30.00 sec
  Variable Time Step ....... YES
  Maximum Trials ........... 8
  Number of Threads ........ 1
  Head Tolerance ........... 0.001524 m


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.164        38.537
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.100        23.497
  Surface Runoff ...........         0.061        14.334
  Final Storage ............         0.003         0.780
  Continuity Error (%) .....        -0.191


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.061         0.610
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........         0.023         0.225
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.038         0.385
  Continuity Error (%) .....         0.000


  ***************************
  Time-Step Critical Elements
  ***************************
  None


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :    29.50 sec
  Average Time Step           :    29.96 sec
  Maximum Time Step           :    30.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.00
  Percent Not Converging      :     0.00
  Time Step Frequencies       :
     30.000 - 13.228 sec      :   100.00 %
     13.228 -  5.833 sec      :     0.00 %
      5.833 -  2.572 sec      :     0.00 %
      2.572 -  1.134 sec      :     0.00 %
      1.134 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ------------------------------------------------------------------------------------------------------------------
-----------------
                            Total      Total      Total      Total     Imperv       Perv      Total        Total
Peak  Runoff
                           Precip     Runon       Evap      Infil     Runoff     Runoff     Runoff       Runoff
Runoff   Coeff
  Subcatchment                 mm         mm         mm         mm         mm         mm         mm     10^6 ltr
LPS
  ------------------------------------------------------------------------------------------------------------------
-----------------
  Del_Degan_Winery          38.54       0.00       0.00      23.50      14.33       0.00      14.33         0.61
367.23   0.372
```

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
Swale	OUTFALL	0.00	0.00	100.00	0 00:00	0.00
SWM_Pond	STORAGE	0.18	0.26	101.26	0 03:07	0.26

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
Swale	OUTFALL	0.00	14.70	0 03:08	0	0.225	0.000
SWM_Pond	STORAGE	367.23	367.23	0 01:30	0.61	0.61	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SWM_Pond	0.352	18	0	0	0.512	26	0 03:07	14.70

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Swale	90.98	11.47	14.70	0.225
System	90.98	11.47	14.70	0.225

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
Pond_Outlet	ORIFICE	14.70	0 03:08			1.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl

Fraction of Time in Flow Class: columns Dry through Inlet Ctrl.

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Aug 20 15:45:48 2024
Analysis ended on: Tue Aug 20 15:45:48 2024
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

Del Degan Winery, 100yr Storm

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

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
1	3hrChicago100yr_R0.46	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
Del_Degan_Winery	4.26	195.00	38.00	1.0000	1	SWM_Pond

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Swale	OUTFALL	100.00	0.00	0.0	
SWM_Pond	STORAGE	101.00	1.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
Pond_Outlet	SWM_Pond	Swale	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

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

****
Analysis Options
****
Flow Units .... LPS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO
  Snowmelt .... NO
  Groundwater .... NO
  Flow Routing .... YES
  Ponding Allowed .... NO
  Water Quality .... NO

```
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 08/08/2014 00:00:00
Ending Date .............. 08/08/2014 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.256        60.011
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.156        36.554
Surface Runoff ...........         0.096        22.536
Final Storage ............         0.004         1.036
Continuity Error (%) .....        -0.193


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.096         0.960
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.030         0.299
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.066         0.661
Continuity Error (%) .....         0.000


***************************
Time-Step Critical Elements
***************************
None


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    29.50 sec
Average Time Step           :    29.96 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :   100.00 %
   13.228 -  5.833 sec      :     0.00 %
    5.833 -  2.572 sec      :     0.00 %
    2.572 -  1.134 sec      :     0.00 %
    1.134 -  0.500 sec      :     0.00 %


***************************
Subcatchment Runoff Summary
***************************

--------------------------------------------------------------------------------------------------------------
-------------------
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
Del_Degan_Winery	60.01	0.00	0.00	36.55	22.54	0.00	22.54	0.96	584.11	0.376

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
Swale	OUTFALL	0.00	0.00	100.00	0 00:00	0.00
SWM_Pond	STORAGE	0.29	0.41	101.41	0 03:09	0.41

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
Swale	OUTFALL	0.00	18.90	0 03:09	0	0.299	0.000
SWM_Pond	STORAGE	584.11	584.11	0 01:30	0.96	0.96	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SWM_Pond	0.579	29	0	0	0.828	41	0 03:09	18.90

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Swale	93.20	14.83	18.90	0.299
System	93.20	14.83	18.90	0.299

```
*******************
Link Flow Summary
*******************

-----------------------------------------------------------------------------
                               Maximum  Time of Max   Maximum    Max/    Max/
                                |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type          LPS  days hr:min    m/sec     Flow   Depth
-----------------------------------------------------------------------------
Pond_Outlet          ORIFICE     18.90     0  03:09                      1.00


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Aug 20 16:14:02 2024
Analysis ended on:  Tue Aug 20 16:14:02 2024
Total elapsed time: < 1 sec
```

APPENDIX ‘B’

HydroDome HD8

Sizing Calculations and Schematic

Hydroworks Sizing Summary

Del Degan Winery
17944 Loyalist Pkwy-Wellington

08-23-2024

Recommended Size: HydroDome HD 8

Hydroworks Sizing Program Version 5.8.5

A HydroDome HD 8 is recommended to provide 80 % annual TSS removal based on a drainage area of 4.26 (ha) with an imperviousness of 38 % and St. Catherines A, Ontario rainfall for the ETV particle size distribution (Calgary).

The recommended HydroDome HD 8 treats 100 % of the annual runoff and provides 84 % annual TSS removal for the St. Catherines A rainfall records and ETV particle size distribution (Calgary).

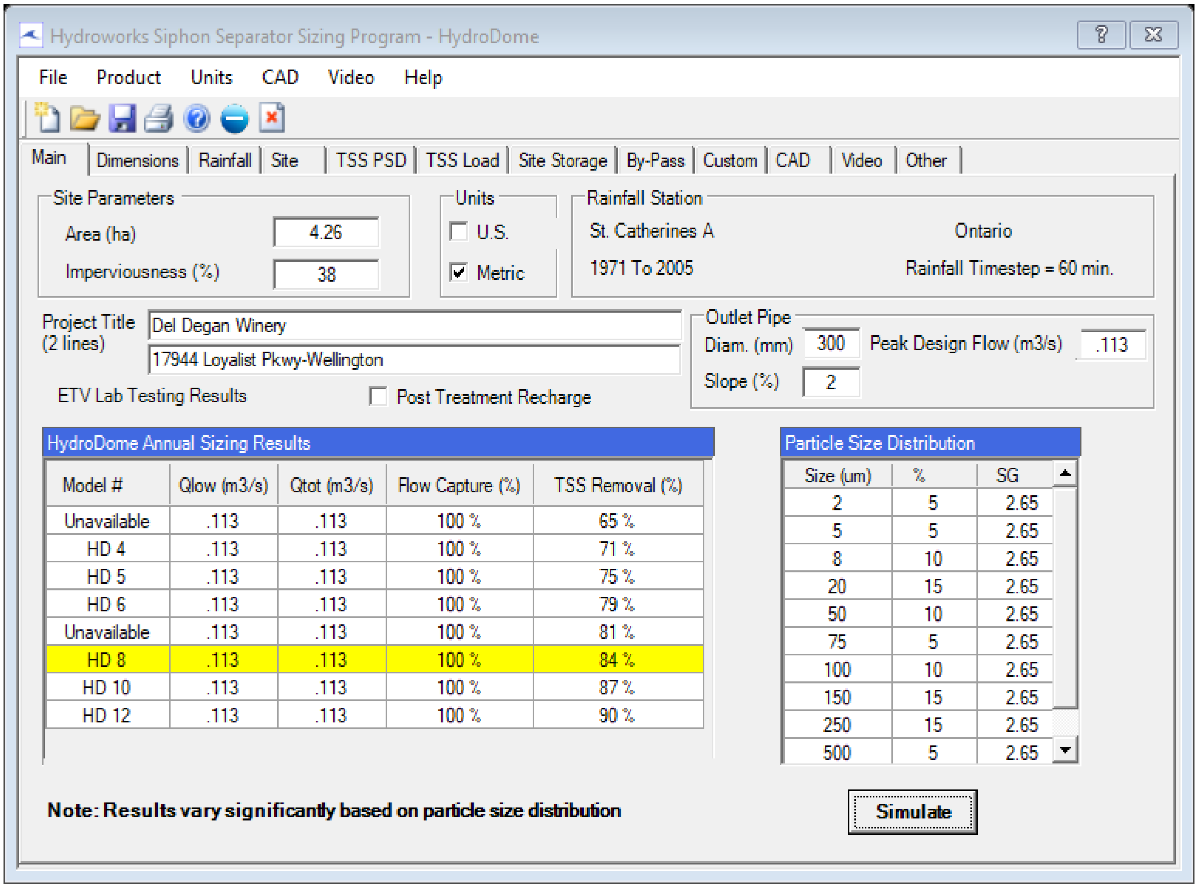
The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .113 (m3/s) Is less than the full pipe flow of .14 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed for the headloss calculations. The headloss was calculated to be 264 (mm) above the crown of the 300 (mm) outlet pipe.

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 HydroDome .

TSS Removal Sizing Summary



Hydroworks Siphon Separator Sizing Program - HydroDome

File Product Units CAD Video Help

Main | Dimensions | Rainfall | Site | TSS PSD | TSS Load | Site Storage | By-Pass | Custom | CAD | Video | Other

Site Parameters

Area (ha) 4.26

Imperviousness (%) 38

Units

U.S.

☑ Metric

Rainfall Station

St. Catherines A Ontario

1971 To 2005 Rainfall Timestep = 60 min.

Project Title (2 lines) Del Degan Winery

17944 Loyalist Pkwy-Wellington

ETV Lab Testing Results

Post Treatment Recharge

Outlet Pipe

Diam. (mm) 300 Peak Design Flow (m3/s) .113

Slope (%) 2

HydroDome Annual Sizing Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
Unavailable	.113	.113	100 %	65 %
HD 4	.113	.113	100 %	71 %
HD 5	.113	.113	100 %	75 %
HD 6	.113	.113	100 %	79 %
Unavailable	.113	.113	100 %	81 %
HD 8	.113	.113	100 %	84 %
HD 10	.113	.113	100 %	87 %
HD 12	.113	.113	100 %	90 %

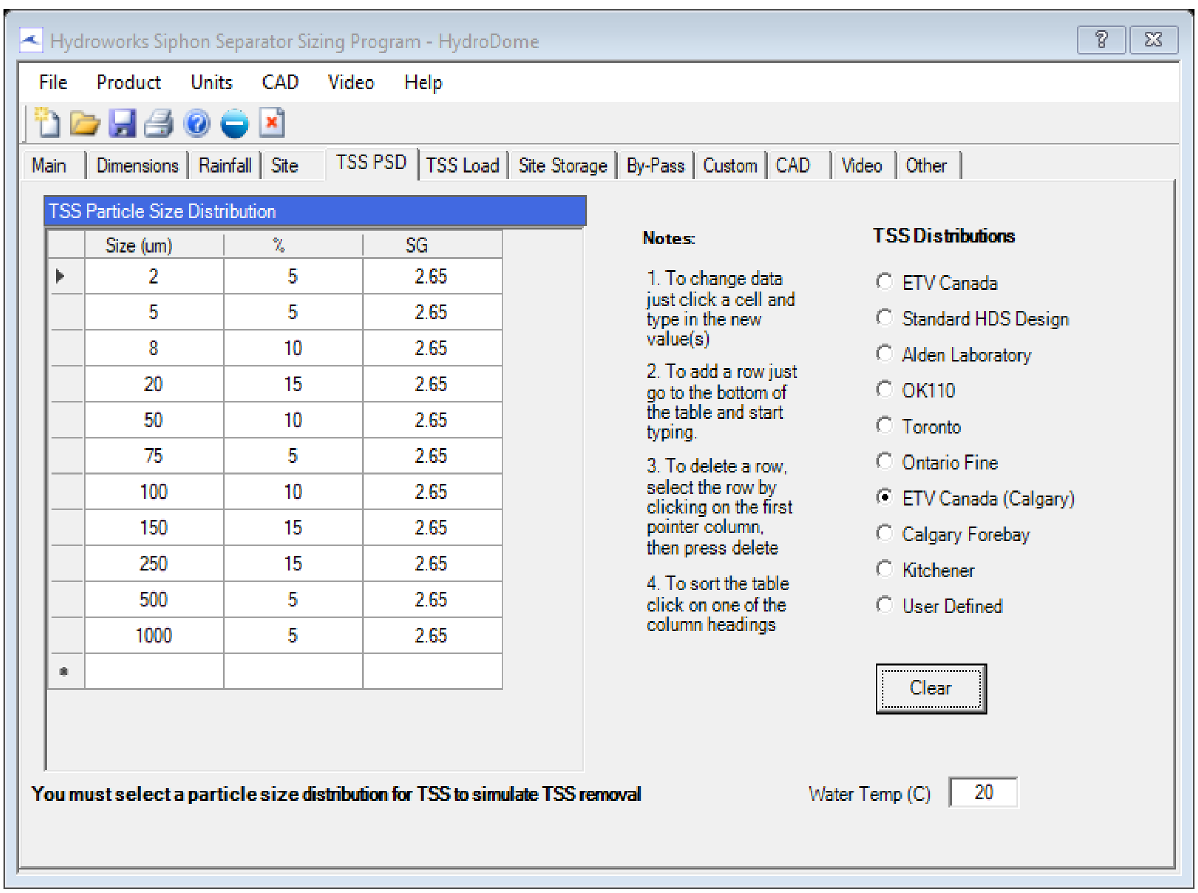
Particle Size Distribution

Size (um)	%	SG
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65

Note: Results vary significantly based on particle size distribution

Simulate

TSS Particle Size Distribution



Hydroworks Siphon Separator Sizing Program - HydroDome

File Product Units CAD Video Help

Main | Dimensions | Rainfall | Site | TSS PSD | TSS Load | Site Storage | By-Pass | Custom | CAD | Video | Other

TSS Particle Size Distribution

Size (um)	%	SG
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65
1000	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

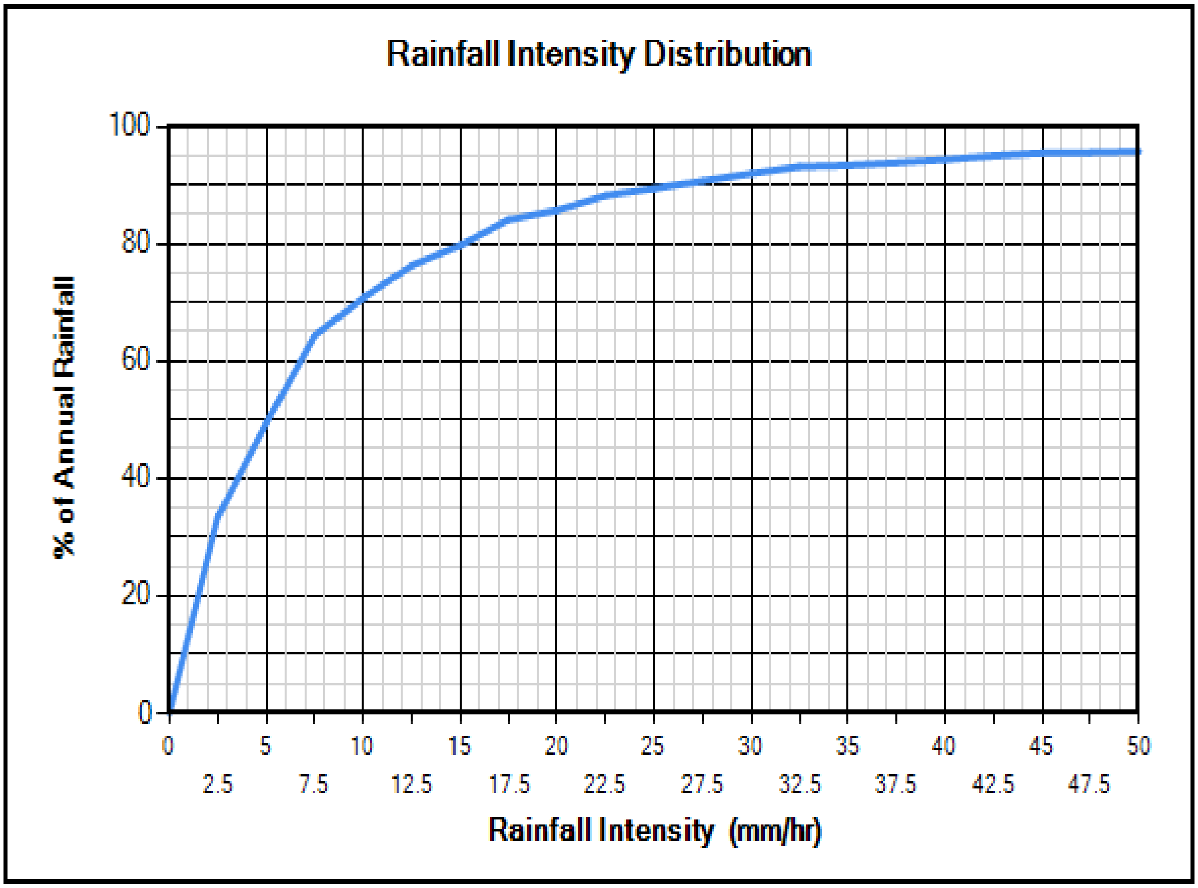
- ETV Canada
- Standard HDS Design
- Alden Laboratory
- OK110
- Toronto
- Ontario Fine
- ◉ ETV Canada (Calgary)
- Calgary Forebay
- Kitchener
- User Defined

Clear

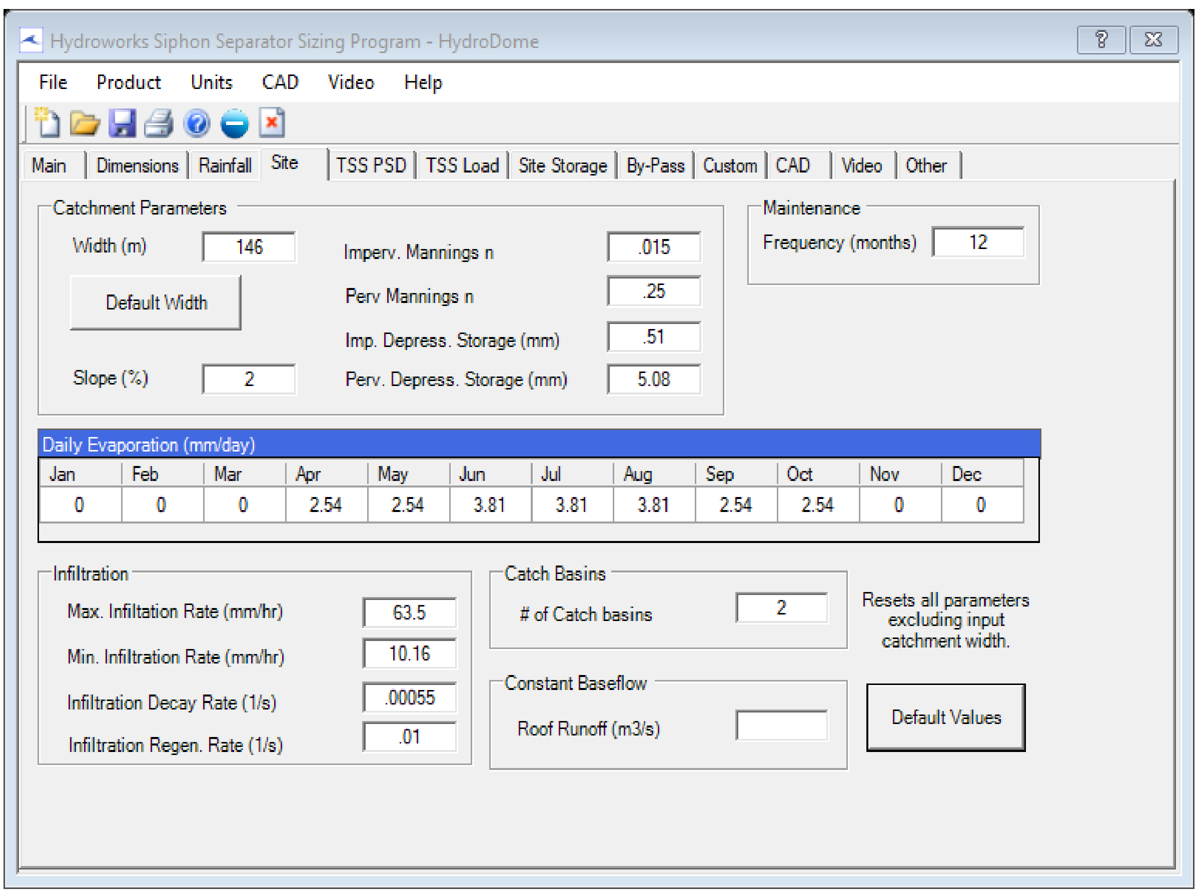
You must select a particle size distribution for TSS to simulate TSS removal

Water Temp (C) 20

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



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Siphon Separator Sizing Program - HydroDome

File Product Units CAD Video Help

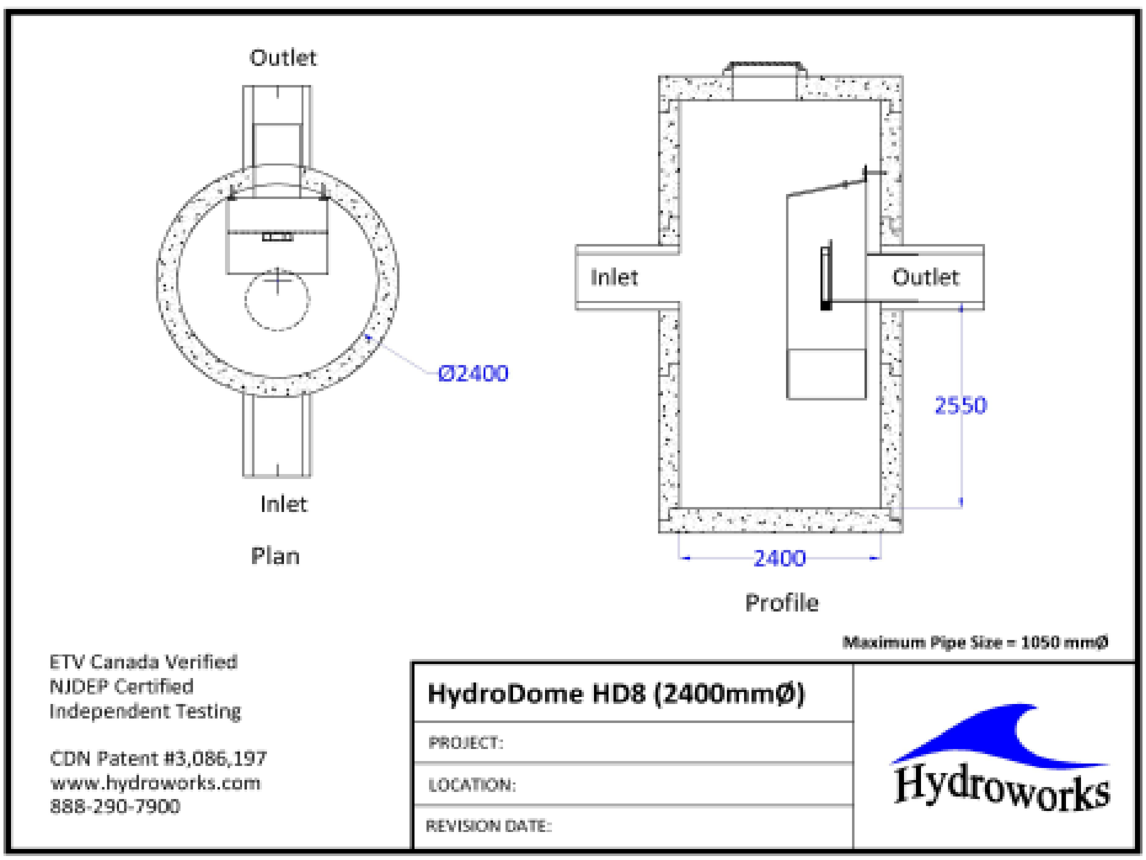
Main | Dimensions | Rainfall | Site | TSS PSD | TSS Load | Site Storage | By-Pass | Custom | CAD | Video | Other

Dimensions and Capacities

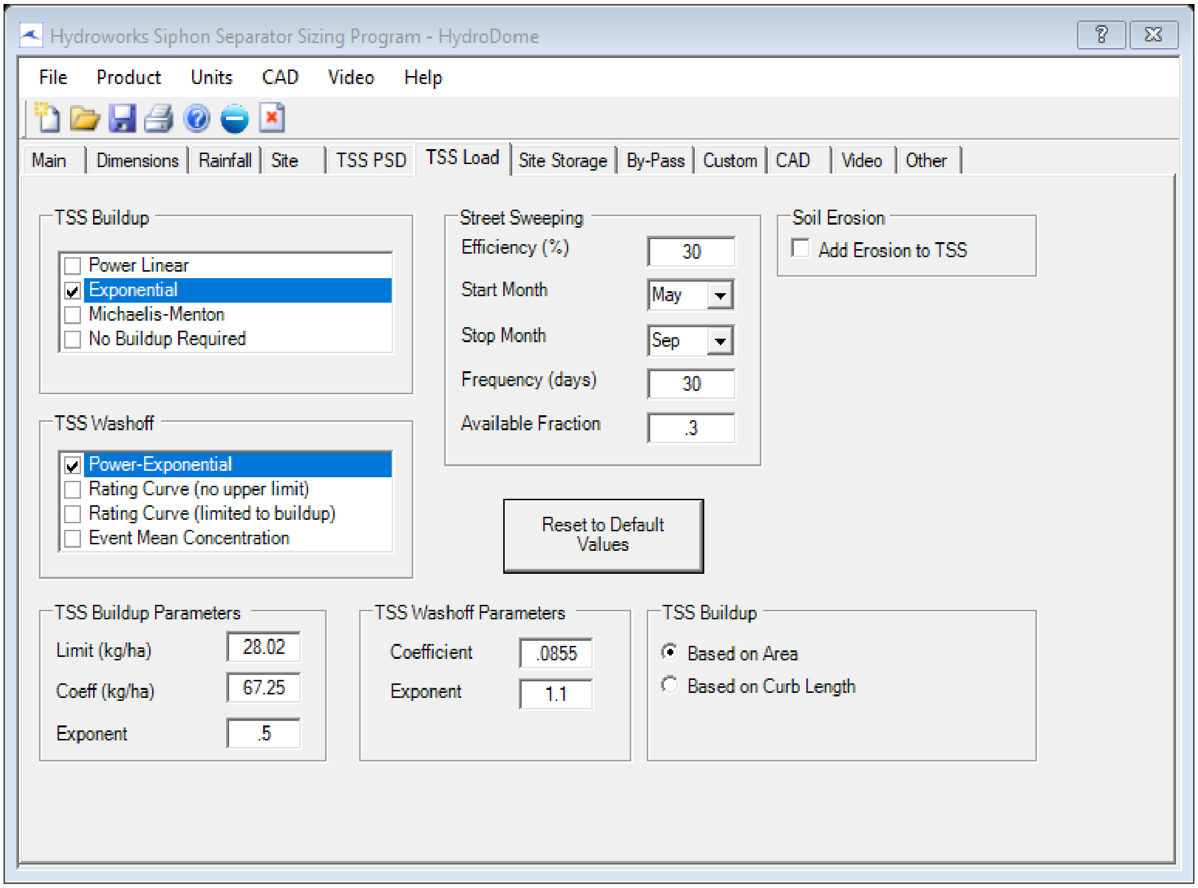
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HD 3	0.91	1.22	123	0.5	0.8
HD 4	1.22	1.37	266	0.9	1.6
HD 5	1.52	1.68	483	1.7	3.1
HD 6	1.83	1.98	803	2.9	5.2
HD 7	2.13	2.29	1226	4.6	8.2
HD 8	2.44	2.59	1863	6.8	12.1
HD 10	3.05	3.2	3617	13	23.3
HD 12	3.66	3.81	6224	22.2	40

Depth = Depth from outlet invert to inside bottom of tank

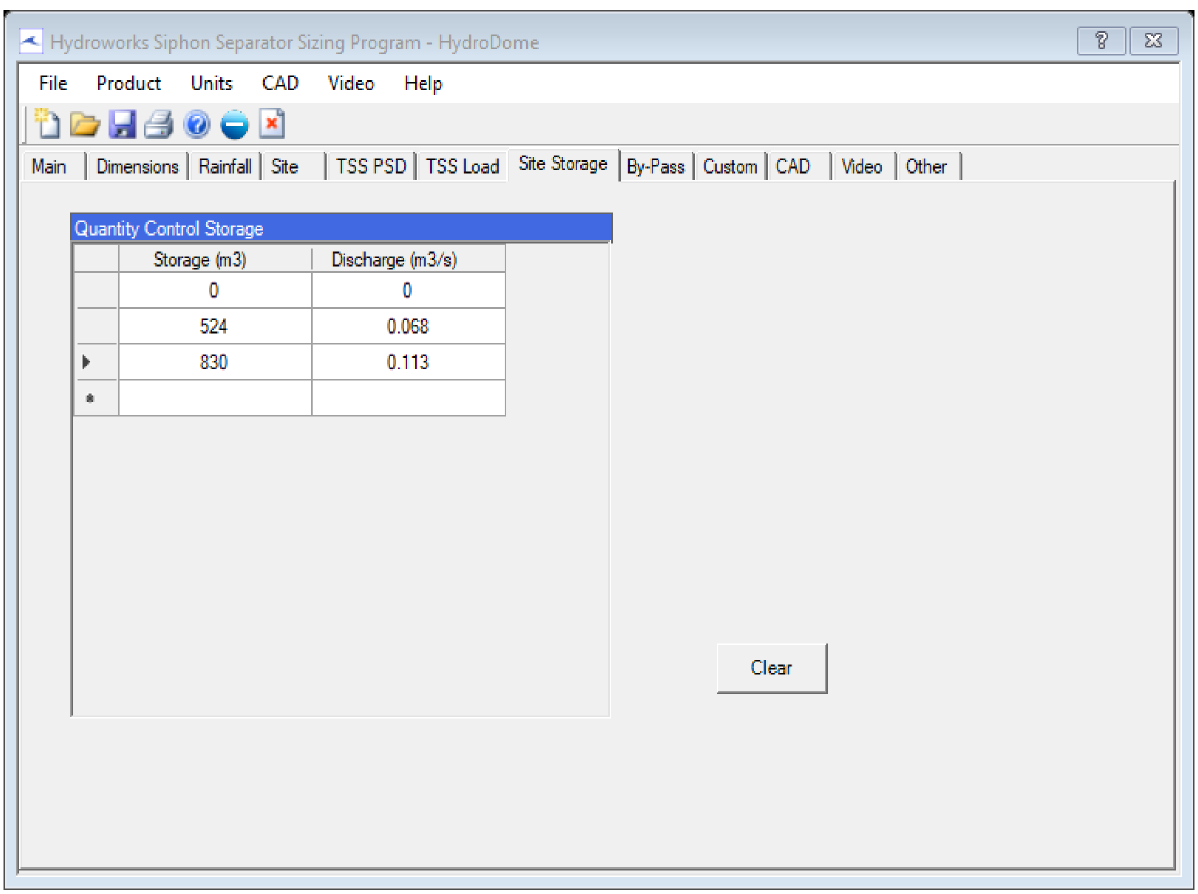
Generic HD 8 CAD Drawing



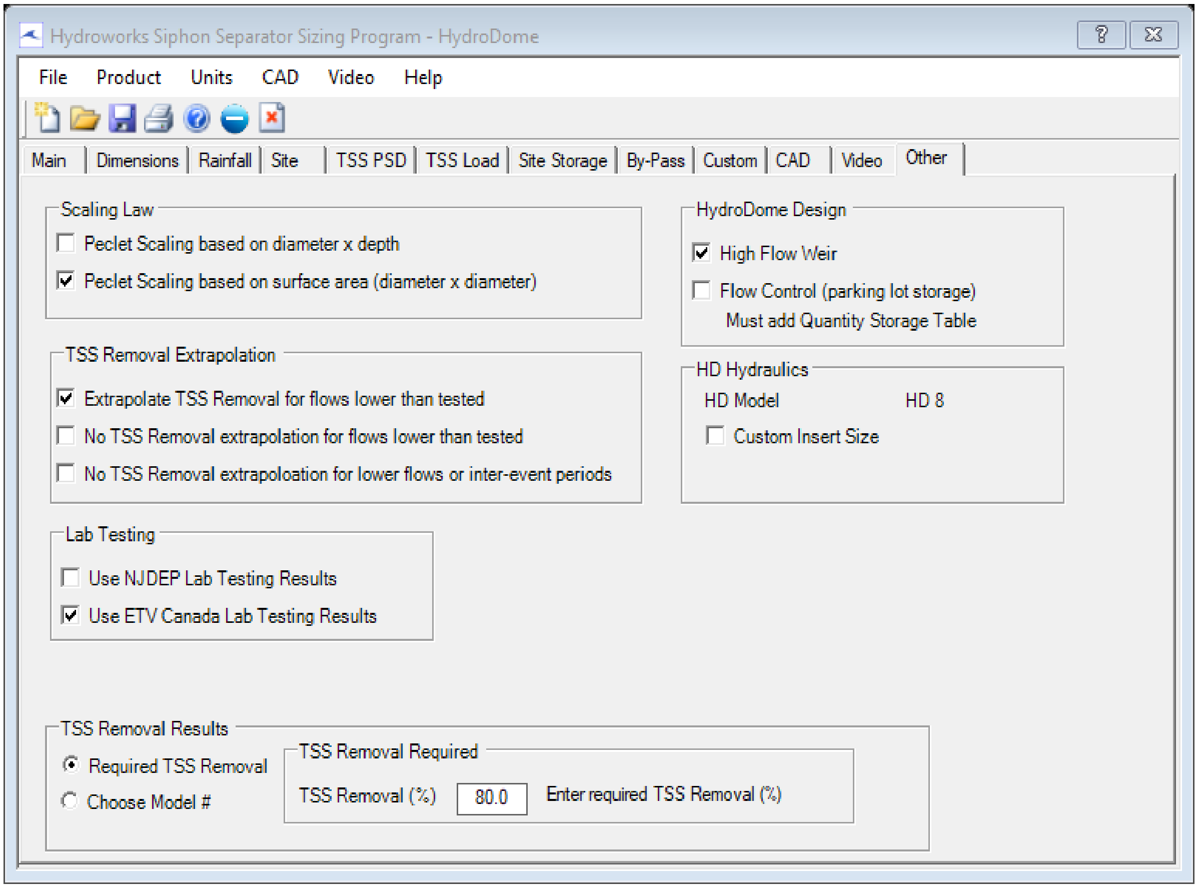
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8.5

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