Hydrograph Report

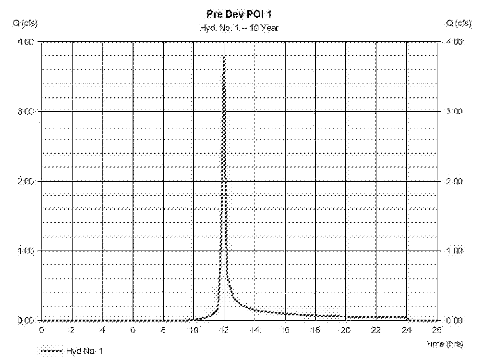
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 1

Pre Dev POI 1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.767 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 8,623 cuft
Drainage area	= 1.040 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.40 min
Total precip.	= 5.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 71)] / 1.040



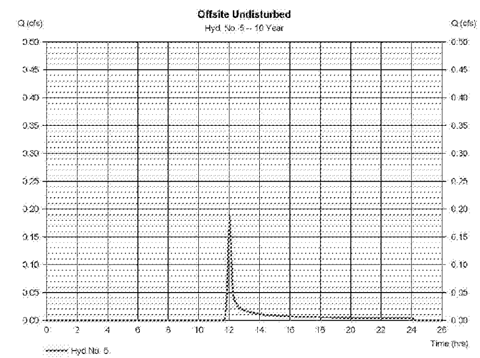
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 5

Offsite Undisturbed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.177 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 504 cuft
Drainage area	= 0.110 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.60 min
Total precip.	= 5.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



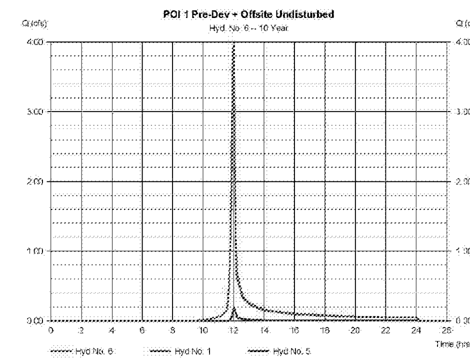
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 6

POI 1 Pre-Dev + Offsite Undisturbed

Hydrograph type	= Combine	Peak discharge	= 3.936 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 9,127 cuft
Inflow hyds.	= 1, 5	Contrib. drain. area	= 1.150 ac



10-YEAR PRE-DEVELOPMENT FLOWS

Hydrograph Report

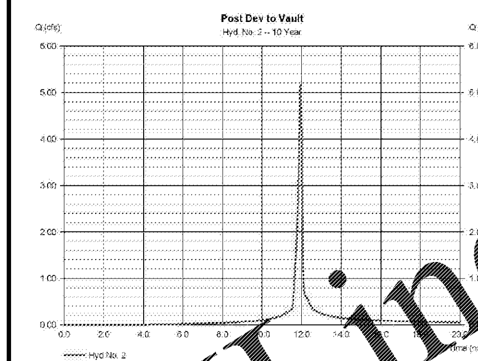
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 2

Post Dev to Vault

Hydrograph type	= SCS Runoff	Peak discharge	= 5.171 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,132 cuft
Drainage area	= 0.800 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.630 x 98) + (0.170 x 61)] / 0.800



Hydrograph Report

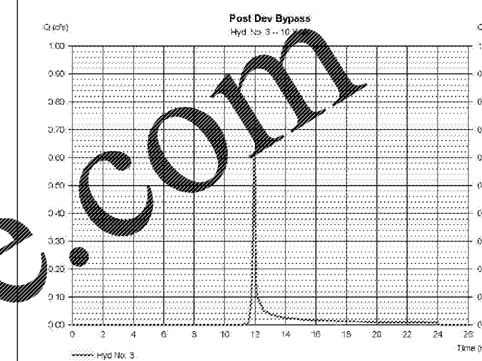
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 3

Post Dev Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.608 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,228 cuft
Drainage area	= 0.240 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.240 x 61)] / 0.240



10-YEAR POST-DEVELOPMENT VAULT FLOW & WSE

Pond Report

2

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Pond No. 2 - Vault

Pond Data

UG Chambers -Invert elev. = 1186.00 ft, Rise x Span = 3.75 x 6.42 ft, Barrel Len = 35.00 ft, No. Barrels = 2, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1186.00	n/a	0	0
0.38	1186.38	n/a	505	505
0.75	1186.75	n/a	500	1,005
1.13	1187.13	n/a	489	1,494
1.50	1187.50	n/a	473	1,967
1.88	1187.88	n/a	451	2,419
2.25	1188.25	n/a	422	2,841
2.63	1188.63	n/a	384	3,224
3.00	1189.00	n/a	334	3,558
3.38	1189.38	n/a	265	3,823
3.75	1189.75	n/a	149	3,972

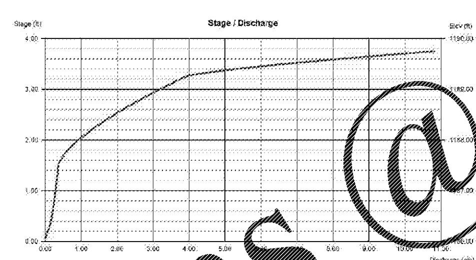
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	2.50	0.00	0.00
Span (in)	= 18.00	3.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1186.00	1186.01	0.00	0.00
Length (ft)	= 12.00	0.01	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.45	0.00	0.00
Crest El. (ft)	= 1189.25	1187.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Report

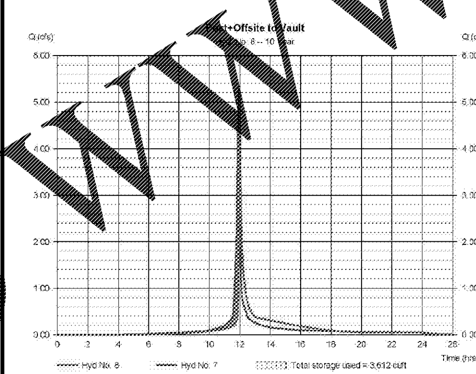
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 8

Post+Offsite to Vault

Hydrograph type	= Reservoir	Peak discharge	= 3.402 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 11,608 cuft
Inflow hyd. No.	= 7 - Post-Dev + Offsite Undisturbed	Max. Elevation	= 1189.13 ft
Reservoir name	= Vault	Max. Storage	= 3,612 cuft

Storage Indication method used.



Hydrograph Report

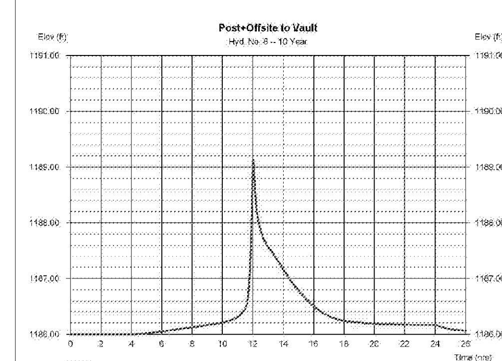
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 8

Post+Offsite to Vault

Hydrograph type	= Reservoir	Peak discharge	= 3.402 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 11,608 cuft
Inflow hyd. No.	= 7 - Post-Dev + Offsite Undisturbed	Max. Elevation	= 1189.13 ft
Reservoir name	= Vault	Max. Storage	= 3,612 cuft

Storage Indication method used.



10-YEAR POST-DEVELOPMENT FLOWS

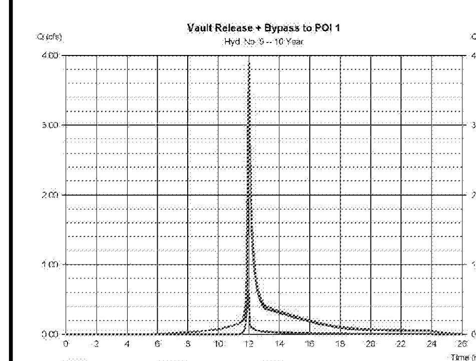
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Thursday, 04 / 4 / 2019

Hyd. No. 9

Vault Release + Bypass to POI 1

Hydrograph type	= Combine	Peak discharge	= 3.907 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 12,836 cuft
Inflow hyds.	= 3, 8	Contrib. drain. area	= 0.240 ac



10-YEAR POST-DEV. ROUTED FLOWS

ENERGY BALANCE

Site:	Rocky Mount - O'Reilly
County:	Franklin
Storm Event:	1 Year
24-Hour Rainfall Depth: (see note 4)	3.5"

Point of Interest ID	1	Comments
Pre-Development		
Q, Flow (cfs)	1.06	
CN, Curve Number	71	
RV, Runoff Depth (in)	1.04	
Drainage Area (ac)	1.04	
RV, Runoff Volume (ac-in)	1.08	
Post-Development		
Q, Flow (cfs)	0.45	
I.F.	0.80	Improvement Factor
CN, Curve Number	83	
RV, Runoff Depth (in)	1.82	
Drainage Area (ac)	1.02	
RV, Runoff Volume (ac-in)	1.85	
Energy Balance (EB)		
Q, Post-Dev (cfs)	0.45	
I.F. * Qpre * RVpre / RVpost	0.490	Q, Post-Dev Allowable (cfs)
EB Achieved	Yes	*See Outfall Narrative for compliance via 9VAC25-870-66.B.3.A

Notes:
1. Q Post-Dev must always be less than or equal to Q Pre-Dev
2. Q Post-Dev is not required to be less than that calculated in the equation (Q forest x RV forest) / RV Post-Dev
3. I.F. = 0.8 for POIs > 1.0 acre, 0.9 for POIs ≤ 1.0 acre
4. 24-Hour Rainfall Depth per VA SWM Handbook, Ch. 11, App. 11-D
5. RV, Runoff Volumes per VA SWM Handbook, Ch. 11, App. 11C

EXCERPT FROM VA ADMINISTRATIVE CODE 9VAC25-870-66:

a. Natural stormwater conveyance systems. When stormwater from a development is discharged to a natural stormwater conveyance system, the maximum peak flow rate from the one-year 24-hour storm following the land-disturbing activity shall be calculated either:

(1) In accordance with the following methodology:

$Q_{Developed} \le I.F. * (Q_{Pre-Developed} * RV_{Pre-Developed}) / RV_{Developed}$

Under no condition shall $Q_{Developed}$ be greater than $Q_{Pre-Developed}$ nor shall $Q_{Developed}$ be required to be less than that calculated in the equation $(Q_{Forest} * RV_{Forest}) / RV_{Developed}$; where

I.F. (Improvement Factor) equals 0.8 for sites > 1 acre or 0.9 for sites ≤ 1 acre.

$Q_{Developed}$ = The allowable peak flow rate of runoff from the developed site.

$RV_{Developed}$ = The volume of runoff from the site in the developed condition.

$Q_{Pre-Developed}$ = The peak flow rate of runoff from the site in the pre-developed condition.

$RV_{Pre-Developed}$ = The volume of runoff from the site in pre-developed condition.

Q_{Forest} = The peak flow rate of runoff from the site in a forested condition.

RV_{Forest} = The volume of runoff from the site in a forested condition; or

(2) In accordance with another methodology that is demonstrated by the VSMP authority to achieve equivalent results and is approved by the board.

Hydrograph Summary Report

1

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.0[illegible]	2	720	2,572	----	----	----	Pre Dev POI 1
2	SCS Runoff	2.452	2	716	5,053	----	----	----	Post Dev to Vault
3	SCS Runoff	0.089	2	718	253	----	----	----	Post Dev Bypass
4	SCS Runoff	2.320	2	718	4,678	----	----	----	Post POI 1 EB Weighted CN Comp C
5	SCS Runoff	0.011	2	726	84	----	----	----	Offsite Undisturbed
6	Combine	1.069	2	720	2,656	1, 5	----	----	POI 1 Pre-Dev + Offsite Undisturbed
7	Combine	2.453	2	716	5,137	2, 5,	----	----	Post-Dev + Offsite Undisturbed
8	Reservoir	0.425	2	726	5,110	7	1187.61	2,099	Post+Offsite to Vault
9	Combine	0.453	2	724	5,366	3, 8	----	----	Vault Release + Bypass to POI 1

2nd Submission Pond Sizing ADS Arch (Vault Sizing) | Return Period: 1 Year | Thursday, 04 / 4 / 2019

Hydrograph Summary Report

2

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.681	2	720	3,820	----	----	----	Pre Dev POI 1
2	SCS Runoff	3.145	2	716	6,563	----	----	----	Post Dev to Vault
3	SCS Runoff	0.189	2	718	453	----	----	----	Post Dev Bypass
4	SCS Runoff	3.162	2	716	6,397	----	----	----	Post POI 1 EB Weighted CN Comp C
5	SCS Runoff	0.039	2	724	165	----	----	----	Offsite Undisturbed
6	Combine	1.713	2	720	4,085	1, 5	----	----	POI 1 Pre-Dev + Offsite Undisturbed
7	Combine	3.158	2	716	6,728	2, 5,	----	----	Post-Dev + Offsite Undisturbed
8	Reservoir	0.992	2	724	6,700	7	1188.04	2,601	Post+Offsite to Vault
9	Combine	1.069	2	722	7,153	3, 8	----	----	Vault Release + Bypass to POI 1

2nd Submission Pond Sizing ADS Arch (Vault Sizing) | Return Period: 2 Year | Thursday, 04 / 4 / 2019

Hydrograph Summary Report

3

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.767	2	720	8,623	----	----	----	Pre Dev POI 1
2	SCS Runoff	5.171	2	716	11,132	----	----	----	Post Dev to Vault
3	SCS Runoff	0.608	2	718	1,228	----	----	----	Post Dev Bypass
4	SCS Runoff	5.742	2	716	11,826	----	----	----	Post POI 1 EB Weighted CN Comp C
5	SCS Runoff	0.177	2	722	504	----	----	----	Offsite Undisturbed
6	Combine	3.936	2	720	9,127	1, 5	----	----	POI 1 Pre-Dev + Offsite Undisturbed
7	Combine	5.264	2	716	11,636	2, 5,	----	----	Post-Dev + Offsite Undisturbed
8	Reservoir	3.402	2	720	11,608	7	1189.13	3,612	Post+Offsite to Vault
9	Combine	3.907	2	720	12,836	3, 8	----	----	Vault Release + Bypass to POI 1

2nd Submission Pond Sizing ADS Arch (Vault Sizing) | Return Period: 10 Year | Thursday, 04 / 4 / 2019

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