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## STORMWATER MANAGEMENT REPORT

# Franklin Taco Bell

## Franklin, IN

200 Paris Drive  
Franklin, IN 44311

Prepared For:  
City of Franklin

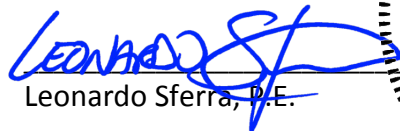
Designer:

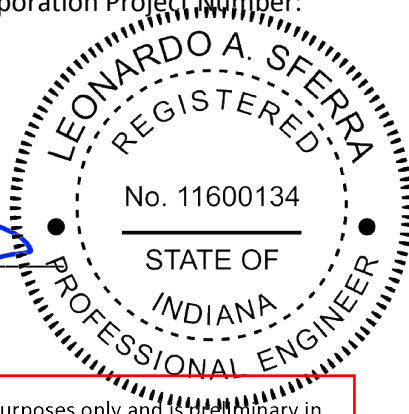
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Project Manager:  
Ryan Oyster

Design Date:  
February 2019

GPD Group, Professional Corporation Project Number:  
2018088.55

  
Leonardo Sferra, P.E.



02/07/19

Date

"This submittal is for permitting purposes only and is preliminary in nature. As such, any other use or reliance is strictly prohibited."

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## **Section 1 - Introduction**

The proposed Taco Bell will be located on the north side of S.R. 44 and is Lot 2 of the Franklin Gateway Development Section II. The site contains 0.91 acres. The proposed project includes the construction of a 1,742 SF Taco Bell restaurant and 23,958 SF of impervious surface. The north and south private drives, along with the associated drainage, was designed by others. This report will analyze the proposed peak flows from the proposed site, provide analysis for the proposed storm water conveyance system, and design the required stormwater detention and water quality for the proposed Taco Bell. The report will follow the guidelines established in the City of Franklin, Indiana Subdivision Control Ordinance Section 6.19, and Franklin Gateway Development Secondary Plan Drainage Report Section II, prepared by Independent Land Surveying and dated November 20, 2018. Hereafter this report will be referred to as the Master Plan.

A summary of peak flows calculated in this report are included in Appendix A.

## **Section 2 - Existing Site**

The existing site was a parking lot for a retail store. All impervious surfaces have or will be removed. The existing site peak flows were analyzed in the Master Plan.

The soil located on site are predominately Crosby silt loam, Brookston silty loam, and Miami silt loam. Soils are classified as Group B. A Soils Map and description are included in Appendix B of this report.

### **Existing Peak Flows**

Peak flows for the existing site were calculated in the Master Plan. The allowable release rates from the Master Plan are as follows:

10-year developed rate = 0.47 cfs

100-year developed rate = 0.98 cfs

## **Section 3 - Proposed Site**

The proposed site contains 4 stormwater inlet structures. The inlets will collect stormwater and route it through the proposed underground detention system and discharges into offsite manhole structure that will be designed by others. The stormwater that is not collected by the inlet structures will be collected offsite by inlet structures that will be designed by others. A copy of the drainage map is included in Appendix C of this report.

### **Proposed Peak Flows and Stormwater Detention**

Using the 2018 Hydraflow Hydrograph Program, the proposed peak flows and detention requirements were calculated using the SCS method. The runoff was analyzed for the 2, 5, 10, 50, and 100 year return storm events and for the 1, 2, 3, 6, 12, and 24 hour storm duration. The "time of concentration" for each basin was assumed at 5 minutes. The runoff "CN" factors used in the calculations are as follows:

98 For all roof, asphalt, and concrete areas

74 For all grass areas

The allowable release rates from the Master Plan are as follows:

10-year developed rate — 0.47 c.f.s.

100-year developed rate - 0.98 c.f.s.

The 1 hour storm duration provided the highest peak flows

The 2 hour storm duration provided the highest storage volume

The proposed peak flows discharging from each basin are included in the Summary of this report (Appendix A).

The program results are included in Appendix D of this report.

#### Detention Control

Stormwater detention will be provided by a 4'x 6' concrete manhole. The concrete manhole will contain a weir wall. A (two) 4-inch diameter holes will be provided at the bottom of the weir wall (739.67) and at elevation 740.93 to serve as outlet control. An emergency overflow weir will be provided in the weir wall at elevation of 741.67.

Results of the routing through the detention pond are provided in Appendix D of this report.

#### Water Quality

Water quality will be provided by:

1. Isolator rows (woven geotextile fabric) installed at the inlet to each underground chamber.
2. One (1) foot of stone placed below the underground chambers drained by a 6" perforated underdrain napped in a geotextile sock.

#### Storm Sewer Sizing

Using the 2018 Hydraflow Storm Sewer Program, the proposed storm sewers were sized to accommodate the peak run-off from a 10-yr. storm event without the hydraulic grade line exceeding the any inlet casting.

Storm Sewer Sizing Calculations for are provided in Appendix E of this report.

#### **Section 4 - Conclusion**

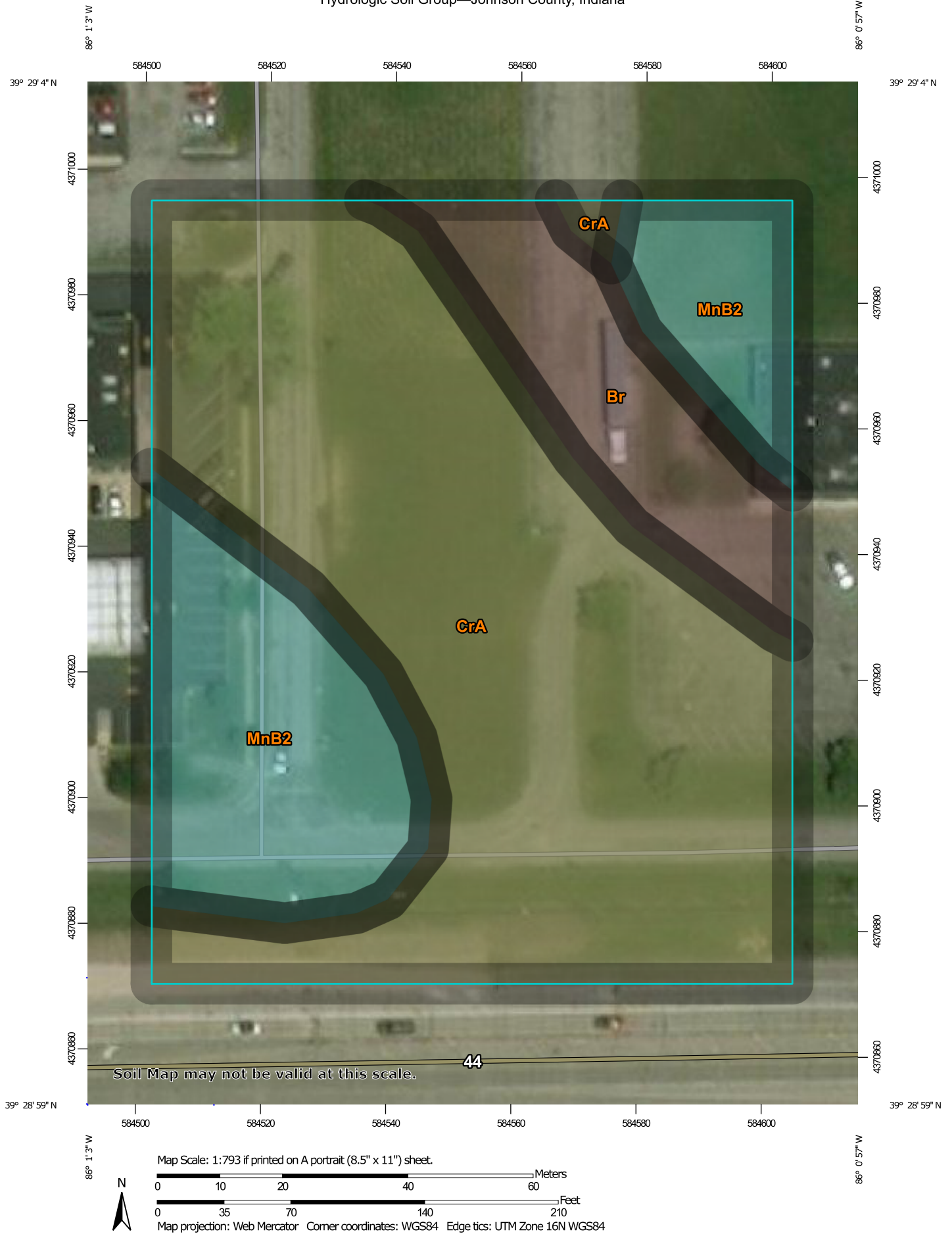
With the reduction of peak runoff from the entire site from the existing, the proposed project will not adversely affect the surrounding properties or any existing storm sewer system.

## **Appendix A**

Calculated Runoff Rates						
	Storm Event					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
Predeveloped Flows (cfs)	1.382	1.763	2.040	2.389	2.657	2.916
Allowable Postdeveloped Flow (cfs)	-	-	0.47			0.98
Underground Detention						
Controlled Release Rate (cfs)	0.395	0.431	0.467	0.528	0.620	0.740
High Water Elevation (ft)	740.72	740.89	741.02	741.17	741.30	741.41
Storage Volume Utilized (cf)	1,088	1,423	1,668	1,967	2,192	2,390

## **Appendix B**


# Hydrologic Soil Group—Johnson County, Indiana





## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnson County, Indiana  
 Survey Area Data: Version 26, Sep 7, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 24, 2014—Mar 20, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Br	Brookston silty clay loam, 0 to 2 percent slopes	B/D	0.4	12.9%
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	C/D	2.0	62.4%
MnB2	Miami silt loam, 2 to 6 percent slopes, eroded	C	0.8	24.7%
<b>Totals for Area of Interest</b>			<b>3.2</b>	<b>100.0%</b>

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

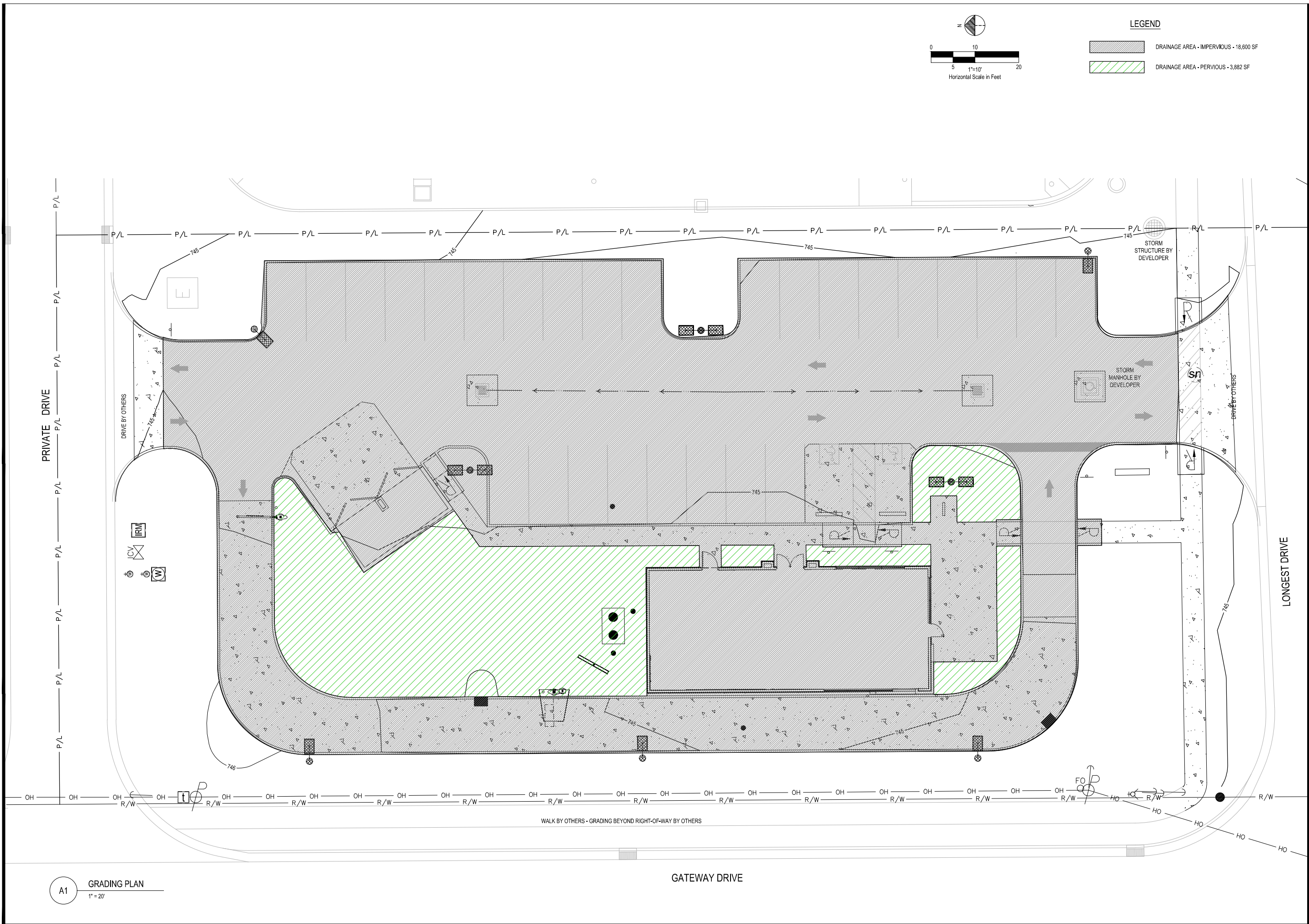
## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

## **Appendix C**



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**NOT FOR CONSTRUCTION**

△	
△	
△	
△	
△	
△	
△	
△	

CONTRACT DATE:  
BUILDING TYPE: ME T40  
PLAN VERSION:  
BRAND DESIGNER:  
SITE NUMBER: 313327  
STORE NUMBER: 2018088.55

TACO BELL  
200 PARIS DRIVE  
FRANKLIN, IN 44311

T40

**DRAINAGE MAP**

**DMAP**

## **Appendix E**

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C:\Users\Njell\OneDrive\TEMP\2019\02 - FEBRUARY\TACO BELL\FRANKLIN\New folder\Hydrograph.gpw

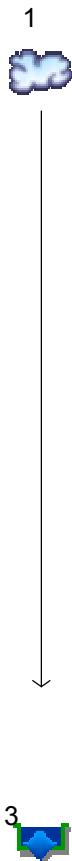
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 02 / 6 / 2019

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# Watershed Model Schematic

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



**Legend**

<b><u>Hyd.</u></b>	<b><u>Origin</u></b>	<b><u>Description</u></b>
1	SCS Runoff	Post Developed Project Area
3	Reservoir	Pond Routing





# Hydrograph Summary Report

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	1.382	2	716	2,914	-----	-----	-----	Post Developed Project Area
3	Reservoir	0.395	2	724	2,898	1	740.72	1,088	Pond Routing
C:\Users\Myanda\Desktop\TEMP\2019\02 - FEBRUARY PERIOD BAR FRANKLIN					Wednesday, 02/07/2019				

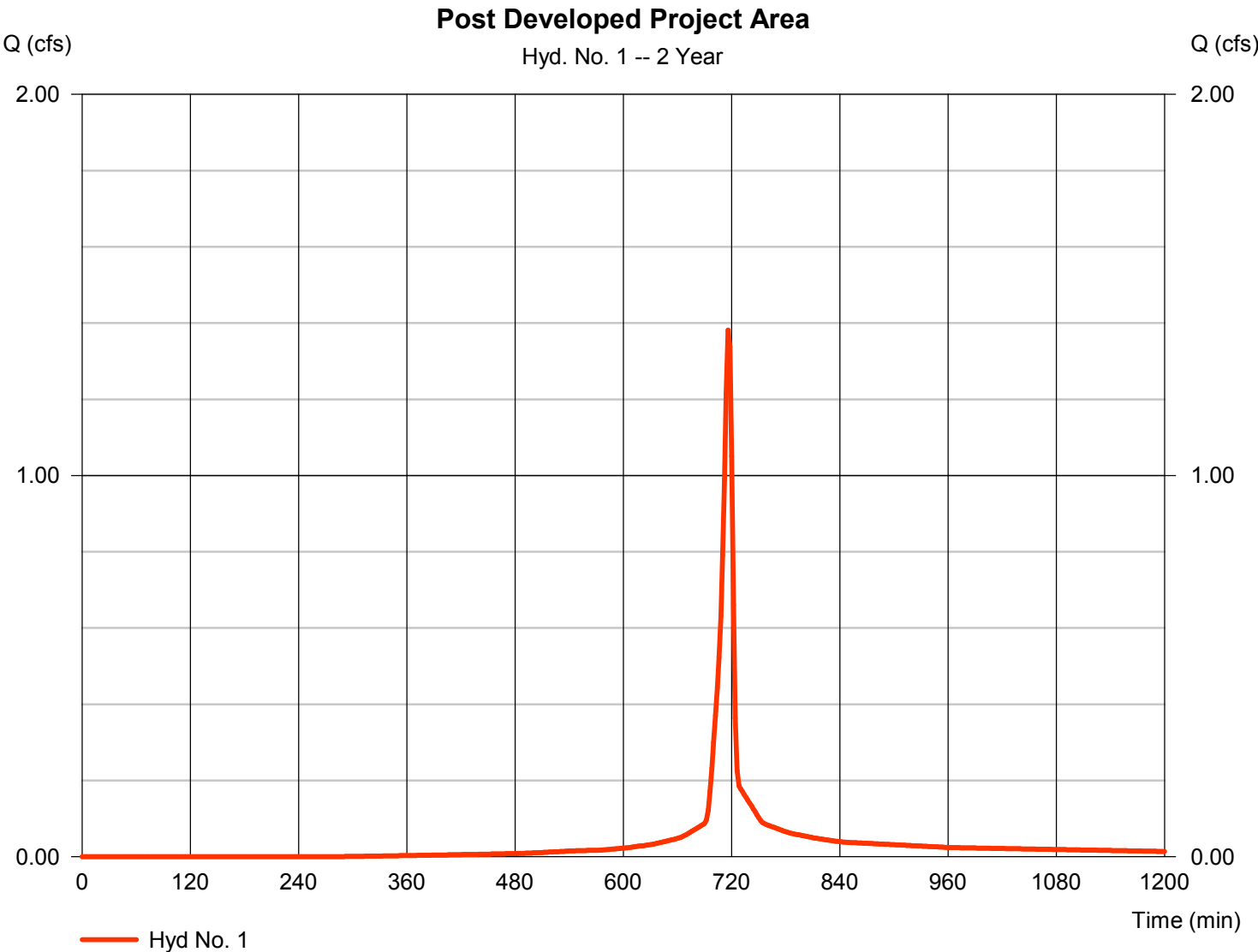
# Hydrograph Report

## Hyd. No. 1

### Post Developed Project Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.382 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	2,914 cuft
Drainage area	=	0.510 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

\* Composite (Area/CN) = [(0.420 x 98) + (0.090 x 74)] / 0.510



# Hydrograph Report

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

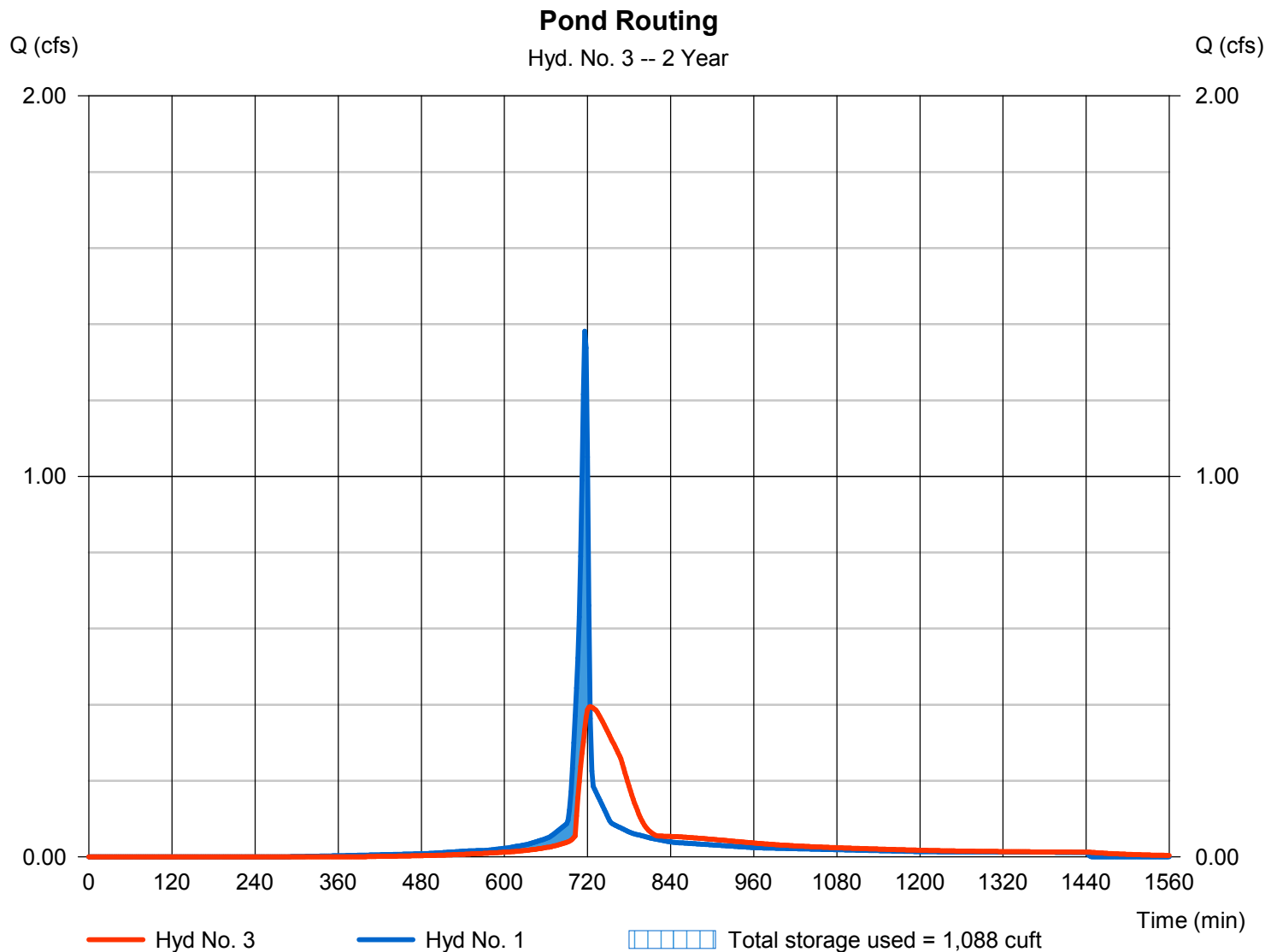
Wednesday, 02 / 6 / 2019

## Hyd. No. 3

### Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.395 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,898 cuft
Inflow hyd. No.	= 1 - Post Developed Project Area	Max. Elevation	= 740.72 ft
Reservoir name	= Underground Detention	Max. Storage	= 1,088 cuft

Storage Indication method used.



# Pond Report

6

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Wednesday, 02 / 6 / 2019

## Pond No. 1 - Underground Detention

### Pond Data

Pond storage is based on user-defined values.

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	739.67	n/a	0	0
0.25	739.92	n/a	248	248
0.50	740.17	n/a	247	495
0.75	740.42	n/a	248	743
1.00	740.67	n/a	247	990
1.25	740.92	n/a	499	1,489
1.50	741.17	n/a	478	1,967
1.75	741.42	n/a	440	2,407
2.00	741.67	n/a	398	2,805
2.25	741.92	n/a	303	3,108
2.50	742.17	n/a	254	3,362
2.75	742.42	n/a	247	3,609
3.00	742.67	n/a	248	3,857

### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 4.00	4.00	0.00	0.00
Span (in)	= 4.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 739.67	740.93	0.00	0.00
Length (ft)	= 1.00	1.00	0.00	0.00
Slope (%)	= 1.00	1.00	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	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.00	0.00	0.00	0.00
Crest El. (ft)	= 741.67	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
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).

### Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	739.67	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.03	25	739.70	0.00 oc	0.00	---	---	0.00	---	---	---	---	---	0.002
0.05	50	739.72	0.00 oc	0.00	---	---	0.00	---	---	---	---	---	0.005
0.08	74	739.75	0.01 oc	0.00	---	---	0.00	---	---	---	---	---	0.009
0.10	99	739.77	0.01 oc	0.00	---	---	0.00	---	---	---	---	---	0.014
0.13	124	739.80	0.02 oc	0.00	---	---	0.00	---	---	---	---	---	0.019
0.15	149	739.82	0.02 oc	0.00	---	---	0.00	---	---	---	---	---	0.024
0.18	174	739.85	0.03 oc	0.00	---	---	0.00	---	---	---	---	---	0.030
0.20	198	739.87	0.04 oc	0.00	---	---	0.00	---	---	---	---	---	0.035
0.23	223	739.90	0.04 oc	0.00	---	---	0.00	---	---	---	---	---	0.040
0.25	248	739.92	0.05 oc	0.00	---	---	0.00	---	---	---	---	---	0.045
0.28	273	739.95	0.05 oc	0.00	---	---	0.00	---	---	---	---	---	0.049
0.30	297	739.97	0.05 oc	0.00	---	---	0.00	---	---	---	---	---	0.053
0.33	322	740.00	0.05 oc	0.00	---	---	0.00	---	---	---	---	---	0.055
0.35	347	740.02	0.09 oc	0.00	---	---	0.00	---	---	---	---	---	0.093
0.38	372	740.05	0.13 oc	0.00	---	---	0.00	---	---	---	---	---	0.127
0.40	396	740.07	0.15 oc	0.00	---	---	0.00	---	---	---	---	---	0.153
0.43	421	740.10	0.18 oc	0.00	---	---	0.00	---	---	---	---	---	0.176
0.45	446	740.12	0.20 oc	0.00	---	---	0.00	---	---	---	---	---	0.196
0.48	470	740.15	0.21 oc	0.00	---	---	0.00	---	---	---	---	---	0.214
0.50	495	740.17	0.23 oc	0.00	---	---	0.00	---	---	---	---	---	0.230
0.52	520	740.19	0.25 oc	0.00	---	---	0.00	---	---	---	---	---	0.246
0.55	545	740.22	0.26 ic	0.00	---	---	0.00	---	---	---	---	---	0.260
0.57	569	740.24	0.27 ic	0.00	---	---	0.00	---	---	---	---	---	0.268
0.60	594	740.27	0.28 ic	0.00	---	---	0.00	---	---	---	---	---	0.276
0.62	619	740.29	0.28 ic	0.00	---	---	0.00	---	---	---	---	---	0.284
0.65	644	740.32	0.29 ic	0.00	---	---	0.00	---	---	---	---	---	0.291
0.67	669	740.34	0.30 ic	0.00	---	---	0.00	---	---	---	---	---	0.299
0.70	693	740.37	0.31 ic	0.00	---	---	0.00	---	---	---	---	---	0.306
0.72	718	740.39	0.31 ic	0.00	---	---	0.00	---	---	---	---	---	0.313
0.75	743	740.42	0.32 ic	0.00	---	---	0.00	---	---	---	---	---	0.320

Continues on next page...

## Underground Detention

**Stage / Storage / Discharge Table**

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.77	768	740.44	0.33 ic	0.00	---	---	0.00	---	---	---	---	---	0.327
0.80	792	740.47	0.33 ic	0.00	---	---	0.00	---	---	---	---	---	0.333
0.82	817	740.49	0.34 ic	0.00	---	---	0.00	---	---	---	---	---	0.340
0.85	842	740.52	0.35 ic	0.00	---	---	0.00	---	---	---	---	---	0.347
0.87	867	740.54	0.35 ic	0.00	---	---	0.00	---	---	---	---	---	0.353
0.90	891	740.57	0.36 ic	0.00	---	---	0.00	---	---	---	---	---	0.359
0.92	916	740.59	0.37 ic	0.00	---	---	0.00	---	---	---	---	---	0.366
0.95	941	740.62	0.37 ic	0.00	---	---	0.00	---	---	---	---	---	0.372
0.97	965	740.64	0.38 ic	0.00	---	---	0.00	---	---	---	---	---	0.378
1.00	990	740.67	0.38 ic	0.00	---	---	0.00	---	---	---	---	---	0.384
1.03	1,040	740.70	0.39 ic	0.00	---	---	0.00	---	---	---	---	---	0.389
1.05	1,090	740.72	0.40 ic	0.00	---	---	0.00	---	---	---	---	---	0.395
1.08	1,140	740.75	0.40 ic	0.00	---	---	0.00	---	---	---	---	---	0.401
1.10	1,190	740.77	0.41 ic	0.00	---	---	0.00	---	---	---	---	---	0.406
1.13	1,240	740.80	0.41 ic	0.00	---	---	0.00	---	---	---	---	---	0.412
1.15	1,289	740.82	0.42 ic	0.00	---	---	0.00	---	---	---	---	---	0.417
1.18	1,339	740.85	0.42 ic	0.00	---	---	0.00	---	---	---	---	---	0.422
1.20	1,389	740.87	0.43 ic	0.00	---	---	0.00	---	---	---	---	---	0.428
1.23	1,439	740.90	0.43 ic	0.00	---	---	0.00	---	---	---	---	---	0.433
1.25	1,489	740.92	0.44 ic	0.00	---	---	0.00	---	---	---	---	---	0.438
1.28	1,537	740.95	0.44 ic	0.00 oc	---	---	0.00	---	---	---	---	---	0.444
1.30	1,585	740.97	0.45 ic	0.00 oc	---	---	0.00	---	---	---	---	---	0.452
1.33	1,632	741.00	0.45 ic	0.01 oc	---	---	0.00	---	---	---	---	---	0.460
1.35	1,680	741.02	0.46 ic	0.01 oc	---	---	0.00	---	---	---	---	---	0.470
1.38	1,728	741.05	0.46 ic	0.02 oc	---	---	0.00	---	---	---	---	---	0.479
1.40	1,776	741.07	0.47 ic	0.02 oc	---	---	0.00	---	---	---	---	---	0.489
1.43	1,824	741.10	0.47 ic	0.03 oc	---	---	0.00	---	---	---	---	---	0.499
1.45	1,871	741.12	0.48 ic	0.03 oc	---	---	0.00	---	---	---	---	---	0.509
1.48	1,919	741.15	0.48 ic	0.04 oc	---	---	0.00	---	---	---	---	---	0.518
1.50	1,967	741.17	0.49 ic	0.04 oc	---	---	0.00	---	---	---	---	---	0.528
1.52	2,011	741.19	0.49 ic	0.05 oc	---	---	0.00	---	---	---	---	---	0.537
1.55	2,055	741.22	0.49 ic	0.05 oc	---	---	0.00	---	---	---	---	---	0.545
1.57	2,099	741.24	0.50 ic	0.05 oc	---	---	0.00	---	---	---	---	---	0.552
1.60	2,143	741.27	0.50 ic	0.07 oc	---	---	0.00	---	---	---	---	---	0.570
1.62	2,187	741.29	0.51 ic	0.11 oc	---	---	0.00	---	---	---	---	---	0.616
1.65	2,231	741.32	0.51 ic	0.14 oc	---	---	0.00	---	---	---	---	---	0.650
1.67	2,275	741.34	0.52 ic	0.16 oc	---	---	0.00	---	---	---	---	---	0.679
1.70	2,319	741.37	0.52 ic	0.18 oc	---	---	0.00	---	---	---	---	---	0.704
1.72	2,363	741.39	0.52 ic	0.20 oc	---	---	0.00	---	---	---	---	---	0.727
1.75	2,407	741.42	0.53 ic	0.22 oc	---	---	0.00	---	---	---	---	---	0.749
1.77	2,447	741.44	0.53 ic	0.24 oc	---	---	0.00	---	---	---	---	---	0.770
1.80	2,487	741.47	0.54 ic	0.25 oc	---	---	0.00	---	---	---	---	---	0.790
1.82	2,526	741.49	0.54 ic	0.26 ic	---	---	0.00	---	---	---	---	---	0.805
1.85	2,566	741.52	0.54 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.817
1.87	2,606	741.54	0.55 ic	0.28 ic	---	---	0.00	---	---	---	---	---	0.829
1.90	2,646	741.57	0.55 ic	0.29 ic	---	---	0.00	---	---	---	---	---	0.841
1.92	2,686	741.59	0.56 ic	0.30 ic	---	---	0.00	---	---	---	---	---	0.853
1.95	2,725	741.62	0.56 ic	0.30 ic	---	---	0.00	---	---	---	---	---	0.865
1.97	2,765	741.64	0.56 ic	0.31 ic	---	---	0.00	---	---	---	---	---	0.876
2.00	2,805	741.67	0.57 ic	0.32 ic	---	---	0.00	---	---	---	---	---	0.887
2.03	2,835	741.70	0.57 ic	0.33 ic	---	---	0.03	---	---	---	---	---	0.925
2.05	2,866	741.72	0.58 ic	0.33 ic	---	---	0.08	---	---	---	---	---	0.985
2.08	2,896	741.75	0.58 ic	0.34 ic	---	---	0.14	---	---	---	---	---	1.059
2.10	2,926	741.77	0.58 ic	0.35 ic	---	---	0.22	---	---	---	---	---	1.145
2.13	2,957	741.80	0.59 ic	0.35 ic	---	---	0.30	---	---	---	---	---	1.241
2.15	2,987	741.82	0.59 ic	0.36 ic	---	---	0.40	---	---	---	---	---	1.346
2.18	3,017	741.85	0.60 ic	0.36 ic	---	---	0.50	---	---	---	---	---	1.459
2.20	3,047	741.87	0.60 ic	0.37 ic	---	---	0.61	---	---	---	---	---	1.579
2.23	3,078	741.90	0.60 ic	0.38 ic	---	---	0.73	---	---	---	---	---	1.707
2.25	3,108	741.92	0.61 ic	0.38 ic	---	---	0.85	---	---	---	---	---	1.842
2.28	3,133	741.95	0.61 ic	0.39 ic	---	---	0.98	---	---	---	---	---	1.978
2.30	3,159	741.97	0.61 ic	0.39 ic	---	---	1.11	---	---	---	---	---	2.119
2.33	3,184	742.00	0.62 ic	0.40 ic	---	---	1.25	---	---	---	---	---	2.267
2.35	3,210	742.02	0.62 ic	0.40 ic	---	---	1.39	---	---	---	---	---	2.419
2.38	3,235	742.05	0.62 ic	0.41 ic	---	---	1.54	---	---	---	---	---	2.576
2.40	3,260	742.07	0.63 ic	0.41 ic	---	---	1.70	---	---	---	---	---	2.738
2.43	3,286	742.10	0.63 ic	0.42 ic	---	---	1.85	---	---	---	---	---	2.905
2.45	3,311	742.12	0.63 ic	0.43 ic	---	---	2.02	---	---	---	---	---	3.076
2.48	3,337	742.15	0.64 ic	0.43 ic	---	---	2.18	---	---	---	---	---	3.252
2.50	3,362	742.17	0.64 ic	0.44 ic	---	---	2.35	---	---	---	---	---	3.432
2.52	3,387	742.19	0.65 ic	0.44 ic	---	---	2.53	---	---	---	---	---	3.616
2.55	3,411	742.22	0.65 ic	0.45 ic	---	---	2.71	---	---	---	---	---	3.804

Continues on next page...

Underground Detention

**Stage / Storage / Discharge Table**

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.57	3,436	742.24	0.65 ic	0.45 ic	---	---	2.89	---	---	---	---	---	3.997
2.60	3,461	742.27	0.66 ic	0.45 ic	---	---	3.08	---	---	---	---	---	4.193
2.62	3,485	742.29	0.66 ic	0.46 ic	---	---	3.27	---	---	---	---	---	4.393
2.65	3,510	742.32	0.66 ic	0.46 ic	---	---	3.47	---	---	---	---	---	4.597
2.67	3,535	742.34	0.67 ic	0.47 ic	---	---	3.67	---	---	---	---	---	4.804
2.70	3,560	742.37	0.67 ic	0.47 ic	---	---	3.87	---	---	---	---	---	5.015
2.72	3,584	742.39	0.67 ic	0.48 ic	---	---	4.08	---	---	---	---	---	5.230
2.75	3,609	742.42	0.67 ic	0.48 ic	---	---	4.29	---	---	---	---	---	5.448
2.77	3,634	742.44	0.68 ic	0.49 ic	---	---	4.51	---	---	---	---	---	5.677
2.80	3,659	742.47	0.68 ic	0.49 ic	---	---	4.74	---	---	---	---	---	5.910
2.82	3,683	742.49	0.68 ic	0.50 ic	---	---	4.96	---	---	---	---	---	6.146
2.85	3,708	742.52	0.69 ic	0.50 ic	---	---	5.20	---	---	---	---	---	6.385
2.87	3,733	742.54	0.69 ic	0.51 ic	---	---	5.43	---	---	---	---	---	6.628
2.90	3,758	742.57	0.69 ic	0.51 ic	---	---	5.67	---	---	---	---	---	6.875
2.92	3,783	742.59	0.70 ic	0.51 ic	---	---	5.91	---	---	---	---	---	7.124
2.95	3,807	742.62	0.70 ic	0.52 ic	---	---	6.16	---	---	---	---	---	7.377
2.97	3,832	742.64	0.70 ic	0.52 ic	---	---	6.41	---	---	---	---	---	7.633
3.00	3,857	742.67	0.71 ic	0.53 ic	---	---	6.66	---	---	---	---	---	7.894

...End

# Hydrograph Summary Report

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	1.763	2	716	3,777	-----	-----	-----	Post Developed Project Area
3	Reservoir	0.431	2	724	3,761	1	740.89	1,423	Pond Routing
C:\Users\Myanda\Desktop\TEMP\2019\02 - FEBRUARY TACO BEAR\FRANKLIN Meadows Hydrograph 2019									



# Hydrograph Report

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

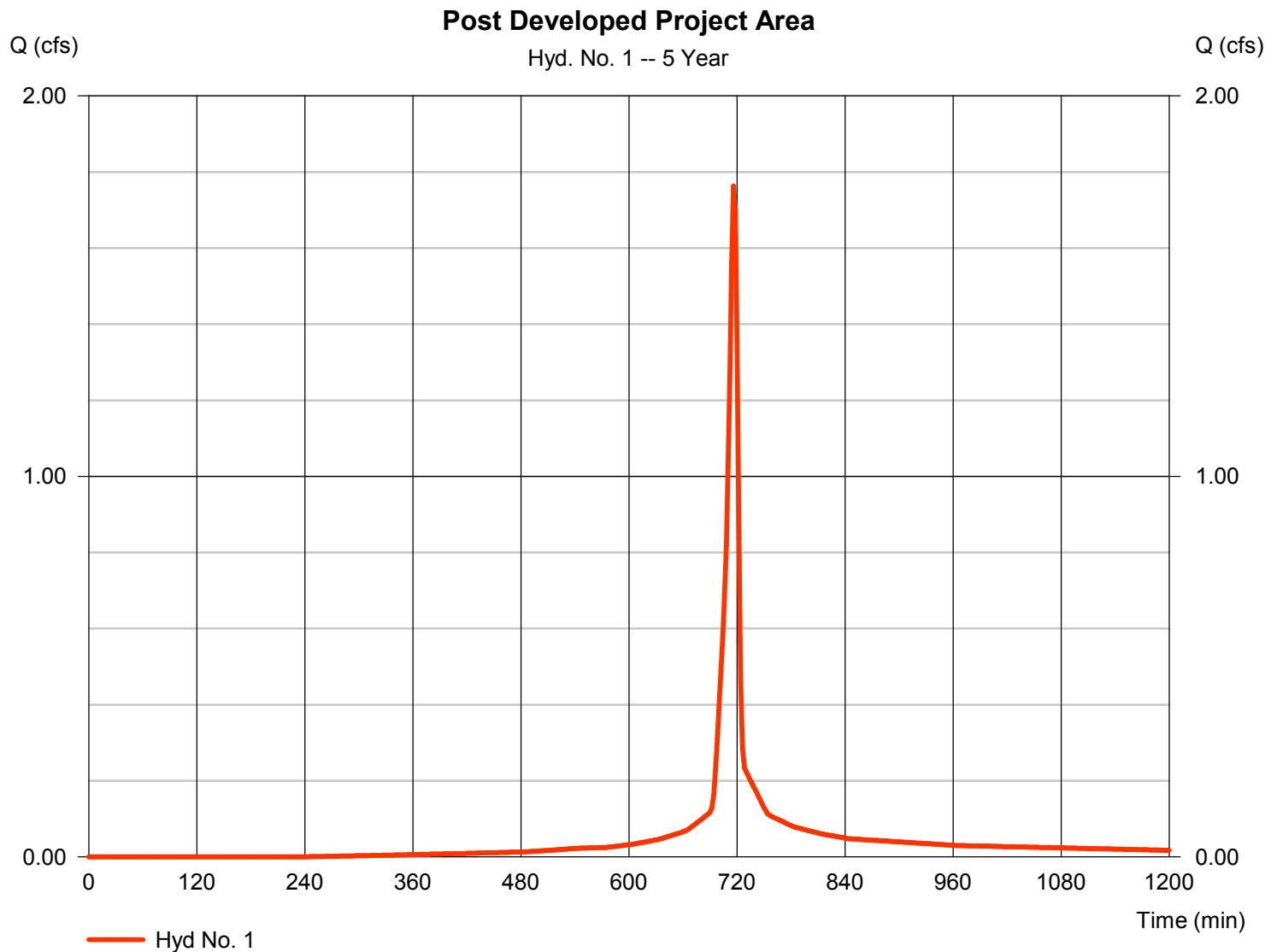
Wednesday, 02 / 6 / 2019

## Hyd. No. 1

### Post Developed Project Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.763 cfs
Storm frequency	= 5 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,777 cuft
Drainage area	= 0.510 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.420 \times 98) + (0.090 \times 74)] / 0.510$



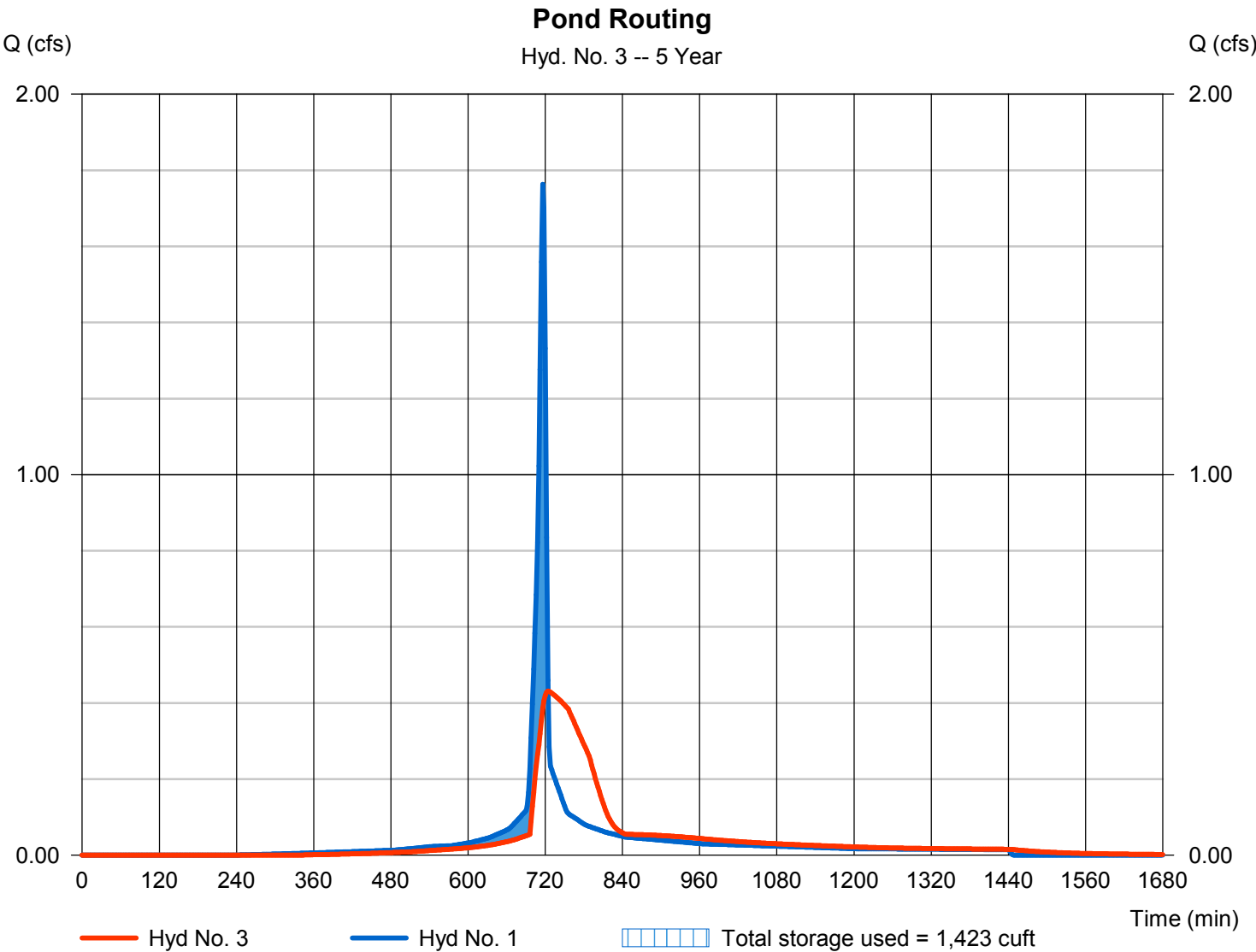
# Hydrograph Report

## Hyd. No. 3

### Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.431 cfs
Storm frequency	= 5 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 3,761 cuft
Inflow hyd. No.	= 1 - Post Developed Project Area	Max. Elevation	= 740.89 ft
Reservoir name	= Underground Detention	Max. Storage	= 1,423 cuft

Storage Indication method used.





# Hydrograph Report

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

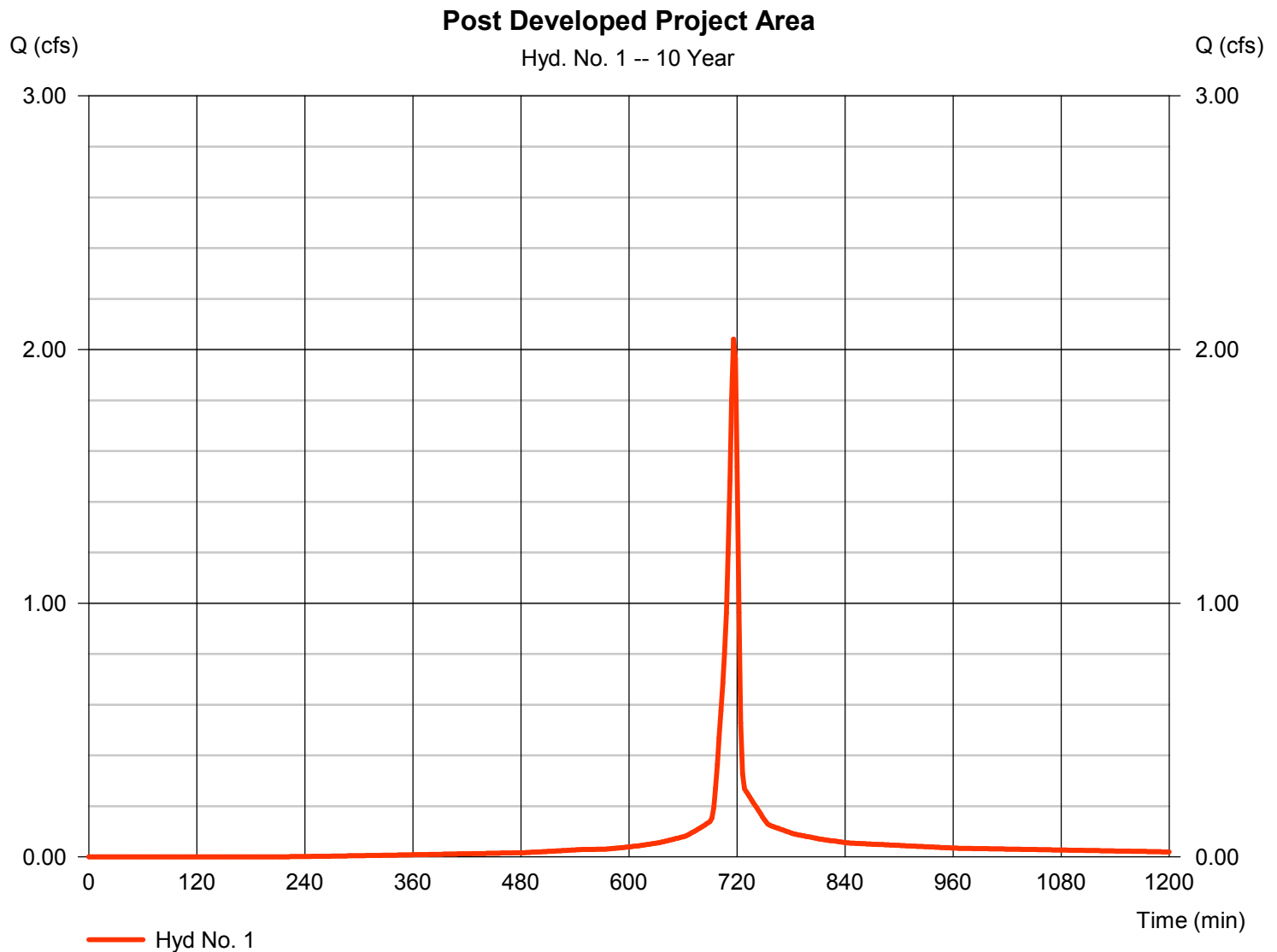
Wednesday, 02 / 6 / 2019

## Hyd. No. 1

### Post Developed Project Area

Hydrograph type	= SCS Runoff	Peak discharge	= 2.040 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 4,415 cuft
Drainage area	= 0.510 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.420 \times 98) + (0.090 \times 74)] / 0.510$



# Hydrograph Report

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

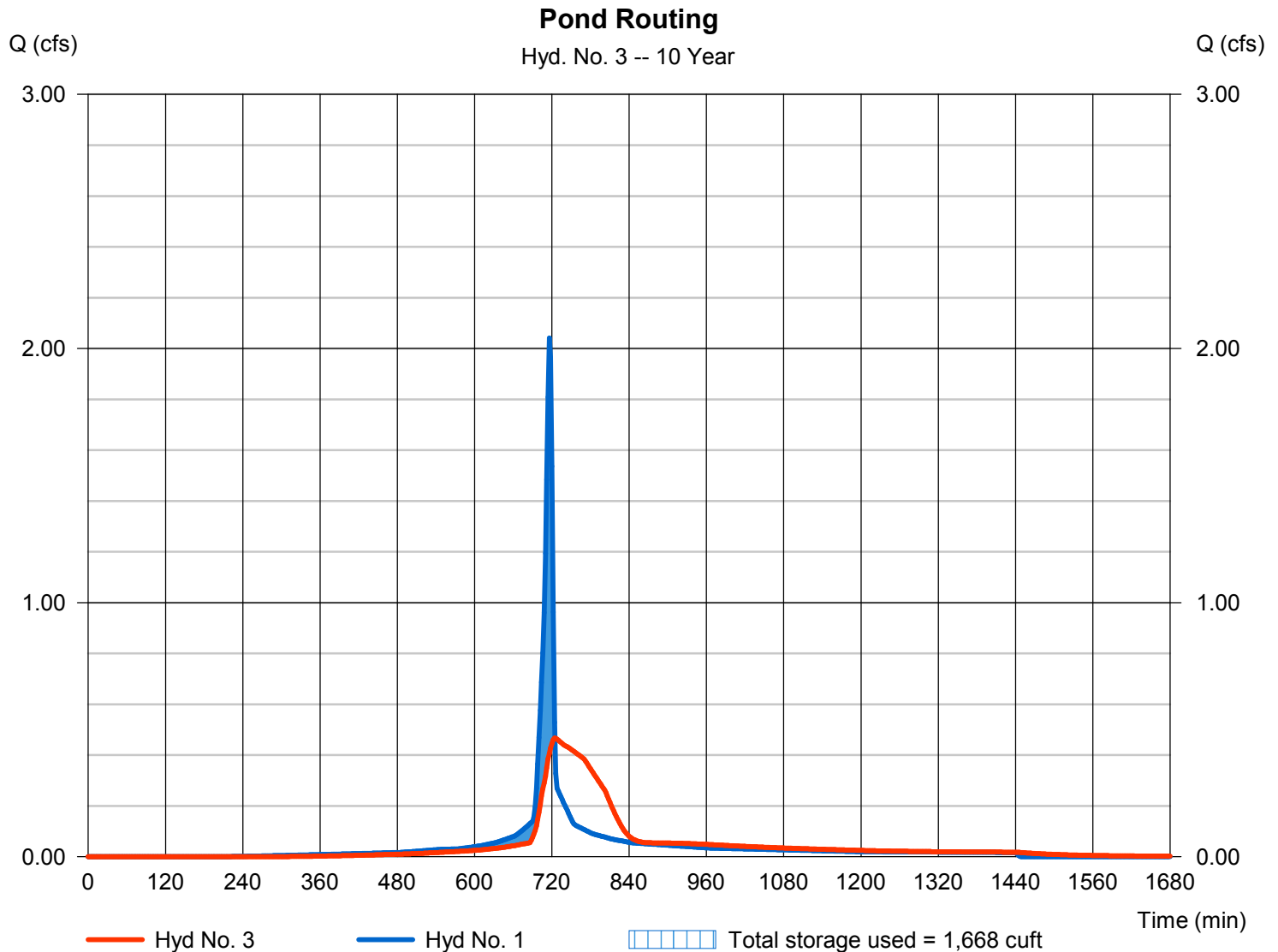
Wednesday, 02 / 6 / 2019

## Hyd. No. 3

### Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.467 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 4,399 cuft
Inflow hyd. No.	= 1 - Post Developed Project Area	Max. Elevation	= 741.02 ft
Reservoir name	= Underground Detention	Max. Storage	= 1,668 cuft

Storage Indication method used.



# Hydrograph Summary Report

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	2.389	2	716	5,226	-----	-----	-----	Post Developed Project Area
3	Reservoir	0.528	2	724	5,210	1	741.17	1,967	Pond Routing
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# Hydrograph Report

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

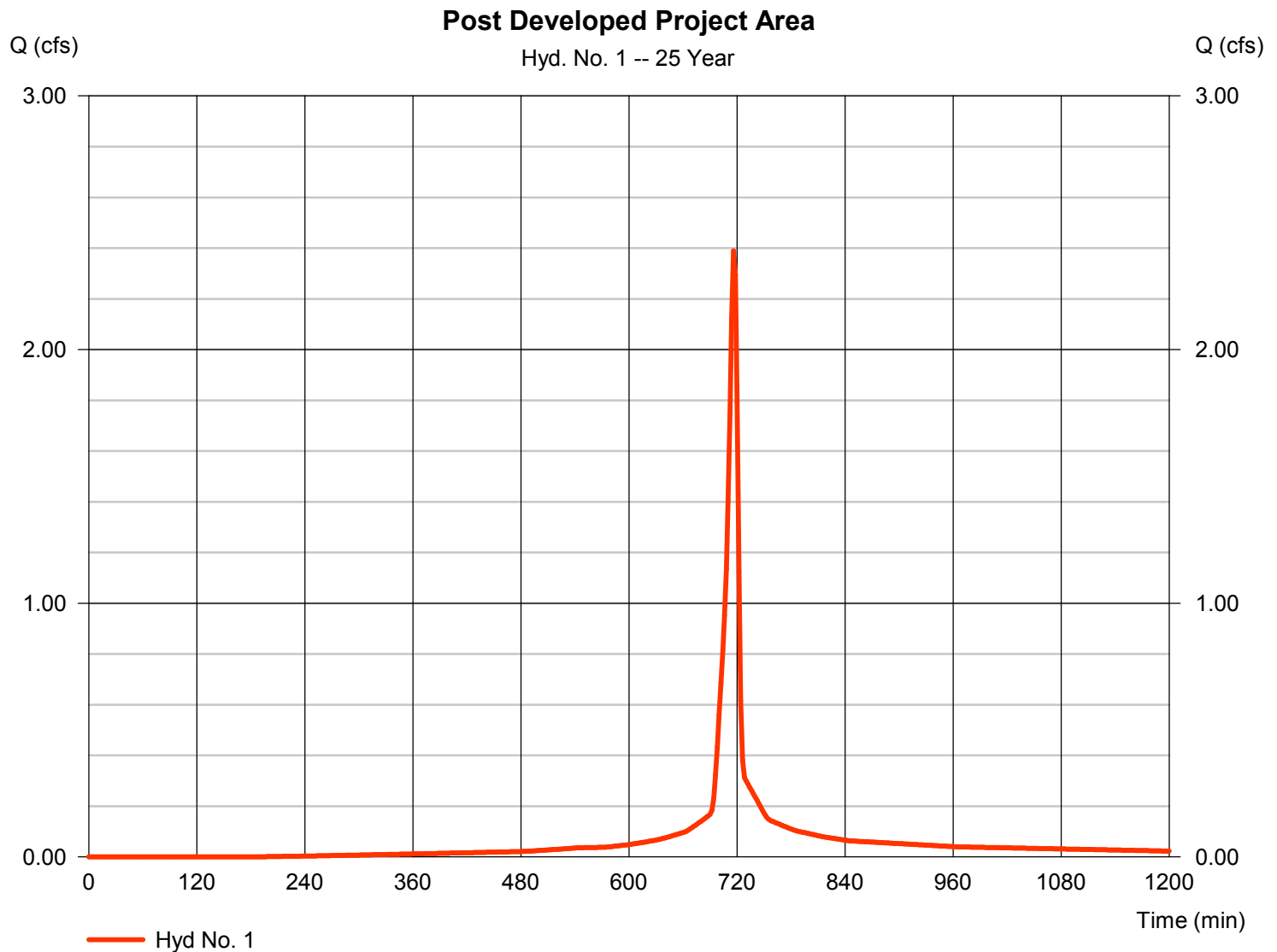
Wednesday, 02 / 6 / 2019

## Hyd. No. 1

### Post Developed Project Area

Hydrograph type	= SCS Runoff	Peak discharge	= 2.389 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,226 cuft
Drainage area	= 0.510 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.420 \times 98) + (0.090 \times 74)] / 0.510$



# Hydrograph Report

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

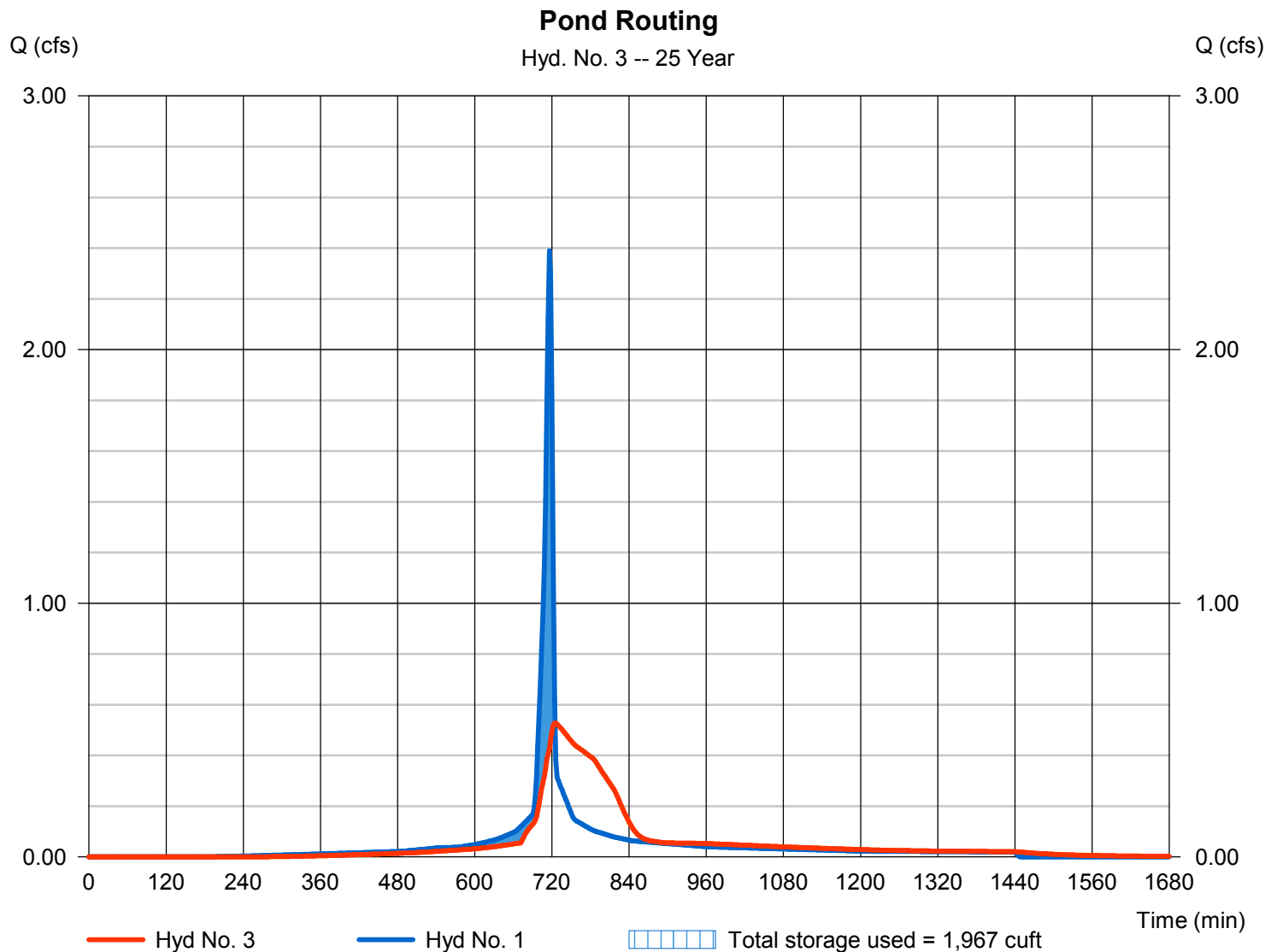
Wednesday, 02 / 6 / 2019

## Hyd. No. 3

### Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.528 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,210 cuft
Inflow hyd. No.	= 1 - Post Developed Project Area	Max. Elevation	= 741.17 ft
Reservoir name	= Underground Detention	Max. Storage	= 1,967 cuft

Storage Indication method used.







# Hydrograph Report

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

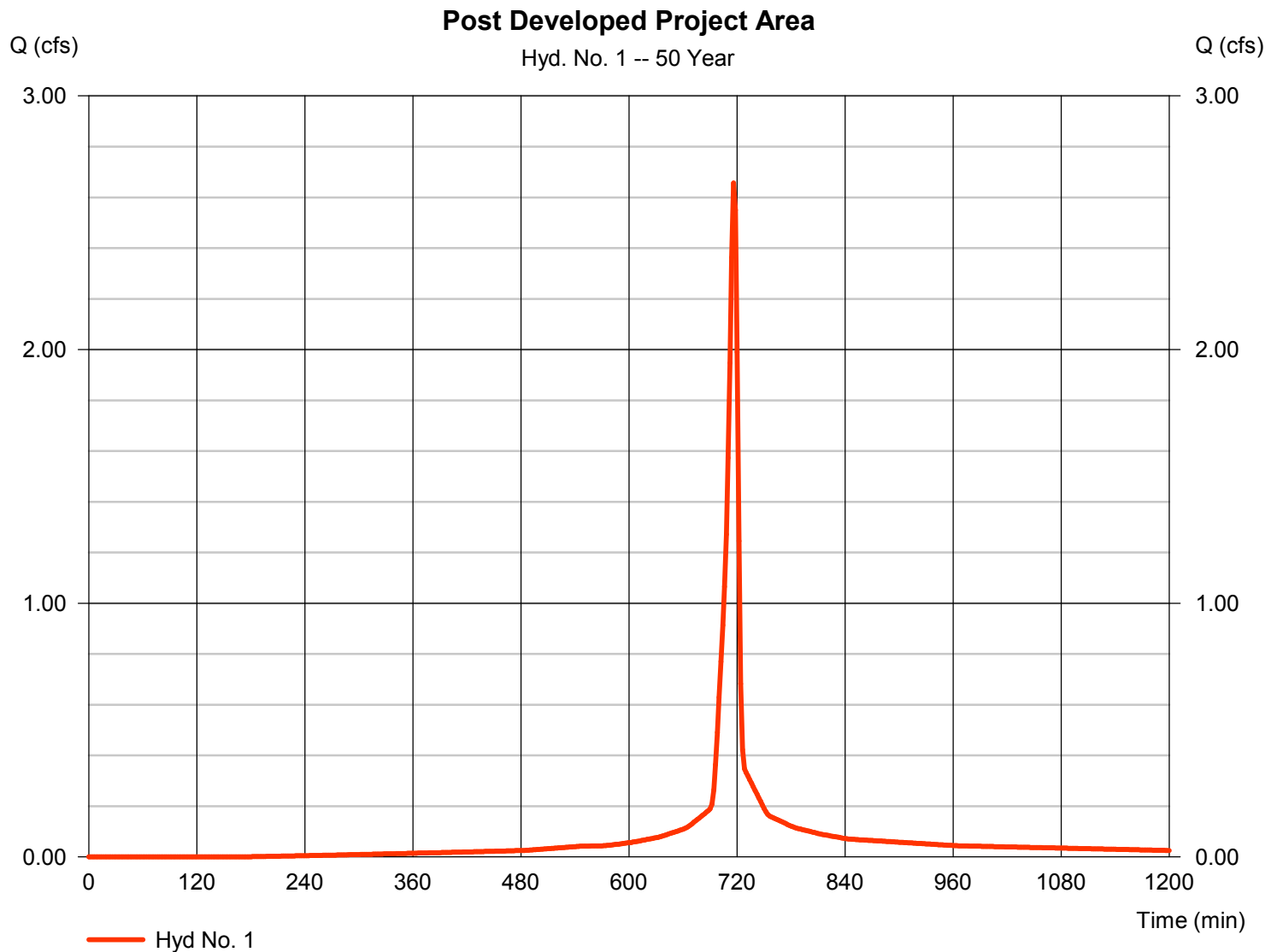
Wednesday, 02 / 6 / 2019

## Hyd. No. 1

### Post Developed Project Area

Hydrograph type	= SCS Runoff	Peak discharge	= 2.657 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,855 cuft
Drainage area	= 0.510 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.420 \times 98) + (0.090 \times 74)] / 0.510$



# Hydrograph Report

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

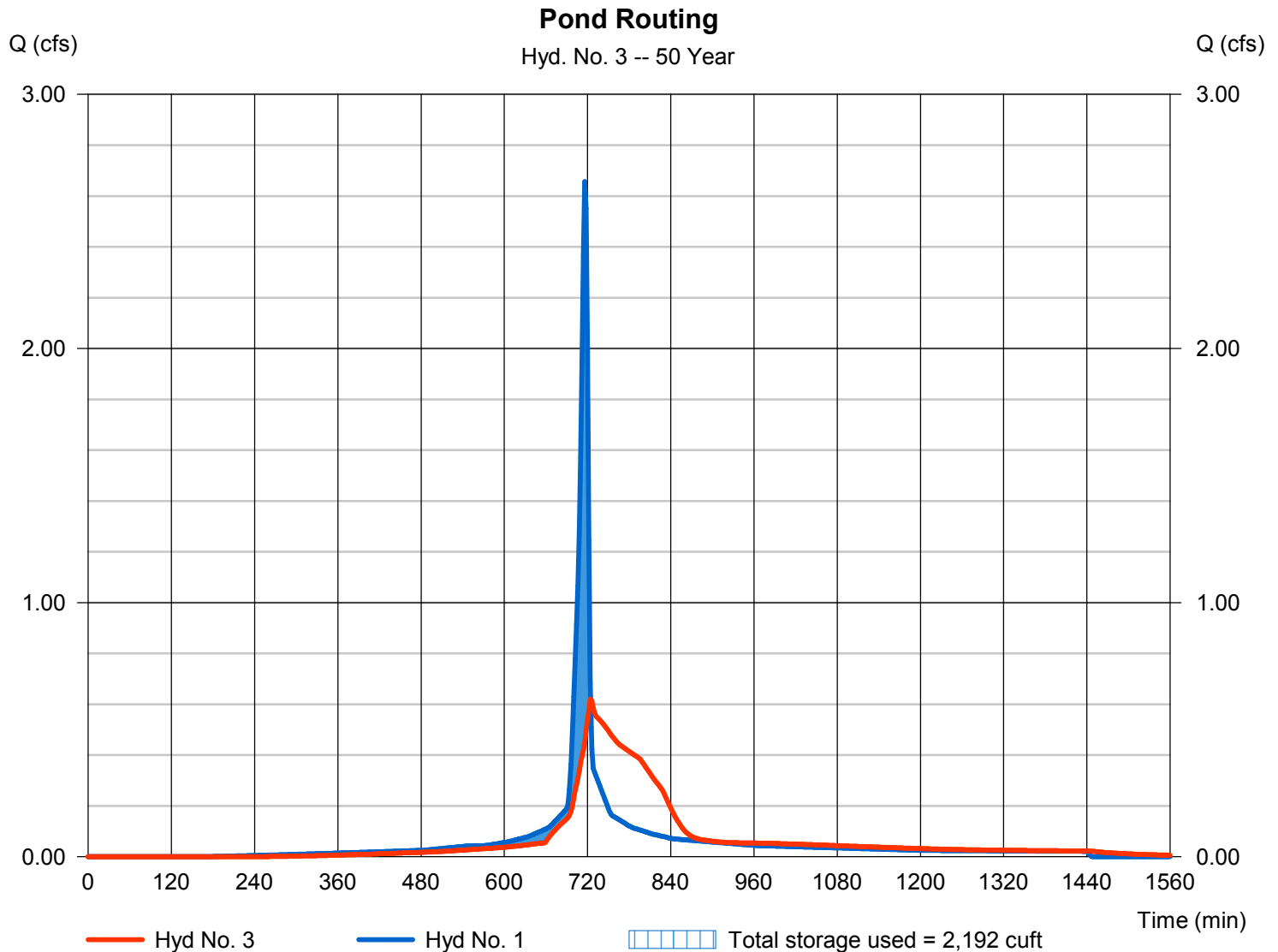
Wednesday, 02 / 6 / 2019

## Hyd. No. 3

### Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.620 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,838 cuft
Inflow hyd. No.	= 1 - Post Developed Project Area	Max. Elevation	= 741.30 ft
Reservoir name	= Underground Detention	Max. Storage	= 2,192 cuft

Storage Indication method used.





# Hydrograph Report

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

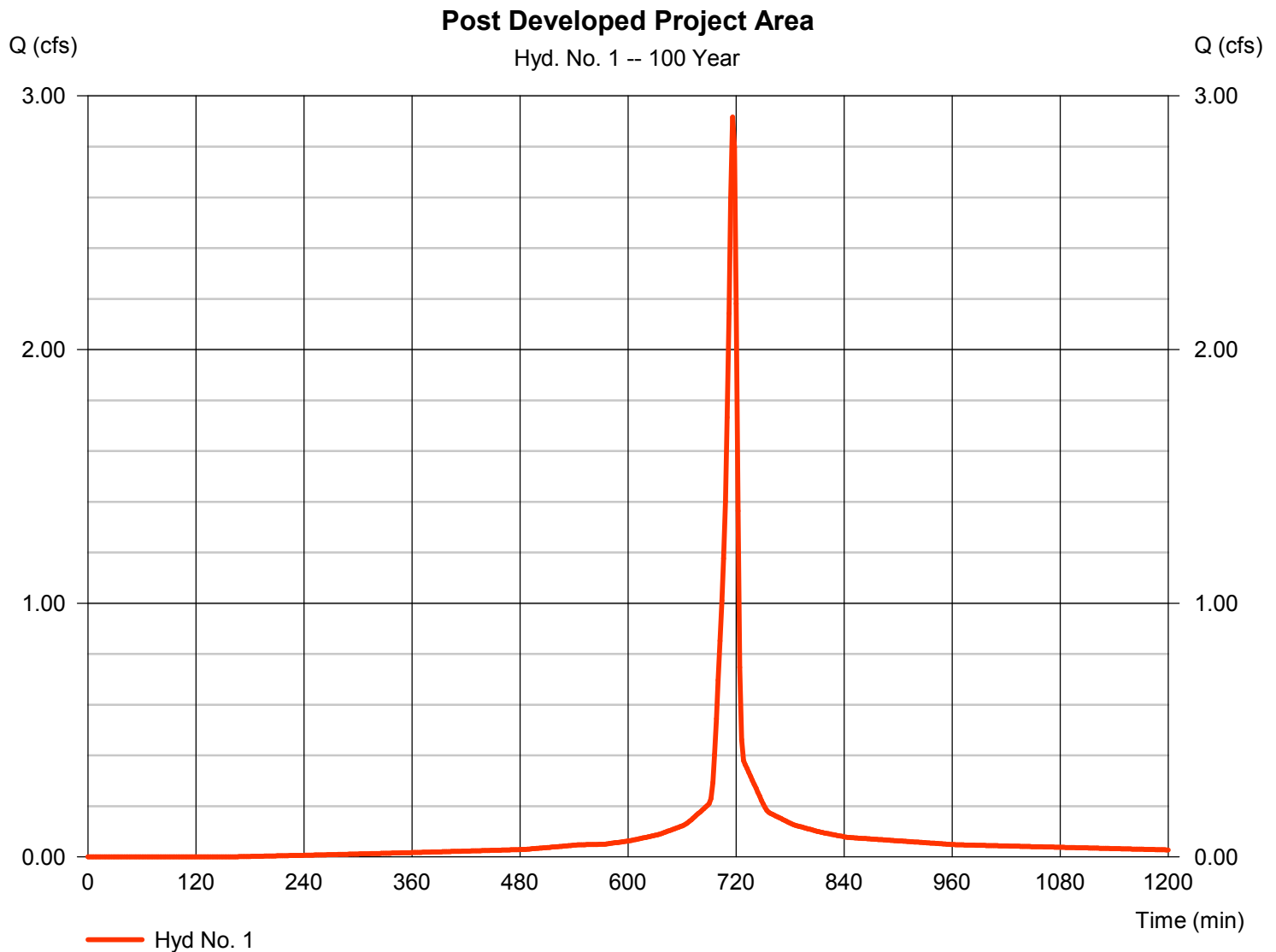
Wednesday, 02 / 6 / 2019

## Hyd. No. 1

### Post Developed Project Area

Hydrograph type	= SCS Runoff	Peak discharge	= 2.916 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 6,468 cuft
Drainage area	= 0.510 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.420 \times 98) + (0.090 \times 74)] / 0.510$



# Hydrograph Report

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

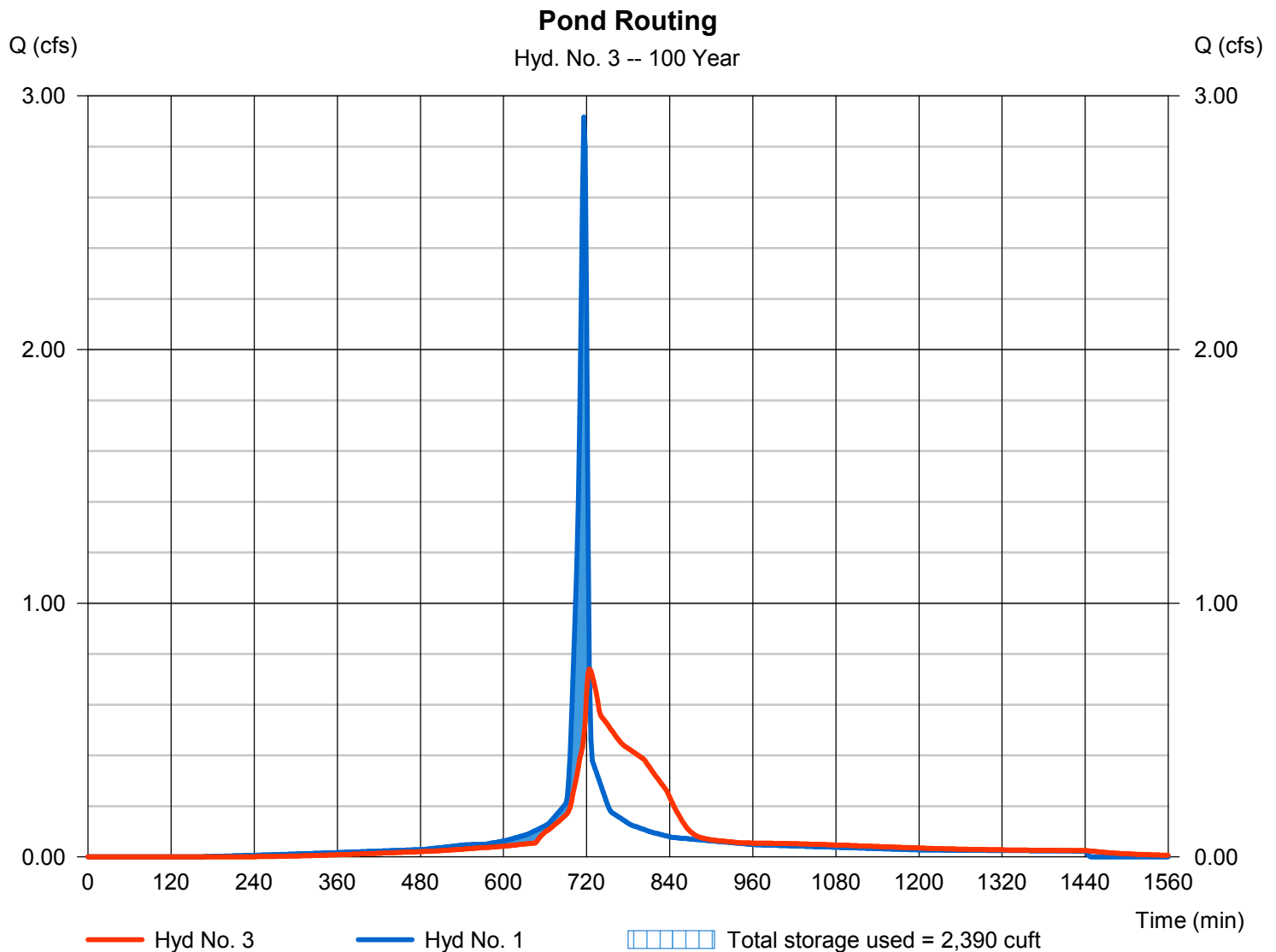
Wednesday, 02 / 6 / 2019

## Hyd. No. 3

### Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.740 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 6,452 cuft
Inflow hyd. No.	= 1 - Post Developed Project Area	Max. Elevation	= 741.41 ft
Reservoir name	= Underground Detention	Max. Storage	= 2,390 cuft

Storage Indication method used.



Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	46.8066	9.7000	0.8733	-----
2	59.5280	10.4000	0.8832	-----
3	0.0000	0.0000	0.0000	-----
5	59.0945	9.6000	0.8309	-----
10	55.0893	8.5000	0.7821	-----
25	54.5166	7.7000	0.7419	-----
50	51.1794	6.7000	0.7013	-----
100	47.7226	5.7000	0.6611	-----

File name: SampleFHA.idf

$$\text{Intensity} = B / (T_c + D)^E$$

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.48	3.47	2.85	2.42	2.11	1.88	1.70	1.55	1.42	1.32	1.23	1.15
2	5.32	4.15	3.42	2.92	2.55	2.27	2.05	1.87	1.72	1.59	1.48	1.39
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.37	4.99	4.13	3.54	3.11	2.78	2.52	2.31	2.13	1.98	1.85	1.74
10	7.19	5.62	4.66	4.01	3.53	3.17	2.88	2.65	2.45	2.29	2.14	2.02
25	8.27	6.47	5.38	4.64	4.10	3.69	3.36	3.10	2.88	2.69	2.53	2.39
50	9.12	7.10	5.91	5.11	4.53	4.09	3.74	3.45	3.22	3.01	2.84	2.69
100	9.96	7.73	6.44	5.58	4.96	4.49	4.12	3.81	3.56	3.35	3.16	3.00

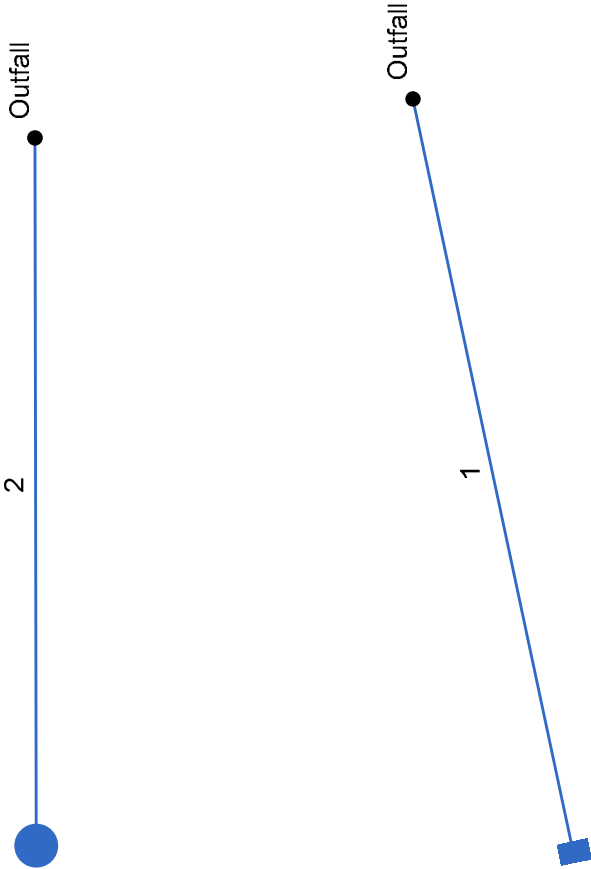
Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

[illegible]

## **Appendix D**





# Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
2	CI C	Grate	744.41	Cir	4.00	4.00	12	Cir	740.86			
1	CI B	Grate	744.50	Rect	2.00	3.00	12	Cir	740.92			
Project File: swm.stm				Number of Structures: 2			Run Date: 2/6/2019					

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
2	CIC TO CBD	0.48	12	Cir	69,000	740.17	740.86	1.000	740.42	741.15	0.10	741.15	End	Grate
1	CIB TO CBA	0.71	12	Cir	75,000	740.17	740.92	1.000	740.47	741.27	0.13	741.27	End	Grate
Project File: swm.stm														Run Date: 2/6/2019
Number of lines: 2														
NOTES: Return period = 100 Yrs.														

# Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)			
2	End	69,000	0.10	0.10	0.62	0.06	0.06	10.0	10.0	7.7	0.48	3.56	2.85	12	1.00	740.17	740.86	740.42	741.15	744.00	744.41	CI C TO CB D
1	End	75,000	0.12	0.12	0.77	0.09	0.09	10.0	10.0	7.7	0.71	3.56	3.22	12	1.00	740.17	740.92	740.47	741.27	744.00	744.50	CI B TO CB A
Project File: swm.stm																						Run Date: 2/6/2019
Number of lines: 2																						
NOTES: Intensity = 47.72 / (Inlet time + 5.70) ^ 0.66; Return period = Yrs. 100 ; c = cir e = ellip b = box																						

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1	Coeff C2	Coeff C3	Capac Full (cfs)	Crit Depth (ft)	Cross SI, Sw (ft/ft)	Cross SI, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
2	0.15	0.19	Sag	0.20	0.50	0.90	3.56	0.29	0.050	0.020	...	179.873	0.25	0.29**	Outfall	0.10	229184.98	740.52	741.25	0.000
1	0.20	0.25	Sag	0.20	0.50	0.90	3.56	0.35	0.050	0.020	...	168.221	0.30	0.35**	Outfall	0.12	229184.36	740.60	741.40	0.000
Project File: swm.stm													Number of lines: 2			Date: 2/6/2019				
NOTES: ** Critical depth																				

Flow Rate	Sf Ave	Sf Dn	Grate Area	Grate Len	Grate Width	Gnd/Rim El Dn	Gnd/Rim El Up	Gutter Depth	Gutter Slope	Gutter Spread	Gutter Width	HGL Dn	HGL Up	HGL Jnct	HGL Jmp Dn	HGL Jmp Up	Incr CxA	Incr Q	Inlet Depth	Inlet Eff
(cfs)	(ft/ft)	(ft/ft)	(sqft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)		(cfs)	(ft)	(%)
0.48	0.000	0.000	6.00	3.00	2.00	744.00	744.41	0.13	Sag	3.52	2.00	740.42	741.15	741.15	....	....	0.06	0.48	0.13	100
0.71	0.000	0.000	6.00	3.00	2.00	744.00	744.50	0.15	Sag	4.74	2.00	740.47	741.27	741.27	....	....	0.09	0.71	0.15	100
																	Number of lines: 2		Date: 2/6/2019	
Project File: swm.stm																				
NOTES: ** Critical depth																				

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID	Line Length (ft)
CI C	Sag		10.0	7.73	7.73	740.17	740.86	...	...	0.00	0.00	1.00 z	Grate	0.00	2,032	1,829	1,727	CI C TO CB D	69,000
CI B	Sag		10.0	7.73	7.73	740.17	740.92	...	...	0.00	0.00	1.00 z	Grate	0.00	2,200	1,980	1,870	CI B TO CBA	75,000
Number of lines: 2														Date: 2/6/2019					
Project File: swm.stm																			
NOTES: Intensity = 47.72 / (Inlet time + 5.70) ^ 0.66 -- Return period = 100 Yrs. ; ** Critical depth																			

Line Size	Line Slope	Line Type	Local Depr	n-val Gutter	n-val Pipe	Minor Loss	Northing Y	Pipe Travel	Q Byp	Q Capt	Q Carry	Line Rise	Runoff Coeff	Line Span	Area A1	Area A2	Area A3	Tc	Throat Ht	Total Area	Total CxA	Total Total Runoff						
(in)	(%)		(in)			(ft)	(ft)	(min)	(cfs)	(cfs)	(cfs)	(in)	(C)	(in)	(ac)	(ac)	(ac)	(min)	(in)	(ac)		(cfs)						
12	1.00	Cir	0.0	....	0.013	0.10	1542853.97	0.40	0.00	0.48	0.00	12	0.62	12	0.00	0.00	0.00	10.0	....	0.10	0.06	0.48						
12	1.00	Cir	0.0	....	0.013	0.13	1542802.81	0.39	0.00	0.71	0.00	12	0.77	12	0.00	0.00	0.00	10.0	....	0.12	0.09	0.71						
Project File: swm.stm																							Number of lines: 2			Date: 2/6/2019		
NOTES: ** Critical depth																												





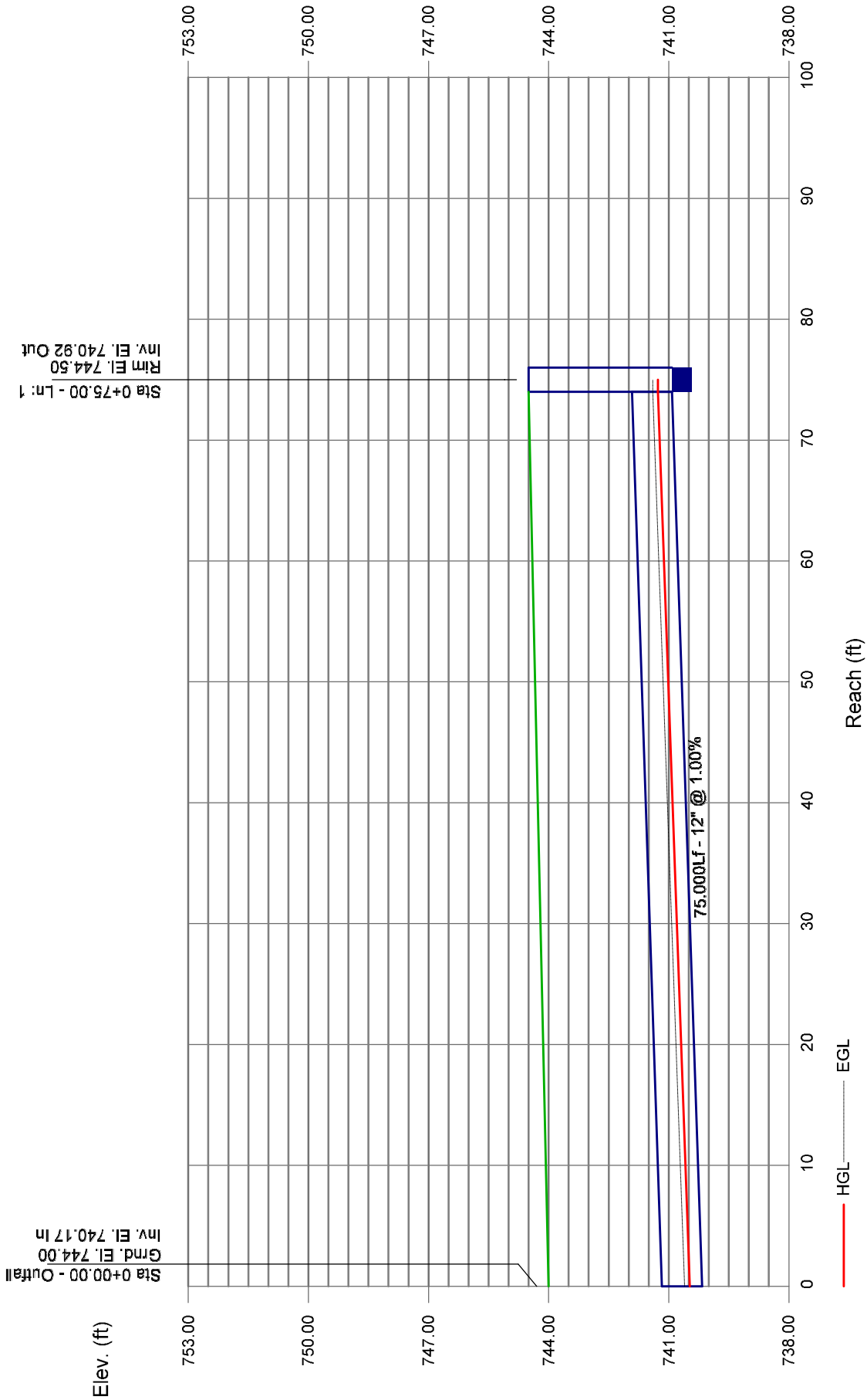
# Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow						Total Travel Time (min)		
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)		Travel Time (min)	
2	CI C TO CB D	User																	10.00		
1	CI B TO CB A	User																	10.00		
Project File: swm.stm			Min. Tc used for intensity calculations = 5 min							Number of lines: 2							Date: 2/6/2019				

# Hydraulic Grade Line Computations

Line	Size  (in)	Q  (cfs)	Downstream								Len  (ft)	Upstream								Check		JL coeff  (K)	Minor loss  (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
2	12	0.48	740.17	740.42	0.25	0.15	3.12	0.10	740.52	0.000	69.000	740.86	741.15	0.29**	0.19	2.58	0.10	741.25	0.000	0.000	n/a	1.00	0.10
1	12	0.71	740.17	740.47	0.30	0.20	3.54	0.13	740.60	0.000	75.000	740.92	741.27	0.35**	0.25	2.89	0.13	741.40	0.000	0.000	n/a	1.00	0.13
Project File: swm.stm												Number of lines: 2								Run Date: 2/6/2019			
Notes: ; ** Critical depth. ; c = cir e = ellip b = box																							

# Storm Sewer Profile



# Storm Sewer Profile

