

LEGENDS INDIANA

INDOOR TRAINING FACILITY

Commercial Development

Johnson County, Greenwood, Indiana

July 23, 2018



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Legends Indiana

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Professional Certification

Legends Indiana

The following report and accompanying computations have been developed by me or under my direct supervision.



Venus Thorne
Professional Engineer
Registration Number: 11200278



Drainage Summary

Legends Indiana

Project Overview

The proposed project entails construction of an indoor training facility building addition at the existing Legends of Indiana Golf Course. The expansion covers approximately 3,000 square feet (0.08 ac). The facility is located at 2555 Hurricane Road in Franklin, Indiana.

Existing Site Conditions

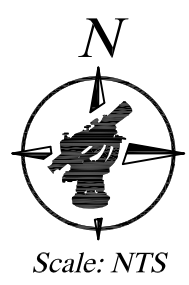
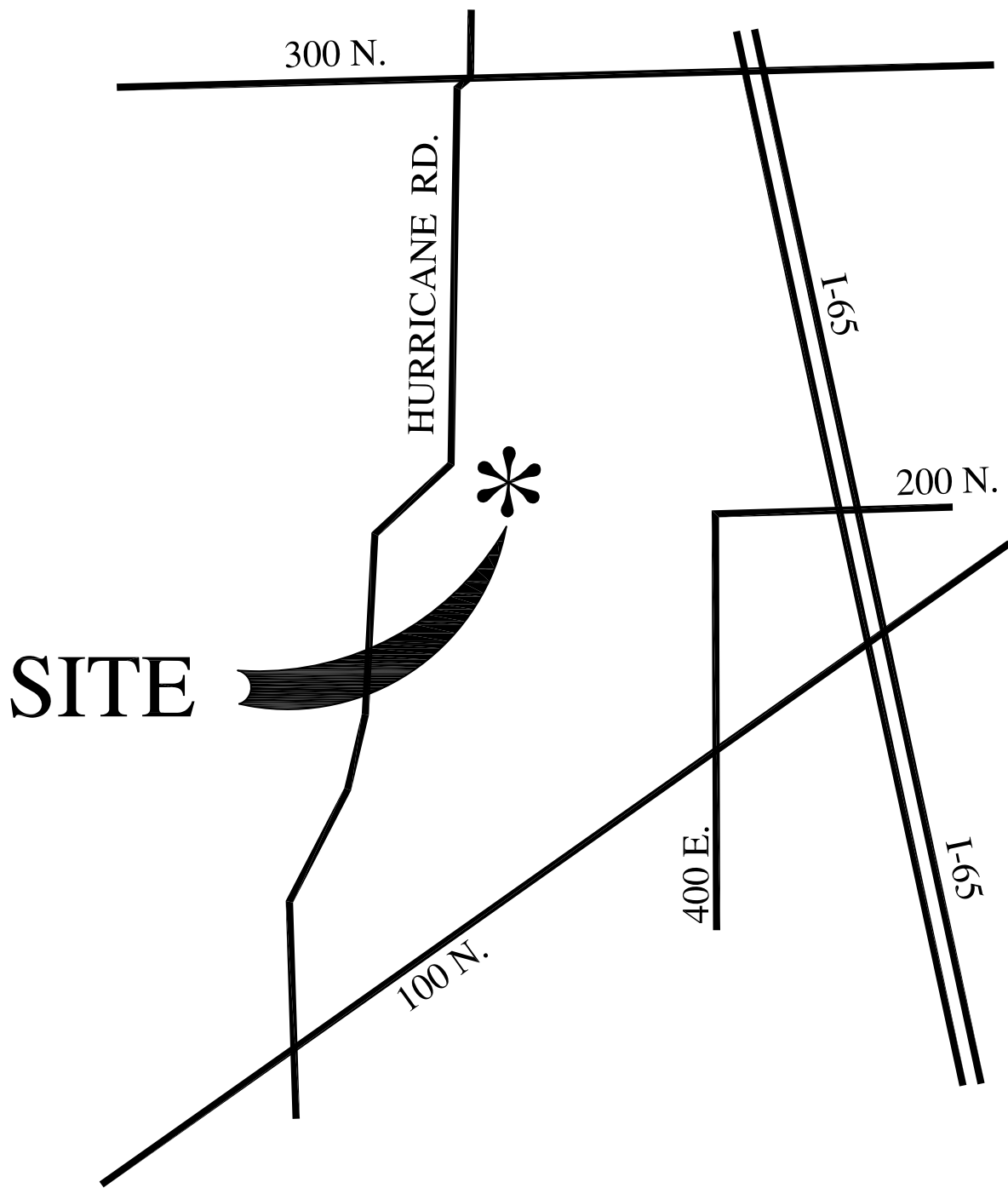
The area where the proposed training facility is to be constructed currently consists of grass area. The area to be developed drains under a drive to an existing drainage swale to the south. An aerial map as well as a site map showing the impervious areas and grass areas is included within this report.

Proposed Site Conditions

The proposed building is located near the existing pool and clubhouse. The building area is shown on the attached Proposed Site Conditions Map. The existing swale on the site will be relocated to the south of the proposed building. The runoff from the area was calculated using the Type II rainfall distribution. The site drains to an existing ditch located to the south of the proposed building. Since this is a small drainage area (0.07 ac), the runoff from the construction area is minimal during existing and proposed conditions. A summary of existing and proposed runoff rates is as follows:

	Existing Runoff (cfs)	Proposed Runoff (cfs)
2-yr	0.03	0.27
10-yr	0.11	0.41
100-yr	0.26	0.59

The proposed site will drain through existing storm pipes and into an existing drainage ditch located south of the site. Approximately 2.66 acres of runoff from the project area drain to the existing 8" pipes and ditch. There are three (3) 8" pipes at 1.2%. The capacity of these pipes is 26.8 cfs. The 100-year runoff to the pipes, including the proposed building is 10.30 cfs. Therefore the existing pipes have plenty of capacity to handle the runoff.



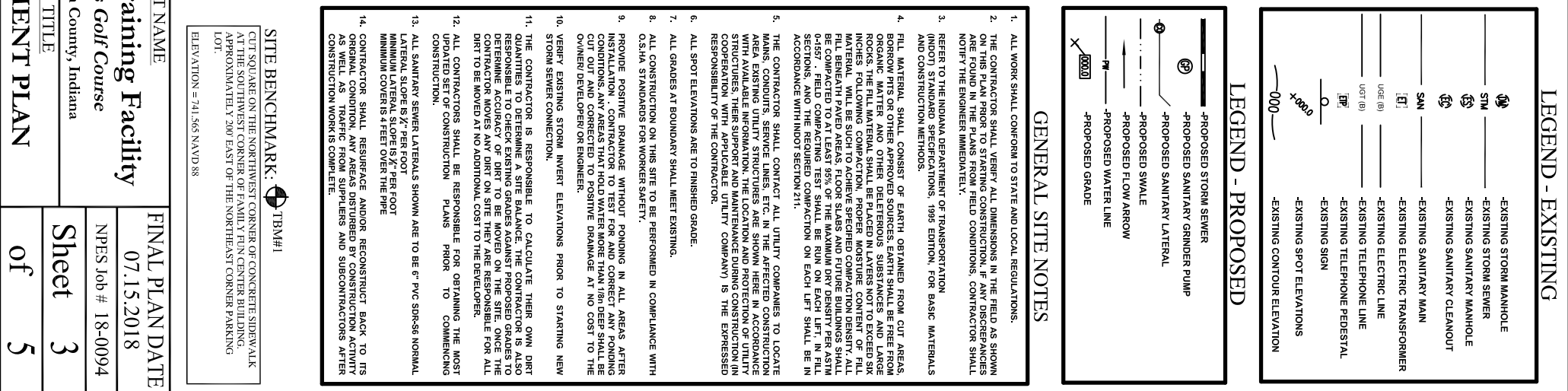
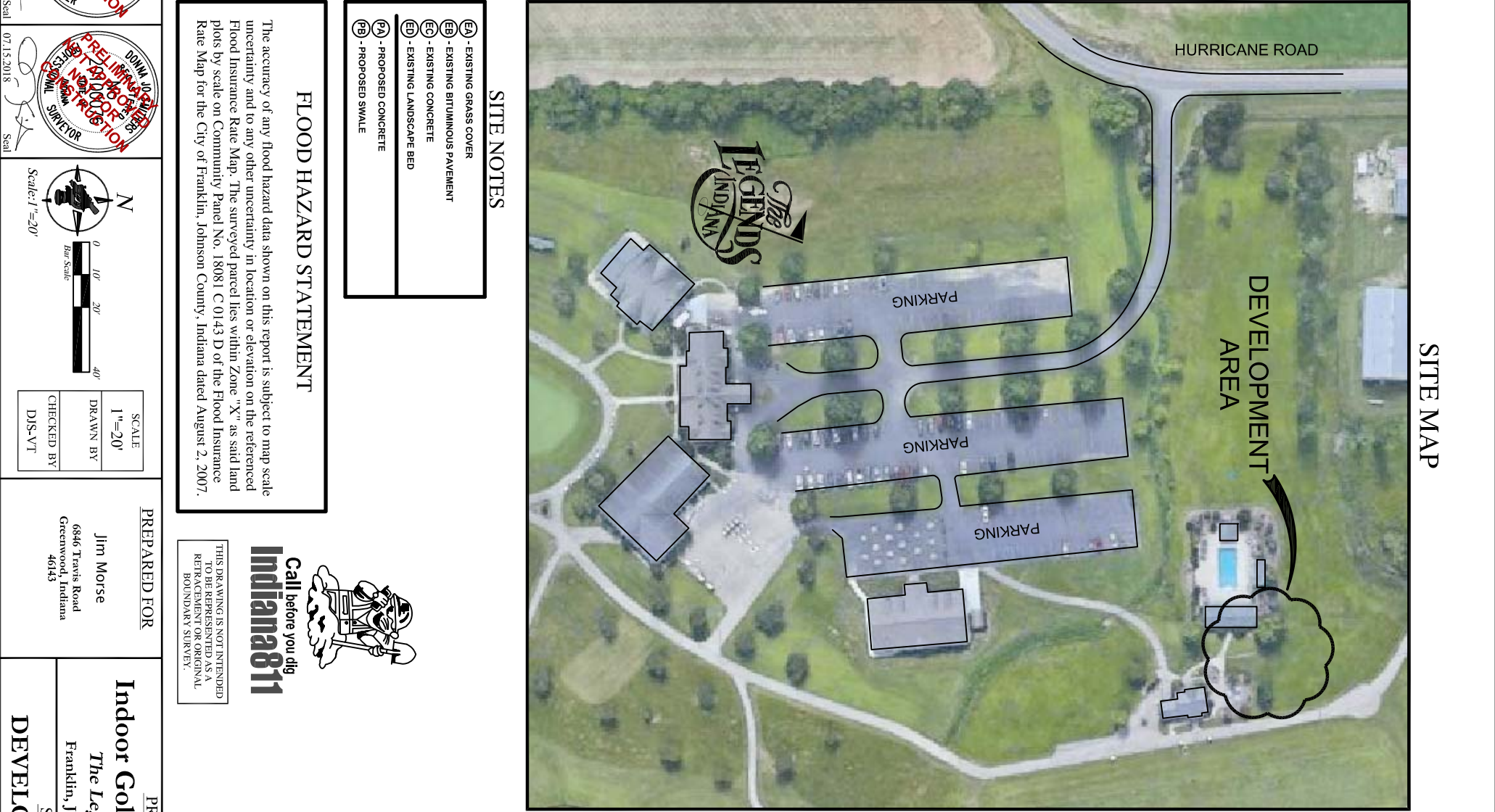
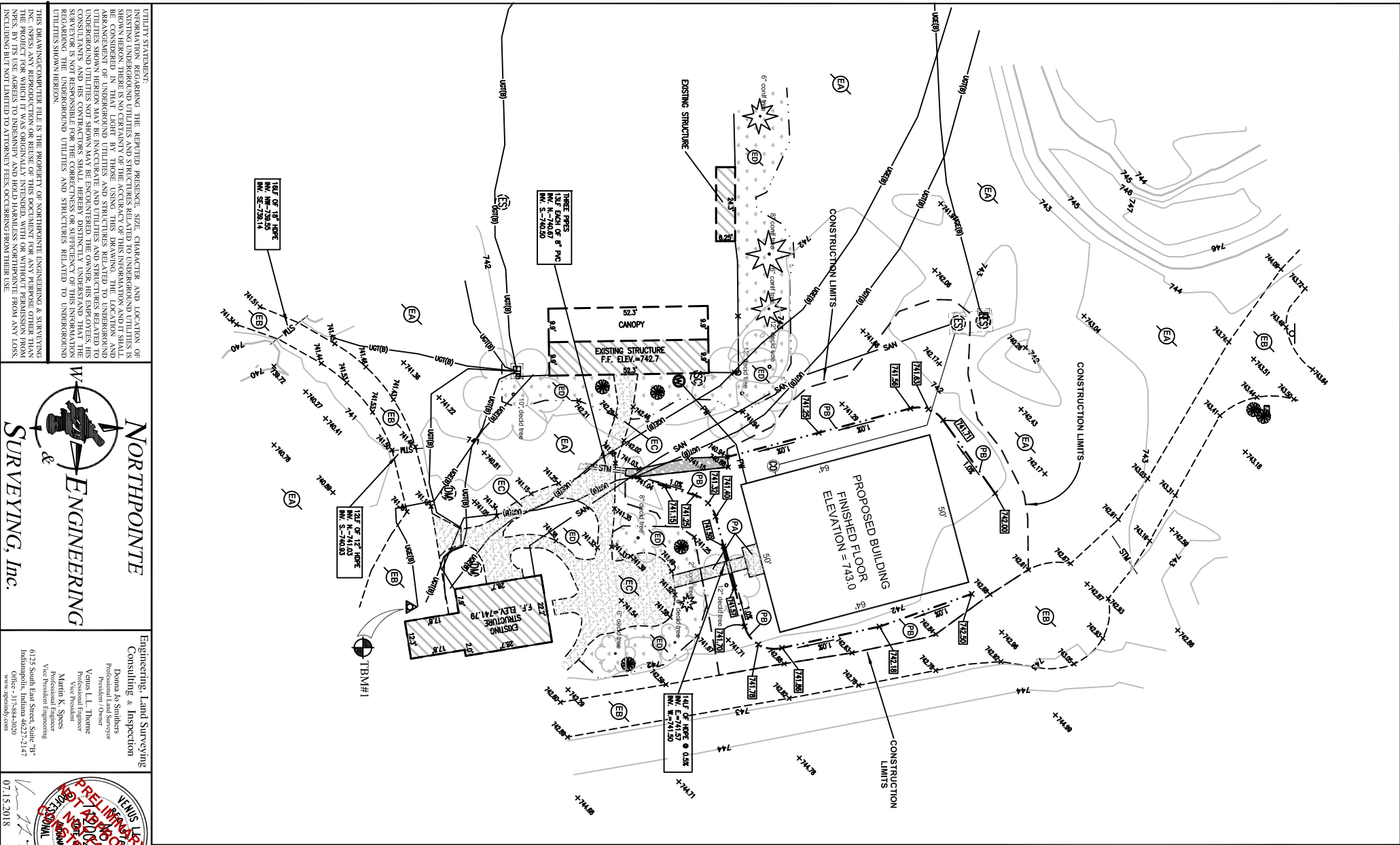


Table 2-2a Runoff curve numbers for urban areas ^{1/}

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area ^{2/}	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) ^{3/} :					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ^{4/}		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
<i>Developing urban areas</i>					
Newly graded areas (pervious areas only, no vegetation) ^{5/}		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

^{1/} Average runoff condition, and $I_a = 0.2S$.

^{2/} The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

^{3/} CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

^{4/} Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

^{5/} Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 3.3.2 (TR-55 Table 2-2a): Runoff Curve Numbers for Urban Areas

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.028	2	718	78	-----	-----	-----	Existing
2	SCS Runoff	0.273	2	716	636	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 2 Year			Monday, 07 / 23 / 2018 Page 15 of 36	

Hydrograph Report

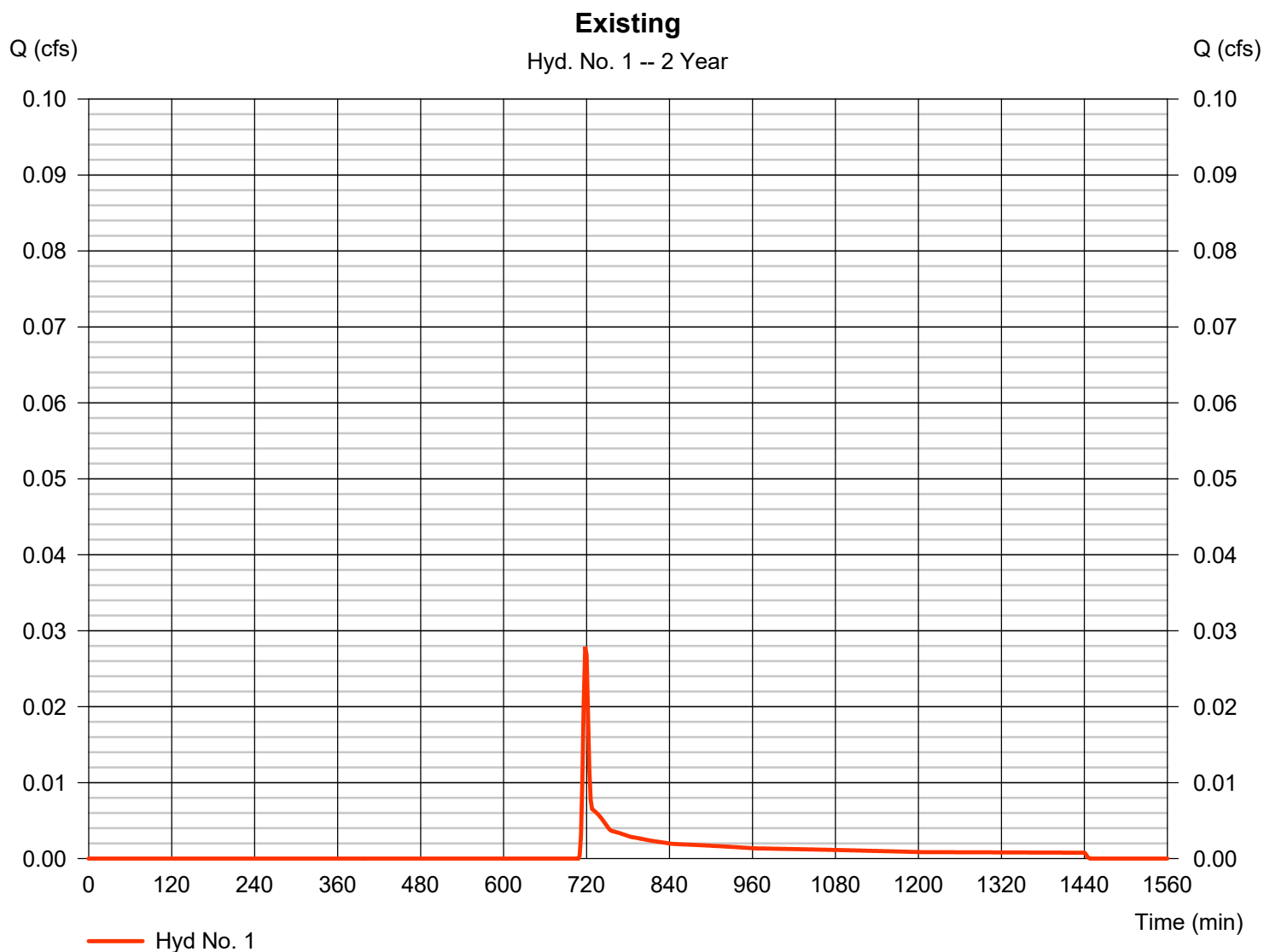
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 0.028 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 78 cuft
Drainage area	= 0.070 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.110	2	718	230	-----	-----	-----	Existing
2	SCS Runoff	0.407	2	716	966	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 10 Year			Monday, 07 / 23 / 2018 Page 17 of 36	

Hydrograph Report

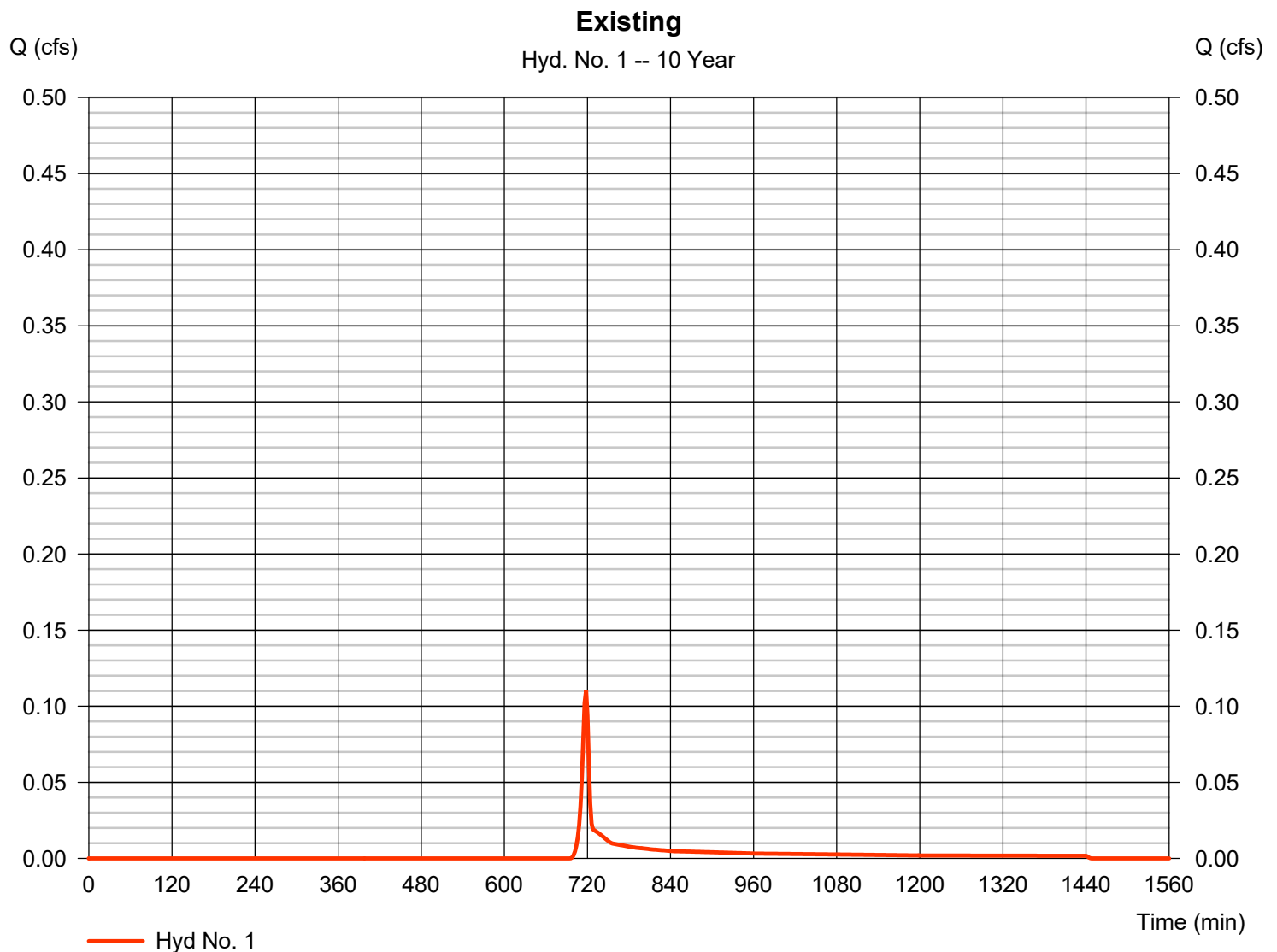
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 0.110 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 230 cuft
Drainage area	= 0.070 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.142	2	718	290	-----	-----	-----	Existing
2	SCS Runoff	0.451	2	716	1,073	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 25 Year			Monday, 07 / 23 / 2018 Page 19 of 36	

Hydrograph Report

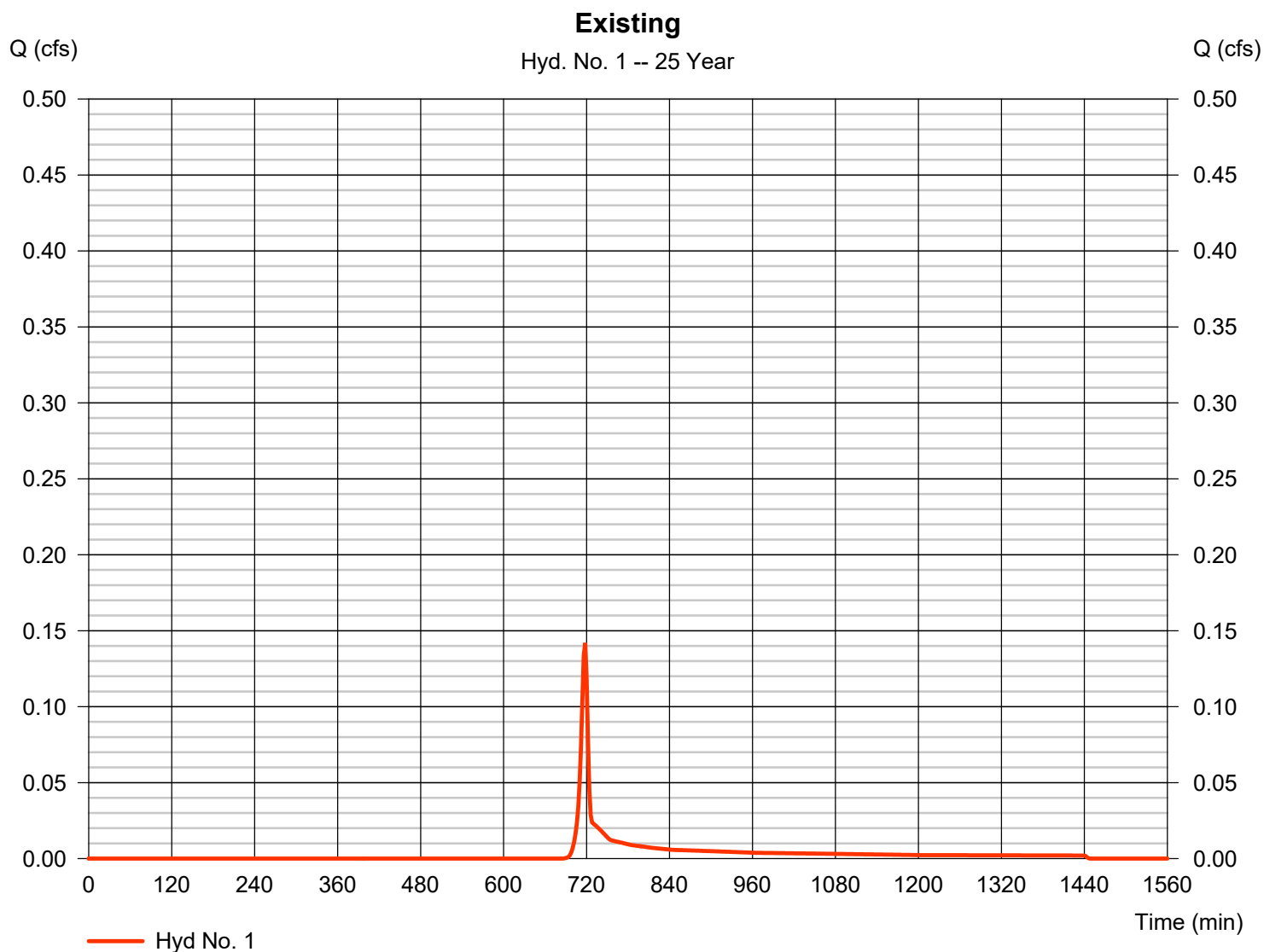
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 0.142 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 290 cuft
Drainage area	= 0.070 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.74 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.256	2	718	513	-----	-----	-----	Existing
2	SCS Runoff	0.593	2	716	1,425	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 100 Year			Monday, 07 / 23 / 2018 Page 21 of 36	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 0.256 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 513 cuft
Drainage area	= 0.070 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

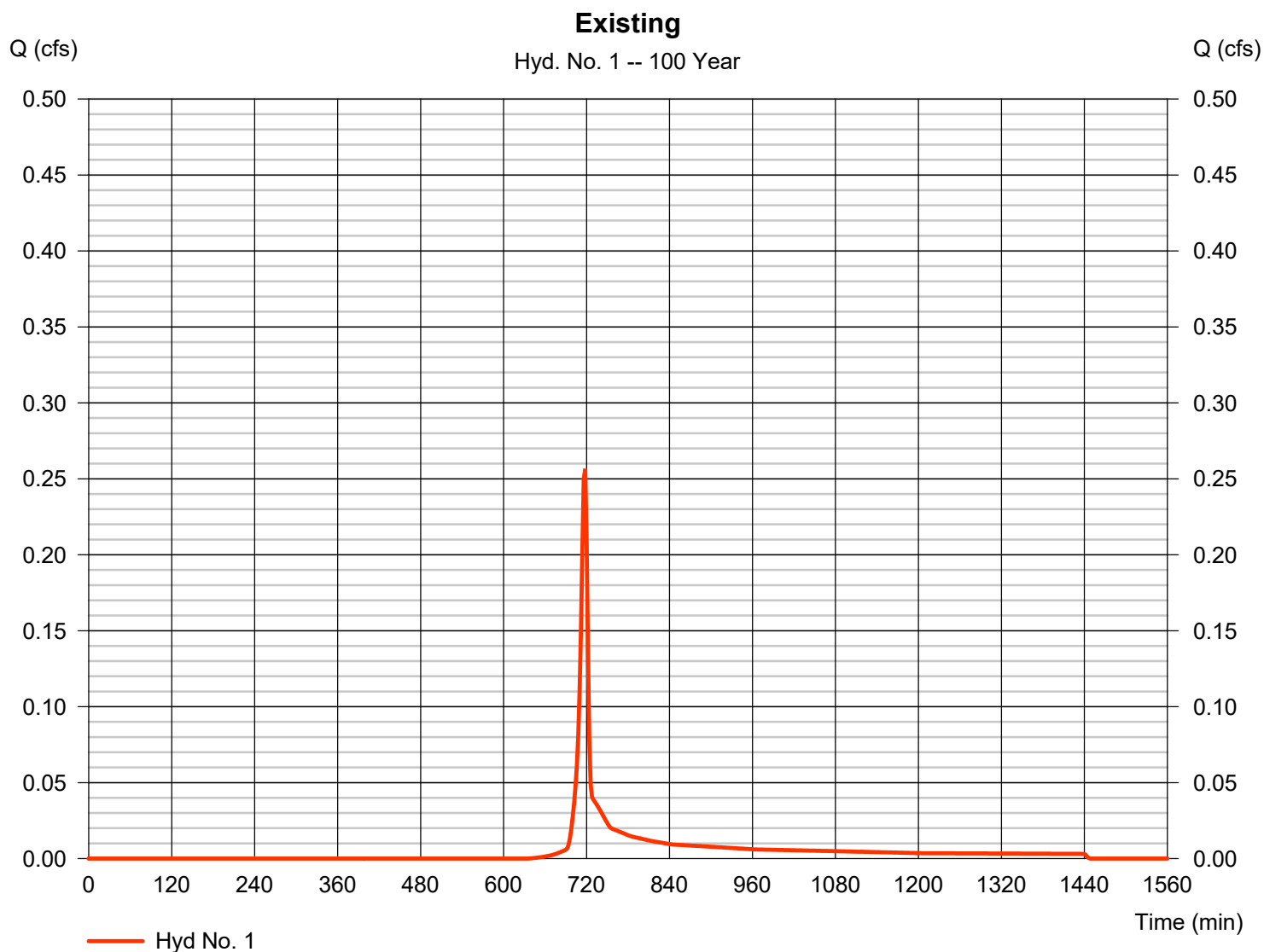


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Streets and roads:					
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Paved; open ditches (including right-of-way)		83	89	92	93
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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.028	2	718	78	-----	-----	-----	Existing
2	SCS Runoff	0.273	2	716	636	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 2 Year			Monday, 07 / 23 / 2018 Page 25 of 36	

Hydrograph Report

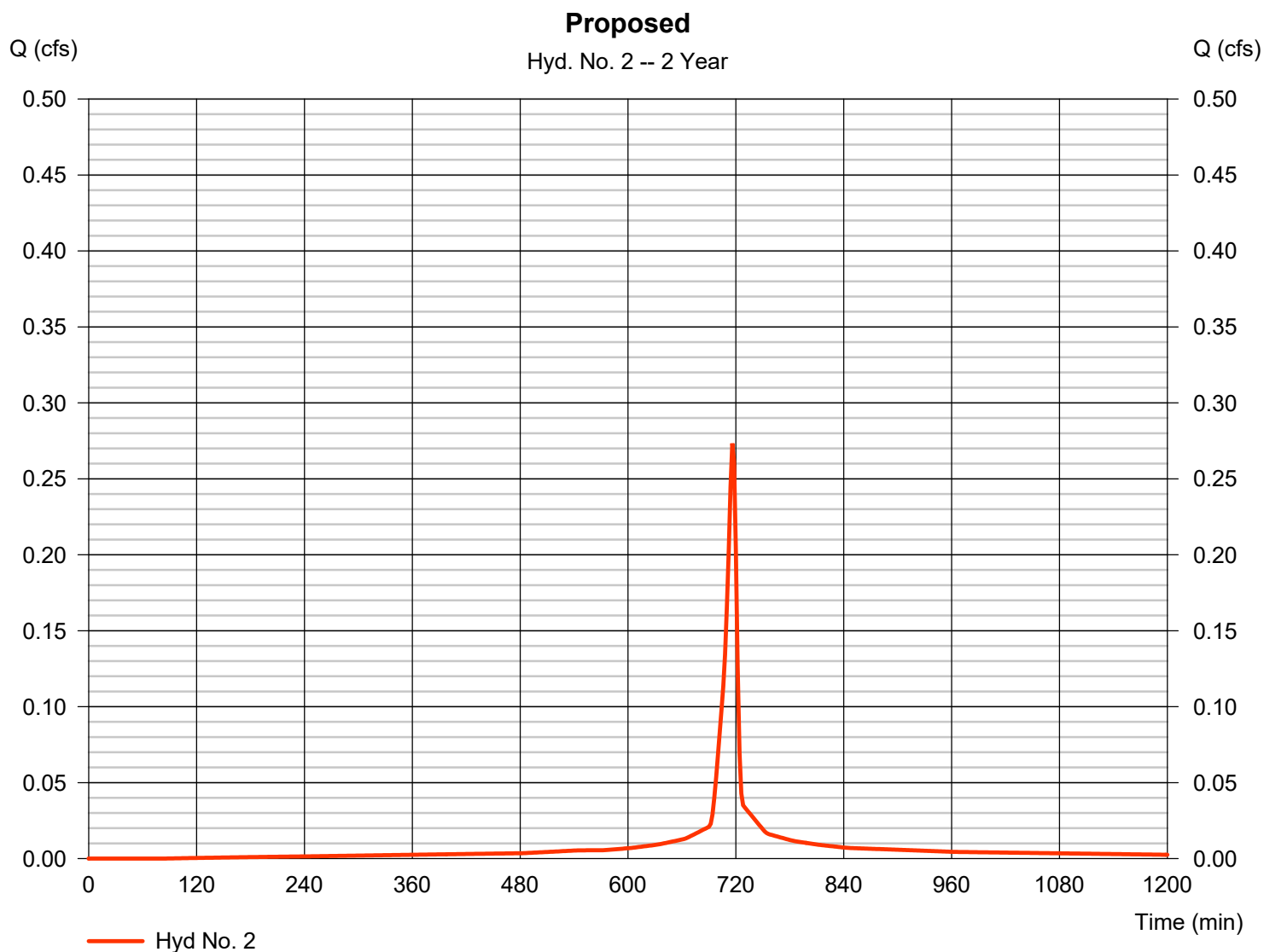
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.273 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 636 cuft
Drainage area	= 0.070 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.110	2	718	230	-----	-----	-----	Existing
2	SCS Runoff	0.407	2	716	966	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 10 Year			Monday, 07 / 23 / 2018 Page 27 of 36	

Hydrograph Report

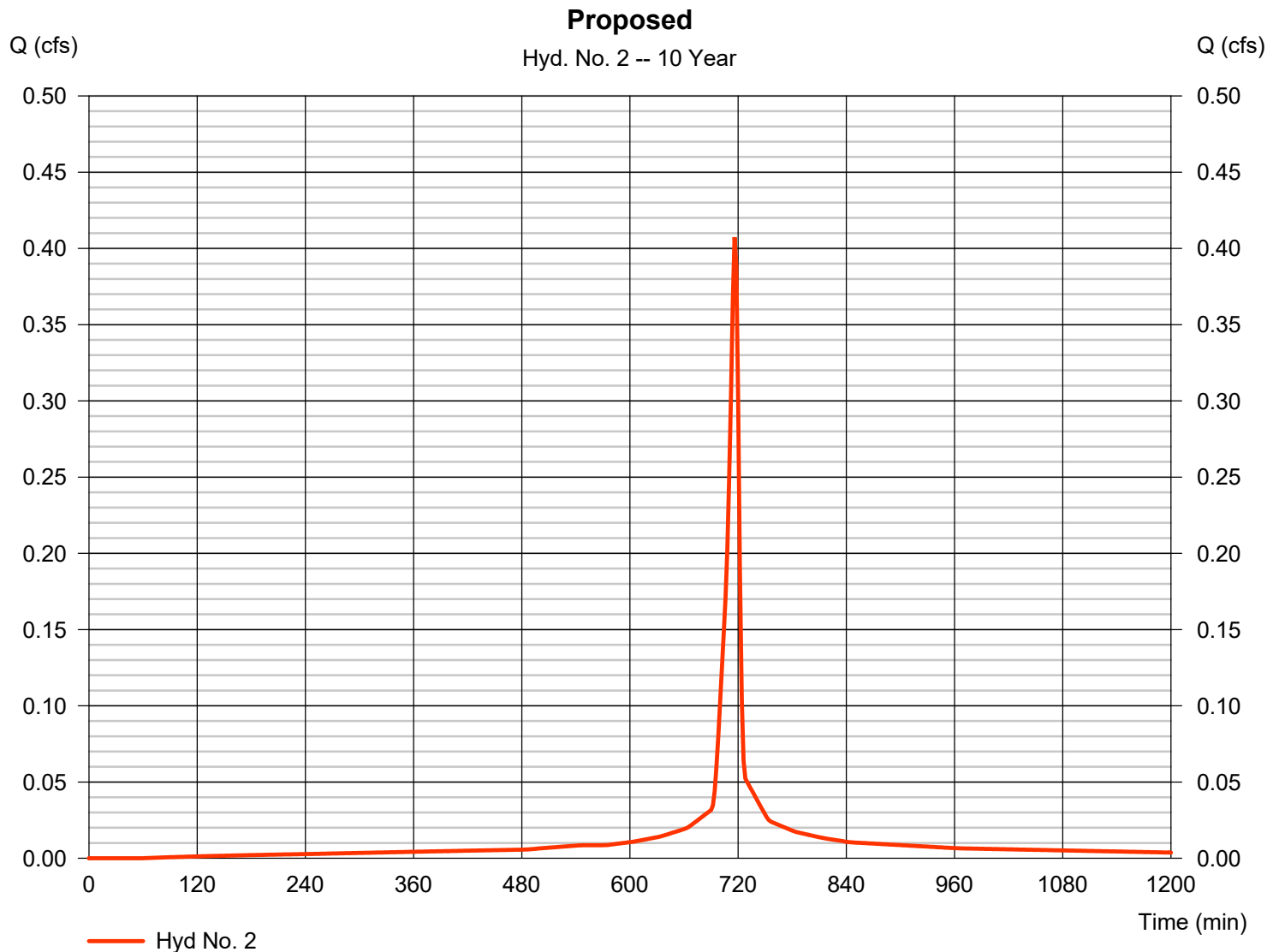
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.407 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 966 cuft
Drainage area	= 0.070 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.142	2	718	290	-----	-----	-----	Existing
2	SCS Runoff	0.451	2	716	1,073	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 25 Year			Monday, 07 / 23 / 2018 Page 29 of 36	

Hydrograph Report

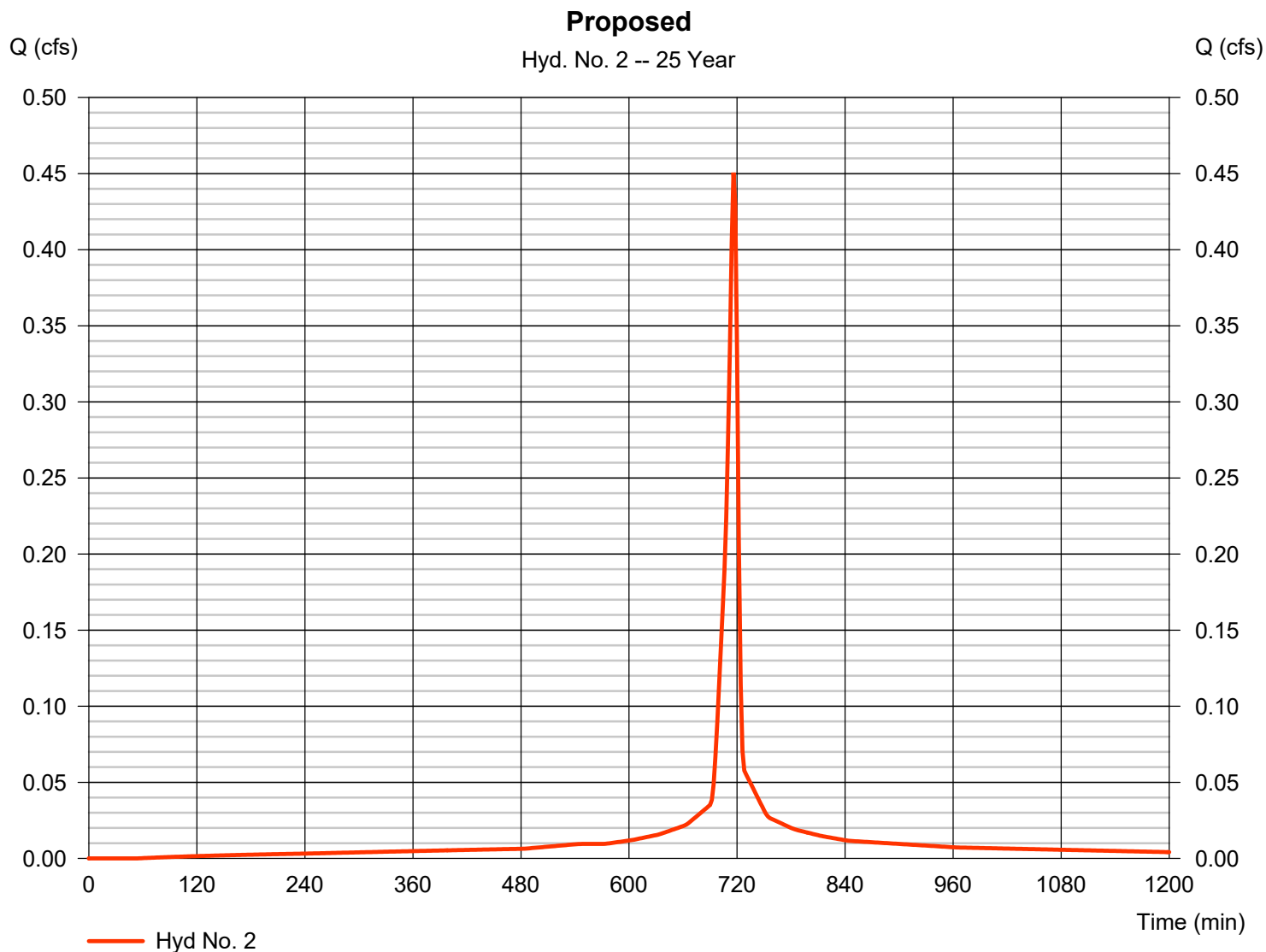
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 07 / 23 / 2018

Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.451 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,073 cuft
Drainage area	= 0.070 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.74 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.256	2	718	513	-----	-----	-----	Existing
2	SCS Runoff	0.593	2	716	1,425	-----	-----	-----	Proposed
Runoff.gpw					Return Period: 100 Year			Monday, 07 / 23 / 2018 Page 31 of 36	

Hydrograph Report

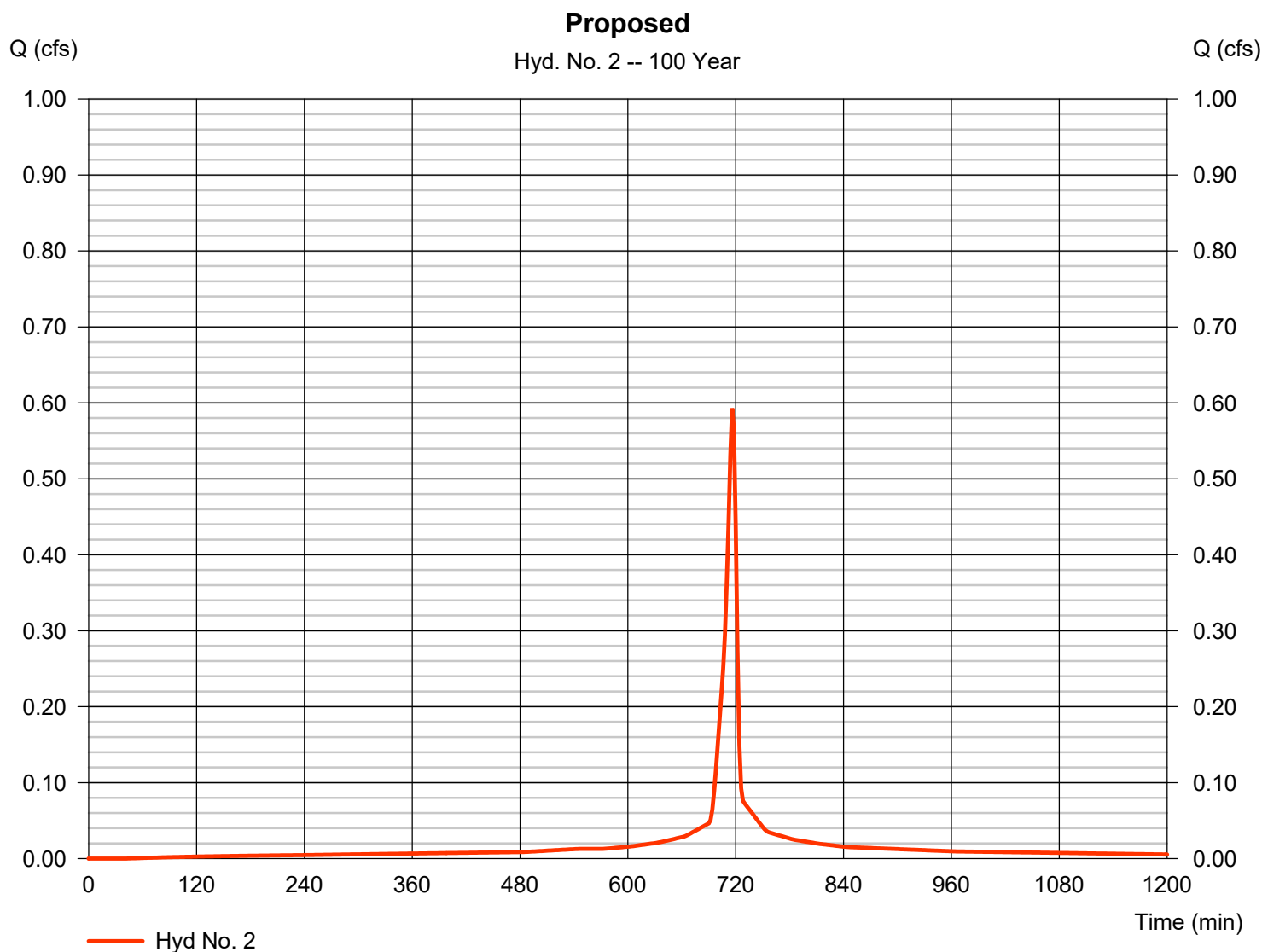
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Monday, 07 / 23 / 2018

Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.593 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,425 cuft
Drainage area	= 0.070 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Area to Existing Storm



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	Rational	10.30	1	5	3,091	-----	-----	-----	Storm
Area to Ex. Pipes.gpw					Return Period: 100 Year			Monday, 07 / 23 / 2018 Page 35 of 36	

Hydrograph Report

Hyd. No. 1

Storm

Hydrograph type	= Rational	Peak discharge	= 10.30 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 3,091 cuft
Drainage area	= 2.660 ac	Runoff coeff.	= 0.4*
Intensity	= 9.685 in/hr	Tc by User	= 5.00 min
IDF Curve	= Greenwood.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(2.190 x 0.30) + (0.470 x 0.85)] / 2.660

