WOODFIELD WILMINGTON APARTMENTS

CITY OF WILMINGTON, NC

STORMWATER MANAGEMENT

DESIGN NARRATIVE

Prepared for:

WOODFIELD ACQUISITIONS, LLC
300 Mountain Maple Drive
Cary, North Carolina 27519

Prepared by:

McKIM & CREED

243 North Front Street
Wilmington, NC 28401
(910)343-1048

NORTH CAROLINA PROFESSIONAL SEAL 042127 ENGINEER ERIC A. SEIDEL

8/10/17

RECEIVED
AUG 10 2017
ENGINEERING

Project #7075-002

August 2017

Final SW Calcs
11/2/17
SWP 2017046
Rac

WOODFIELD WILMINGTON APARTMENTS

NEW HANOVER COUNTY, NORTH CAROLINA

Project #7075-0002 (40)

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WOODFIELD WILMINGTON APARTMENTS

NEW HANOVER COUNTY, NORTH CAROLINA

Project #7075-002

I. PROJECT DESCRIPTION

Woodfield Acquisitions, LLC proposes to develop a 254-unit apartment complex at 3828 & 3970 Independence Boulevard in New Hanover County within its 15.1-acre parcel. The site is located near the intersection of Independence Boulevard (SR 1209) and Carolina Beach Road (US 421). Impervious areas will cover approximately 6.20 acres of the project area. Stormwater will be treated using three wet detention ponds.

Clearing and grading within the Woodfield Wilmington Apartments site will consist of an approximate total disturbed area of 11.7 acres.

II. EXISTING SITE

The proposed project is located at 3828 & 3970 Independence Boulevard (PIDs: R06500-004-020-000 and R06518-001-001-000). The site is bounded to the north by a proposed church, to the west by a vacant parcel, to the east by wetlands, and to the south by a proposed shopping center.

Wetlands within the parcel's boundary have been delineated by Southern Environmental Group, Inc. and impacts have been approved by the US Army Corps of Engineers. The area of wetlands shown along the southern portion of the parcel are located within the 0.2% annual chance flood hazard area as shown on the New Hanover County flood insurance rate map (Community Panel No. 3720312500J, revised 4/3/06). The site generally drains to the northwest and south towards the rear and side of the property.

A survey of the site was completed by McKim and Creed, Inc. in May 2014. The proposed project tract and subsequent project boundary is 15.1 acres and located within the City of Wilmington's Multiple Family Residential District – Medium Density (MF-M) zoning district. The receiving water body is Barnard's Creek and is classified as C; Sw, Index No. 18-80.

Information gathered from the USGS National Resources Conservation Service indicates that the soils on the parcel are a mixture of primarily Leon (Le), Lynn Haven fine sand (Ly), & Johnston Soils (JO) with small amounts of Baymeade fine sand (Be), Kureb sand (Kr), Rimini sand (Rm), & Wakulla sand (Wa). The project is within a drainage basin that ultimately drains to the Cape Fear River (SC, Index-No. 18-(71)) as illustrated on the attached USGS Topo Map.

III. PROPOSED IMPROVEMENTS

The stormwater management design plans are found in the enclosed plan set, including:

- DA 1 Exhibit – Post Development and Inlet Drainage Area Map
- CX-101 – Existing Conditions with Existing Soil Type Designations
- CG-101 through CG-108 – Storm Drainage and Grading Plans
- CG-501 – Storm Drainage Details
- CN-501 – 503 Stormwater Management Details

The total property area/stormwater project area for the Woodfield Wilmington project is 491,075 square feet (11.27 acres). Stormwater from the project area will be conveyed through stormwater pipe systems to various stormwater control measures (SCMs). Roof drainage from the proposed apartment buildings will be conveyed to the shown structures via a roof drainage header system. There are three (3) proposed SCMs for this site, all of which are wet detention ponds.

Drainage Areas

Based upon proposed topography and design information, the onsite post development drainage area was delineated into three (3) sub-drainage areas that flow to each SCM in the proposed plan. Each watershed was delineated into individual sub-drainage areas that flow to catch basins and drop inlets as shown in the drainage plan. See Drainage Area Exhibit attached for a breakdown of the post development drainage areas.

IV. STORMWATER CONTROL MEASURES (SCM)

The proposed project will be permitted as a high-density project utilizing three wet detention ponds for stormwater treatment. Runoff from each SCM drainage area will be piped to each pond using a systematic conveyance system. The proposed water quality SCMs are sized to treat, at a minimum, the first 1.5-inches of runoff from the contributing drainage areas. State Calculations have excluded all proposed pervious concrete and take no pervious credit. Ponds meet the 1.5" volume and SA/DA requirements with all parking being 100% impervious. Pervious concrete has been used for the City's 25yr-24hr pre-post routing requirements. A reduced Curve Number (CN) has been used for the Pre-Post routing only. Pervious pavement has been used throughout parking areas within the site to reduce impervious surface runoff to the wet detention ponds. The SCM ponds have been appropriately sized to meet State 1.5" treatment volume and City's Pre-Post routing requirements.

The proposed storm drainage pipe system and drainage pipes are sized to convey the 10-year return event within the proposed pipes and to check for flooding during the 50-year return event. Please see attached spreadsheet for sizing calculations. Emergency spillway sizing has been routed for the 50 year storm event with no pervious concrete reduction credit and clogged riser structure. The 20' emergency spillways are adequate and do not allow the ponds to stage above the top of the berm.

The SCMs were modeled using Hydraflow software to calculate the existing and proposed peak discharges. A routing analysis is attached that details SCM performance for the 2-, 10- and 25-year storm events. Results for routing of larger storms are also included in the enclosed calculations. Routing of the post development condition for the three (3) SCM wet ponds, for the 25 year – 24 hour storm, results in less peak flow than pre-development conditions.

2 Year Pre/Post Peak Flows:

- 2yr 24hr Pre Peak Flow: **0.139 cfs**

- 2yr 24hr Post Peak Flow (Pond #1): 0.119 cfs
- 2yr 24hr Post Peak Flow (Pond #2): 0.091 cfs
- 2yr 24hr Post Peak Flow (Pond #3): 0.046 cfs
- Total Post Pond Discharge: **0.256 cfs**

10 Year Pre/Post Peak Flows:

- 10yr 24hr Pre Peak Flow: **3.193 cfs**

- 10yr 24hr Post Peak Flow (Pond #1): 0.805 cfs
- 10yr 24hr Post Peak Flow (Pond #2): 1.246 cfs
- 10yr 24hr Post Peak Flow (Pond #3): 0.526 cfs
- Total Post Pond Discharge: **2.001 cfs**

25 Year Pre/Post Peak Flows:

- 25yr 24hr Pre Peak Flow: **8.441 cfs**

- 25yr 24hr Post Peak Flow (Pond #1): 2.53 cfs
- 25yr 24hr Post Peak Flow (Pond #2): 5.425 cfs
- 25yr 24hr Post Peak Flow (Pond #3): 2.269cfs
- Total Post Pond Routed Discharge: **7.84 cfs**

ATTACHMENTS- SUPPORTING INFORMATION

A. PARCEL DEED

3
24
1210 RP

2013018152

FOR REGISTRATION REGISTER OF DEED
TAMMY THEUSCH BEASLEY
NEW HANOVER COUNTY, NC
2013 MAY 20 02 24 05 PM
BK 5738 PG 1072-1075 FEE $26 00
NC REV STAMP $1,210 00
INSTRUMENT # 2013018152

NORTH CAROLINA GENERAL WARRANTY DEED

Excise Tax: $1210.00

Parcel Identifier No._____ Verified by _____ County on the ____ day of_____, 20__
By._____

Mail/Box to Dan Rizzo, Attorney, Post Office Box 2676, Surf City, NC 28445

This instrument was prepared by Dan Rizzo, Attorney, Post Office Box 2676, Surf City, NC 28445

Brief description for the Index:_____

THIS DEED made this 16th day of May, 2013 by and between

GRANTOR	GRANTEE
Independence West Properties, LLC 1508 Military Cutoff Road, Suite 302 Wilmington, NC 28403	Wilson W Ki and wife, Angie C Ki Post Office Box 12615 Wilmington, NC 28405

Enter in appropriate block for each Grantor and Grantee name, mailing address, and, if appropriate, character of entity, e g corporation or partnership

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of Wilmington, _____ Township, New Hanover County, North Carolina and more particularly described as follows

See Exhibit "A" for legal description

The property hereinabove described was acquired by Grantor by instrument recorded in Book 4401 page 696 & 703

All or a portion of the property herein conveyed ___ includes or X does not include the primary residence of a Grantor

A map showing the above described property is recorded in Plat Book _____ page _____

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever, other than the following exceptions Subject to easements, restrictions and rights of way of record, if any

IN WITNESS WHEREOF, the Grantor has duly executed the foregoing as of the day and year first above written.

Independence West Properties, LLC
(Entity Name)

By _____

Print/Type Name & Title , ~~President~~ MGR

By _____

Print/Type Name & Title , Secretary/Treasurer

By _____

Print/Type Name & Title _____

_____ (SEAL)
Print/Type Name. _____

_____ (SEAL)
Print/Type Name _____

_____ (SEAL)
Print/Type Name. _____

_____ (SEAL)
Print/Type Name _____

State of _____ - County or City of _____

I, the undersigned Notary Public of the County or City of _____ and State aforesaid, certify that _____ personally appeared before me this day and acknowledged the due execution of the foregoing instrument for the purposes therein expressed. Witness my hand and Notarial stamp or seal this _____ day of _____, 20___

My Commission Expires: _____
(Affix Seal)

_____ Notary Public
Notary's Printed or Typed Name

State of North Carolina - County or City of New Hanover

I, the undersigned Notary Public of the County or City of New Hanover and State aforesaid, certify that Jon T. Vincent personally came before me this day and acknowledged that he is the ~~President~~ Mgr of Independence West Properties, LLC, a North Carolina or _____ corporation/limited liability company/general partnership/limited partnership (strike through the inapplicable), and that by authority duly given and as the act of such entity, he signed the foregoing instrument in its name on its behalf as its act and deed Witness my hand and Notarial stamp or seal, this 16th day of May, 2013

My Commission Expires 1-09-16
(Affix Seal)

R. Daniel Rizzo Notary Public
Notary's Printed or Typed Name

State of _____ - County or City of _____

I, the undersigned Notary Public of the County or City of _____ and State aforesaid, certify that _____

Witness my hand and Notarial stamp or seal, this _____ day of _____, 20___

My Commission Expires: _____
(Affix Seal)

_____ Notary Public
Notary's Printed or Typed Name

EXHIBIT "A"

Tract I:
Parcel # R06500-004-020-000 - 3828 Independence Boulevard, Wilmington, NC

ALL OF TRACT B AS SHOWN UPON THAT MAP RECORDED IN THE NEW HANOVER COUNTY REGISTRY IN MAP BOOK 42 AT PAGE 33, SAID MAP BEING ENTITLED "SURVEY OF LOTS 9 & 10, AND PART OF LOT 8, OF THE SEIGLER-AHRENS FARM....for the C. D Parker heirs "

Subject, however, to the rights of others entitled thereto, to the uninterrupted flow of Fork Branch, and to easements of record

Tract II:
Parcel # R06518-001-001-000 – 3970 Independence Boulevard, Wilmington NC

BEING all of Tract 4 shown as a 5.15 acre tract as set forth on the Map of Tracts 6A, 6B and 4 of ECHO FARMS Subdivision as prepared by Stroud Engineering, PA, and recorded in Map Book 35 at Pages 370 and 371 of the New Hanover County, North Carolina Registry, reference to which is hereby made for a more particular description

TAMMY THEUSCH BEASLEY
REGISTER OF DEEDS, NEW HANOVER
216 NORTH SECOND STREET

WILMINGTON, NC 28401

****

Filed For Registration.	**05/20/2013 02:24:05 PM**
Book.	**RE 5738 Page: 1072-1075**
Document No..	**2013018152**
	4 PGS $26.00
NC REAL ESTATE EXCISE TAX.	**$1,210.00**
Recorder.	**JOHNSON, CAROLYN**

State of North Carolina, County of New Hanover

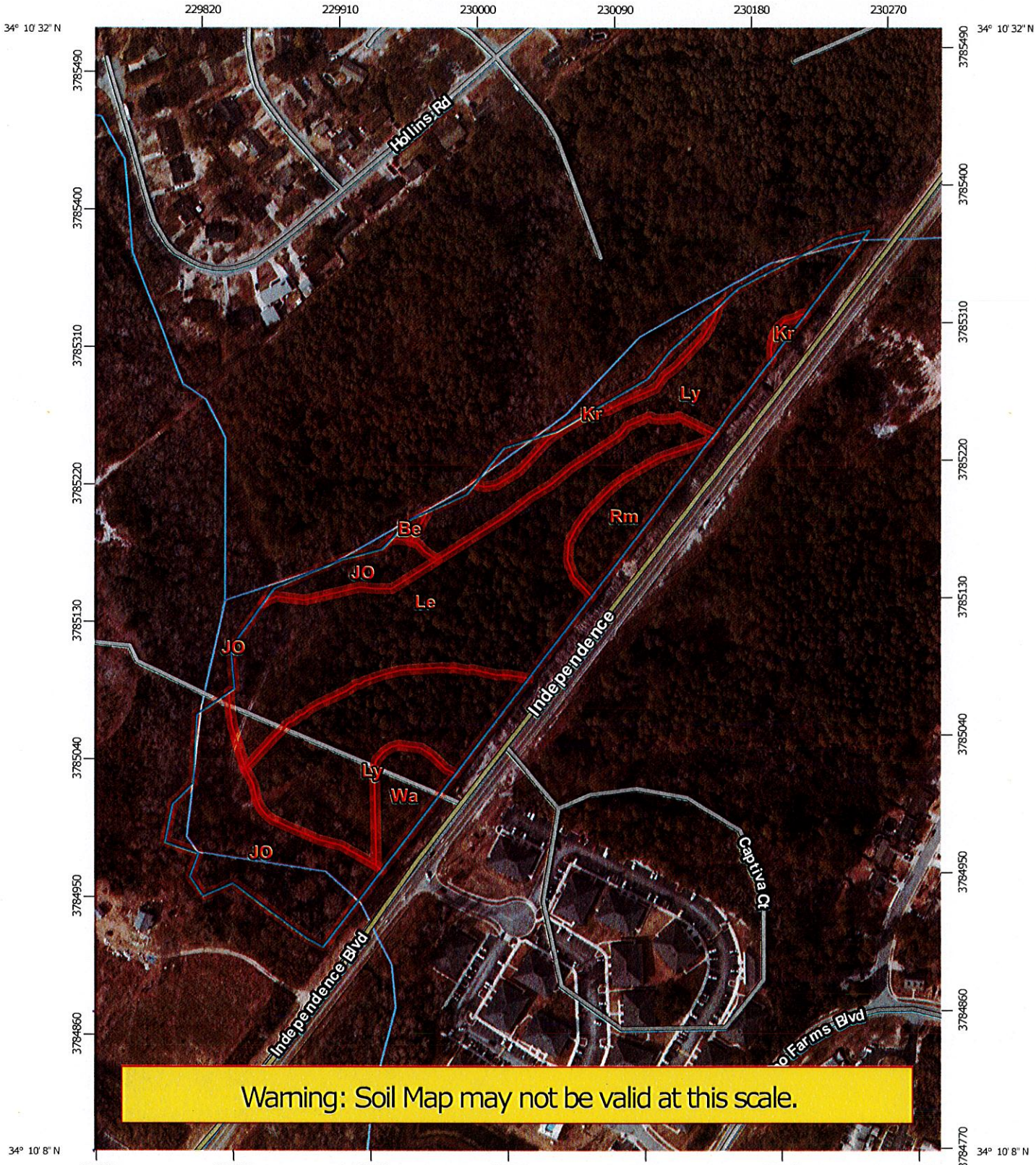
PLEASE RETAIN YELLOW TRAILER PAGE WITH ORIGINAL DOCUMENT.

2013018152

2013018152

B. NRCS SOILS MAP

Soil Map—New Hanover County, North Carolina
(Woodfield Wilmington)



Map Scale: 1:3,580 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: http://websoilsurvey.nrcs.usda.gov
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: New Hanover County, North Carolina
Survey Area Data: Version 16, Sep 29, 2015

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

Date(s) aerial images were photographed: Data not available.

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.

Map Unit Legend

New Hanover County, North Carolina (NC129)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Be	Baymeade fine sand, 1 to 6 percent slopes	0.0	0.3%
JO	Johnston soils	2.8	18.3%
Kr	Kureb sand, 1 to 8 percent slopes	0.4	2.7%
Le	Leon sand	5.2	34.3%
Ly	Lynn Haven fine sand	5.3	35.1%
Rm	Rimini sand, 1 to 6 percent slopes	0.8	5.3%
Wa	Wakulla sand, 1 to 8 percent slopes	0.6	4.0%
Totals for Area of Interest		**15.1**	**100.0%**

C. ECS GEOTECHNICAL REPORT

ECS CAROLINAS, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities
NC Registered Engineering Firm P-1078
NC Registered Geologists Firm C-406
SC Registered Engineering Firm 3239

November 3, 2016

Mr. Scott Underwood
Woodfield Acquisitions
11425 Horsemans Trail
Raleigh, North Carolina 27613

Reference: Report of Seasonal High Water Table Estimation and Infiltration Testing
Independence West Apartments
Wilmington, New Hanover County, North Carolina
ECS Project No. 49.3314

Dear Mr. Underwood:

ECS Carolinas, LLP (ECS) recently conducted a seasonal high water table (SHWT) estimation and infiltration testing within the stormwater best management practice (BMP) area(s) at 3790 Independence Boulevard in Wilmington, New Hanover County, North Carolina. This letter, with attachments, is the report of our testing.

Field Testing

On November 2, 2016, ECS conducted an exploration of the subsurface soil and groundwater conditions at four requested locations shown on the attached Boring Location Plan (Figure 1). ECS located the borings using GPS equipment and a site plan provided by McKim & Creed. The purpose of this exploration was to obtain subsurface information of the in situ soils for the stormwater BMP area(s). ECS explored the subsurface soil and groundwater conditions by advancing one hand auger boring into the existing ground surface at each of the requested boring locations. ECS visually classified the subsurface soils and obtained representative samples of each soil type encountered. ECS also recorded the SHWT and groundwater elevation observed at the time of the hand auger borings. The attached Infiltration Testing Form provides a summary of the subsurface conditions encountered at the hand auger boring locations.

The SHWT and groundwater elevation was estimated at the boring locations below the existing grade elevation. A summary of the findings are as follows:

Location	SHWT	Groundwater
B-1	18 inches	32 inches
B-2	20 inches	32 inches
B-3	40 inches	60 inches
B-4	18 inches	24 inches

ECS has conducted four infiltration tests utilizing a compact constant head permeameter near the hand auger borings in order to estimate the infiltration rate for the subsurface soils. Infiltration tests are typically conducted at two feet above the SHWT or in the most restrictive soil horizon. Tests in clayey conditions are conducted and calculated up to 30 minute intervals. If an exact hydraulic conductivity is necessary for these locations, then ECS recommends collecting samples by advancing Shelby tubes and performing laboratory permeability testing.

Field Test Results

Below is a summary of the infiltration test results:

Location	Description	Depth	Inches/ hour
B-1	Tan/orange/gray fine SAND w/ clay	10 inches	5.10
B-2	Gray fine to med. SAND	10 inches	19.96
B-3	Gray fine SAND w/ hardpan lens	16 inches	5.72
B-4	Gray silty SAND	18 inches	0.42

Infiltration rates and SHWT may vary within the proposed site due to changes in elevation and subsurface conditions.

Closure

ECS's analysis of the site has been based on our understanding of the site, the project information provided to us, and the data obtained during our exploration. If the project information provided to us is changed, please contact us so that our recommendations can be reviewed and appropriate revisions provided, if necessary. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration should be reported to us for our review, analysis and revision of our recommendations, if necessary. The assessment of site environmental conditions for the presence of pollutants in the soil and groundwater of the site is beyond the scope of this geotechnical exploration.

ECS appreciates the opportunity to provide our services to you on this project. If you have any questions concerning this report or this project, please contact us at (910) 686-9114.

Respectfully,

ECS CAROLINAS, LLP

K. Brooks Wall
Project Manager
bwall@ecslimited.com
910-686-9114

W. Brandon Fulton, PSC, PWS, LSS
Environmental Department Manager
bfulton@ecslimited.com
704-525-5152

Attachments: Figure 1 - Boring Location Plan
Infiltration Testing Form
ASFE Document

Infiltration Testing Form
Independence West Apartments
Wilmington, New Hanover County, North Carolina
ECS Project No. 49.3314
November 2, 2016

Location	Depth	USCS	Soil Description
B-1	0-36"	SC	Tan/orange/gray fine SAND w/clay

Seasonal High Water Table was estimated to be at 18 inches below the existing grade elevation.
Groundwater was encountered at 32 inches below the existing grade elevation.
Test was conducted at 10 inches below existing grade elevation
Infiltration Rate: 5.10 inches per hour

Location	Depth	USCS	Soil Description
B-2	0-30"	SP	Gray fine to medium SAND
	30"-48"	SM	Dark gray fine SAND w/silt

Seasonal High Water Table was estimated to be at 20 inches below the existing grade elevation.
Groundwater was encountered at 32 inches below the existing grade elevation.
Test was conducted at 10 inches below existing grade elevation
Infiltration Rate: 19.96 inches per hour

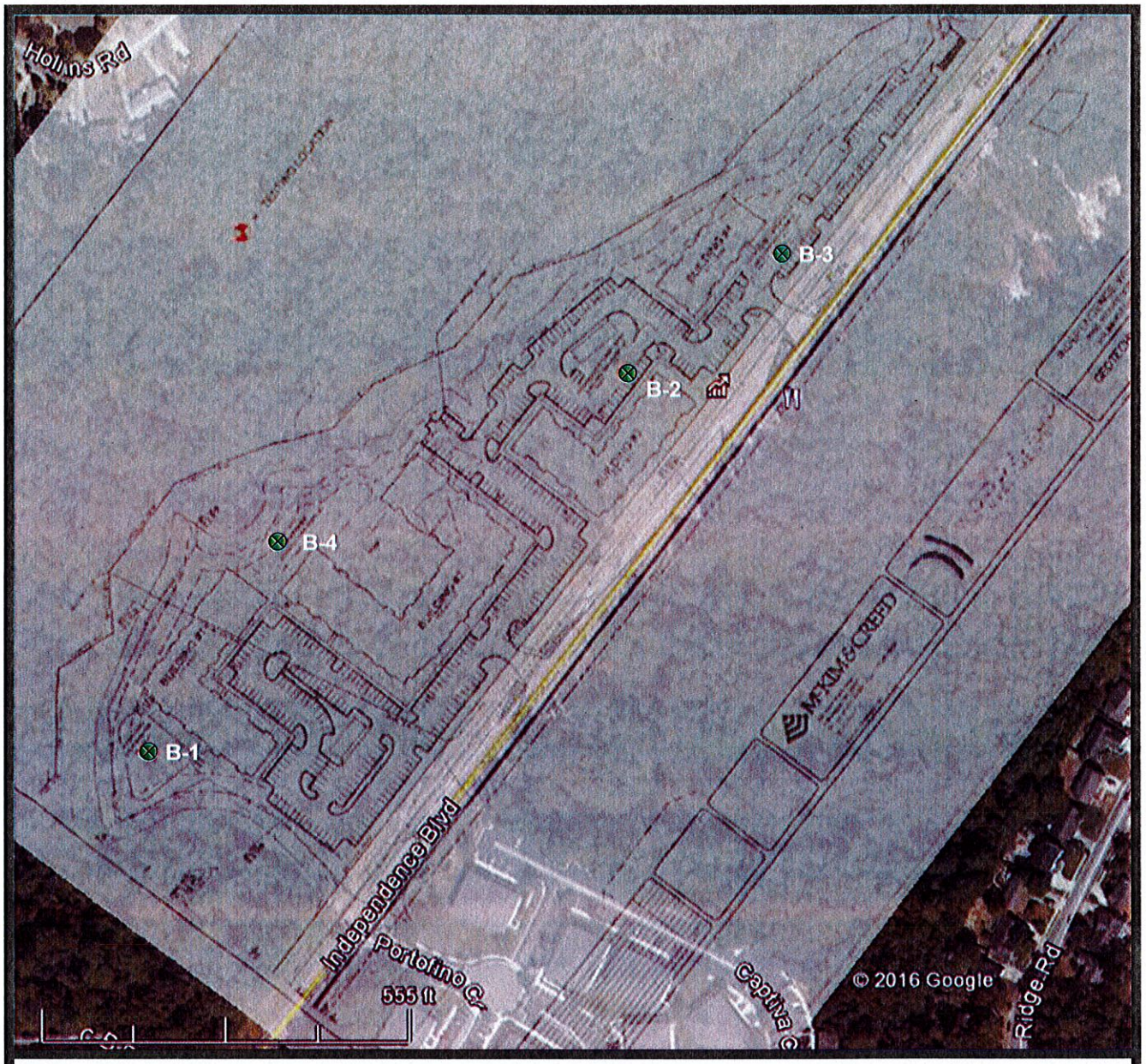
Location	Depth	USCS	Soil Description
B-3	0-42"	SM	Gray fine SAND w/ hardpan lenses
	42"-48"	SM	Dark gray silty SAND

Seasonal High Water Table was estimated to be at 40 inches below the existing grade elevation.
Groundwater was encountered at 60 inches below the existing grade elevation.
Test was conducted at 10 inches below existing grade elevation
Infiltration Rate: 5.72 inches per hour

Infiltration Testing Form
Independence West Apartments
Wilmington, New Hanover County, North Carolina
ECS Project No. 49.3314
November 2, 2016

Location	Depth	USCS	Soil Description
B-4	0-18"	SP	Gray fine SAND
	30"-48"	SM	Gray silty SAND

Seasonal High Water Table was estimated to be at 18 inches below the existing grade elevation.
Groundwater was encountered at 24 inches below the existing grade elevation.
Test was conducted at 18 inches below existing grade elevation
Infiltration Rate: 0.42 inches per hour



APPROXIMATE BORING LOCATIONS

SCALE SHOWN ABOVE

N
W E
S

Independence West Apartments
Wilmington, New Hanover County,
North Carolina

ECS Project # 49.3314
November 2, 2016
KBW

Figure 1– Boring Location Plan

Provided by: Google Earth and
Mckim & Creed

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone:' 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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D.CALCULATIONS

Project Name: Woodfield Wilmington
County: New Hanover
Project Number: 7075-0002

McKIM & CREED

Soil Symbols	Soil Names	HSG		
Ly	Lynn Haven fine sand	A	89444	56%
Le	Leon sand	A	27645	17%
JO	Johnston soils	A	2168.9	1%
Wa	Wakulla sand	A	24486	15%

Pre-Development Drainage Area #1

Basin: Drainage area= 3.68 acres = 0.006 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Woods						
Good Condition	100.00	39	60	73	79	39.00
						0.00
	0.00					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	39.00

Curve numbers taken from: TR-55 **Use: 39**

Project Name: Woodfield Wilmington
County: New Hanover
Project Number: 7075-0002

McKIM & CREED

Soil Symbols	Soil Names	HSG		
Ly	Lynn Haven fine sand	A	89444	56%
Le	Leon sand	A	27645	17%
JO	Johnston soils	A	2168.9	1%
Wa	Wakulla sand	A	24486	15%

Post-Development Drainage Area #1 **(CN with No PC)**

Basin: Drainage area= 3.68 acres = 0.006 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Commercial / Bus	73.80	89	92	94	95	65.68
Pevious Pavement	0.00	39				0.00
Open Space	26.20	39	61	74	80	10.22
Good Conditon						
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	75.90

Curve numbers taken from: TR-55 **Use:** **76**

Project Name: Woodfield Wilmington
County: New Hanover
Project Number: 7075-0002

McKIM & CREED

Soil Symbols	Soil Names	HSG		
Ly	Lynn Haven fine sand	A	16614	10%
Le	Leon sand	A	142238	85%
Rm	Rimini sand	A	22354	13%
JO	Johnston soils	A	1857.4	1%
Kr	Kureb sand	A	0	0%

Pre-Development Drainage Area #2

Basin: Drainage area= 3.82 acres = 0.006 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Woods						
Good Condition	100.00	39	60	73	79	39.00
						0.00
	0.00					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	39.00

Curve numbers taken from: TR-55 **Use: 39**

Project Name: Woodfield Wilmington
County: New Hanover
Project Number: 7075-0002

McKIM & CREED

Soil Symbols	Soil Names	HSG		
Ly	Lynn Haven fine sand	A	16614	10%
Le	Leon sand	A	142238	85%
Rm	Rimini sand	A	22354	13%
JO	Johnston soils	A	1857.4	1%
Kr	Kureb sand	A	0	0%

Post-Development Drainage Area #2 (CN with No PC)

Basin: Drainage area= 3.82 acres = 0.006 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Commercial / Bus	67.89	89	92	94	95	60.42
Pevious Pavement	0.00	39				0.00
Open Space Good Condition	32.11	39	61	74	80	12.52
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	72.95

Curve numbers taken from: TR-55 **Use: 73**

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Project Name: Woodfield Wilmington
County: New Hanover
Project Number: 7075-0002

McKIM&CREED

Soil Symbols	Soil Names	HSG		
Ly	Lynn Haven fine sand	A	43229	63%
Le	Leon sand	A	49006	72%
Rm	Rimini sand	A	34616	51%
Kr	Kureb sand	A	2306	3%

Pre-Development Drainage Area #3

Basin: Drainage area= 1.57 acres = 0.002 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Woods						
Good Condition	100.00	39	60	73	79	39.00
						0.00
	0.00					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	39.00

Curve numbers taken from: TR-55 **Use: 39**

Project Name: Woodfield Wilmington
County: New Hanover
Project Number: 7075-0002

McKIM&CREED

Soil Symbols	Soil Names	HSG		
Ly	Lynn Haven fine sand	A	43229	63%
Le	Leon sand	A	49006	72%
Rm	Rimini sand	A	34616	51%
Kr	Kureb sand	A	2306	3%

Post-Development Drainage Area #3 **(CN with No PC**

Basin: Drainage area= 1.57 acres = 0.002 mi^2

Curve Number						
	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area Commercial/Bus	61.48	89	92	94	95	54.72
Pervious Pavement	0.00	39				0.00
Open Space Good Condition	38.52	39	61	74	80	15.02
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	69.74
Curve numbers taken from:		TR-55			**Use:**	**70**

Woodfield Wilmington

NCDEQ Retention Requirements

Pond #1

Site Data

Total DA	[illegible]	ACRE	*Value from CAD*
On-Site Drainage Area	[illegible]	ACRE	*Value from CAD*
Off-Site Drainage Area	[illegible]	ACRE	*Value from CAD*
Impervious	2.72	ACRE	*Value from CAD*
Buildings	[illegible]	SF	*Value from CAD*
Sidewalks	[illegible]	SF	*Value from CAD*
Pervious Parking	[illegible]	SF	*Value from CAD includes 100% pevious credit*
Parking	[illegible]	SF	*Value from CAD*
Future	[illegible]	SF	*Value from CAD*
Offsite	[illegible]	SF	
Impervious Cover	73.8%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*

Treatment Volume

Runoff Coefficient, Rv	0.715	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	14,319	CF	*1.5 inch*Rv*1ftt/12 in*(Total DA)*
Provided Treatment Volume	[illegible]	CF	*Volume between permanent pool & next-highest orifice*

Stormwater Pond

Bottom of Pond Elevation - Main Bay	[illegible]	FT	*Value selected by designer*
Bottom of Pond Elevation - Forebay	[illegible]	FT	
Sediment Storage Elevation - Main Bay	[illegible]	FT	*Value selected by designer*
Sediment Storage Elevation - Forebay	[illegible]	FT	
Sediment Storage Volume	[illegible]	CF	*Pond volume below sediment storage elev.*
Permanent Pool Elevation	[illegible]	FT	*Value selected by designer*
Temporary Pool Elevation	[illegible]	FT	*Elevation of the next-highest outlet*
Average Depth Provided	[illegible]	FT	*See Attached SA/DA Cacluations*
Required SA/DA Ratio Coastal	[illegible]	%	*Value from Coastal 2017 SA/DA Table*
Required Permanent Pool Surface Area	[illegible]	SF	*(Req'd SA/DA Ratio)*(Total Drainage Area)*
Provided Permanent Pool Surface Area	[illegible]	SF	*Value from stage-storage calculations*

Flow Path

Basin Length	[illegible]	FT	*Value from CAD*
Basin Width	[illegible]	FT	*Value from CAD (average)*
Basin L:W ratio	2		*Basin length / basin width*
Flow Length	[illegible]	FT	*Distance from nearest inlet to outlet structure*
Flow path width	[illegible]	FT	*Required surface area / flow length*
Flow path L:W ratio	3		*Flow length / flow path width*

Forebay

Permanent Pool Volume	[illegible]	CF	*Total pond volume between permanent pool elevation & sediment storage elevation*
Total Required Forebay Volume	[illegible]	CF	*20% of permanent pool volume*
Provided Volume - Forebay	[illegible]	CF	*Provided volume between permanent pool elev. & sediment storage elevation*
Total Forebay % of Permanent Pool	[illegible]		*Total between 15 - 20% - OK*

Drawdown

Diameter of Low Flow Orifice	[illegible]	IN	*Value selected by designer*
Weir Elevation of Outlet Structure	[illegible]	FT	*Elevation of the next-highest weir*
Total Elevation Head Above Weir Invert	[illegible]	FT	*Total elevation head above center of orifice*
Average Elevation Head Above Weir Invert	1.20	FT	*1/3 of total elevation head*
Average Elevation Head (1.5")	0.53		*1/3 of total elevation head*
Cd, Coefficient of Discharge	[illegible]		*Value selected by designer*
Q, Flowrate Through Low-flow Orifice	0.09	CFS	*Q=Cd*Weir Area*sqrt(2*32.2*Avg Head) Weir*
Q, Flowrate Through Low-flow Orifice (1.5")	0.06	CFS	*Q=Cd*Weir Area*sqrt(2*32.2*Avg Head) 1.5"*
Drawdown Time	2.82	DAYS	*1.5" Runoff Volume/Flowrate through Wier/86400*
Drawdown Time	4.61	DAYS	*Temporary Pool Drawdown*

Woodfield Wilmington

Stage-Storage Calculations for the Proposed Wet Detention Pond

Pond #1

Stage/Storage Above Permanent Pool

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
10.00	7,026	0	0	←Permanent Pool
10.50	7,968	3,749	3,749	←Top of Shelf
11.00	8,867	4,209	7,957	
12.00	10,050	9,459	17,416	
13.60	12,062	17,690	35,105	←Temporary Pool
14.6	14,874	13,468	48,573	←Top of Pond

Stage/Storage Below Permanent Pool

Main Bay

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
1.00	991	0	0	←Pond Bottom
2.00	1,280	1,136	1,136	←Sed. Storage
3.00	1,604	1,442	2,578	
4.00	1,962	1,783	4,361	
5.00	2,351	2,157	6,517	
6.00	2,768	2,560	9,077	
7.00	3,211	2,990	12,066	
8.00	3,680	3,446	15,512	
9.00	4,177	3,929	19,440	
9.50	4,436	2,153	21,593	←Bottom of Shelf
10.00	5,250	2,422	24,015	←Permanent Pool

Forebay 1

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
1.00	0	0	0	
2.00	0	0	0	
3.00	112	0	0	←Forebay Bottom
4.00	233	173	173	←Sed. Storage
5.00	397	315	488	
6.00	638	518	1,005	
7.00	956	797	1,802	
8.00	1,167	1,062	2,864	
9.00	1,439	1,303	4,167	←Top of Forebay
9.50	1,608	762	4,928	
10.00	1,776	846	5,774	←Permanent Pool

Stage/Storage Below Permanent Pool

Total (Main Bay + Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
1.00	991	0	0	←Pond Bottom
2.00	1,280	1,136	1,136	←Sed. Storage
3.00	1,716	1,498	2,634	
4.00	2,195	1,956	4,589	
5.00	2,748	2,472	7,061	
6.00	3,406	3,077	10,138	
7.00	4,167	3,787	13,924	
8.00	4,847	4,507	18,431	
9.00	5,616	5,232	23,663	
9.50	6,044	2,915	26,578	←Bottom of Shelf
10.00	7,026	3,268	29,845	←Permanent Pool

Woodfield Wilmington

NC DEQ Retention Requirements

Pond #2

Site Data			
Total DA		ACRE	*Value from CAD*
On-Site Drainage Area		ACRE	*Value from CAD*
Off-Site Drainage Area		ACRE	*Value from CAD*
Impervious		ACRE	*Value from CAD*
Buildings		SF	*Value from CAD*
Sidewalks		SF	*Value from CAD*
Amenity		SF	*Value from CAD*
Parking		SF	*Value from CAD*
Pervious Parking		SF	*Value from CAD includes 100% pevious credit*
Offsite		SF	
Impervious Cover	67.89%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*
Treatment Volume			
Runoff Coefficient, Rv	0.661	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	13,749	CF	*1.5 inch*Rv*1ft/12 in*(Total DA)*
Provided Treatment Volume		CF	*Volume between permanent pool & next-highest orifice*
Stormwater Pond			
Bottom of Pond Elevation - Main Bay		FT	*Value selected by designer*
Bottom of Pond Elevation - Forebay		FT	
Sediment Storage Elevation - Main Bay		FT	*Value selected by designer*
Sediment Storage Elevation - Forebay		FT	
Sediment Storage Volume		CF	*Pond volume below sediment storage elev.*
Permanent Pool Elevation		FT	*Value selected by designer*
Temporary Pool Elevation		FT	*Elevation of the next-highest outlet*
Average Depth Provided		FT	*See calculations attached*
Required SA/DA Ratio for 90% TSS Removal		%	*Value from 90% TSS removal chart*
Required Permanent Pool Surface Area		SF	*(Req'd SA/DA Ratio)*(Total Drainage Area)*
Provided Permanent Pool Surface Area		SF	*Value from stage-storage calculations*
Flow Path			
Basin Length		FT	*Value from CAD*
Basin Width		FT	*Value from CAD (average)*
Basin L:W ratio			*Basin length / basin width*
Flow Length		FT	*Distance from nearest inlet to outlet structure*
Flow path width		FT	*Required surface area / flow length*
Flow path L:W ratio			*Flow length / flow path width*
Forebay			
Permanent Pool Volume		CF	*Total pond volume between permanent pool elevation & sediment storage elevation*
Total Required Forebay Volume	5,114	CF	*20% of permanent pool volume*
Provided Volume - Forebay	5,012	CF	*Provided volume between permanent pool elev. & sediment storage elevation*
Total Forebay % of Permanent Pool	19.6%		*Total between 15 - 20% - OK*
Drawdown			
Diameter of Low Flow Orifice		IN	*Value selected by designer*
Weir Elevation of Outlet Structure		FT	*Elevation of the next-highest weir*
Total Elevation Head Above Weir Invert		FT	*Total elevation head above center of orifice*
Average Elevation Head Above Weir Invert	0.87	FT	*1/3 of total elevation head*
Average Elevation Head (1.5")	0.47		*1/3 of total elevation head*
Cd, Coefficient of Discharge			*Value selected by designer*
Q, Flowrate Through Low-flow Orifice	0.06	CFS	*Q=Cd*Weir Area*sqrt(2*32.2*Avg Head) Weir*
Q, Flowrate Through Low-flow Orifice (1.5")	0.05	CFS	*Q=Cd*Weir Area*sqrt(2*32.2*Avg Head) 1.5"*
Drawdown Time	3.46	DAYS	*1.5" Runoff Volume/Flowrate through Wier/86400*
Drawdown Time	4.81	DAYS	*Temporary Pool Drawdown*

Woodfield Wilmington

Stage-Storage Calculations for the Proposed Wet Detention Pond

Pond #2

Stage/Storage Above Permanent Pool

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
13.50	7,376	0	0	←Permanent Pool
14.00	8,937	4,078	4,078	←Top of Shelf
15.00	10,354	9,646	13,724	
16.10	11,979	12,283	26,007	←Temporary Pool
17.10	14,946	13,463	39,469	←Top of Pond

Stage/Storage Below Permanent Pool

Main Bay

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
4	165	0	0	←Pond Bottom
5	330	248	248	←Sed. Storage
6	556	443	691	
7	1053	805	1,495	
8	1577	1,315	2,810	
9.00	2,130	1,854	4,664	
10.00	2,715	2,423	7,086	
11.00	3,332	3,024	10,110	
12.00	3,975	3,654	13,763	
13.00	4,646	4,311	18,074	←Bottom of Shelf
13.50	5,707	2,588	20,662	←Permanent Pool

Forebay 1

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
4	0	0	0	
5	0	0	0	
6	61	0	0	←Forebay Bottom
7	162	112	112	←Sed. Storage
8	296	229	341	
9.00	461	379	719	
10.00	657	559	1,278	
11.00	884	771	2,049	
12.00	1,142	1,013	3,062	
13.00	1,432	1,287	4,349	←Top of Forebay
13.50	1,669	775	5,124	←Permanent Pool

Stage/Storage Below Permanent Pool

Total (Main Bay + Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
4	165	0	0	←Pond Bottom
5	330	248	248	←Sed. Storage
6	617	474	721	
7	1,215	916	1,637	
8	1,873	1,544	3,181	
9.00	2,591	2,232	5,413	
10.00	3,372	2,982	8,395	
11.00	4,216	3,794	12,189	
12.00	5,117	4,667	16,855	
13.00	6,078	5,598	22,453	←Bottom of Shelf
13.50	7,376	3,364	25,816	←Permanent Pool

Woodfield Wilmington

NCDEQ Retention Requirements

Pond #3

Site Data

Total DA		ACRE	*Value from CAD*
On-Site Drainage Area		ACRE	*Value from CAD*
Off-Site Drainage Area		ACRE	*Value from CAD*
Impervious	0.97	ACRE	*Value from CAD*
Buildings		SF	*Value from CAD*
Sidewalks		SF	*Value from CAD*
Pervious Parking		SF	*Value from CAD w/ Pervious Credit*
Parking		SF	*Value from CAD*
Future		SF	*Value from CAD*
Offsite		SF	
Impervious Cover	61.48%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*

Treatment Volume

Runoff Coefficient, Rv	0.603	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	5,158	CF	*1.5 inch*Rv*1ftt/12 in*(Total DA)*
Provided Treatment Volume		CF	*Volume between permanent pool & next-highest orifice*

Stormwater Pond

Bottom of Pond Elevation - Main Bay		FT	*Value selected by designer*
Bottom of Pond Elevation - Forebay		FT	
Sediment Storage Elevation - Main Bay		FT	*Value selected by designer*
Sediment Storage Elevation - Forebay		FT	
Sediment Storage Volume		CF	*Pond volume below sediment storage elev.*
Permanent Pool Elevation		FT	*Value selected by designer*
Temporary Pool Elevation		FT	*Elevation of the next-highest outlet*
Average Depth Provided		FT	*See formula below*
Required SA/DA Ratio Coastal		%	*Value from Coastal chart*
Required Permanent Pool Surface Area		SF	*(Req'd SA/DA Ratio)*(Total Drainage Area)*
Provided Permanent Pool Surface Area		SF	*Value from stage-storage calculations*

Flow Path

Basin Length		FT	*Value from CAD*
Basin Width		FT	*Value from CAD (average)*
Basin L:W ratio	5		*Basin length / basin width*
Flow Length		FT	*Distance from nearest inlet to outlet structure*
Flow path width		FT	*Required surface area / flow length*
Flow path L:W ratio	3		*Flow length / flow path width*

Forebay

Permanent Pool Volume		CF	*Total pond volume between permanent pool elevation & sediment storage elevation*
Total Required Forebay Volume		CF	*20% of permanent pool volume*
Provided Volume - Forebay		CF	*Provided volume between permanent pool elev. & sediment storage elevation*
Total Forebay % of Permanent Pool			*Total between 18 - 22% - OK*

Drawdown

Diameter of Low Flow Orifice		IN	*Value selected by designer*
Weir Elevation of Outlet Structure		FT	*Elevation of the next-highest weir*
Total Elevation Head Above Weir Invert		FT	*Total elevation head above center of orifice*
Average Elevation Head Above Weir Invert	0.63	FT	*1/3 of total elevation head*
Average Elevation Head (1.5")	0.30		*1/3 of total elevation head*
Cd, Coefficient of Discharge			*Value selected by designer*
Q, Flowrate Through Low-flow Orifice	0.03	CFS	*Q=Cd*Weir Area*sqrt(2*32.2*Avg Head) Weir*
Q, Flowrate Through Low-flow Orifice	0.02	CFS	*Q=Cd*Weir Area*sqrt(2*32.2*Avg Head) Riser*
Drawdown Time	2.66	DAYS	*1.5" Runoff Volume/Flowrate through Wier/86400*
Drawdown Time	4.39	DAYS	*Temporary Pool Drawdown*

Woodfield Wilmington

Stage-Storage Calculations for the Proposed Wet Detention Pond

Pond #3

Stage/Storage Above Permanent Pool

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
17.50	4,711	0	0	+Permanent Pool
18.00	6,275	2,747	2,747	+Top of Shelf
19.00	7,157	6,716	9,463	
19.40	7,448	2,921	12,384	+Temporary Pool
20.40	8,940	8,194	20,578	+Top of Pond

Stage/Storage Below Permanent Pool

Main Bay

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
11	122	0	0	+Pond Bottom
12.00	345	234	234	+Sed. Storage
13.00	602	474	707	
14.00	979	791	1,498	
15.00	1,446	1,213	2,710	
16.00	2,024	1,735	4,445	
17.00	2,644	2,334	6,779	+Bottom of Shelf
17.50	3,642	1,572	8,351	+Permanent Pool

Forebay 1

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
11	0	0	0	+Pond Bottom
12.00	0	0	0	+Sed. Storage
13.00	105	0	0	
14.00	229	167	167	
15.00	390	310	477	
16.00	587	489	965	
17.00	814	701	1,666	+Bottom of Shelf
17.50	1,069	471	2,136	+Permanent Pool

Stage/Storage Below Permanent Pool

Total (Main Bay + Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
11	122	0	0	+Pond Bottom
12.00	345	234	234	+Sed. Storage
13.00	707	526	760	
14.00	1,208	958	1,717	
15.00	1,836	1,522	3,239	
16.00	2,611	2,224	5,463	
17.00	3,458	3,035	8,497	+Bottom of Shelf
17.50	4,711	2,042	10,539	+Permanent Pool

CALCULATION

Project Woodfield Wilmington
Client
Subject SA/DA Calcs

Proj. No.
Date 9/5/17
Des. By Eric Seidel, PE
Chk. By

- Pond #1: $D_{avg} = \frac{V_{pp}}{A_{pp}} = \frac{22,879}{5250} = 4.36$
  - * 69 % Impervious USE 70 %
  - * Davg USE 4.0
  - * SA/DA Ratio Coastal: 3.92

- Pond #2: USE Equation #3

$$\frac{V_{pp} - V_{shelf}}{A_{btmShelf}} = \frac{2041.4 - 275.25}{4646} = 4.33$$

  - * 67.99 % Impervious USE 70 %
  - * Davg USE 4.0
  - * SA/DA Ratio Coastal: 3.92

$V_{shelf} = 0.5 * 0.5 * 367 * 3 = 275.25$

- Pond #3: USE Equation #3

$$\frac{V_{pp} - V_{shelf}}{A_{btmshelf}} = \frac{811.7 - 239.25}{2643} = 2.98$$

$V_{shelf} = 0.5 * 0.5 * 319 * 3 = 239.25$

  - * 61.48 % Impervious USE 63 %
  - * Davg USE 3.0
  - * SA/DA Ratio Coastal: 4.61

Table 1: Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

Percent Impervious Cover	Permanent Pool Average Depth (ft)					
	3.0	4.0	5.0	6.0	7.0	8.0
10%	0.51	0.43	0.37	0.30	0.27	0.25
20%	0.84	0.69	0.61	0.51	0.44	0.40
30%	1.17	0.94	0.84	0.72	0.61	0.56
40%	1.51	1.24	1.09	0.91	0.78	0.71
50%	1.79	1.51	1.31	1.13	0.95	0.87
60%	2.09	1.77	1.49	1.31	1.12	1.03
70%	2.51	2.09	1.80	1.56	1.34	1.17
80%	2.92	2.41	2.07	1.82	1.62	1.40
90%	3.25	2.64	2.31	2.04	1.84	1.59
100%	3.55	2.79	2.52	2.34	2.04	1.75

Table 2: Coastal SA/DA Table (Adapted from Driscoll, 1986)

Percent Impervious Cover	Permanent Pool Average Depth (ft)					
	3.0	4.0	5.0	6.0	7.0	8.0
10%	0.78	0.61	0.44	0	0	0
20%	1.48	1.04	0.87	0.70	0.52	0.35
30%	2.18	1.65	1.39	1.13	0.87	0.70
40%	2.96	2.26	1.83	1.39	0.96	0.78
50%	3.65	2.87	2.35	1.83	1.31	1.96
60%	4.35	3.31	2.78	2.26	1.74	1.13
70%	5.22	3.92	3.22	2.52	1.83	1.31
80%	5.92	4.52	3.65	2.78	1.91	1.57
90%	6.53	5.05	4.18	2.96	2.44	1.74
100%	7.13	5.92	4.87	3.83	2.78	1.83

MDC 2: MAIN POOL DEPTH.
The average depth of the main pool shall be three to eight feet below the permanent pool elevation. The applicant shall have the option of excluding the submerged portion of the vegetated shelf from the calculation of average depth.

Depth is an important engineering design criterion because most of the pollutants are removed through settling through the water column. Very shallow wet ponds may develop currents that can re-suspend materials; on the other hand, very deep wet ponds can become thermally stratified or anoxic and release pollutants back into the water.

Depths between 8 and 20 feet may be allowed when an existing excavated area is being converted to a wet pond. Deeper ponds may only use the main pool volume in the first 8 feet for the HRT method. For the SA/DA Table method, the 8.0 foot depth column should be used.

The calculation of average depth shall exclude both the volume and area of any portion of the vegetated shelf that is submerged.

Equation 2. Average depth when the shelf is not submerged or the shelf is being included in the average depth calculation

$$D_{avg} = \frac{VPP}{APP}$$

Where:

D_{avg}	=	Average depth in feet
V_{PP}	=	Volume of permanent pool (feet^3)
A_{PP}	=	Area of permanent pool (feet^2)

Equation 3. Average depth when the shelf is submerged and the shelf is being excluded from the average depth calculation

$$D_{avg} = \frac{VPP - Vshelf}{Abottomofshelf}$$

Where:

D_{avg}	=	Average depth in feet
V_{PP}	=	Total volume of permanent pool (feet^3)
V_{shelf}	=	Volume over the shelf only (feet^3) – see below
$A_{bottom\ of\ shelf}$	=	Area of wet pond at the bottom of the shelf (feet^2)

$$V_{shelf} = 0.5 * Depth_{max\ over\ shelf} * Perimeter_{perm\ pool} * Width_{submerged\ part\ of\ shelf}$$

Where:

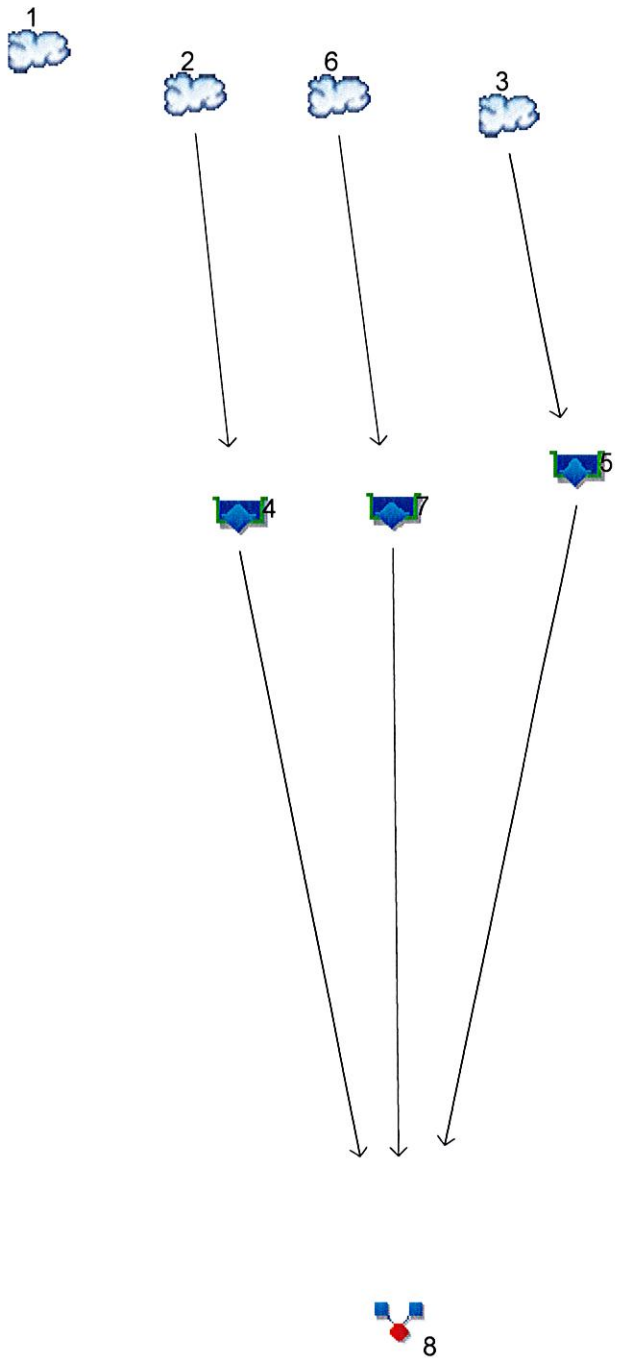
$D_{max\ over\ shelf}$	=	Depth of water at the deep side of the shelf as measured at permanent pool (feet)
$Perimeter_{permanent\ pool}$	=	Perimeter of permanent pool at the bottom of the shelf (feet)
$Width_{submerged\ part\ of\ shelf}$	=	Width from the deep side to the dry side of the shelf as measured at permanent pool (feet)

Hydraflow Table of Contents

100 - Year

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5



Legend

Hyd.	Origin	Description
1	SCS Runoff	DA PRR
2	SCS Runoff	DA #1 POST
3	SCS Runoff	DA 3 POST
4	Reservoir	POND #1
5	Reservoir	POND 3
6	SCS Runoff	DA POST #2
7	Reservoir	POND #2
8	Combine	Post DA Total

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

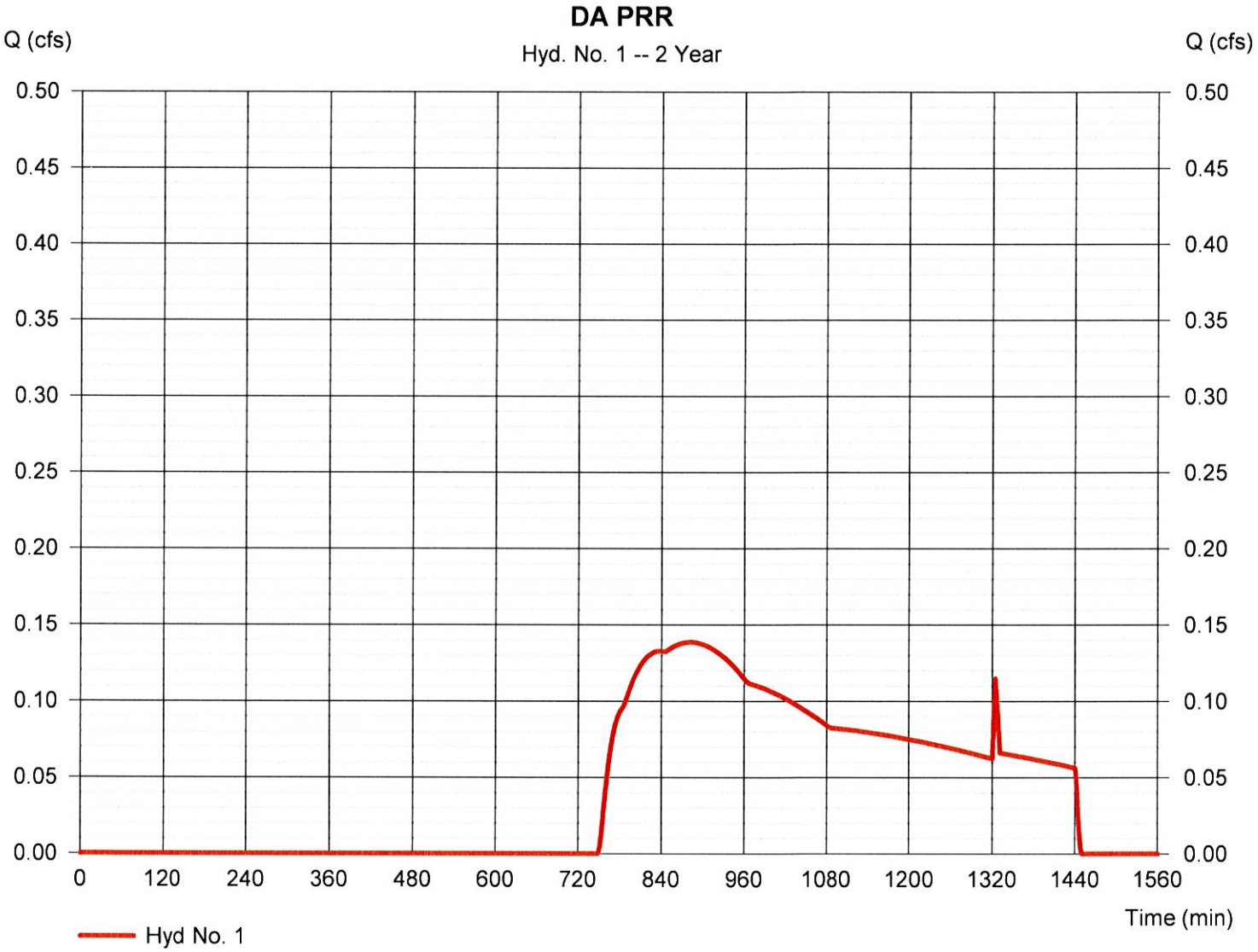
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.139	1	881	3,756	------	------	------	DA PRR
2	SCS Runoff	6.817	1	729	25,936	------	------	------	DA #1 POST
3	SCS Runoff	3.264	1	725	10,264	------	------	------	DA 3 POST
4	Reservoir	0.119	1	1398	14,106	2	12.33	20,918	POND #1
5	Reservoir	0.046	1	1440	5,368	3	18.84	8,375	POND 3
6	SCS Runoff	6.856	1	726	22,629	------	------	------	DA POST #2
7	Reservoir	0.091	1	1442	10,882	6	15.46	18,858	POND #2
8	Combine	0.256	1	1440	30,355	4, 5, 7	------	------	Post DA Total

Hydrograph Report

Hyd. No. 1

DA PRR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.139 cfs
Storm frequency	= 2 yrs	Time to peak	= 881 min
Time interval	= 1 min	Hyd. volume	= 3,756 cuft
Drainage area	= 9.070 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

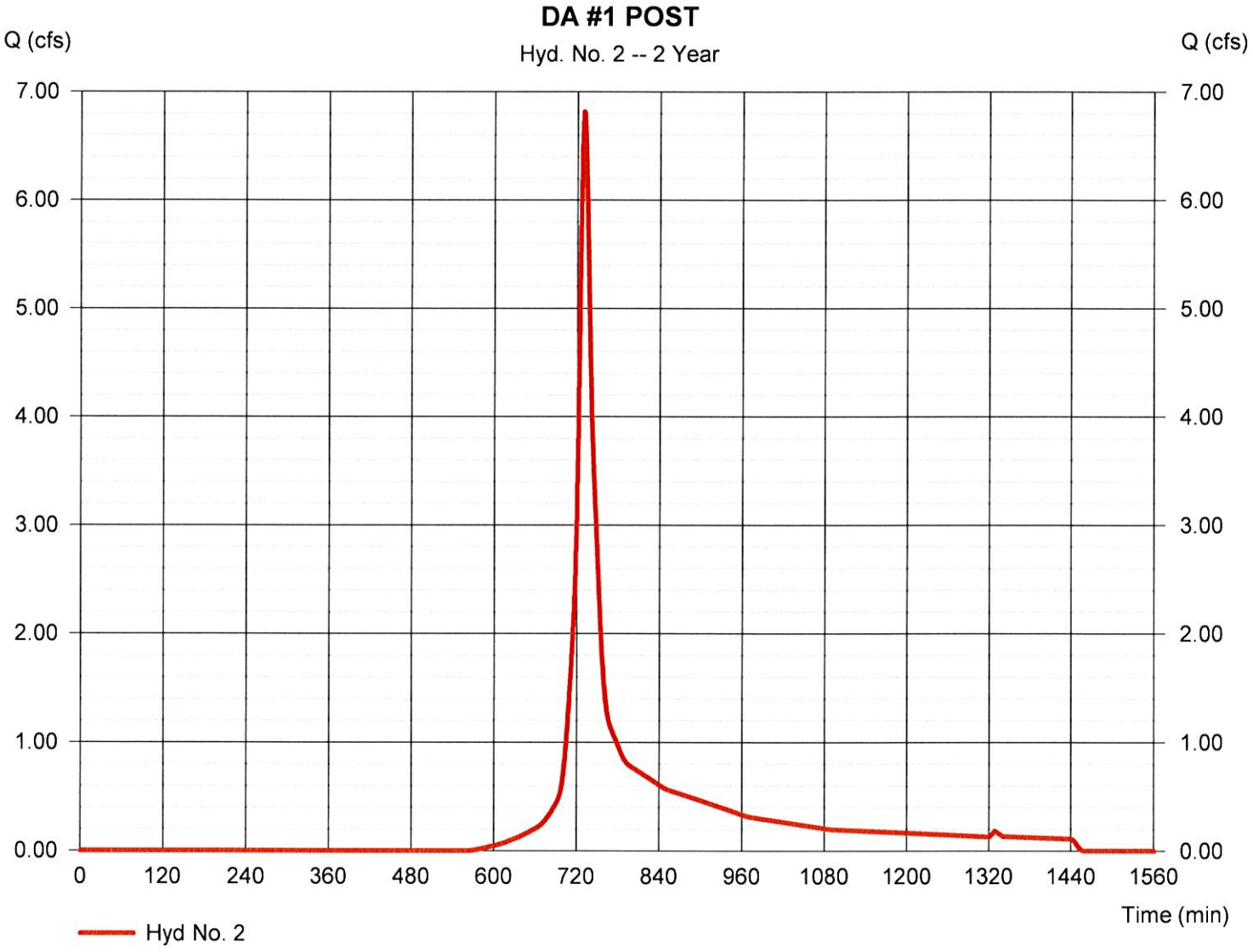


Hydrograph Report

Hyd. No. 2

DA #1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 6.817 cfs
Storm frequency	= 2 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 25,936 cuft
Drainage area	= 3.680 ac	Curve number	= 74 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

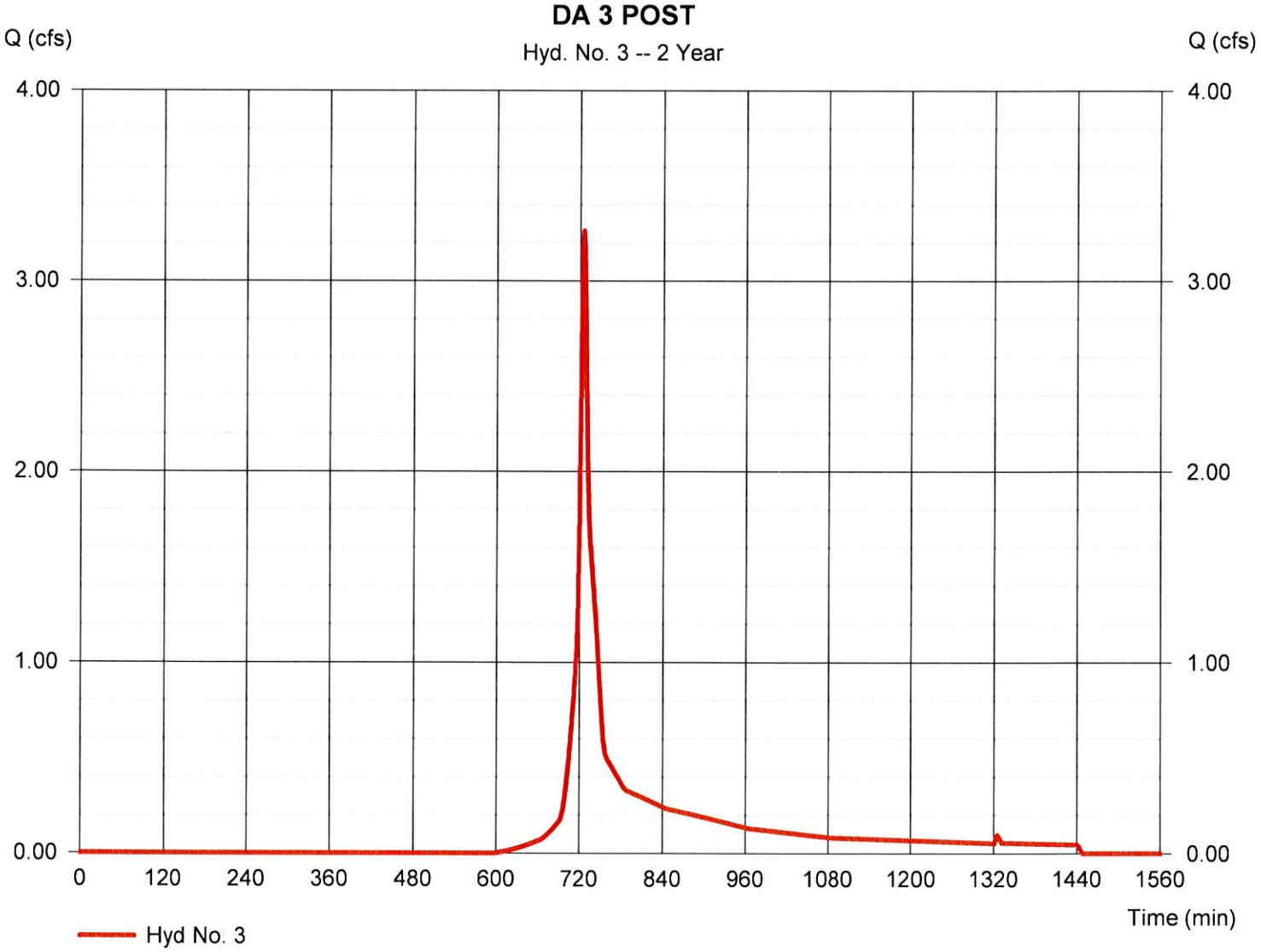


Hydrograph Report

Hyd. No. 3

DA 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 3.264 cfs
Storm frequency	= 2 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 10,264 cuft
Drainage area	= 1.570 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



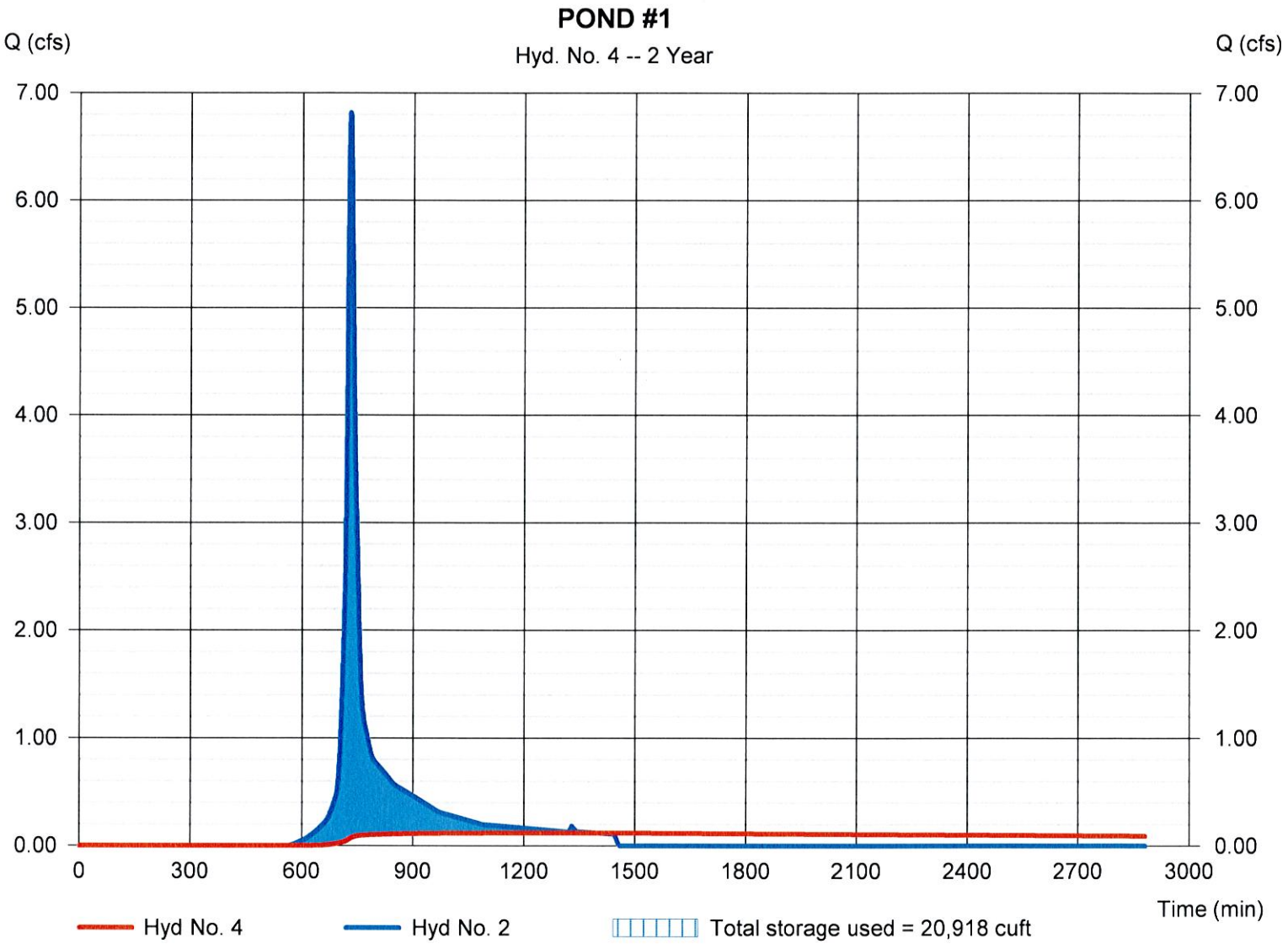
Hydrograph Report

Hyd. No. 4

POND #1

Hydrograph type	= Reservoir	Peak discharge	= 0.119 cfs
Storm frequency	= 2 yrs	Time to peak	= 1398 min
Time interval	= 1 min	Hyd. volume	= 14,106 cuft
Inflow hyd. No.	= 2 - DA #1 POST	Max. Elevation	= 12.33 ft
Reservoir name	= Pond#1	Max. Storage	= 20,918 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Pond#1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 10.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	10.00	7,026	0	0
0.50	10.50	7,968	3,746	3,746
1.00	11.00	8,867	4,206	7,952
2.00	12.00	10,050	9,451	17,403
3.00	13.00	11,291	10,663	28,067
3.60	13.60	12,062	7,004	35,071
4.60	14.60	14,874	13,442	48,513

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	1.75	0.00	0.00
Span (in)	= 24.00	1.75	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 10.00	10.00	0.00	0.00
Length (ft)	= 41.00	0.00	0.00	0.00
Slope (%)	= 1.34	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

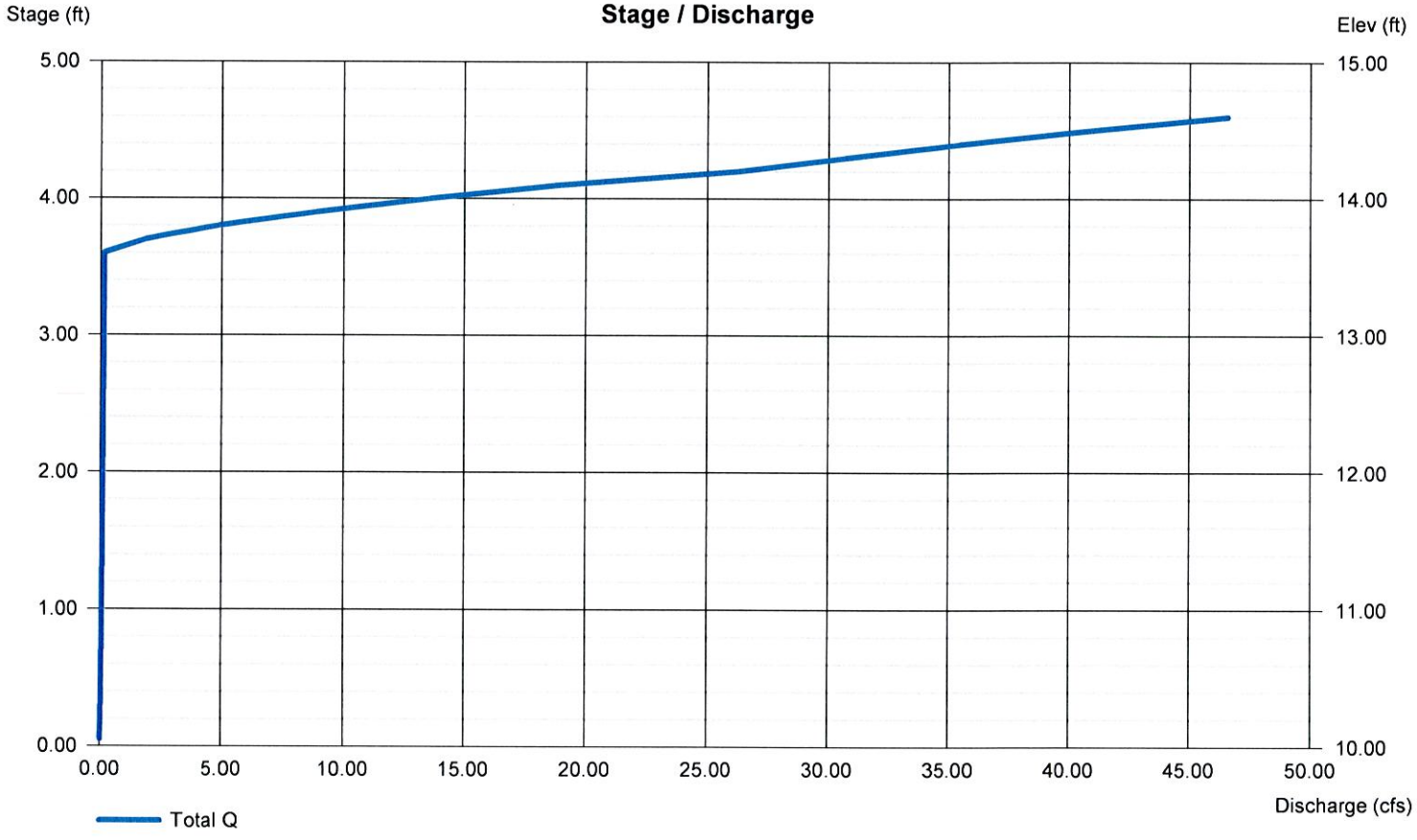
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	20.00	0.00	0.00
Crest El. (ft)	= 13.60	14.10	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	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).



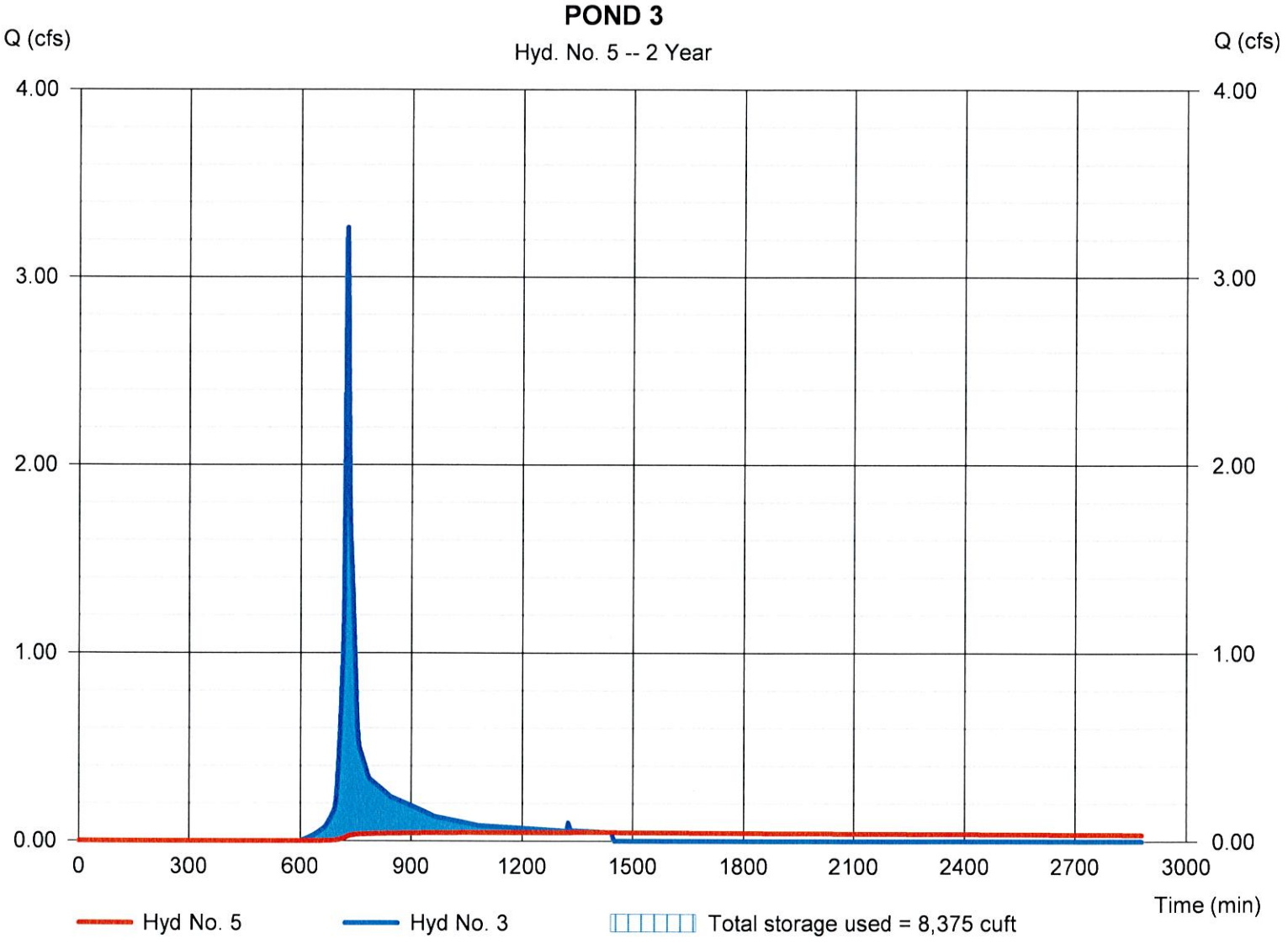
Hydrograph Report

Hyd. No. 5

POND 3

Hydrograph type	= Reservoir	Peak discharge	= 0.046 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 1 min	Hyd. volume	= 5,368 cuft
Inflow hyd. No.	= 3 - DA 3 POST	Max. Elevation	= 18.84 ft
Reservoir name	= Pond 3	Max. Storage	= 8,375 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Pond 3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 17.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	17.50	4,711	0	0
0.50	18.00	6,275	2,737	2,737
1.50	19.00	7,157	6,710	9,447
1.90	19.40	7,448	2,921	12,368
2.90	20.40	8,940	8,182	20,550

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	1.25	0.00	0.00
Span (in)	= 15.00	1.25	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 17.50	17.50	0.00	0.00
Length (ft)	= 35.00	0.00	0.00	0.00
Slope (%)	= 0.30	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

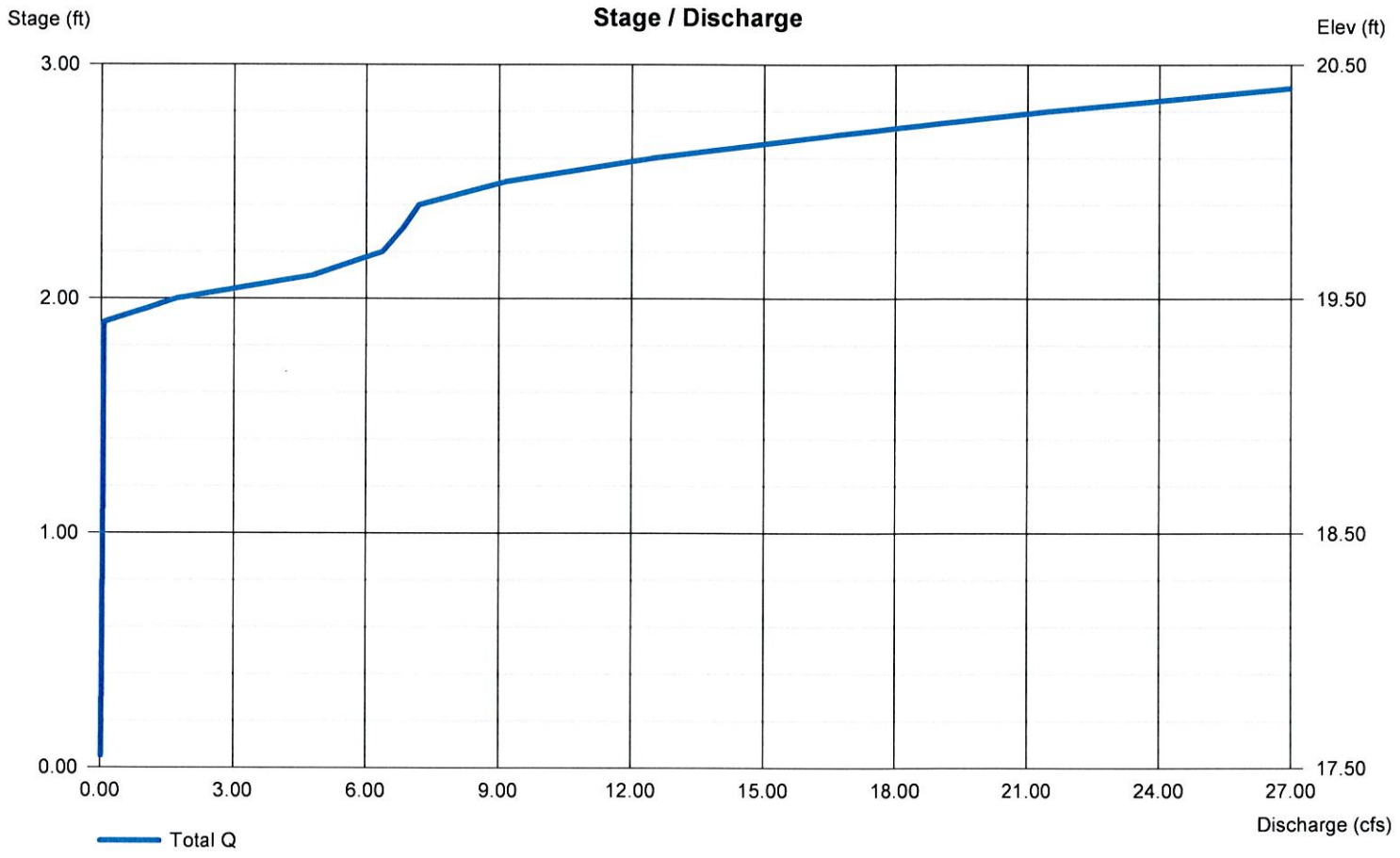
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	20.00	0.00	0.00
Crest El. (ft)	= 19.40	19.90	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	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).

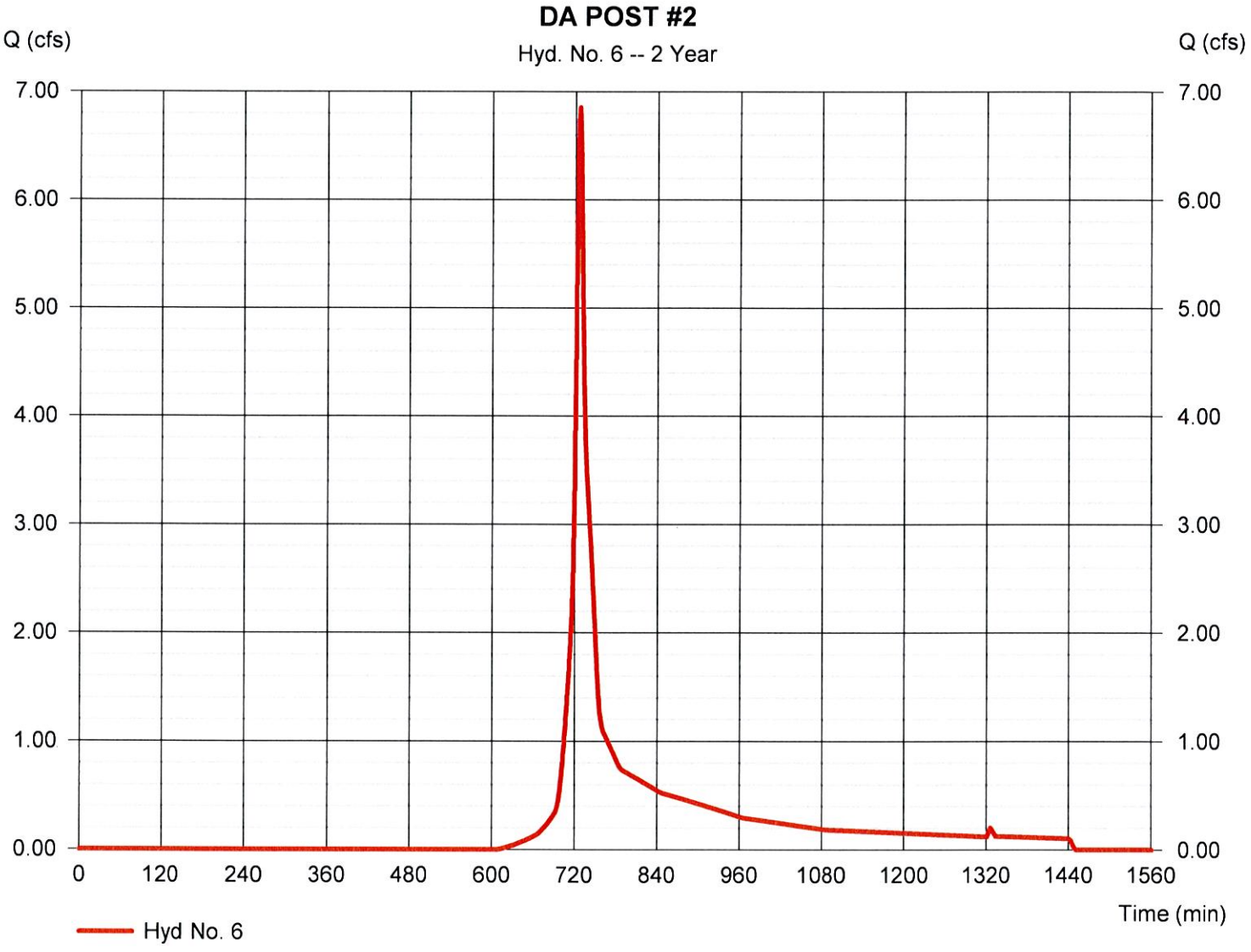


Hydrograph Report

Hyd. No. 6

DA POST #2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.856 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 22,629 cuft
Drainage area	= 3.820 ac	Curve number	= 70 (73)
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



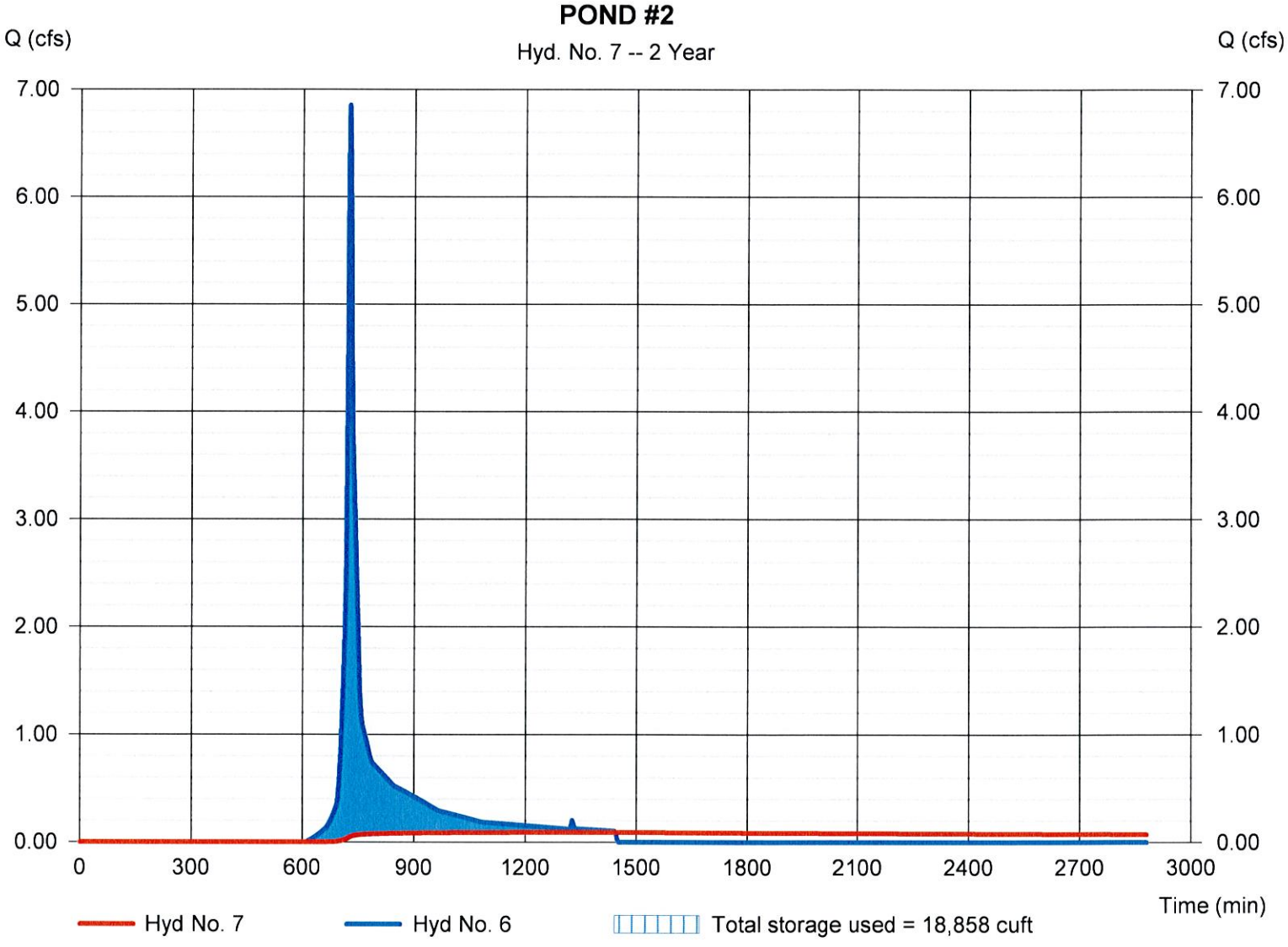
Hydrograph Report

Hyd. No. 7

POND #2

Hydrograph type	= Reservoir	Peak discharge	= 0.091 cfs
Storm frequency	= 2 yrs	Time to peak	= 1442 min
Time interval	= 1 min	Hyd. volume	= 10,882 cuft
Inflow hyd. No.	= 6 - DA POST #2	Max. Elevation	= 15.46 ft
Reservoir name	= POND#2	Max. Storage	= 18,858 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - POND#2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 13.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	13.50	7,376	0	0
0.50	14.00	8,937	4,072	4,072
1.50	15.00	10,354	9,636	13,707
2.50	16.00	11,828	11,082	24,789
2.60	16.10	11,979	1,190	25,979
3.60	17.00	14,946	13,434	39,413

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	1.60	0.00	0.00
Span (in)	= 24.00	1.60	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 13.50	13.50	0.00	0.00
Length (ft)	= 34.00	0.00	0.00	0.00
Slope (%)	= 1.25	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

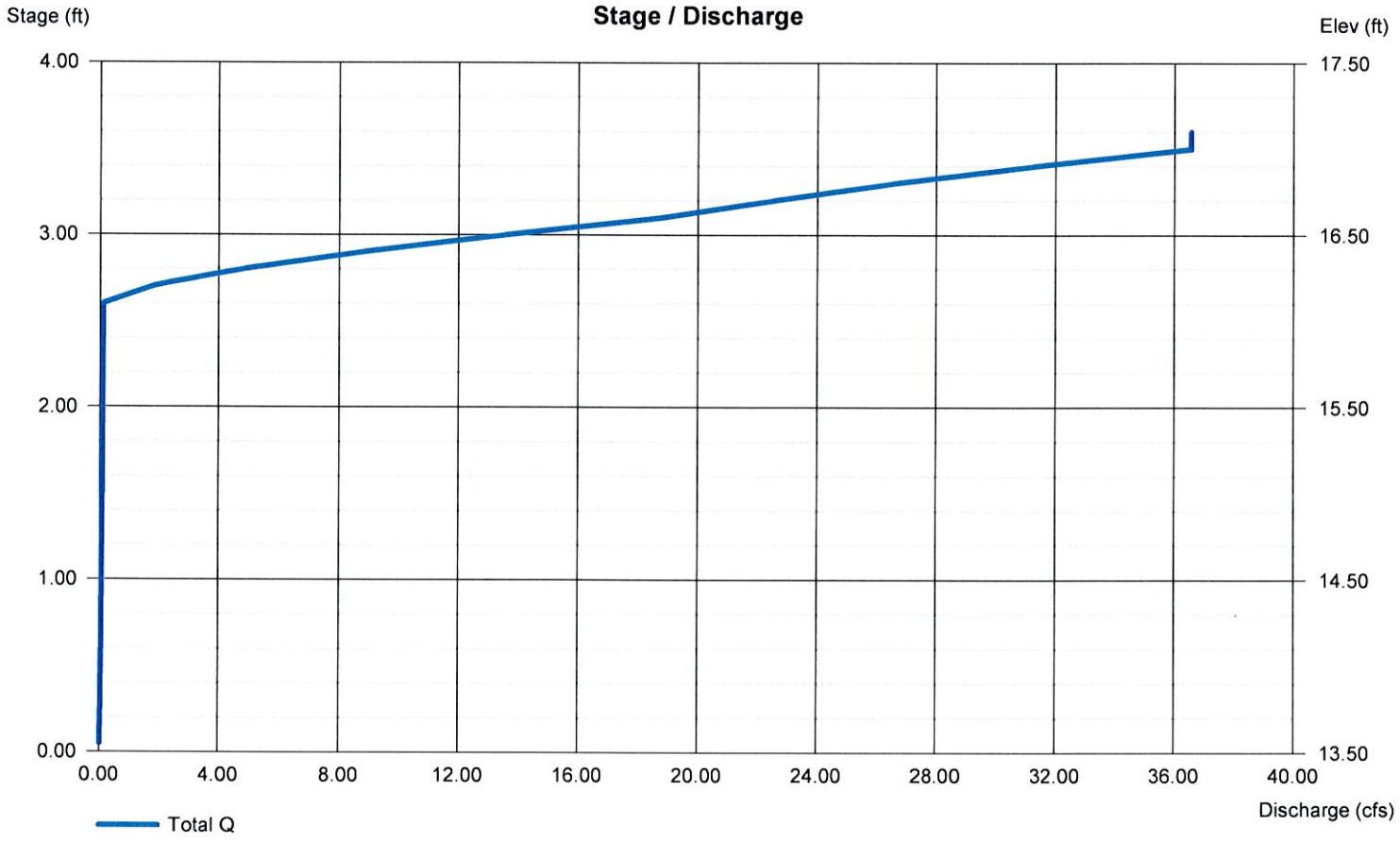
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	20.00	0.00	0.00
Crest El. (ft)	= 16.10	16.60	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	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).

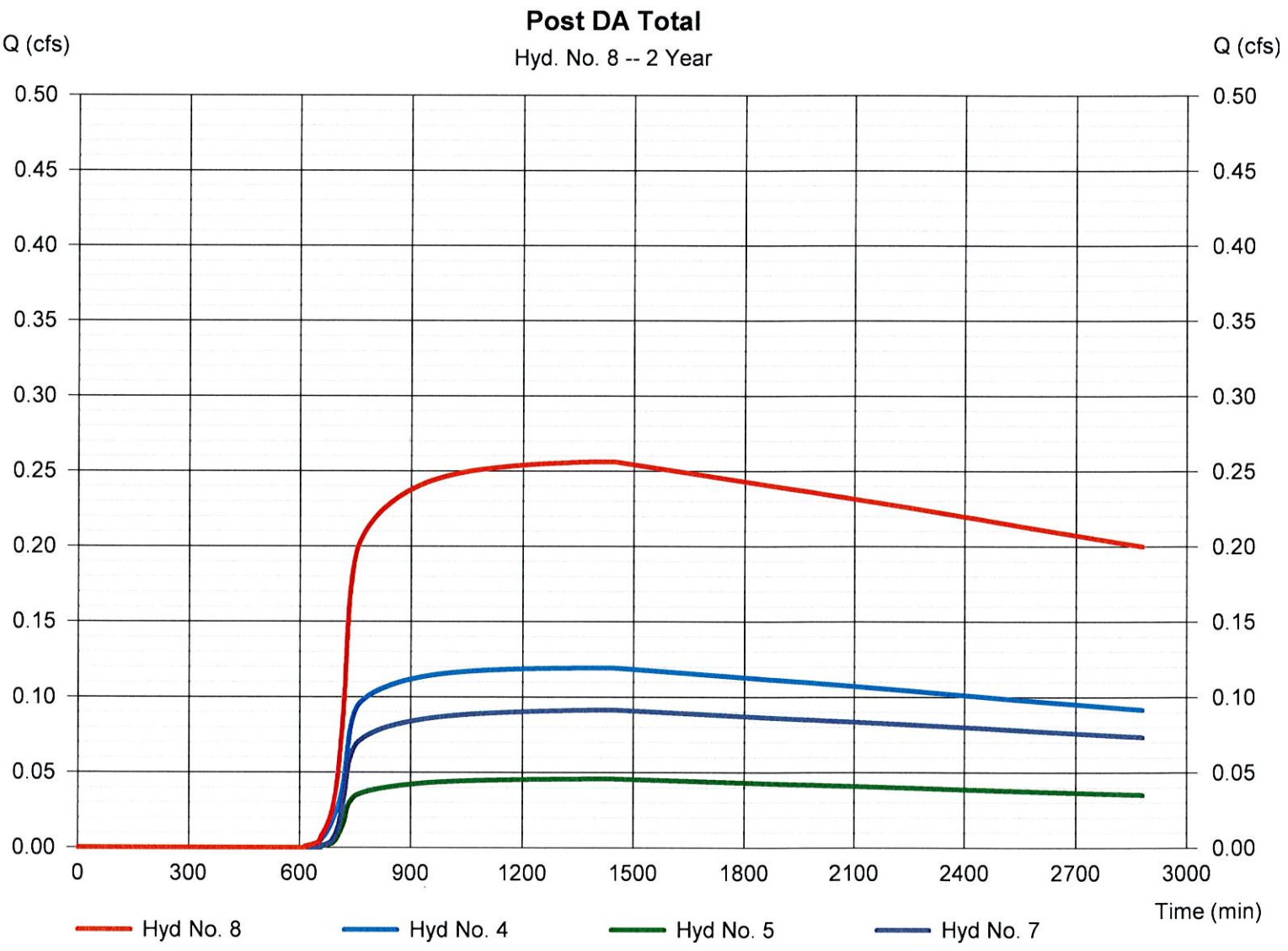


Hydrograph Report

Hyd. No. 8

Post DA Total

Hydrograph type	= Combine	Peak discharge	= 0.256 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 1 min	Hyd. volume	= 30,355 cuft
Inflow hyds.	= 4, 5, 7	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

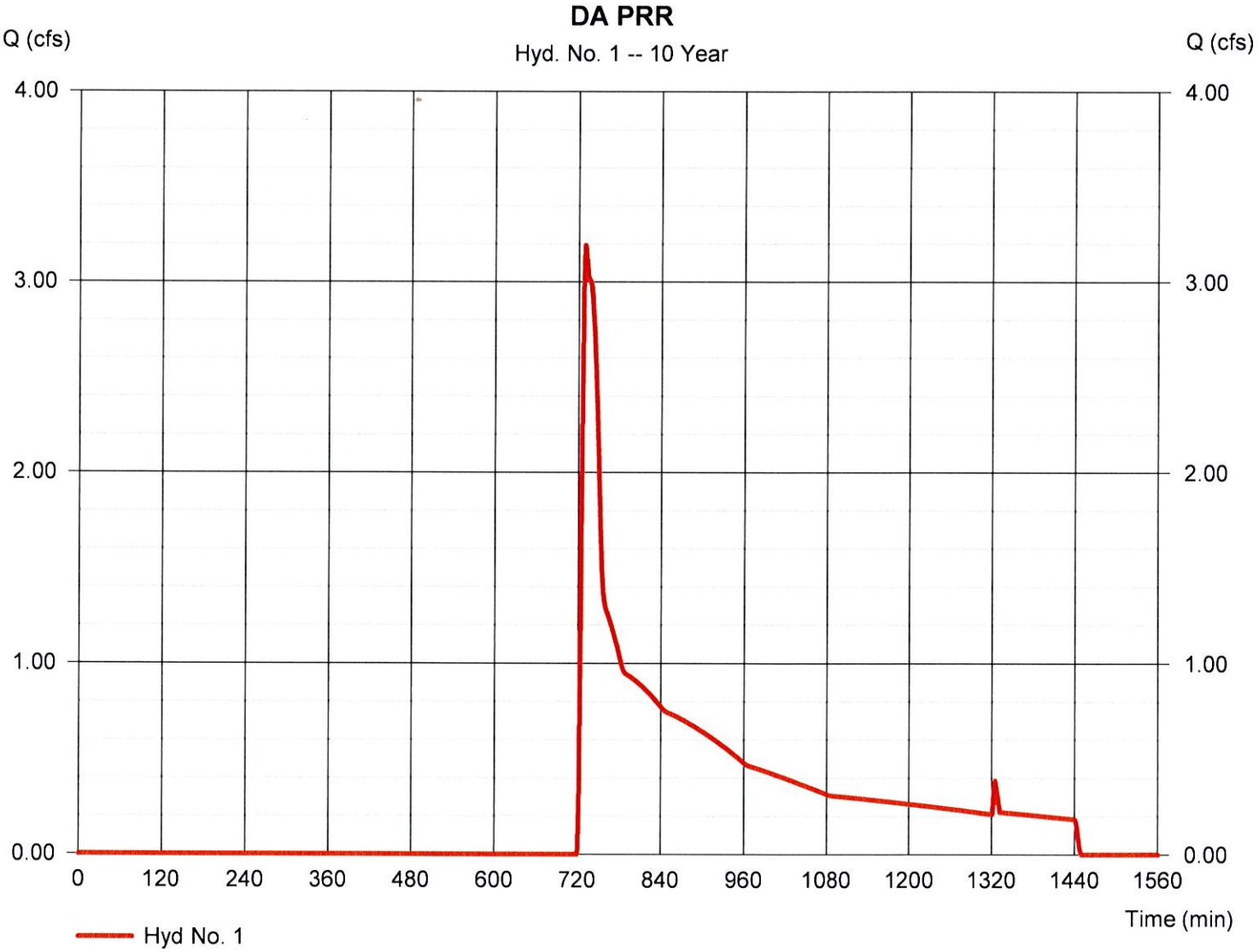
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.193	1	729	22,775	------	------	------	DA PRR
2	SCS Runoff	13.29	1	729	49,956	------	------	------	DA #1 POST
3	SCS Runoff	6.655	1	725	20,505	------	------	------	DA 3 POST
4	Reservoir	0.805	1	899	26,658	2	13.64	35,596	POND #1
5	Reservoir	0.526	1	811	12,431	3	19.43	12,598	POND 3
6	SCS Runoff	14.24	1	726	45,792	------	------	------	DA POST #2
7	Reservoir	1.246	1	804	28,143	6	16.17	26,893	POND #2
8	Combine	2.001	1	887	67,232	4, 5, 7	------	------	Post DA Total

Hydrograph Report

Hyd. No. 1

DA PRR

Hydrograph type	= SCS Runoff	Peak discharge	= 3.193 cfs
Storm frequency	= 10 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 22,775 cuft
Drainage area	= 9.070 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.72 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

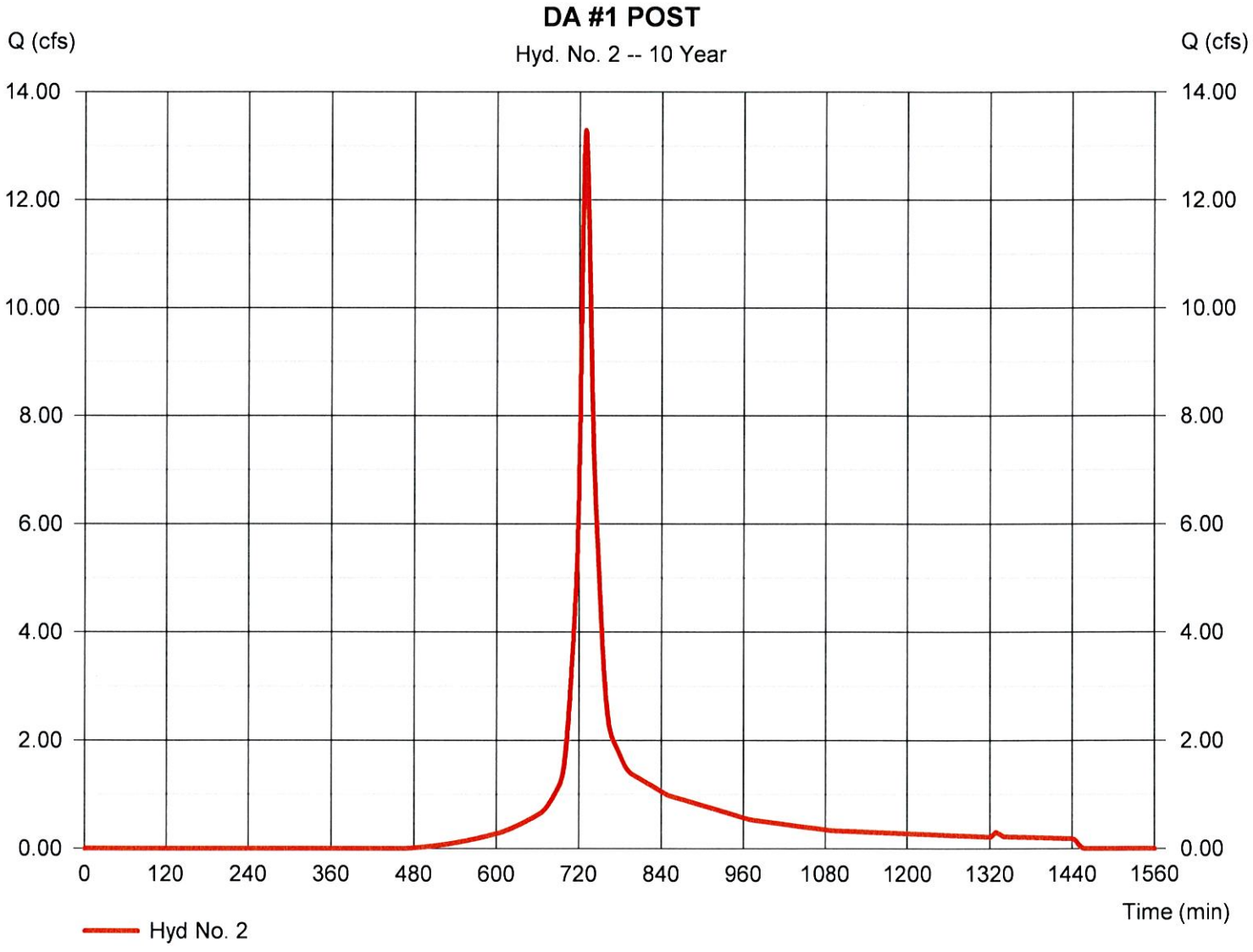


Hydrograph Report

Hyd. No. 2

DA #1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 13.29 cfs
Storm frequency	= 10 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 49,956 cuft
Drainage area	= 3.680 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 6.72 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

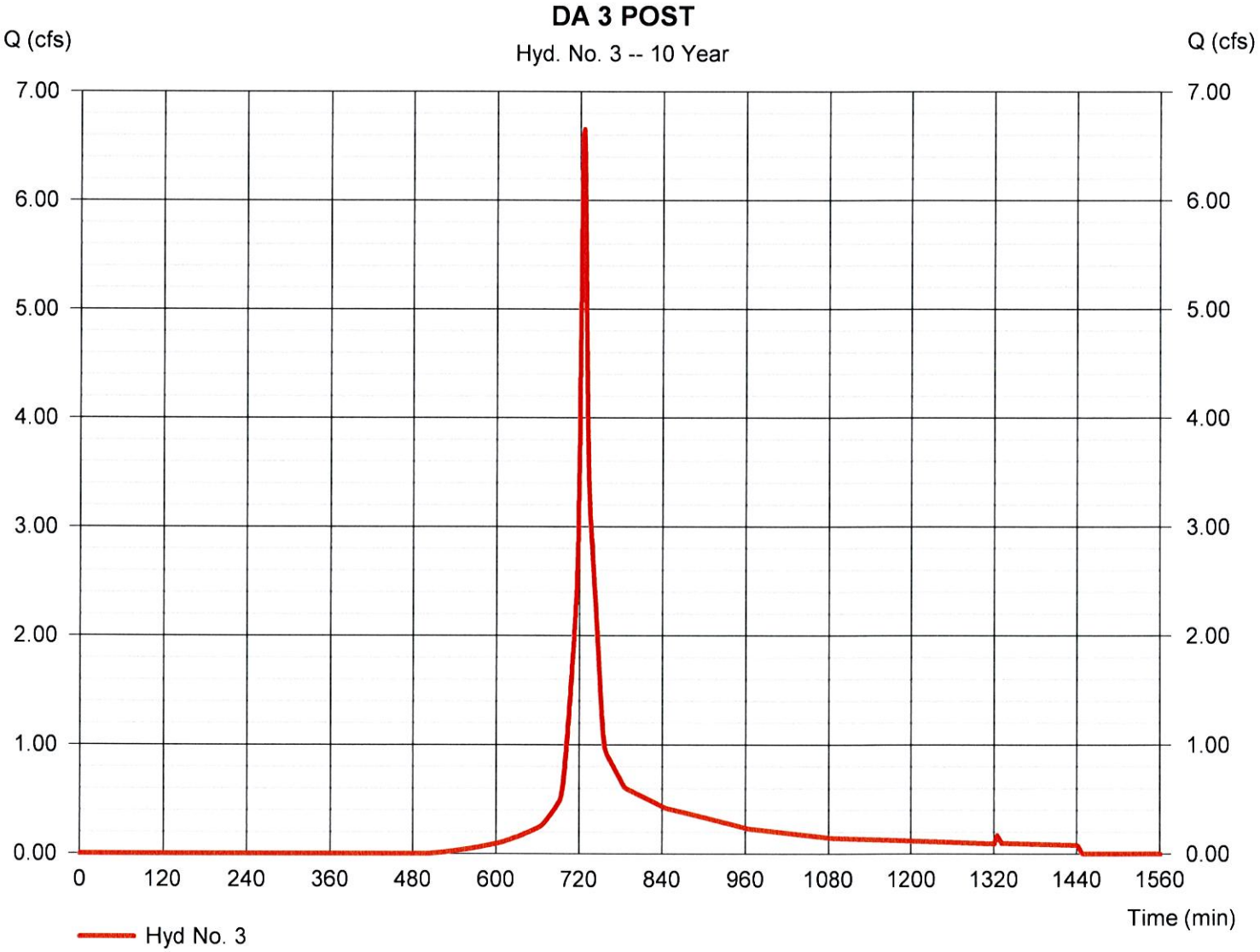


Hydrograph Report

Hyd. No. 3

DA 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 6.655 cfs
Storm frequency	= 10 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 20,505 cuft
Drainage area	= 1.570 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.72 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

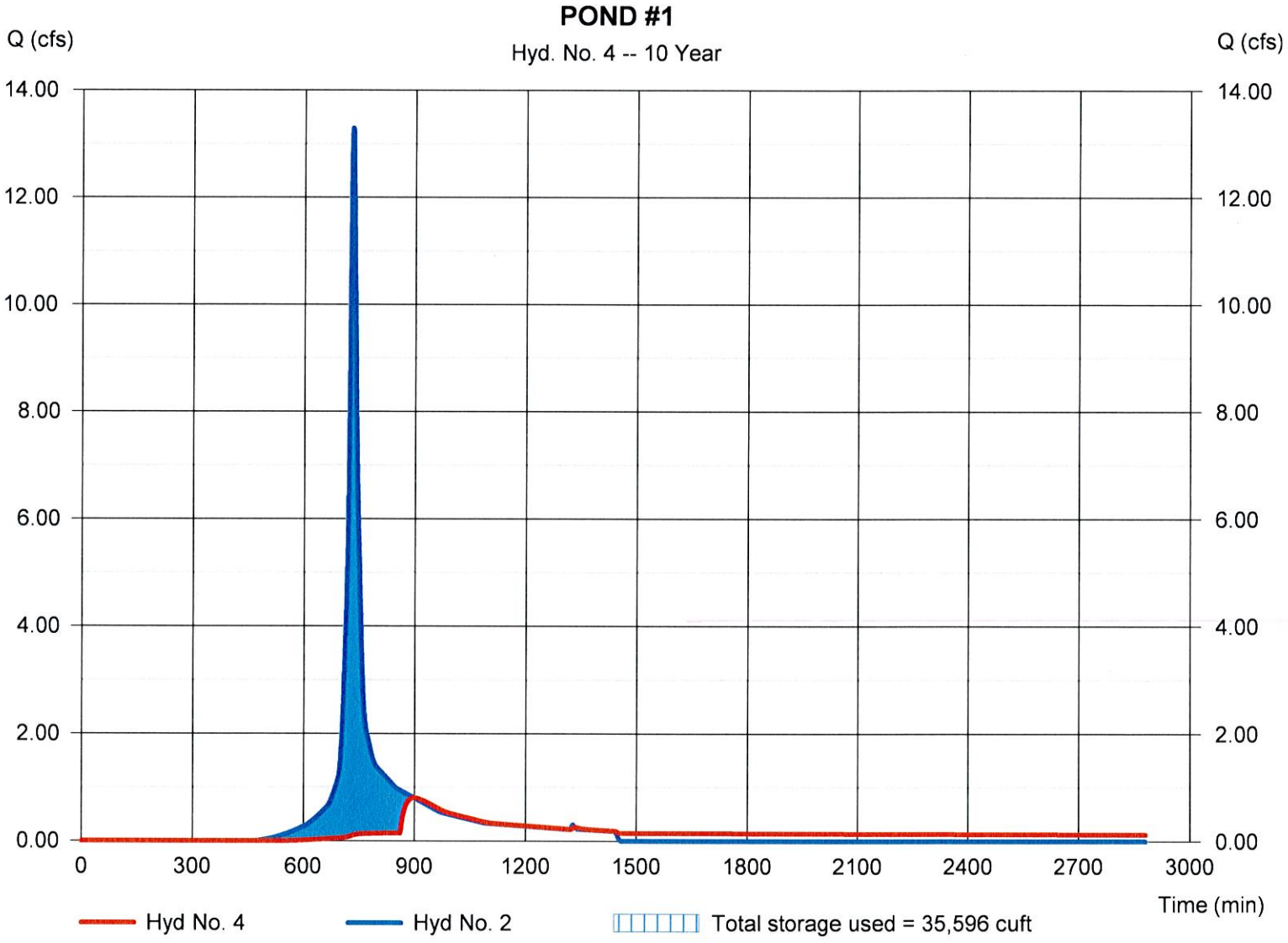
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 4

POND #1

Hydrograph type	= Reservoir	Peak discharge	= 0.805 cfs
Storm frequency	= 10 yrs	Time to peak	= 899 min
Time interval	= 1 min	Hyd. volume	= 26,658 cuft
Inflow hyd. No.	= 2 - DA #1 POST	Max. Elevation	= 13.64 ft
Reservoir name	= Pond#1	Max. Storage	= 35,596 cuft

Storage Indication method used.



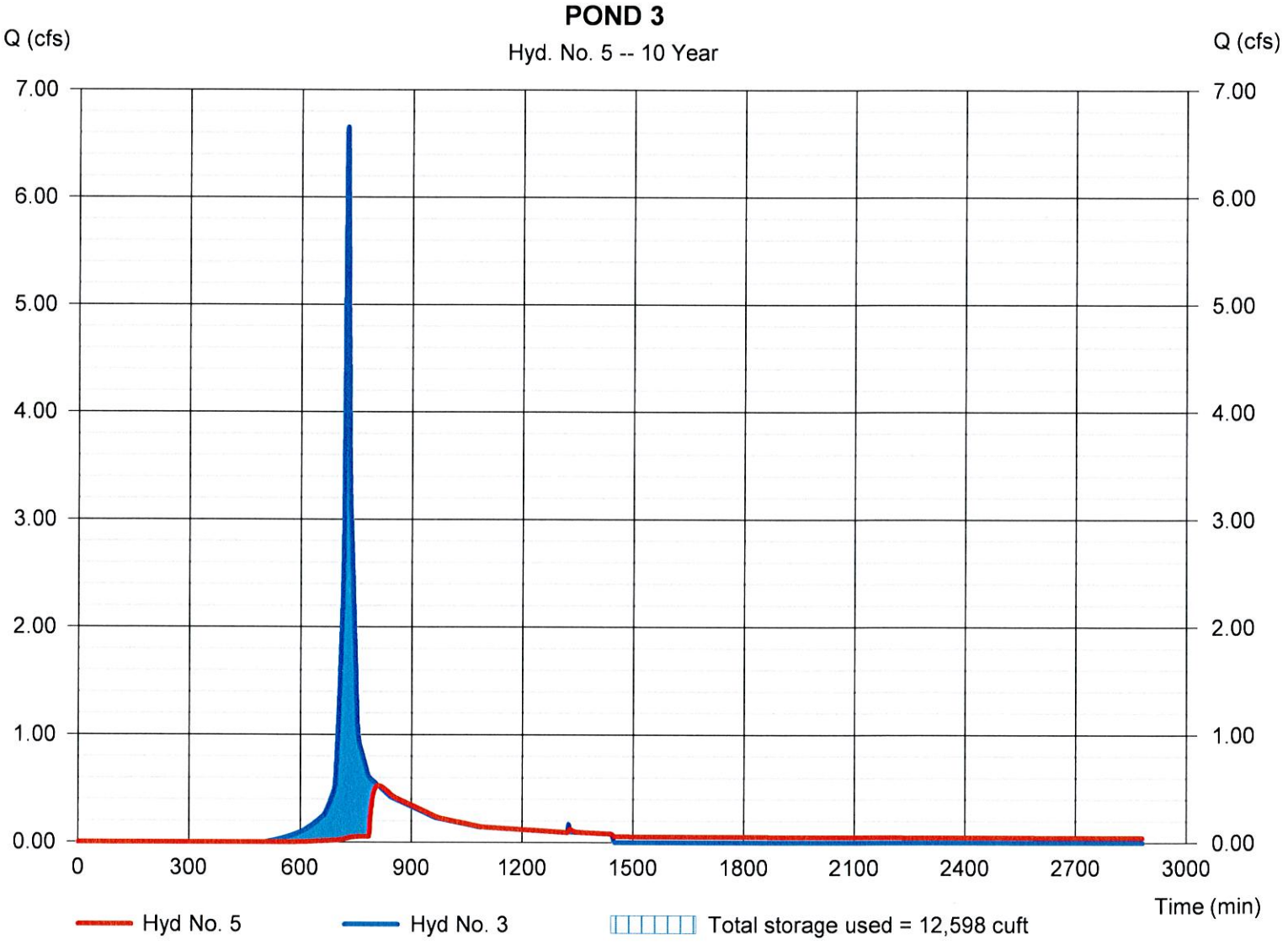
Hydrograph Report

Hyd. No. 5

POND 3

Hydrograph type	= Reservoir	Peak discharge	= 0.526 cfs
Storm frequency	= 10 yrs	Time to peak	= 811 min
Time interval	= 1 min	Hyd. volume	= 12,431 cuft
Inflow hyd. No.	= 3 - DA 3 POST	Max. Elevation	= 19.43 ft
Reservoir name	= Pond 3	Max. Storage	= 12,598 cuft

Storage Indication method used.

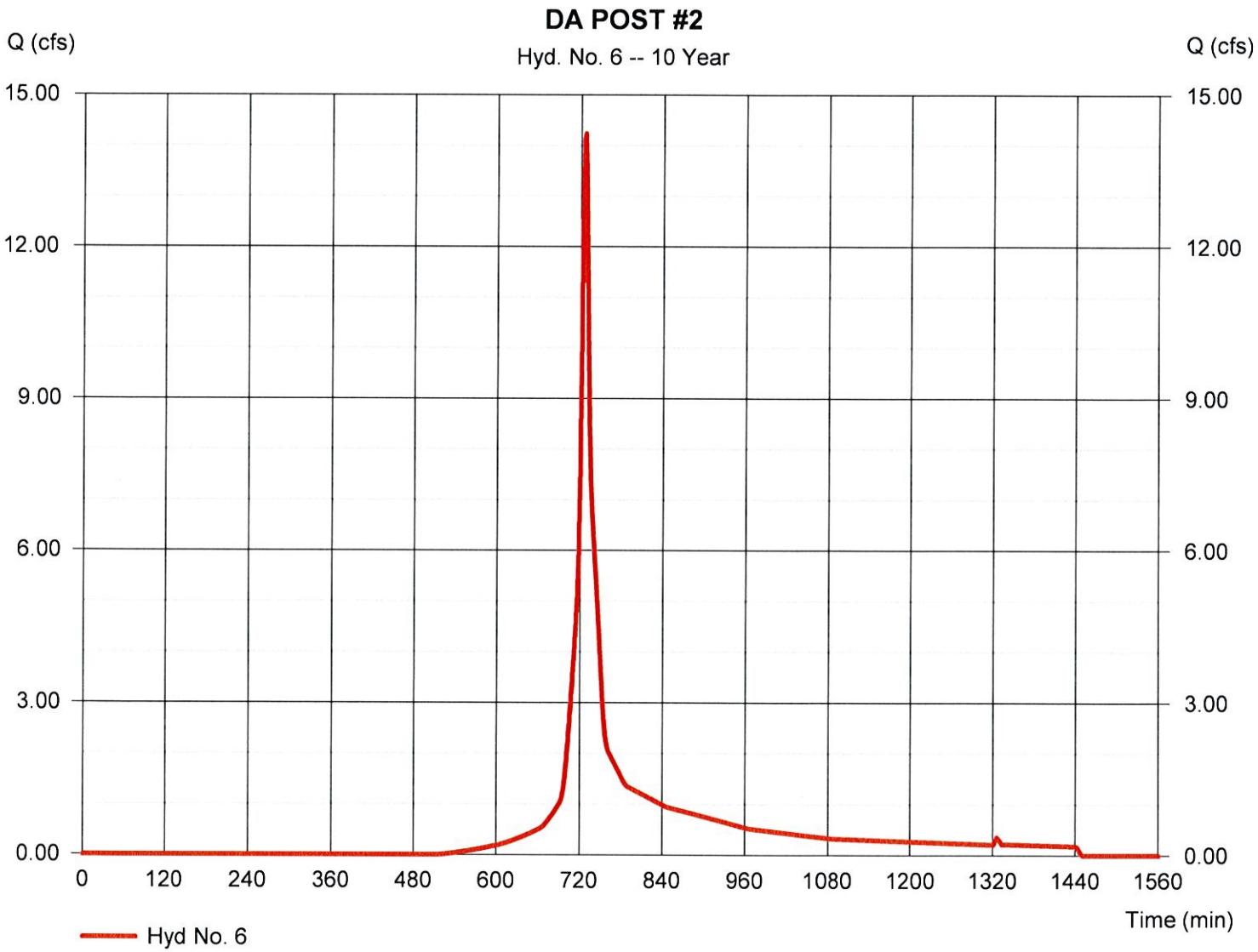


Hydrograph Report

Hyd. No. 6

DA POST #2

Hydrograph type	= SCS Runoff	Peak discharge	= 14.24 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 45,792 cuft
Drainage area	= 3.820 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 6.72 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



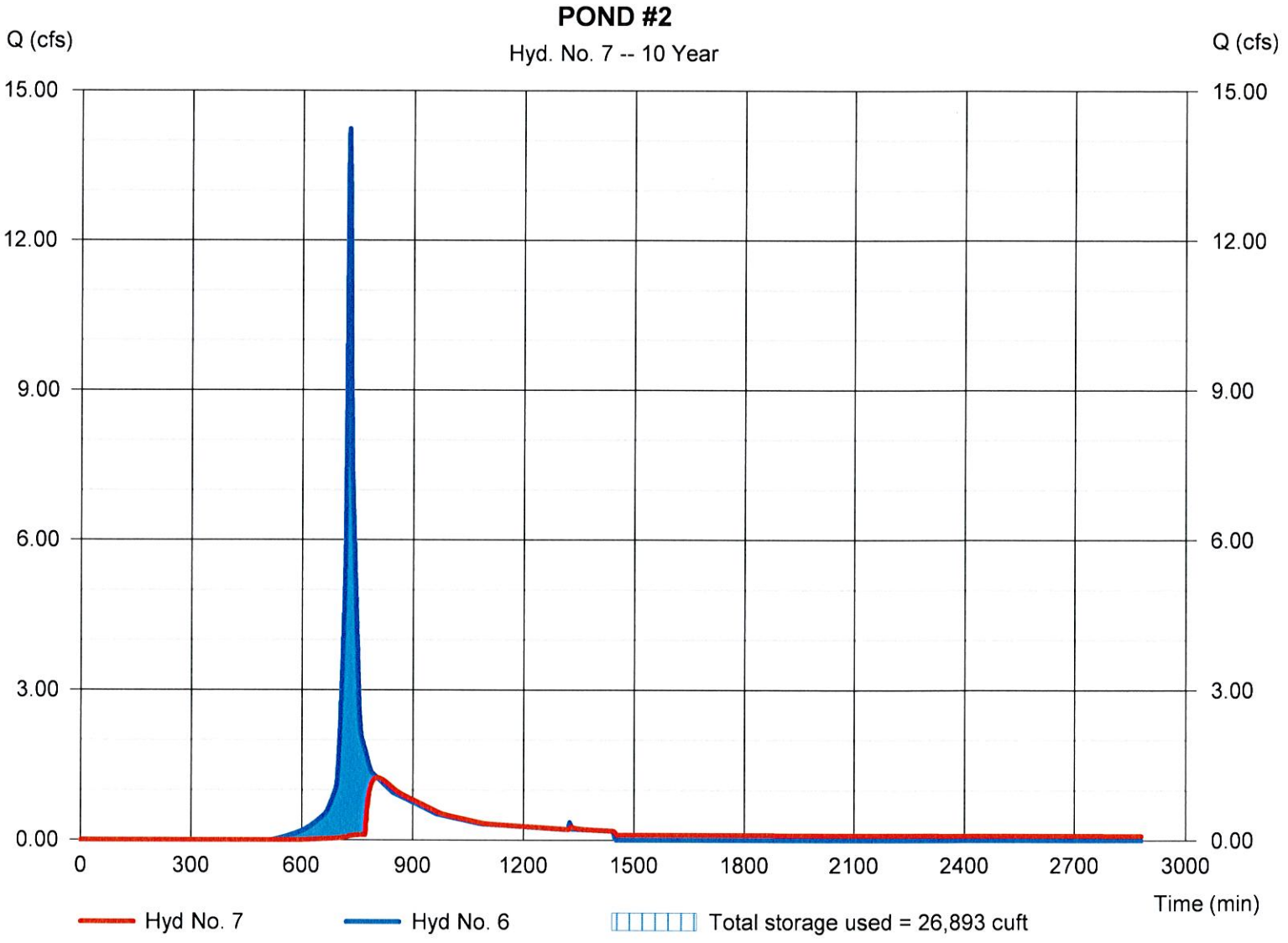
Hydrograph Report

Hyd. No. 7

POND #2

Hydrograph type	= Reservoir	Peak discharge	= 1.246 cfs
Storm frequency	= 10 yrs	Time to peak	= 804 min
Time interval	= 1 min	Hyd. volume	= 28,143 cuft
Inflow hyd. No.	= 6 - DA POST #2	Max. Elevation	= 16.17 ft
Reservoir name	= POND#2	Max. Storage	= 26,893 cuft

Storage Indication method used.

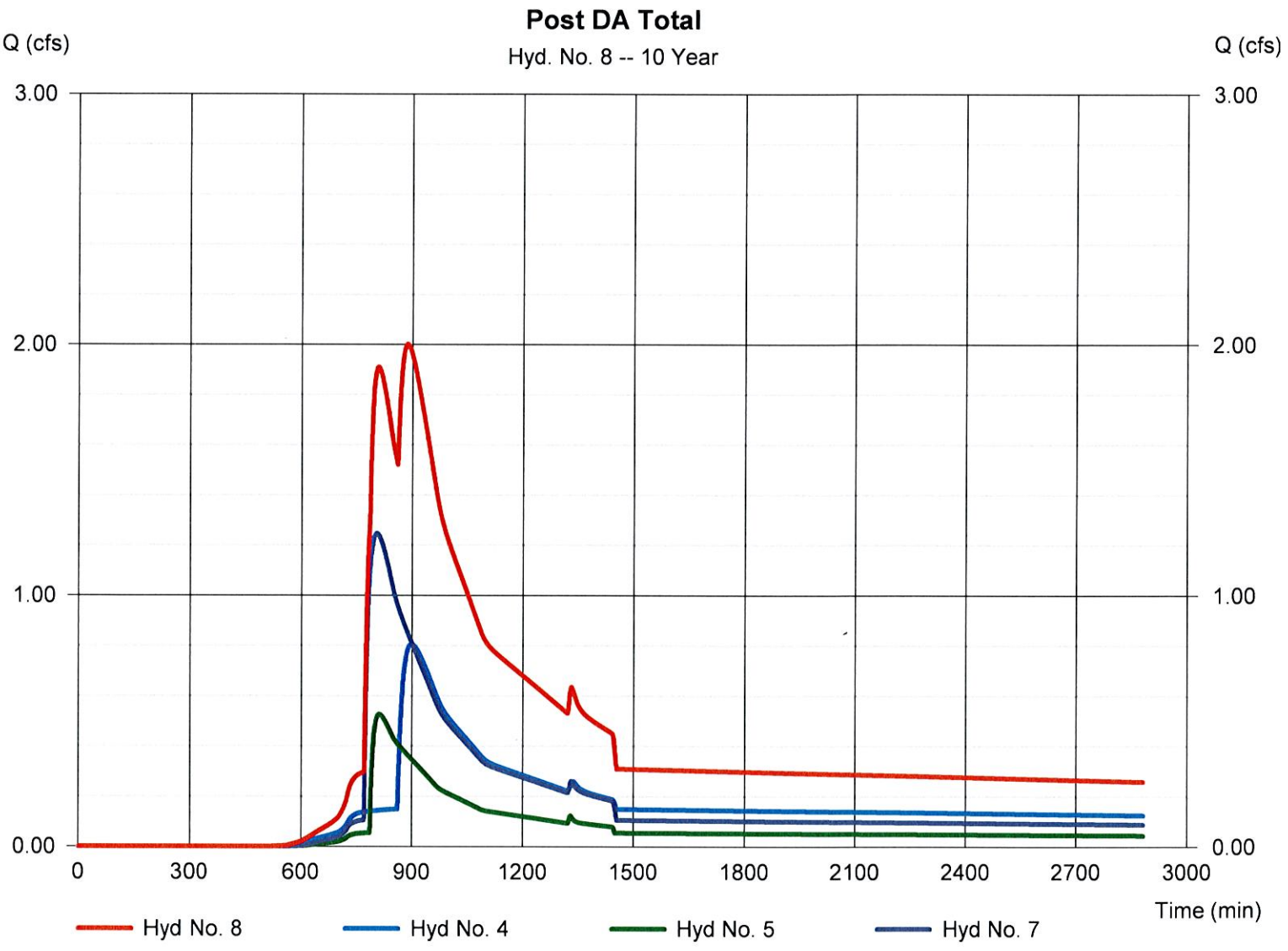


Hydrograph Report

Hyd. No. 8

Post DA Total

Hydrograph type	= Combine	Peak discharge	= 2.001 cfs
Storm frequency	= 10 yrs	Time to peak	= 887 min
Time interval	= 1 min	Hyd. volume	= 67,232 cuft
Inflow hyds.	= 4, 5, 7	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

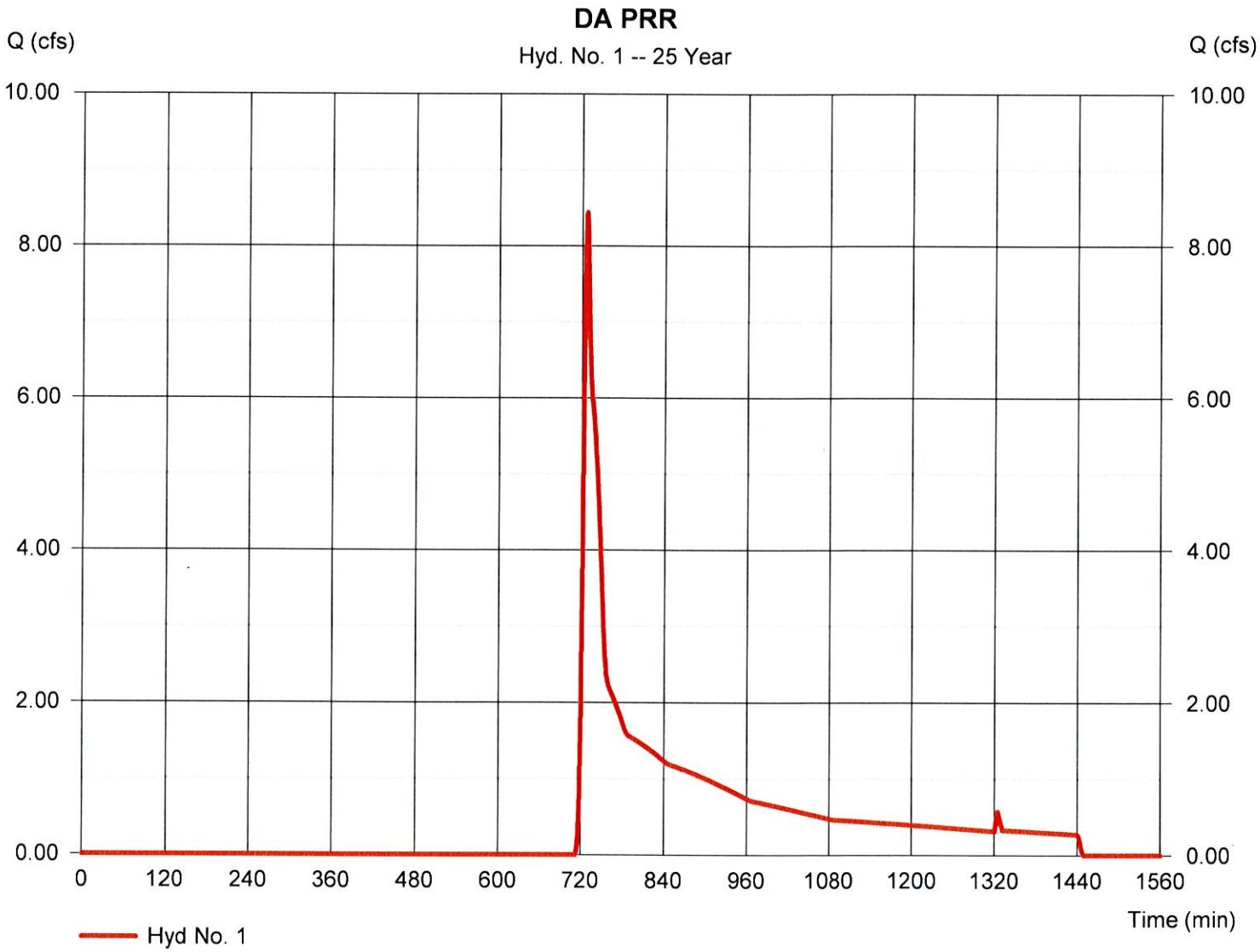
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.441	1	727	39,426	------	------	------	DA PRR
2	SCS Runoff	17.22	1	729	64,889	------	------	------	DA #1 POST
3	SCS Runoff	8.744	1	725	26,964	------	------	------	DA 3 POST
4	Reservoir	2.530	1	769	41,569	2	13.72	36,722	POND #1
5	Reservoir	2.269	1	747	18,885	3	19.52	13,331	POND 3
6	SCS Runoff	18.81	1	726	60,473	------	------	------	DA POST #2
7	Reservoir	5.425	1	748	42,808	6	16.31	28,858	POND #2
8	Combine	7.840	1	748	103,262	4, 5, 7	------	------	Post DA Total

Hydrograph Report

Hyd. No. 1

DA PRR

Hydrograph type	= SCS Runoff	Peak discharge	= 8.441 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 39,426 cuft
Drainage area	= 9.070 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

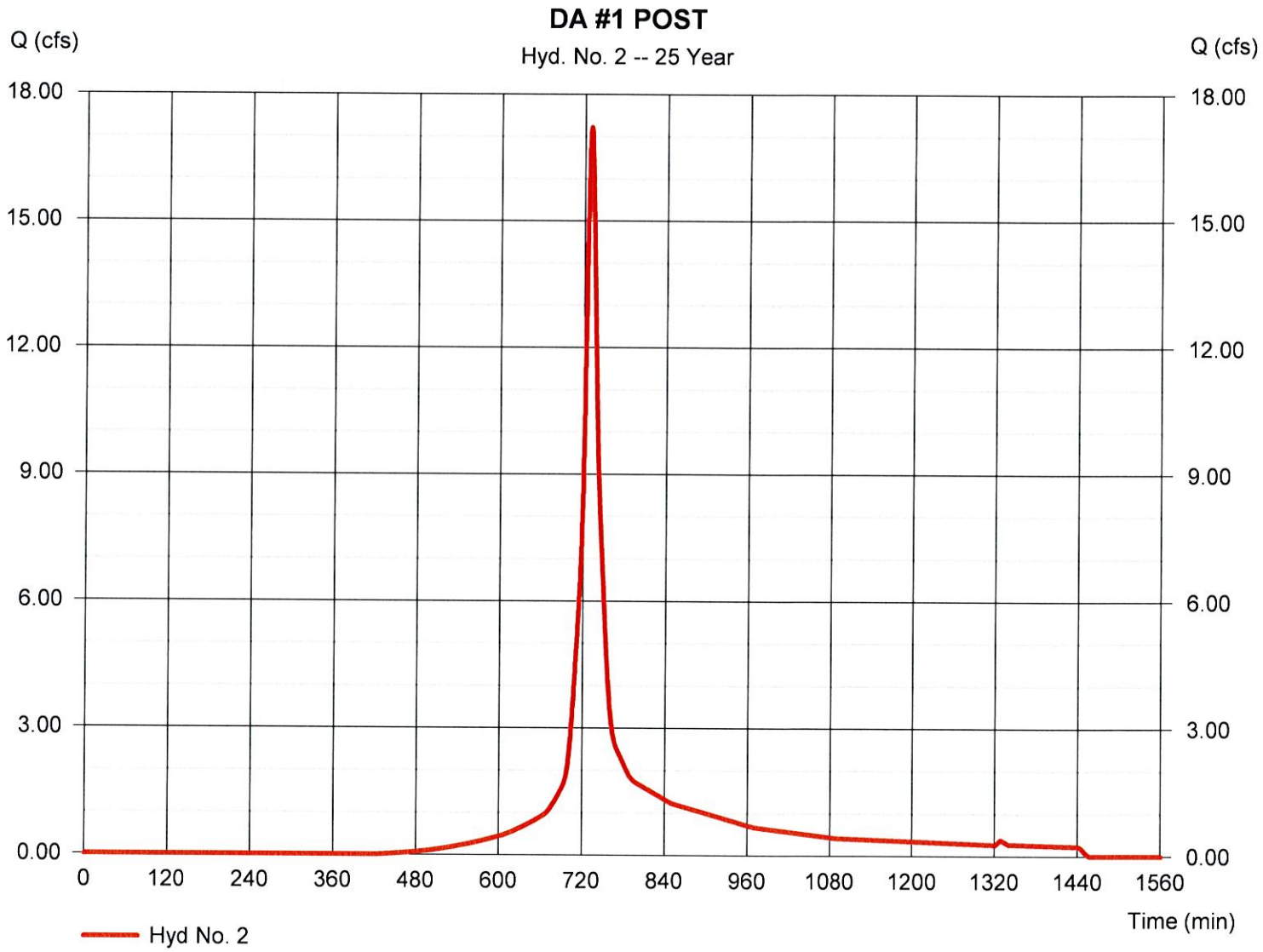


Hydrograph Report

Hyd. No. 2

DA #1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 17.22 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 64,889 cuft
Drainage area	= 3.680 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 8.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



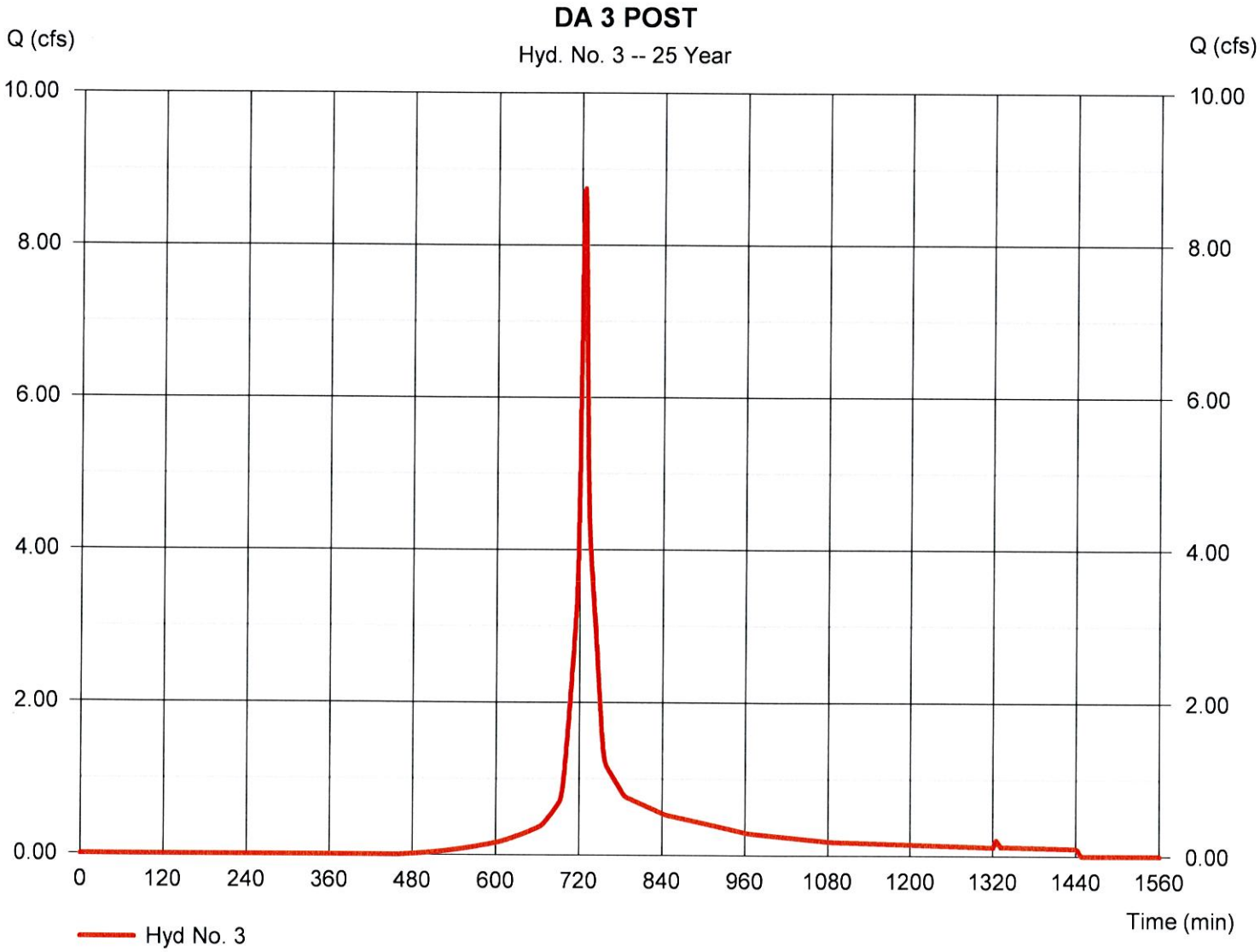
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 3

DA 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 8.744 cfs
Storm frequency	= 25 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 26,964 cuft
Drainage area	= 1.570 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

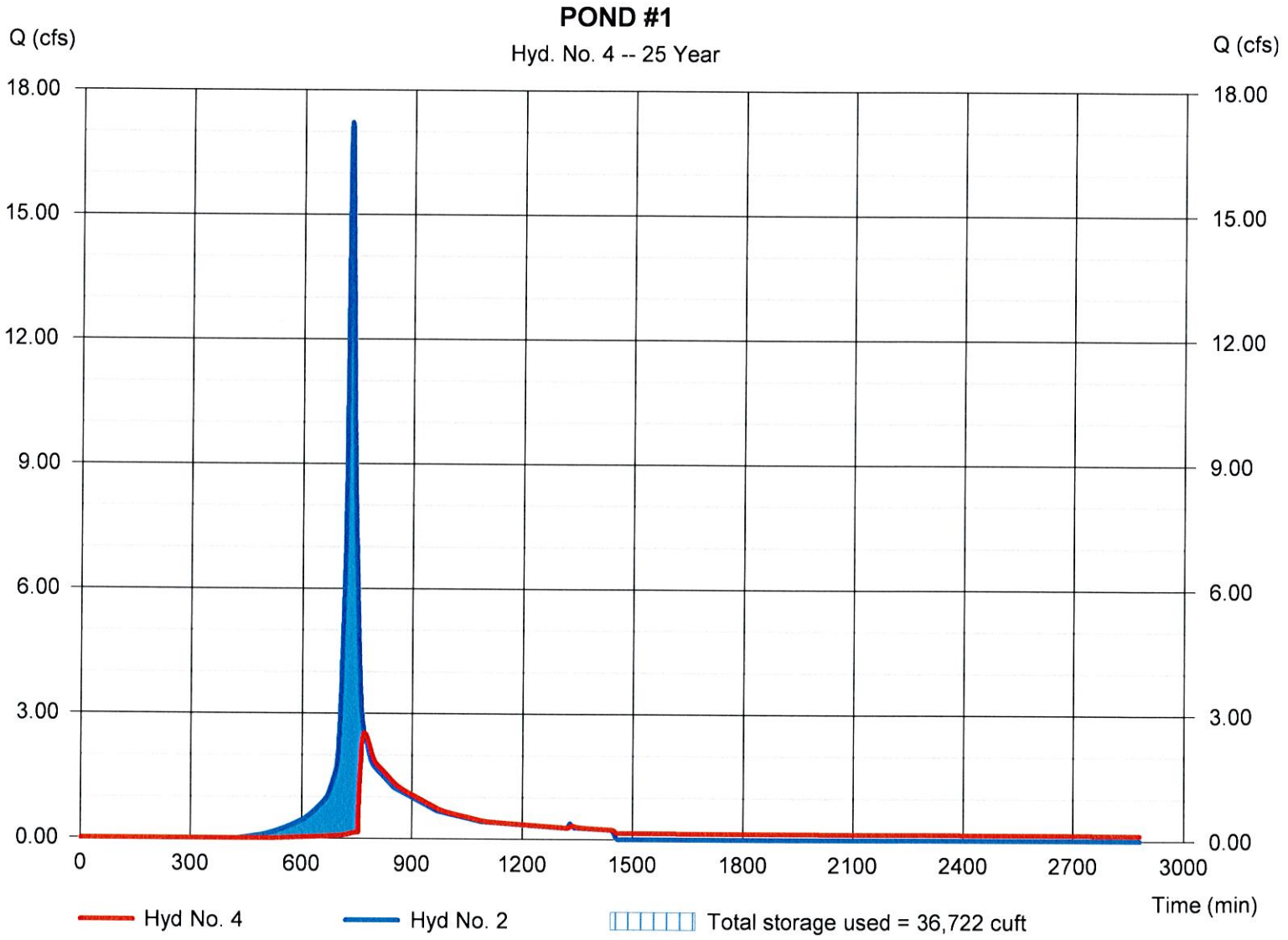
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 4

POND #1

Hydrograph type	= Reservoir	Peak discharge	= 2.530 cfs
Storm frequency	= 25 yrs	Time to peak	= 769 min
Time interval	= 1 min	Hyd. volume	= 41,569 cuft
Inflow hyd. No.	= 2 - DA #1 POST	Max. Elevation	= 13.72 ft
Reservoir name	= Pond#1	Max. Storage	= 36,722 cuft

Storage Indication method used.



Hydrograph Report

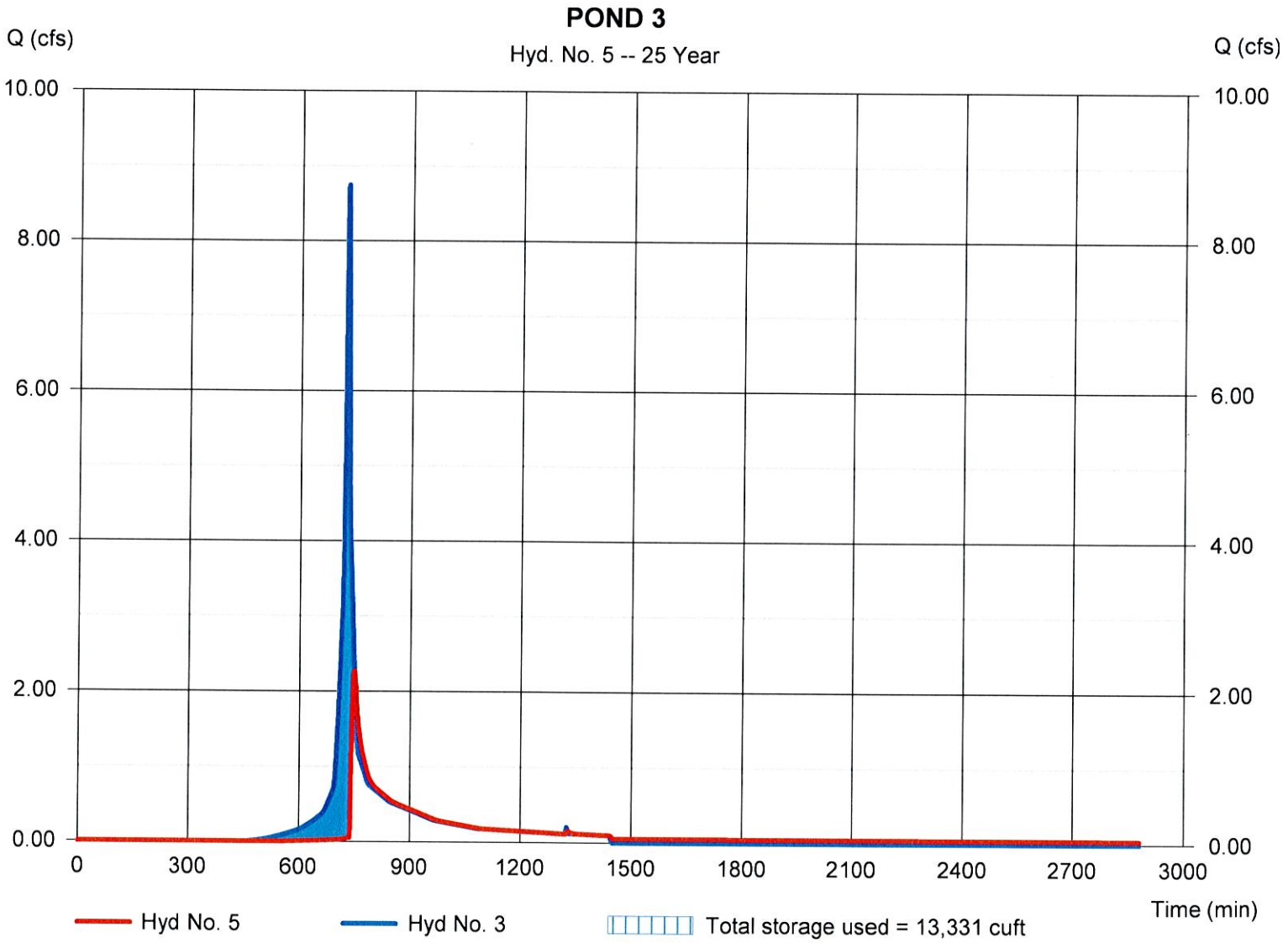
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 5

POND 3

Hydrograph type	= Reservoir	Peak discharge	= 2.269 cfs
Storm frequency	= 25 yrs	Time to peak	= 747 min
Time interval	= 1 min	Hyd. volume	= 18,885 cuft
Inflow hyd. No.	= 3 - DA 3 POST	Max. Elevation	= 19.52 ft
Reservoir name	= Pond 3	Max. Storage	= 13,331 cuft

Storage Indication method used.

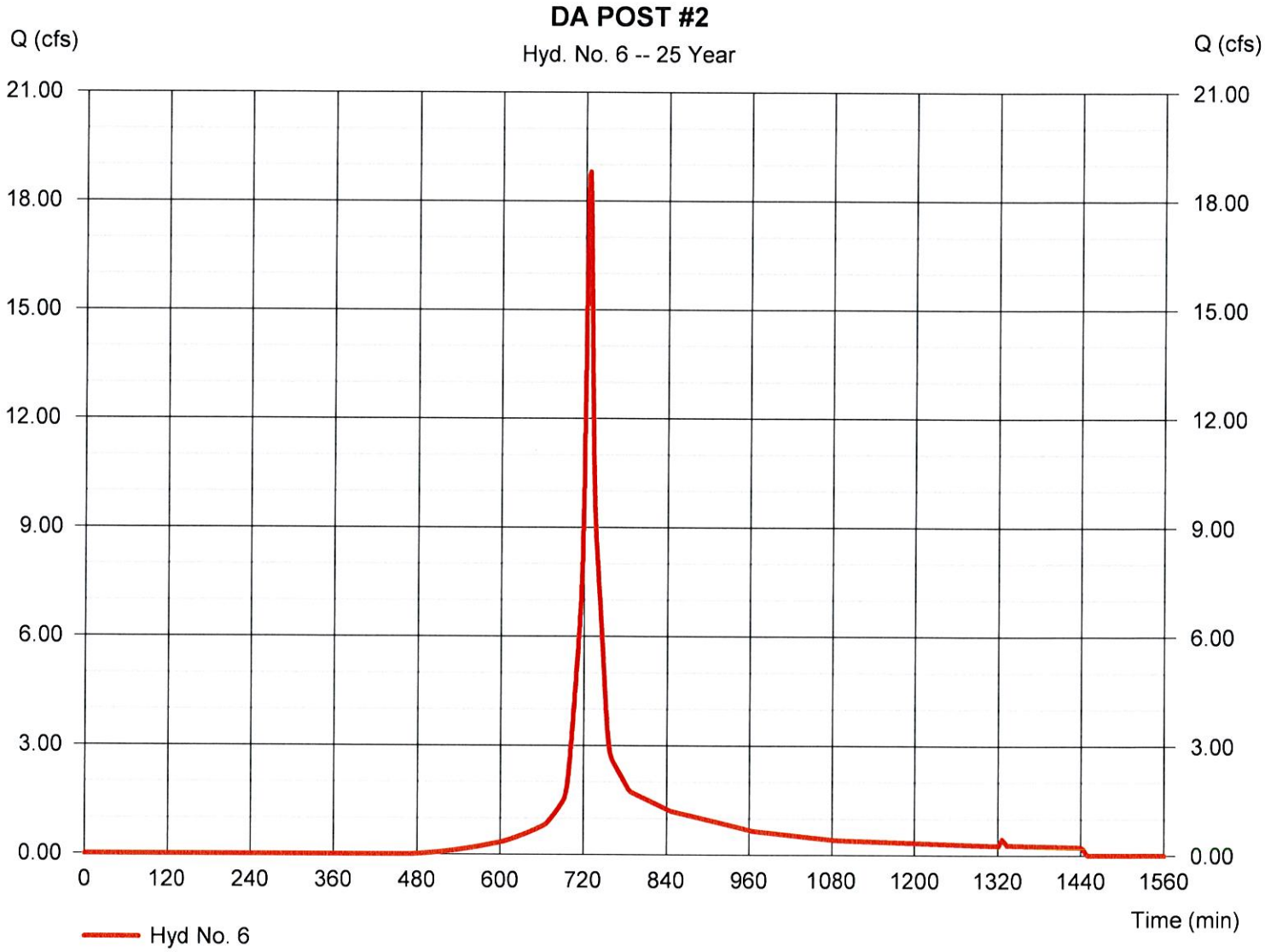


Hydrograph Report

Hyd. No. 6

DA POST #2

Hydrograph type	= SCS Runoff	Peak discharge	= 18.81 cfs
Storm frequency	= 25 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 60,473 cuft
Drainage area	= 3.820 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 8.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

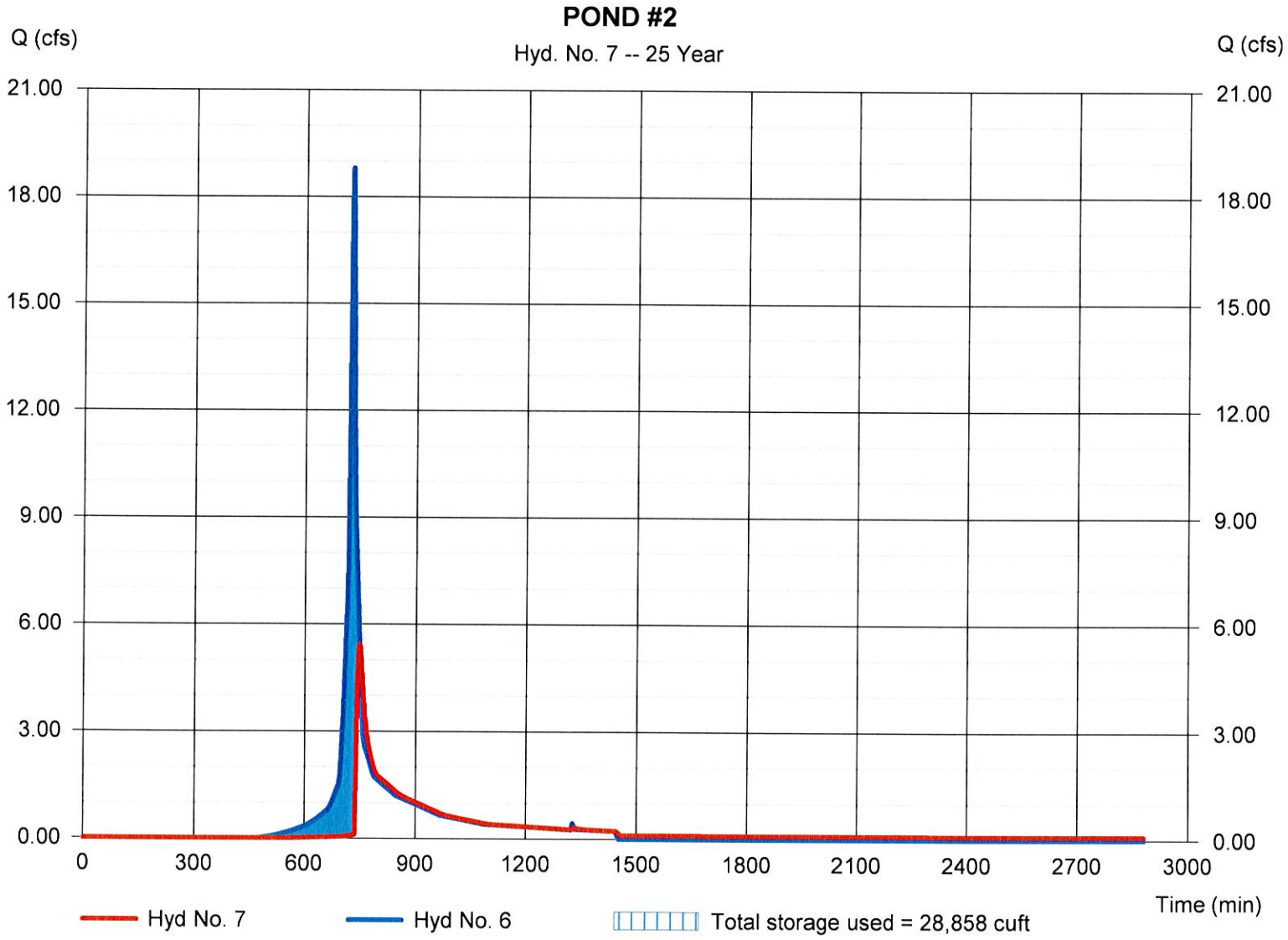
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 7

POND #2

Hydrograph type	= Reservoir	Peak discharge	= 5.425 cfs
Storm frequency	= 25 yrs	Time to peak	= 748 min
Time interval	= 1 min	Hyd. volume	= 42,808 cuft
Inflow hyd. No.	= 6 - DA POST #2	Max. Elevation	= 16.31 ft
Reservoir name	= POND#2	Max. Storage	= 28,858 cuft

Storage Indication method used.



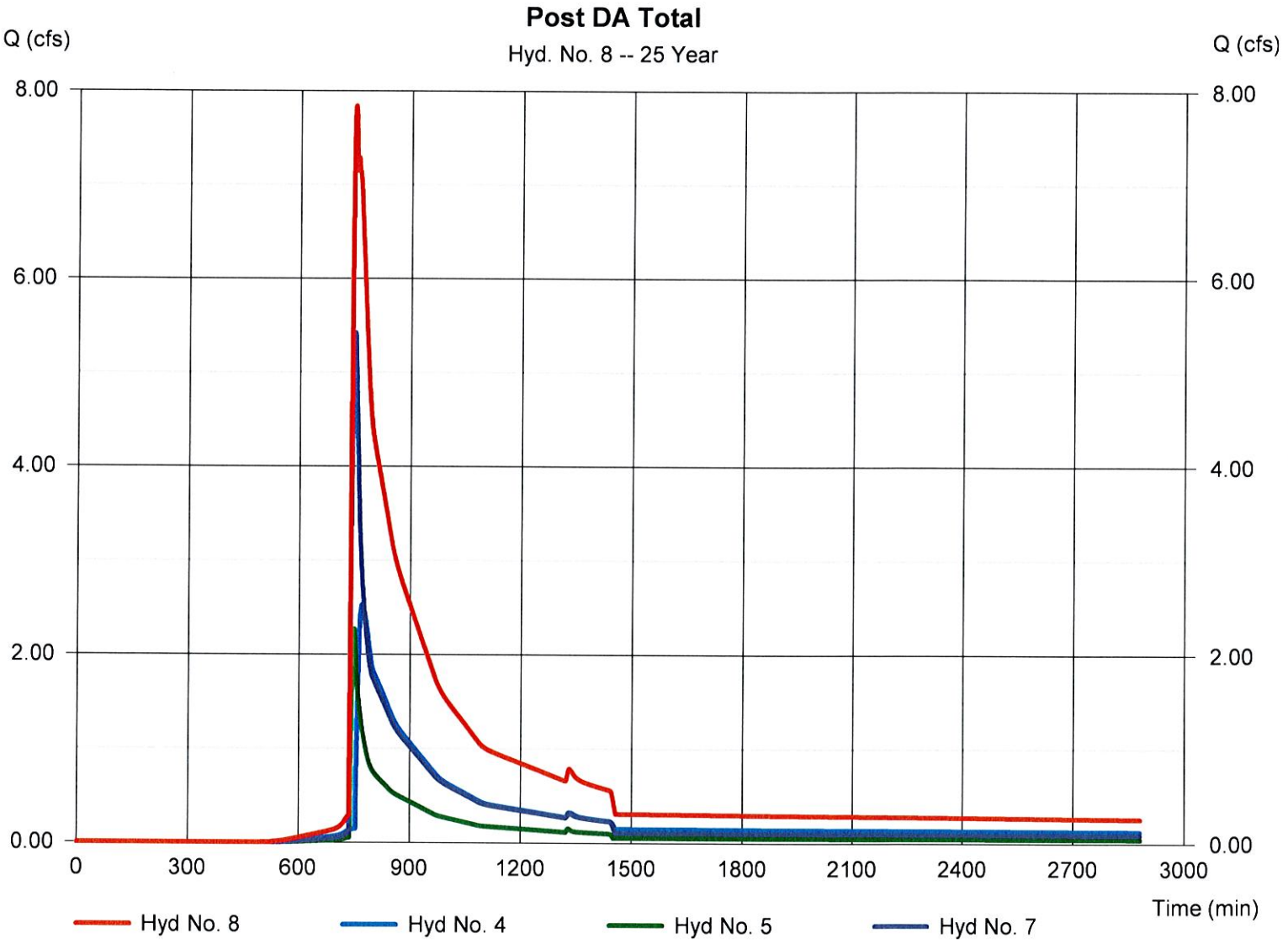
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 8

Post DA Total

Hydrograph type	= Combine	Peak discharge	= 7.840 cfs
Storm frequency	= 25 yrs	Time to peak	= 748 min
Time interval	= 1 min	Hyd. volume	= 103,262 cuft
Inflow hyds.	= 4, 5, 7	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

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	13.58	1	726	54,574	------	------	------	DA PRR
2	SCS Runoff	20.30	1	729	76,769	------	------	------	DA #1 POST
3	SCS Runoff	10.39	1	725	32,133	------	------	------	DA 3 POST
4	Reservoir	6.992	1	750	53,436	2	13.85	38,465	POND #1
5	Reservoir	4.165	1	738	24,050	3	19.58	13,837	POND 3
6	SCS Runoff	22.43	1	726	72,248	------	------	------	DA POST #2
7	Reservoir	9.580	1	739	54,573	6	16.42	30,221	POND #2
8	Combine	18.14	1	746	132,059	4, 5, 7	------	------	Post DA Total

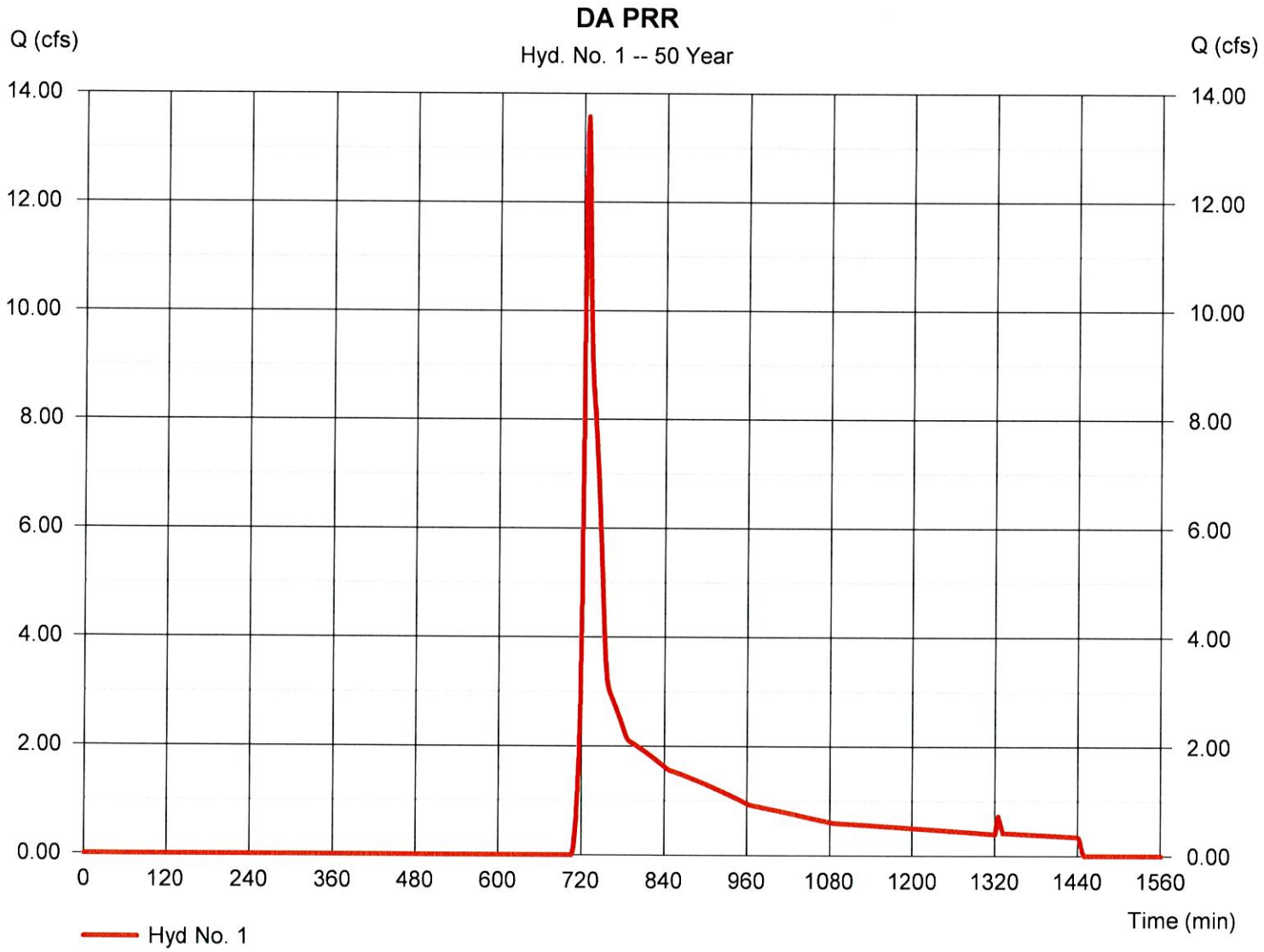
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 1

DA PRR

Hydrograph type	= SCS Runoff	Peak discharge	= 13.58 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 54,574 cuft
Drainage area	= 9.070 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

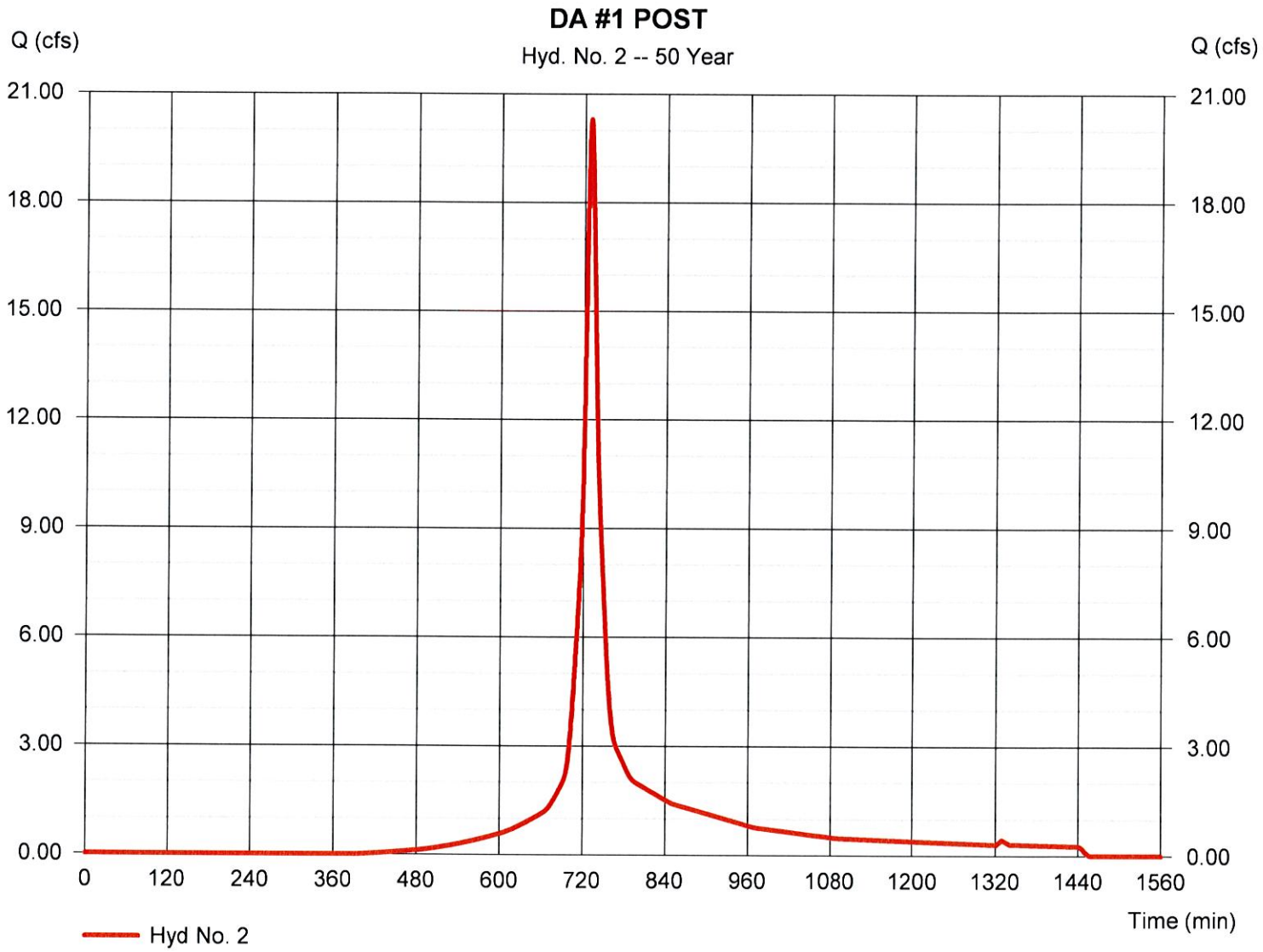


Hydrograph Report

Hyd. No. 2

DA #1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 20.30 cfs
Storm frequency	= 50 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 76,769 cuft
Drainage area	= 3.680 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



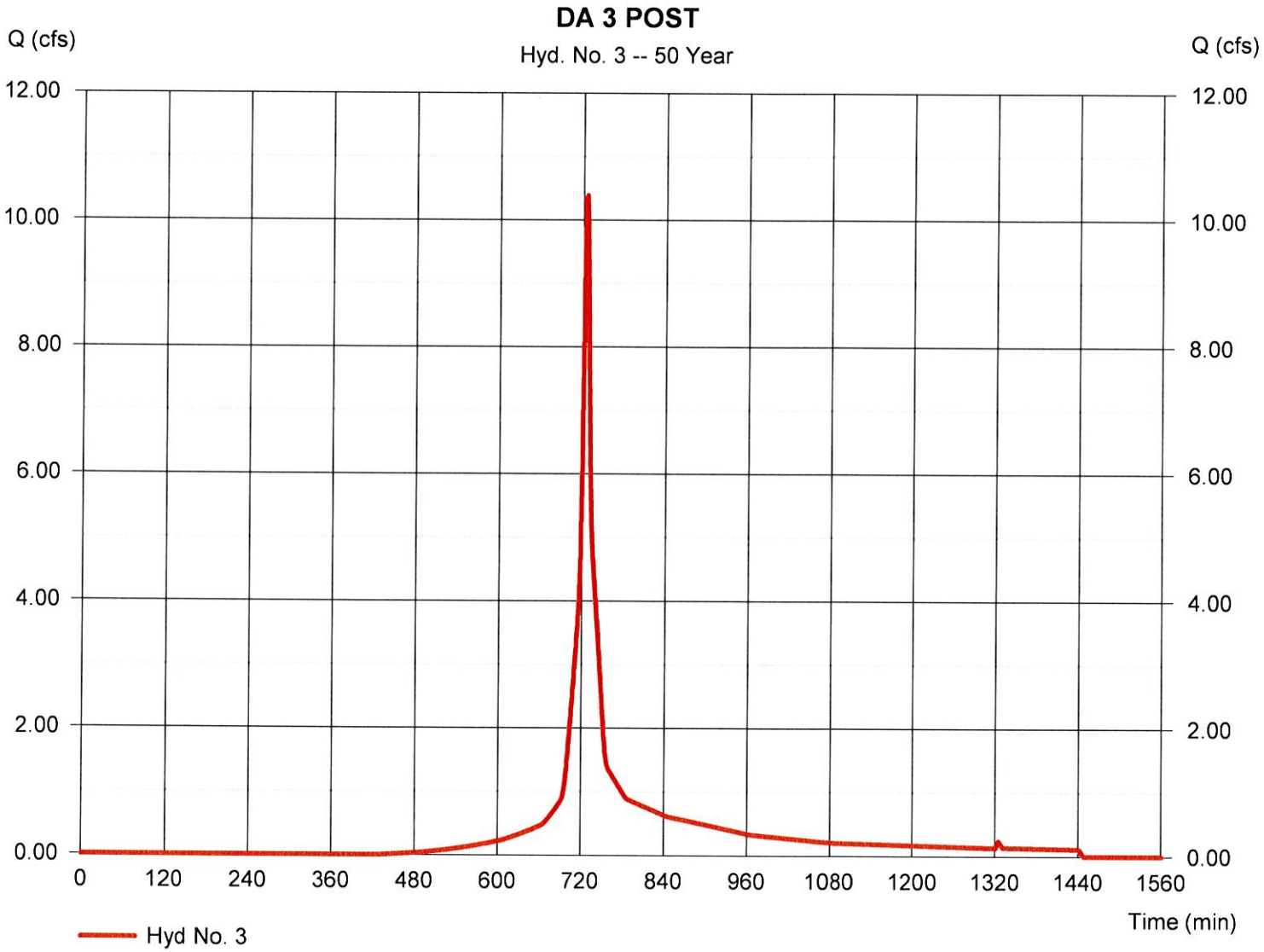
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 3

DA 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 10.39 cfs
Storm frequency	= 50 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 32,133 cuft
Drainage area	= 1.570 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



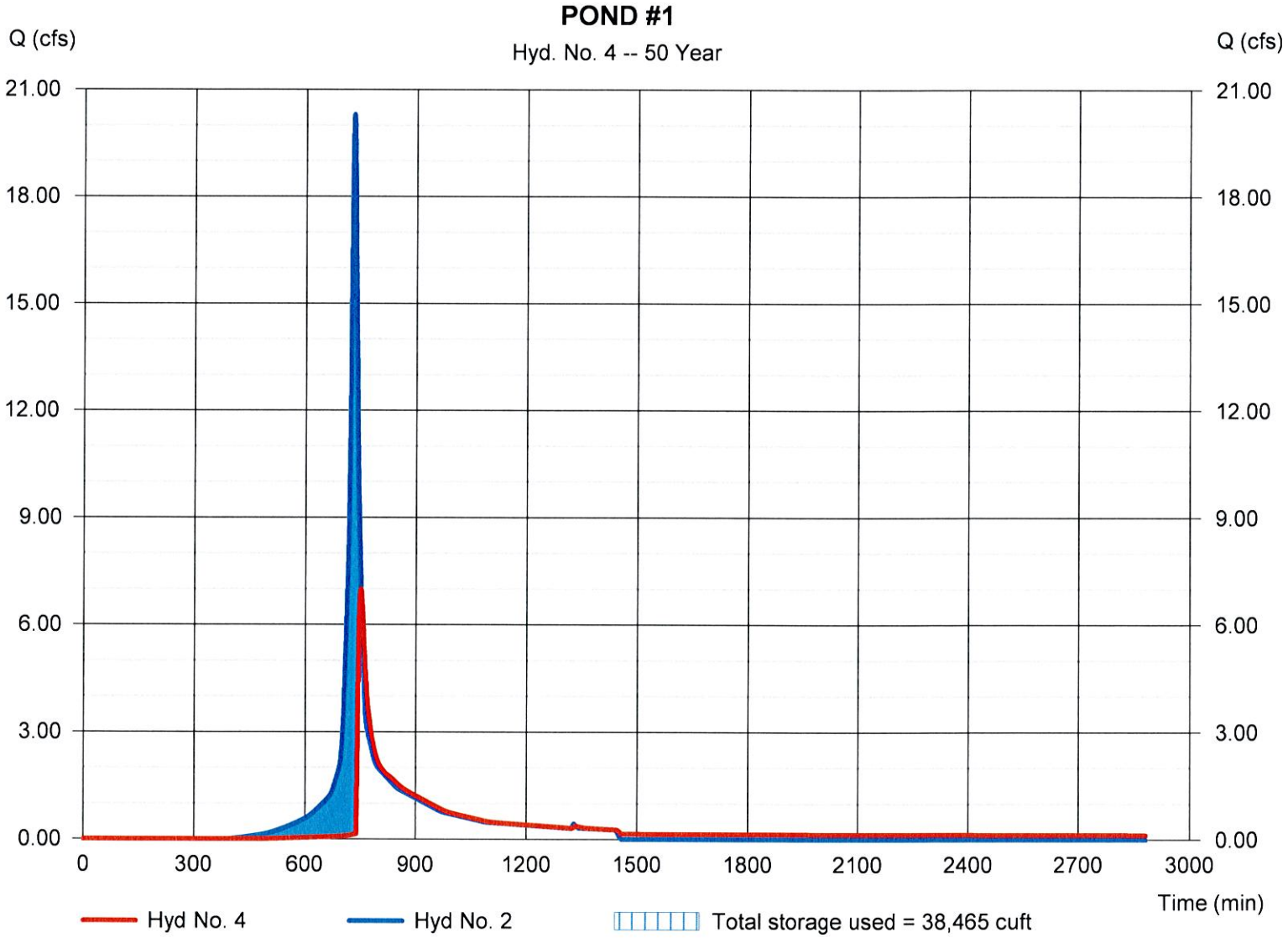
Hydrograph Report

Hyd. No. 4

POND #1

Hydrograph type	= Reservoir	Peak discharge	= 6.992 cfs
Storm frequency	= 50 yrs	Time to peak	= 750 min
Time interval	= 1 min	Hyd. volume	= 53,436 cuft
Inflow hyd. No.	= 2 - DA #1 POST	Max. Elevation	= 13.85 ft
Reservoir name	= Pond#1	Max. Storage	= 38,465 cuft

Storage Indication method used.



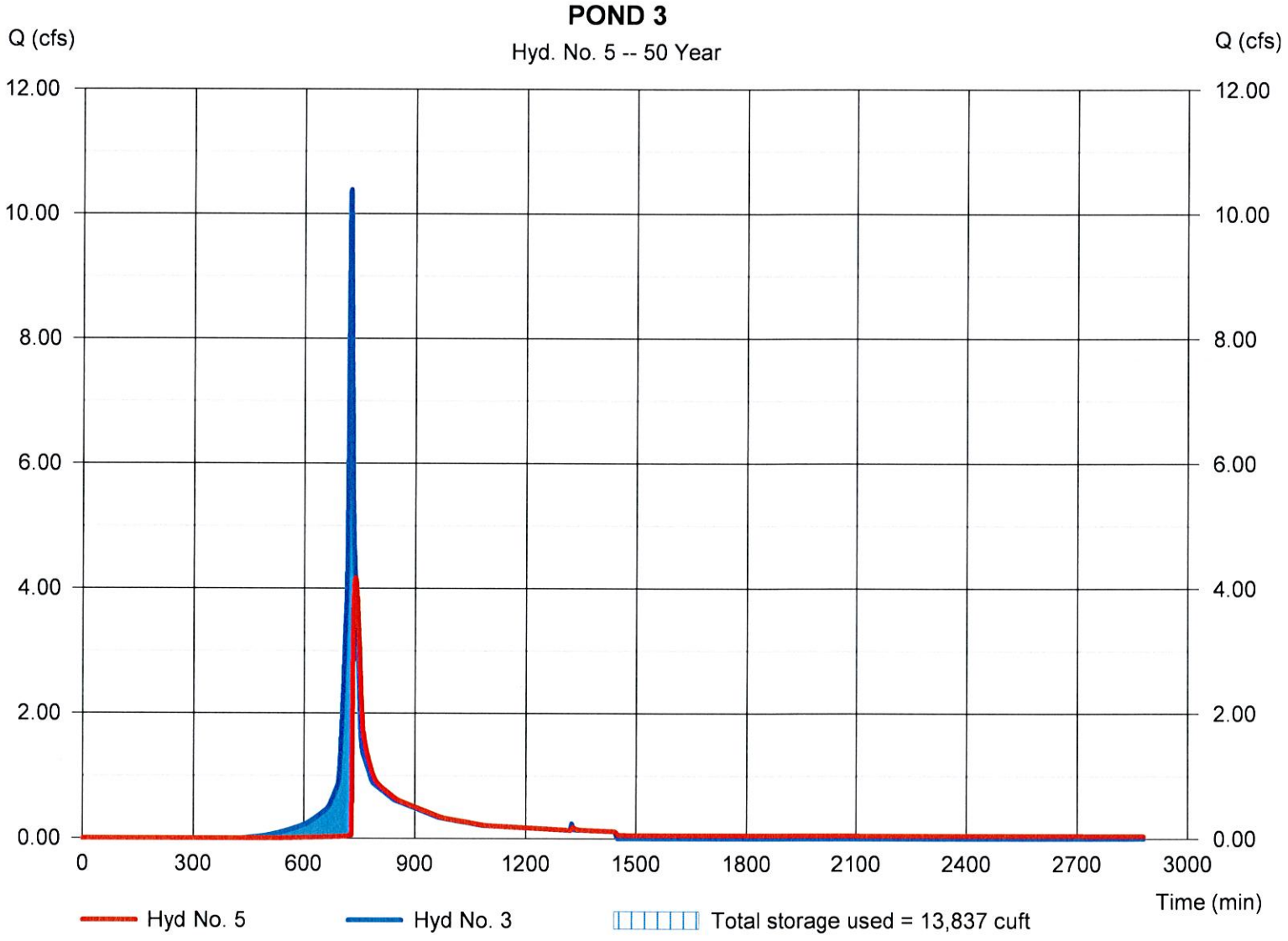
Hydrograph Report

Hyd. No. 5

POND 3

Hydrograph type	= Reservoir	Peak discharge	= 4.165 cfs
Storm frequency	= 50 yrs	Time to peak	= 738 min
Time interval	= 1 min	Hyd. volume	= 24,050 cuft
Inflow hyd. No.	= 3 - DA 3 POST	Max. Elevation	= 19.58 ft
Reservoir name	= Pond 3	Max. Storage	= 13,837 cuft

Storage Indication method used.

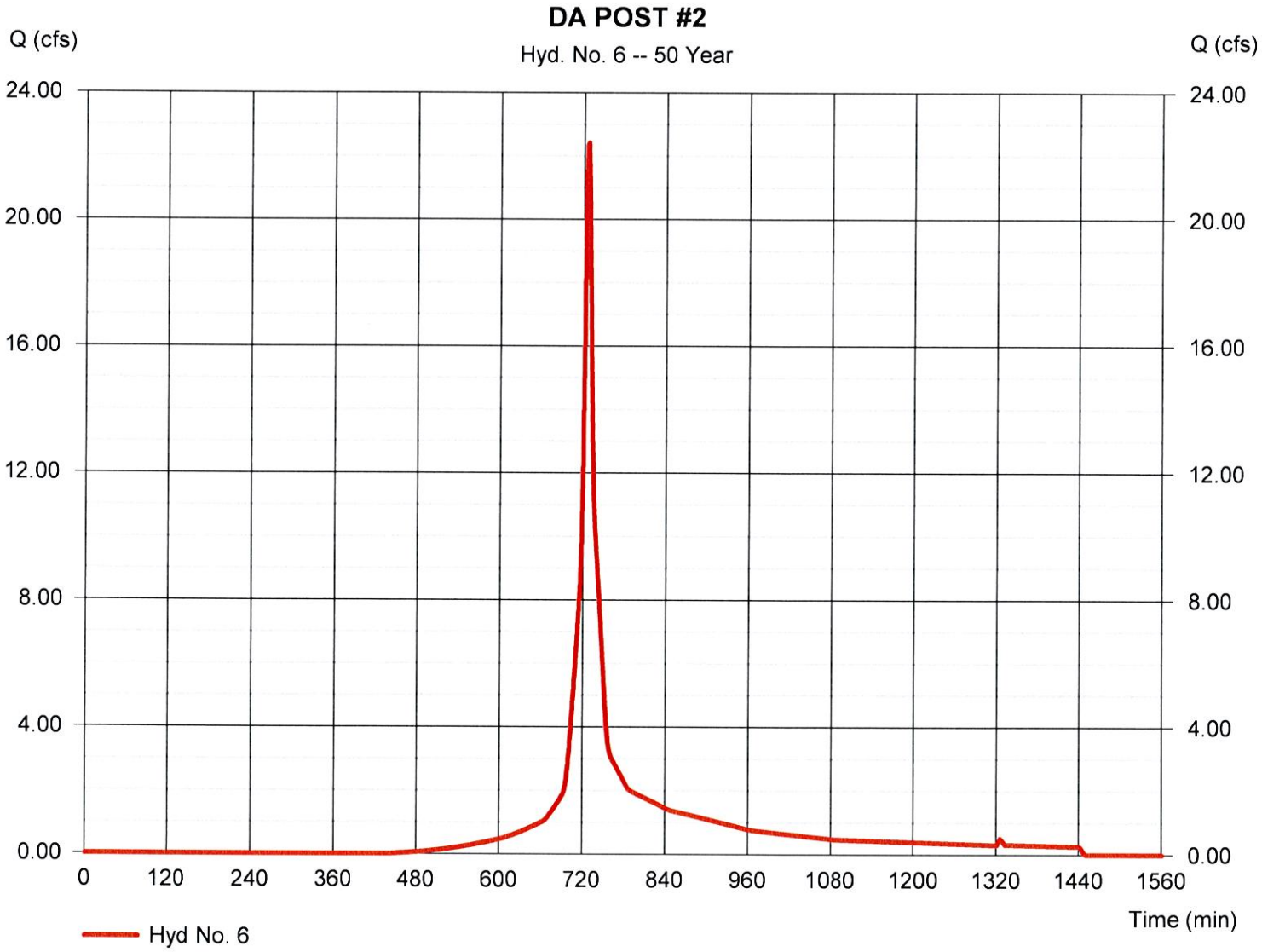


Hydrograph Report

Hyd. No. 6

DA POST #2

Hydrograph type	= SCS Runoff	Peak discharge	= 22.43 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 72,248 cuft
Drainage area	= 3.820 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



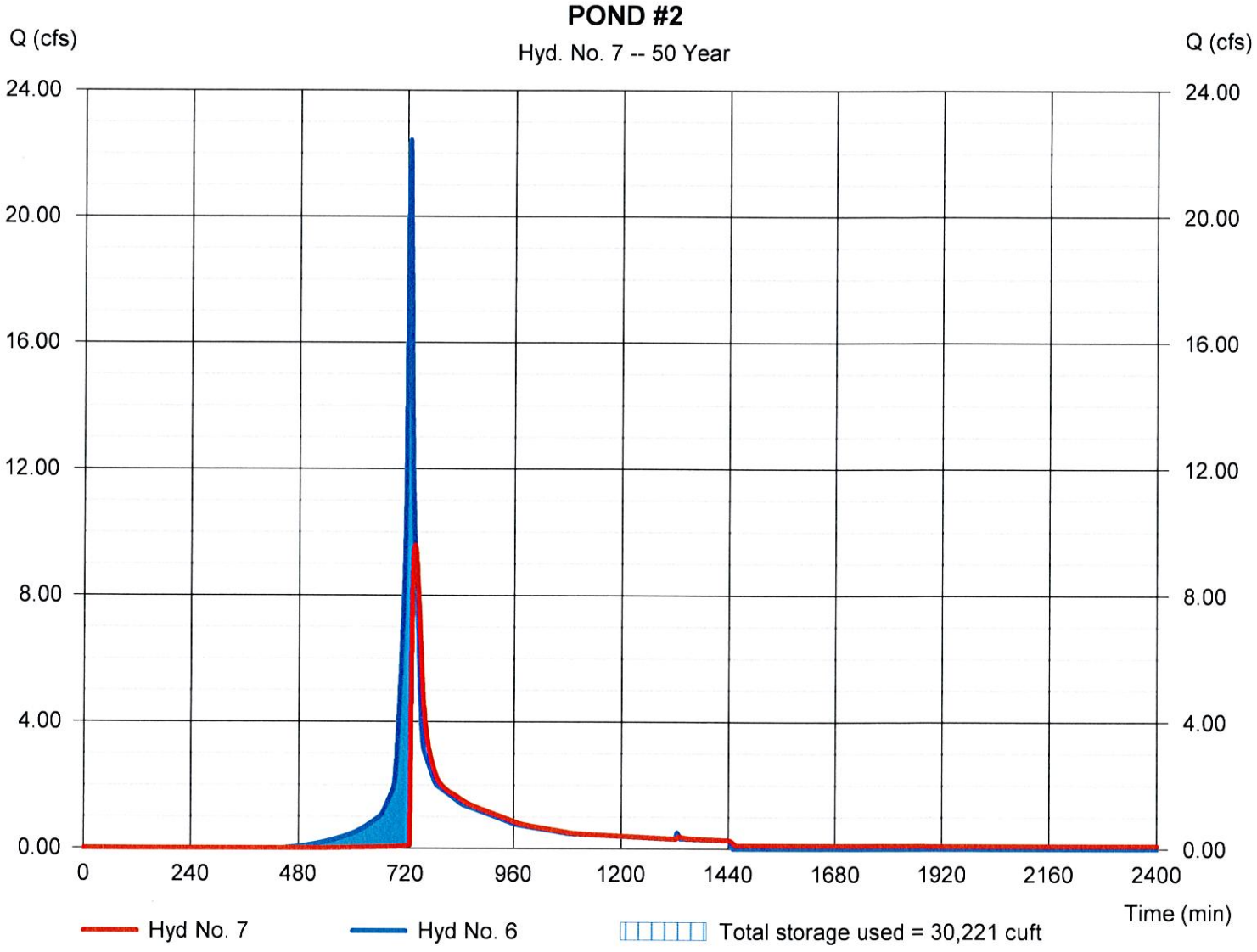
Hydrograph Report

Hyd. No. 7

POND #2

Hydrograph type	= Reservoir	Peak discharge	= 9.580 cfs
Storm frequency	= 50 yrs	Time to peak	= 739 min
Time interval	= 1 min	Hyd. volume	= 54,573 cuft
Inflow hyd. No.	= 6 - DA POST #2	Max. Elevation	= 16.42 ft
Reservoir name	= POND#2	Max. Storage	= 30,221 cuft

Storage Indication method used.

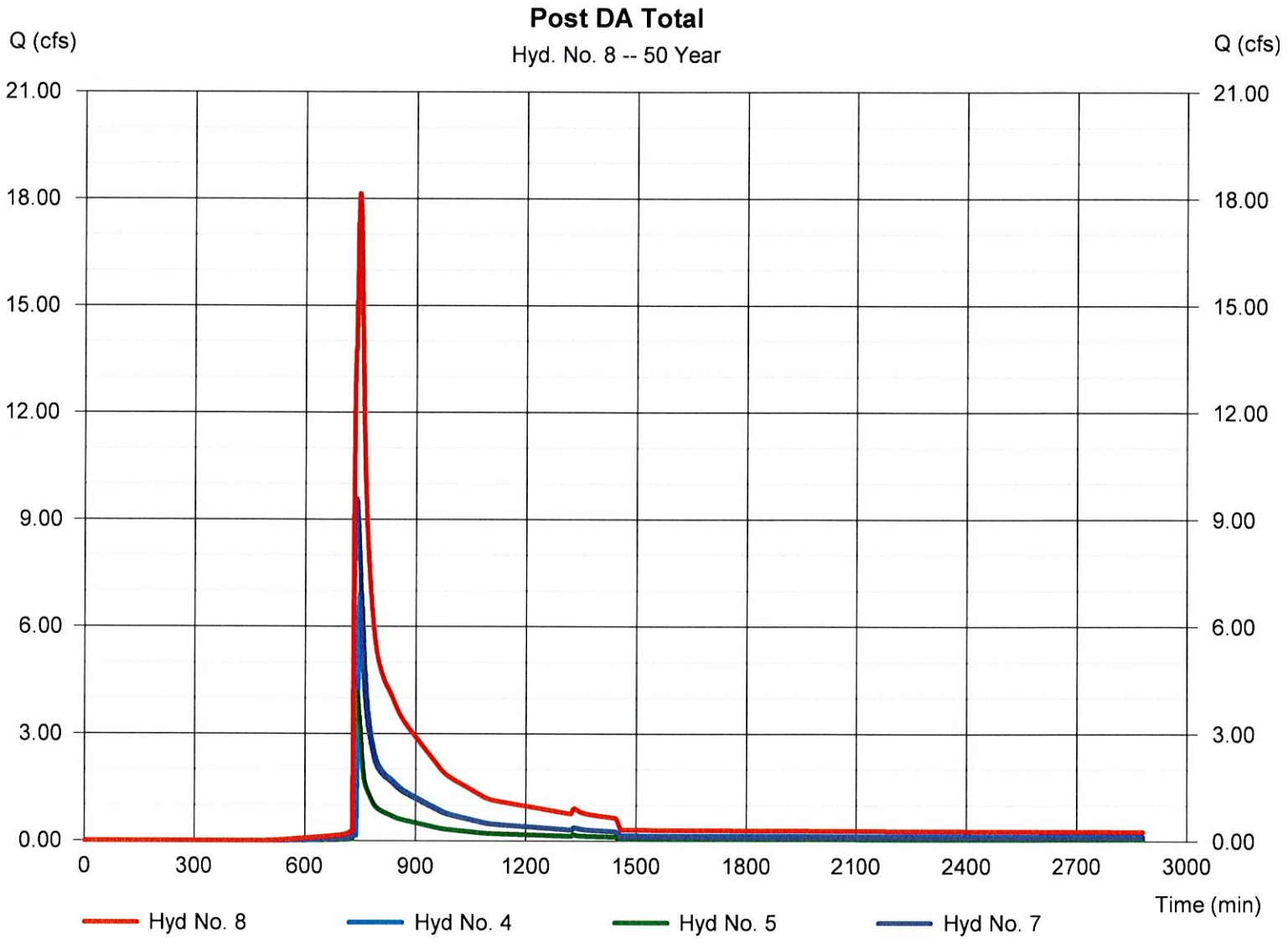


Hydrograph Report

Hyd. No. 8

Post DA Total

Hydrograph type	= Combine	Peak discharge	= 18.14 cfs
Storm frequency	= 50 yrs	Time to peak	= 746 min
Time interval	= 1 min	Hyd. volume	= 132,059 cuft
Inflow hyds.	= 4, 5, 7	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

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	19.21	1	726	71,217	------	------	------	DA PRR
2	SCS Runoff	23.37	1	729	88,726	------	------	------	DA #1 POST
3	SCS Runoff	12.04	1	725	37,356	------	------	------	DA 3 POST
4	Reservoir	11.81	1	742	65,381	2	13.96	39,940	POND #1
5	Reservoir	6.021	1	733	29,270	3	19.68	14,648	POND 3
6	SCS Runoff	26.05	1	726	84,161	------	------	------	DA POST #2
7	Reservoir	15.32	1	733	66,477	6	16.54	31,813	POND #2
8	Combine	29.44	1	740	161,128	4, 5, 7	------	------	Post DA Total

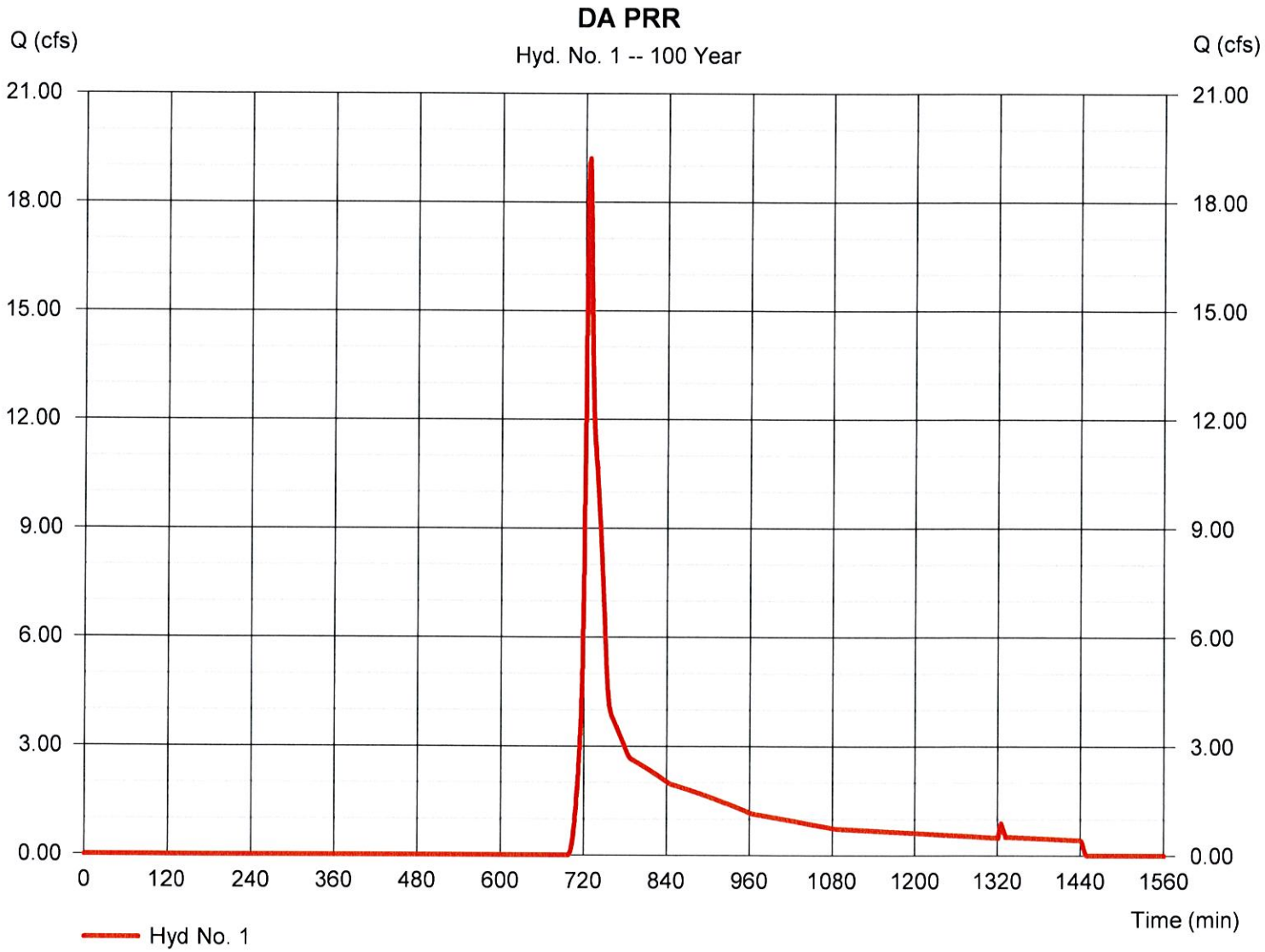
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 1

DA PRR

Hydrograph type	= SCS Runoff	Peak discharge	= 19.21 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 71,217 cuft
Drainage area	= 9.070 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



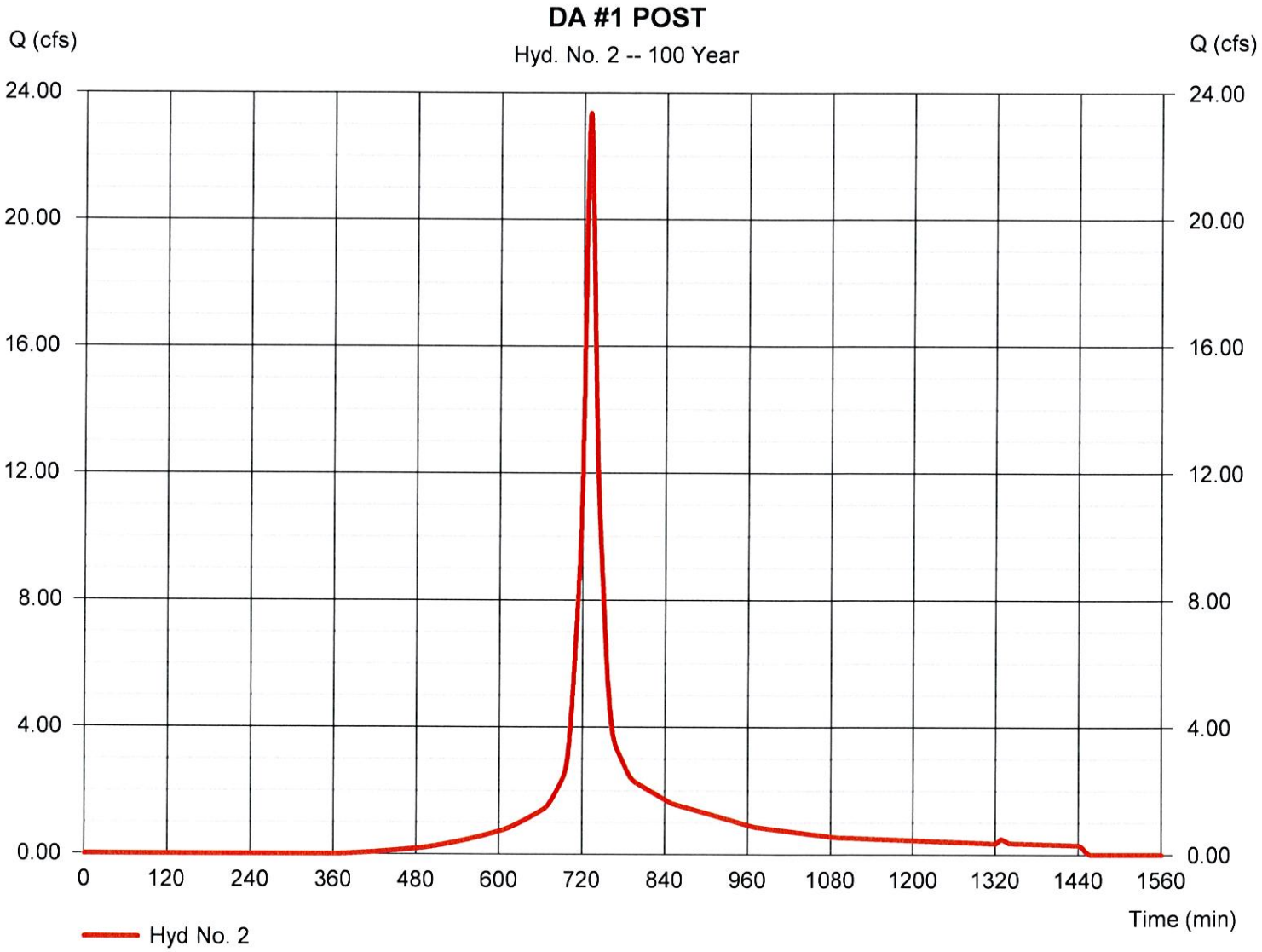
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 2

DA #1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 23.37 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 88,726 cuft
Drainage area	= 3.680 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



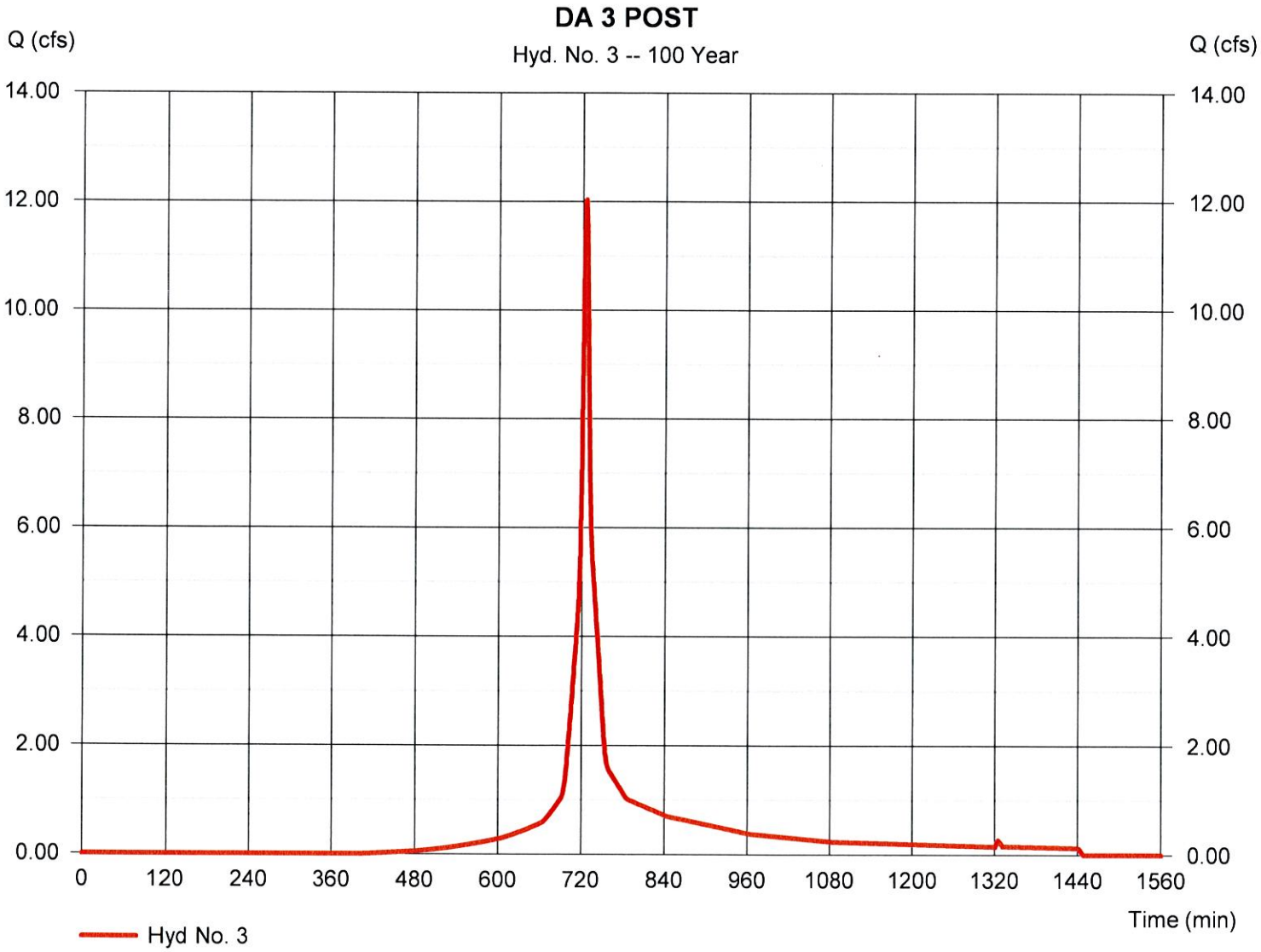
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 3

DA 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 12.04 cfs
Storm frequency	= 100 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 37,356 cuft
Drainage area	= 1.570 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



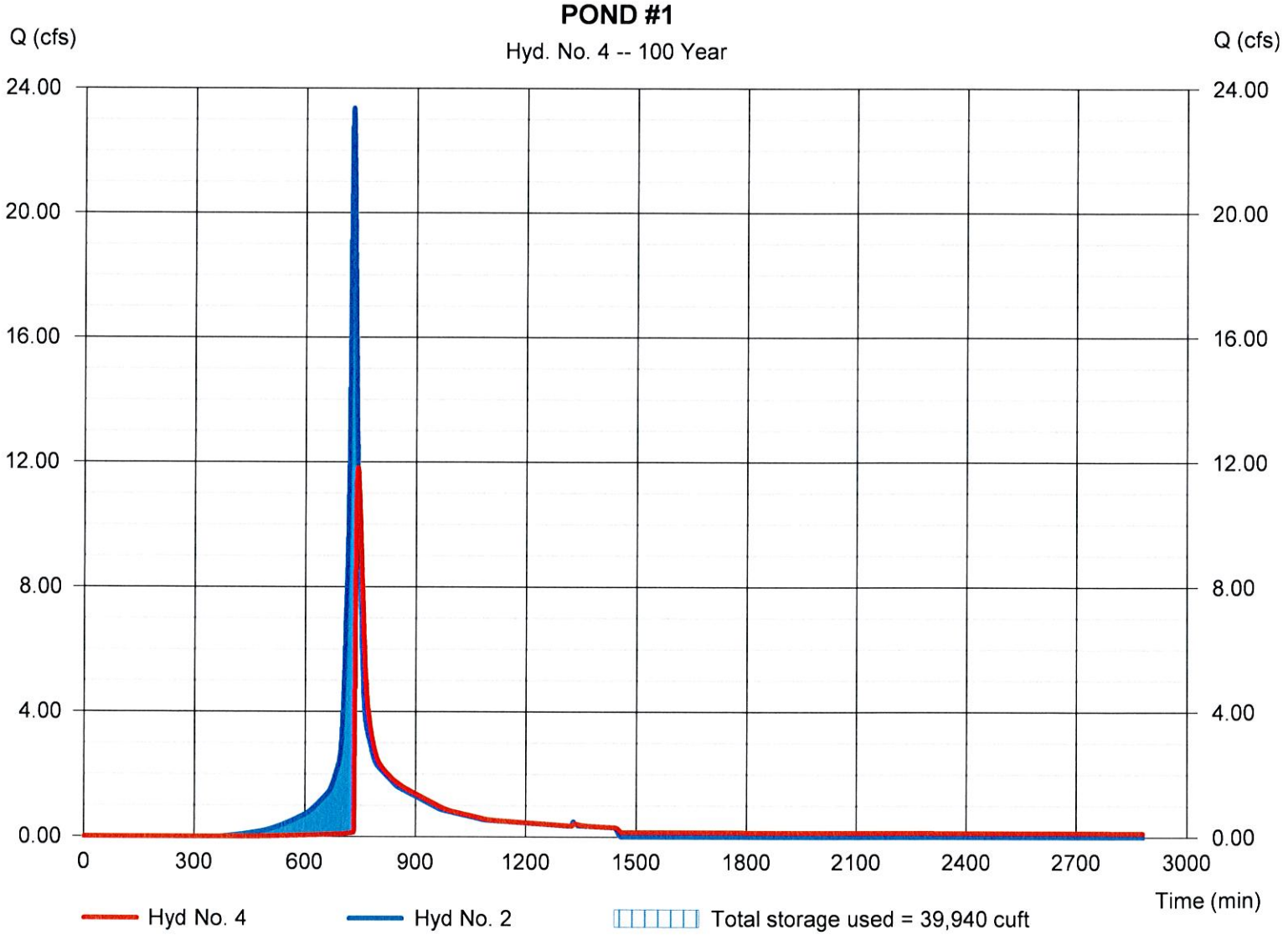
Hydrograph Report

Hyd. No. 4

POND #1

Hydrograph type	= Reservoir	Peak discharge	= 11.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 742 min
Time interval	= 1 min	Hyd. volume	= 65,381 cuft
Inflow hyd. No.	= 2 - DA #1 POST	Max. Elevation	= 13.96 ft
Reservoir name	= Pond#1	Max. Storage	= 39,940 cuft

Storage Indication method used.



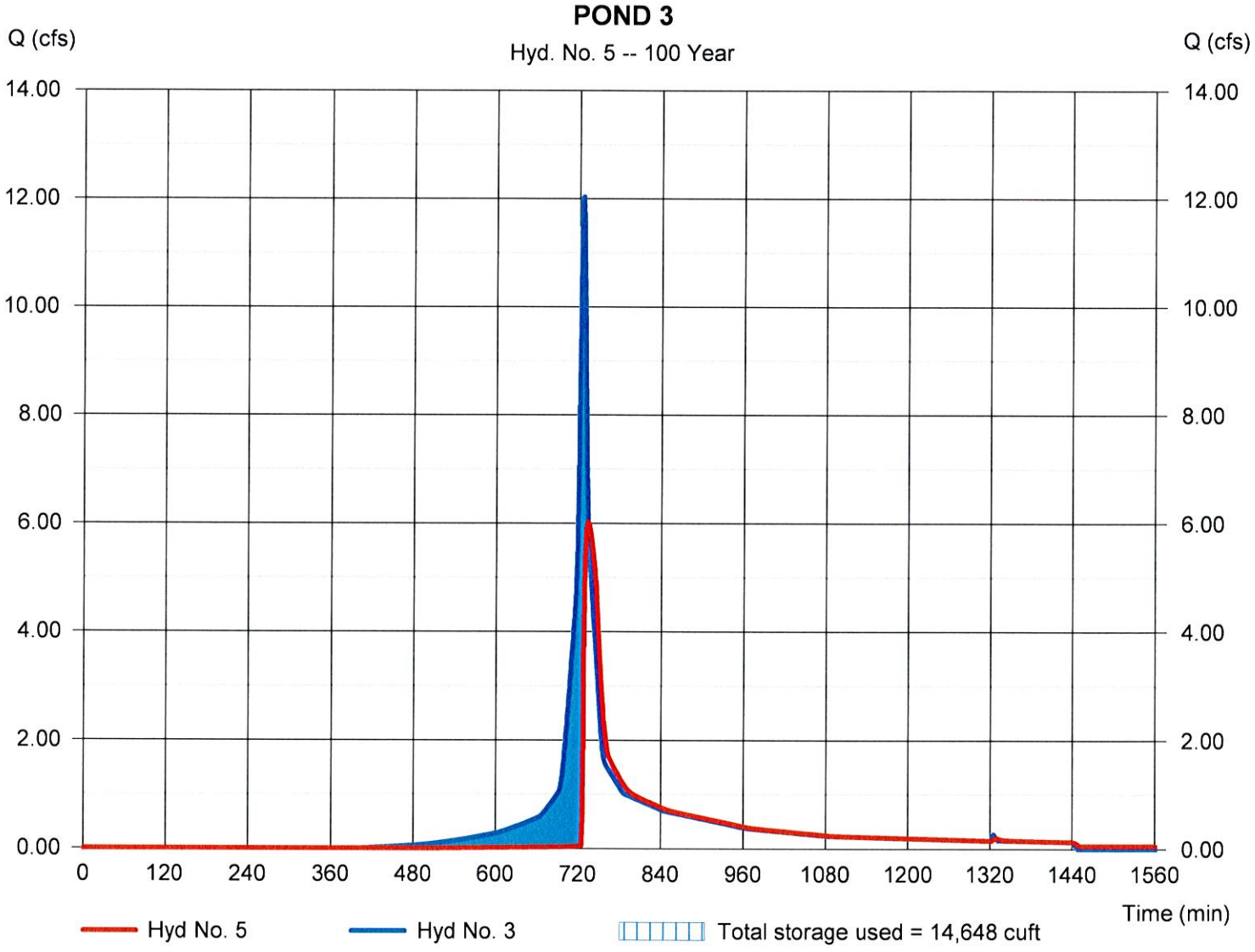
Hydrograph Report

Hyd. No. 5

POND 3

Hydrograph type	= Reservoir	Peak discharge	= 6.021 cfs
Storm frequency	= 100 yrs	Time to peak	= 733 min
Time interval	= 1 min	Hyd. volume	= 29,270 cuft
Inflow hyd. No.	= 3 - DA 3 POST	Max. Elevation	= 19.68 ft
Reservoir name	= Pond 3	Max. Storage	= 14,648 cuft

Storage Indication method used.



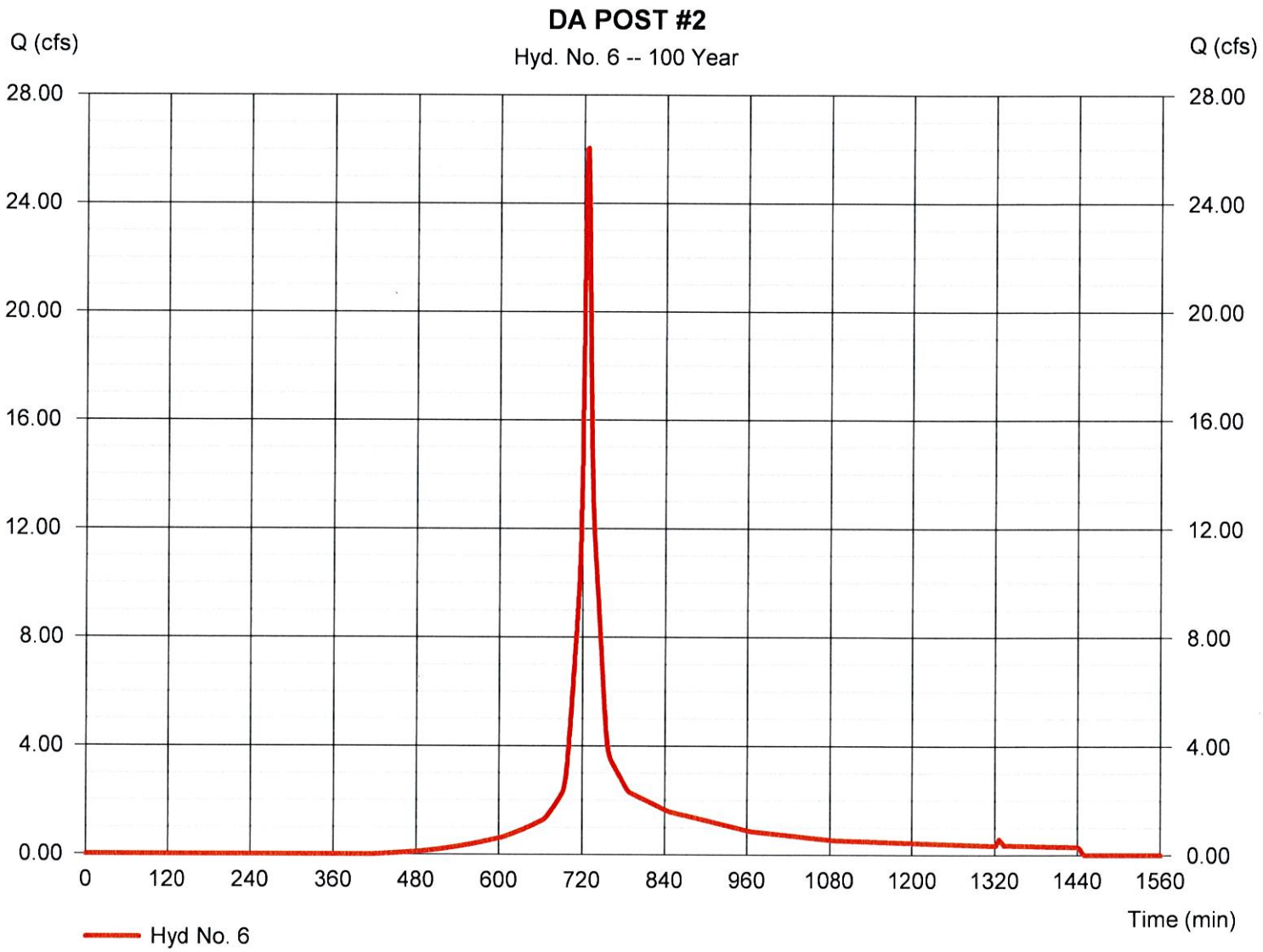
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 6

DA POST #2

Hydrograph type	= SCS Runoff	Peak discharge	= 26.05 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 84,161 cuft
Drainage area	= 3.820 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

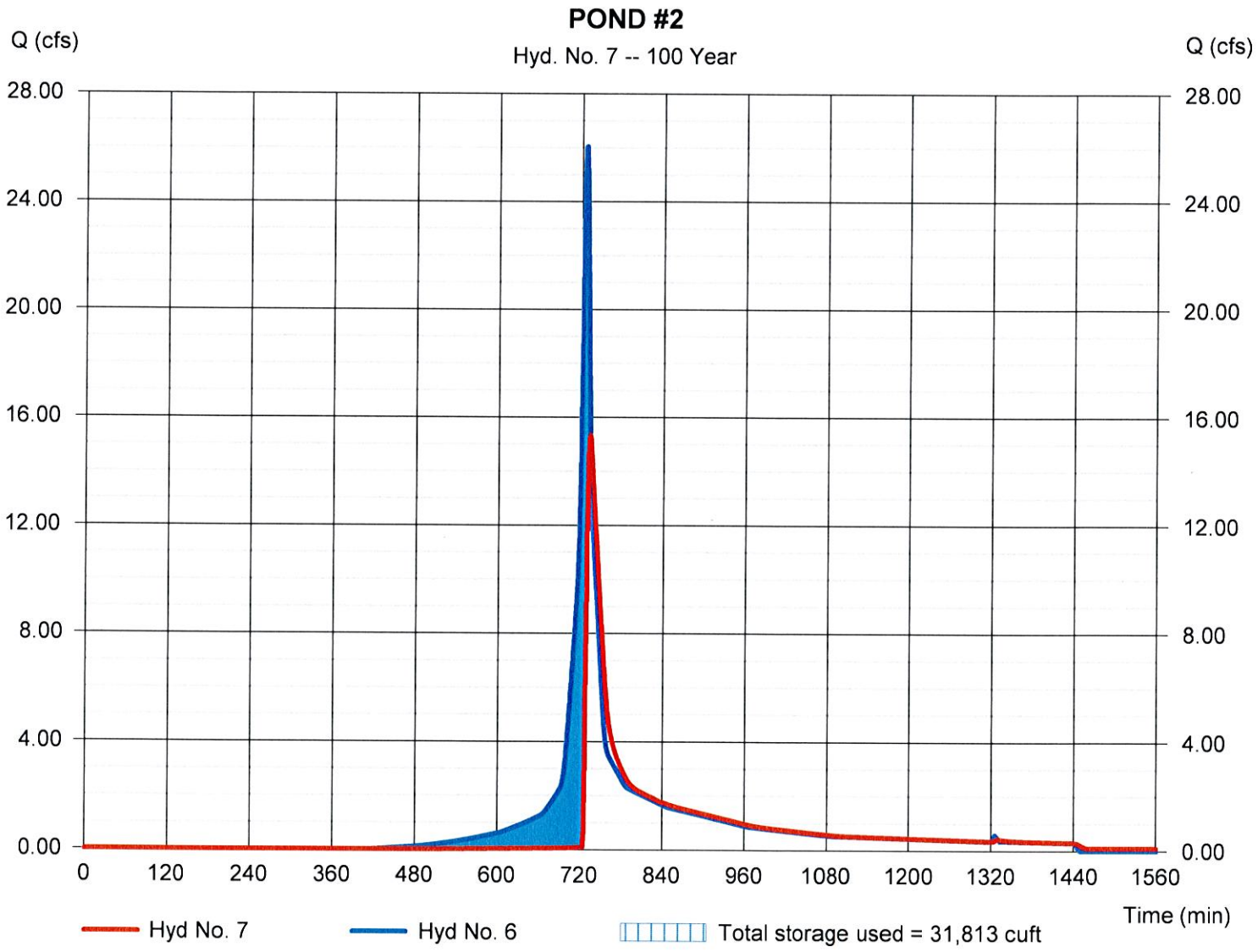
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 — Tuesday, 08 / 29 / 2017

Hyd. No. 7

POND #2

Hydrograph type	= Reservoir	Peak discharge	= 15.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 733 min
Time interval	= 1 min	Hyd. volume	= 66,477 cuft
Inflow hyd. No.	= 6 - DA POST #2	Max. Elevation	= 16.54 ft
Reservoir name	= POND#2	Max. Storage	= 31,813 cuft

Storage Indication method used.



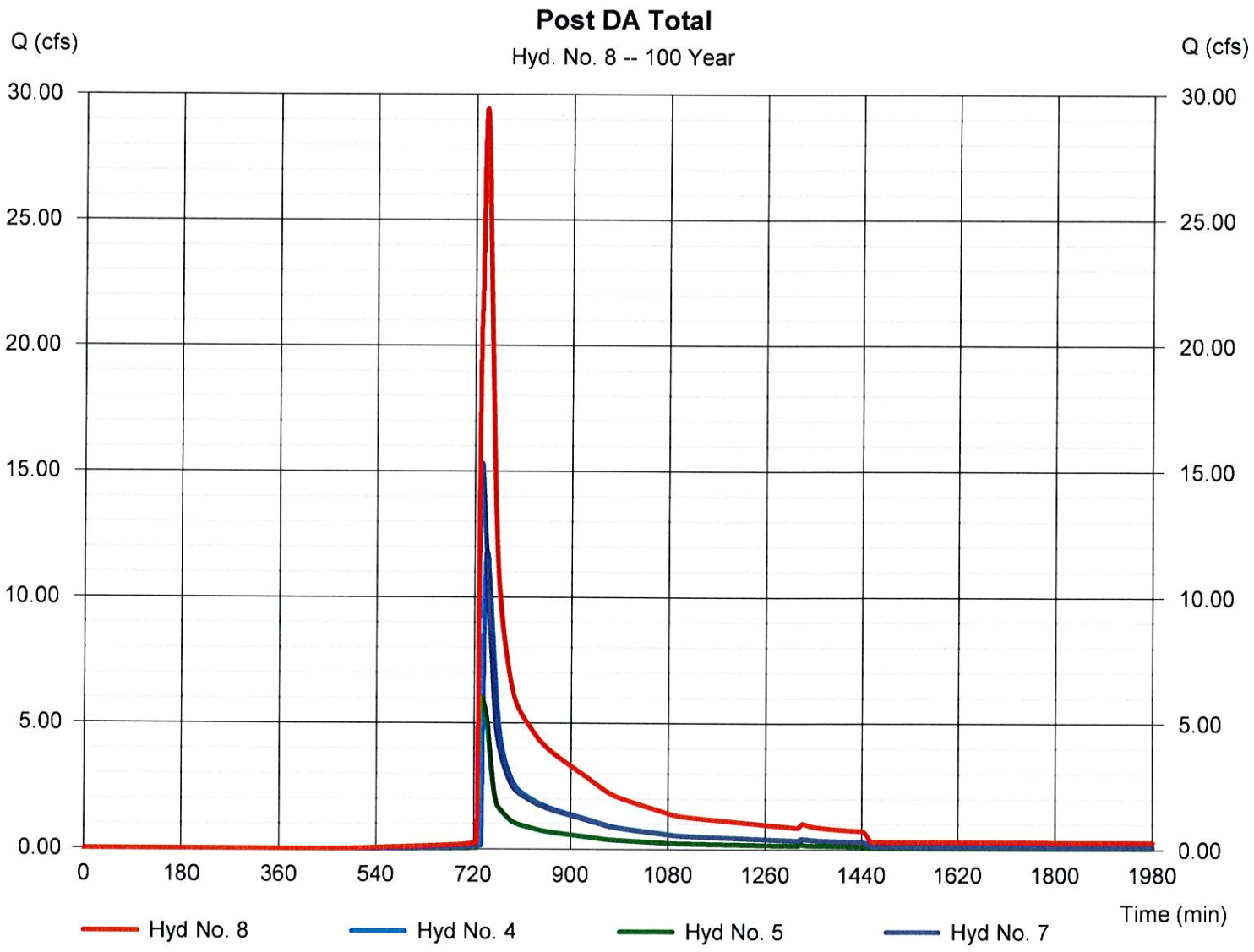
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hyd. No. 8

Post DA Total

Hydrograph type	= Combine	Peak discharge	= 29.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 1 min	Hyd. volume	= 161,128 cuft
Inflow hyds.	= 4, 5, 7	Contrib. drain. area	= 0.000 ac



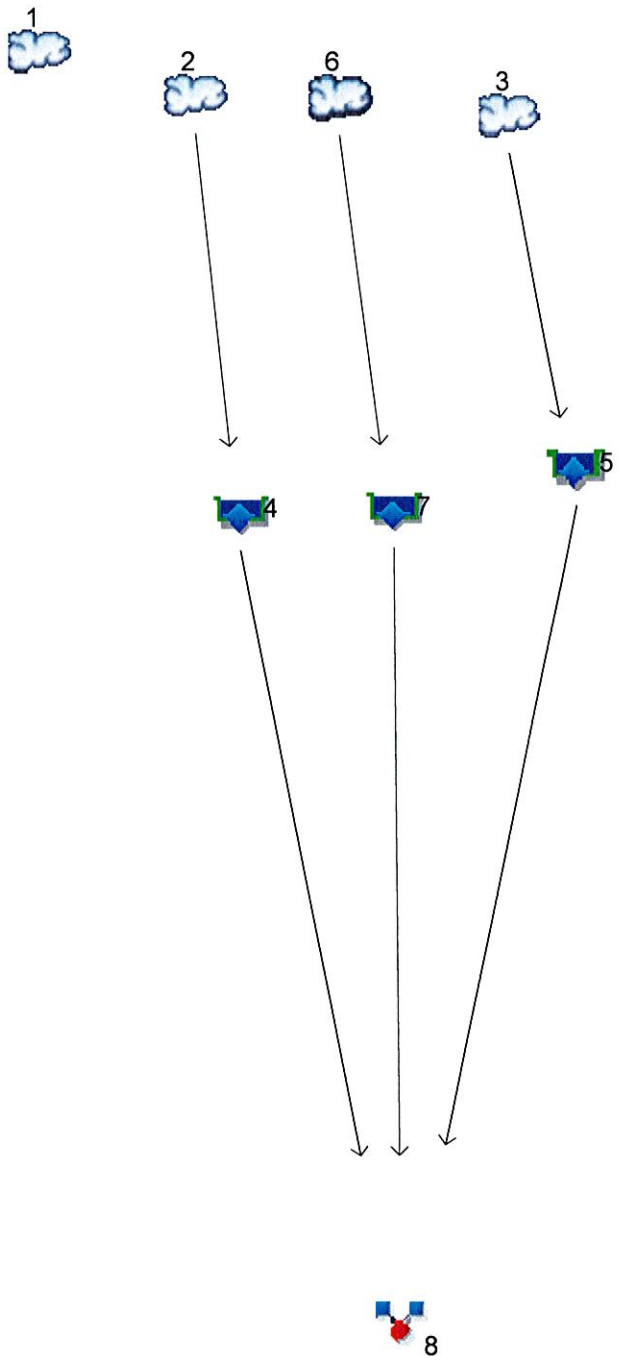
Hydraflow Table of Contents

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Tuesday, 08 / 29 / 2017

Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

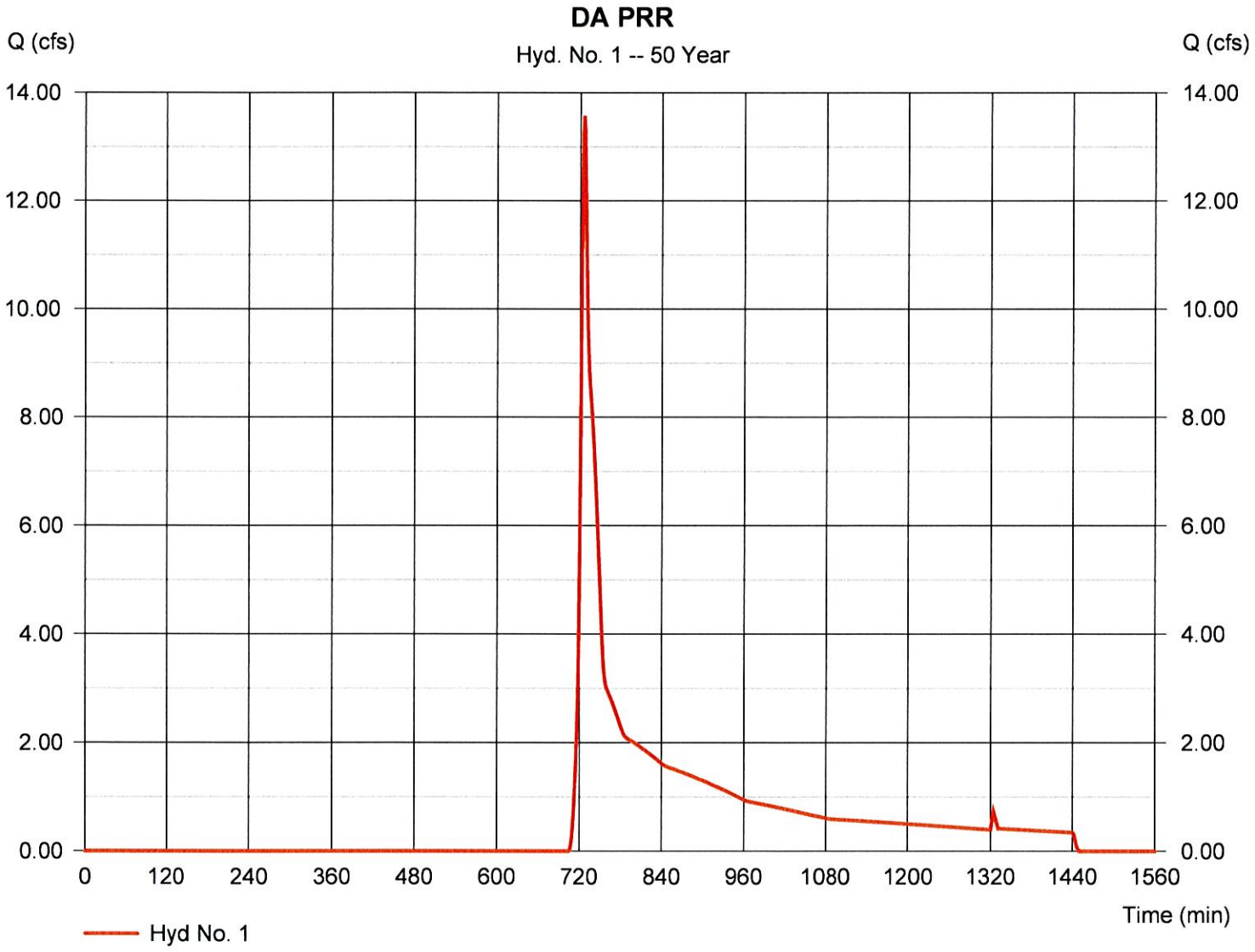
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	13.58	1	726	54,574	------	------	------	DA PRR
2	SCS Runoff	21.07	1	729	80,015	------	------	------	DA #1 POST
3	SCS Runoff	10.17	1	725	31,407	------	------	------	DA 3 POST
4	Reservoir	5.134	1	755	38,223	2	14.31	44,647	POND #1
5	Reservoir	1.588	1	754	14,947	3	20.00	17,249	POND 3
6	SCS Runoff	23.87	1	726	77,261	------	------	------	DA POST #2
7	Reservoir	8.490	1	743	44,564	6	16.90	36,708	POND #2
8	Combine	12.93	1	752	97,734	4, 5, 7	------	------	Post DA Total

Hydrograph Report

Hyd. No. 1

DA PRR

Hydrograph type	= SCS Runoff	Peak discharge	= 13.58 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 54,574 cuft
Drainage area	= 9.070 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

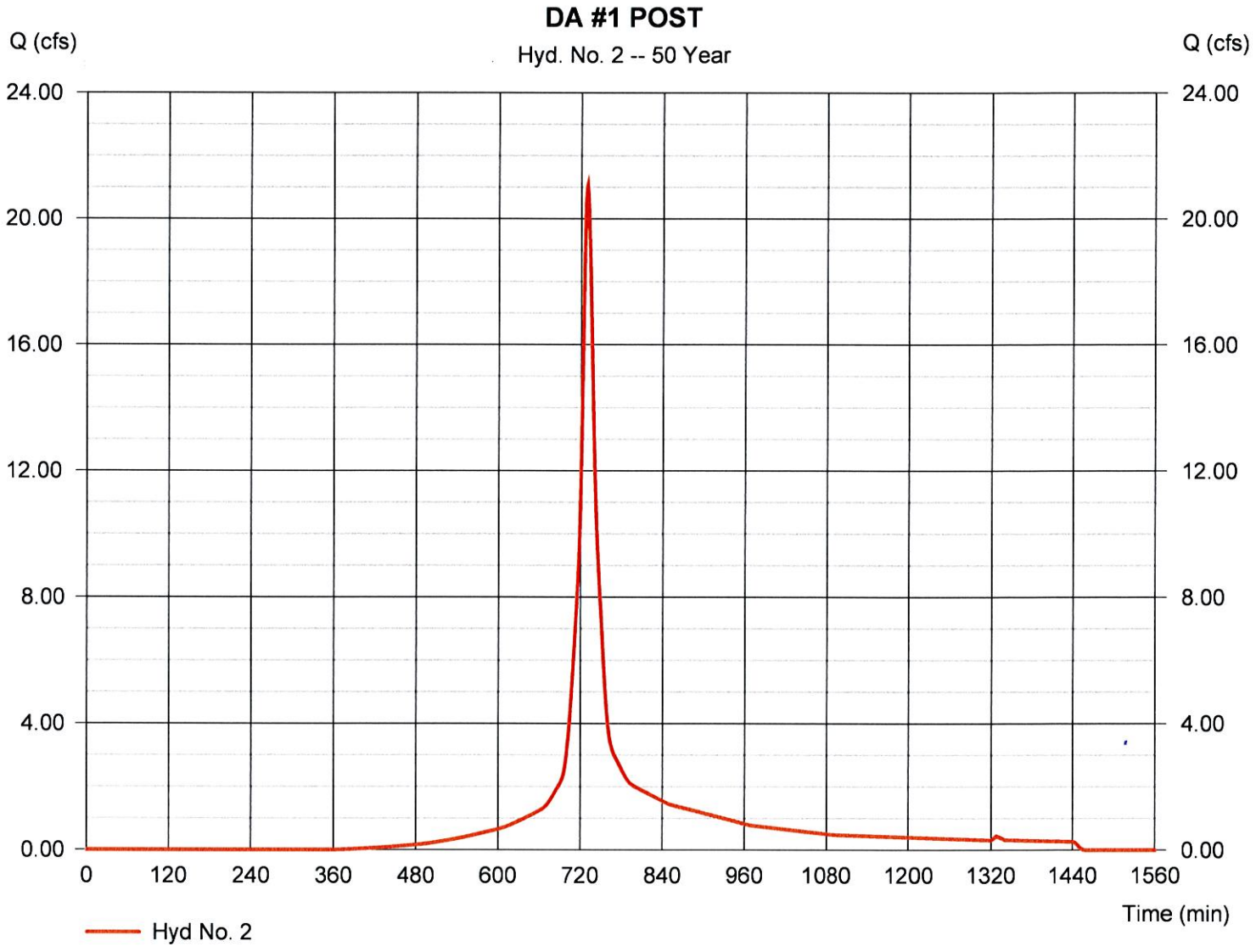


Hydrograph Report

Hyd. No. 2

DA #1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 21.07 cfs
Storm frequency	= 50 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 80,015 cuft
Drainage area	= 3.680 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



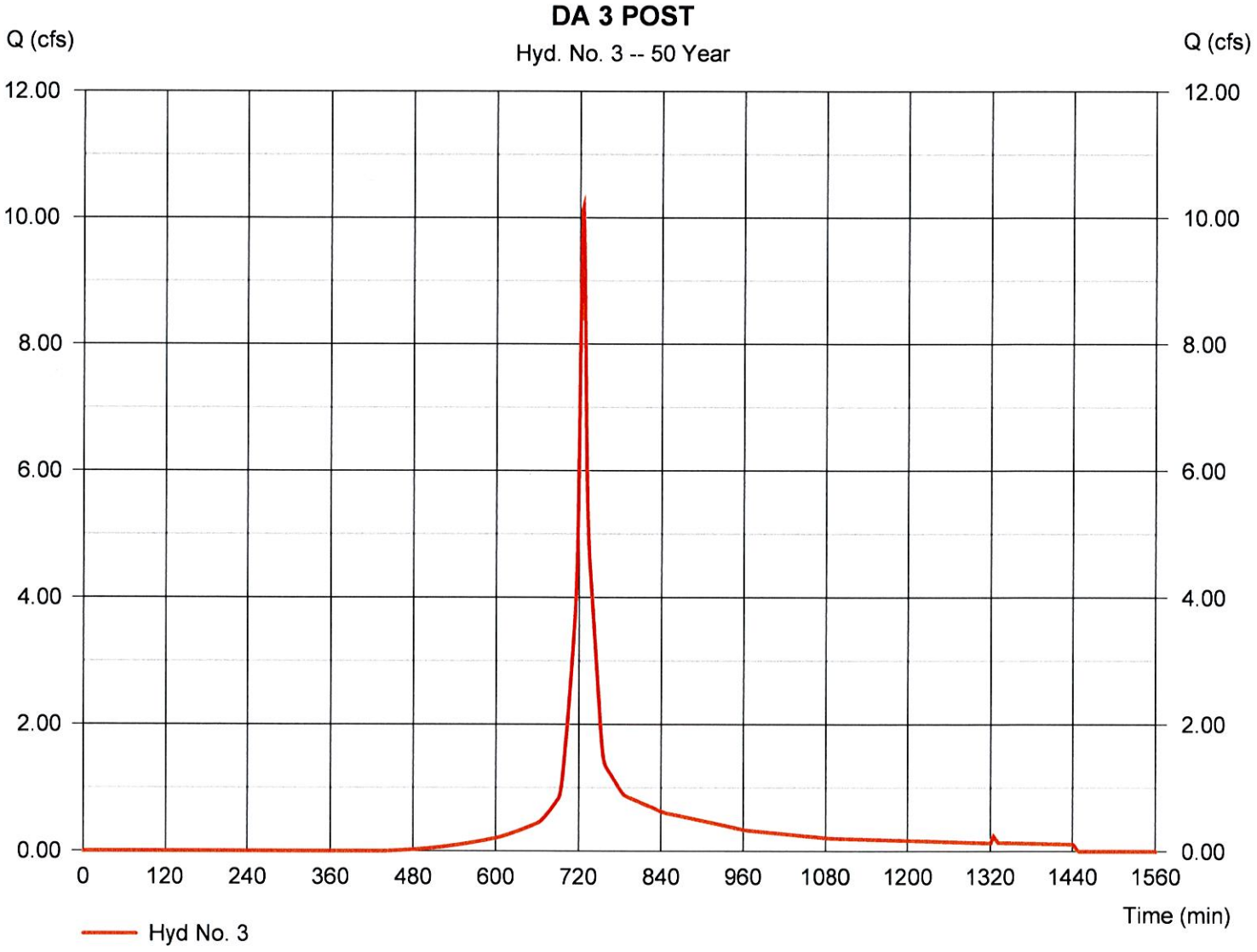
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 09 / 4 / 2017

Hyd. No. 3

DA 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 10.17 cfs
Storm frequency	= 50 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 31,407 cuft
Drainage area	= 1.570 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



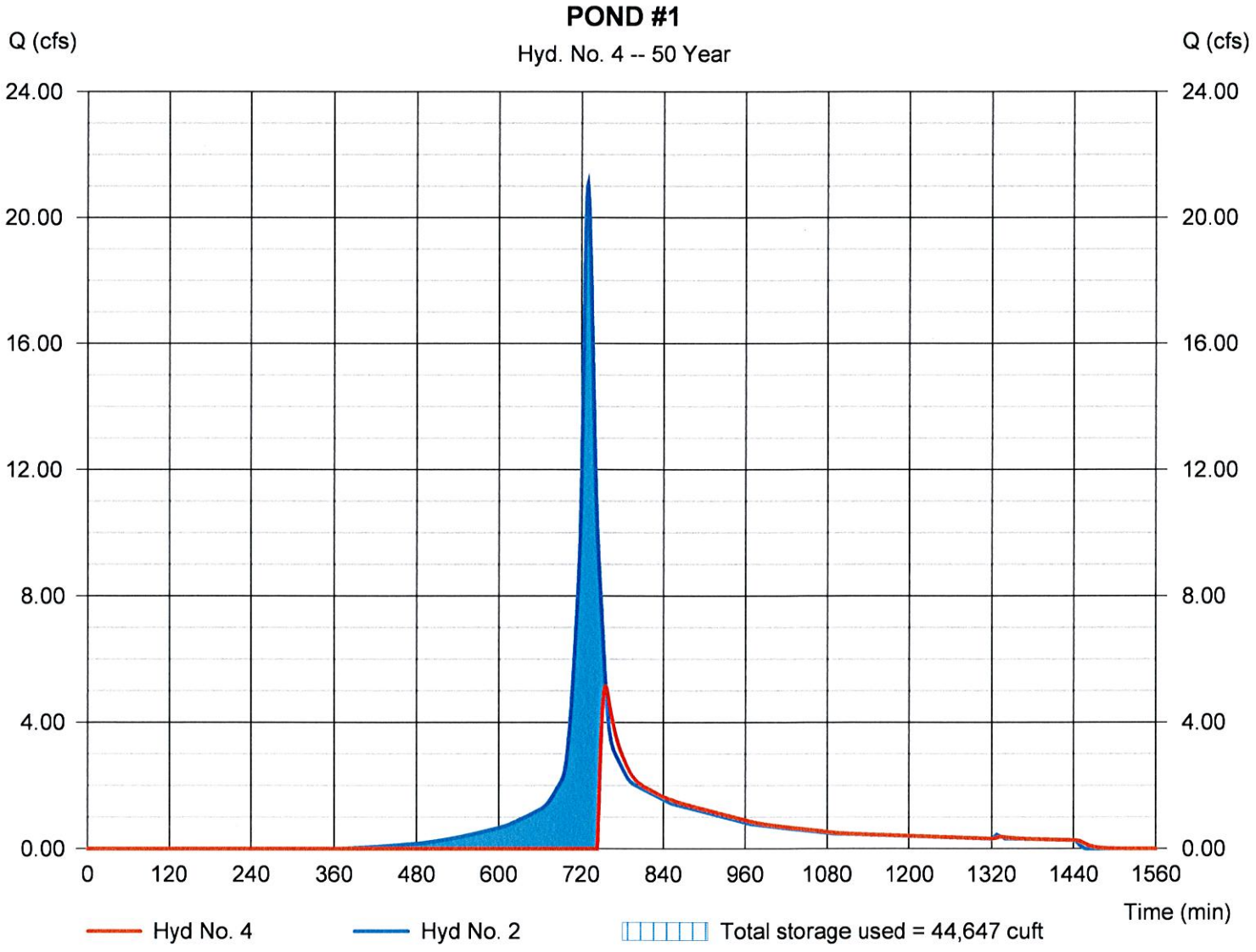
Hydrograph Report

Hyd. No. 4

POND #1

Hydrograph type	= Reservoir	Peak discharge	= 5.134 cfs
Storm frequency	= 50 yrs	Time to peak	= 755 min
Time interval	= 1 min	Hyd. volume	= 38,223 cuft
Inflow hyd. No.	= 2 - DA #1 POST	Max. Elevation	= 14.31 ft
Reservoir name	= Pond#1	Max. Storage	= 44,647 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Pond#1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 10.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	10.00	7,026	0	0
0.50	10.50	7,968	3,746	3,746
1.00	11.00	8,867	4,206	7,952
2.00	12.00	10,050	9,451	17,403
3.00	13.00	11,291	10,663	28,067
3.60	13.60	12,062	7,004	35,071
4.60	14.60	14,874	13,442	48,513

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	0.00	0.00
Span (in)	= 24.00	1.75	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 10.00	10.00	0.00	0.00
Length (ft)	= 41.00	0.00	0.00	0.00
Slope (%)	= 1.34	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)	Inactive	20.00	0.00	0.00
Crest El. (ft)	= 13.60	14.10	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	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).

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	10.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.50	3,746	10.50	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.00	7,952	11.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.00	17,403	12.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.00	28,067	13.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.60	35,071	13.60	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
4.60	48,513	14.60	0.00	0.00	---	---	0.00	18.38	---	---	---	---	18.38

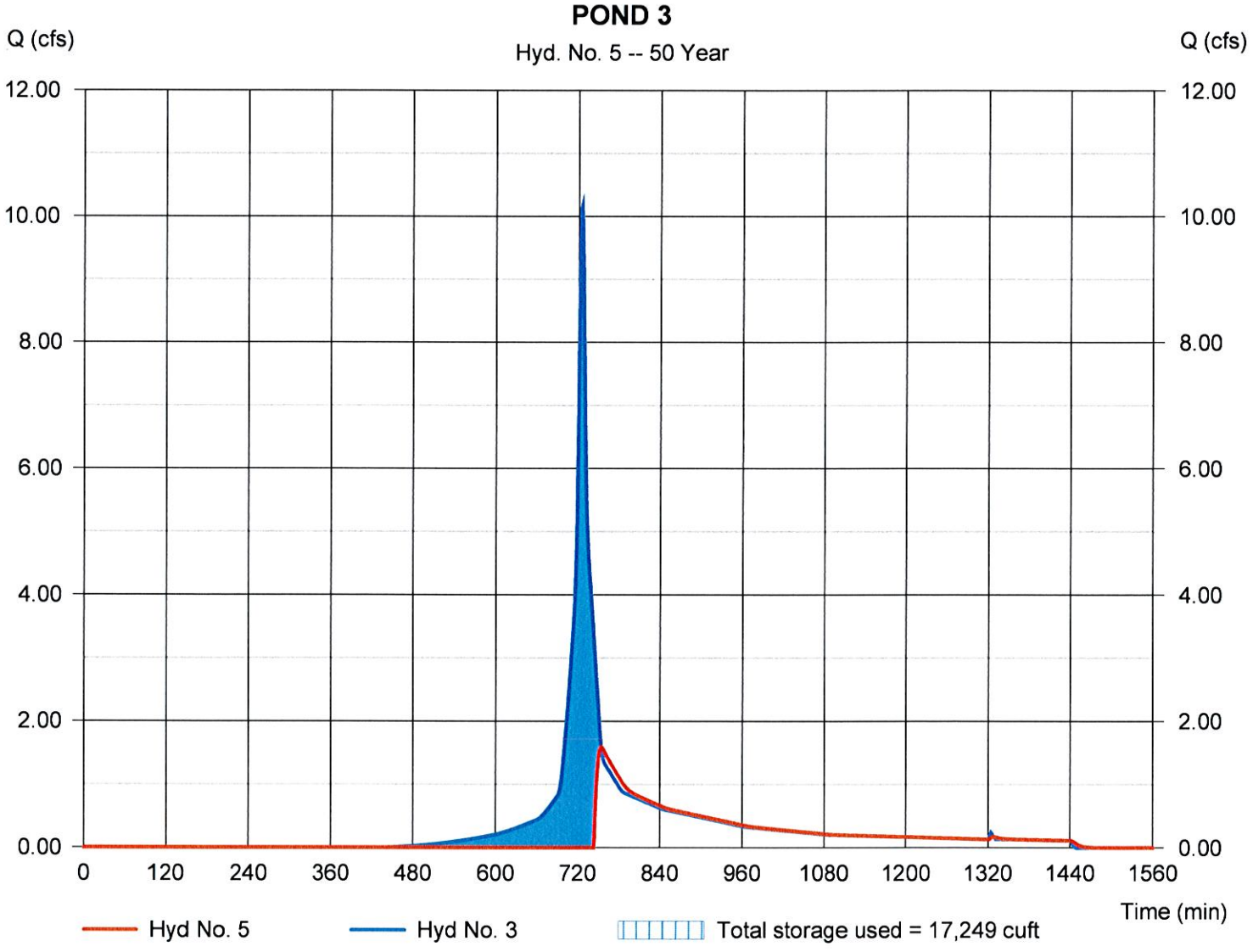
Hydrograph Report

Hyd. No. 5

POND 3

Hydrograph type	= Reservoir	Peak discharge	= 1.588 cfs
Storm frequency	= 50 yrs	Time to peak	= 754 min
Time interval	= 1 min	Hyd. volume	= 14,947 cuft
Inflow hyd. No.	= 3 - DA 3 POST	Max. Elevation	= 20.00 ft
Reservoir name	= Pond 3	Max. Storage	= 17,249 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Pond 3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 17.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	17.50	4,711	0	0
0.50	18.00	6,275	2,737	2,737
1.50	19.00	7,157	6,710	9,447
1.90	19.40	7,448	2,921	12,368
2.90	20.40	8,940	8,182	20,550

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	0.00	0.00
Span (in)	= 15.00	1.25	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 17.50	17.50	0.00	0.00
Length (ft)	= 35.00	0.00	0.00	0.00
Slope (%)	= 0.30	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)	Inactive	20.00	0.00	0.00
Crest El. (ft)	= 19.40	19.90	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	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).

Stage / Storage / Discharge Table

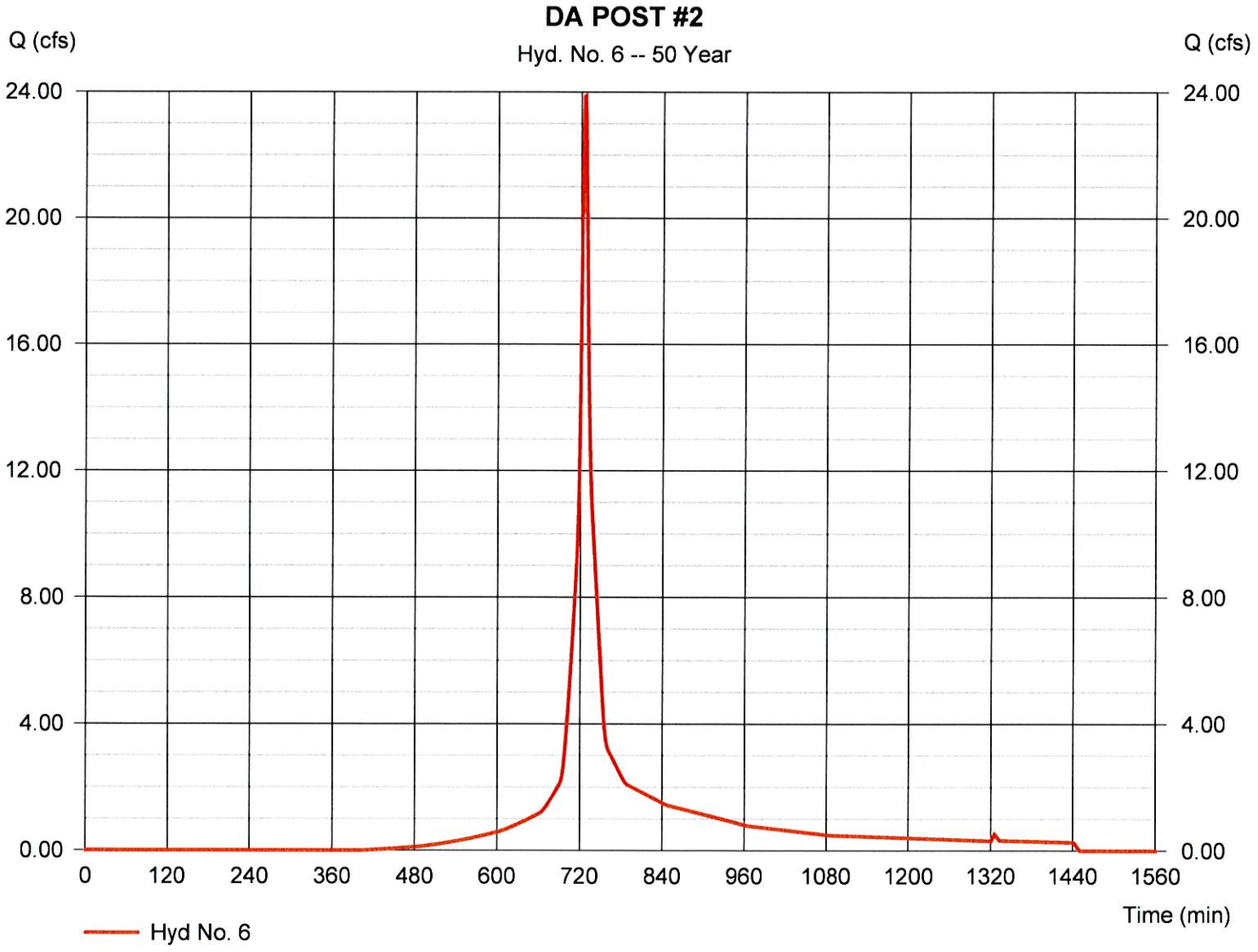
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	17.50	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.50	2,737	18.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.50	9,447	19.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.90	12,368	19.40	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.90	20,550	20.40	0.00	0.00	---	---	0.00	18.38	---	---	---	---	18.38

Hydrograph Report

Hyd. No. 6

DA POST #2

Hydrograph type	= SCS Runoff	Peak discharge	= 23.87 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 77,261 cuft
Drainage area	= 3.820 ac	Curve number	= 73
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 9.01 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



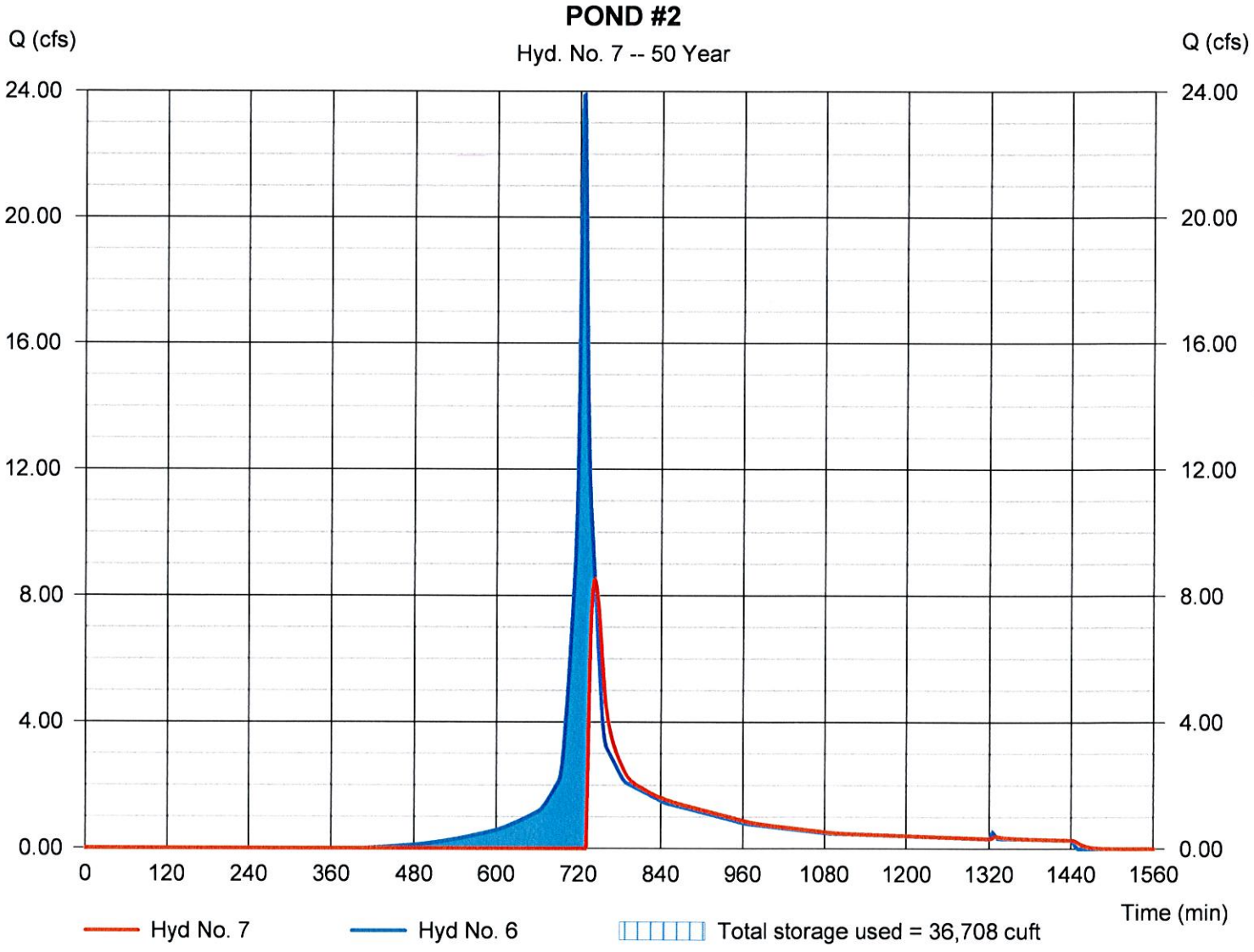
Hydrograph Report

Hyd. No. 7

POND #2

Hydrograph type	= Reservoir	Peak discharge	= 8.490 cfs
Storm frequency	= 50 yrs	Time to peak	= 743 min
Time interval	= 1 min	Hyd. volume	= 44,564 cuft
Inflow hyd. No.	= 6 - DA POST #2	Max. Elevation	= 16.90 ft
Reservoir name	= POND#2	Max. Storage	= 36,708 cuft

Storage Indication method used.



Pond No. 3 - POND#2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 13.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	13.50	7,376	0	0
0.50	14.00	8,937	4,072	4,072
1.50	15.00	10,354	9,636	13,707
2.50	16.00	11,828	11,082	24,789
2.60	16.10	11,979	1,190	25,979
3.60	17.00	14,946	13,434	39,413

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	0.00	0.00
Span (in)	= 24.00	1.60	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 13.50	13.50	0.00	0.00
Length (ft)	= 34.00	0.00	0.00	0.00
Slope (%)	= 1.25	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)	Inactive	20.00	0.00	0.00
Crest El. (ft)	= 16.10	16.60	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	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).

Stage / Storage / Discharge Table

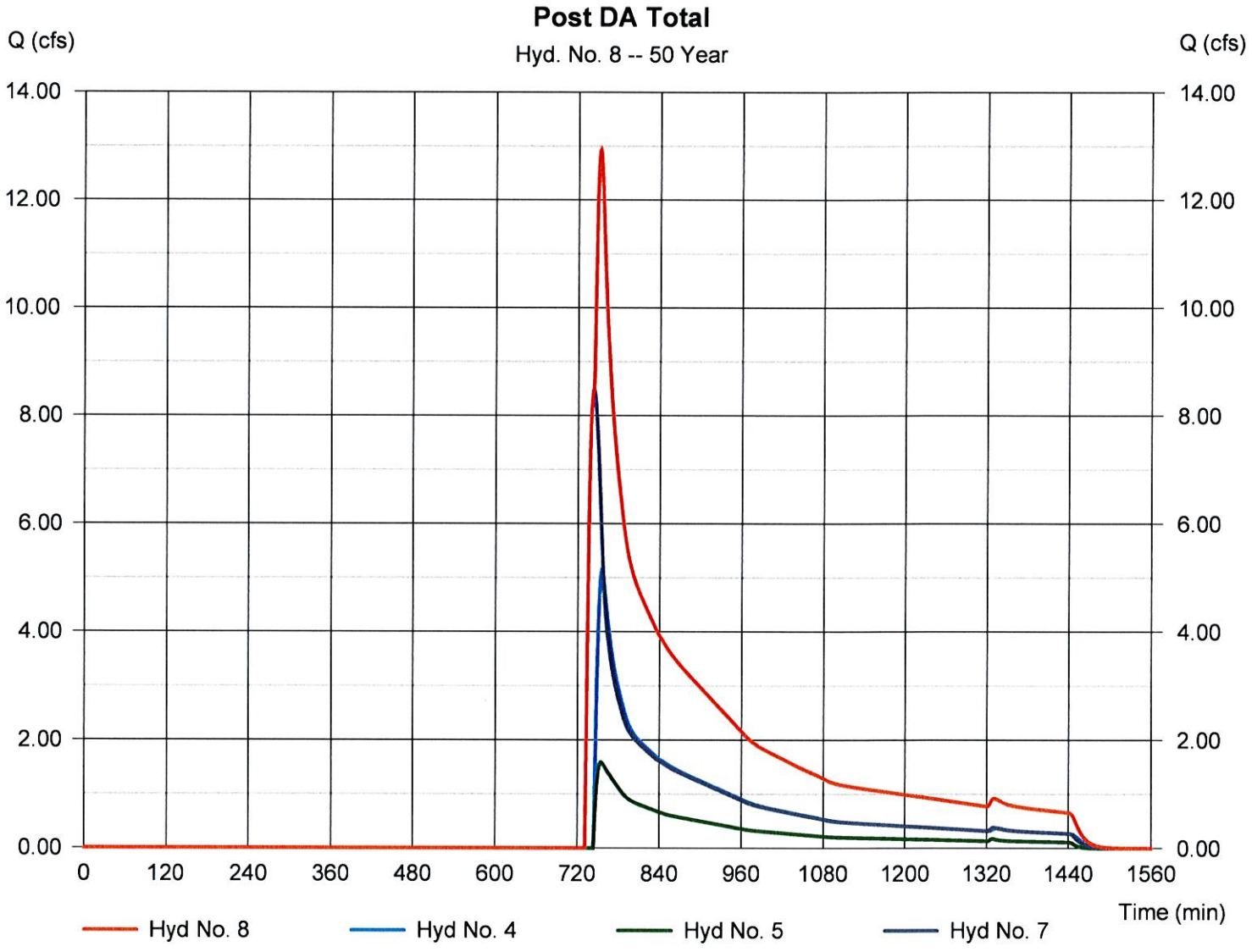
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	13.50	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.50	4,072	14.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.50	13,707	15.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.50	24,789	16.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.60	25,979	16.10	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.60	39,413	17.00	0.00	0.00	---	---	0.00	13.16	---	---	---	---	13.16

Hydrograph Report

Hyd. No. 8

Post DA Total

Hydrograph type	= Combine	Peak discharge	= 12.93 cfs
Storm frequency	= 50 yrs	Time to peak	= 752 min
Time interval	= 1 min	Hyd. volume	= 97,734 cuft
Inflow hyds.	= 4, 5, 7	Contrib. drain. area	= 0.000 ac



CATCH BASIN TABLE (10-YEAR)

PROJECT: **Woodfield Wilmington**
DESCRIPTION: **CATCH BASIN**
PROJECT NO. **7075-0002**
DATE PREPARED: **7/25/2017**
PREPARED FOR : **WF INDEPENDENCE BOULEVARD, LLC**
PREPARED BY : **MB**
REVIEWED BY : **ES**

Label	Spread / Top Width (ft)	Inlet Location	Longitudinal Slope (Inlet) (ft/ft)	Intercepted Rational Flow (cfs)	Bypassed Rational Flow (cfs)	Bypass Target	Inlet Drainage Area (acres)	Inlet C	Total Inlet Tc (hours)	Total Inlet Intensity (in/h)	Curb Opening Length (ft)
CB-100	7.8	In Sag		1.44	0.00		0.60	0.64	0.700	3.7	3
CB-101	2.7	In Sag		0.33	0.00		0.12	0.74	0.700	3.7	3
CB-102	5.6	In Sag		0.89	0.00		0.32	0.74	0.700	3.7	3
CB-103	1.0	In Sag		0.08	0.00		0.03	0.74	0.700	3.7	3
CB-104	2.9	In Sag		0.35	0.00		0.13	0.72	0.700	3.7	3
CB-105	4.8	In Sag		0.70	0.00		0.24	0.78	0.700	3.7	3
CB-106	7.5	In Sag		1.36	0.00		0.49	0.74	0.700	3.7	3
DI-100	13.9	In Sag		2.78	0.00		0.95	0.78	0.700	3.7	
DI-101	9.5	In Sag		1.43	0.00		0.49	0.78	0.700	3.7	
CB-209	3.8	In Sag		0.51	0.00		0.20	0.68	0.700	3.7	3
CB-210	2.4	In Sag		0.28	0.00		0.11	0.68	0.700	3.7	3
CB-211	1.0	In Sag		0.05	0.00		0.02	0.68	0.700	3.7	3
CB-212	4.7	In Sag		0.69	0.00		0.27	0.68	0.700	3.7	3
CB-208	1.2	In Sag		0.10	0.00		0.04	0.68	0.700	3.7	3
CB-207	3.1	In Sag		0.39	0.00		0.15	0.7	0.700	3.7	3
CB-206	1.1	In Sag		0.10	0.00		0.04	0.64	0.700	3.7	3
CB-205	2.6	In Sag		0.31	0.00		0.13	0.64	0.700	3.7	3
CB-204	1.7	In Sag		0.17	0.00		0.07	0.64	0.700	3.7	3
CB-203	2.4	In Sag		0.29	0.00		0.12	0.64	0.700	3.7	3
CB-202	2.6	In Sag		0.31	0.00		0.12	0.7	0.700	3.7	3
CB-201	7.0	In Sag		1.23	0.00		0.47	0.7	0.700	3.7	3
CB-200	7.0	In Sag		1.22	0.00		0.44	0.74	0.700	3.7	3
CB-304	3.0	In Sag		0.38	0.00		0.14	0.72	0.700	3.7	3
CB-305	2.4	In Sag		0.27	0.00		0.10	0.72	0.700	3.7	3
CB-306	2.4	In Sag		0.27	0.00		0.10	0.72	0.700	3.7	3
CB-303	5.0	In Sag		0.76	0.00		0.28	0.72	0.700	3.7	3
CB-302	2.6	In Sag		0.31	0.00		0.11	0.74	0.700	3.7	3
CB-301	5.4	In Sag		0.83	0.00		0.30	0.74	0.700	3.7	3
DI-300	2.9	In Sag		0.11	0.00		0.03	0.95	0.700	3.7	

CATCH BASIN TABLE (50-YEAR)

PROJECT: **Woodfield Wilmington**
DESCRIPTION: **CATCH BASIN**
PROJECT NO. **7075-0002**

DATE PREPARED: **7/25/2017**
PREPARED FOR : **WF INDEPENDENCE BOULEVARD, LLC**
PREPARED BY : **MB**
REVIEWED BY : **ES**

Label	Spread / Top Width (ft)	Inlet Location	Longitudinal Slope (Inlet) (ft/ft)	Intercepted Rational Flow (cfs)	Bypassed Rational Flow (cfs)	Bypass Target	Inlet Drainage Area (acres)	Inlet C	Total Inlet Tc (hours)	Total Inlet Intensity (in/h)	Curb Opening Length (ft)
CB-100	9.2	In Sag		1.85	0.00		0.60	0.6	0.700	4.8	3
CB-101	3.3	In Sag		0.43	0.00		0.12	0.7	0.700	4.8	3
CB-102	6.7	In Sag		1.14	0.00		0.32	0.7	0.700	4.8	3
CB-103	1.2	In Sag		0.11	0.00		0.03	0.7	0.700	4.8	3
CB-104	3.5	In Sag		0.45	0.00		0.13	0.7	0.700	4.8	3
CB-105	5.7	In Sag		0.90	0.00		0.24	0.8	0.700	4.8	3
CB-106	8.9	In Sag		1.75	0.00		0.49	0.7	0.700	4.8	3
DI-100	16.2	In Sag		3.57	0.00		0.95	0.8	0.700	4.8	
DI-101	11.0	In Sag		1.84	0.00		0.49	0.8	0.700	4.8	
CB-209	4.6	In Sag		0.66	0.00		0.20	0.7	0.700	4.8	3
CB-210	2.9	In Sag		0.36	0.00		0.11	0.7	0.700	4.8	3
CB-211	1.0	In Sag		0.07	0.00		0.02	0.7	0.700	4.8	3
CB-212	5.6	In Sag		0.89	0.00		0.27	0.7	0.700	4.8	3
CB-208	1.4	In Sag		0.13	0.00		0.04	0.7	0.700	4.8	3
CB-207	3.8	In Sag		0.51	0.00		0.15	0.7	0.700	4.8	3
CB-206	1.4	In Sag		0.12	0.00		0.04	0.6	0.700	4.8	3
CB-205	3.2	In Sag		0.40	0.00		0.13	0.6	0.700	4.8	3
CB-204	2.0	In Sag		0.22	0.00		0.07	0.6	0.700	4.8	3
CB-203	3.0	In Sag		0.37	0.00		0.12	0.6	0.700	4.8	3
CB-202	3.2	In Sag		0.41	0.00		0.12	0.7	0.700	4.8	3
CB-201	8.3	In Sag		1.59	0.00		0.47	0.7	0.700	4.8	3
CB-200	8.3	In Sag		1.57	0.00		0.44	0.7	0.700	4.8	3
CB-304	3.7	In Sag		0.49	0.00		0.14	0.7	0.700	4.8	3
CB-305	2.8	In Sag		0.35	0.00		0.10	0.7	0.700	4.8	3
CB-306	2.8	In Sag		0.35	0.00		0.10	0.7	0.700	4.8	3
CB-303	6.0	In Sag		0.97	0.00		0.28	0.7	0.700	4.8	3
CB-302	3.1	In Sag		0.39	0.00		0.11	0.7	0.700	4.8	3
CB-301	6.4	In Sag		1.07	0.00		0.30	0.7	0.700	4.8	3
DI-300	3.2	In Sag		0.14	0.00		0.03	1.0	0.700	4.8	

PIPE TABLE (10-YEAR)

PROJECT: **Woodfield Wilmington**
DESCRIPTION: **Pipe Table**
PROJECT NO. **7075-0002**

DATE PREPARED: **7/25/2017**
PREPARED FOR : **WF INDEPENDENCE BOULEVARD, LLC**
PREPARED BY : **MB**
REVIEWED BY : **ES**

Start Node	Stop Node	Upstream Inlet Area (acres)	System Drainage Area (acres)	Upstream Inlet Tc (hours)	Upstream Inlet C	Flow (cfs)	Slope (Calculated) (ft/ft)	Diameter (in)	Velocity (ft/s)	Length (Unified) (ft)	Capacity (Full Flow) (cfs)	Time (Pipe Flow) (hours)	Invert (Start) (ft)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (Out) (ft)
CB-203	CB-204	0.12	0.10	0.700	0.64	0.29	0.005	12	0.37	39.1	2.61	0.030	13.78	16.35	16.25	13.57	16.30	16.25
CB-204	CB-205	0.07	0.20	0.700	0.64	0.45	0.006	12	0.57	59.3	2.66	0.029	13.57	16.30	16.25	13.24	16.26	16.24
CB-205	SDMH-200	0.13	0.30	0.700	0.64	0.74	0.004	15	0.6	51	4.14	0.024	13.24	16.26	16.24	13.03	18.93	16.24
SDMH-200	CB-207	(N/A)	1.40	0.000	(N/A)	3.42	0.002	24	1.09	117.2	9.35	0.030	13.03	18.93	16.24	12.83	16.30	16.21
CB-207	CB-208	0.15	1.50	0.700	0.70	3.70	0.002	24	1.18	80.8	9.42	0.019	12.83	16.30	16.21	12.69	16.20	16.19
CB-208	FES-200	0.04	2.20	0.700	0.68	5.12	0.002	30	1.04	108.5	17.16	0.029	12.69	16.20	16.19	12.50	17.00	16.17
CB-200	CB-201	0.44	0.40	0.700	0.74	1.22	0.012	12	1.55	112.3	3.83	0.020	14.60	18.95	16.43	13.30	16.60	16.30
CB-201	CB-202	0.47	0.90	0.700	0.70	2.42	0.003	18	1.37	27.8	5.64	0.006	13.30	16.60	16.30	13.22	16.60	16.28
CB-202	SDMH-200	0.12	1.00	0.700	0.70	2.72	0.003	18	1.54	73.6	5.34	0.013	13.22	16.60	16.28	13.03	18.93	16.24
CB-206	SDMH-200	0.04	0.00	0.700	0.64	0.10	0.019	12	0.12	24.1	4.97	0.055	13.50	16.50	16.24	13.03	18.93	16.24
CB-209	CB-210	0.20	0.20	0.700	0.68	0.51	0.005	15	0.42	69.5	4.58	0.046	13.55	16.30	16.21	13.20	16.24	16.20
CB-210	CB-211	0.11	0.30	0.700	0.68	0.76	0.009	15	0.62	10.7	6.25	0.005	13.20	16.24	16.20	13.10	16.30	16.20
CB-211	CB-212	0.02	0.30	0.700	0.68	0.81	0.005	15	0.66	57.2	4.52	0.024	13.10	16.30	16.20	12.82	16.23	16.19
CB-212	CB-208	0.27	0.60	0.700	0.68	1.45	0.003	18	0.82	39.1	6.06	0.013	12.82	16.23	16.19	12.69	16.20	16.19
CB-304	CB-305	0.14	0.10	0.700	0.72	0.38	0.002	12	0.48	82.8	1.52	0.048	17.90	20.15	19.48	17.75	20.45	19.47
CB-305	CB-306	0.10	0.20	0.700	0.72	0.63	0.003	12	0.8	16.2	1.98	0.006	17.75	20.45	19.47	17.70	20.45	19.47
CB-306	CB-303	0.10	0.30	0.700	0.72	0.88	0.006	15	0.72	120	4.93	0.046	17.70	20.45	19.47	17.00	20.10	19.44
CB-303	FES-300	0.28	1.10	0.700	0.72	2.71	0.011	18	1.53	22.5	11.06	0.004	17.00	20.10	19.44	16.75	20.00	19.43
DI-300	CB-301	0.03	0.00	0.700	0.95	0.11	0.015	12	2.33	167.1	4.36	0.020	21.00	25.40	21.13	18.50	22.00	19.55
CB-301	CB-302	0.30	0.30	0.700	0.74	0.93	0.006	12	1.18	78.1	2.85	0.018	18.50	22.00	19.55	18.00	20.80	19.49
CB-302	CB-303	0.11	0.40	0.700	0.74	1.21	0.023	12	1.54	42.8	5.44	0.008	18.00	20.80	19.49	17.00	20.10	19.44
CB-100	CB-101	0.60	0.60	0.700	0.64	1.44	0.003	15	1.17	114.9	3.67	0.027	11.93	15.00	14.33	11.56	14.90	14.27
CB-101	CB-102	0.12	0.70	0.700	0.74	1.74	0.003	18	0.98	62.6	5.31	0.018	11.56	14.90	14.27	11.40	14.90	14.26
CB-102	CB-103	0.32	1.00	0.700	0.74	2.57	0.003	18	1.46	79.1	5.41	0.015	11.40	14.90	14.26	11.19	15.20	14.21
CB-103	CB-104	0.03	1.10	0.700	0.74	2.62	0.005	18	1.49	21.5	7.16	0.004	11.19	15.20	14.21	11.09	14.80	14.20
CB-104	CB-105	0.13	1.20	0.700	0.72	2.95	0.003	18	1.67	129.4	5.38	0.022	11.09	14.80	14.20	10.75	14.50	14.09
CB-105	CB-106	0.24	1.40	0.700	0.78	3.56	0.003	18	2.02	97.2	5.33	0.013	10.75	14.50	14.09	10.50	14.00	13.98
CB-106	SDMH-100	0.49	3.40	0.700	0.74	8.70	0.002	24	2.77	226	11.26	0.023	10.50	14.00	13.98	9.94	15.50	13.65
SDMH-100	FES-100	(N/A)	3.40	0.000	(N/A)	8.55	0.002	30	1.74	19.6	18.54	0.003	9.94	15.50	13.65	9.90	14.00	13.64
DI-100	DI-101	0.95	0.90	0.700	0.78	2.78	0.012	15	2.26	45.2	7.13	0.006	11.50	14.75	14.34	10.95	14.75	14.26
DI-101	CB-106	0.49	1.40	0.700	0.78	4.19	0.003	18	2.37	173.4	5.35	0.020	10.95	14.75	14.26	10.50	14.00	13.98

PIPE TABLE (50-YEAR)

PROJECT: **Woodfield Wilmington**
DESCRIPTION: **Pipe Table**
PROJECT NO. **7075-0002**

DATE PREPARED: **7/25/2017**
PREPARED FOR : **WF INDEPENDENCE BOULEVARD, LLC**
PREPARED BY : **MB**
REVIEWED BY : **ES**

Start Node	Stop Node	Upstream Inlet Area (acres)	System Drainage Area (acres)	Upstream Inlet Tc (hours)	Upstream Inlet C	Flow (cfs)	Slope (Calculated) (ft/ft)	Diameter (in)	Velocity (ft/s)	Length (Unified) (ft)	Capacity (Full Flow) (cfs)	Time (Pipe Flow) (hours)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (Out) (ft)
CB-203	CB-204	0.12	0.10	0.700	0.6	0.37	0.005	12	0.47	39.1	2.61	0.023	13.78	16.35	16.28	13.57	16.30	16.28
CB-204	CB-205	0.07	0.20	0.700	0.6	0.58	0.006	12	0.73	59.3	2.66	0.022	13.57	16.30	16.28	13.24	16.26	16.26
CB-205	SDMH-200	0.13	0.30	0.700	0.6	0.96	0.004	15	0.78	51	4.14	0.018	13.24	16.26	16.29	13.03	18.93	16.28
SDMH-200	CB-207	(N/A)	1.40	0.000	(N/A)	4.47	0.002	24	1.42	117.2	9.35	0.023	13.03	18.93	16.28	12.83	16.30	16.24
CB-207	CB-208	0.15	1.50	0.700	0.7	4.87	0.002	24	1.55	80.8	9.42	0.014	12.83	16.30	16.24	12.69	16.20	16.20
CB-208	FES-200	0.04	2.20	0.700	0.7	6.77	0.002	30	1.38	108.5	17.16	0.022	12.69	16.20	16.45	12.50	17.00	16.42
CB-200	CB-201	0.44	0.40	0.700	0.7	1.57	0.012	12	2.00	112.3	3.83	0.016	14.60	18.95	16.61	13.30	16.60	16.39
CB-201	CB-202	0.47	0.90	0.700	0.7	3.12	0.003	18	1.77	27.8	5.64	0.004	13.30	16.60	16.39	13.22	16.60	16.37
CB-202	SDMH-200	0.12	1.00	0.700	0.7	3.51	0.003	18	1.99	73.6	5.34	0.010	13.22	16.60	16.37	13.03	18.93	16.28
CB-206	SDMH-200	0.04	0.00	0.700	0.6	0.12	0.019	12	0.16	24.1	4.97	0.043	13.50	16.50	16.28	13.03	18.93	16.28
CB-209	CB-210	0.20	0.20	0.700	0.7	0.66	0.005	15	0.53	69.5	4.58	0.036	13.55	16.30	16.24	13.20	16.24	16.23
CB-210	CB-211	0.11	0.30	0.700	0.7	0.99	0.009	15	0.81	10.7	6.25	0.004	13.20	16.24	16.23	13.10	16.30	16.23
CB-211	CB-212	0.02	0.30	0.700	0.7	1.05	0.005	15	0.86	57.2	4.52	0.019	13.10	16.30	16.23	12.82	16.23	16.21
CB-212	CB-208	0.27	0.60	0.700	0.7	1.89	0.003	18	1.07	39.1	6.06	0.010	12.82	16.23	16.21	12.69	16.20	16.20
CB-304	CB-305	0.14	0.10	0.700	0.7	0.49	0.002	12	0.62	82.8	1.52	0.037	17.90	20.15	19.67	17.75	20.45	19.65
CB-305	CB-306	0.10	0.20	0.700	0.7	0.81	0.003	12	1.03	16.2	1.98	0.004	17.75	20.45	19.65	17.70	20.45	19.64
CB-306	CB-303	0.10	0.30	0.700	0.7	1.15	0.006	15	0.93	120	4.93	0.036	17.70	20.45	19.64	17.00	20.10	19.61
CB-303	FES-300	0.28	1.10	0.700	0.7	3.55	0.011	18	2.01	22.5	11.06	0.003	17.00	20.10	19.61	16.75	20.00	19.58
DI-300	CB-301	0.03	0.00	0.700	1.0	0.14	0.015	12	2.53	167.1	4.36	0.018	21.00	25.40	21.15	18.50	22.00	19.78
CB-301	CB-302	0.30	0.30	0.700	0.7	1.19	0.006	12	1.52	78.1	2.85	0.014	18.50	22.00	19.78	18.00	20.80	19.69
CB-302	CB-303	0.11	0.40	0.700	0.7	1.56	0.023	12	1.99	42.8	5.44	0.006	18.00	20.80	19.69	17.00	20.10	19.61
CB-100	CB-101	0.60	0.60	0.700	0.6	1.85	0.003	15	1.51	114.9	3.67	0.021	11.93	15.00	14.59	11.56	14.90	14.50
CB-101	CB-102	0.12	0.70	0.700	0.7	2.25	0.003	18	1.27	62.6	5.31	0.014	11.56	14.90	14.50	11.40	14.90	14.47
CB-102	CB-103	0.32	1.00	0.700	0.7	3.34	0.003	18	1.89	79.1	5.41	0.012	11.40	14.90	14.47	11.19	15.20	14.39
CB-103	CB-104	0.03	1.10	0.700	0.7	3.42	0.005	18	1.93	21.5	7.16	0.003	11.19	15.20	14.39	11.09	14.80	14.36
CB-104	CB-105	0.13	1.20	0.700	0.7	3.85	0.003	18	2.18	129.4	5.38	0.017	11.09	14.80	14.36	10.75	14.50	14.19
CB-105	CB-106	0.24	1.40	0.700	0.8	4.66	0.003	18	2.64	97.2	5.33	0.010	10.75	14.50	14.19	10.50	14.00	14.00
CB-106	SDMH-100	0.49	3.40	0.700	0.7	11.42	0.002	24	3.63	226	11.26	0.017	10.50	14.00	14.44	9.94	15.50	13.86
SDMH-100	FES-100	(N/A)	3.40	0.000	(N/A)	11.27	0.002	30	2.30	19.6	18.54	0.002	9.94	15.50	13.86	9.90	14.00	13.85
DI-100	DI-101	0.95	0.90	0.700	0.8	3.57	0.012	15	2.91	45.2	7.13	0.004	11.50	14.75	14.60	10.95	14.75	14.46
DI-101	CB-106	0.49	1.40	0.700	0.8	5.40	0.003	18	3.06	173.4	5.35	0.016	10.95	14.75	14.46	10.50	14.00	14.00

McKIM&CREED **Project #:7075-0002**

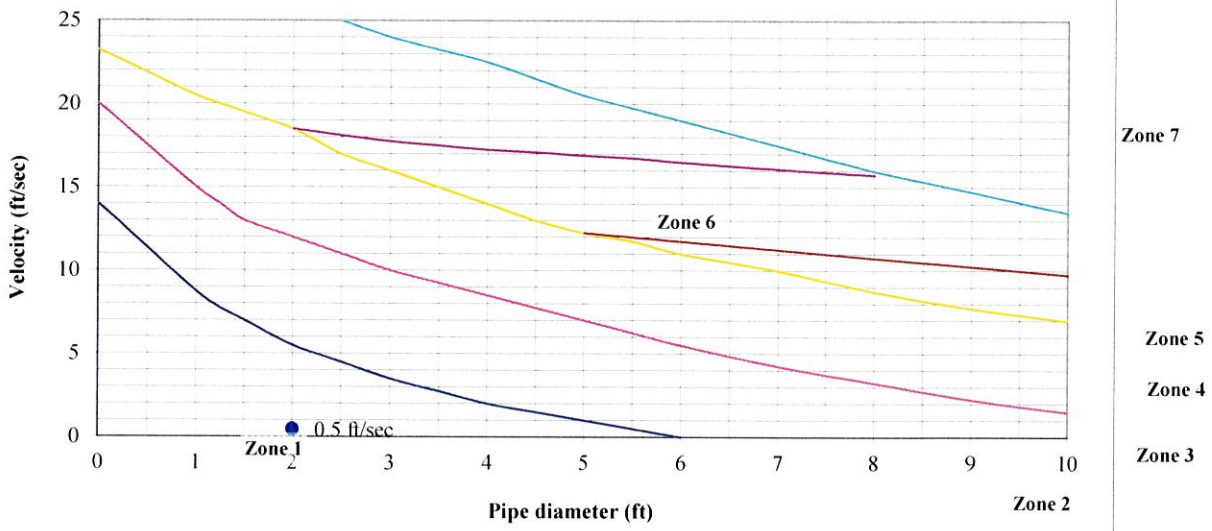
Energy Dissipater Design

Date: 8/03/17

Project Name: Woodfield Apartments (Pond #1 24" RCP Outlet)

Outlet flowrate	0.817	cfs
Pipe diameter	24	inches
Outlet pipe slope	1.34	percent
Des. flow velocity	0.46	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	24 in.	Length =	8.0 ft.
Outlet flowrate	0.8 cfs	Width =	6.0 ft.
Outlet velocity	0.5 ft/sec	Stone diameter =	3 in.
Material =	Class A	Thickness =	9 in.

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	4 x D(o)	3 x D(o)
2	Class B	6	22	6 x D(o)	3 x D(o)
3	Class I	13	22	8 x D(o)	3 x D(o)
4	Class I	13	22	8 x D(o)	3 x D(o)
5	Class II	23	27	10 x D(o)	3 x D(o)
6	Class II	23	27	10 x D(o)	3 x D(o)
7	Special study required				

Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual

McKIM&CREED **Project #:7075-0002**

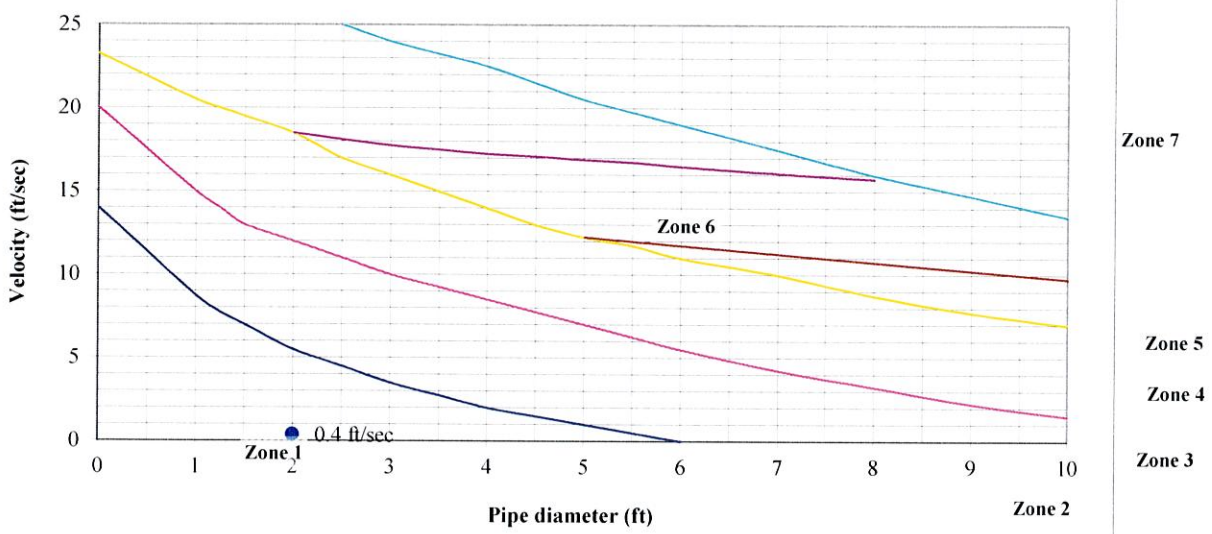
Energy Dissipater Design

Date: 8/03/17

Project Name: Woodfield Apartments (Pond #2 24" RCP Outlet)

Outlet flowrate	1.246	cfs
Pipe diameter	24	inches
Outlet pipe slope	1.25	percent
Des. flow velocity	0.40	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	24 in.	Length =	8.0 ft.
Outlet flowrate	1.2 cfs	Width =	6.0 ft.
Outlet velocity	0.4 ft/sec	Stone diameter =	3 in.
Material =	Class A	Thickness =	9 in.

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	4 x D(o)	3 x D(o)
2	Class B	6	22	6 x D(o)	3 x D(o)
3	Class I	13	22	8 x D(o)	3 x D(o)
4	Class I	13	22	8 x D(o)	3 x D(o)
5	Class II	23	27	10 x D(o)	3 x D(o)
6	Class II	23	27	10 x D(o)	3 x D(o)
7	Special study required				

Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual

McKIM&CREED **Project #:7075-0002**

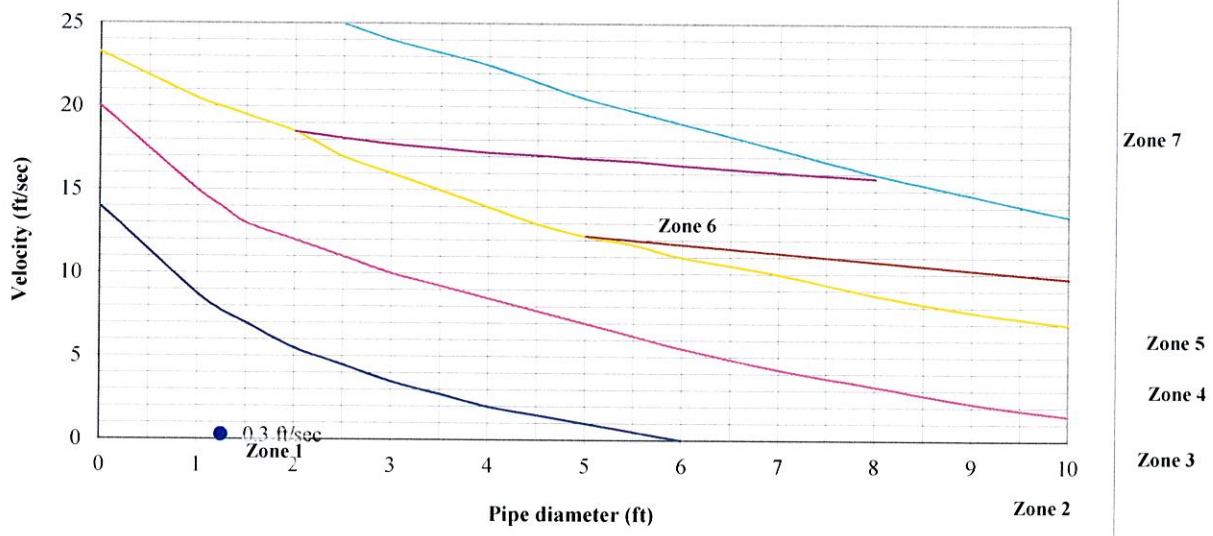
Energy Dissipater Design

Date: 8/03/2017

Project Name: Woodfield Apartments (Pond #3 15" RCP Outlet)

Outlet flowrate	0.531	cfs
Pipe diameter	15	inches
Outlet pipe slope	0.29	percent
Des. flow velocity	0.30	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	15 in.	Length =	5.0 ft.
Outlet flowrate	0.5 cfs	Width =	3.8 ft.
Outlet velocity	0.3 ft/sec	Stone diameter =	3 in.
Material =	Class A	Thickness =	9 in.

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	4 x D(o)	3 x D(o)
2	Class B	6	22	6 x D(o)	3 x D(o)
3	Class I	13	22	8 x D(o)	3 x D(o)
4	Class I	13	22	8 x D(o)	3 x D(o)
5	Class II	23	27	10 x D(o)	3 x D(o)
6	Class II	23	27	10 x D(o)	3 x D(o)
7	Special study required				

Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual