40 Wickes Way

A.P. 347, Lot 476
50 Child Street
Warwick, Rhode Island

Drainage Analysis

Prepared for:

40 Wicks Way, LLC
c/o Frank Paolino
144 Metro Center Blvd, Unit F
Warwick, RI 02886

Prepared by:

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STATE OF RHODE ISLAND
No. 5238
10/24/23
REGISTERED PROFESSIONAL ENGINEER

Project Number: 21.345.591

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Folder at the end of the report holds the full-size Project Watershed Maps (24x36)

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I. INTRODUCTION

This Stormwater Management Plan is prepared in support of 40 Wickes Way, a proposed 39-Lot residential subdivision located in Warwick, Rhode Island.

The property is located on the south side of Main Avenue, between Child Lane and Buttonwoods Avenue. The property is 10.67 acres in size and is identified as Warwick Tax Assessors Plat 347, Lot 476. The property is the site of the former John Wicke Elementary School. The school building was recently razed.

The proposed subdivision is for the development of 39 single family house lots with associated improvements. All the proposed lots will be accessed by newly constructed roadways as part of the subdivision proposal. Each dwelling will be serviced by public water, sewer, underground electric and natural gas.

The property lies within "Urban Region" which designates a twenty-five-foot (25') buffer zone from the edge of the swamp that falls along the western border of eth property. Additionally due to the presence of a stream within 50-fet of the delineated wetland edge an additional 25-foot buffer would be applied (50-foot total). (See Freshwater Wetland Delineation report by Natural Resource Services, Inc. attached)

There are no documented occurrences of any rare native plants, rare native animals, or rare freshwater wetland types on the property.

The site lies within a Zone "X" – Areas determined to be outside the 0.2% annual chance floodplain as shown on the National Flood Insurance Rate Map\ for Kent County Community Panel Number 44003C0133H, Map Revised September 18, 2013. No work is proposed that will result in any net reduction in flood storage capacity or reduce the rate at which floodwater is stored by the floodplain.

The current ground cover consists of the existing school building (to be razed) and associated paved areas as well as a lawn area and wooded perimeter. There is a wetlands complex located to the west end of the property. The existing terrain slopes generally to the southwest and into the wetland complex. The appropriate jurisdictional buffers have been maintained to protect the existing wetlands. According to RIDEM mapping, the site does not lie within any natural heritage areas or groundwater protection areas. The site does not lie within any of the town historic districts.

The total impervious surface existing on site is 3.25 acres which is only 30.5 % of the site so it does not qualify as a "Redevelopment Site".

This report analyses the existing and proposed condition of the entire project site.

Soils and Rainfall

The soils within the subject project are defined by the Soil Survey of Rhode Island and comprised of UD (Udorthents Land Complex) but surrounded by native soils Ss (Sudbury) sandy loams with a hydrologic soil group (HSG) rating of B and Udorthents, urban land complex with an HSG of B. Sub-classifications of these soils are considered suitable for community development. Water tables have been determined in the areas of the development and designs have taken them into account.

For this study, the storm events utilize the NRCS Type III precipitation distribution for a 24-hour duration storm (see Table 1). Additional information about the soils and Kent County rainfall can be found the Appendix.

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Storm Frequency	1-yr	10-yr	100-yr
Rainfall Amount (in)	2.70	4.80	8.70

Table 1. Rainfall Amounts

Test Holes
Seven test holes were performed and analyzed throughout the site. The seasonable high groundwater was estimated to be at 3 and 4 feet in the area of the stormwater management facilities and deeper elsewhere on site. The soils were established to be sandy loam and sands. Ledge was not encountered in any of the testing. Detailed results of the test holes are in the Appendix.

II. PRE-DEVELOPMENT HYDROLOGIC CONDITIONS

Under existing conditions, the site was divided into 2 watersheds (E1 – POS 1) & E2 – POS 2). E1drains to Point of Study 1 (POS 1) the existing wetlands located along the western edge of the project site. E2 drains toward POS 2 , Buttonwoods Avenue to the east. Watershed maps are provided in the Appendix.

Watershed E1 – POS 1 flows in a southwesterly direction and contains most of the site including the entire existing building and paved area as well as some lawn and wooded grounds.

Stormwater within watershed E2 - POS 2 flows in an easterly direction toward the city drainage system within Buttonwoods Avenue. The predeveloped conditions of watershed E2 – POS 2 is entirely wooded.

Existing Runoff Curve Number Data (CN) and Hydrologic Calculations

Hydraflow Hydrograph Extension for AutoCAD 2019, a TR-55 stormwater-based analysis for AutoCAD software was used to demonstrate existing peak runoff flows and volumes at the subject points of study using the Runoff Curve Numbers (CN), times of concentration (Tc), watershed areas and rainfall distribution. For this analysis, existing cover was considered woods, grass/woods combination in "good" condition or impervious. The details are provided in Appendix C and a summary is provided below.

Watershed ID	Land Cover	Area (ac)	CN
E1 - POS 1	Woods	4.0	55
	Grass	2.02	61
	Impervious (school)	1.20	98
	Impervious (paved)	2.06	98
	Total / Composite CN	**9.28**	**71**
	Tc (min)	**49.2**	
E2 – POS 2	Woods	0.62	55
	Grass	n/a	61
	Impervious	n/a	98
	Total / Composite CN	**1.09**	**55**
	Tc (min)	**28.5**	

Table 2. Existing Watershed Descriptions

Peak Flow (cfs)			
Storm Frequency	**1-year**	**10-year**	**100-year**
E1 - POS 1 (Wetland)	2.50	9.54	25.80
E2 – POS 2 (Buttonwoods Ave)	0.14	0.31	1.40

Table 3. Existing Runoff Summary

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III. POST DEVELOPMENT HYDROLOGIC CONDITIONS

The proposed project encompasses the demolition of the former elementary school and its parking areas as well as the construction of two new roadways and the creation of 39 new residential parcels (min. 7,000 sf). Access to the site will be from both Child Lane at the west end and Buttonwoods Avenue at the east end of the new subdivision.

The site incorporates the use of new roadway catch basins to capture stormwater, a sediment forebay to settle sands and heavy pollutants and infiltration basin to provide stormwater quality treatment. Together, the Stormwater Management System (SMS) reduces peak flow rates and treats stormwater to improve water quality downstream. The overall Stormwater Management Plan (SMP) mitigates the impacts of stormwater due to the proposed development.

For this study, the proposed site was divided into six watersheds (P1, P2, P3, P4, P5, P6 and P7 – POS 1 Direct) and analyzed at point of study (POS 1), the existing wetland. POS 2, Buttonwoods Avenue's drainage system, does not receive any measurable stormwater flow in the post development condition so there was no need to analyze POS 2.

Watershed P1-P6 isolate the developed site into drainage areas that are captured by each set of catch basins within the new roadways. The watersheds are captured and directed via underground drain lines to the SMS. Each parcel is assumed to have the following development:

1 - 26' x 46' dwelling ~ 1,196 sf
1 – driveway/sidewalk ~ 600 sf

Summary:

ID	# homes
P1	6
P2	4.5
P3	8
P4	9
P5	8
P6	2.5
P7	1
Total:	39 homes

Flow is directed from the rear of each house lot toward the front, draining into the roadway and captured by the proposed drainage system. The drainage system directs the stormwater to the SMS where it is collected, detained, treated, and infiltrated or discharged back to the wetland located on-site.

Watershed P7 – POS 1 Direct consists of a small area of the site in the northwest portion that cannot be captured by the drainage system, so it drains directly into the wetland area.

Total impervious surface in post developed site is 3.15 acres, a reduction in the overall coverage but much of the new impervious surface is located in areas that were not impervious under existing conditions thus the site was treated as new impervious with all required water quality volume being accounted for.

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Proposed Runoff Curve Number Data (CN) and Hydrologic Calculations

Hydraflow Hydrograph Extension for AutoCAD 2019, a TR-55 stormwater based analysis for AutoCAD software was used to demonstrate the proposed peak runoff flows and volumes at the subject points of study using the Runoff Curve Numbers (CN), times of concentration (Tc), watershed areas and rainfall distribution. The details for the analysis are provided in Appendix D and a summary is provided below.

Watershed ID	Land Cover	Area (ac)	CN
P1	Grass	1.54	61
	Impervious (6 dwellings)	0.16	98
	Impervious (driveway)	0.08	98
	Impervious (public walk)	0.05	98
	Impervious (public road)	0.17	98
	Total / Composite CN	**2.00**	**70**
	Tc (min)	**13.6**	
P2	Grass	0.77	61
	Impervious (4.5 dwellings)	0.12	98
	Impervious (driveway)	0.06	98
	Impervious (public walk)	0.04	98
	Impervious (public road)	0.15	98
	Total / Composite CN	**1.14**	**73**
	Tc (min)	**11.2**	
P3	Grass	1.27	61
	Impervious (4.5 dwellings)	0.22	98
	Impervious (driveway)	0.11	98
	Impervious (public walk)	0.07	98
	Impervious (public road)	0.26	98
	Total / Composite CN	**1.93**	74
	Tc (min)	**16.3**	
P4	Grass	1.24	61
	Impervious (4.5 dwellings)	0.25	98
	Impervious (driveway)	0.12	98
	Impervious (public walk)	0.06	98
	Impervious (public road)	0.20	98
	Total / Composite CN	**1.87**	**73**
	Tc (min)	**16.7**	
P5	Grass	0.96	61
	Impervious (4.5 dwellings)	0.22	98
	Impervious (driveway)	0.11	98
	Impervious (public walk)	0.07	98
	Impervious (public road)	0.28	98
	Total / Composite CN	**1.64**	**76**
	Tc (min)	**14.7**	
P6	Grass	0.40	61
	Impervious (4.5 dwellings)	0.07	98

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	Impervious (driveway)	0.03	98
	Impervious (public walk)	0.02	98
	Impervious (public road)	0.07	98
	Total / Composite CN	**0.59**	**82**
	Tc (min)	**13.2**	
P7 – POS 1 Direct	Grass	0.58	61
	Impervious (4.5 dwellings)	0.03	98
	Impervious (driveway)	0.01	98
	Impervious (public walk)	0.02	98
	Impervious (public road)	0.06	98
	Total / Composite CN	**0.70**	**67**
	Tc (min)	**6.8**	

Table 4. Proposed Watershed Data

Peak Flow (cfs)			
Storm Frequency	**1-year**	**10-year**	**100-year**
P1	0.84	3.39	9.32
P2	0.63	2.20	5.68
P3	1.12	3.76	9.50
P4	1.00	3.50	9.02
P5	1.15	3.56	8.67
P6	0.63	1.63	3.56
Combined flow into CB-1	**5.33**	**17.95**	**45.57**
P7 – POS 1 Direct	0.25	1.24	3.63

Table 5. Proposed Runoff Summary

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IV. STORMWATER QUALITY AND BMPS

The proposed development incorporates several BMPs throughout the site to maximize water quality and infiltration. Stormwater is collected in proposed catch basins and piped into a riprap lined Sediment Forebay, providing settling, water quality treatment and infiltration. This structure is designed to accept large flows and calm them, allowing discharge into a grass sloped, sandy bottom infiltration basin. This basin provides treatment through infiltration, and peak attenuation through storage of stormwater. The recharge volumes below do not include the additional recharge volume obtained within the Sediment Forebay as it is expected the bottom will silt in quickly. Below please find details of each BMP.

Recharge Volume (cf)		
Watershed ID	Required	Provided
P1-P7	**4,002**	**9,860**

Water Quality Volume (cf)		
Watershed ID	Required	Provided
P1-7	**11,433**	**11,817**

Table 6. Recharge & Water Quality Volumes

BMP Geometry:

CB-1

Inside Bottom	**33.0**	**elev.**
Inside Top	**39.7**	**elev.**
Rim	**40.63**	**elev.**
Length	**16**	**ft**
Width	**8**	**ft**
Height	**6.7**	**ft**
Outlet	**3**	**ft vr weir**
Weir Inv.	**36.0**	**elev.**

Sediment Forebay

Bottom	**35.0**	**elev.**
Bot. Area	**414**	**sf**
Rim	**40.0**	**elev.**
Rim Area	**1,245**	**sf**
Outlet	**12**	**ft cipoletti weir**
Weir Inv.	**38.1**	**elev.**

Infiltration Basin

Bottom	**37.0**	**elev.**
Bot. Area	**16,000**	**sf**
Rim	**40.0**	**elev.**
Rim Area	**20,590**	**sf**

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Outlet	**4**	**12" dia ADS**
	4	**8" dia ADS**
Outlet Invs.	**37.6**	**elev.**
Emergency Overflow	**10**	**ft cipoletti weir**
Overflow Inv.	**39.5**	**elev.**
Separation to SHGWT	**3**	**ft**

PROPOSED BMP OPERATIONAL SUMMARY

Storm Frequency	1-yr			10-yr			100-yr		
Data	Q in (cfs)	Q out (cfs)	Water Surface	Q in (cfs)	Q out (cfs)	Water Surface	Q in (cfs)	Q out (cfs)	Water Surface
CB-1	5.3	5.3	36.6	18.0	18.0	37.5	45.6	45.6	38.7
Sed. Forebay	5.3	5.1	38.4	18.0	17.7	38.7	45.6	45.3	39.2
Infil. Basin	5.1	0.0	37.3	17.7	6.2	38.1	45.3	24.4	39.3

Table 7. Proposed BMP Summary

EXISTING / PROPOSED PEAK RUNOFF COMPARISON

Storm Frequency	1-yr		10-yr		100-yr	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
POS 1	2.5	0.25	9.5	6.7	25.8	25.8
Difference (cfs)	-2.25		-2.8		0	
% Reduction	-90 %		-30 %		-0 %	

Table 8. Existing vs. Proposed Runoff Summary

V. MINIMUM STORMWATER MANAGEMENT STANDARDS

The Rhode Island Stormwater Design and Installation Standards Manual (RISDISM) defines eleven (11) minimum design standards for stormwater management. Please refer to Appendix A for the completed Stormwater Management Checklist. Below is a summary of how this project addresses each of the design standards.

Standard 1: LID Site Planning and Design Strategies

The site utilizes a sediment forebay and an infiltration basin for stormwater for stormwater quantity management.

Standard 2: Groundwater Recharge

The SMP incorporates a 16,000 sf infiltration basin which provided more than required groundwater recharge for the site (Appendix E).

Standard 3: Water Quality

The stormwater quality for the site is achieved using a sediment forebay and infiltration basin. The provided volume exceeds the required water quality volume for the site (Appendix E).

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Standard 4: Conveyance and Natural Channel Protection

This standard requires that open drainage and pipe conveyance systems provide for at least the peak flow from the 10-year, 24-hour storm. For this project, the system has been designed for the peak 100-year storm. In addition, the infiltration basin provides infiltration.

Standard 5: Overbank Flood Protection

The infiltration basin is designed to decrease or hold even the 1- through 100-year peak discharge rates. Please refer to Section IV of this report.

Standard 6: Redevelopment and Infill Projects

This standard is not applicable to this project.

Standard 7: Pollution Prevention

A Pollution Prevention Plan has been provided as part of the Operation and Maintenance Plan (Appendix G).

Standard 8: LUHPPLs

This standard is not applicable to this project.

Standard 9: Illicit Discharges

No illicit discharges exist or are proposed.

Standard 10: Construction Erosion and Sediment Control

Please refer to the site plans for the short and long term SESC maintenance requirements. A stand-alone Soil Erosion and Sediment Control Plan is also provided.

Standard 11: Stormwater Management Operation and Maintenance

Please refer to Appendix G for the Stormwater Management Operation and Maintenance Plan.

VI. PIPE SIZING CALCULATIONS

The proposed drainage pipes in the project were sized for the 100-year storm. Please refer to the Grading and Drainage Plan for detailed information about the drainage pipes throughout the site. Calculations are provide in section E of the appendix.

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VII. CONCLUSION

The stormwater design proposed for this development is in conformance with the Rhode Island Stormwater Design and Installation Standards Manual. Stormwater runoff will be reduced as a result of the proposed development, greatly reducing any impacts to neighboring properties. The BMPs throughout the site provide the required recharge and stormwater quality requirements. This development provides a sound and safe stormwater design.

VIII - APPENDICES

Appendix A – Stormwater Management Checklist

Appendix B – Reduced Project Watershed Maps (11x17)

Appendix C – Pre-Development Hydraflow Stormwater Modeling Printouts

Appendix D – Post Development Stormwater Modeling Printouts

Appendix E – BMP Sizing Calculation Worksheets

Appendix F – Stormwater Management Operation and Maintenance Plan

Appendix G – Supporting Documentation

- Rainfall data
- Soils Data & Evaluation Forms

Folder at rear holds the full-size Project Watershed Maps (24x36)

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Appendix A

Stormwater Management Checklist A

APPENDIX A: STORMWATER MANAGEMENT PLAN CHECKLIST AND LID PLANNING REPORT – STORMWATER DESIGN SUMMARY

PROJECT NAME 40 Wickes Way	(RIDEM USE ONLY) STW/WQC File #:
TOWN Warwick	Date Received:
BRIEF PROJECT DESCRIPTION: R&D existing elementary School and creation of 39 lot (7,000 sf parcels) residential subdivision with 2 new public roadways.	

Stormwater Management Plan (SMP) Elements – Minimum Standards

Submit four separately bound documents: Appendix A Checklist; Stormwater Site Planning, Analysis and Design Report with Plan Set/Drawings; Soil Erosion and Sediment Control (SESC) Plan, and Post Construction Operations and Maintenance (O&M) Plan. Please refer to Suggestions to Promote Brevity.

Note: **All stormwater construction projects must submit a Stormwater Management Plan (SMP). However, not every element listed below is required per the RIDEM Stormwater Rules and the RIPDES Construction General Permit (CGP). This checklist will help identify the required elements to be submitted with an Application for Stormwater Construction Permit & Water Quality Certification.**

PART 1. PROJECT AND SITE INFORMATION

PROJECT TYPE (Check all that apply)

☒ Residential	☐ Commercial	☐ Federal	☐ Retrofit	☐ Restoration
☒ Road	☐ Utility	☐ Fill	☐ Dredge	☐ Mine
☐ Other (specify):				

SITE INFORMATION

☒ Vicinity Map

INITIAL DISCHARGE LOCATION(S): The WQv discharges to: (You may choose more than one answer if several discharge points are associated with the project.) See Guidance to identify receiving waters.

☒ **Groundwater**	☒ **Surface Water**	☐ **MS4**
☐ GAA	☒ Isolated Wetland	☐ RIDOT
☐ GA	☐ Named Waterbody	☐ RIDOT Alteration Permit is Approved
☒ GB	☒ Unnamed Waterbody Connected to Named Waterbody	☐ Town
		☐ Other (specify):

ULTIMATE RECEIVING WATERBODY LOCATION(S): Include pertinent information that applies to both WQ_v and flow from larger storm events including overflows. Choose all that apply, and repeat table for each waterbody.

☒ Groundwater or Disconnected Wetland	☒ SRWP		
☒ Waterbody Name: Brushneck Cove	☐ Coldwater	☐ Warmwater	☒ Unassessed
☒ Waterbody ID: RI0007025E-02	☒ 4th order stream of pond 50 acres or more		
☒ TMDL for: Fecal Coliform	☐ Watershed of flood prone river (e.g., Pocasset River)		
☐ Contributes to a priority outfall listed in the TMDL	☒ Contributes stormwater to a public beach		
☒ 303(d) list – Impairment(s) for: Fecal Coliform / Dissolved Oxygen / Total Nigrogen	☒ Contributes to shellfishing grounds		

PROJECT HISTORY		
☐ RIDEM Pre- Application Meeting	Meeting Date:	☐ Minutes Attached
☒ Municipal Master Plan Approval	Approval Date: 12/14/2022	☒ Minutes Attached
☐ Subdivision Suitability Required	Approval #:	
☐ Previous Enforcement Action has been taken on the property	Enforcement #:	

FLOODPLAIN & FLOODWAY See Guidance Pertaining to Floodplain and Floodways	
☐ Riverine 100-year floodplain: **FEMA FLOODPLAIN FIRMETTE** has been reviewed and the 100-year floodplain is on site	
☐ Delineated from FEMA Maps	
NOTE: Per Rule 250-RICR-150-10-8-1.1(B)(5)(d)(3), provide volumetric floodplain compensation calculations for cut and fill/displacement calculated by qualified professional	
☐ Calculated by Professional Engineer	
☐ Calculations are provided for cut vs. fill/displacement volumes proposed within the 100-year floodplain	Amount of Fill (CY): Amount of Cut (CY):
☐ Restrictions or modifications are proposed to the flow path or velocities in a floodway	
☐ Floodplain storage capacity is impacted	
☒ Project area is not within 100-year floodplain as defined by RIDEM	

CRMC JURISDICTION
☐ CRMC Assent required
☐ Property subject to a Special Area Management Plan (SAMP). If so, specify which SAMP:
☐ Sea level rise mitigation has been designed into this project

LUHPPL IDENTIFICATION - MINIMUM STANDARD 8:

1. OFFICE OF WASTE MANAGEMENT (OWM)

	☐ Known or suspected releases of HAZARDOUS MATERIAL are present at the site (Hazardous Material is defined in Rule 1.4(A)(33) of 250-140-30-1 of the RIDEM Rules and Regulations for Investigation and Remediation of Hazardous Materials (the Remediation Regulations))	**RIDEM CONTACT:**
	☐ Known or suspected releases of PETROLEUM PRODUCT are present at the site (Petroleum Product as defined in Rule 1.5(A)(84) of 250-140-25-1 of the RIDEM Rules and Regulations for Underground Storage Facilities Used for Regulated Substances and Hazardous Materials)	
	☐ This site is identified on the RIDEM Environmental Resources Map as one of the following regulated facilities	**SITE ID#:**
	☐ CERCLIS/Superfund (NPL)	
	☐ State Hazardous Waste Site (SHWS)	
	☐ Environmental Land Usage Restriction (ELUR)	
	☐ Leaking Underground Storage Tank (LUST)	
	☐ Closed Landfill	

Note: If any boxes in 1 above are checked, the applicant must contact the RIDEM OWM Project Manager associated with the Site to determine if subsurface infiltration of stormwater is allowable for the project. Indicate if the infiltration corresponds to "Red," "Yellow" or "Green" as described in Section 3.2.8 of the RISDISM Guidance (Subsurface Contamination Guidance). Also, note and reference approval in PART 3, Minimum Standard 2: Groundwater Recharge/Infiltration.

2. PER MINIMUM STANDARD 8 of RICR 8.14.C.1-6 "LUHPPLS," THE SITE IS/HAS:

	☐ Industrial Site with RIPDES MSGP, except where No Exposure Certification exists. http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/status.php	
	☐ Auto Fueling Facility (e.g., gas station)	
	☐ Exterior Vehicles Service, Maintenance, or Equipment Cleaning Area	

	☐ Road Salt Storage and Loading Areas (exposed to rainwater)	
	☐ Outdoor Storage and Loading/Unloading of Hazardous Substances	
3. STORMWATER INDUSTRIAL PERMITTING		
	☐ The site is associated with existing or proposed activities that are considered Land Uses with Higher Potential Pollutant Loads (LUHPPLS) (see RICR 8.14.C)	Activities: Sector:
	☐ Construction is proposed on a site that is subject to THE MULTI-SECTOR GENERAL PERMIT (MSGP) UNDER RULE 31(B)15 OF THE RIPDES REGULATIONS.	MSGP permit #
	☐ Additional stormwater treatment is required by the MSGP **Explain:**	

REDEVELOPMENT STANDARD – MINIMUM STANDARD 6		
☒ Pre-Construction Impervious Area		
3.25 ac	☒ Total Pre-Construction Impervious Area (**TIA**)	
10.67 ac	☒ Total Site Area (**TSA**)	
0.77 ac	☒ Jurisdictional Wetlands (**JW**)	
0.25 ac	☒ Conservation Land (**CL**)	
☒ Calculate the Site Size (defined as contiguous properties under same ownership)		
9.65 ac	☒ Site Size (**SS**) = (**TSA**) – (**JW**) – (**CL**)	
33.7%	☒ (**TIA**) / (**SS**) = 3.25/9.65 = 0.337	☐ (**TIA**) / (**SS**) >**0.4**? NO
☐ YES, Redevelopment		

PART 2. LOW IMPACT DEVELOPMENT ASSESSMENT – MINIMUM STANDARD 1

(NOT REQUIRED FOR REDEVELOPMENT OR RETROFITS)

This section may be deleted if not required.

Note: A written description must be provided specifying why each method is not being used or is not applicable at the Site. Appropriate answers may include:

- Town requires … (state the specific local requirement)
- Meets Town's dimensional requirement of …
- Not practical for site because …
- Applying for waiver/variance to achieve this (pending/approved/denied)
- Applying for wavier/variance to seek relief from this (pending/approved/denied)

A) PRESERVATION OF UNDISTURBED AREAS, BUFFERS, AND FLOODPLAINS	**IF NOT IMPLEMENTED, EXPLAIN HERE**
☒ Sensitive resource areas and site constraints are identified (required) ☒ Local development regulations have been reviewed (required) ☒ All vegetated buffers and coastal and freshwater wetlands will be protected during and after construction ☐ Conservation Development or another site design technique has been incorporated to protect open space and pre-development hydrology. **Note:** If Conservation Development has been used, check box and skip to Subpart C ☒ As much natural vegetation and pre-development hydrology as possible has been maintained	The infill development is matching the surrounding neighborhood w/ 7,000 sf lots.

B) LOCATE DEVELOPMENT IN LESS SENSITIVE AREAS AND WORK WITH THE NATURAL LANDSCAPE CONDITIONS, HYDROLOGY, AND SOILS ☒ Development sites and building envelopes have been appropriately distanced from wetlands and waterbodies ☒ Development and stormwater systems have been located in areas with greatest infiltration capacity (e.g., soil groups A and B) ☒ Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPA's) ☒ Development sites and building envelopes have been positioned outside of floodplains ☒ Site design positions buildings, roadways and parking areas in a manner that avoids impacts to surface water features ☒ Development sites and building envelopes have been located to minimize impacts to steep slopes (≥15%) ☐ Other (describe):	
C) MINIMIZE CLEARING AND GRADING ☐ Site clearing has been restricted to minimum area needed for building footprints, development activities, construction access, and safety. ☒ Site has been designed to position buildings, roadways, and parking areas in a manner that minimizes grading (cut and fill quantities) ☐ Protection for stands of trees and individual trees and their root zones to be preserved has been specified, and such protection extends at least to the tree canopy drip line(s) ☐ Plan notes specify that public trees removed or damaged during construction shall be replaced with equivalent	The infill development is capturing all stormwater within the property to ensure no impacts to surrounding neighborhoods and neighbors.
D) REDUCE IMPERVIOUS COVER ☐ Reduced roadway widths (≤22 feet for ADT ≤ 400; ≤ 26 feet for ADT 400 - 2,000) ☒ Reduced driveway areas (length minimized via reduced ROW width (≤ 45 ft.) and/or reduced (or absolute minimum) front yard setback; width minimized to ≤ 9 ft. wide one lane; ≤ 18 ft. wide two lanes; shared driveways; pervious surface) ☐ Reduced building footprint: Explain approach: ☒ Reduced sidewalk area (≤ 4 ft. wide; one side of the street; unpaved path; pervious surface) ☐ Reduced cul-de-sacs (radius < 45 ft; vegetated island; alternative turn-around) ☐ Reduced parking lot area: Explain approach ☐ Use of pervious surfaces for driveways, sidewalks, parking areas/overflow parking areas, etc. ☐ Minimized impervious surfaces (project meets or is less than maximum specified by Zoning Ordinance) ☐ Other (describe):	The roadway width has been set in accordance with town standards. Sidewalks are proposed as appropriate to promote a safe development and removed from the inside loop of homes.
E) DISCONNECT IMPERVIOUS AREA ☐ Impervious surfaces have been disconnected, and runoff has been diverted to QPAs to the maximum extent possible ☐ Residential street edges allow side-of-the-road drainage into vegetated open swales ☐ Parking lot landscaping breaks up impervious expanse AND accepts runoff ☐ Other (describe):	W/ the public streets and drainage system proposed all stormwater is being directed toward the on-site FWW for treatment and discharge.
F) MITIGATE RUNOFF AT THE POINT OF GENERATION ☐ Small-scale BMPs have been designated to treat runoff as close as possible to the source	The site collects runoff, treats, infiltrates and mitigates impacts

G) PROVIDE LOW-MAINTENANCE NATIVE VEGETATION ☒ Low-maintenance landscaping has been proposed using native species and cultivars ☐ Plantings of native trees and shrubs in areas previously cleared of native vegetation are shown on site plan ☐ Lawn areas have been limited/minimized, and yards have been kept undisturbed to the maximum extent practicable on residential lots	Grass; a native seed mix has been specified.
H) RESTORE STREAMS/WETLANDS ☐ Historic drainage patterns have been restored by removing closed drainage systems, daylighting buried streams, and/or restoring degraded stream channels and/or wetlands ☐ Removal of invasive species ☐ Other	N/A

PART 3. SUMMARY OF REMAINING STANDARDS

GROUNDWATER RECHARGE – MINIMUM STANDARD 2

YES	NO	
☒	☐	The project has been designed to meet the groundwater recharge standard.
☐	☐	If "No," the justification for groundwater recharge criterion waiver has been explained in the Narrative (e.g., threat of groundwater contamination or physical limitation), if applicable (see RICR 8.8.D);
☐	☐	Your waiver request has been explained in the Narrative, if applicable.
☐	☒	Is this site identified as a Regulated Facility in Part 1, Minimum Standard 8: LUHPPL Identification?
☐	☐	If "Yes," has approval for infiltration by the Office of Waste Management Site Project Manager, per Part 1, Minimum Standard 8, been requested?

TABLE 2-1: Summary of Recharge (see RISDISM Section 3.3.2)
(Add or Subtract Rows as Necessary)

Design Point	Impervious Area Treated (sq ft)	Total Re_v Required (cu ft)	LID Stormwater Credits (see RISDISM Section 4.6.1)	Recharge Required by Remaining BMPs (cu ft)	Recharge Provided by BMPs (cu ft)
			Portion of Re_v directed to a QPA (cu ft)		
POS-1	137,201 sf (Total impervious proposed)	4,002 cf (calculated based on proposed impervious)	N/A	4,002	9,860
TOTALS:	144,941	4,002		4,002	9,860

Notes:
1. Only BMPs listed in RISDISM Table 3-5 "List of BMPs Acceptable for Recharge" may be used to meet the recharge requirement.
2. Recharge requirement must be satisfied for each waterbody ID.

☒ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):

40 Wickes Way Drainage Analysis, Appendix E

WATER QUALITY – MINIMUM STANDARD 3

YES	NO	
☒	☐	Does this project meet or exceed the required water quality volume WQv (see RICR 8.9.E-I)?
☒	☐	Is the proposed final impervious cover greater than 20% of the disturbed area (see RICR 8.9.E-I)?
☒	☐	If "Yes," either the Modified Curve Number Method or the Split Pervious/Impervious method in Hydro-CAD was used to calculate WQv; or,

☒	☐	If "Yes," either TR-55 or TR-20 was used to calculate WQv; and,
☐	☐	If "No," the project meets the minimum WQv of 0.2 watershed inches over the entire disturbed area.
☐	☐	Not Applicable
☒	☐	Does this project meet or exceed the ability to treat required water quality flow WQf (see RICR 8.9.I.1-3)?
☐	☒	Does this project propose an increase of impervious cover to a receiving water body with impairments? If "Yes," please indicate below the method that was used to address the water quality requirements of no further degradation to a low-quality water.
☐	☒	RICR 8.36. A Pollutant Loading Analysis is needed and has been completed.
☐	☒	The Water Quality Guidance Document (Water Quality Goals and Pollutant Loading Analysis Guidance for Discharges to Impaired Waters) has been followed as applicable.
☐	☒	BMPs are proposed that are on the approved technology list. If "Yes," please provide all required worksheets from the manufacturer.
☐	☒	Additional pollutant-specific requirements and/or pollutant removal efficiencies are applicable to the site as the result of a TMDL, SAMP, or other watershed-specific requirements. If "Yes," please describe:

TABLE 3-1: Summary of Water Quality (see RICR 8.9)

Design Point and WB ID	Impervious area treated (sq ft)	Total WQv Required (cu ft)	LID Stormwater Credits (see RICR 8.18) WQv directed to a QPA (cu ft)	Water Quality Treatment Remaining (cu ft)	Water Quality Provided by BMPs (cu ft)
P1-P7	3.15	11,433	n/a	11,433	11,817
TOTALS:	137,201	11,433		11,433	11,817

Notes:
1. Only BMPs listed in RICR 8.20 and 8.25 or the Approved Technologies List of BMPs is Acceptable for Water Quality treatment.
2. For each Design Point, the Water Quality Volume Standard must be met for each Waterbody ID.

☒ YES ☐ NO	This project has met the setback requirements for each BMP. If "No," please explain:

☒ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):
See 40 Wickes Way Drainage Analysis, Section V., Appendix E

CONVEYANCE AND NATURAL CHANNEL PROTECTION (RICR 8.10) – MINIMUM STANDARD 4

YES	NO		
☐	☒	Is this standard waived? If "Yes," please indicate one or more of the reasons below:	
		☐	The project directs discharge to a large river (i.e., 4th-order stream or larger. See RISDISM Appendix I for State-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters.
		☐	The project directs is a small facility with impervious cover of less than or equal to 1 acre.
		☐	The project has a post-development peak discharge rate from the facility that is less than 2 cfs for the 1-year, 24-hour Type III design storm event (prior to any attenuation). (Note: LID design strategies can greatly reduce the peak discharge rate).
☒	☐	Conveyance and natural channel protection for the site have been met. If "No,' explain why:	

TABLE 4-1: Summary of Channel Protection Volumes (see RICR 8.10)

Design Point	Receiving Water Body Name	Coldwater Fishery? (Y/N)	Total CPv Required (cu ft)	Total CPv Provided (cu ft)	Average Release Rate Modeled in the 1-yr storm (cfs)
POS 1 (Wetland)	All subwatersheds are collected and pre-treated before infiltrated using an infiltration basin. After reducing flows, the basin outlets into the adjacent wetland, reducing flowrates from pre-existing drainage conditions for all design storms.				
TOTALS:					

Note: The Channel Protection Volume Standard must be met in each waterbody ID.

☒ YES ☐ NO	The CPv is captured and held within the infiltration basin and sediment forebay and infiltrated completely.
☐ YES ☒ NO	Do additional design restrictions apply resulting from any discharge to cold-water fisheries; If "Yes," please indicate restrictions and solutions below.

☒ Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).

N/A

OVERBANK FLOOD PROTECTION (RICR 8.11) AND OTHER POTENTIAL HIGH FLOWS – MINIMUM STANDARD 5

YES	NO		
☐	☒	Is this standard waived? If yes, please indicate one or more of the reasons below:	
		☐ ☐	The project reduces peak flow rates for all designs storms.
☐	☒	Does the project flow to an MS4 system or subject to other stormwater requirements? If "Yes," indicate as follows:	
		☐ ☐	RIDOT Other (specify):

Note: The project could be approved by RIDEM but not meet RIDOT or Town standards. RIDOT's regulations indicate that post-volumes must be **less** than pre-volumes for the 10-yr storm at the design point entering the RIDOT system. If you have not already received approval for the discharge to an MS4, please explain below your strategy to comply with RIDEM and the MS4.

Indicate below which model was used for your analysis.

☒ TR-55 ☐ TR-20 ☐ HydroCAD ☐ Bentley/Haestad ☐ Intellisolve

☒ Other (Specify): Hydraflow Hydrograph Extension for AutoCAD

YES	NO	
☒	☐	Does the drainage design demonstrate that flows from the 100-year storm event through a BMP will safely manage and convey the 100-year storm? If "No," please explain briefly below and reference where in the application further documentation can be found (i.e., name of report/document, page numbers, appendices, etc.):
☐	☒	Do off-site areas contribute to the sub-watersheds and design points? If "Yes,"
☐	☐	Are the areas modeled as "present condition" for both pre- and post-development analysis?
☐	☐	Are the off-site areas shown on the subwatershed maps?
☒	☐	Does the drainage design confirm safe passage of the 100-year flow through the site for off-site runoff?
☐	☒	Is a Downstream Analysis required (see RICR 8.11.E.1)?
☐	☐	Calculate the following:
9.90 ac	☒	Area of disturbance within the sub-watershed (areas)

32.6%	☒	Impervious cover (%)
☐	☒	Is a dam breach analysis required (earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and contributes to a significant or high hazard dam)?
☒	☐	Does this project meet the overbank flood protection standard?

Table 5-1 Hydraulic Analysis Summary

Subwatershed (Design Point)	1.2" Peak Flow (cfs) **		1-yr Peak Flow (cfs)		10-yr Peak Flow (cfs)		100-yr Peak Flow (cfs)	
	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
POS-1	1.54	0.09	2.5	0.28	9.5	6.7	25.8	25.8
TOTALS:								

** Utilize modified curve number method or split pervious /impervious method in HydroCAD.

Note: The hydraulic analysis must demonstrate no impact to each individual subwatershed DP unless each DP discharges to the same wetland or water resource.

Indicate as follows where the pertinent calculations and/or information for the items above are provided	**Name of report/document, page numbers, appendices, etc.**
Existing conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, and water surface elevations showing methodologies used and supporting calculations.	40 Wickes Way Drainage Analysis, Section II and Appendix C
Proposed conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, water surface elevations, and routing showing the methodologies used and supporting calculations.	40 Wickes Way Drainage Analysis, Section III and Appendix D
Final sizing calculations for structural stormwater BMPs, including contributing drainage area, storage, and outlet configuration.	40 Wickes Way Drainage Analysis, Section IV and Appendix E
Stage-storage, inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).	40 Wickes Way Drainage Analysis, Section IV and Appendix D

Table 5-2 Summary of Best Management Practices

BMP ID	DP #	BMP Type (e.g., bioretention, tree filter)	BMP Functions					Bypass Type	Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4		
			Pre-Treatment (Y/N/ NA)	Re_v (cf)	WQ_v (cf)	CP_v (Y/N/ NA)	Overbank Flood Reduction (Y/N/NA)	External (E) Internal (I) or NA	Yes/No	Technical Justification (Design Report page number)	Distance Provided
A1 SF	POS 1	Sediment Forebay	Y	N/A	1,957	Y	Y	N/A	Y	Down-gradient from building structures	>25'
A2 INFIL BASIN	POS 1	Infiltration Basin	N	9,860	9,860	Y	Y	N/E	Y	Down-gradient from building structure	>25'
		TOTALS:		9,860	11,817						

Table 5.3 Summary of Soils to Evaluate Each BMP

DP #	BMP ID	BMP Type (e.g., bioretention,	Soils Analysis for Each BMP					
			Test Pit ID# and Ground Elevation	SHWT Elevation	Bottom of Practice	Separation Distance	Hydrologic Soil Group	Exfiltration Rate

		tree filter)	Primary	Secondary	(ft)	Elevation* (ft)	Provided (ft)	(A, B, C, D)	Applied (in/hr)
POS-1	A1	Sediment Forebay	D-5	D-7	33.0	35.0	2	A	8.27
POS-1	A2	Infiltration Basin	D-6	D-5 / D-7	34.0	37.0	3	A	8.27
		TOTALS:							

* For underground infiltration systems (UICs) bottom equals bottom of stone, for surface infiltration basins bottom equals bottom of basin, for filters bottom equals interface of storage and top of filter layer

LAND USES WITH HIGHER POTENTIAL POLLUTANTS LOADS (LUHPPLs) – MINIMUM STANDARD 8

YES	NO	N/A	
☐	☐	☒	Describe any LUHPPLs identified in Part 1, Minimum Standard 8, Section 2. If not applicable, continue to Minimum Standard 9.
☐	☐	☐	Are these activities already covered under an MSGP? If "No," please explain if you have applied for an MSGP or intend to do so?
☐	☐	☐	List the specific BMPs that are proposed for this project that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in RISDISM Table 3-3, "Acceptable BMPs for Use at LUHPPLs." Please list BMPs:
☐	☐	☐	Additional BMPs, or additional pretreatment BMP's if any, that meet RIPDES MSGP requirements; Please list BMPs:
			Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).

ILLICIT DISCHARGES – MINIMUM STANDARD 9

Illicit discharges are defined as unpermitted discharges to Waters of the State that do not consist entirely of stormwater or uncontaminated groundwater, except for certain discharges identified in the RIPDES Phase II Stormwater General Permit.

YES	NO	N/A	
☐	☐	☒	Have you checked for illicit discharges?
☐	☐	☒	Have any been found and/or corrected? If "Yes," please identify.
☐	☐	☒	Does your report explain preventative measures that keep non-stormwater discharges out of the Waters of the State (during and after construction)?

SOIL EROSION AND SEDIMENT CONTROL (SESC) – MINIMUM STANDARD 10

YES	NO	N/A		
☒	☐	☐	Have you included a Soil Erosion and Sediment Control Plan Set and/or Complete Construction Plan Set?	
☒	☐	☐	Have you provided a **separately-bound** document based upon the SESC Template? If yes, proceed to Minimum Standard 11 (the following items can be assumed to be addressed).	
			If "No," include a document with your submittal that addresses the following elements of an SESC Plan:	
			☐	Soil Erosion and Sediment Control Plan Project Narrative, including a description of how the fifteen (15) Performance Criteria have been met:
			☐	Provide Natural Buffers and Maintain Existing Vegetation
			☐	Minimize Area of Disturbance
			☐	Minimize the Disturbance of Steep Slopes
			☐	Preserve Topsoil
			☐	Stabilize Soils
			☐	Protect Storm Drain Inlets

	☐	Protect Storm Drain Outlets
	☐	Establish Temporary Controls for the Protection of Post-Construction Stormwater Control Measures
	☐	Establish Perimeter Controls and Sediment Barriers
	☐	Divert or Manage Run-On from Up-Gradient Areas
	☐	Properly Design Constructed Stormwater Conveyance Channels
	☐	Retain Sediment On-Site
	☐	Control Temporary Increases in Stormwater Velocity, Volume, and Peak Flows
	☐	Apply Construction Activity Pollution Prevention Control Measures
	☐	Install, Inspect, and Maintain Control Measures and Take Corrective Actions
	☐	Qualified SESC Plan Preparer's Information and Certification
	☐	Operator's Information and Certification; if not known at the time of application, the Operator must certify the SESC Plan upon selection and prior to initiating site activities
	☐	Description of Control Measures, such as Temporary Sediment Trapping and Conveyance Practices, including design calculations and supporting documentation, as required

STORMWATER MANAGEMENT SYSTEM OPERATION, MAINTENANCE, AND POLLUTION PREVENTION PLAN – MINIMUM STANDARDS 7 AND 9

Operation and Maintenance Section

YES	NO	
☒	☐	Have you minimized all sources of pollutant contact with stormwater runoff, to the maximum extent practicable?
☒	☐	Have you provided a **separately-bound** Operation and Maintenance Plan for the site and for all of the BMPs, and does it address each element of RICR 8.17 and RISDISM Appendix C and E?
☒	☐	Lawn, Garden, and Landscape Management meet the requirements of RISDISM Section G.7? If "No," why not?
☐	☒	Is the property owner or homeowner's association responsible for the stormwater maintenance of all BMP's? If "No," you must provide a legally binding and enforceable maintenance agreement (see RISDISM Appendix E, page 26) that identifies the entity that will be responsible for maintenance of the stormwater. Indicate where this agreement can be found in your report (i.e., name of report/document, page numbers, appendices, etc.). The facility shall become the ownership of the City of Warwick, to date we've never found a municipality willing to sign any such document
☒	☐	Do you anticipate that you will need legal agreements related to the stormwater structures? (e.g. off-site easements, deed restrictions, covenants, or ELUR per the Remediation Regulations). If "Yes," have you obtained them? Or please explain your plan to obtain them:
☒	☐	Is stormwater being directed from public areas to private property? If "Yes," note the following: Note: This is not allowed unless a funding mechanism is in place to provide the finances for the long-term maintenance of the BMP and drainage, or a funding mechanism is demonstrated that can guarantee the long-term maintenance of a stormwater BMP by an individual homeowner.

Pollution Prevention Section

☒	☐	Designated snow stockpile locations?
☒	☐	Trash racks to prevent floatables, trash, and debris from discharging to Waters of the State?
☒	☐	Asphalt-only based sealants?
☒	☐	Pet waste stations? (Note: If a receiving water has a bacterial impairment, and the project involves housing units, then this could be an important part of your pollution prevention plan).
☒	☐	Regular sweeping? Please describe: Street sweeping shall be performed on an annual basis and when the project is completed.
☒	☐	De-icing specifications, in accordance with RISDISM Appendix G. (NOTE: If the groundwater is GAA, or this area contributes to a drinking water supply, then this could be an important part of your pollution prevention plan).
☒	☐	A prohibition of phosphate-based fertilizers? (Note: If the site discharges to a phosphorus impaired waterbody, then this could be an important part of your pollution prevention plan).

PART 4. SUBWATERSHED MAPPING AND SITE-PLAN DETAILS

Existing and Proposed Subwatershed Mapping (REQUIRED)		
YES	**NO**	
☒	☐	Existing and proposed drainage area delineations
☒	☐	Locations of all streams and drainage swales
☒	☐	Drainage flow paths, mapped according to the DEM *Guidance for Preparation of Drainage Area Maps* (included in RISDISM Appendix K)
☒	☐	Complete drainage area boundaries; include off-site areas in both mapping and analyses, as applicable
☒	☐	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report
☒	☐	Mapped seasonal high-water-table test pit locations
☒	☐	Mapped locations of the site-specific borings and/or test pits and soils information from the test pits at the locations of the BMPs
☒	☐	Mapped locations of the BMPs, with the BMPs consistently identified on the Site Construction Plans
☒	☐	Mapped bedrock outcrops adjacent to any infiltration BMP
☒	☐	Soils were logged by a:
	☒	DEM-licensed Class IV soil evaluator Name: Kevin Fetzer
	☐	RI-registered P.E. Name:

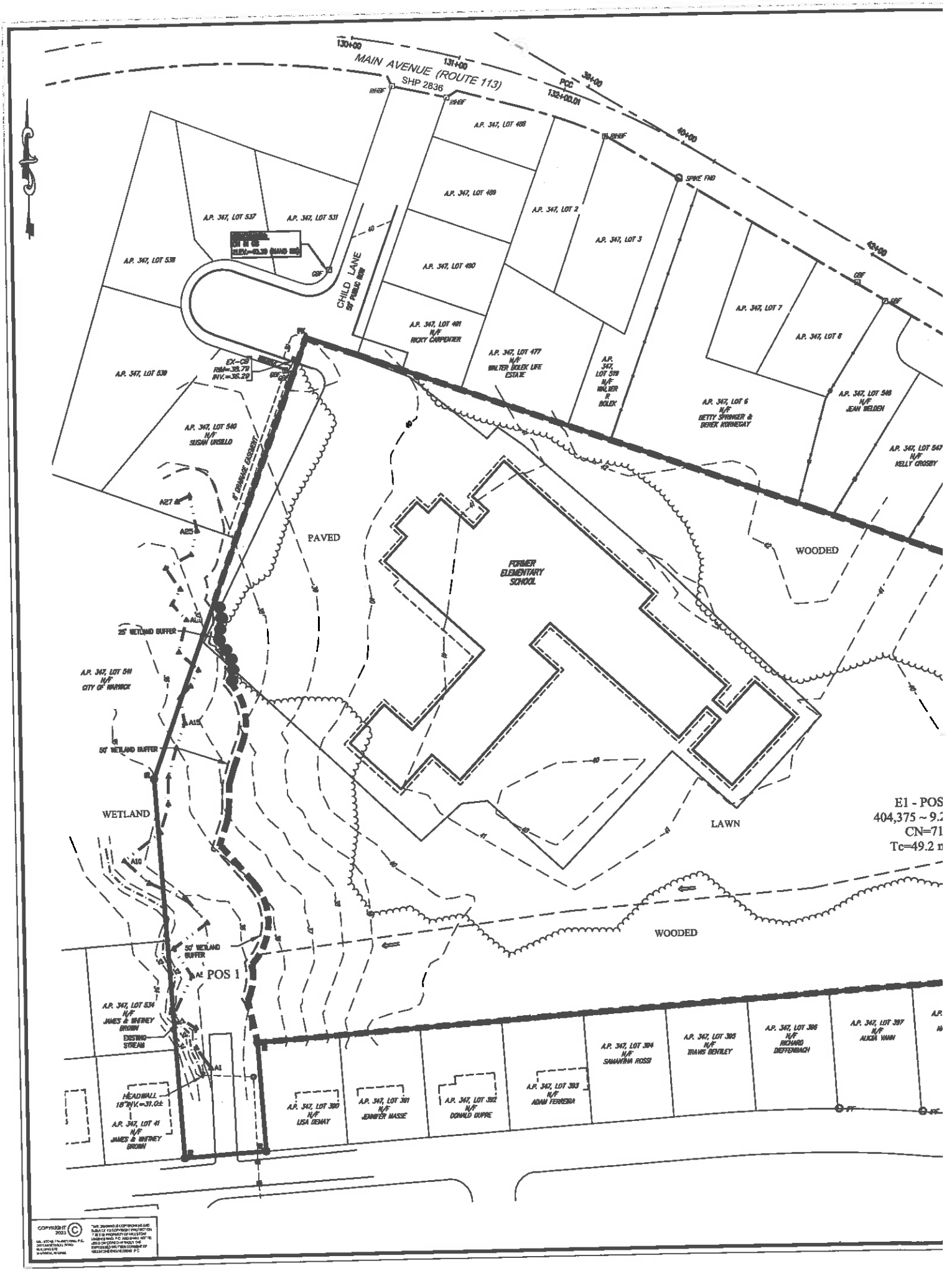
Subwatershed and Impervious Area Summary				
Subwatershed (area to each design point)	**First Receiving Water ID or MS4**	**Area Disturbed (units)**	**Existing Impervious (units)**	**Proposed Impervious (units) – (TOTAL)**
P1	Groundwater	2.01 ac	0.59 ac	0.46 ac
P2	Groundwater	1.15 ac	0.08 ac	0.38 ac
P3	Groundwater	1.94 ac	0.00 ac	0.67 ac
P4	Groundwater	1.87 ac	0.67 ac	0.63 ac
P5	Groundwater	1.64 ac	1.50 ac	0.69 ac
P6	Groundwater	0.60 ac	0.00 ac	0.20 ac
P7	Groundwater	0.70 ac	0.40 ac	0.12 ac
TOTALS:		9.90 ac	3.24 ac	3.15 ac

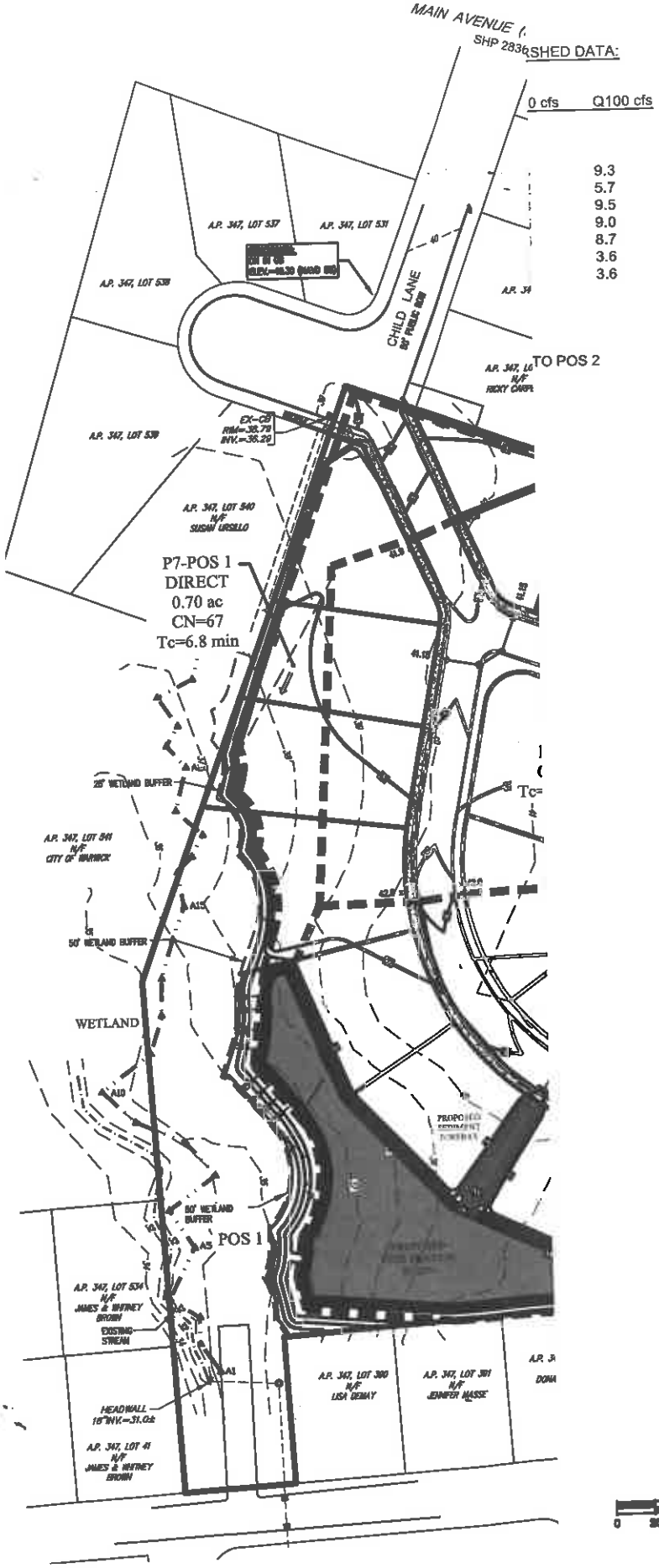
Site Construction Plans (Indicate that the following applicable specifications are provided)		
YES	**NO**	
☒	☐	Existing and proposed plans (scale not greater than 1" = 40') with North arrow
☒	☐	Existing and proposed site topography (with 1 or 2-foot contours); 10-foot contours accepted for off-site areas
☒	☐	Boundaries of existing predominant vegetation and proposed limits of clearing
☒	☐	Site Location clarification
☒	☐	Location and field-verified boundaries of resource protection areas such as: ▸ freshwater and coastal wetlands, including lakes and ponds ▸ coastal shoreline features Perennial and intermittent streams, in addition to Areas Subject to Storm Flowage (ASSFs)
☒	☐	All required setbacks (e.g., buffers, water-supply wells, septic systems)
☒	☐	Representative cross-section and profile drawings, and notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include: ▸ Location and size of the stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) must have labels that correspond to RISDISM Table 5-2; ▸ Design water surface elevations (applicable storms); ▸ Structural details of outlet structures, embankments, spillways, stilling basins, grade-control structures, conveyance channels, etc.; ▸ Existing and proposed structural elevations (e.g., inverts of pipes, manholes, etc.); ▸ Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties or drainage that could be affected by work in the floodplain; ▸ Planting plans for structural stormwater BMPs, including species, size, planting methods, and maintenance requirements of proposed planting
☒	☐	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report and corresponding water tables
☒	☐	Mapping of any OWM-approved remedial actions/systems (including ELURs)
☒	☐	Location of existing and proposed roads, buildings, and other structures including limits of disturbance; ▸ Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements; ▸ Location of existing and proposed conveyance systems, such as grass channels, swales, and storm drains, and location(s) of final discharge point(s) (wetland, waterbody, etc.); ▸ Cross sections of roadways, with edge details such as curbs and sidewalks; ▸ Location and dimensions of channel modifications, such as bridge or culvert crossings
☒	☐	Locations, cross sections, and profiles of all stream or wetland crossings and their method of stabilization

Appendix B

Reduced Plans

- **Site Plans**
- **Watershed Maps**


MAIN AVENUE (ROUTE 113)
SHP 2836
130+00
131+00
132+00.01
POS
SPIKE FND
RHBF
CHILD LANE
50' PUBLIC ROW
A.P. 347, LOT 468
A.P. 347, LOT 469
A.P. 347, LOT 2
A.P. 347, LOT 3
A.P. 347, LOT 490
A.P. 347, LOT 491
N/F
RICKY CARPENTER
A.P. 347, LOT 477
N/F
WALTER BOLEK LIFE ESTATE
A.P. 347, LOT 519
N/F
WALTER & BOLEK
A.P. 347, LOT 7
A.P. 347, LOT 8
A.P. 347, LOT 6
N/F
BETTY SPRINGER & DEREK KORNEGAY
A.P. 347, LOT 546
N/F
JEAN WELDEN
A.P. 347, LOT 547
N/F
KELLY CROSBY
A.P. 347, LOT 537
A.P. 347, LOT 531
A.P. 347, LOT 538
A.P. 347, LOT 539
EX-CB
RIM=35.79
INV.=35.29
A.P. 347, LOT 540
N/F
SUSAN URSILLO
6" DRAINAGE EASEMENT
PAVED
FORMER ELEMENTARY SCHOOL
WOODED
25' WETLAND BUFFER
50' WETLAND BUFFER
A.P. 347, LOT 541
N/F
CITY OF WARWICK
WETLAND
LAWN
WOODED
POS 1
EXISTING STREAM
HEADWALL
18"W
INV.=31.03±
A.P. 347, LOT 534
N/F
JAMES & WHITNEY BROWN
A.P. 347, LOT 41
N/F
JAMES & WHITNEY BROWN
A.P. 347, LOT 389
N/F
LISA DEHAY
A.P. 347, LOT 391
N/F
JENNIFER MASSE
A.P. 347, LOT 392
N/F
DONALD DUPRE
A.P. 347, LOT 393
N/F
ADAM FERREIRA
A.P. 347, LOT 394
N/F
SAMANTHA ROSSI
A.P. 347, LOT 395
N/F
TRAVIS BENTLEY
A.P. 347, LOT 396
N/F
RICHARD DIEFFENBACH
A.P. 347, LOT 397
N/F
ALICIA WANN
E1 - POS
404,375 ~ 9.2
CN=71
Tc=49.2 m
COPYRIGHT © 2003



NO.	DATE	REVISION

MILLSTONE ENGINEERING, P.C.
CIVIL ENGINEERING • LAND PLANNING
250 Centerville Road, Building E-12 Warwick, Rhode Island 02886
780 Aquidneck Avenue, Building B Middletown, Rhode Island 02842
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POST DEVELOPED WATERHSED MAP

40 WICKES WAY

A.P. 347, LOT 476
50 CHILD LANE
WARWICK, RI

PREPARED FOR:
40 WICKES WAY, LLC

SCALE: 1"=50'
JULY 2023

Drawn By: MJV
Checked By: JCH
Sheet 1 of 1

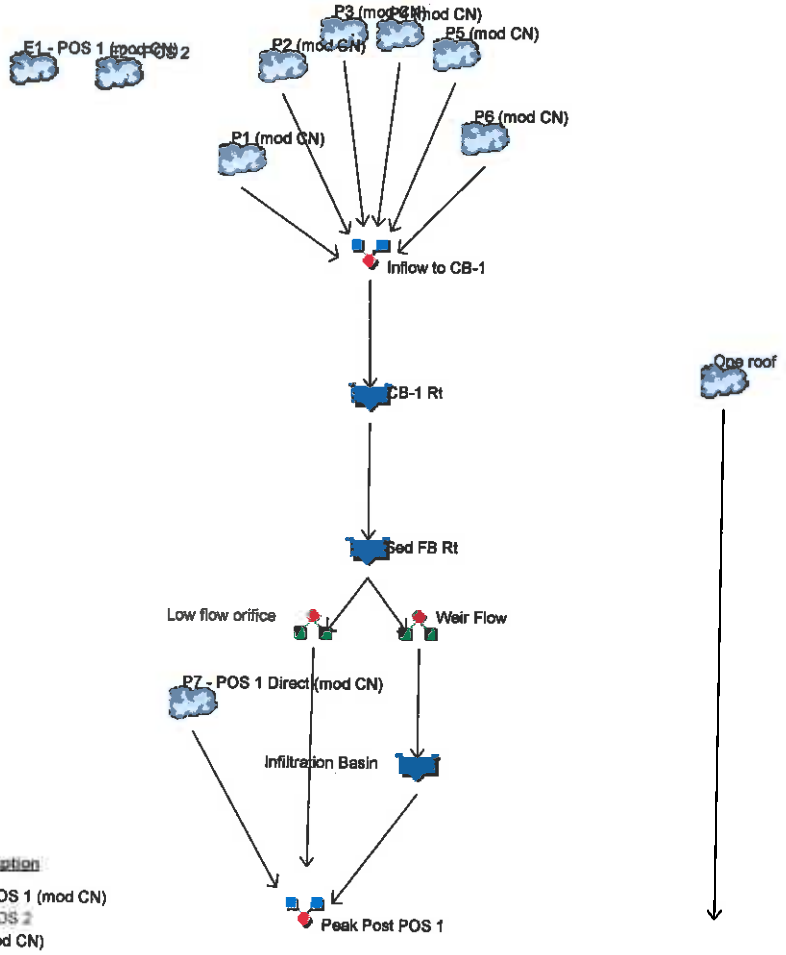
FILE NO.: 21.345.691

Appendix C

Pre-Development Hydraflow Stormwater Modeling Printouts

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	E1 - POS 1 (mod CN)
2	SCS Runoff	E2 - POS 2
3	SCS Runoff	P1 (mod CN)
4	SCS Runoff	P2 (mod CN)
5	SCS Runoff	P3 (mod CN)
6	SCS Runoff	P4 (mod CN)
7	SCS Runoff	P5 (mod CN)
8	SCS Runoff	P6 (mod CN)
9	SCS Runoff	P7 - POS 1 Direct (mod CN)
10	Combine	Inflow to CB-1
11	Reservoir	CB-1 Rt
12	Reservoir	Sed FB Rt
13	Diversion1	Low flow orifice
14	Diversion2	Weir Flow
15	Reservoir	Infiltration Basin
16	Combine	Peak Post POS 1
17	SCS Runoff	One roof
18	Reservoir	UG Chambers

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.535	1	759	11,420	—	—	—	E1 - POS 1 (mod CN)
2	SCS Runoff	0.000	1	n/a	0	—	—	—	E2 - POS 2
3	SCS Runoff	0.314	1	733	1,598	—	—	—	P1 (mod CN)
4	SCS Runoff	0.325	1	732	1,403	—	—	—	P2 (mod CN)
5	SCS Runoff	0.533	1	733	2,405	—	—	—	P3 (mod CN)
6	SCS Runoff	0.517	1	733	2,330	—	—	—	P4 (mod CN)
7	SCS Runoff	0.599	1	731	2,469	—	—	—	P5 (mod CN)
8	SCS Runoff	0.174	1	730	715	—	—	—	P6 (mod CN)
9	SCS Runoff	0.088	1	728	430	—	—	—	P7 - POS 1 Direct (mod CN)
10	Combine	2.449	1	732	10,919	3, 4, 5, 6, 7, 8, 10	—	—	Inflow to CB-1
11	Reservoir	2.445	1	732	10,576	10	36.38	433	CB-1 Rt
12	Reservoir	1.853	1	741	4,077	11	38.22	2,166	Sed FB Rt
13	Diversion1	0.030	1	741	1,120	12	—	—	Low flow orifice
14	Diversion2	1.823	1	741	2,957	12	—	—	Weir Flow
15	Reservoir	0.000	1	758	0	14	37.08	1,329	Infiltration Basin
16	Combine	0.109	1	728	1,550	9, 13, 15	—	—	Peak Post POS 1
17	SCS Runoff	0.029	2	724	91	—	—	—	One roof
18	Reservoir	0.000	2	718	0	17	38.15	9.14	UG Chambers

Hydrograph Report

Hyd. No. 1

E1 - POS 1 (mod CN)

Hydrograph type	= SCS Runoff	Peak discharge	= 1.535 cfs
Storm frequency	= 3 yrs	Time to peak	= 759 min
Time interval	= 1 min	Hyd. volume	= 11,420 cuft
Drainage area	= 9.280 ac	Curve number	= 87.000*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.2 min
Total precip.	= 1.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.000 x 55) + (2.020 x 61) + (1.200 x 98) + (2.060 x 98)] / 9.280

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time -- Outflow (min cfs)		Time -- Outflow (min cfs)		Time -- Outflow (min cfs)		Time -- Outflow (min cfs)	
695	0.017	713	0.100	731	0.599	749	1.404
696	0.019	714	0.110	732	0.643	750	1.434
697	0.021	715	0.122	733	0.687	751	1.459
698	0.023	716	0.134	734	0.733	752	1.480
699	0.025	717	0.148	735	0.779	753	1.496
700	0.028	718	0.165	736	0.826	754	1.509
701	0.031	719	0.184	737	0.873	755	1.519
702	0.034	720	0.205	738	0.920	756	1.526
703	0.037	721	0.231	739	0.967	757	1.531
704	0.041	722	0.259	740	1.015	758	1.534
705	0.046	723	0.290	741	1.062	759	1.535
706	0.050	724	0.323	742	1.109	760	1.534
707	0.056	725	0.359	743	1.156	761	1.530
708	0.062	726	0.396	744	1.201	762	1.525
709	0.068	727	0.434	745	1.246	763	1.519
710	0.075	728	0.473	746	1.290	764	1.510
711	0.083	729	0.514	747	1.331	765	1.500
712	0.091	730	0.556	748	1.369	766	1.488

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
767	1.474	794	0.808	821	0.425	848	0.346
768	1.459	795	0.781	822	0.420	849	0.344
769	1.442	796	0.755	823	0.416	850	0.342
770	1.424	797	0.729	824	0.412	851	0.340
771	1.405	798	0.704	825	0.408	852	0.338
772	1.385	799	0.681	826	0.404	853	0.336
773	1.363	800	0.659	827	0.400	854	0.334
774	1.341	801	0.639	828	0.397	855	0.332
775	1.318	802	0.620	829	0.394	856	0.330
776	1.294	803	0.603	830	0.391	857	0.328
777	1.269	804	0.587	831	0.388	858	0.327
778	1.244	805	0.572	832	0.385	859	0.325
779	1.218	806	0.558	833	0.382	860	0.323
780	1.192	807	0.545	834	0.379	861	0.321
781	1.165	808	0.532	835	0.377	862	0.319
782	1.138	809	0.520	836	0.374	863	0.318
783	1.111	810	0.509	837	0.371	864	0.316
784	1.084	811	0.499	838	0.369	865	0.314
785	1.057	812	0.489	839	0.366	866	0.313
786	1.029	813	0.480	840	0.364	867	0.311
787	1.002	814	0.471	841	0.361	868	0.309
788	0.974	815	0.463	842	0.359	869	0.308
789	0.946	816	0.455	843	0.357	870	0.306
790	0.918	817	0.448	844	0.355	871	0.304
791	0.891	818	0.442	845	0.352	872	0.303
792	0.863	819	0.436	846	0.350	873	0.301
793	0.836	820	0.430	847	0.348	874	0.300

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time (min)	Outflow cfs)	Time (min	Outflow cfs)	Time (min	Outflow cfs)	Time (min	Outflow cfs)
875	0.298	902	0.265	929	0.238	956	0.209
876	0.297	903	0.264	930	0.237	957	0.208
877	0.295	904	0.263	931	0.235	958	0.207
878	0.294	905	0.262	932	0.234	959	0.206
879	0.293	906	0.261	933	0.233	960	0.205
880	0.291	907	0.260	934	0.232	961	0.203
881	0.290	908	0.259	935	0.231	962	0.202
882	0.289	909	0.258	936	0.230	963	0.201
883	0.287	910	0.257	937	0.229	964	0.200
884	0.286	911	0.256	938	0.228	965	0.199
885	0.285	912	0.255	939	0.227	966	0.198
886	0.283	913	0.254	940	0.226	967	0.197
887	0.282	914	0.253	941	0.225	968	0.196
888	0.281	915	0.252	942	0.224	969	0.195
889	0.280	916	0.251	943	0.223	970	0.194
890	0.279	917	0.250	944	0.222	971	0.193
891	0.277	918	0.249	945	0.221	972	0.192
892	0.276	919	0.248	946	0.220	973	0.190
893	0.275	920	0.247	947	0.219	974	0.189
894	0.274	921	0.246	948	0.218	975	0.188
895	0.273	922	0.245	949	0.217	976	0.187
896	0.272	923	0.244	950	0.215	977	0.186
897	0.270	924	0.243	951	0.214	978	0.185
898	0.269	925	0.242	952	0.213	979	0.184
899	0.268	926	0.241	953	0.212	980	0.183
900	0.267	927	0.240	954	0.211	981	0.182
901	0.266	928	0.239	955	0.210	982	0.181

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time -- Outflow (min cfs)		Time -- Outflow (min cfs)		Time -- Outflow (min cfs)		Time -- Outflow (min cfs)	
983	0.180	1010	0.159	1037	0.145	1064	0.131
984	0.179	1011	0.158	1038	0.144	1065	0.131
985	0.178	1012	0.158	1039	0.144	1066	0.130
986	0.177	1013	0.157	1040	0.143	1067	0.130
987	0.176	1014	0.157	1041	0.143	1068	0.129
988	0.176	1015	0.156	1042	0.142	1069	0.129
989	0.175	1016	0.155	1043	0.142	1070	0.128
990	0.174	1017	0.155	1044	0.141	1071	0.128
991	0.173	1018	0.154	1045	0.141	1072	0.127
992	0.172	1019	0.154	1046	0.140	1073	0.127
993	0.171	1020	0.153	1047	0.140	1074	0.126
994	0.170	1021	0.153	1048	0.139	1075	0.126
995	0.170	1022	0.152	1049	0.139	1076	0.125
996	0.169	1023	0.152	1050	0.138	1077	0.125
997	0.168	1024	0.151	1051	0.138	1078	0.124
998	0.167	1025	0.151	1052	0.137	1079	0.124
999	0.166	1026	0.150	1053	0.137	1080	0.123
1000	0.166	1027	0.150	1054	0.136	1081	0.123
1001	0.165	1028	0.149	1055	0.136	1082	0.122
1002	0.164	1029	0.149	1056	0.135	1083	0.122
1003	0.164	1030	0.148	1057	0.135	1084	0.121
1004	0.163	1031	0.148	1058	0.134	1085	0.121
1005	0.162	1032	0.147	1059	0.134	1086	0.120
1006	0.162	1033	0.147	1060	0.133	1087	0.119
1007	0.161	1034	0.146	1061	0.133	1088	0.119
1008	0.160	1035	0.146	1062	0.132	1089	0.118
1009	0.160	1036	0.145	1063	0.132	1090	0.118

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time (min)	Outflow cfs)	Time (min)	Outflow cfs)	Time (min)	Outflow cfs)	Time (min)	Outflow cfs)
1091	0.117	1118	0.106	1145	0.100	1172	0.096
1092	0.117	1119	0.106	1146	0.100	1173	0.096
1093	0.117	1120	0.106	1147	0.100	1174	0.096
1094	0.116	1121	0.106	1148	0.100	1175	0.096
1095	0.116	1122	0.105	1149	0.100	1176	0.096
1096	0.115	1123	0.105	1150	0.100	1177	0.096
1097	0.115	1124	0.105	1151	0.099	1178	0.095
1098	0.114	1125	0.104	1152	0.099	1179	0.095
1099	0.114	1126	0.104	1153	0.099	1180	0.095
1100	0.113	1127	0.104	1154	0.099	1181	0.095
1101	0.113	1128	0.104	1155	0.099	1182	0.095
1102	0.112	1129	0.103	1156	0.099	1183	0.095
1103	0.112	1130	0.103	1157	0.099	1184	0.095
1104	0.111	1131	0.103	1158	0.098	1185	0.094
1105	0.111	1132	0.103	1159	0.098	1186	0.094
1106	0.111	1133	0.103	1160	0.098	1187	0.094
1107	0.110	1134	0.102	1161	0.098	1188	0.094
1108	0.110	1135	0.102	1162	0.098	1189	0.094
1109	0.109	1136	0.102	1163	0.098	1190	0.094
1110	0.109	1137	0.102	1164	0.097	1191	0.093
1111	0.109	1138	0.102	1165	0.097	1192	0.093
1112	0.108	1139	0.101	1166	0.097	1193	0.093
1113	0.108	1140	0.101	1167	0.097	1194	0.093
1114	0.108	1141	0.101	1168	0.097	1195	0.093
1115	0.107	1142	0.101	1169	0.097	1196	0.093
1116	0.107	1143	0.101	1170	0.097	1197	0.093
1117	0.107	1144	0.101	1171	0.096	1198	0.092

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
1199	0.092	1226	0.088	1253	0.084	1280	0.080
1200	0.092	1227	0.088	1254	0.084	1281	0.080
1201	0.092	1228	0.088	1255	0.084	1282	0.080
1202	0.092	1229	0.088	1256	0.084	1283	0.079
1203	0.092	1230	0.088	1257	0.083	1284	0.079
1204	0.092	1231	0.087	1258	0.083	1285	0.079
1205	0.091	1232	0.087	1259	0.083	1286	0.079
1206	0.091	1233	0.087	1260	0.083	1287	0.079
1207	0.091	1234	0.087	1261	0.083	1288	0.079
1208	0.091	1235	0.087	1262	0.083	1289	0.078
1209	0.091	1236	0.087	1263	0.082	1290	0.078
1210	0.091	1237	0.087	1264	0.082	1291	0.078
1211	0.090	1238	0.086	1265	0.082	1292	0.078
1212	0.090	1239	0.086	1266	0.082	1293	0.078
1213	0.090	1240	0.086	1267	0.082	1294	0.078
1214	0.090	1241	0.086	1268	0.082	1295	0.077
1215	0.090	1242	0.086	1269	0.082	1296	0.077
1216	0.090	1243	0.086	1270	0.081	1297	0.077
1217	0.090	1244	0.085	1271	0.081	1298	0.077
1218	0.089	1245	0.085	1272	0.081	1299	0.077
1219	0.089	1246	0.085	1273	0.081	1300	0.077
1220	0.089	1247	0.085	1274	0.081	1301	0.077
1221	0.089	1248	0.085	1275	0.081	1302	0.076
1222	0.089	1249	0.085	1276	0.080	1303	0.076
1223	0.089	1250	0.085	1277	0.080	1304	0.076
1224	0.088	1251	0.084	1278	0.080	1305	0.076
1225	0.088	1252	0.084	1279	0.080	1306	0.076

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time (min)	Outflow cfs)	Time (min	Outflow cfs)	Time (min	Outflow cfs)	Time (min	Outflow cfs)
1307	0.076	1334	0.075	1361	0.076	1388	0.071
1308	0.075	1335	0.075	1362	0.076	1389	0.070
1309	0.075	1336	0.076	1363	0.076	1390	0.070
1310	0.075	1337	0.076	1364	0.076	1391	0.070
1311	0.075	1338	0.076	1365	0.076	1392	0.070
1312	0.075	1339	0.076	1366	0.076	1393	0.069
1313	0.075	1340	0.076	1367	0.075	1394	0.069
1314	0.074	1341	0.077	1368	0.075	1395	0.069
1315	0.074	1342	0.077	1369	0.075	1396	0.069
1316	0.074	1343	0.077	1370	0.075	1397	0.068
1317	0.074	1344	0.077	1371	0.075	1398	0.068
1318	0.074	1345	0.077	1372	0.074	1399	0.068
1319	0.074	1346	0.078	1373	0.074	1400	0.068
1320	0.074	1347	0.078	1374	0.074	1401	0.067
1321	0.074	1348	0.078	1375	0.074	1402	0.067
1322	0.074	1349	0.078	1376	0.073	1403	0.067
1323	0.074	1350	0.078	1377	0.073	1404	0.067
1324	0.074	1351	0.078	1378	0.073	1405	0.067
1325	0.074	1352	0.078	1379	0.073	1406	0.067
1326	0.074	1353	0.078	1380	0.073	1407	0.067
1327	0.074	1354	0.078	1381	0.072	1408	0.067
1328	0.074	1355	0.078	1382	0.072	1409	0.066
1329	0.075	1356	0.077	1383	0.072	1410	0.066
1330	0.075	1357	0.077	1384	0.072	1411	0.066
1331	0.075	1358	0.077	1385	0.071	1412	0.066
1332	0.075	1359	0.077	1386	0.071	1413	0.066
1333	0.075	1360	0.077	1387	0.071	1414	0.066

Continues on next page...

E1 - POS 1 (mod CN)

Hydrograph Discharge Table

Time (min)	Outflow cfs)	Time (min)	Outflow cfs)	Time (min)	Outflow cfs)
1415	0.066	1442	0.062	1469	0.038
1416	0.066	1443	0.062	1470	0.037
1417	0.066	1444	0.062	1471	0.035
1418	0.065	1445	0.061	1472	0.034
1419	0.065	1446	0.061	1473	0.033
1420	0.065	1447	0.061	1474	0.031
1421	0.065	1448	0.060	1475	0.030
1422	0.065	1449	0.059	1476	0.028
1423	0.065	1450	0.059	1477	0.027
1424	0.065	1451	0.058	1478	0.026
1425	0.065	1452	0.058	1479	0.025
1426	0.064	1453	0.057	1480	0.023
1427	0.064	1454	0.056	1481	0.022
1428	0.064	1455	0.055	1482	0.021
1429	0.064	1456	0.054	1483	0.020
1430	0.064	1457	0.053	1484	0.019
1431	0.064	1458	0.052	1485	0.018
1432	0.064	1459	0.051	1486	0.017
1433	0.064	1460	0.050	1487	0.016
1434	0.063	1461	0.049		
1435	0.063	1462	0.048		
1436	0.063	1463	0.047		
1437	0.063	1464	0.045		
1438	0.063	1465	0.044		
1439	0.063	1466	0.043		
1440	0.063	1467	0.041		
1441	0.063	1468	0.040		

...End

TR55 Tc Worksheet

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

Hyd. No. 1

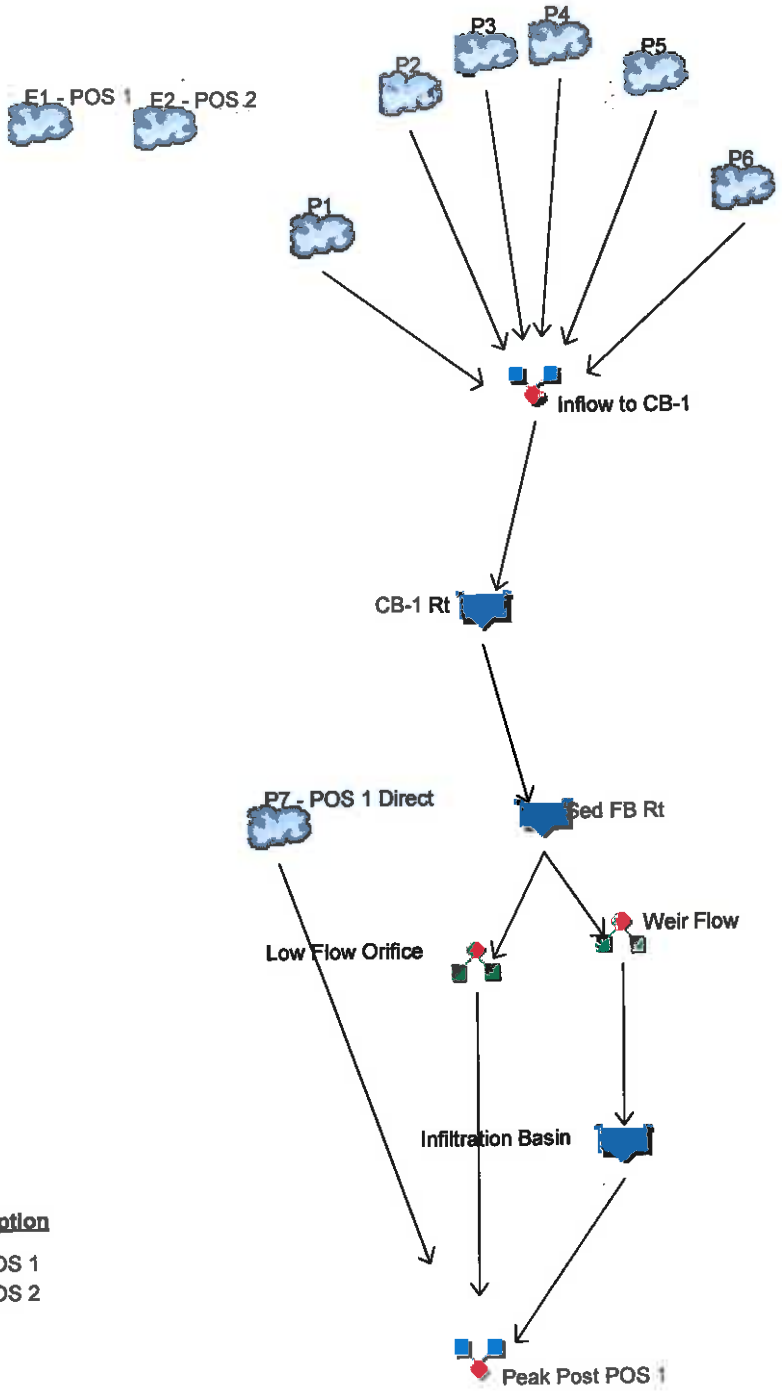
E1 - POS 1 (mod CN)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.30		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 36.82**	**+**	**0.00**	**+**	**0.00**	**=**	**36.82**
Shallow Concentrated Flow							
Flow length (ft)	= 535.00		0.00		0.00		
Watercourse slope (%)	= 0.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=0.72		0.00		0.00		
Travel Time (min)	**= 12.36**	**+**	**0.00**	**+**	**0.00**	**=**	**12.36**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**49.20 min**

Appendix D

Post Development Hydraflow Stormwater Modeling Printouts

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	E1 - POS 1
2	SCS Runoff	E2 - POS 2
3	SCS Runoff	P1
4	SCS Runoff	P2
5	SCS Runoff	P3
6	SCS Runoff	P4
7	SCS Runoff	P5
8	SCS Runoff	P6
9	SCS Runoff	P7 - POS 1 Direct
10	Combine	Inflow to CB-1
11	Reservoir	CB-1 Rt
12	Reservoir	Sed FB Rt
13	Diversion1	Low Flow Orifice
14	Diversion2	Weir Flow
15	Reservoir	Infiltration Basin
16	Combine	Peak Post POS 1

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.489	1	762	20,017	----	----	----	E1 - POS 1
2	SCS Runoff	0.014	1	770	273	----	----	----	E2 - POS 2
3	SCS Runoff	0.836	1	733	4,023	----	----	----	P1
4	SCS Runoff	0.631	1	732	2,810	----	----	----	P2
5	SCS Runoff	1.122	1	733	5,135	----	----	----	P3
6	SCS Runoff	1.000	1	733	4,667	----	----	----	P4
7	SCS Runoff	1.150	1	731	4,873	----	----	----	P5
8	SCS Runoff	0.634	1	729	2,419	----	----	----	P6
9	SCS Runoff	0.247	1	727	1,097	----	----	----	P7 - POS 1 Direct
10	Combine	5.327	1	732	23,927	3, 4, 5, 6, 7, 8, 10	----	----	Inflow to CB-1
11	Reservoir	5.325	1	732	23,584		36.62	463	CB-1 Rt
12	Reservoir	5.136	1	733	14,780	11	38.35	2,290	Sed FB Rt
13	Diversion1	0.031	1	733	1,513	12	----	----	Low Flow Orifice
14	Diversion2	5.106	1	733	13,266	12	----	----	Weir Flow
15	Reservoir	0.000	1	749	0	14	37.29	4,738	Infiltration Basin
16	Combine	0.276	1	728	2,611	9, 13, 15	----	----	Peak Post POS 1

Hydrograph Report

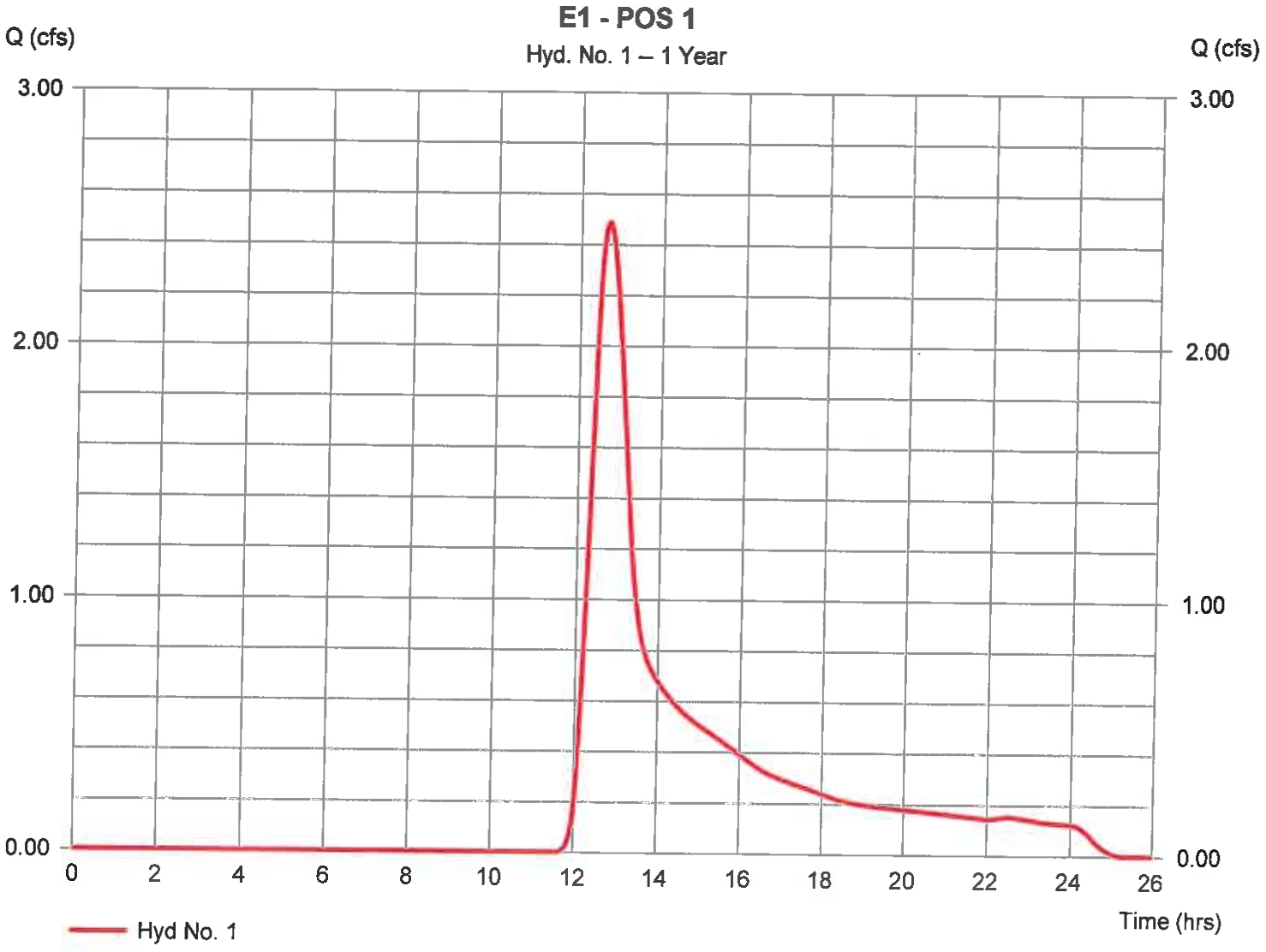
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 1

E1 - POS 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.489 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.70 hrs
Time interval	= 1 min	Hyd. volume	= 20,017 cuft
Drainage area	= 9.280 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.20 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.000 x 55) + (2.020 x 61) + (1.200 x 98) + (2.060 x 98)] / 9.280



Hydrograph Report

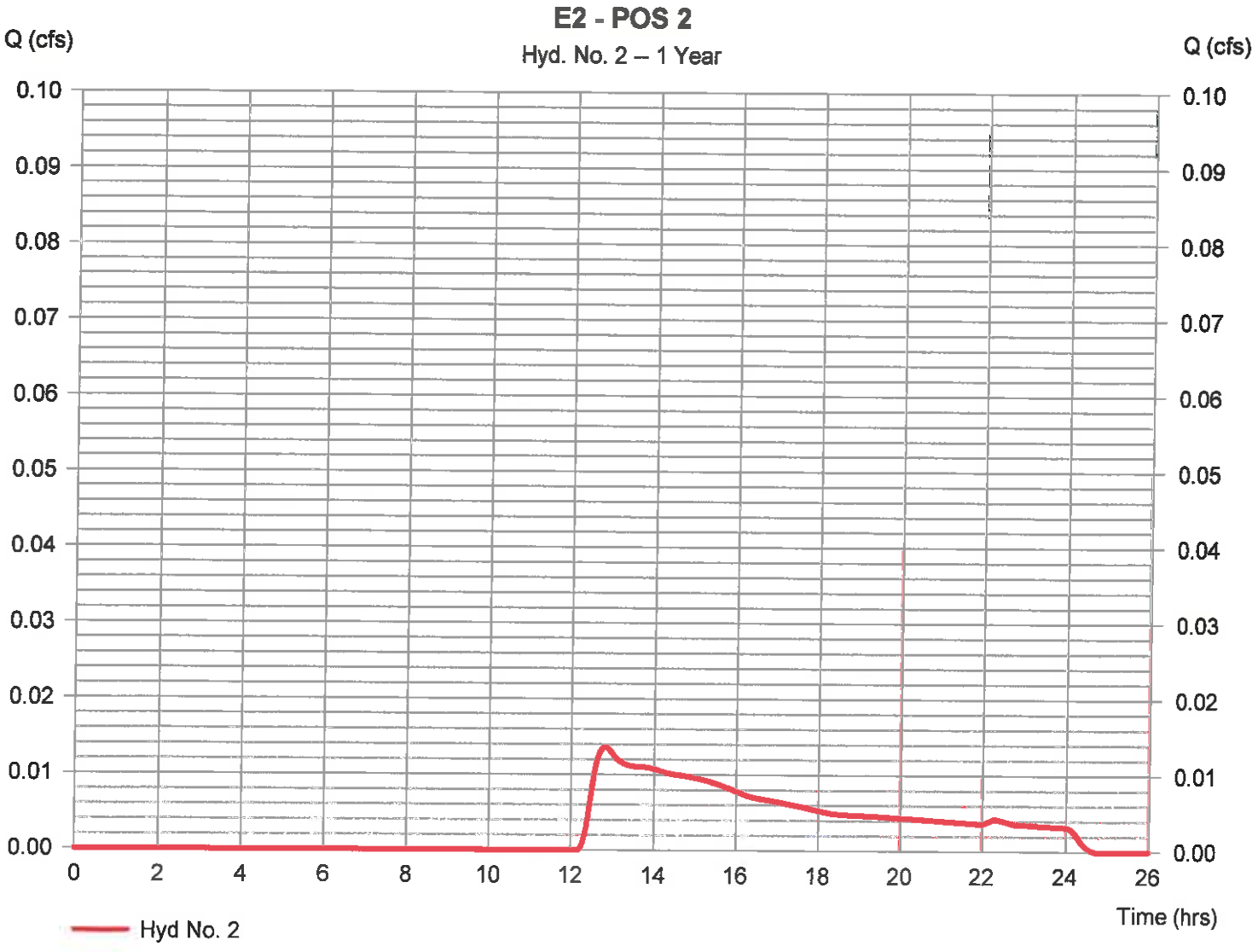
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 2

E2 - POS 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.014 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.83 hrs
Time interval	= 1 min	Hyd. volume	= 273 cuft
Drainage area	= 0.620 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.50 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

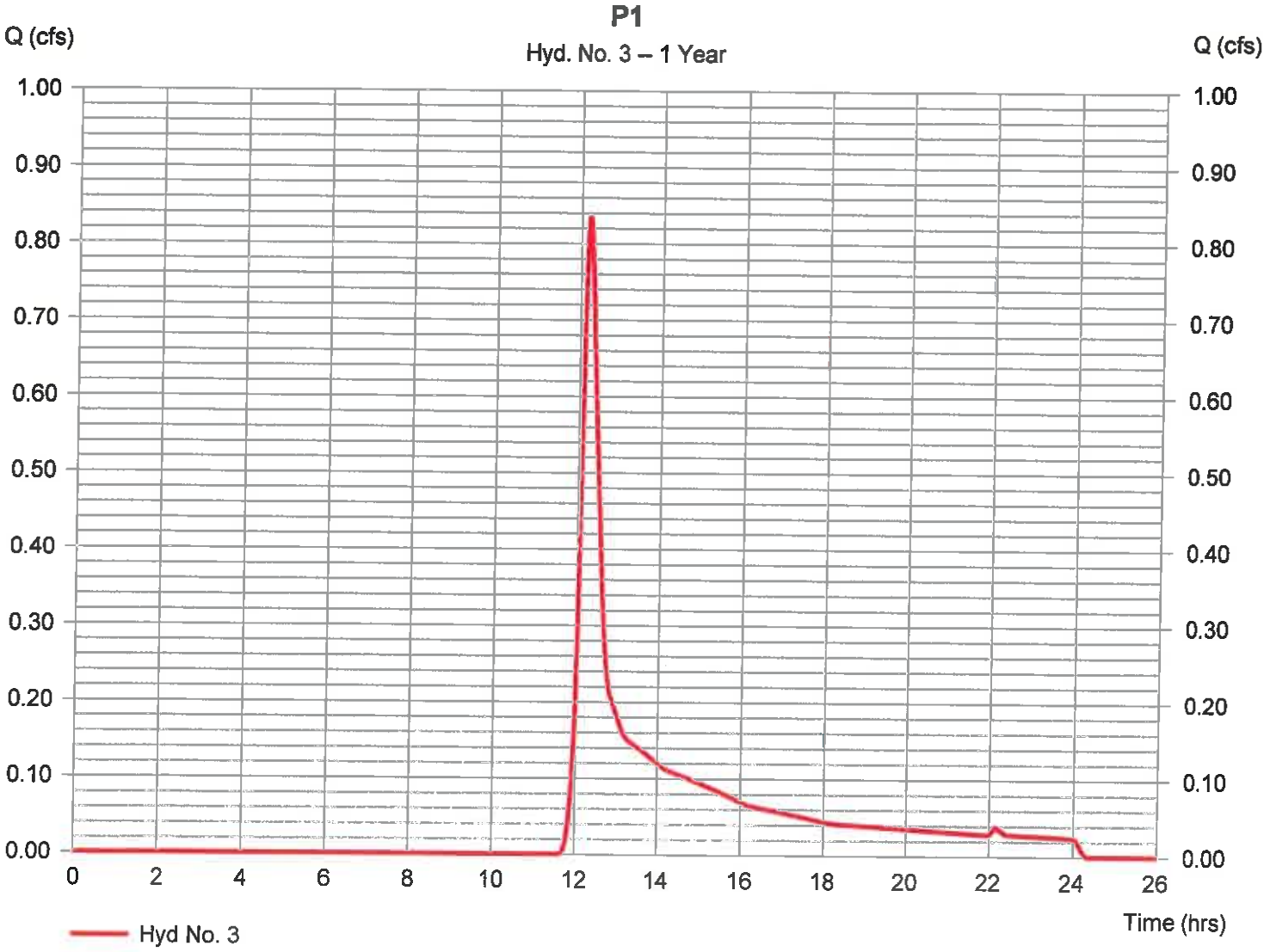
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 3

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.836 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.22 hrs
Time interval	= 1 min	Hyd. volume	= 4,023 cuft
Drainage area	= 2.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.60 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.540 x 61) + (0.160 x 98) + (0.080 x 98) + (0.050 x 98) + (0.170 x 98)] / 2.000



Hydrograph Report

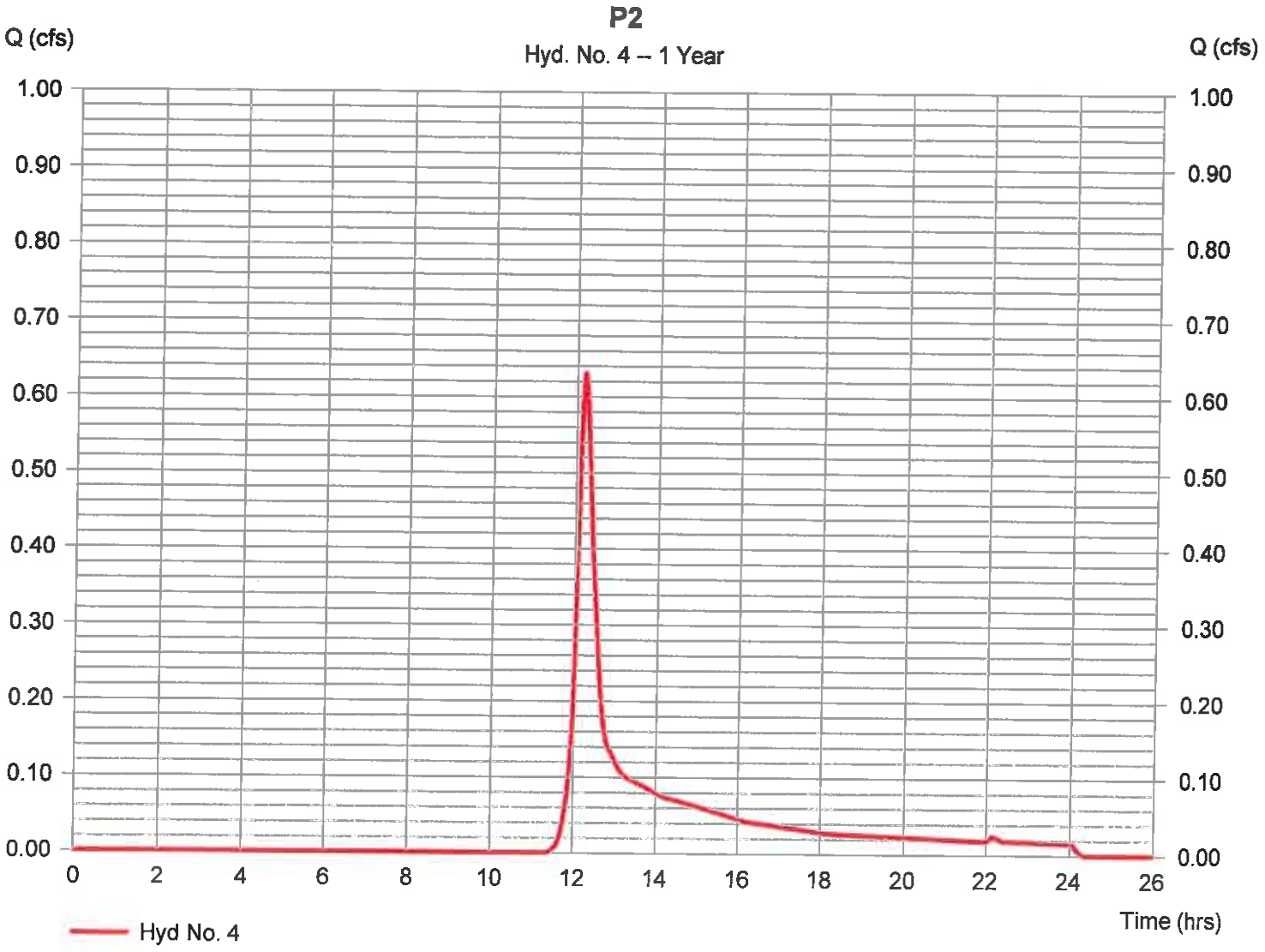
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 4

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.631 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 1 min	Hyd. volume	= 2,810 cuft
Drainage area	= 1.140 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.70 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.770 x 61) + (0.120 x 98) + (0.060 x 98) + (0.040 x 98) + (0.150 x 98)] / 1.140



Hydrograph Report

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

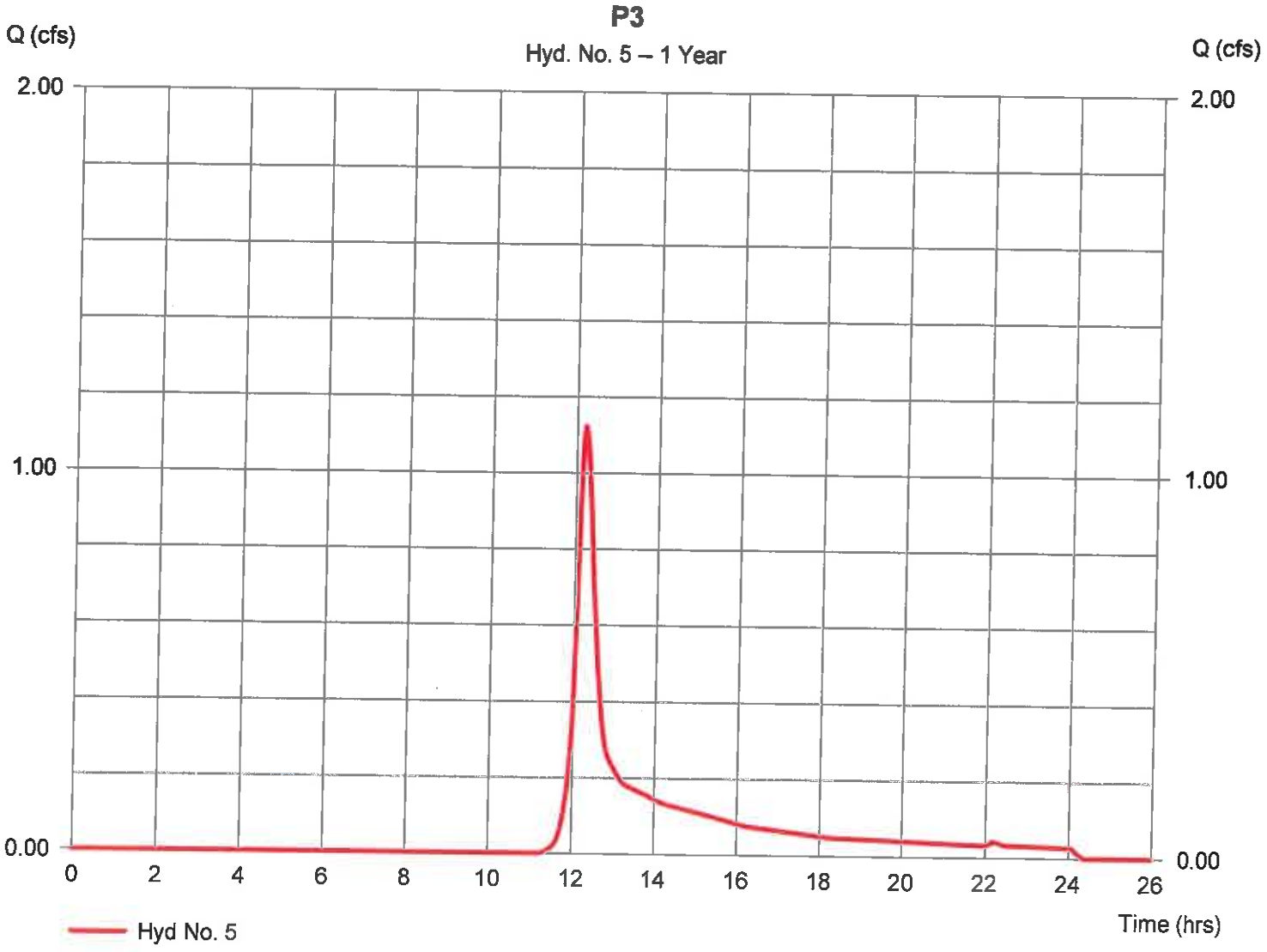
Tuesday, 10 / 24 / 2023

Hyd. No. 5

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.122 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.22 hrs
Time interval	= 1 min	Hyd. volume	= 5,135 cuft
Drainage area	= 1.930 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.30 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.270 x 61) + (0.220 x 98) + (0.110 x 98) + (0.070 x 98) + (0.260 x 98)] / 1.930



Hydrograph Report

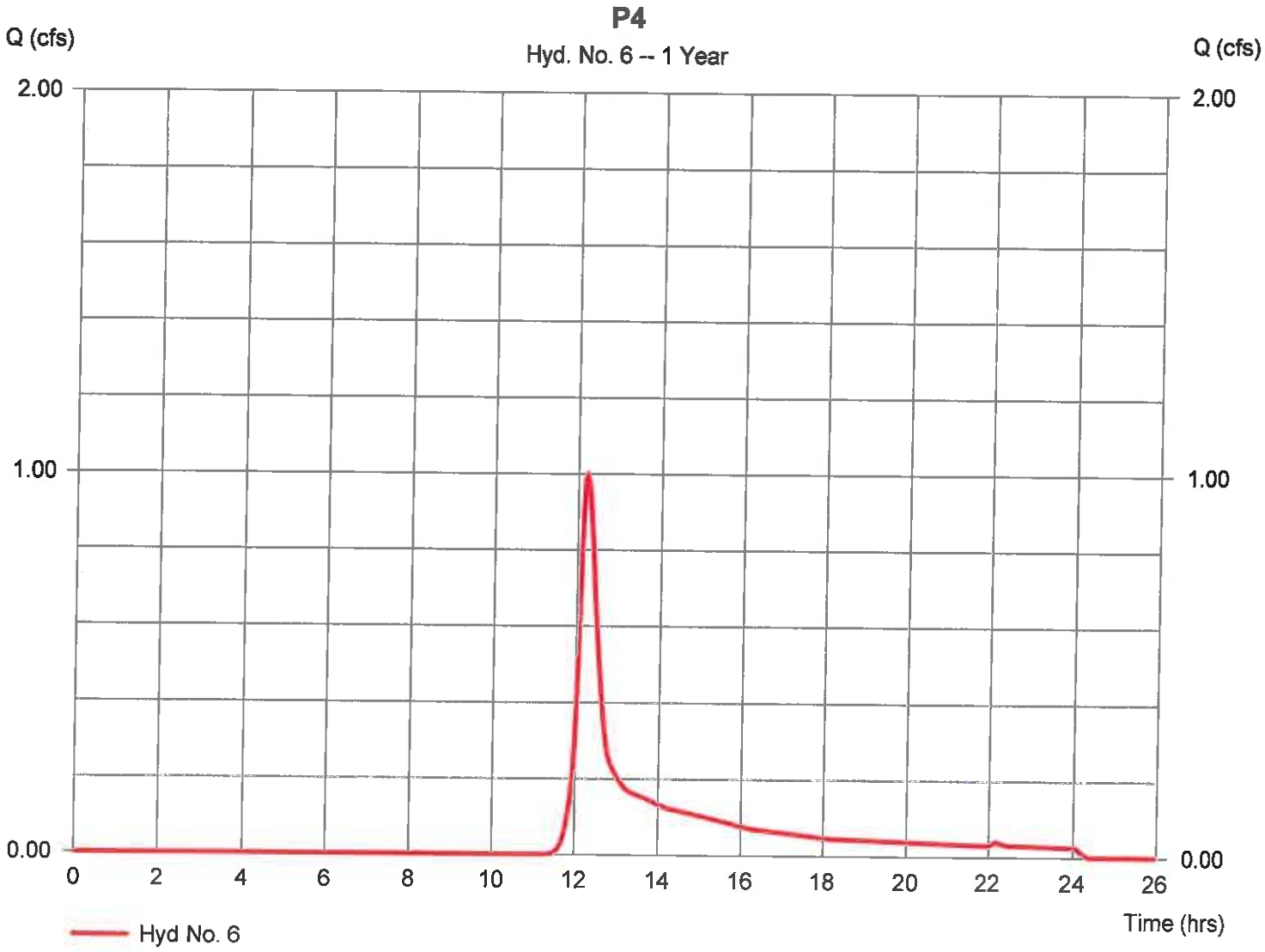
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.22 hrs
Time interval	= 1 min	Hyd. volume	= 4,667 cuft
Drainage area	= 1.870 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.70 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.240 x 61) + (0.250 x 98) + (0.120 x 98) + (0.060 x 98) + (0.200 x 98)] / 1.870



Hydrograph Report

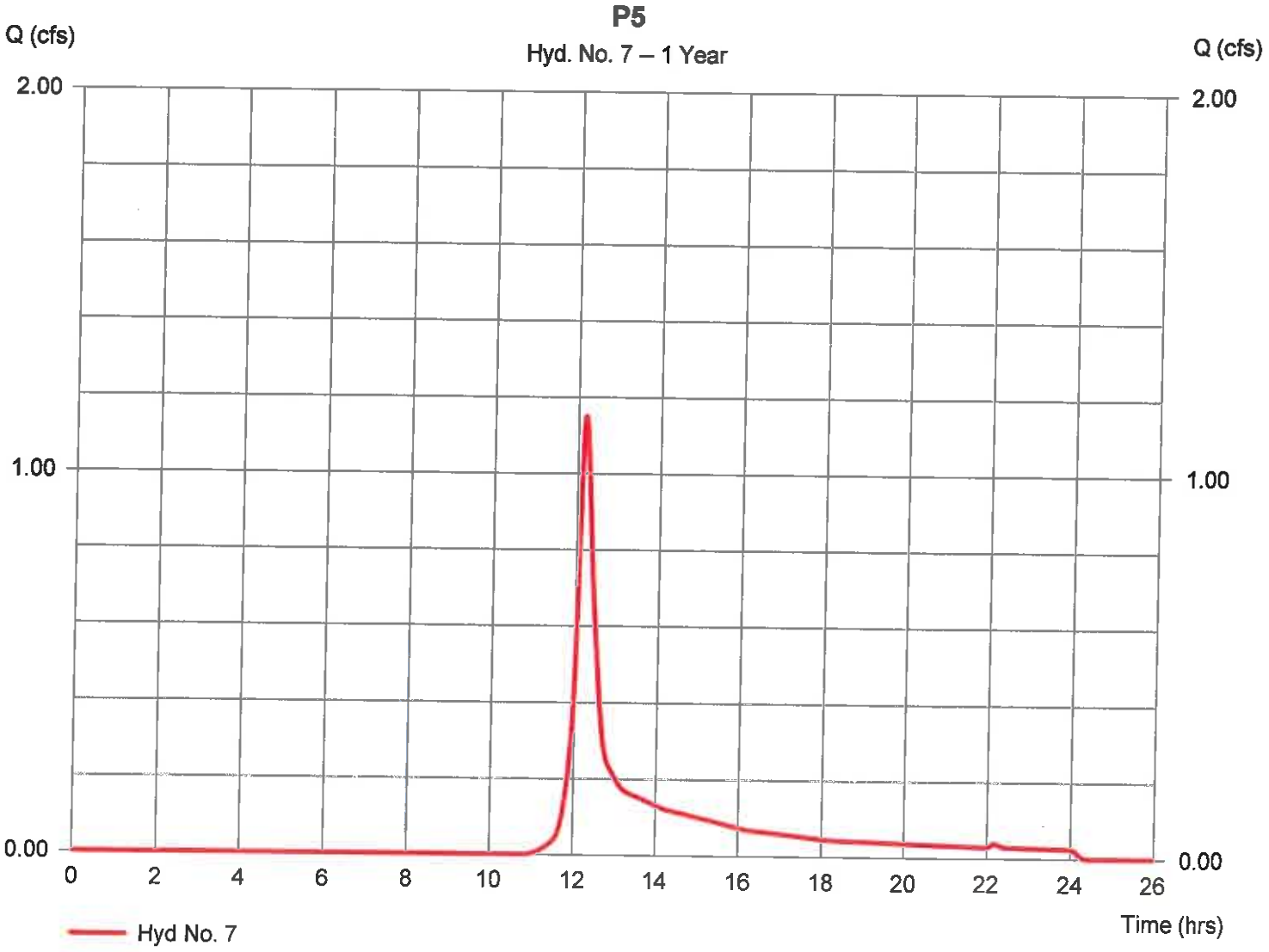
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 7

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 1.150 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 4,873 cuft
Drainage area	= 1.640 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.70 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.960 x 61) + (0.220 x 98) + (0.110 x 98) + (0.070 x 98) + (0.280 x 98)] / 1.640



Hydrograph Report

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

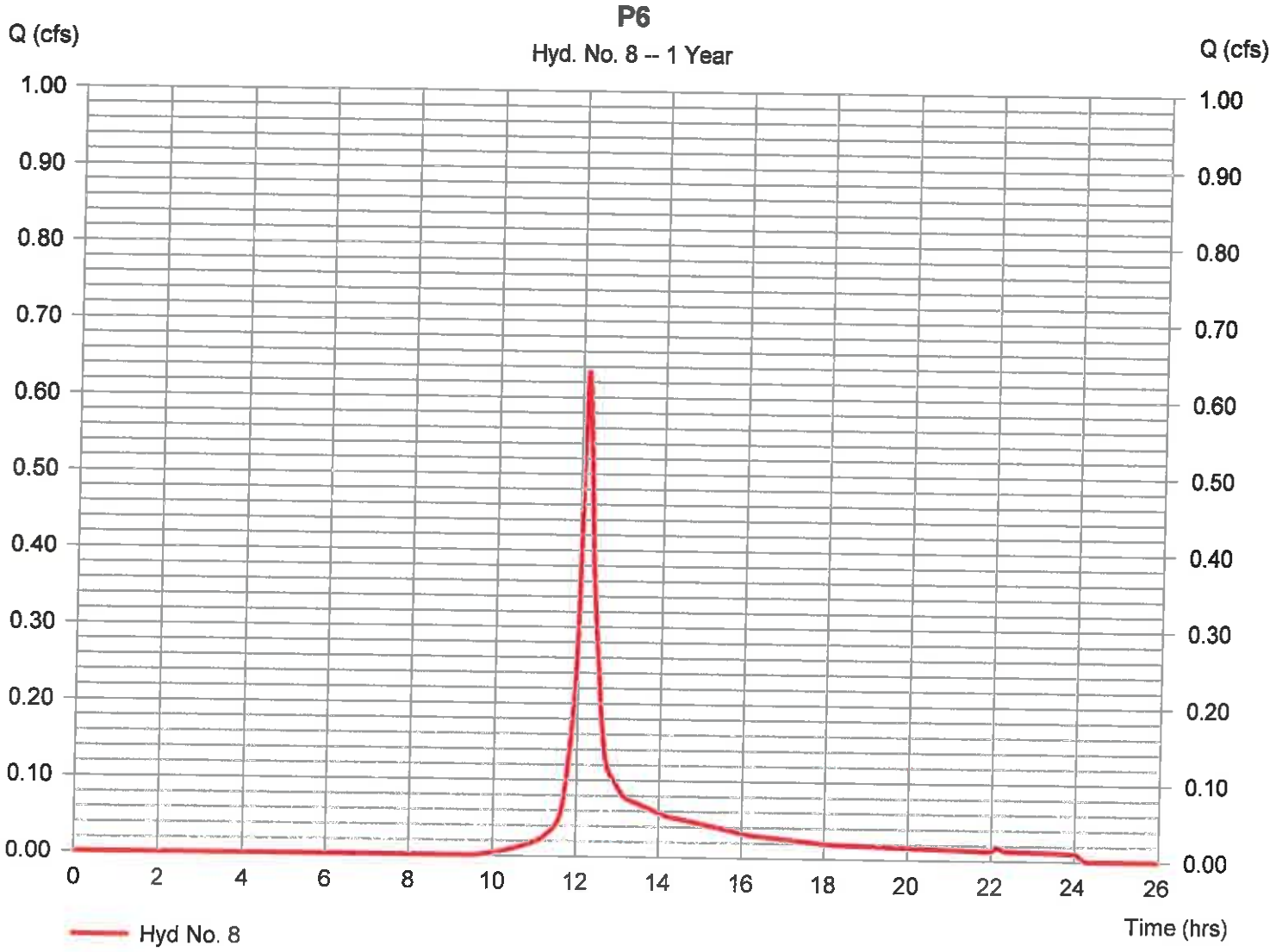
Tuesday, 10 / 24 / 2023

Hyd. No. 8

P6

Hydrograph type	= SCS Runoff	Peak discharge	= 0.634 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.15 hrs
Time interval	= 1 min	Hyd. volume	= 2,419 cuft
Drainage area	= 0.590 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.20 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 74) + (0.070 x 98) + (0.030 x 98) + (0.020 x 98) + (0.070 x 98)] / 0.590



Hydrograph Report

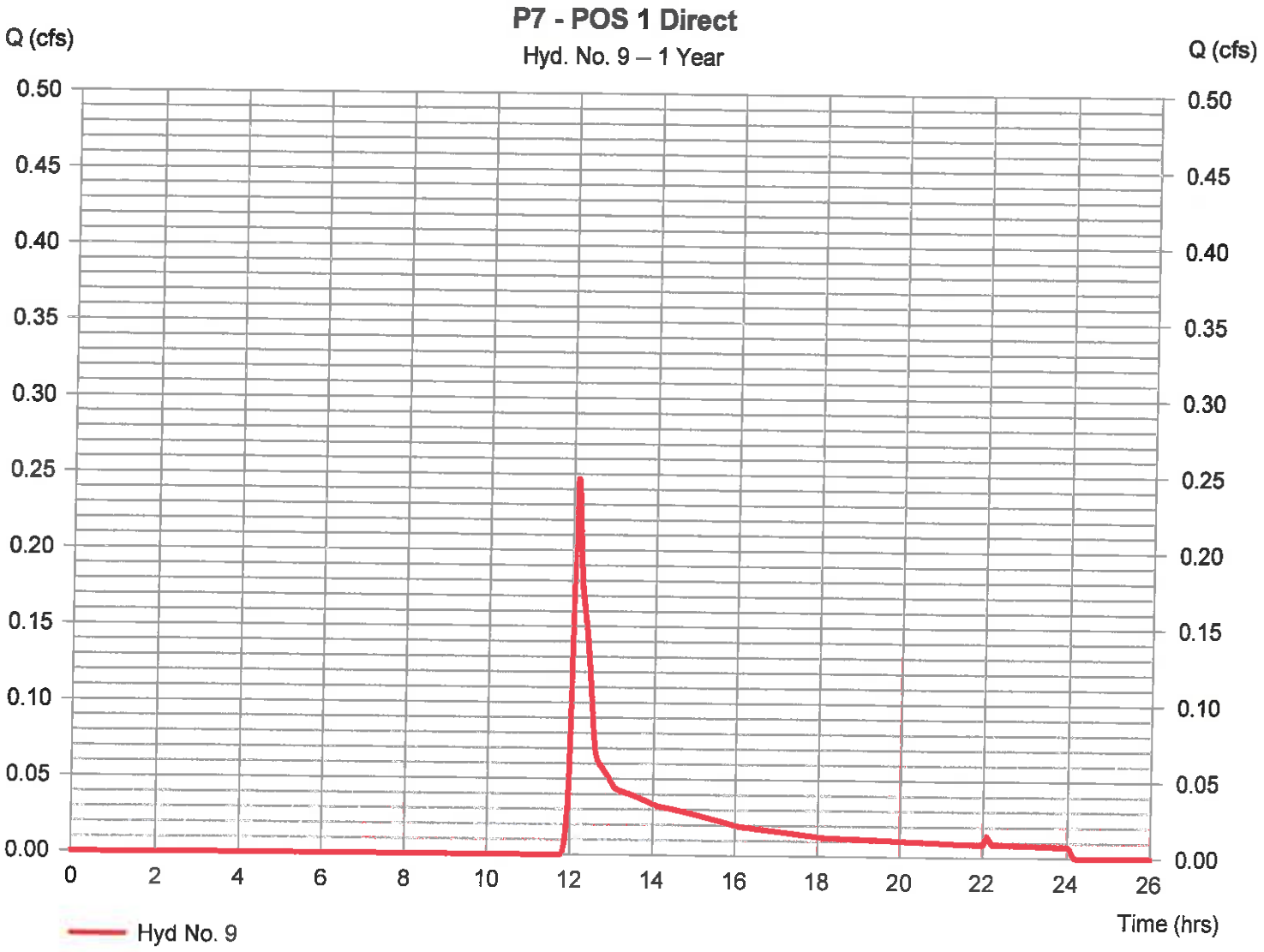
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 9

P7 - POS 1 Direct

Hydrograph type	= SCS Runoff	Peak discharge	= 0.247 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.12 hrs
Time interval	= 1 min	Hyd. volume	= 1,097 cuft
Drainage area	= 0.700 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 2.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.580 x 61) + (0.030 x 98) + (0.010 x 98) + (0.020 x 98) + (0.060 x 98)] / 0.700



Hydrograph Report

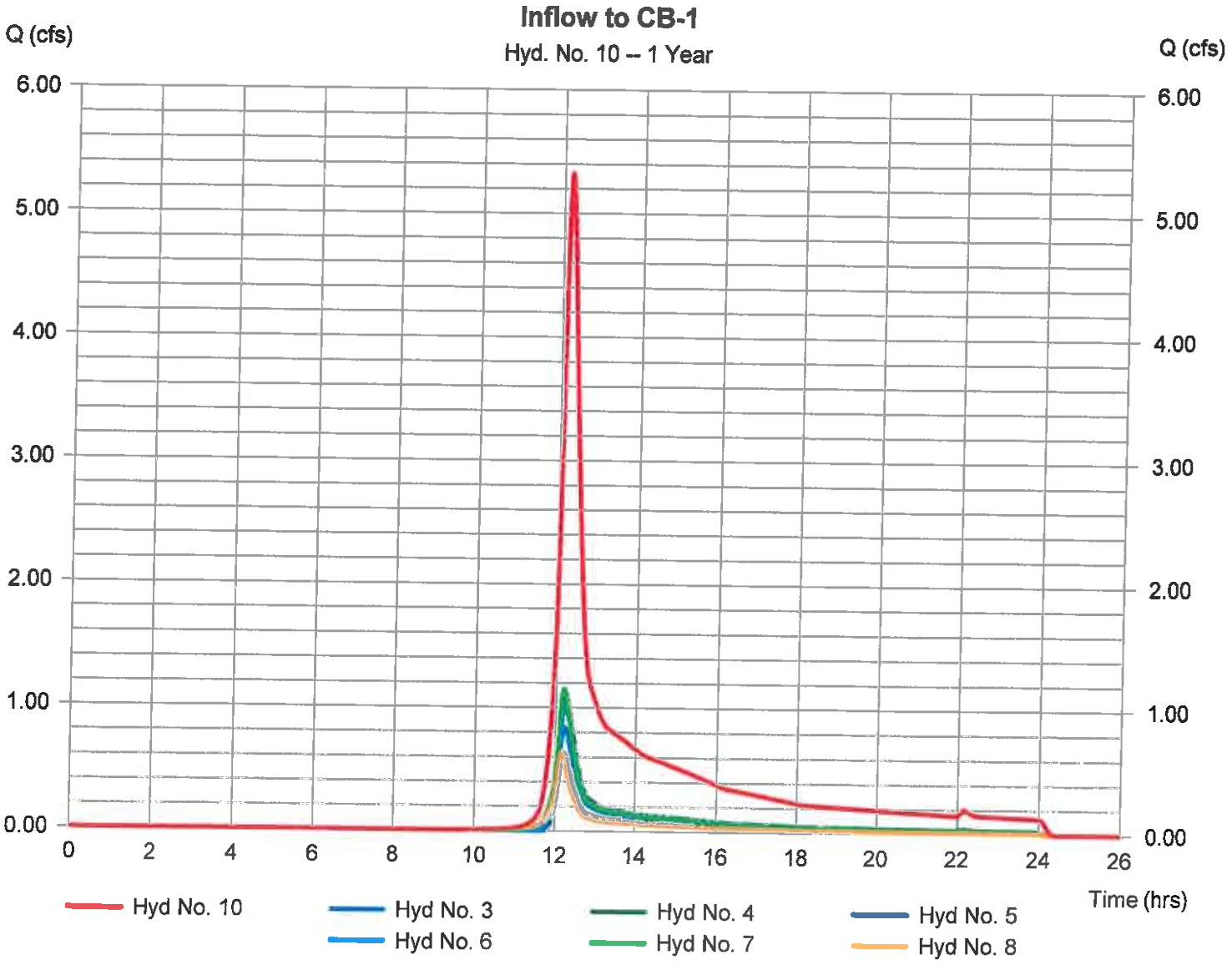
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 10

Inflow to CB-1

Hydrograph type	= Combine	Peak discharge	= 5.327 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 1 min	Hyd. volume	= 23,927 cuft
Inflow hyds.	= 3, 4, 5, 6, 7, 8	Contrib. drain. area	= 9.170 ac



Hydrograph Report

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

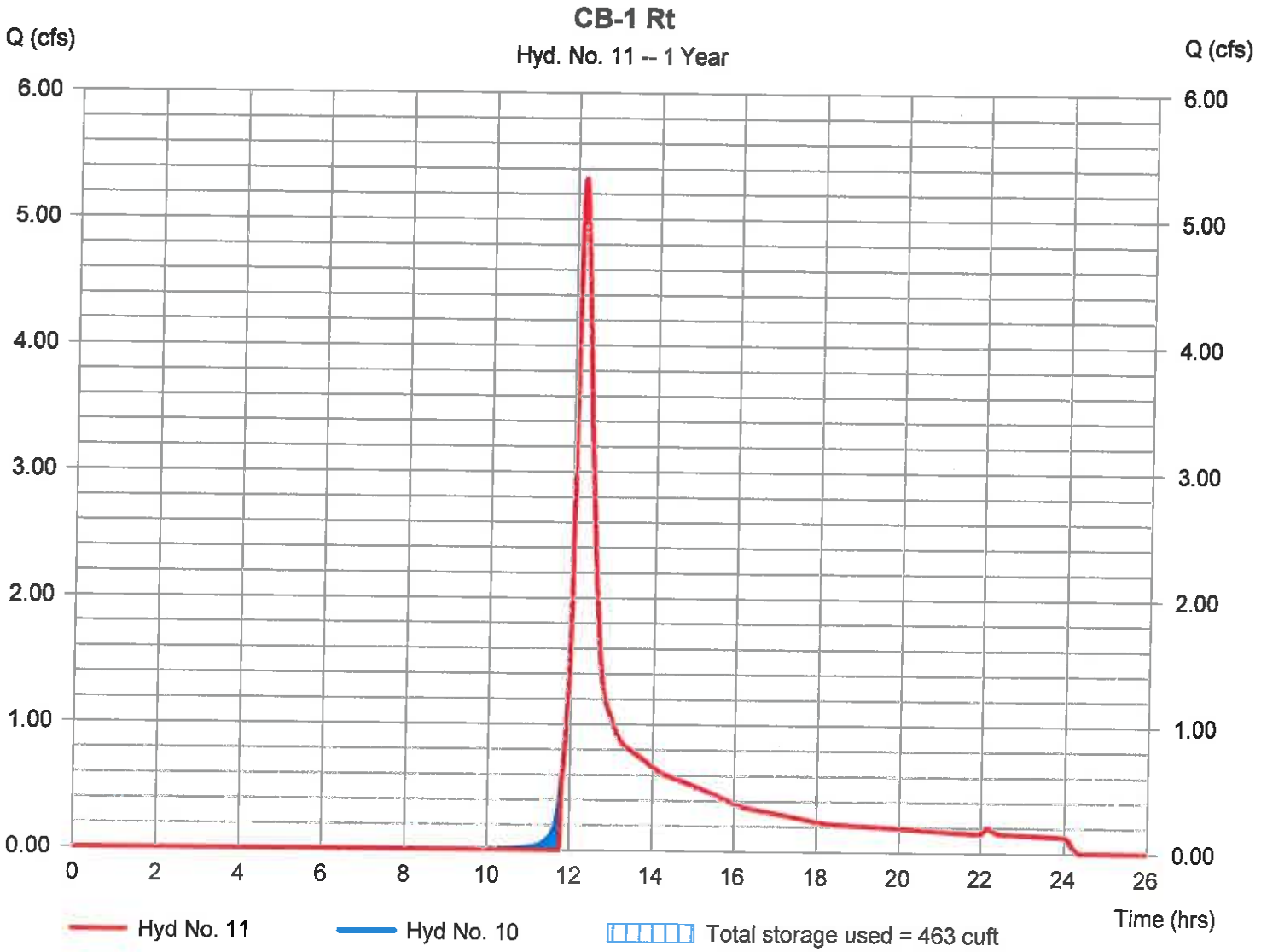
Tuesday, 10 / 24 / 2023

Hyd. No. 11

CB-1 Rt

Hydrograph type	= Reservoir	Peak discharge	= 5.325 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 1 min	Hyd. volume	= 23,584 cuft
Inflow hyd. No.	= 10 - Inflow to CB-1	Max. Elevation	= 36.62 ft
Reservoir name	= CB-1	Max. Storage	= 463 cuft

Storage Indication method used.



Pond No. 3 - CB-1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 33.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	33.00	128	0	0
6.70	39.70	128	858	858

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 36.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	33.00	---	---	---	---	0.00	---	---	---	---	---	0.000
0.67	86	33.67	---	---	---	---	0.00	---	---	---	---	---	0.000
1.34	172	34.34	---	---	---	---	0.00	---	---	---	---	---	0.000
2.01	257	35.01	---	---	---	---	0.00	---	---	---	---	---	0.000
2.68	343	35.68	---	---	---	---	0.00	---	---	---	---	---	0.000
3.35	429	36.35	---	---	---	---	2.07	---	---	---	---	---	2.068
4.02	515	37.02	---	---	---	---	10.29	---	---	---	---	---	10.29
4.69	600	37.69	---	---	---	---	21.95	---	---	---	---	---	21.95
5.36	686	38.36	---	---	---	---	36.22	---	---	---	---	---	36.22
6.03	772	39.03	---	---	---	---	52.69	---	---	---	---	---	52.69
6.70	858	39.70	---	---	---	---	71.10	---	---	---	---	---	71.10

Hydrograph Report

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

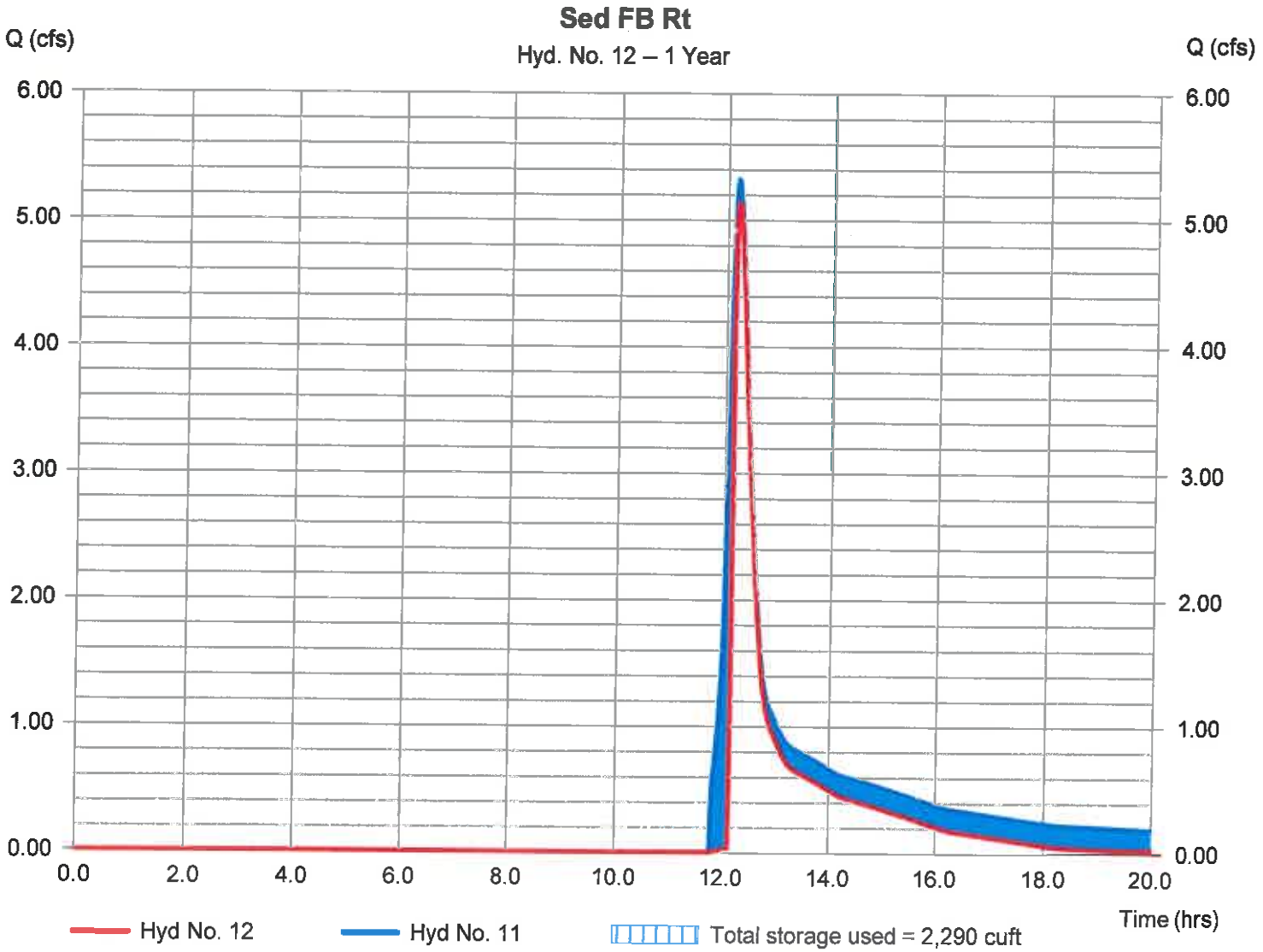
Tuesday, 10 / 24 / 2023

Hyd. No. 12

Sed FB Rt

Hydrograph type	= Reservoir	Peak discharge	= 5.136 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.22 hrs
Time interval	= 1 min	Hyd. volume	= 14,780 cuft
Inflow hyd. No.	= 11 - CB-1 Rt	Max. Elevation	= 38.35 ft
Reservoir name	= Sed Forebay	Max. Storage	= 2,290 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond No. 1 - Sed Forebay

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 35.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	35.00	414	0	0
1.00	36.00	575	492	492
2.00	37.00	725	648	1,141
3.00	38.00	890	806	1,947
4.00	39.00	1,065	976	2,923
5.00	40.00	1,245	1,154	4,077

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.80	0.00	0.00	0.00
Span (in)	= 0.80	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 35.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	0.00
Crest El. (ft)	= 38.10	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (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	35.00	0.00	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	49	35.10	0.00 ic	---	---	---	0.00	---	---	---	0.011	---	0.015
0.20	98	35.20	0.01 ic	---	---	---	0.00	---	---	---	0.022	---	0.029
0.30	148	35.30	0.01 ic	---	---	---	0.00	---	---	---	0.033	---	0.042
0.40	197	35.40	0.01 ic	---	---	---	0.00	---	---	---	0.044	---	0.054
0.50	246	35.50	0.01 ic	---	---	---	0.00	---	---	---	0.055	---	0.067
0.60	295	35.60	0.01 ic	---	---	---	0.00	---	---	---	0.066	---	0.079
0.70	345	35.70	0.01 ic	---	---	---	0.00	---	---	---	0.077	---	0.091
0.80	394	35.80	0.01 ic	---	---	---	0.00	---	---	---	0.088	---	0.103
0.90	443	35.90	0.02 ic	---	---	---	0.00	---	---	---	0.099	---	0.115
1.00	492	36.00	0.02 ic	---	---	---	0.00	---	---	---	0.110	---	0.127
1.10	557	36.10	0.02 ic	---	---	---	0.00	---	---	---	0.113	---	0.130
1.20	622	36.20	0.02 ic	---	---	---	0.00	---	---	---	0.116	---	0.134
1.30	687	36.30	0.02 ic	---	---	---	0.00	---	---	---	0.119	---	0.138
1.40	752	36.40	0.02 ic	---	---	---	0.00	---	---	---	0.122	---	0.141
1.50	816	36.50	0.02 ic	---	---	---	0.00	---	---	---	0.124	---	0.145
1.60	881	36.60	0.02 ic	---	---	---	0.00	---	---	---	0.127	---	0.148
1.70	946	36.70	0.02 ic	---	---	---	0.00	---	---	---	0.130	---	0.152
1.80	1,011	36.80	0.02 ic	---	---	---	0.00	---	---	---	0.133	---	0.155
1.90	1,076	36.90	0.02 ic	---	---	---	0.00	---	---	---	0.136	---	0.159
2.00	1,141	37.00	0.02 ic	---	---	---	0.00	---	---	---	0.139	---	0.162
2.10	1,221	37.10	0.02 ic	---	---	---	0.00	---	---	---	0.142	---	0.166
2.20	1,302	37.20	0.02 ic	---	---	---	0.00	---	---	---	0.145	---	0.170
2.30	1,383	37.30	0.03 ic	---	---	---	0.00	---	---	---	0.148	---	0.174
2.40	1,463	37.40	0.03 ic	---	---	---	0.00	---	---	---	0.151	---	0.177
2.50	1,544	37.50	0.03 ic	---	---	---	0.00	---	---	---	0.155	---	0.181
2.60	1,624	37.60	0.03 ic	---	---	---	0.00	---	---	---	0.158	---	0.185
2.70	1,705	37.70	0.03 ic	---	---	---	0.00	---	---	---	0.161	---	0.188
2.80	1,786	37.80	0.03 ic	---	---	---	0.00	---	---	---	0.164	---	0.192
2.90	1,866	37.90	0.03 ic	---	---	---	0.00	---	---	---	0.167	---	0.196
3.00	1,947	38.00	0.03 ic	---	---	---	0.00	---	---	---	0.170	---	0.199
3.10	2,044	38.10	0.03 ic	---	---	---	0.00	---	---	---	0.174	---	0.203
3.20	2,142	38.20	0.03 ic	---	---	---	1.26	---	---	---	0.177	---	1.471
3.30	2,240	38.30	0.03 ic	---	---	---	3.57	---	---	---	0.180	---	3.785
3.40	2,337	38.40	0.03 ic	---	---	---	6.57	---	---	---	0.184	---	6.780
3.50	2,435	38.50	0.03 ic	---	---	---	10.11	---	---	---	0.187	---	10.33
3.60	2,532	38.60	0.03 ic	---	---	---	14.13	---	---	---	0.190	---	14.35

Continues on next page...

Sed Forebay

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
3.70	2,630	38.70	0.03 ic	—	—	—	18.57	—	—	—	0.194	—	18.80
3.80	2,728	38.80	0.03 ic	—	—	—	23.40	—	—	—	0.197	—	23.63
3.90	2,825	38.90	0.03 ic	—	—	—	28.59	—	—	—	0.201	—	28.83
4.00	2,923	39.00	0.03 ic	—	—	—	34.12	—	—	—	0.204	—	34.36
4.10	3,038	39.10	0.03 ic	—	—	—	39.96	—	—	—	0.207	—	40.20
4.20	3,154	39.20	0.03 ic	—	—	—	46.10	—	—	—	0.211	—	46.35
4.30	3,269	39.30	0.03 ic	—	—	—	52.53	—	—	—	0.214	—	52.78
4.40	3,384	39.40	0.04 ic	—	—	—	59.23	—	—	—	0.218	—	59.48
4.50	3,500	39.50	0.04 ic	—	—	—	66.19	—	—	—	0.221	—	66.45
4.60	3,615	39.60	0.04 ic	—	—	—	73.41	—	—	—	0.225	—	73.67
4.70	3,730	39.70	0.04 ic	—	—	—	80.87	—	—	—	0.228	—	81.14
4.80	3,846	39.80	0.04 ic	—	—	—	88.57	—	—	—	0.231	—	88.84
4.90	3,961	39.90	0.04 ic	—	—	—	96.50	—	—	—	0.235	—	96.77
5.00	4,077	40.00	0.04 ic	—	—	—	104.65	—	—	—	0.238	—	104.93

...End

Hydrograph Report

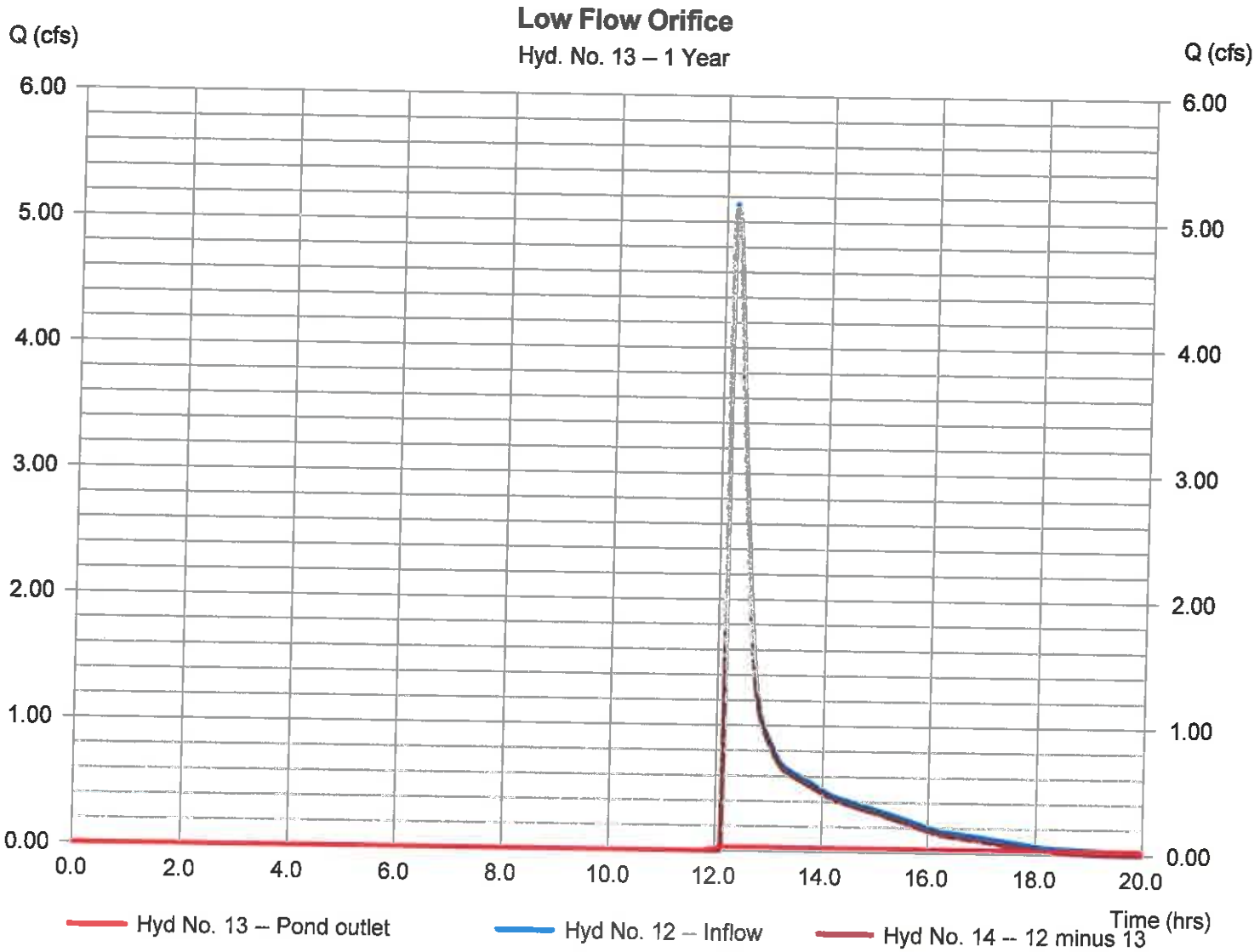
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 13

Low Flow Orifice

Hydrograph type	= Diversion1	Peak discharge	= 0.031 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.22 hrs
Time interval	= 1 min	Hyd. volume	= 1,513 cuft
Inflow hydrograph	= 12 - Sed FB Rt	2nd diverted hyd.	= 14
Diversion method	= Pond - Sed Forebay	Pond structure	= Culv/Orf A



Hydrograph Report

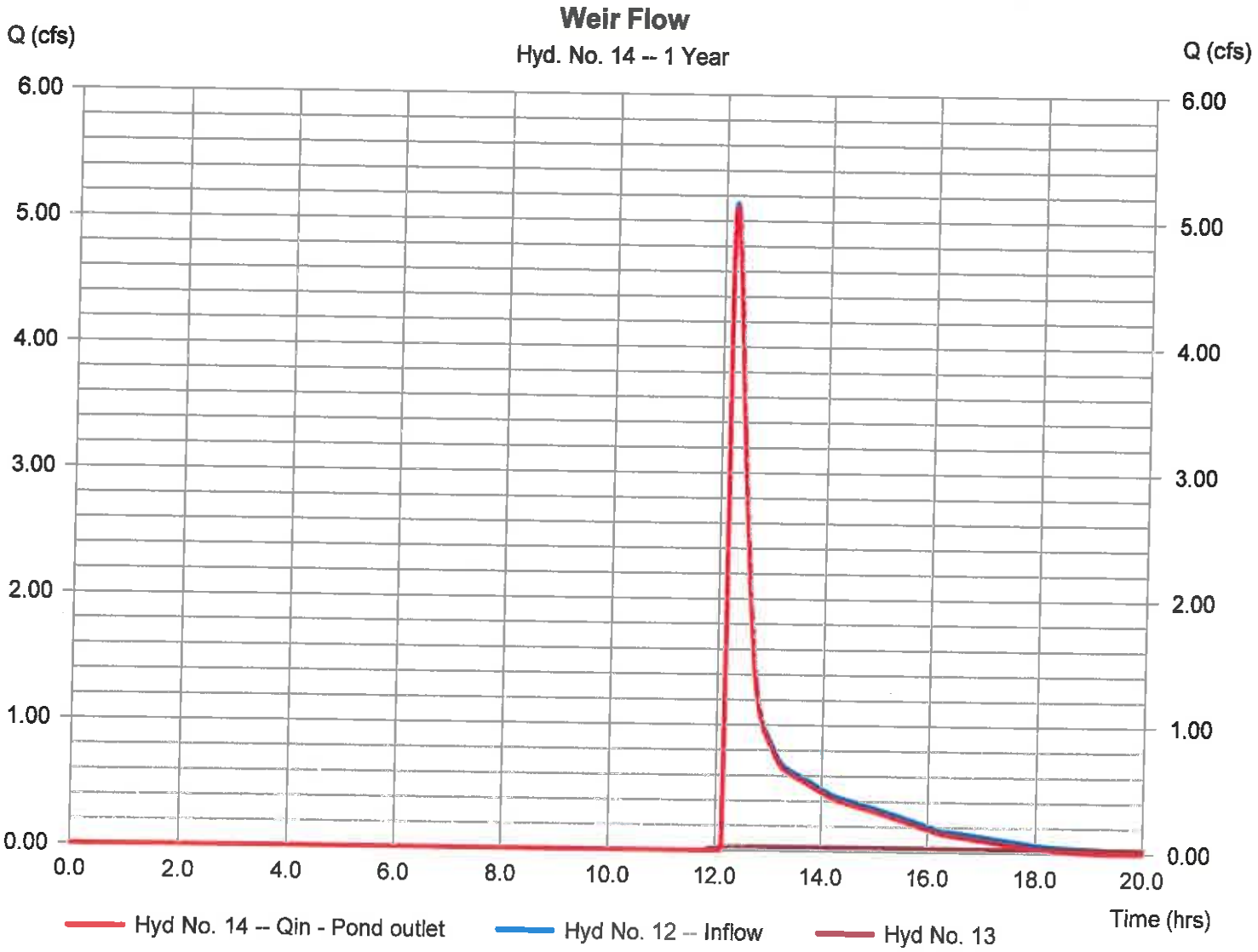
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 14

Weir Flow

Hydrograph type	= Diversion2	Peak discharge	= 5.106 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.22 hrs
Time interval	= 1 min	Hyd. volume	= 13,266 cuft
Inflow hydrograph	= 12 - Sed FB Rt	2nd diverted hyd.	= 13
Diversion method	= Pond - Sed Forebay	Pond structure	= Culv/Orf A



Hydrograph Report

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

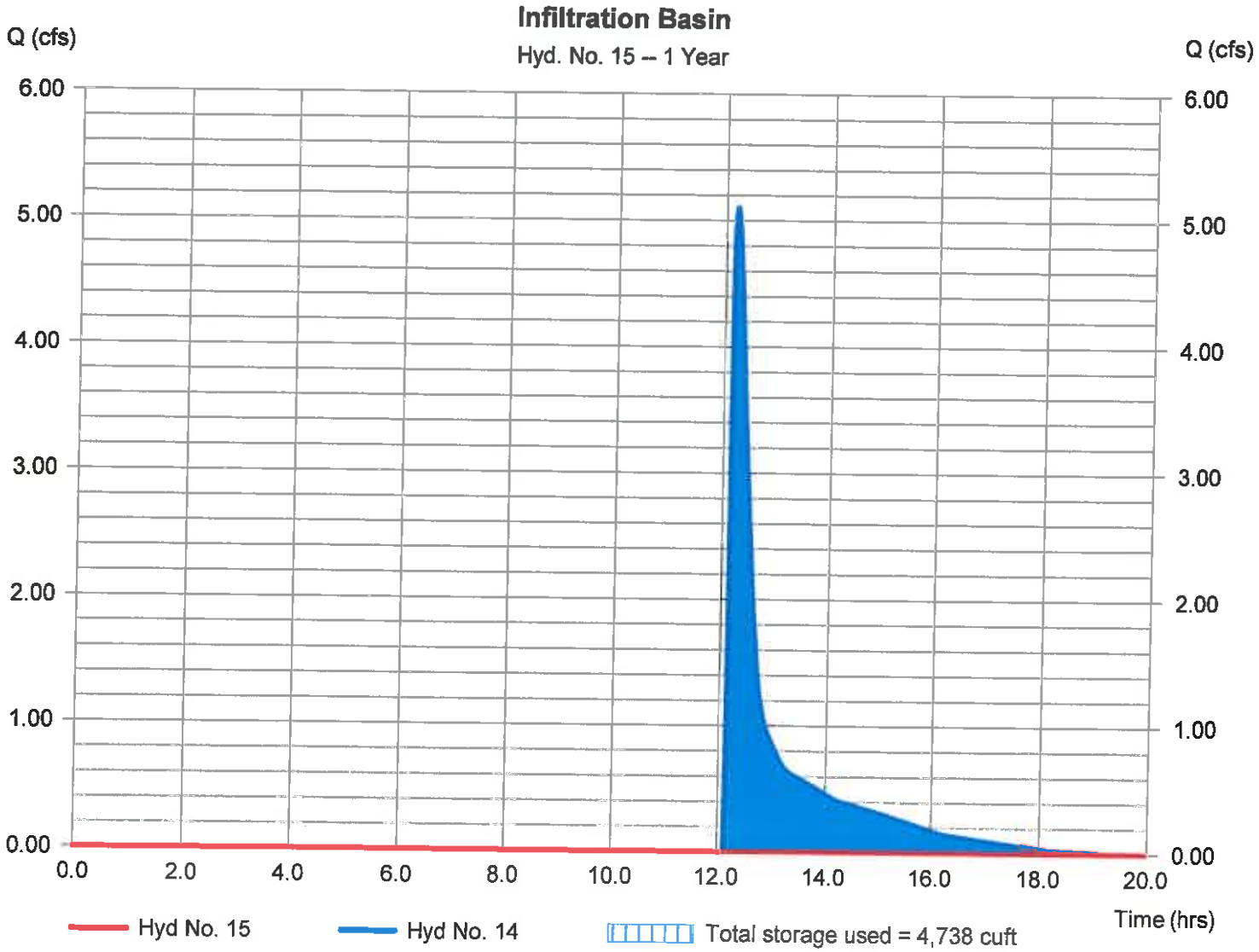
Tuesday, 10 / 24 / 2023

Hyd. No. 15

Infiltration Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.48 hrs
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 14 - Weir Flow	Max. Elevation	= 37.29 ft
Reservoir name	= Infiltration	Max. Storage	= 4,738 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond No. 2 - Infiltration

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 37.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	37.00	16,000	0	0
0.60	37.60	16,775	9,831	9,831
1.00	38.00	17,400	6,834	16,665
2.00	39.00	18,980	18,182	34,847
3.00	40.00	20,590	19,778	54,625

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	12.00	8.00	0.00
Span (in)	= 24.00	12.00	8.00	0.00
No. Barrels	= 2	4	4	0
Invert El. (ft)	= 32.00	37.60	37.60	0.00
Length (ft)	= 60.00	0.50	0.50	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	Inactive	0.00	0.00
Crest El. (ft)	= 39.50	37.85	0.00	0.00
Weir Coeff.	= 3.33	0.45	3.33	3.33
Weir Type	= Rect	20 degV	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (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	37.00	0.00	0.00	0.00	---	0.00	---	---	---	0.000	---	0.000
0.06	983	37.06	0.00	0.00	0.00	---	0.00	---	---	---	0.321	---	0.321
0.12	1,966	37.12	0.00	0.00	0.00	---	0.00	---	---	---	0.642	---	0.642
0.18	2,949	37.18	0.00	0.00	0.00	---	0.00	---	---	---	0.963	---	0.963
0.24	3,932	37.24	0.00	0.00	0.00	---	0.00	---	---	---	1.285	---	1.285
0.30	4,915	37.30	0.00	0.00	0.00	---	0.00	---	---	---	1.606	---	1.606
0.36	5,898	37.36	0.00	0.00	0.00	---	0.00	---	---	---	1.927	---	1.927
0.42	6,881	37.42	0.00	0.00	0.00	---	0.00	---	---	---	2.248	---	2.248
0.48	7,864	37.48	0.00	0.00	0.00	---	0.00	---	---	---	2.569	---	2.569
0.54	8,848	37.54	0.00	0.00	0.00	---	0.00	---	---	---	2.890	---	2.890
0.60	9,831	37.60	0.00	0.00	0.00	---	0.00	---	---	---	3.211	---	3.211
0.64	10,514	37.64	0.00	0.03 ic	0.02 ic	---	0.00	---	---	---	3.223	---	3.276
0.68	11,197	37.68	0.00	0.11 ic	0.09 ic	---	0.00	---	---	---	3.235	---	3.441
0.72	11,881	37.72	0.00	0.25 ic	0.20 ic	---	0.00	---	---	---	3.247	---	3.702
0.76	12,564	37.76	0.00	0.44 ic	0.35 ic	---	0.00	---	---	---	3.259	---	4.052
0.80	13,248	37.80	0.00	0.68 ic	0.54 ic	---	0.00	---	---	---	3.271	---	4.492
0.84	13,931	37.84	0.00	0.97 ic	0.76 ic	---	0.00	---	---	---	3.283	---	5.007
0.88	14,614	37.88	0.00	1.30 ic	1.00 ic	---	0.00	---	---	---	3.295	---	5.596
0.92	15,298	37.92	0.00	1.67 ic	1.28 ic	---	0.00	---	---	---	3.307	---	6.256
0.96	15,981	37.96	0.00	2.08 ic	1.57 ic	---	0.00	---	---	---	3.319	---	6.977
1.00	16,665	38.00	0.00	2.53 ic	1.89 ic	---	0.00	---	---	---	3.331	---	7.745
1.10	18,483	38.10	0.00	3.79 ic	2.71 ic	---	0.00	---	---	---	3.361	---	9.856
1.20	20,301	38.20	0.00	5.20 ic	3.49 ic	---	0.00	---	---	---	3.391	---	12.08
1.30	22,119	38.30	0.00	6.69 ic	1.66 oc	---	0.00	---	---	---	3.422	---	11.77
1.40	23,938	38.40	0.00	8.21 ic	3.31 oc	---	0.00	---	---	---	3.452	---	14.97
1.50	25,756	38.50	0.00	9.62 ic	4.38 oc	---	0.00	---	---	---	3.482	---	17.48
1.60	27,574	38.60	0.00	10.70 ic	5.24 oc	---	0.00	---	---	---	3.512	---	19.44
1.70	29,392	38.70	0.00	6.48 oc	5.89 ic	---	0.00	---	---	---	3.543	---	15.90
1.80	31,211	38.80	0.00	9.16 oc	6.26 ic	---	0.00	---	---	---	3.573	---	18.99
1.90	33,029	38.90	0.00	11.22 oc	6.61 ic	---	0.00	---	---	---	3.603	---	21.43
2.00	34,847	39.00	0.00	12.95 oc	6.94 ic	---	0.00	---	---	---	3.633	---	23.53
2.10	36,825	39.10	0.00	14.48 oc	7.26 ic	---	0.00	---	---	---	3.664	---	25.40
2.20	38,803	39.20	0.00	15.86 oc	7.57 ic	---	0.00	---	---	---	3.695	---	27.12
2.30	40,780	39.30	0.00	16.57 ic	7.86 ic	---	0.00	---	---	---	3.726	---	28.15
2.40	42,758	39.40	0.00	17.24 ic	8.14 ic	---	0.00	---	---	---	3.757	---	29.14
2.50	44,736	39.50	0.00	17.90 ic	8.41 ic	---	0.00	---	---	---	3.788	---	30.10
2.60	46,714	39.60	0.00	18.52 ic	8.68 ic	---	1.05	---	---	---	3.818	---	32.07
2.70	48,691	39.70	0.00	19.13 ic	8.93 ic	---	2.98	---	---	---	3.849	---	34.89

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Infiltration

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.80	50,669	39.80	0.00	19.72 ic	9.18 ic	---	5.47	---	---	---	3.880	---	38.26
2.90	52,647	39.90	0.00	20.29 ic	9.43 ic	---	8.42	---	---	---	3.911	---	42.05
3.00	54,625	40.00	0.00	20.85 ic	9.66 ic	---	11.77	---	---	---	3.942	---	46.23

...End

Hydrograph Report

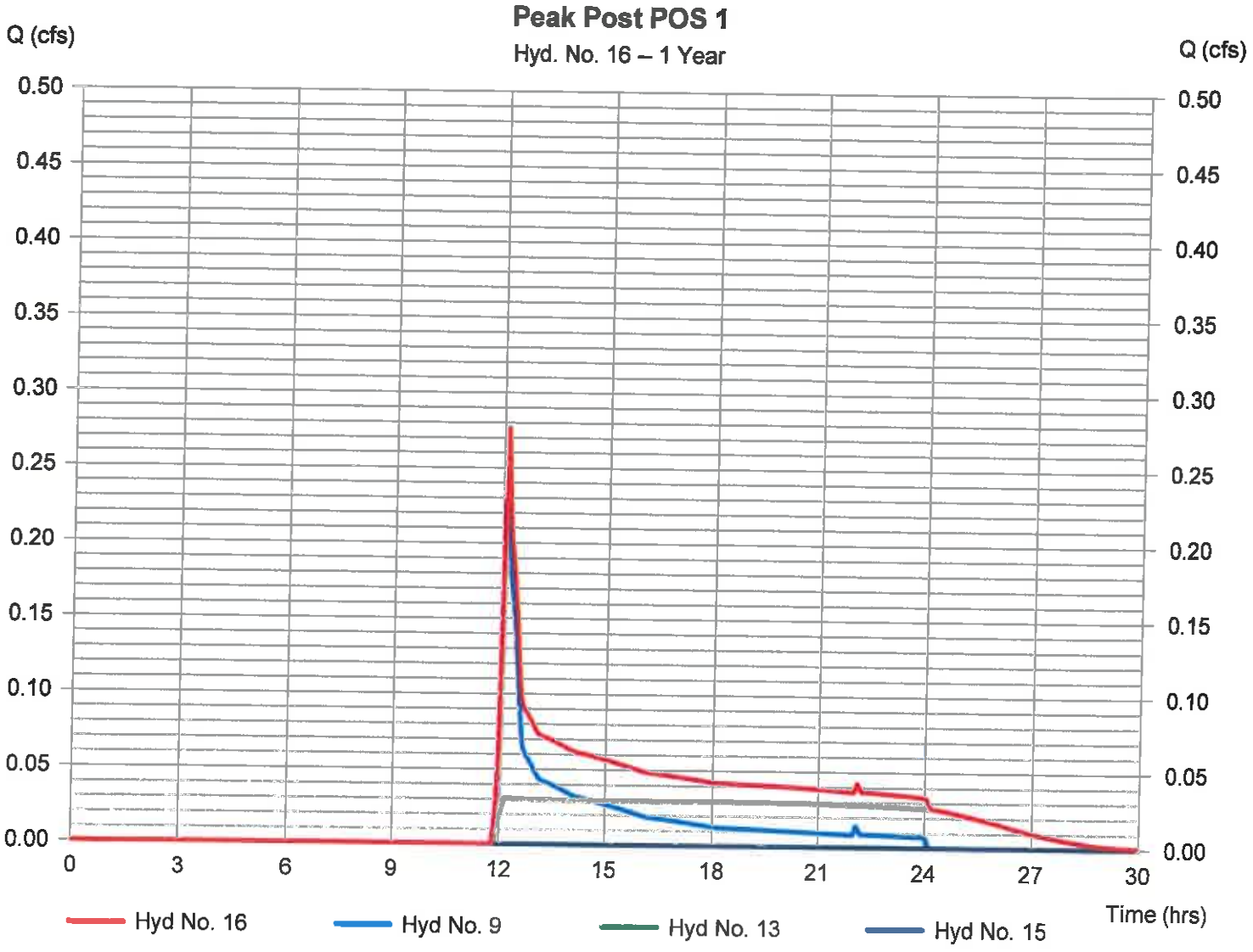
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 16

Peak Post POS 1

Hydrograph type	= Combine	Peak discharge	= 0.276 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.13 hrs
Time interval	= 1 min	Hyd. volume	= 2,611 cuft
Inflow hyds.	= 9, 13, 15	Contrib. drain. area	= 0.700 ac



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	9.541	1	756	66,245	----	----	----	E1 - POS 1
2	SCS Runoff	0.309	1	747	1,971	----	----	----	E2 - POS 2
3	SCS Runoff	3.390	1	731	13,716	----	----	----	P1
4	SCS Runoff	2.200	1	731	8,793	----	----	----	P2
5	SCS Runoff	3.756	1	732	15,647	----	----	----	P3
6	SCS Runoff	3.495	1	732	14,603	----	----	----	P4
7	SCS Runoff	3.561	1	730	14,119	----	----	----	P5
8	SCS Runoff	1.625	1	729	6,116	----	----	----	P6
9	SCS Runoff	1.236	1	726	4,125	----	----	----	P7 - POS 1 Direct
10	Combine	17.95	1	731	72,994	3, 4, 5, 6, 7, 8, 10	----	----	Inflow to CB-1
11	Reservoir	17.95	1	731	72,651		37.46	571	CB-1 Rt
12	Reservoir	17.73	1	731	62,292	11	38.68	2,611	Sed FB Rt
13	Diversion1	0.032	1	731	1,774	12	----	----	Low Flow Orifice
14	Diversion2	17.70	1	731	60,518	12	----	----	Weir Flow
15	Reservoir	6.185	1	747	12,363	14	38.09	18,212	Infiltration Basin
16	Combine	6.657	1	746	18,262	9, 13, 15	----	----	Peak Post POS 1

Hydrograph Report

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

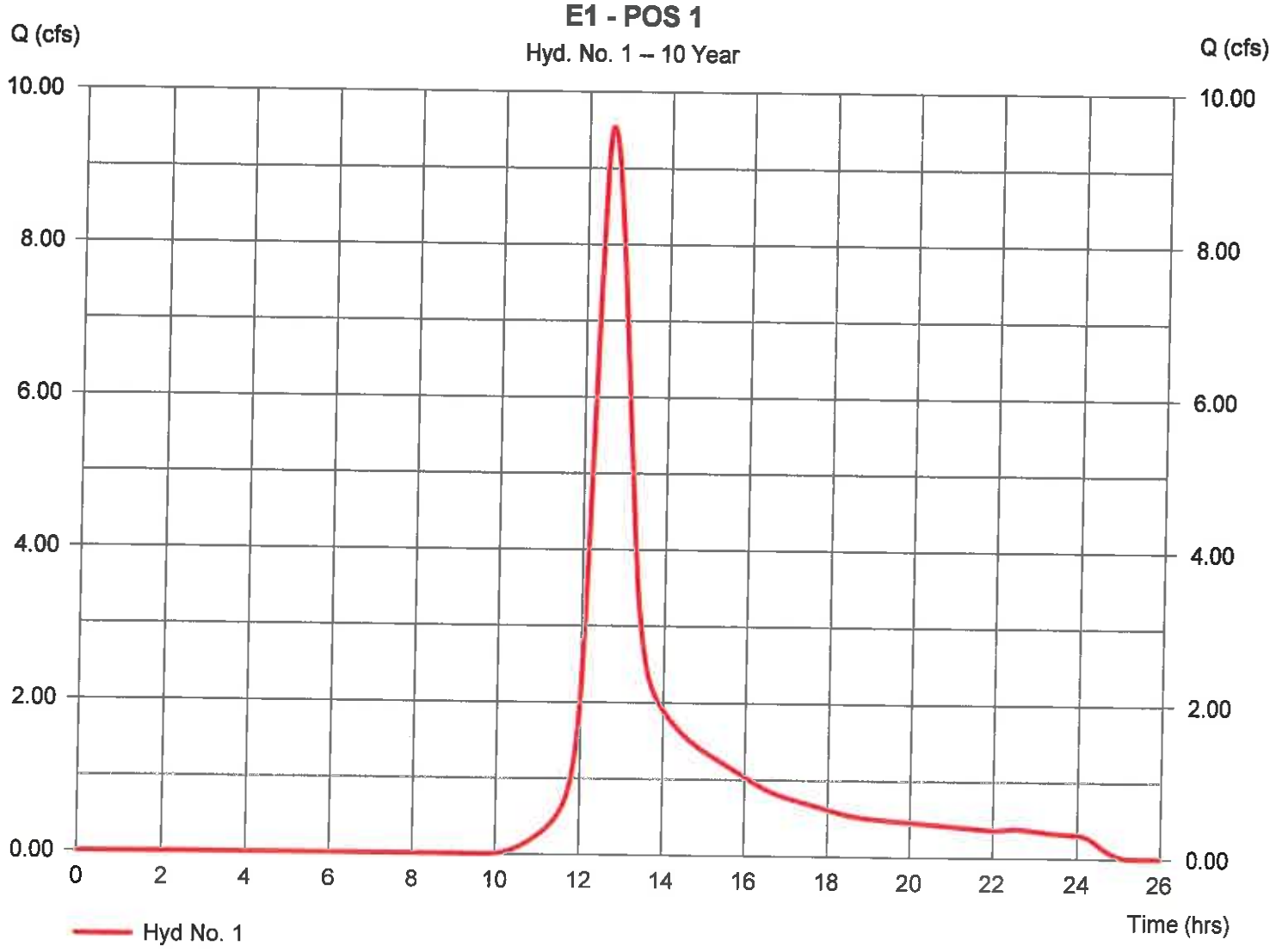
Tuesday, 10 / 24 / 2023

Hyd. No. 1

E1 - POS 1

Hydrograph type	= SCS Runoff	Peak discharge	= 9.541 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.60 hrs
Time interval	= 1 min	Hyd. volume	= 66,245 cuft
Drainage area	= 9.280 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.20 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.000 x 55) + (2.020 x 61) + (1.200 x 98) + (2.060 x 98)] / 9.280



Hydrograph Report

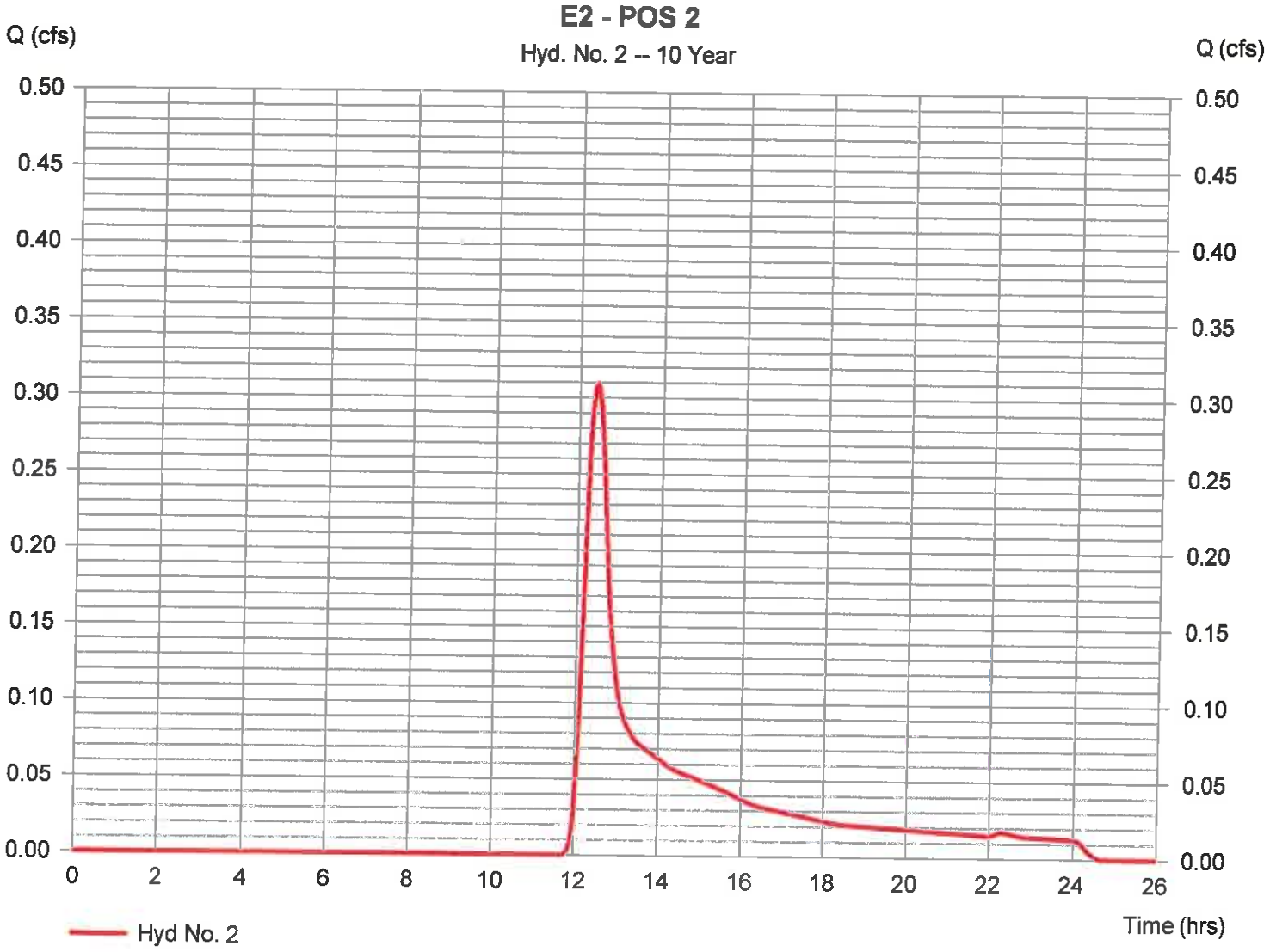
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 2

E2 - POS 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.309 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.45 hrs
Time interval	= 1 min	Hyd. volume	= 1,971 cuft
Drainage area	= 0.620 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.50 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

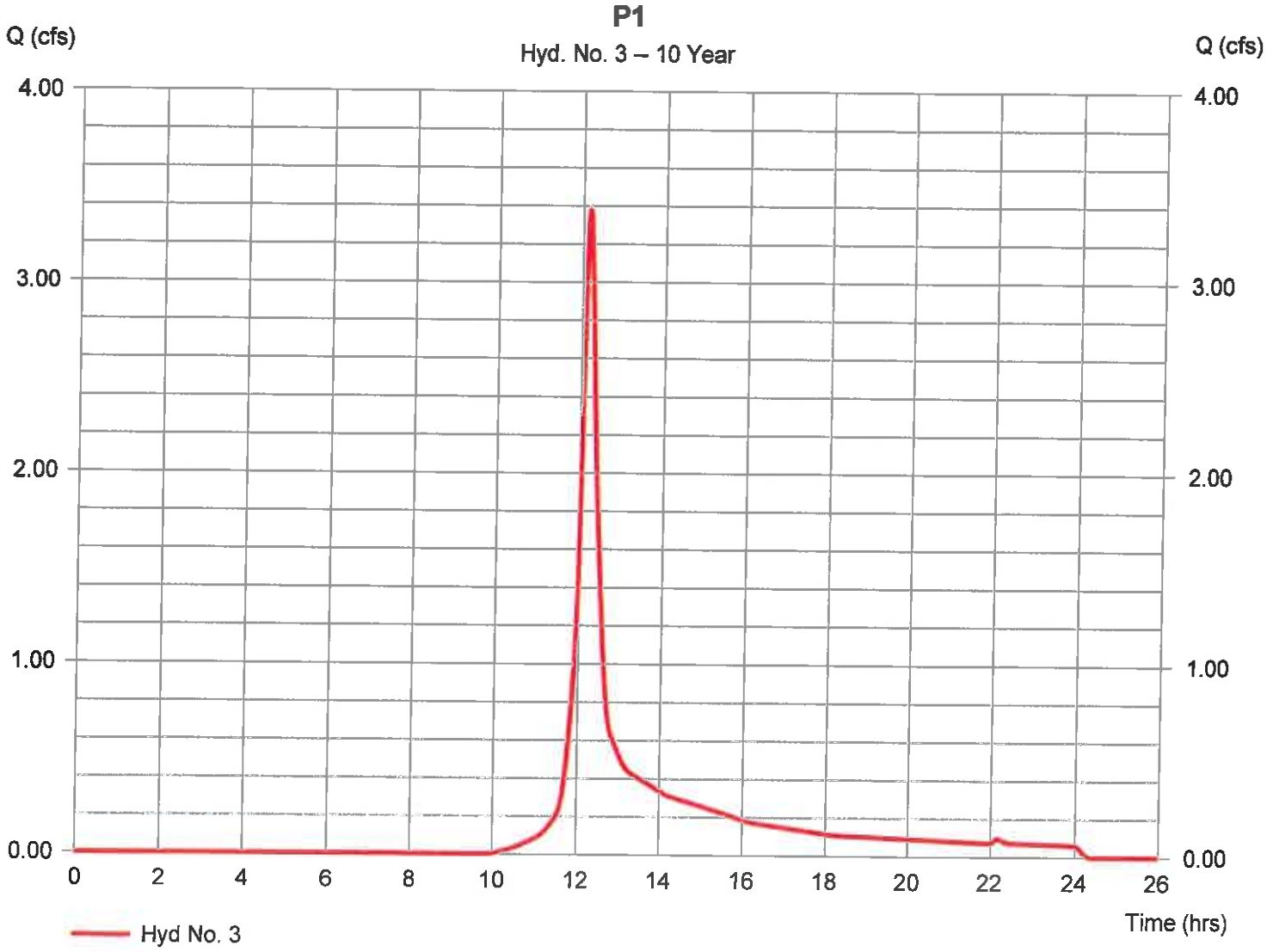
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 10 / 24 / 2023

Hyd. No. 3

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.390 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 13,716 cuft
Drainage area	= 2.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.60 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.540 x 61) + (0.160 x 98) + (0.080 x 98) + (0.050 x 98) + (0.170 x 98)] / 2.000



Hydrograph Report

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

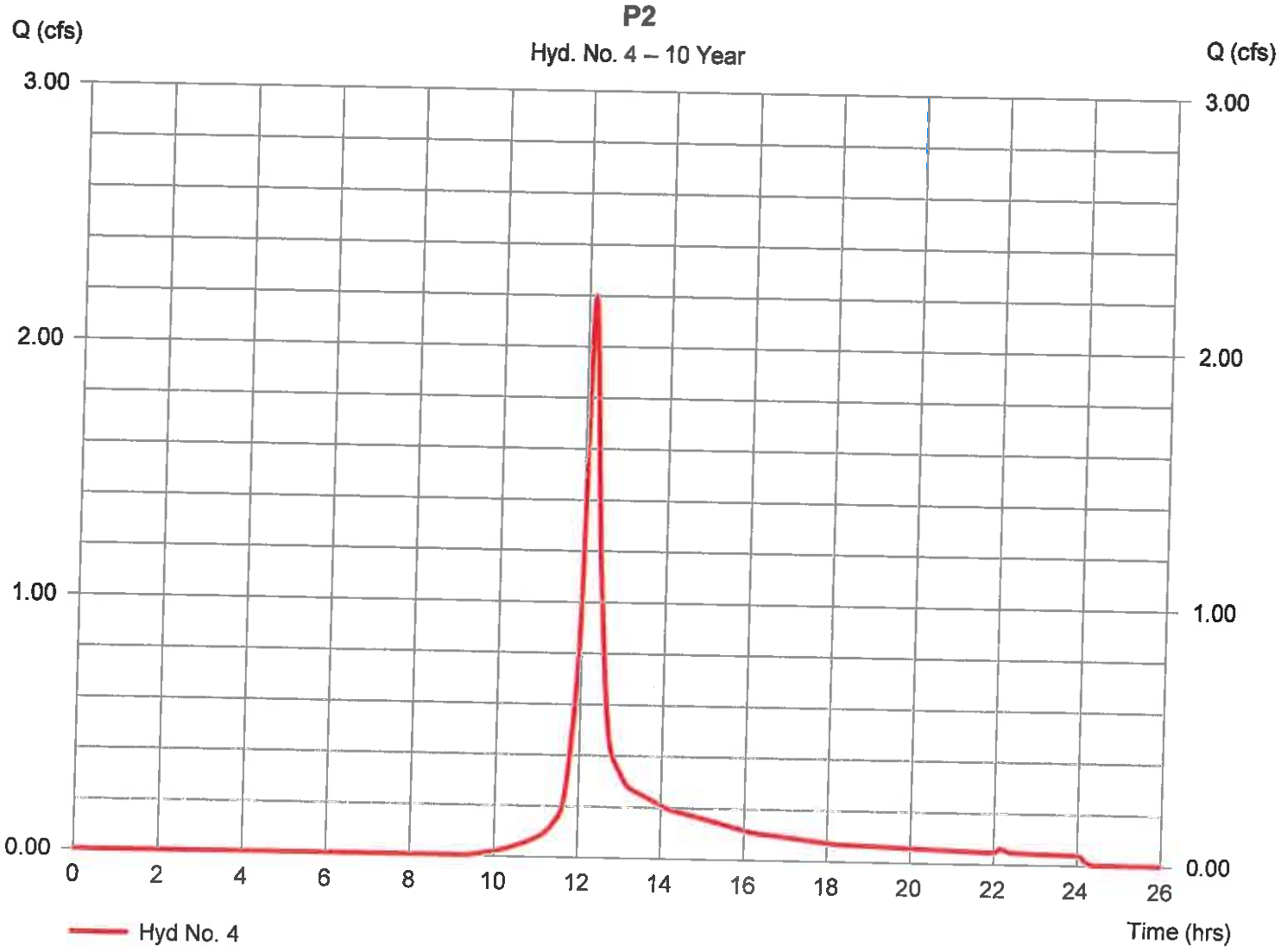
Tuesday, 10 / 24 / 2023

Hyd. No. 4

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.200 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 8,793 cuft
Drainage area	= 1.140 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.70 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.770 x 61) + (0.120 x 98) + (0.060 x 98) + (0.040 x 98) + (0.150 x 98)] / 1.140



Hydrograph Report

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

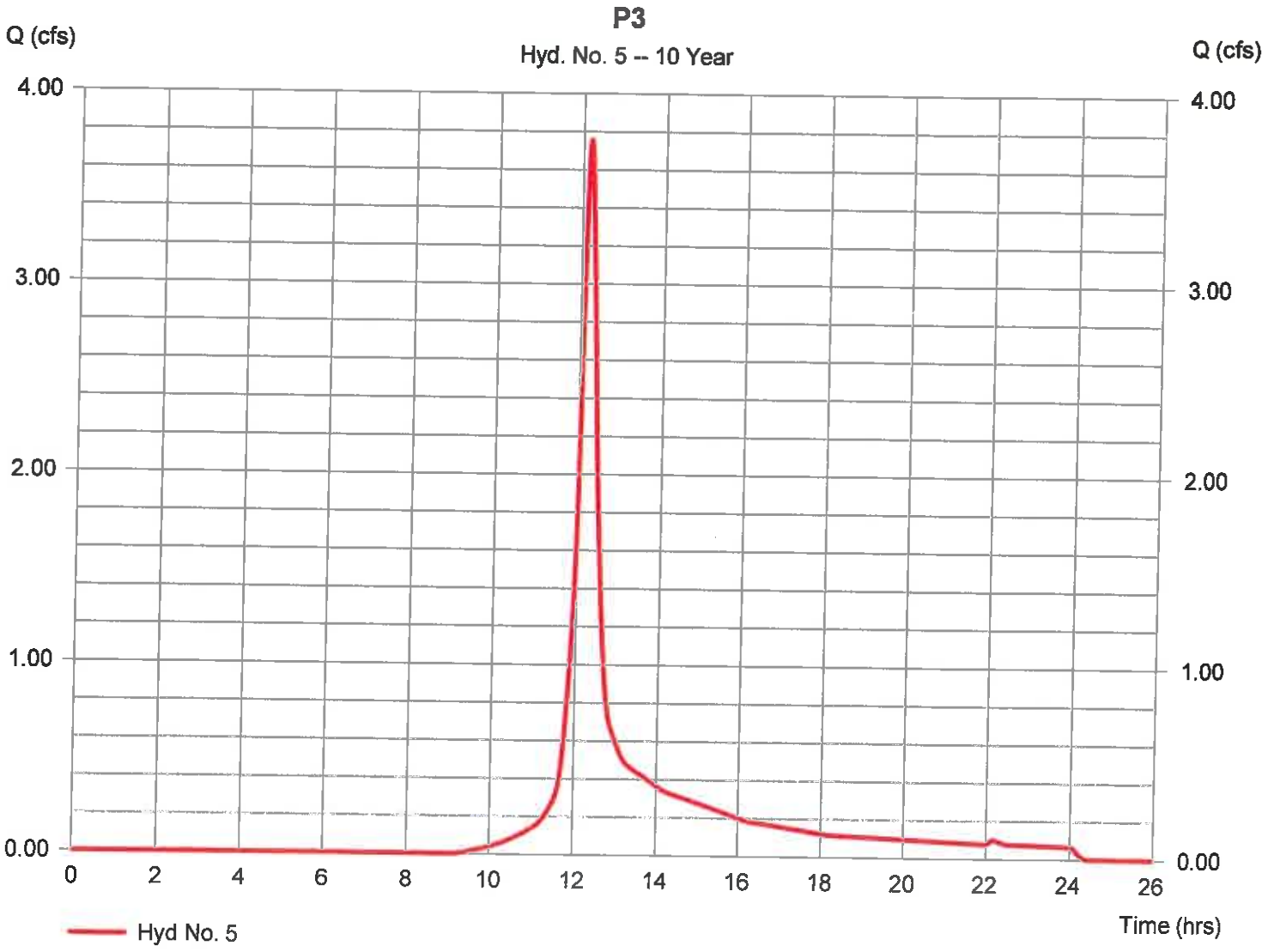
Tuesday, 10 / 24 / 2023

Hyd. No. 5

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.756 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 1 min	Hyd. volume	= 15,647 cuft
Drainage area	= 1.930 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.30 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.270 x 61) + (0.220 x 98) + (0.110 x 98) + (0.070 x 98) + (0.260 x 98)] / 1.930



Hydrograph Report

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

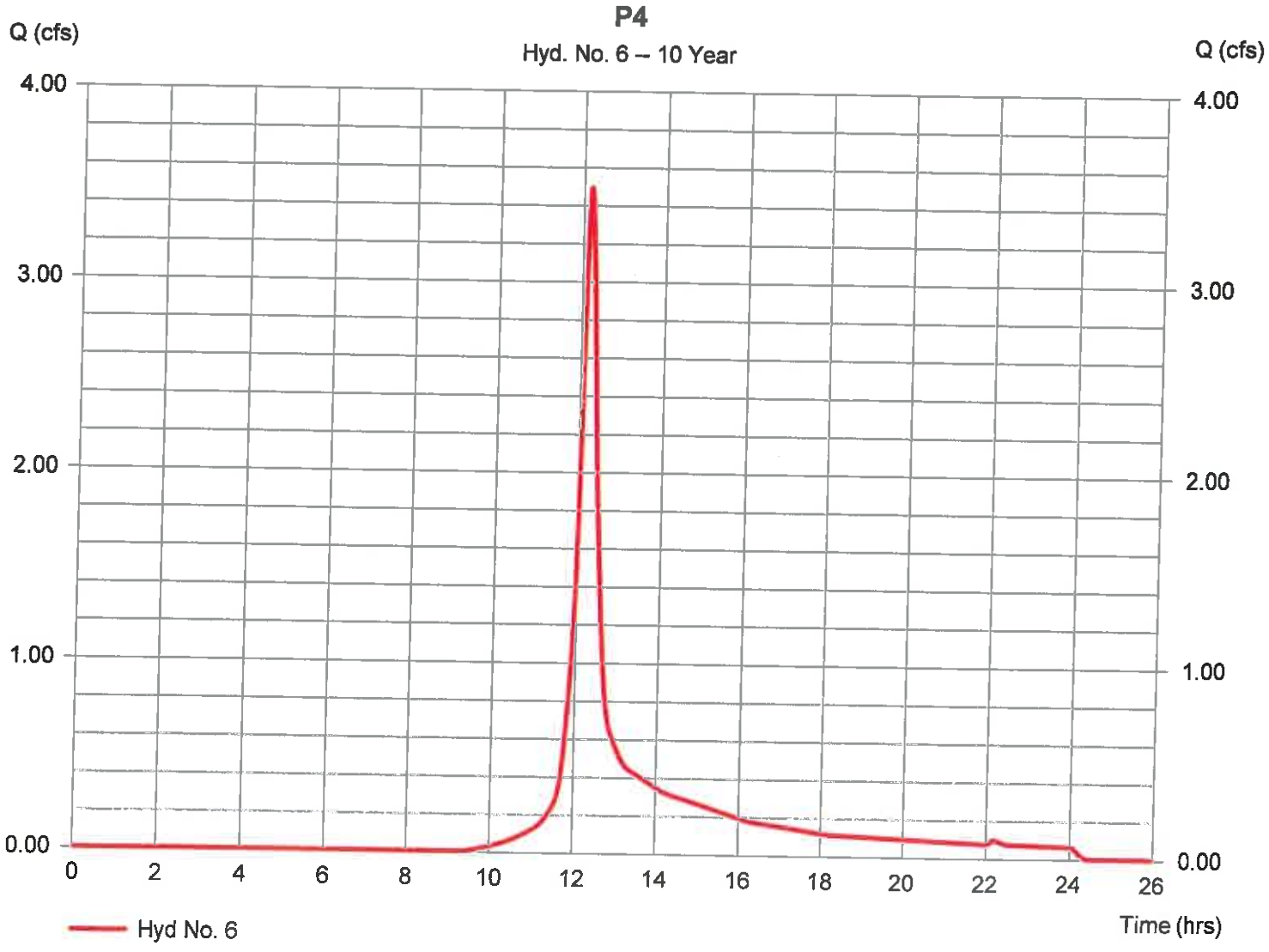
Tuesday, 10 / 24 / 2023

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 3.495 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 1 min	Hyd. volume	= 14,603 cuft
Drainage area	= 1.870 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.70 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.240 x 61) + (0.250 x 98) + (0.120 x 98) + (0.060 x 98) + (0.200 x 98)] / 1.870



Hydrograph Report

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

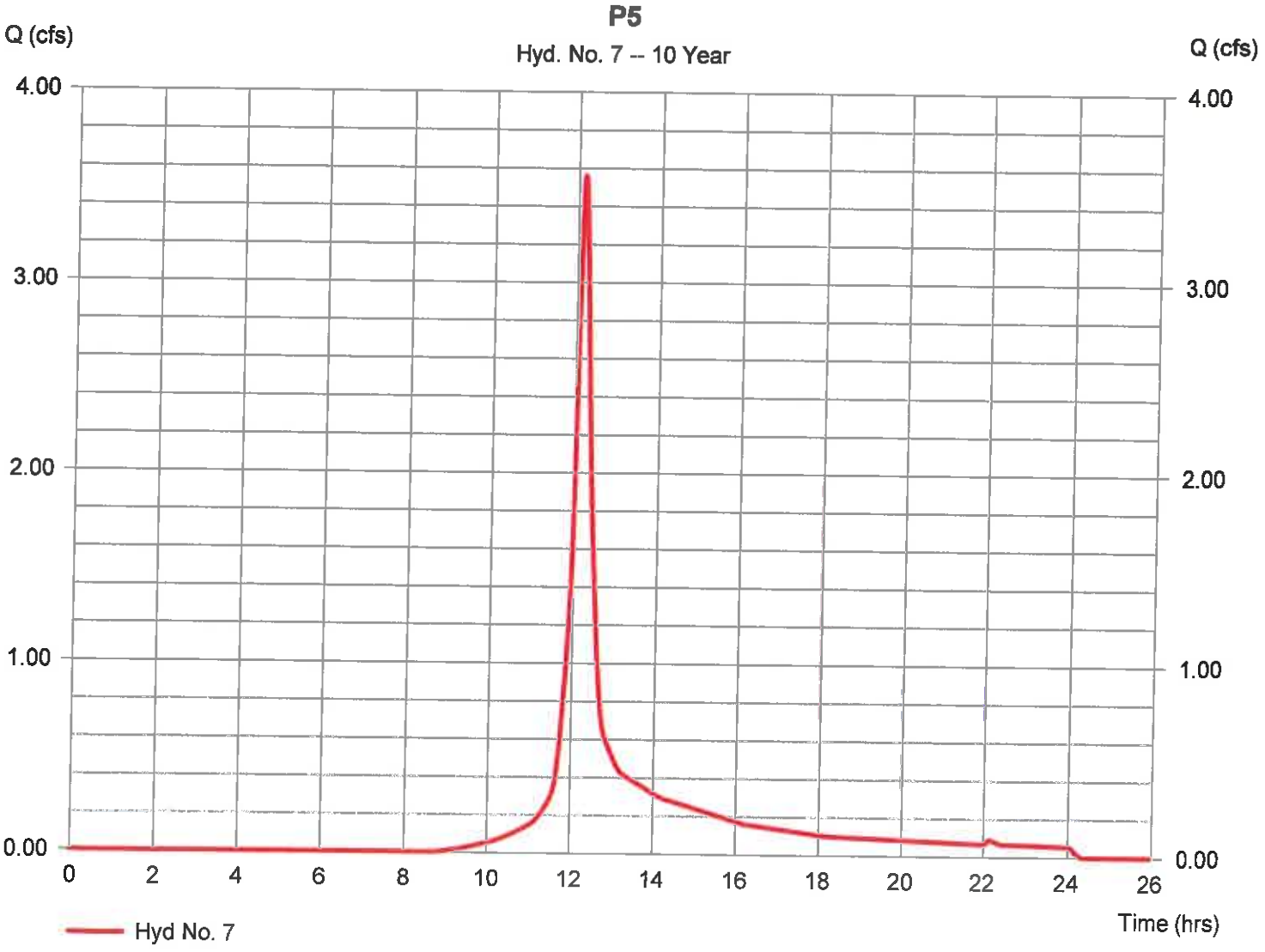
Tuesday, 10 / 24 / 2023

Hyd. No. 7

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 3.561 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 14,119 cuft
Drainage area	= 1.640 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.70 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.960 x 61) + (0.220 x 98) + (0.110 x 98) + (0.070 x 98) + (0.280 x 98)] / 1.640



Hydrograph Report

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

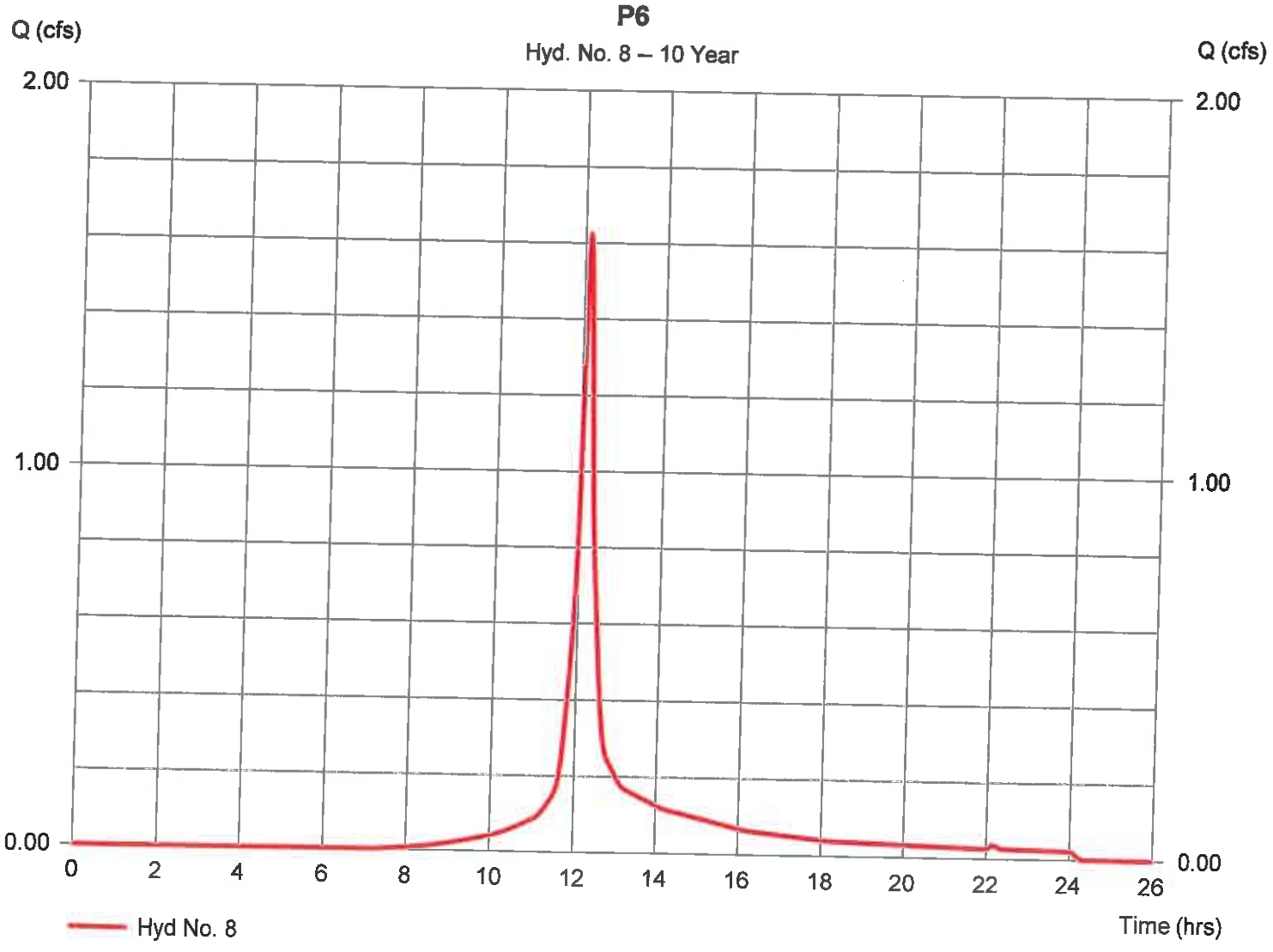
Tuesday, 10 / 24 / 2023

Hyd. No. 8

P6

Hydrograph type	= SCS Runoff	Peak discharge	= 1.625 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.15 hrs
Time interval	= 1 min	Hyd. volume	= 6,116 cuft
Drainage area	= 0.590 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.20 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 74) + (0.070 x 98) + (0.030 x 98) + (0.020 x 98) + (0.070 x 98)] / 0.590



Hydrograph Report

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

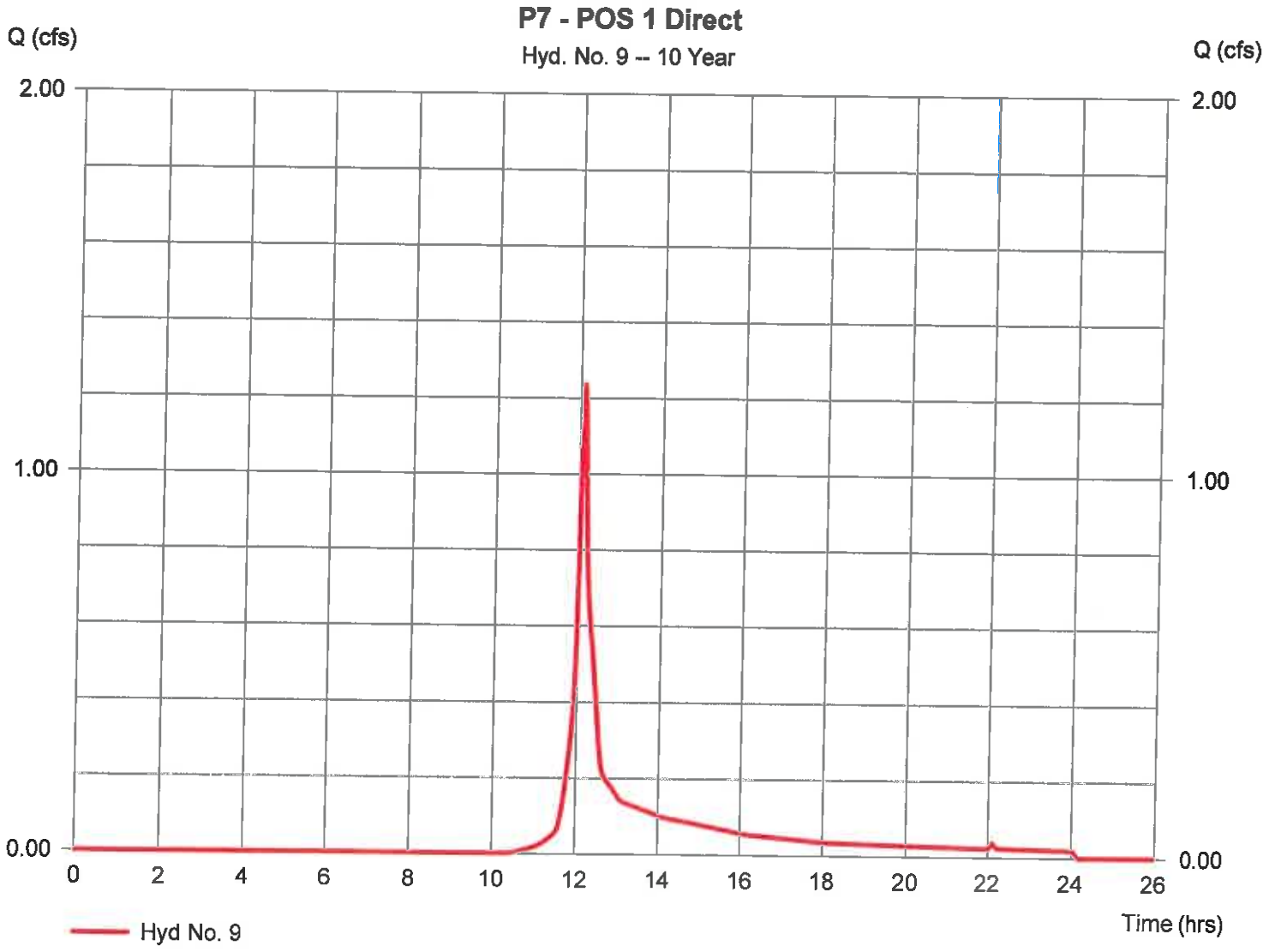
Tuesday, 10 / 24 / 2023

Hyd. No. 9

P7 - POS 1 Direct

Hydrograph type	= SCS Runoff	Peak discharge	= 1.236 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 1 min	Hyd. volume	= 4,125 cuft
Drainage area	= 0.700 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 4.80 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.580 x 61) + (0.030 x 98) + (0.010 x 98) + (0.020 x 98) + (0.060 x 98)] / 0.700



Hydrograph Report

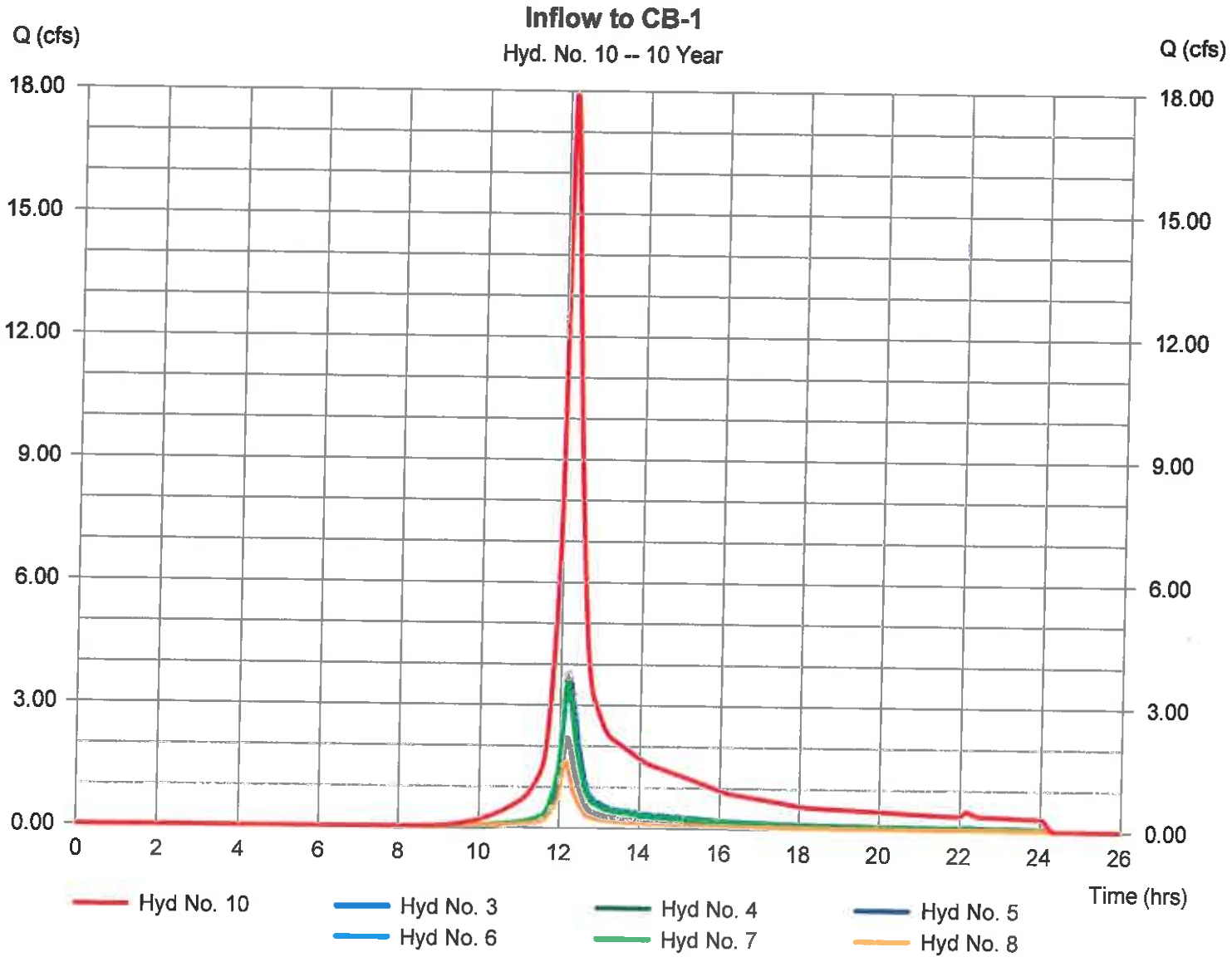
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 10

Inflow to CB-1

Hydrograph type	= Combine	Peak discharge	= 17.95 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 72,994 cuft
Inflow hyds.	= 3, 4, 5, 6, 7, 8	Contrib. drain. area	= 9.170 ac



Hydrograph Report

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

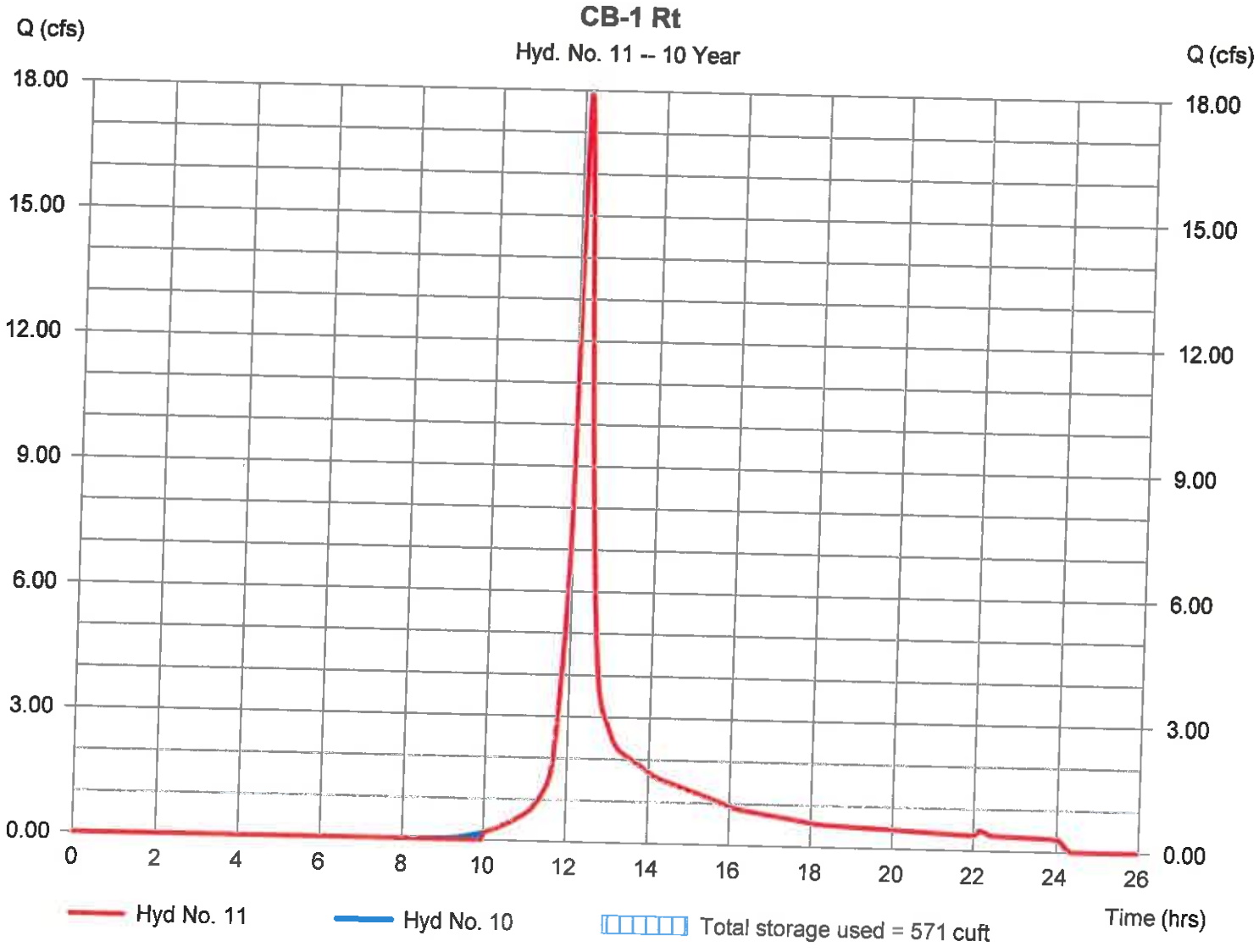
Tuesday, 10 / 24 / 2023

Hyd. No. 11

CB-1 Rt

Hydrograph type	= Reservoir	Peak discharge	= 17.95 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 72,651 cuft
Inflow hyd. No.	= 10 - Inflow to CB-1	Max. Elevation	= 37.46 ft
Reservoir name	= CB-1	Max. Storage	= 571 cuft

Storage Indication method used.



Hydrograph Report

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

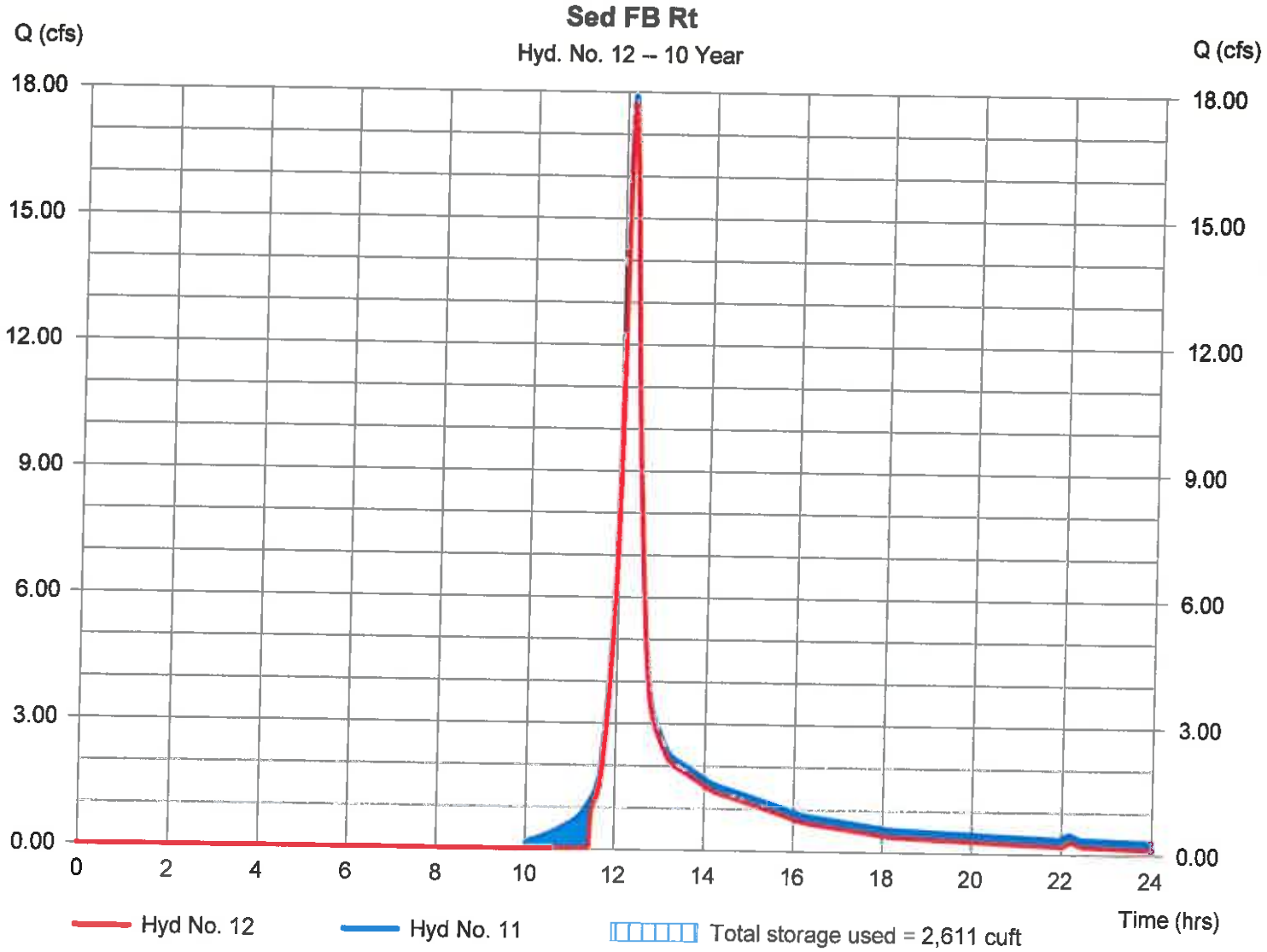
Tuesday, 10 / 24 / 2023

Hyd. No. 12

Sed FB Rt

Hydrograph type	= Reservoir	Peak discharge	= 17.73 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 62,292 cuft
Inflow hyd. No.	= 11 - CB-1 Rt	Max. Elevation	= 38.68 ft
Reservoir name	= Sed Forebay	Max. Storage	= 2,611 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

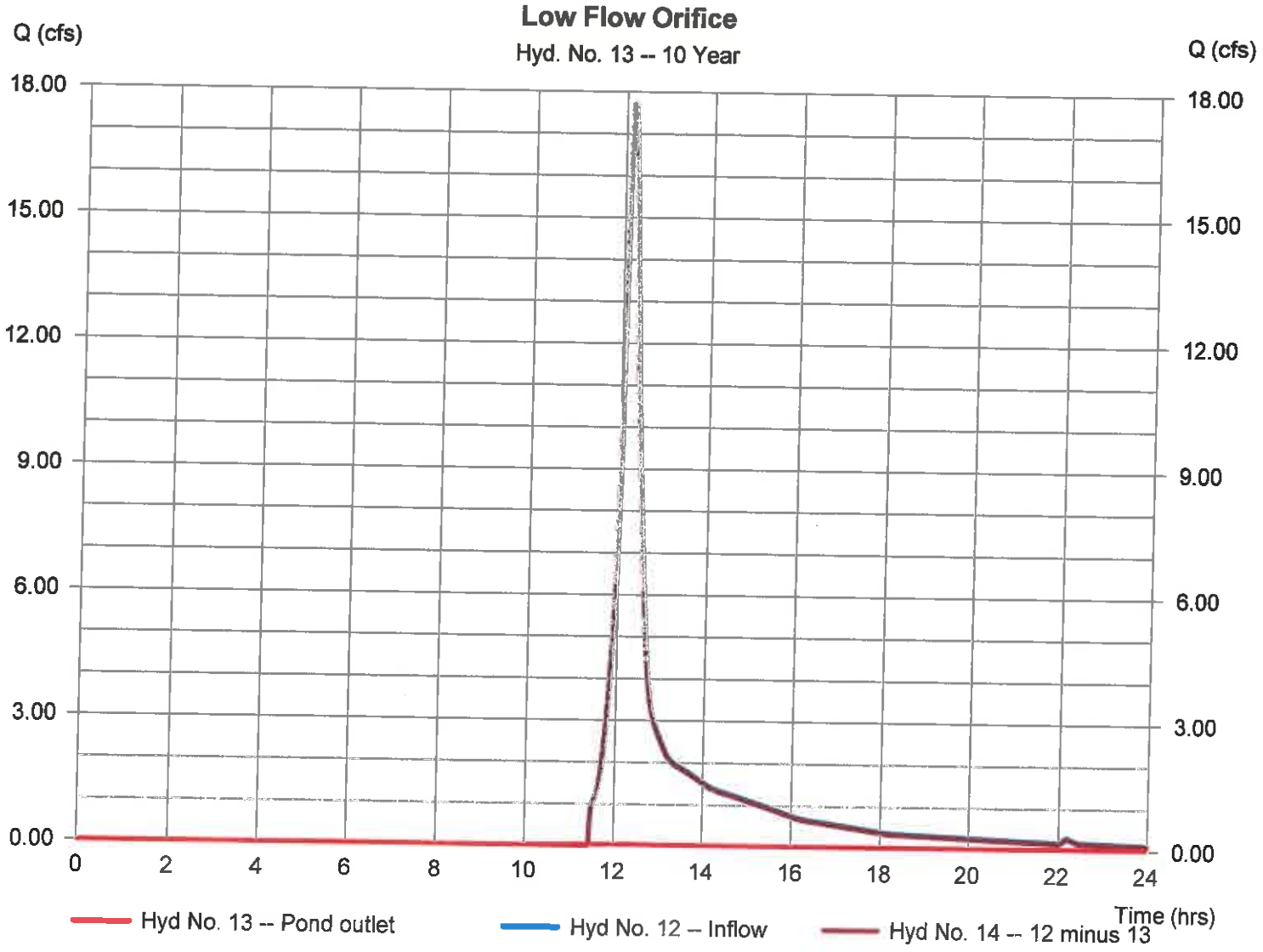
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 13

Low Flow Orifice

Hydrograph type	= Diversion1	Peak discharge	= 0.032 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 1,774 cuft
Inflow hydrograph	= 12 - Sed FB Rt	2nd diverted hyd.	= 14
Diversion method	= Pond - Sed Forebay	Pond structure	= Culv/Orf A



Hydrograph Report

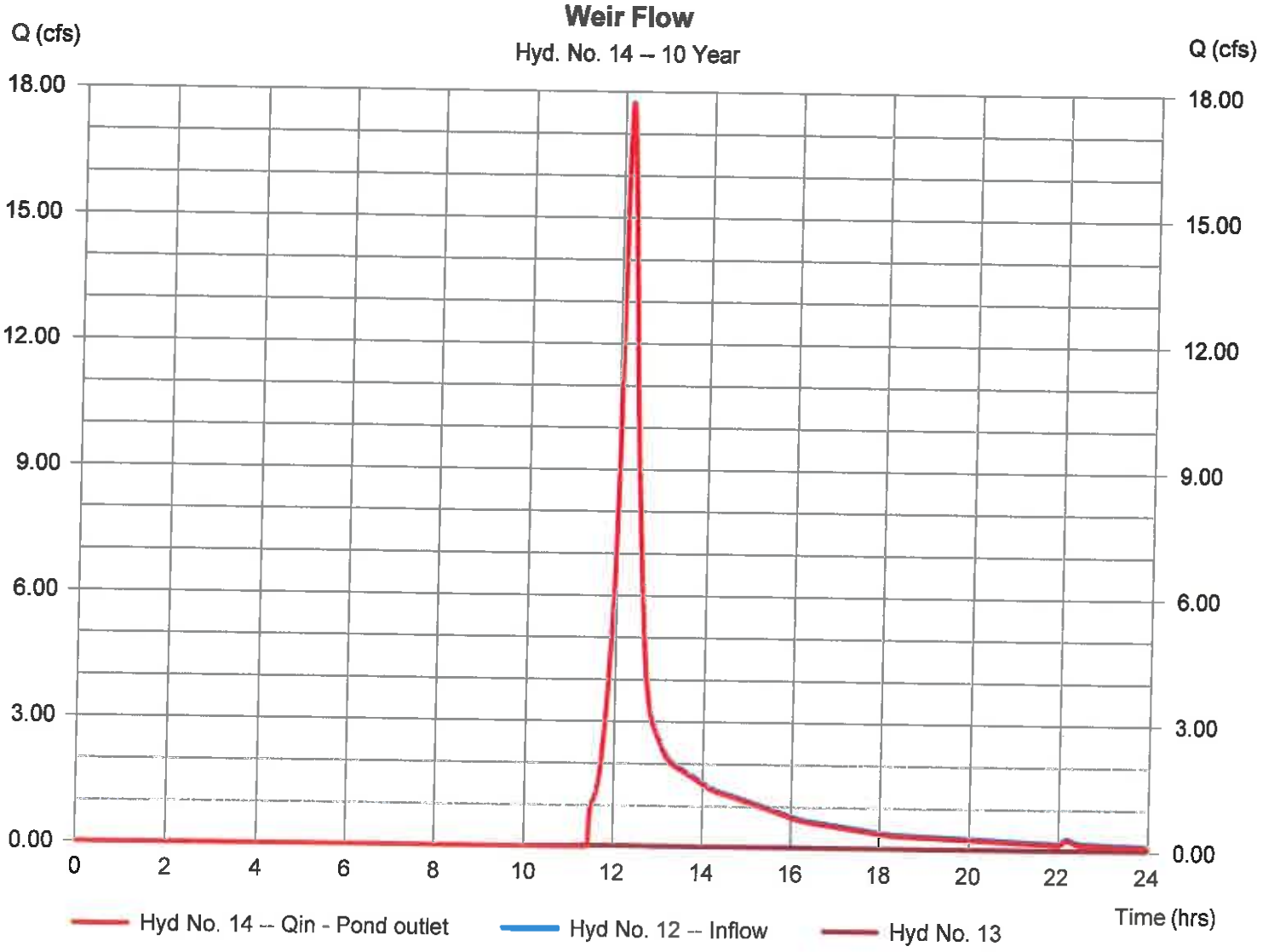
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 14

Weir Flow

Hydrograph type	= Diversion2	Peak discharge	= 17.70 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 60,518 cuft
Inflow hydrograph	= 12 - Sed FB Rt	2nd diverted hyd.	= 13
Diversion method	= Pond - Sed Forebay	Pond structure	= Culv/Orf A



Hydrograph Report

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

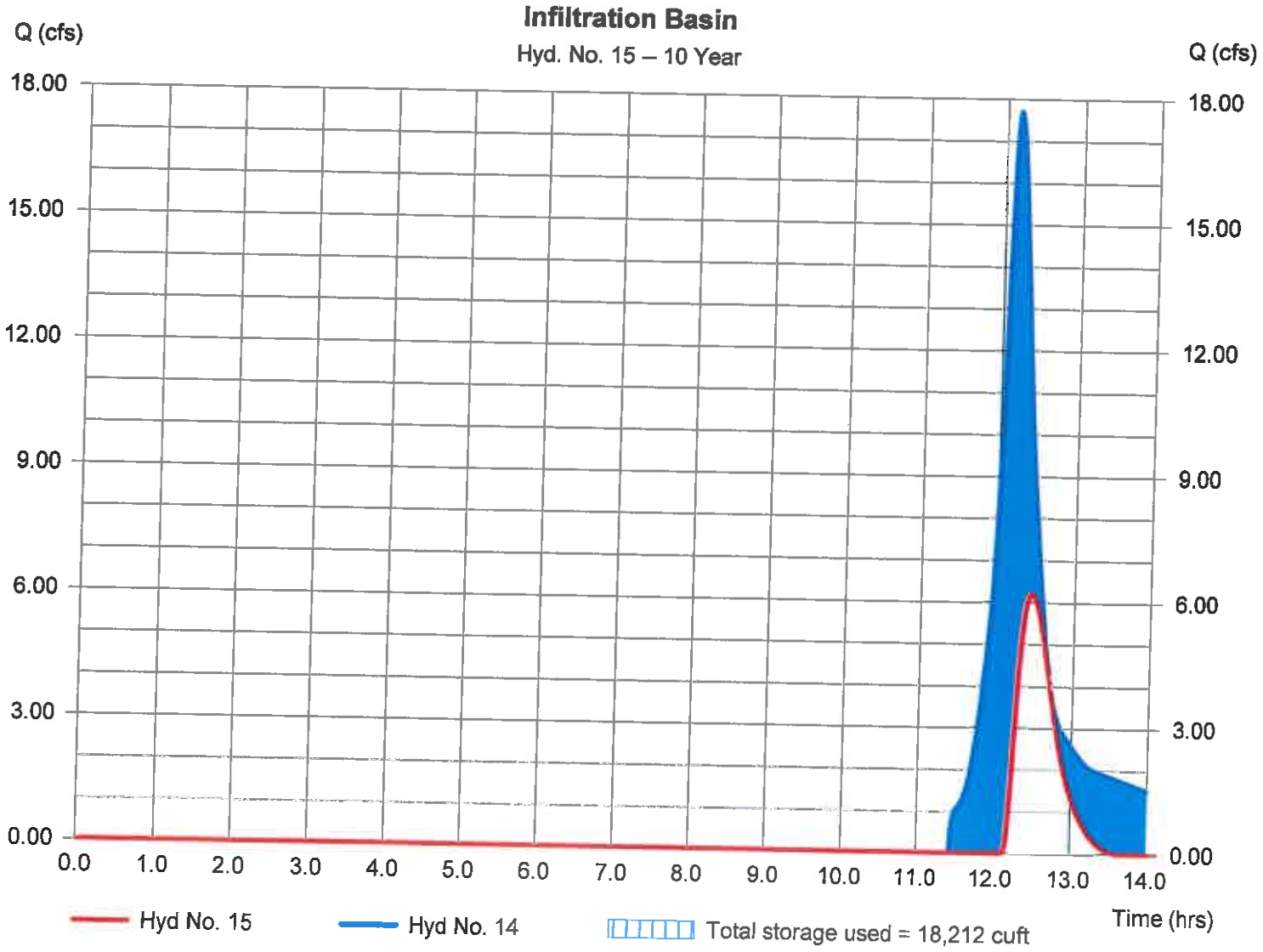
Tuesday, 10 / 24 / 2023

Hyd. No. 15

Infiltration Basin

Hydrograph type	= Reservoir	Peak discharge	= 6.185 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.45 hrs
Time interval	= 1 min	Hyd. volume	= 12,363 cuft
Inflow hyd. No.	= 14 - Weir Flow	Max. Elevation	= 38.09 ft
Reservoir name	= Infiltration	Max. Storage	= 18,212 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

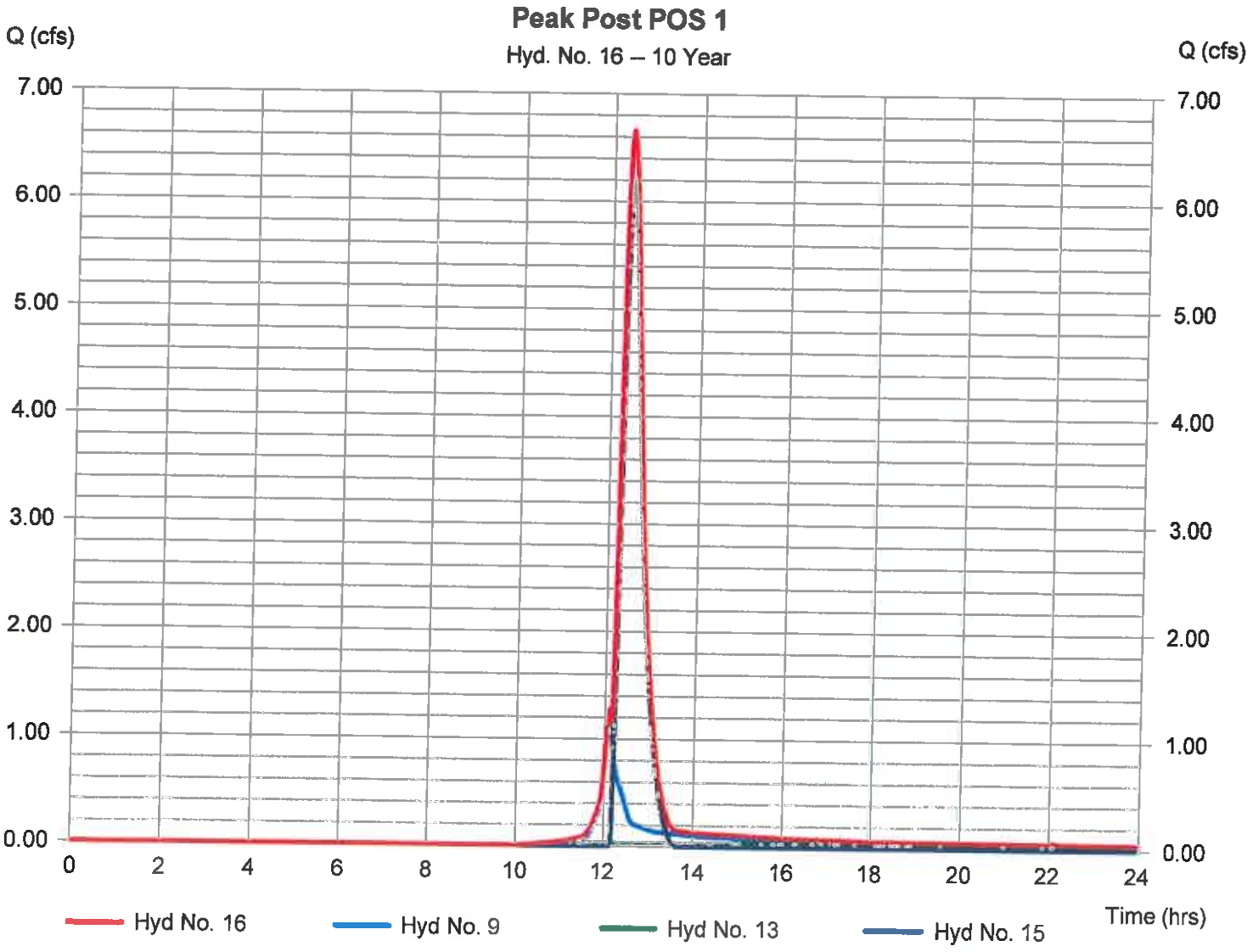
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 16

Peak Post POS 1

Hydrograph type	= Combine	Peak discharge	= 6.657 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.43 hrs
Time interval	= 1 min	Hyd. volume	= 18,262 cuft
Inflow hyds.	= 9, 13, 15	Contrib. drain. area	= 0.700 ac



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	25.80	1	754	174,921	----	----	----	E1 - POS 1
2	SCS Runoff	1.395	1	741	7,312	----	----	----	E2 - POS 2
3	SCS Runoff	9.320	1	730	36,819	----	----	----	P1
4	SCS Runoff	5.679	1	730	22,491	----	----	----	P2
5	SCS Runoff	9.504	1	731	39,413	----	----	----	P3
6	SCS Runoff	9.019	1	731	37,354	----	----	----	P4
7	SCS Runoff	8.673	1	730	34,522	----	----	----	P5
8	SCS Runoff	3.561	1	729	13,760	----	----	----	P6
9	SCS Runoff	3.630	1	726	11,666	----	----	----	P7 - POS 1 Direct
10	Combine	45.57	1	730	184,359	3, 4, 5, 6, 7, 8, 10	----	----	Inflow to CB-1
11	Reservoir	45.55	1	730	184,016	10	38.74	735	CB-1 Rt
12	Reservoir	45.34	1	731	172,039	11	39.19	3,139	Sed FB Rt
13	Diversion1	0.034	1	731	2,044	12	----	----	Low Flow Orifice
14	Diversion2	45.31	1	731	169,995	12	----	----	Weir Flow
15	Reservoir	24.40	1	743	77,945	14	39.30	40,727	Infiltration Basin
16	Combine	25.81	1	742	91,655	9, 13, 15	----	----	Peak Post POS 1

Hydrograph Report

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

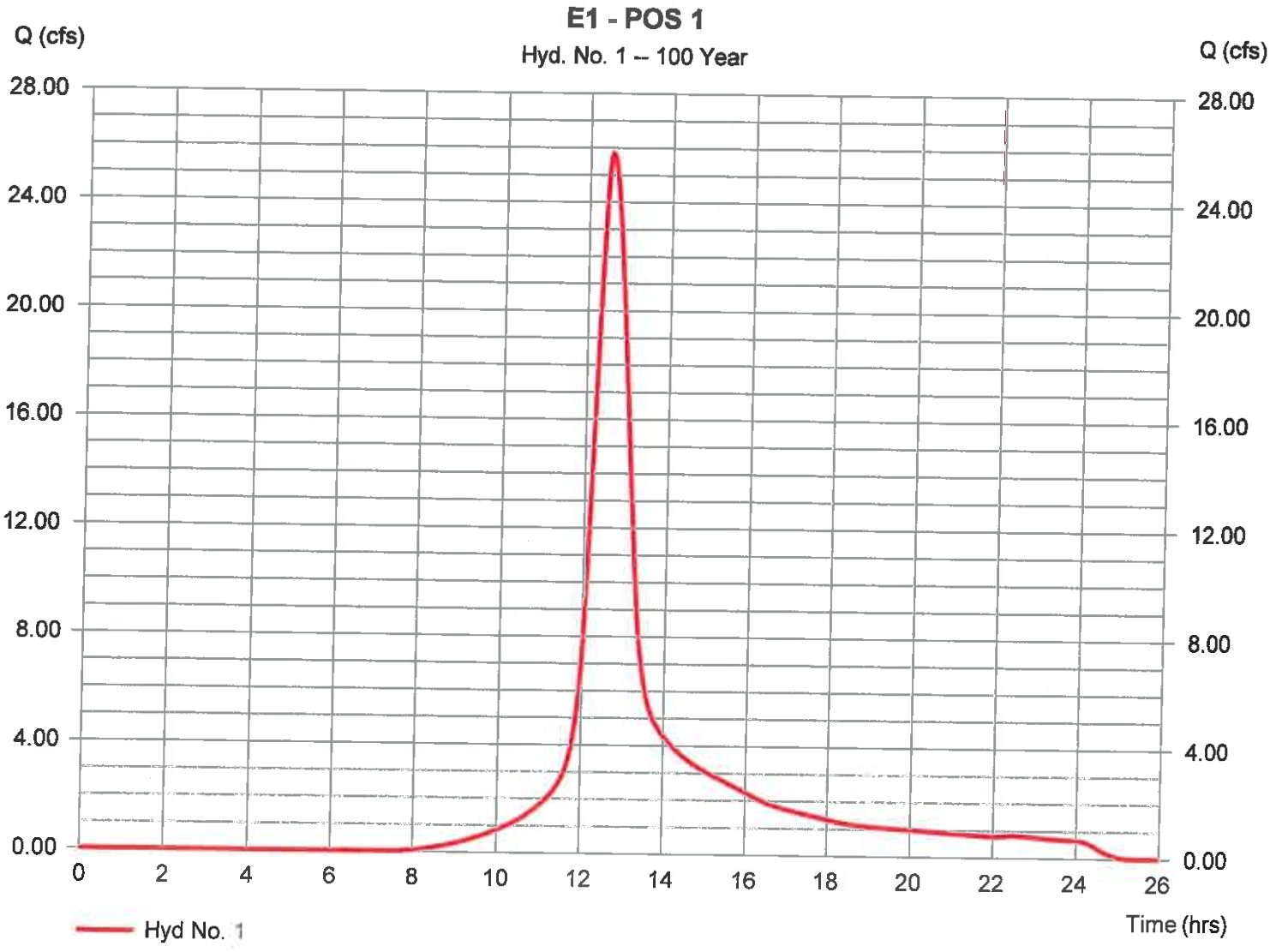
Tuesday, 10 / 24 / 2023

Hyd. No. 1

E1 - POS 1

Hydrograph type	= SCS Runoff	Peak discharge	= 25.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.57 hrs
Time interval	= 1 min	Hyd. volume	= 174,921 cuft
Drainage area	= 9.280 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 49.20 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.000 x 55) + (2.020 x 61) + (1.200 x 98) + (2.060 x 98)] / 9.280



Hydrograph Report

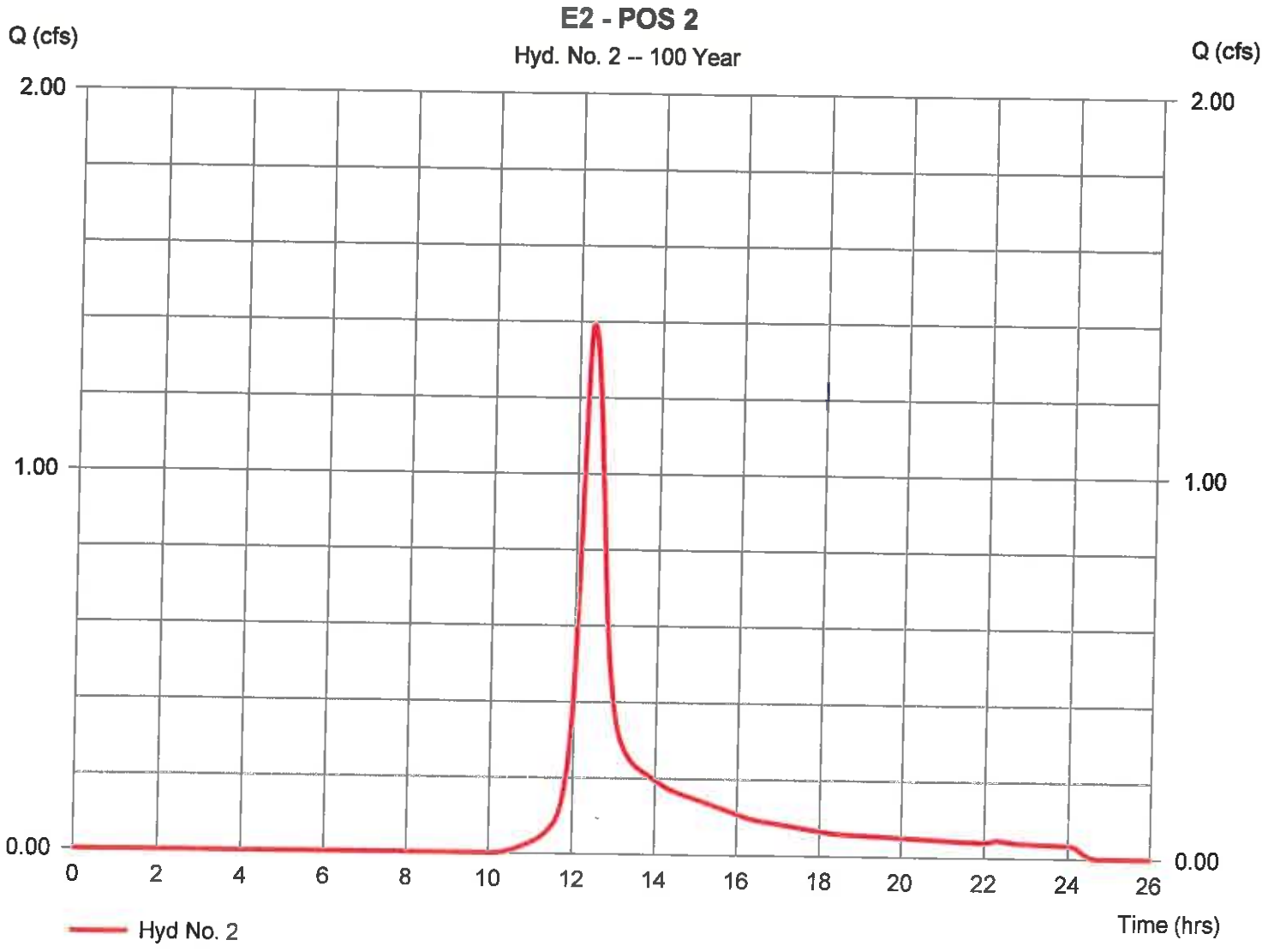
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 2

E2 - POS 2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.395 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.35 hrs
Time interval	= 1 min	Hyd. volume	= 7,312 cuft
Drainage area	= 0.620 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.50 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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

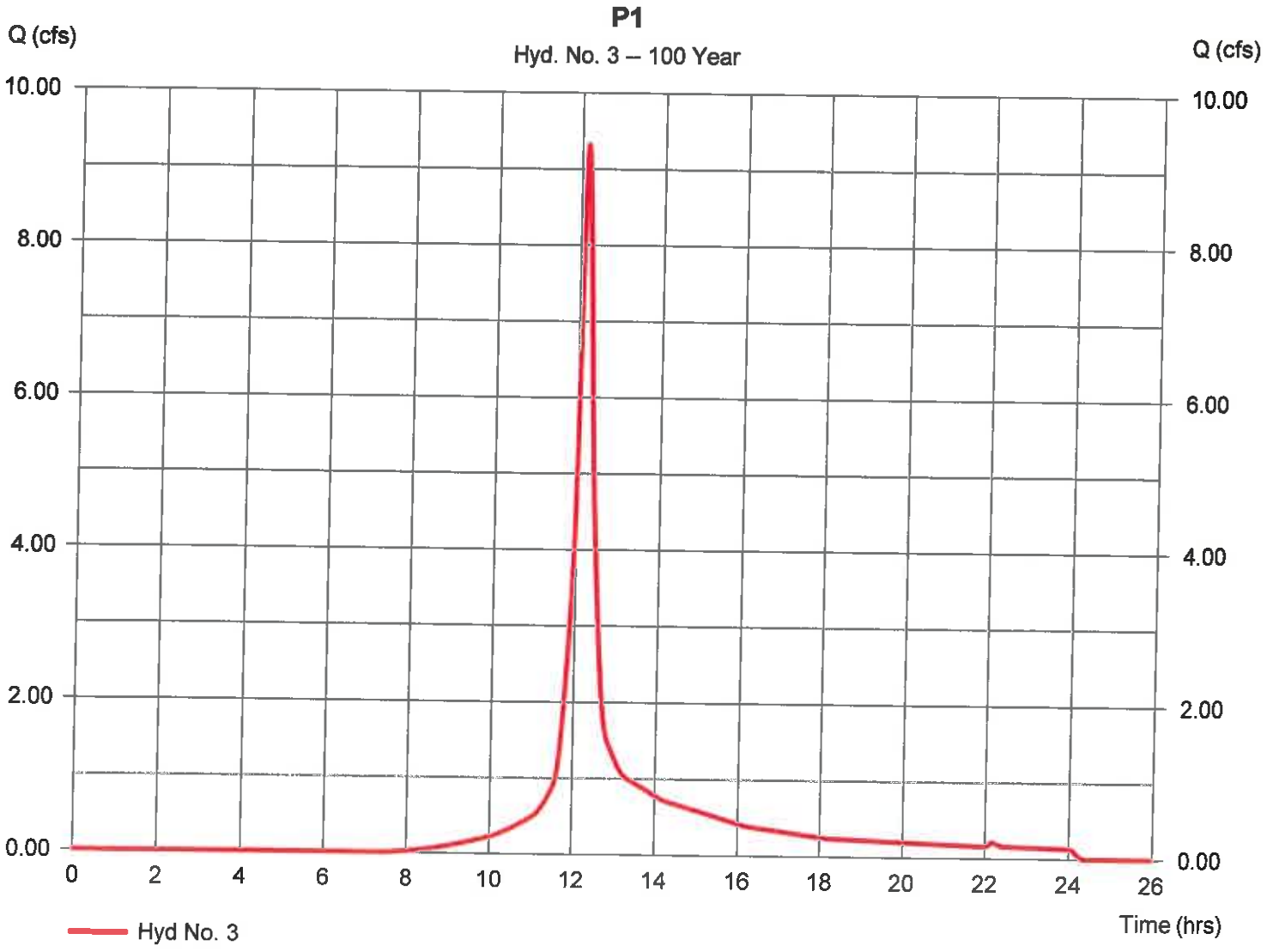
Tuesday, 10 / 24 / 2023

Hyd. No. 3

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 9.320 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 36,819 cuft
Drainage area	= 2.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.60 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.540 x 61) + (0.160 x 98) + (0.080 x 98) + (0.050 x 98) + (0.170 x 98)] / 2.000



Hydrograph Report

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

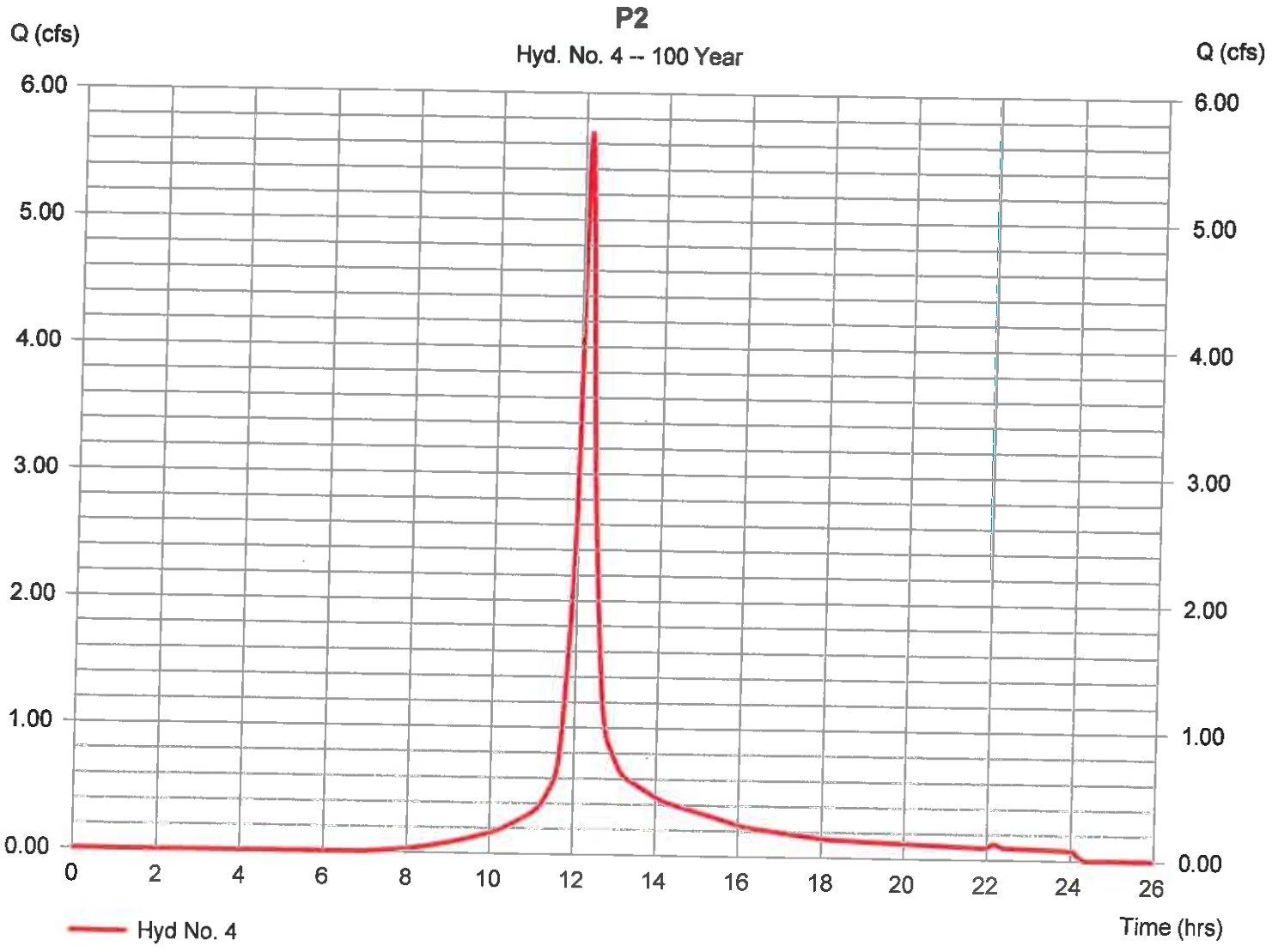
Tuesday, 10 / 24 / 2023

Hyd. No. 4

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.679 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 22,491 cuft
Drainage area	= 1.140 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.70 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.770 x 61) + (0.120 x 98) + (0.060 x 98) + (0.040 x 98) + (0.150 x 98)] / 1.140



Hydrograph Report

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

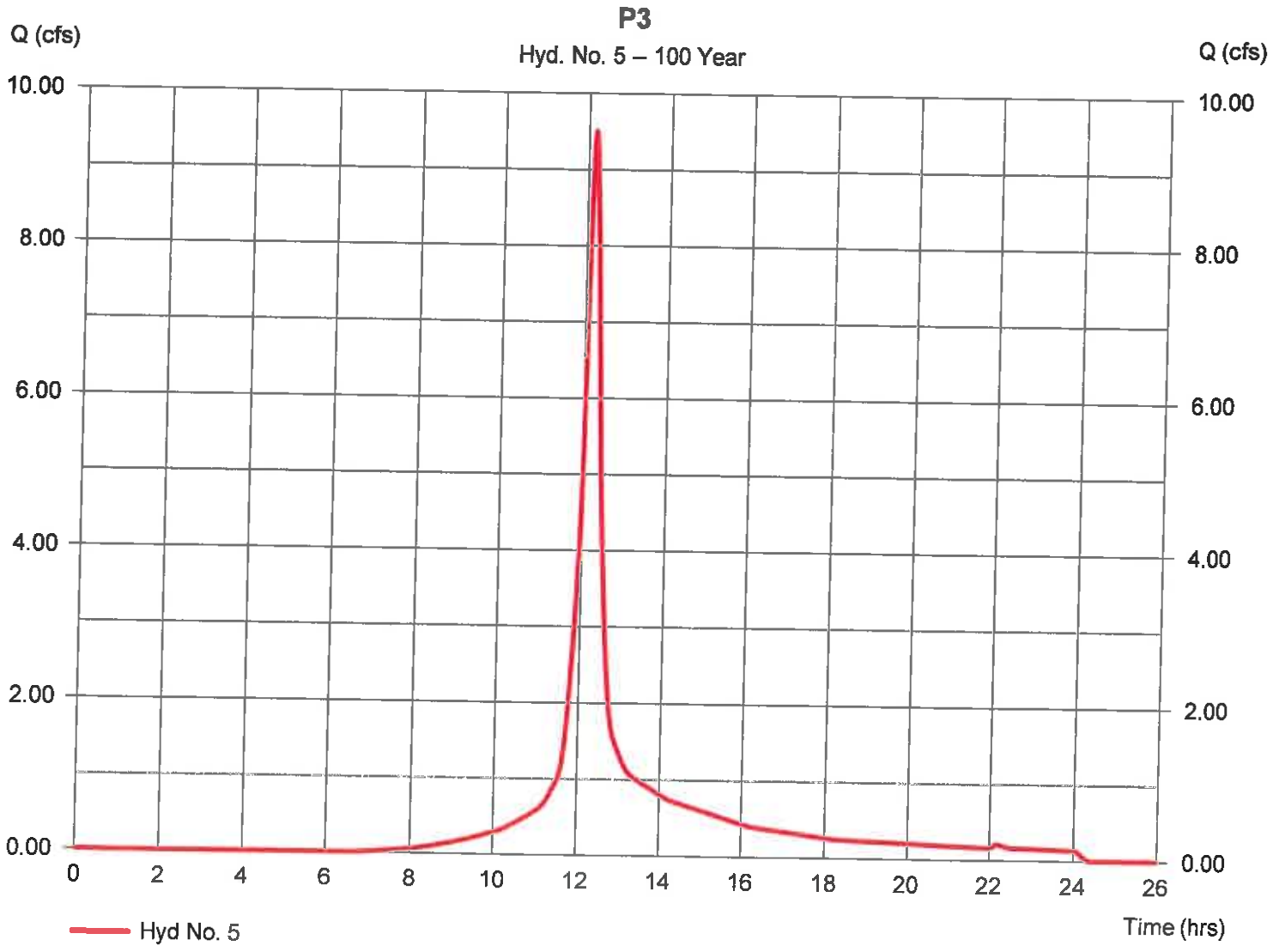
Tuesday, 10 / 24 / 2023

Hyd. No. 5

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 9.504 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 39,413 cuft
Drainage area	= 1.930 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.30 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.270 x 61) + (0.220 x 98) + (0.110 x 98) + (0.070 x 98) + (0.260 x 98)] / 1.930



Hydrograph Report

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

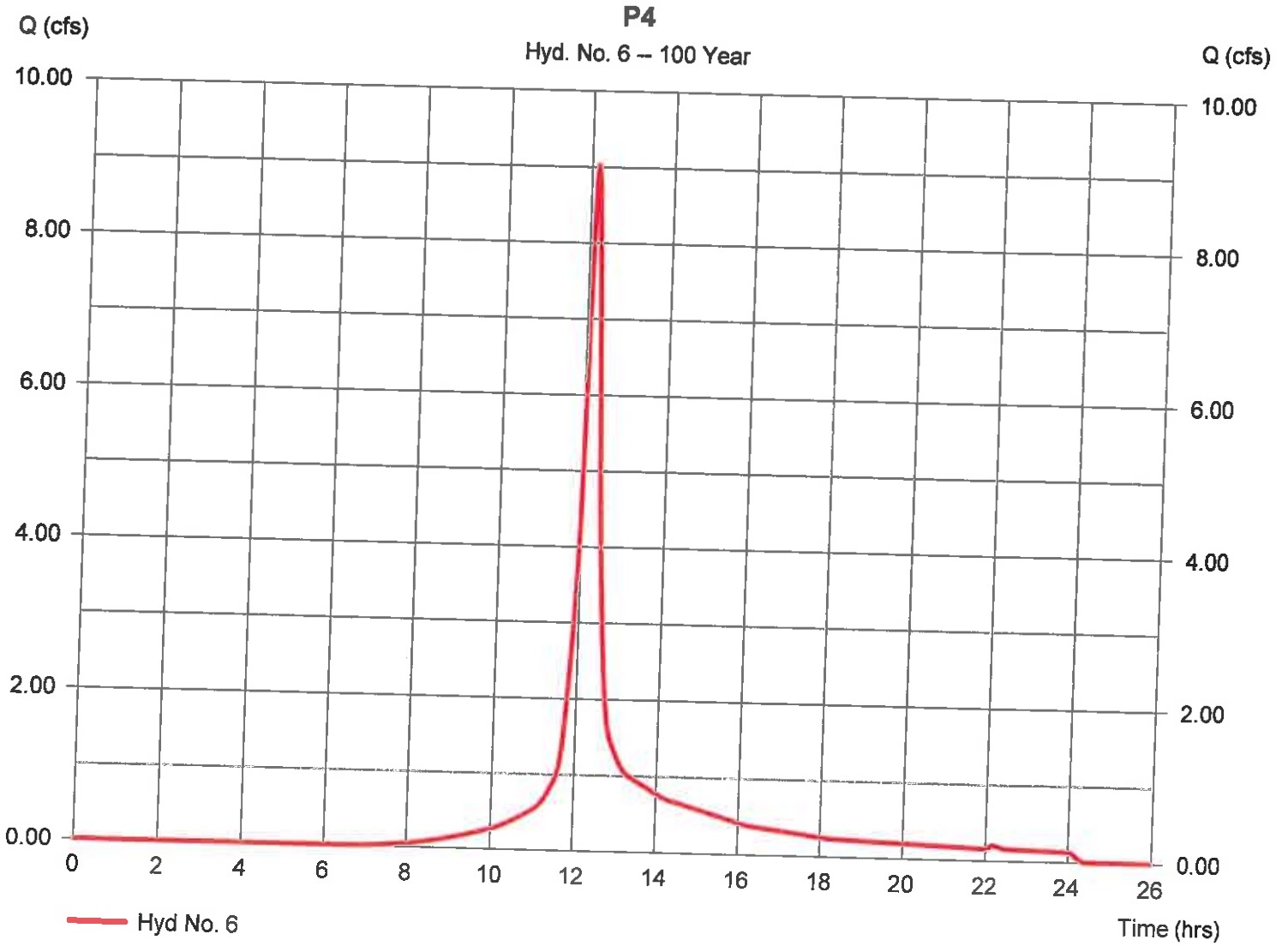
Tuesday, 10 / 24 / 2023

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 9.019 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 37,354 cuft
Drainage area	= 1.870 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.70 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.240 x 61) + (0.250 x 98) + (0.120 x 98) + (0.060 x 98) + (0.200 x 98)] / 1.870



Hydrograph Report

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

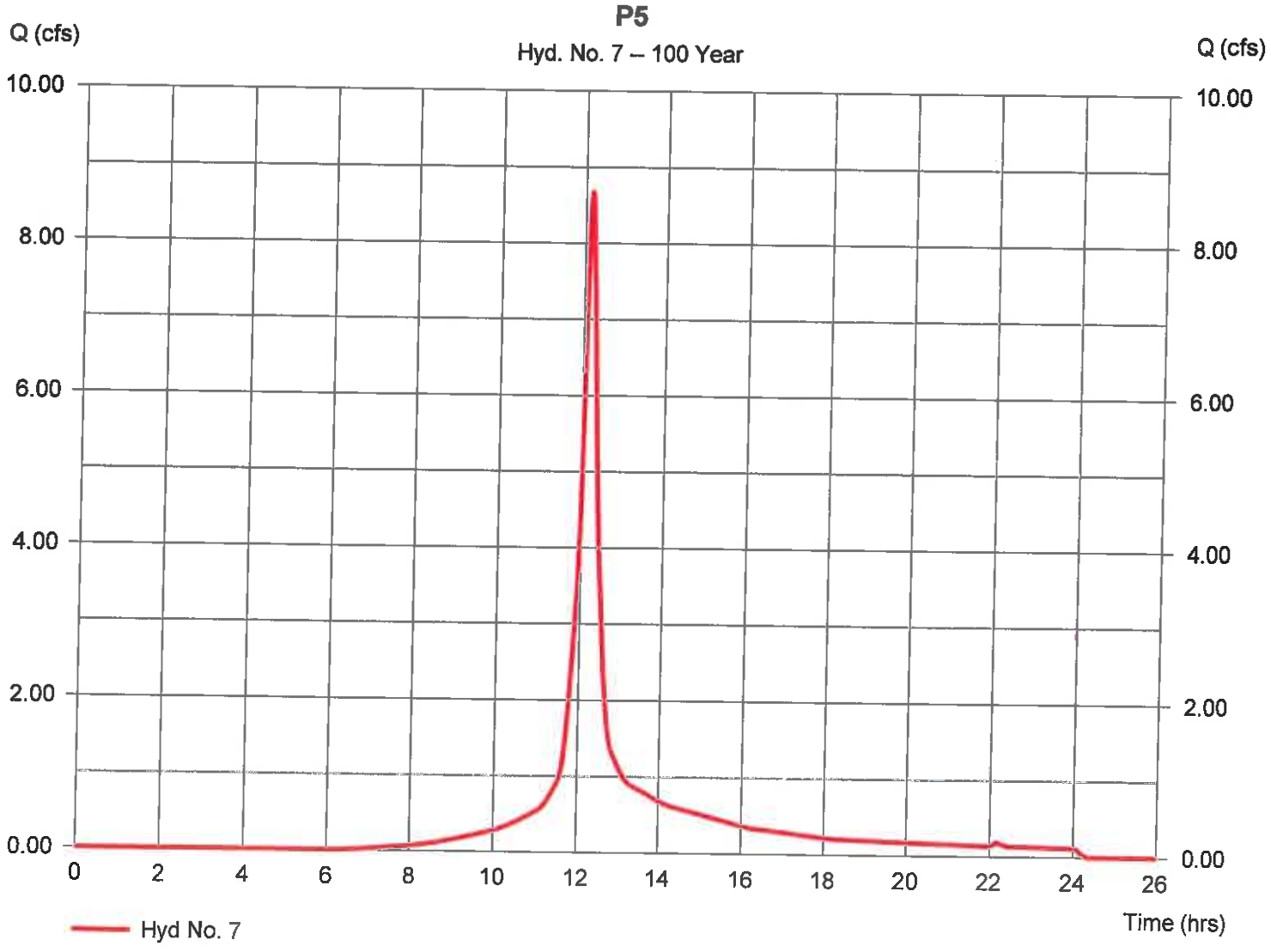
Tuesday, 10 / 24 / 2023

Hyd. No. 7

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 8.673 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 34,522 cuft
Drainage area	= 1.640 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.70 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.960 x 61) + (0.220 x 98) + (0.110 x 98) + (0.070 x 98) + (0.280 x 98)] / 1.640



Hydrograph Report

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

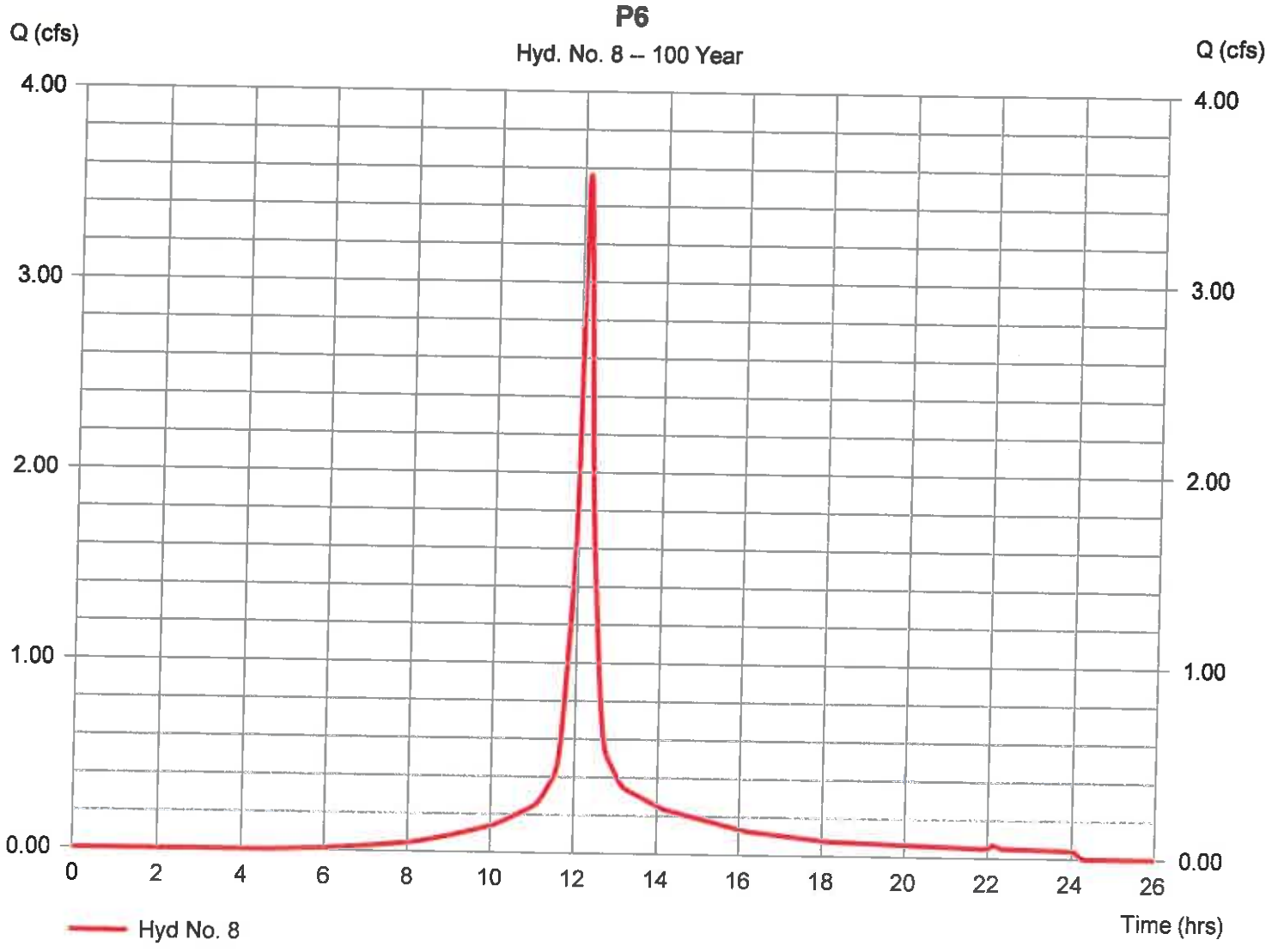
Tuesday, 10 / 24 / 2023

Hyd. No. 8

P6

Hydrograph type	= SCS Runoff	Peak discharge	= 3.561 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.15 hrs
Time interval	= 1 min	Hyd. volume	= 13,760 cuft
Drainage area	= 0.590 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.20 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 74) + (0.070 x 98) + (0.030 x 98) + (0.020 x 98) + (0.070 x 98)] / 0.590



Hydrograph Report

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

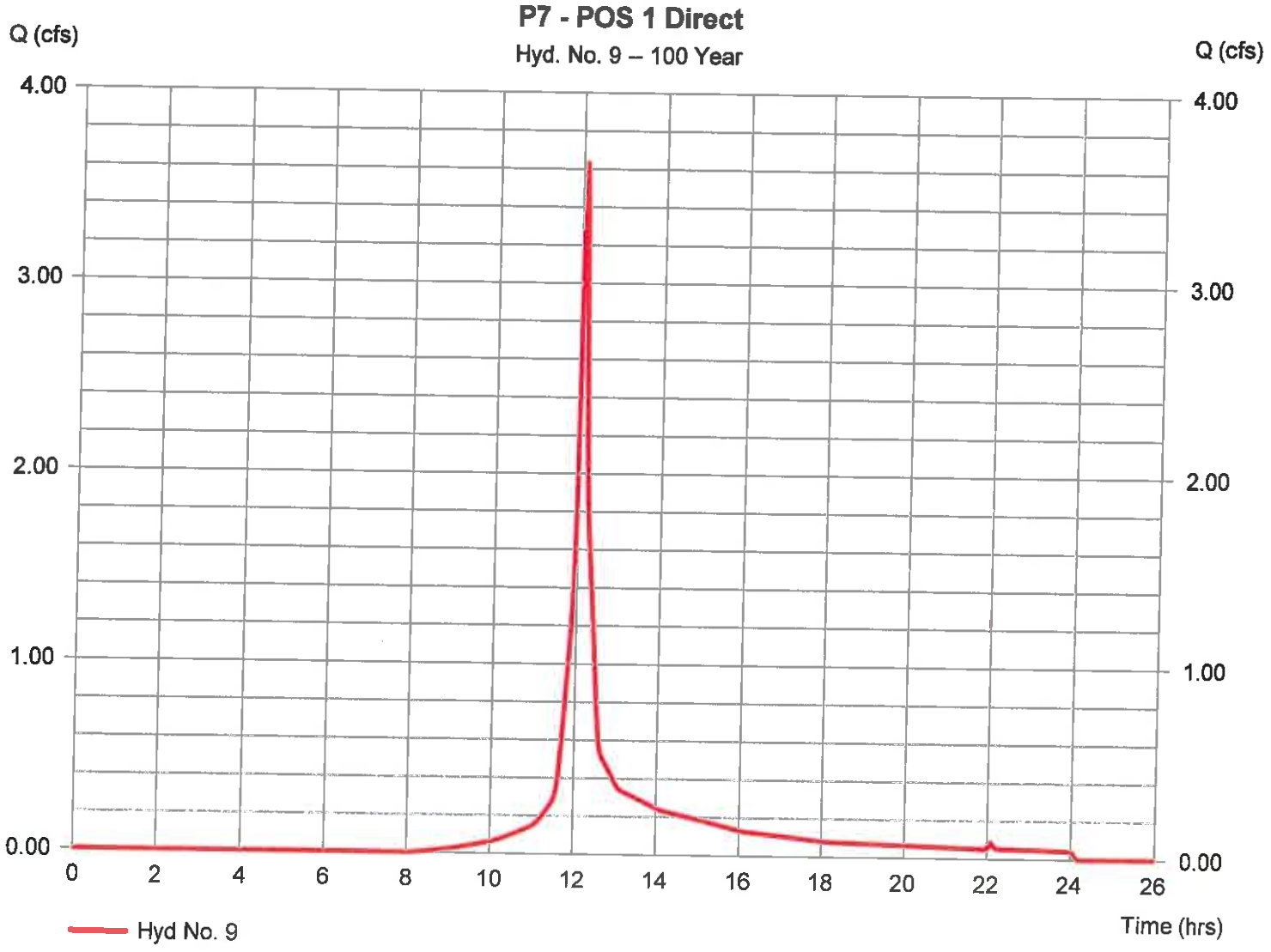
Tuesday, 10 / 24 / 2023

Hyd. No. 9

P7 - POS 1 Direct

Hydrograph type	= SCS Runoff	Peak discharge	= 3.630 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 1 min	Hyd. volume	= 11,666 cuft
Drainage area	= 0.700 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 8.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.580 x 61) + (0.030 x 98) + (0.010 x 98) + (0.020 x 98) + (0.060 x 98)] / 0.700



Hydrograph Report

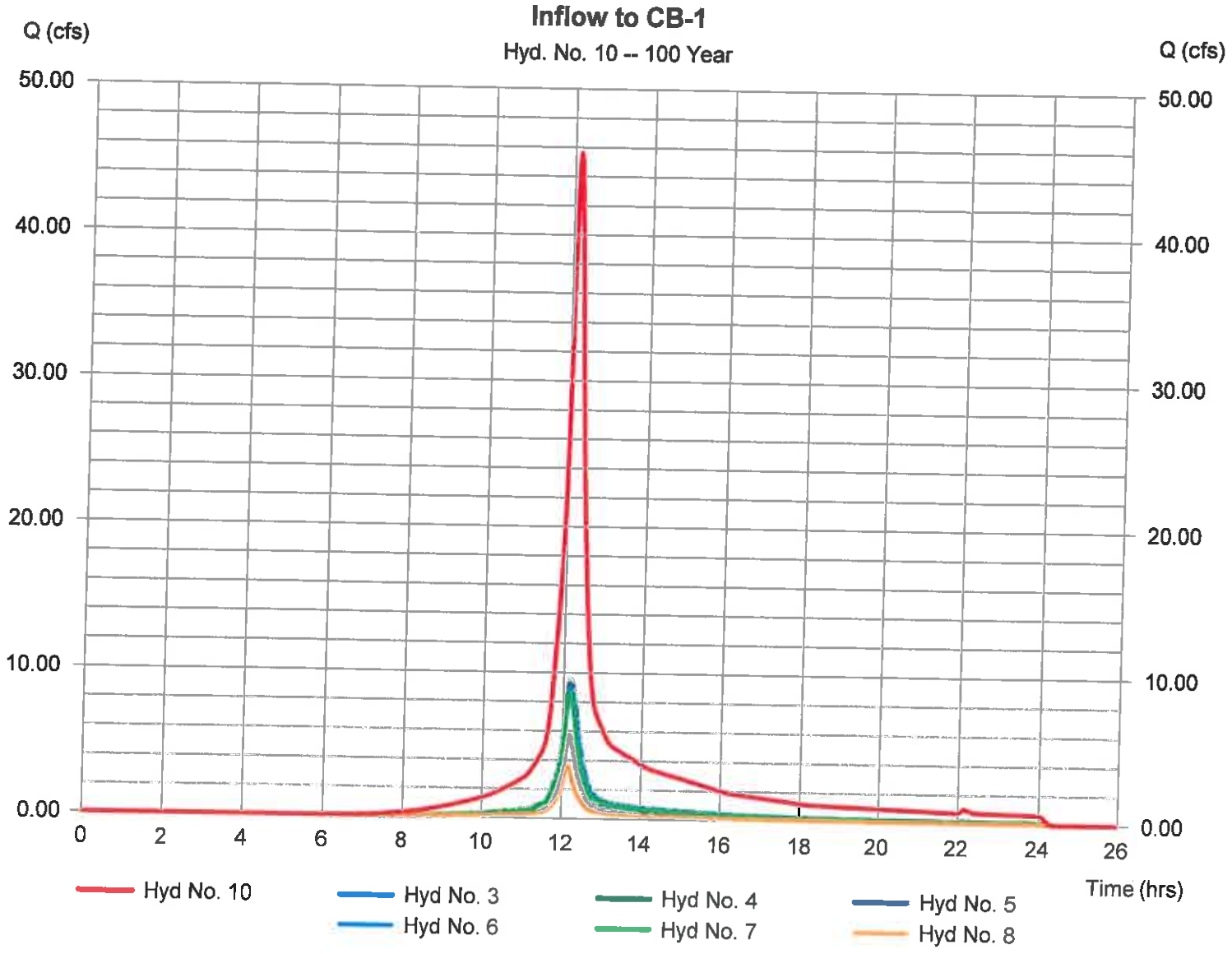
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 10

Inflow to CB-1

Hydrograph type	= Combine	Peak discharge	= 45.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 184,359 cuft
Inflow hyds.	= 3, 4, 5, 6, 7, 8	Contrib. drain. area	= 9.170 ac



Hydrograph Report

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

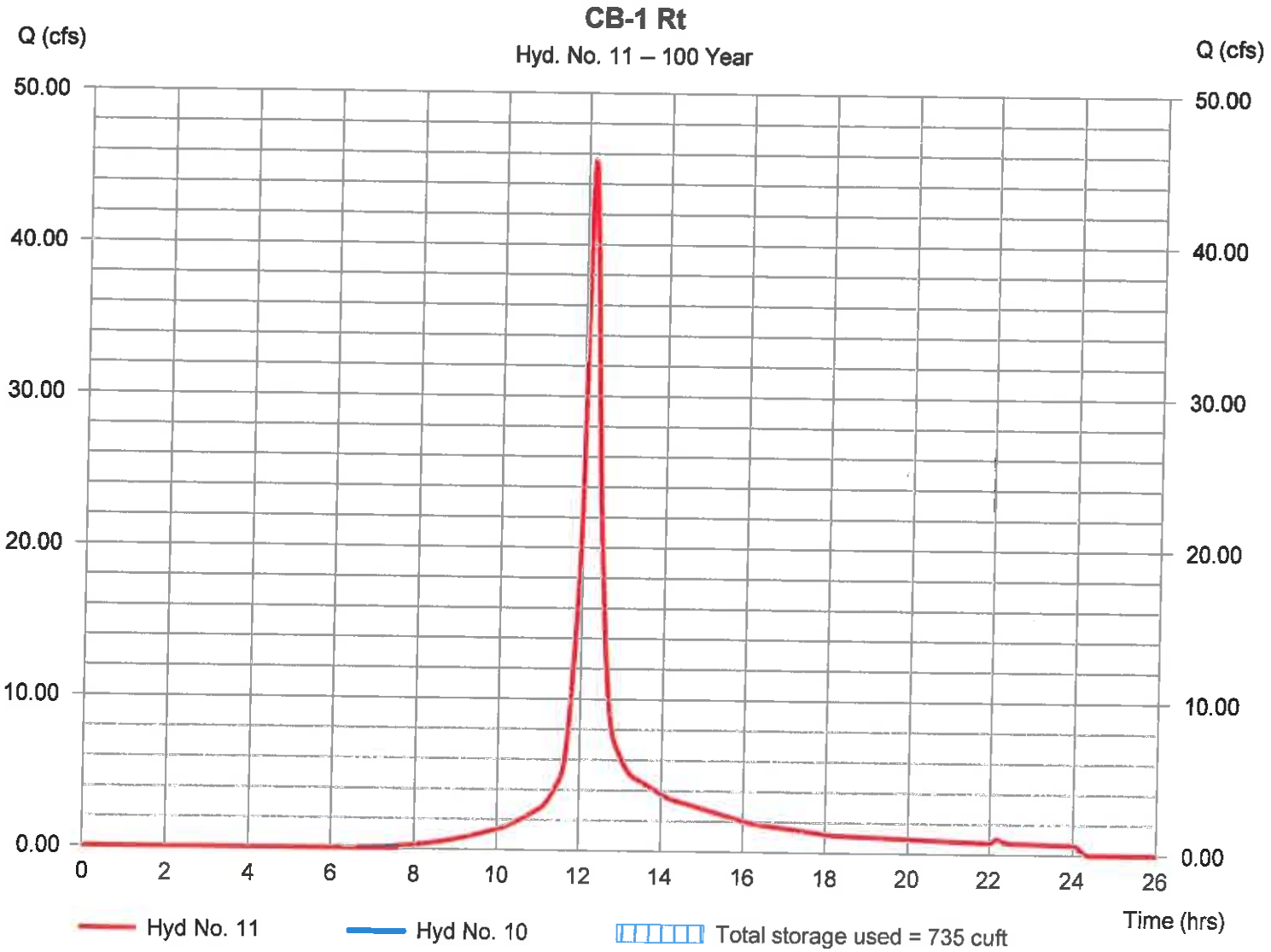
Tuesday, 10 / 24 / 2023

Hyd. No. 11

CB-1 Rt

Hydrograph type	= Reservoir	Peak discharge	= 45.55 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 184,016 cuft
Inflow hyd. No.	= 10 - Inflow to CB-1	Max. Elevation	= 38.74 ft
Reservoir name	= CB-1	Max. Storage	= 735 cuft

Storage Indication method used.



Hydrograph Report

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

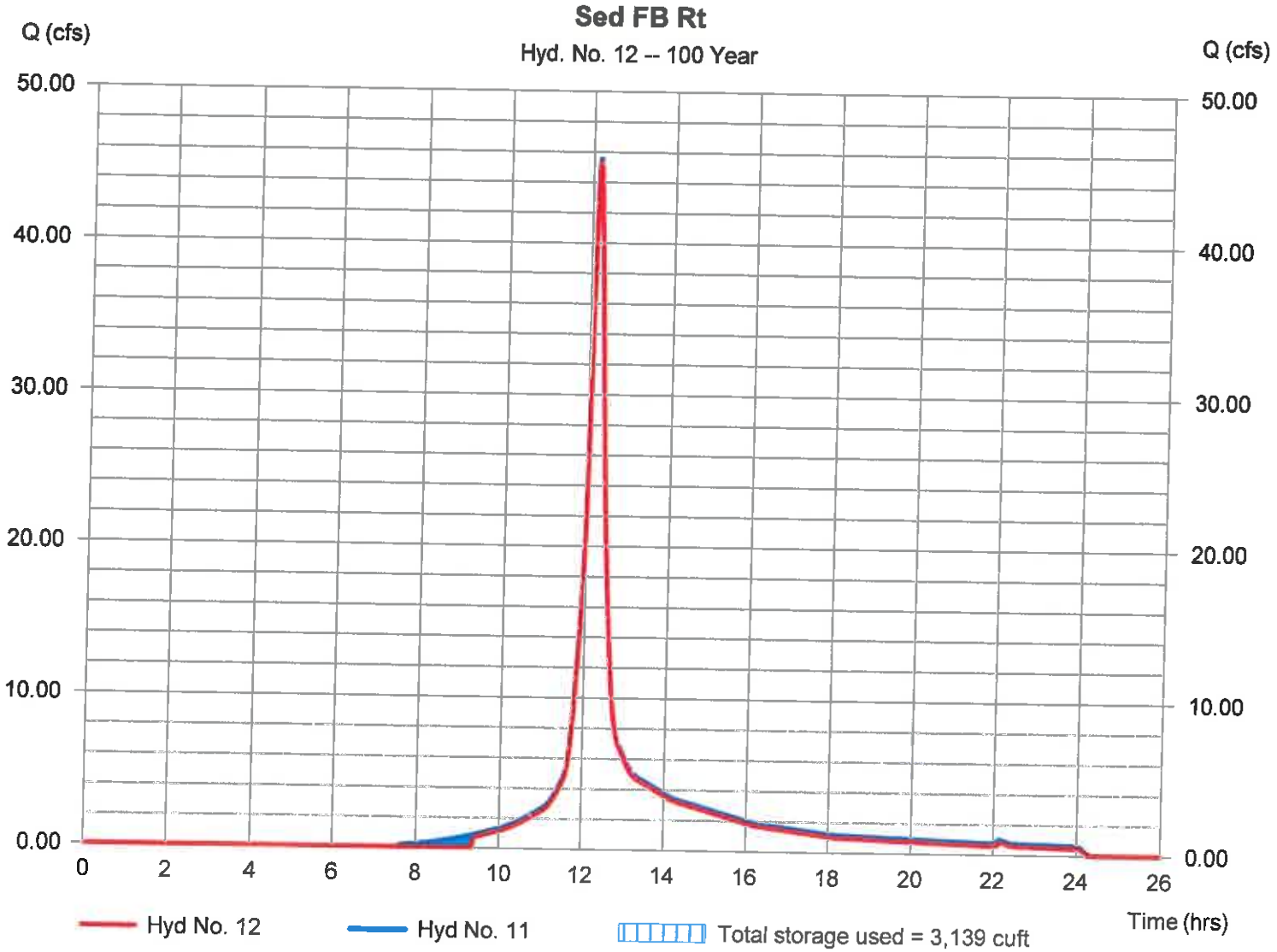
Tuesday, 10 / 24 / 2023

Hyd. No. 12

Sed FB Rt

Hydrograph type	= Reservoir	Peak discharge	= 45.34 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 172,039 cuft
Inflow hyd. No.	= 11 - CB-1 Rt	Max. Elevation	= 39.19 ft
Reservoir name	= Sed Forebay	Max. Storage	= 3,139 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

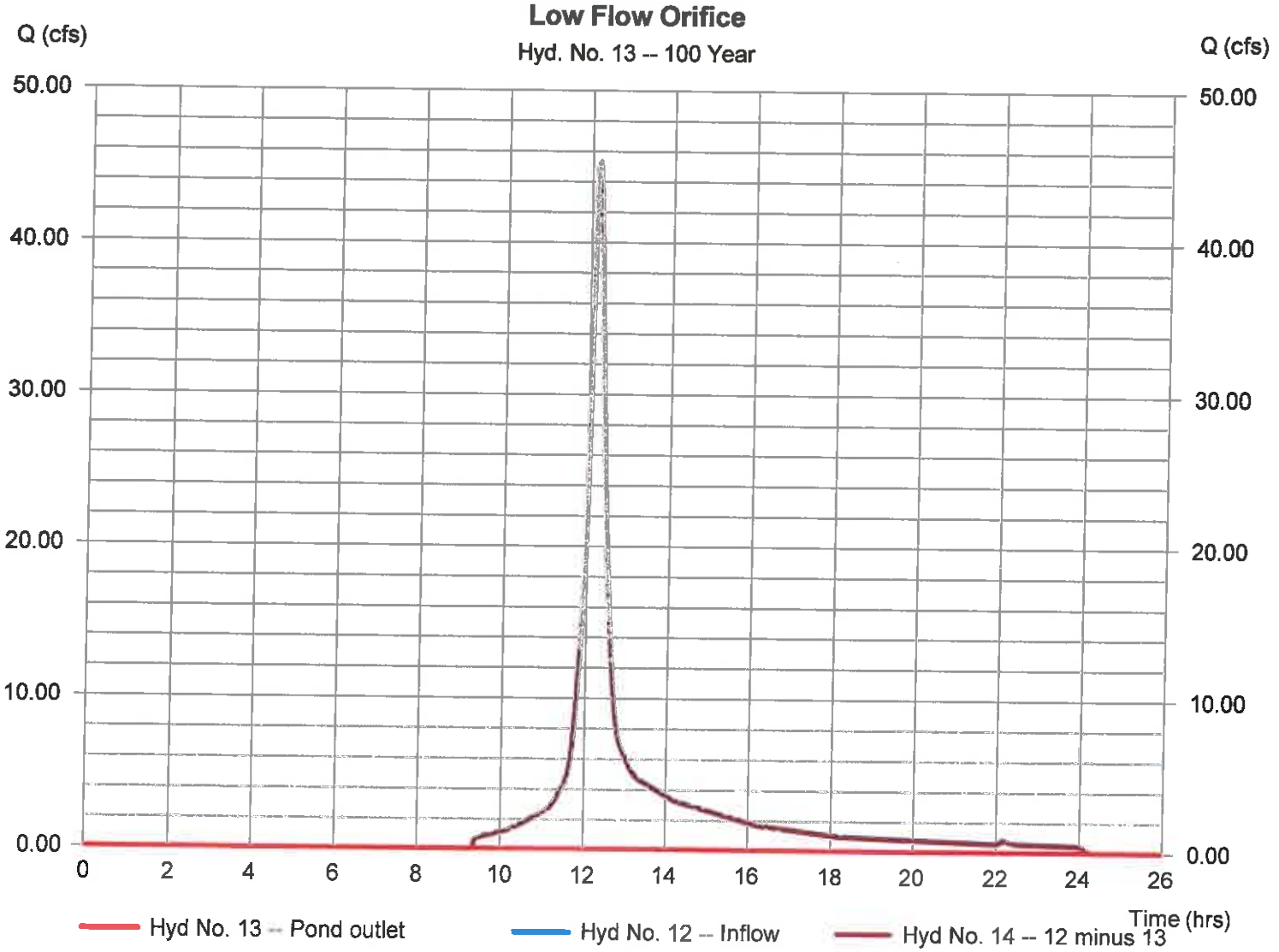
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 13

Low Flow Orifice

Hydrograph type	= Diversion1	Peak discharge	= 0.034 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 2,044 cuft
Inflow hydrograph	= 12 - Sed FB Rt	2nd diverted hyd.	= 14
Diversion method	= Pond - Sed Forebay	Pond structure	= Culv/Orf A



Hydrograph Report

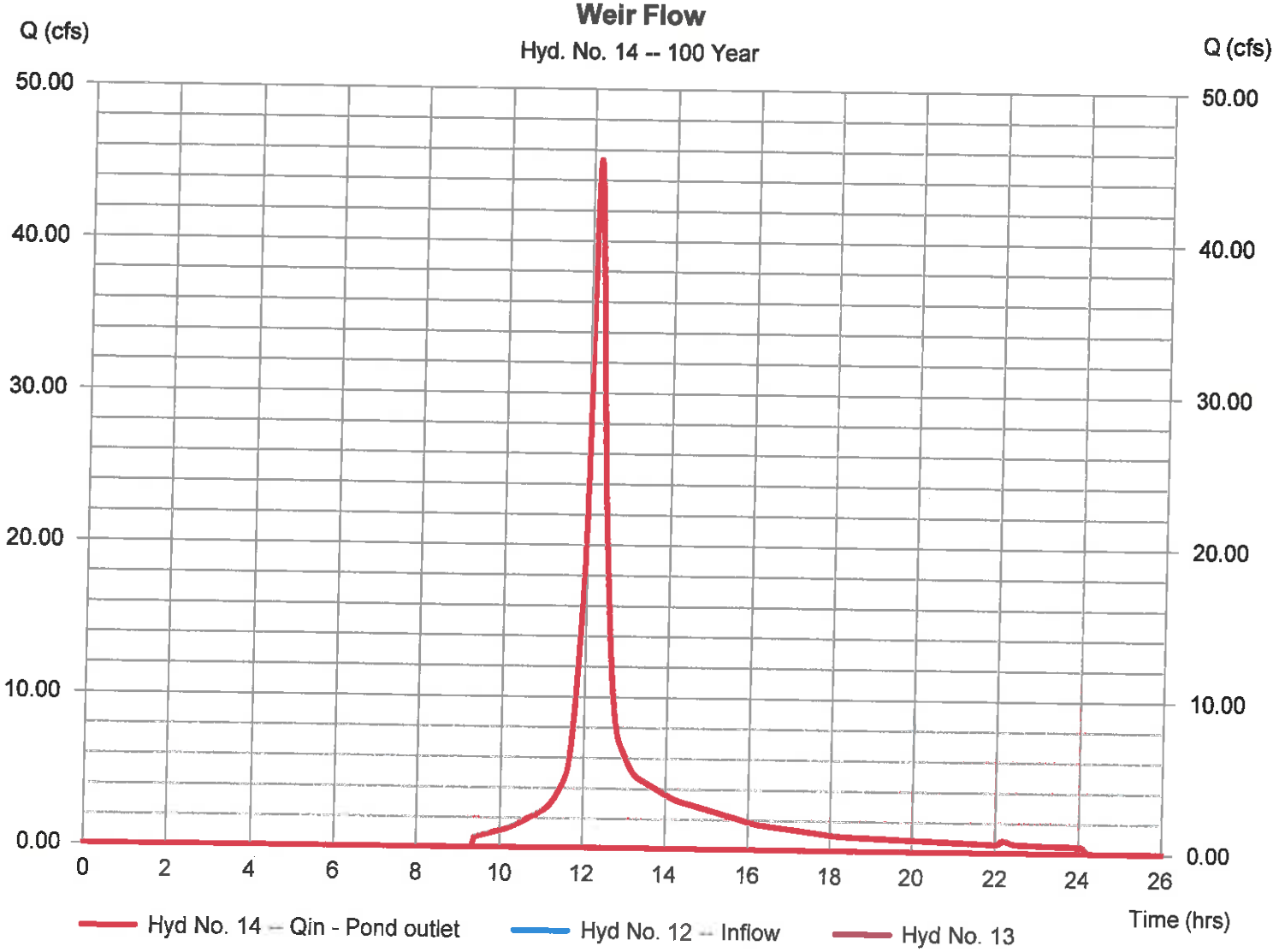
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 14

Weir Flow

Hydrograph type	= Diversion2	Peak discharge	= 45.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 169,995 cuft
Inflow hydrograph	= 12 - Sed FB Rt	2nd diverted hyd.	= 13
Diversion method	= Pond - Sed Forebay	Pond structure	= Culv/Orf A



Hydrograph Report

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

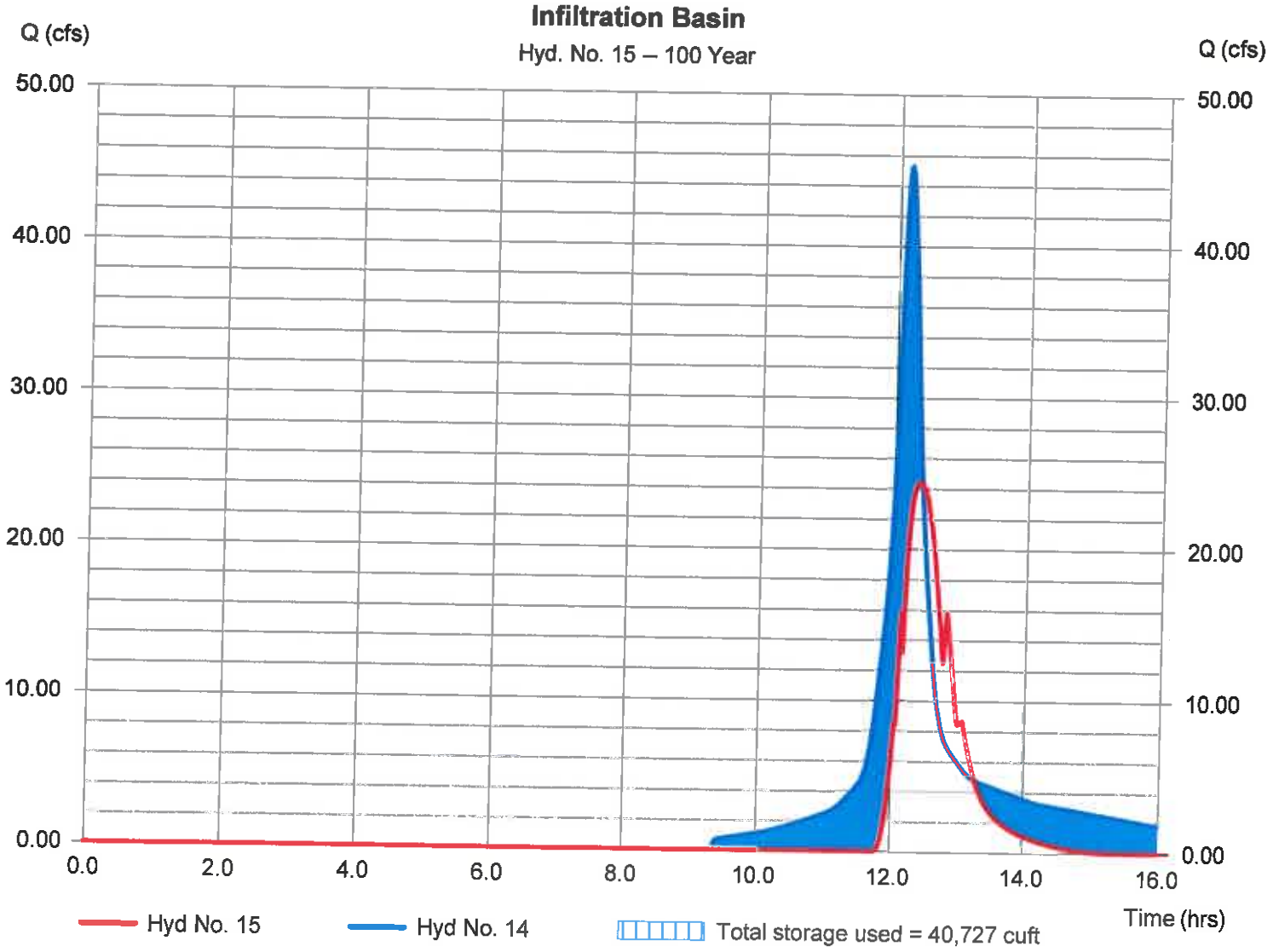
Tuesday, 10 / 24 / 2023

Hyd. No. 15

Infiltration Basin

Hydrograph type	= Reservoir	Peak discharge	= 24.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.38 hrs
Time interval	= 1 min	Hyd. volume	= 77,945 cuft
Inflow hyd. No.	= 14 - Weir Flow	Max. Elevation	= 39.30 ft
Reservoir name	= Infiltration	Max. Storage	= 40,727 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

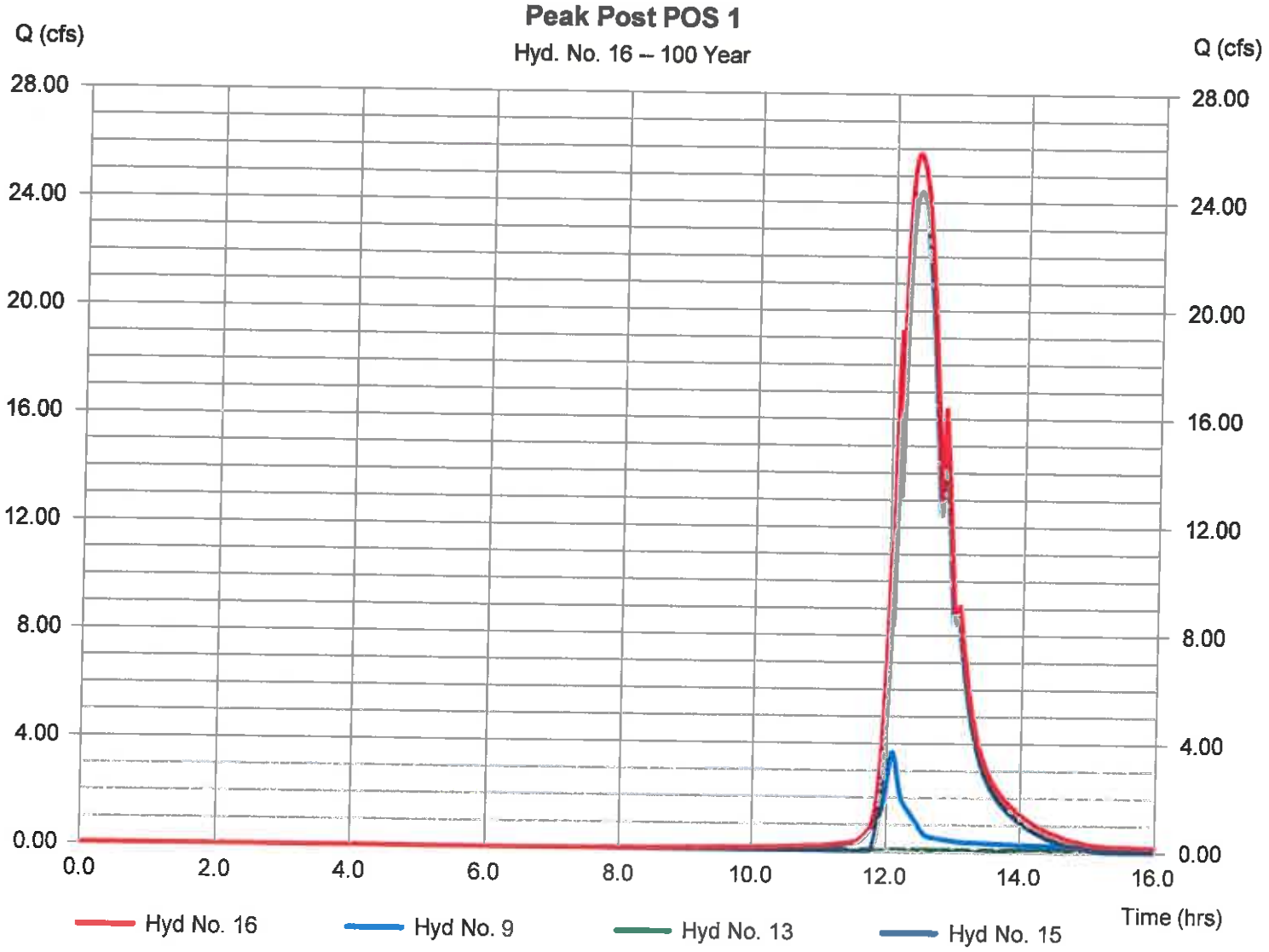
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 10 / 24 / 2023

Hyd. No. 16

Peak Post POS 1

Hydrograph type	= Combine	Peak discharge	= 25.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.37 hrs
Time interval	= 1 min	Hyd. volume	= 91,655 cuft
Inflow hyds.	= 9, 13, 15	Contrib. drain. area	= 0.700 ac



Appendix E

BMP Sizing Calculation Worksheets

Watershed:	P1-P7		
Soils:	B Soils		
Total Area (A, sf):	431,450	sf	
Total Area (A, ac):	9.90	ac	
Impervious Area (I, sf):	137,201	sf	
Impervious Area (I, ac):	3.15	ac	
Recharge Volume Calculation (Re_v)			
$Re_v = (1")(F)(I)/12$	F =	0.35	
Where:	I =	3.15	ac
Re_v = groundwater recharge volume (ac-ft)	Re_v =	0.09	ac-ft
F = recharge factor	Required Re_v =	4,002	ft^3
I = impervious area (ac)			
Recharge Volume provided:	Total Re_v =	9,860	ft^3
Water Quality volume requirements have been met!			
9,860 cf > 4,002 cf			
Water Quality Volume Calculation (WQ_v)			
$WQv = (1")(I)/12$	I =	3.15	ac
Where:	WQ_v =	0.262	ac-ft
WQv = water quality volume (ac-ft)	WQ_v =	11,433	ft^3
I = impervious area (ac)			
WQv minus Rooftop for pretreatment calcs		90,567	ft^2
I = Pre-treatemnt impervious area (ac)		2.079	ac
Water Quality Volume provided:		11,817	ft^3
Water Quality volume requirements have been met!			
11,817 cf > 11,433 cf			
Sediment Forebay Pretreatment (25% of WQ_v required) - not including roof			
$A_s = 5,750*Q$	Required Pretreatment Volume =	1,887	ft^3
Where:	Q =	0.022	cfs
A_s = sedimentation surface area (ft^2)	Minimum Surface Area (A_s) =	125.56	ft^2
Q = discharge from drainage area = %WQ_v / 86400 sec (cfs)	Depth of forebay provided =	3.10	ft
	Pretreatment volume provided =	1,956	ft^3
Pretreatment volume provided is equal to or greater than required!			
1956 cf >= 1887 cf			

$CN = 1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25\ QP)^{1/2}]$

Where:

P = rainfall, in inches

Q = runoff volume (WQ_v / total watershed area)

Subwatershed E1

Impervious area =	3.25	ac
Total Area =	9.28	ac
Calculated WQV =	0.271189164	ac-ft
P =	1.2	in
Q =	0.351	in
CN =	87.33	
Use CN =	87	

Subwatershed P1

Impervious area =	0.46	ac
Total Area =	2.01	ac
Calculated WQV =	0.038707147	ac-ft
P =	1.2	in
Q =	0.231	in
CN =	83.44	
Use CN =	83	

Subwatershed P2

Impervious area =	0.38	ac
Total Area =	1.15	ac
Calculated WQV =	0.031531221	ac-ft
P =	1.2	in
Q =	0.330	in
CN =	86.73	
Use CN =	87	

Subwatershed P3

Impervious area =	0.67	ac
Total Area =	1.94	ac
Calculated WQV =	0.05568947	ac-ft
P =	1.2	in
Q =	0.345	in
CN =	87.17	
Use CN =	87	

Subwatershed P4

Impervious area =	0.63	ac
Total Area =	1.87	ac
Calculated WQV =	0.052645776	ac-ft
P =	1.2	in
Q =	0.338	in
CN =	86.98	
Use CN =	87	

Subwatershed P5

Impervious area =	0.69	ac
Total Area =	1.64	ac
Calculated WQV =	0.057204622	ac-ft
P =	1.2	in
Q =	0.417	in

CN =	89.06	
Use CN =	89	

Subwatershed P6

Impervious area =	0.20	ac
Total Area =	0.60	ac
Calculated WQV =	0.016659014	ac-ft
P =	1.2	in
Q =	0.333	in
CN =	86.82	
Use CN =	87	

Subwatershed P7

Impervious area =	0.12	ac
Total Area =	0.70	ac
Calculated WQV =	0.010037879	ac-ft
P =	1.2	in
Q =	0.172	in
CN =	80.92	
Use CN =	81	

Pipe Sizing Table

From	To	Ai (af)	Ai (ac)	Ap (sf)	Ap (ac)	Atotal (ac)	C_r	C_p	$C_{weighted}$	Tc (min)	Qmax (cfs)	Length (ft)	Pipe Dia. (in)	Wall Thickness (in)	n	U/S Invert Elev (ft)	D/S Invert Elev (ft)	Pipe Slope	No. Barrels	$V_{capacity}$ (fps)	Qcapacity (cfs)	Pipe Size Check	"To" Rim Elev (ft)	Cover Check	NOTES
CB-1	CB-1	54,300.00	1.25	108,216.00	2.44	3.68	0.00	0.18	0.42	10.30	8.32	250.00	[illegible]	2.00	[illegible]	36.30	35.11	[illegible]	1	5.51	17.33	OK	48.68	8.19	Includes Watersheds P2, P3 & P6
[illegible]	[illegible]	37,818.00	0.87	72,138.00	1.67	2.54	0.90	0.18	0.43	[illegible]	5.77	236.00	[illegible]	1.50	[illegible]	37.48	36.50	[illegible]	2	8.06	9.89	OK	[illegible]	2.83	Includes Watersheds P3 & P6
[illegible]	CB-3a	[illegible]	0.20	[illegible]	0.46	0.60	0.90	0.18	0.42	[illegible]	1.47	[illegible]	[illegible]	1.25	[illegible]	38.98	37.48	[illegible]	1	3.47	2.72	OK	40.63	1.04	Includes Watershed P6 only
CB-1	CB-2	[illegible]	0.76	[illegible]	1.49	2.25	0.90	0.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35.21	35.11	[illegible]	1	4.55	8.04	OK	[illegible]	3.69	Includes Watersheds P4 & 1/2 of P1
[illegible]	CB-3	77,519.00	0.65	[illegible]	1.24	1.87	0.90	0.18	0.42	[illegible]	4.17	[illegible]	[illegible]	1.00	[illegible]	37.28	35.22	[illegible]	2	4.03	4.95	OK	[illegible]	2.01	Includes Watershed P4 only
CB-2	[illegible]	[illegible]	0.69	[illegible]	0.96	[illegible]	0.90	0.18	0.48	[illegible]	4.22	[illegible]	[illegible]	2.00	[illegible]	36.67	35.11	[illegible]	[illegible]	4.55	[illegible]	OK	[illegible]	290.91	Includes Watershed 5 only
[illegible]	[illegible]	[illegible]	0.34	[illegible]	0.48	0.82	0.90	0.18	0.48	[illegible]	2.11	[illegible]	[illegible]	1.50	[illegible]	36.83	36.67	[illegible]	[illegible]	4.03	4.95	OK	[illegible]	289.49	Includes 1/2 of Watershed 5
																							[illegible]	[illegible]	CB-6 rim elevation

Appendix F

STORMWATER MANAGEMENT OPERATION AND MAINTENANCE PLAN

Long-term maintenance of the drainage system shall be completed by the applicant/operator under a legally binding and enforceable maintenance agreement. The town of Warwick is NOT responsible for maintenance of the BMPs.

OWNER/APPLICANT:

40 Wickes Way, LLC
144 Metro Center Blvd, Unit F
Warwick, RI 02886

The contractor / operator shall maintain all drainage components during and directly after construction. All operational maintenance requirements will be recorded on the title.

OPERATOR / CONTRACTOR:

TBD

The entire stormwater system shall be inspected throughout the construction process and reported on the attached construction inspection reporting forms.

The entire stormwater management system shall be inspected on a bi-annual basis for general problems and to ensure proper function as well as after storm events greater than or equal to the 1-yr, 24-hr Type III precipitation event (2.7"). These inspections shall be reported on the attached O&M inspection reporting forms.

All inspections reports shall be kept on file with the Stormwater Management Operation and Maintenance Plan.

GENERAL FOR ALL BMP'S:

1. A legally binding and enforceable maintenance agreement shall be executed by the facility owner to ensure the following:

    - Sediment shall be cleaned out of the sediment forebay when it accumulates to a depth of more than one-half the design depth. The sediment chamber outlet devices shall be cleaned/repaired when drawdown times exceed 36 hours. Trash and debris shall be removed as necessary.

2. The contractor shall be responsible for inspection, maintenance and repair to all drainage structures and related appurtenances on the site during construction and for a maximum of

one (1) year following completion of construction, at which time the drainage structures and appurtenances are accepted by the engineer and the owner.

3. Following acceptance, the long-term maintenance shall be the responsibility of the owner until it is deeded to another responsible entity.

4. All costs incurred for maintenance, cleaning, and inspection are the responsibility of the applicant and/or responsible party. In certain cases, the appropriate DEM program may require documentation of maintenance.

5. Inspection of the BMPs and all inlet and outlet structures shall be performed after storms equal to or greater than the 1-year, 24-hour Type III storm (2.7" event) and at least once annually, preferably during a storm event to inspect for proper functioning of the facility. During the first 6 months of operation, BMPs shall be inspected at least during the first two precipitation events of at least 1.0-inches of rainfall.

6. Any inadvertent or deliberate discharge of waste oil or any other pollutant to the stormwater disposal system requires immediate notification of the DEM Oil Pollution Control Program at 222-2284, per Oil Pollution Control Regulations. During non-working hours, notification of spills can be made to the DEM division of enforcement at 222-3070, the 24-hour emergency response phone number.

7. All trash, litter and other debris shall be removed from any stormwater facility including inlet and outlet structures. This must be accomplished at least twice per year, preferably in the spring and fall.

8. Repairs or replacement of inlet/outlet structures, rip-rap channels, fences, or other elements of the facility shall be completed within 30 days of deficiency reports. If an emergency is imminent, then repair/replacement must be completed immediately.

A1 - SEDIMENT FOREBAY O&M:

1. The slopes shall be inspected for erosion and gullying.

2. Stone shall be reinforced if erosion is present at outfalls or if it has been compromised.

3. Inspect all structural components, such as trash racks, access gates, valves, pipes, weirs, walls, orifice structures and spillway structures for defects. If any are found, they must be repaired immediately.

4. Inspect for sediment accumulation and it shall be removed if it reaches 15" or 25% of the storage volume.

5. Mow surrounding grasses to maintain a 4-6" strong stand of turf and shall the grasses reach 10", mowing shall be done immediately. All clippings shall be collected and disposed of properly.

6. No woody growth shall ever be allowed to remain in and around the forebays.

7. Areas of erosion or disturbance shall be re-established immediately.

8. Inlets and outlets shall be cleared of debris as needed.

A2 - INFILTRATION BASIN O&M:

1. The facility shall be inspected annually to ensure it is draining. If standing water is observed for more than 48 hours after a rain event the top 6" shall be rototilled and any compacted sediment removed.

2. The facility shall be inspected annually for erosion, gullying, or damage.

3. Riprap splash pads shall be reinforced if erosion is present at outfalls or if it has been compromised.

4. Mow grassed slopes to maintain a 4-6" strong stand of turf. All clippings shall be collected and disposed of immediately.

5. No vegetative growth of any kind shall be allowed to stand within the sandy bottom, no woody growth shall be allowed to remain within the grassed areas in or around the basin.

6. Areas of erosion or disturbance shall be reestablished immediately.

7. Inlets and outlets shall be cleared of debris and trash as needed (minimally, once a year).

DRAINAGE SYSTEM O&M:

1. All storm drain pipes shall be annually checked for sediment and debris and cleaned / jetted as necessary.

2. All costs incurred for maintenance, cleaning, and inspection are the responsibility of the property owner upon acceptance.

3. Pavement sweeping shall be performed annually, preferably in the spring, after roadway sanding is completed for the season.

ESTIMATED O&M BUDGET & FUNDING SOURCE:

- The project operator shall be the City of Warwick, but until they take over the owner shall be responsible for funding the O&M budget.

Estimate of O&M budget:

Bi-annual inspections:	$1,000 ea x 2	$2,000
Bi-weekly mowing:	$200 ea x 13	$2,600
Misc. Repairs:	$1,000	$1,000
Pavement Sweeping	$1,000	$1,000
Additional inspections:	$1,000 ea x 2	$2,000
	TOTAL ESTIMATE:	**$8,600 / YR**

POLLUTION PREVENTION PLAN:

General: Long-term management of the pollution prevention plan shall be the responsibility of the owner / operator until the responsibility is turned over to another responsible entity.

OWNER:

40 Wickes Way, LLC
144 Metro Center Blvd, Unit F
Warwick, RI 02886

The contractor shall manage the pollution prevention plan during the construction process.

CONTRACTOR:

TBD

SOLID WASTE CONTAINMENT:

1. Where practical, trash racks shall be installed and maintained on all inlet structures within the drainage system.

SNOW DISPOSAL AND DEICING:

1. Sand and deicing materials shall be stored under-cover whether on or offsite to prevent exposure to stormwater.

2. Snow removal shall be performed in accordance with RIDEM's snow removal/disposal policy.

HAZARDOUS MATERIALS CONTAINMENT:

1. No hazardous materials shall be stored outside to avoid exposure to stormwater.

LANDSCAPE MANAGEMENT:

1. Grass clippings from lawn care procedures performed in and around the stormwater facility must be collected.
2. General lawn heights (excluding stormwater basins) onsite shall be kept at a 4-6" height.
3. Fertilizer and watering demands shall have professional oversight, and both uses shall be minimized to the maximum extent practical.

APPENDIX

Appendix A: BMP Map

Appendix B: Inspection Forms and Checklists

Appendix C: Sample O&M Agreement

Appendix G

Supporting Documentation

Rainfall Data

Soils Data

Soil Evaluation Forms

TR-55 data

NRS Wetlands Document

3.0 STORMWATER MANAGEMENT STANDARDS AND PERFORMANCE CRITERIA

3.1 OVERVIEW

Rhode Island has seen an increase in commercial and residential development over the last several decades. Controlling stormwater from development sites is a priority with regards to impacts to receiving water bodies. This chapter presents performance standards and criteria for all new and redevelopment projects in the State of Rhode Island. Project applicants are required to meet the eleven minimum standards, as well as comply with specific criteria for the site planning process, groundwater recharge, water quality, channel protection, and peak flow control requirements. In the case of restoration or retrofitting, deviation from these standards may be appropriate at the discretion of the approving agency. All applicable development proposals must include a stormwater management site plan for review by State and local government. A plan must address all of the above minimum standards through compliance with the requirements of this manual (see checklist in Appendix A of this document).

All of the minimum standards contribute to protecting the water and habitat quality of receiving waters from the negative impacts of stormwater runoff. This is achieved by using a combination of both structural controls and non-structural practices (such as LID) as part of an effective stormwater management system. In general, when a project's stormwater management system is designed, installed, and maintained in accordance with the requirements of this manual, its runoff impacts will be presumed to be in compliance with applicable state regulatory standards and requirements. In some cases, the permitting agency may require that an applicant prepare and submit a pollutant loading analysis developed in accordance with the provisions of Appendix H in order to ascertain compliance.

This manual often refers to storm events of various kinds. Unless otherwise noted, all storm events are 24 hours in duration and utilize NRCS Type III precipitation distribution. Rainfall amounts for Rhode Island for various return frequencies are provided in Table 3-1 and shall be used for design unless otherwise specified.

Table 3-1 Design Rainfall Amounts for Rhode Island

RI County	24-hour (Type III) Rainfall Amount (inches)*						
	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Providence County	2.7	3.3	4.1	4.9	6.1	7.3	8.7
Bristol County	2.8	3.3	4.1	4.9	6.1	7.3	8.6
Newport County	2.8	3.3	4.1	4.9	6.1	7.3	8.6

RI County	24-hour (Type III) Rainfall Amount (inches)*						
	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Kent County	2.7	3.3	4.1	4.8	6.2	7.3	8.7
Washington County	2.8	3.3	4.1	4.9	6.1	7.2	8.5

*All Rhode Island County rainfall values were obtained from the Northeast Regional Climate Center (NRCC) using regional rainfall data processed by NRCC from the period of record through December 2008. The NRCC in collaboration with the Natural Resource Conservation Service has under development an interactive web tool at www.precip.net for analysis of precipitation events based on long-term, station-specific data. Applicants may elect to use site-specific data derived from this web tool once the beta site becomes final rather than the RI County values in Table 3-1.

3.2 MINIMUM STORMWATER MANAGEMENT STANDARDS

3.2.1 Minimum Standard 1: LID Site Planning and Design Strategies

LID site planning and design strategies must be used to the maximum extent practicable[1] in order to reduce the generation of the water runoff volume for both new and redevelopment projects. All development proposals must include a completed Stormwater Management Plan checklist (Appendix A) and Stormwater Management Plan for review by the approving agency that shows compliance with this standard. If full compliance is not provided, an applicant must document why key steps in the process could not be met and what is proposed as mitigation. The objective of the LID Site Planning and Design Strategies standard is to provide a process by which LID is considered at an early stage in the planning process such that stormwater impacts are prevented rather than mitigated for.

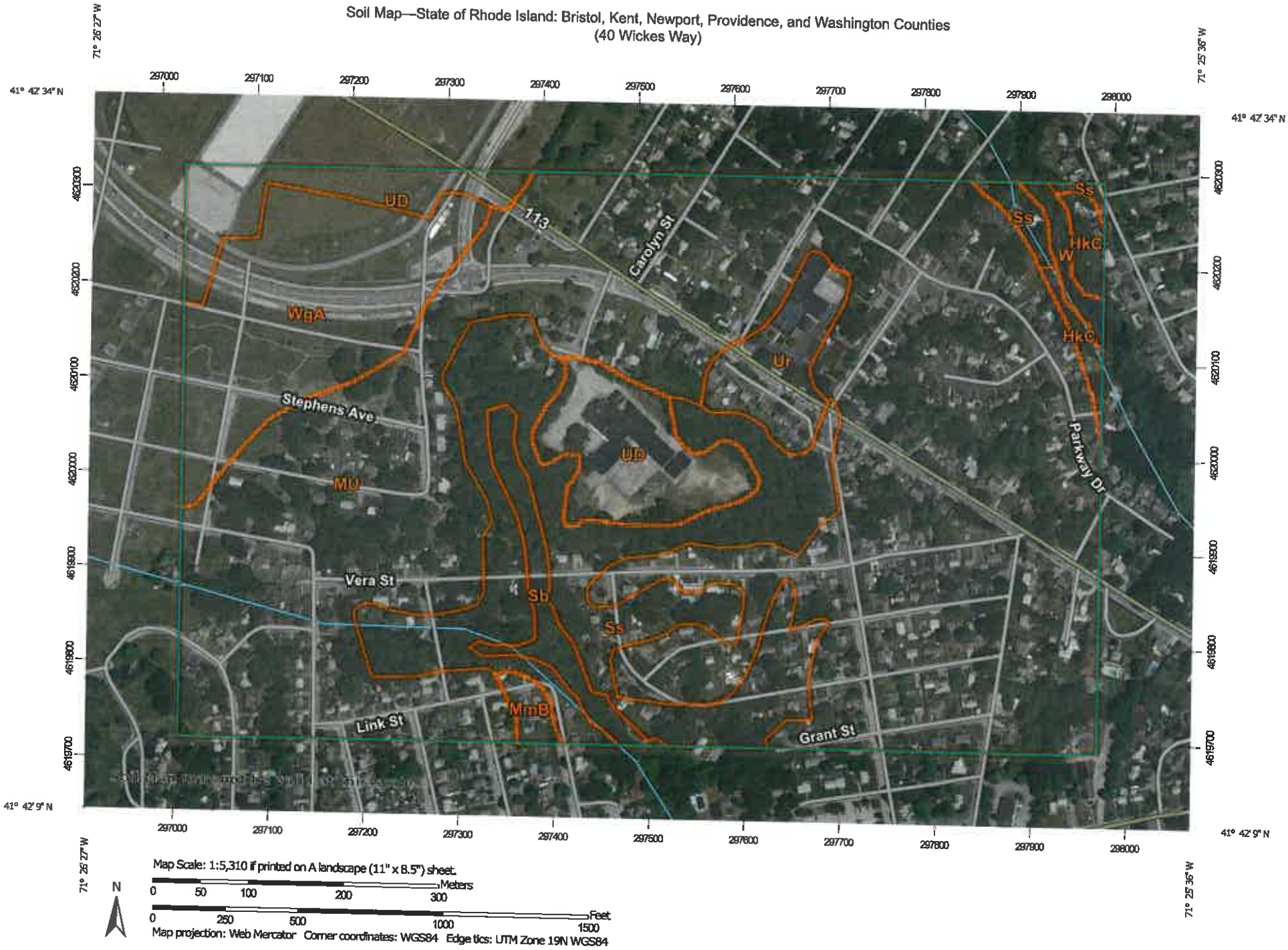
3.2.2 Minimum Standard 2: Groundwater Recharge

Stormwater must be recharged within the same subwatershed to maintain baseflow at pre-development recharge levels to the maximum extent practicable in accordance with the requirements and exemptions[2] described in Section 3.3.2. In addition, applicants may be required to provide a water budget analysis for proposed groundwater dewatering. Recharge volume is determined as a function of annual pre-development

[1] For all references to "maximum extent practicable" in this manual, an applicant must demonstrate the following: (1) all reasonable efforts have been made to meet the standard in accordance with current local, state, and federal regulations, (2) a complete evaluation of all possible management measures has been performed, and (3) if full compliance cannot be achieved, the highest practicable level of management is being implemented.

[2] Some exemptions to the recharge criteria are necessary to ensure public safety, avoid unnecessary threats of groundwater contamination, and avoid common nuisance issues. Stormwater runoff from LUHPPL is not allowed to infiltrate into groundwater. The stormwater recharge requirement may be specifically waived if an applicant can demonstrate a physical limitation that would make implementation impracticable or where unusual geological or soil features may exist such as significant clay deposits, ledge, fill soils, or areas of documented slope failure.

Soil Map—State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
(40 Wickes Way)



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 1:12,000.

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

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

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

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

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

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

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
Survey Area Data: Version 22, Sep 12, 2022

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

Date(s) aerial images were photographed: Jun 14, 2022—Jul 1, 2022

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HkC	Hinckley loamy sand, 8 to 15 percent slopes	1.5	1.1%
MmB	Merrimac fine sandy loam, 3 to 8 percent slopes	0.7	0.5%
MU	Merrimac-Urban land complex, 0 to 8 percent slopes	88.0	61.1%
Sb	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	2.7	1.9%
Ss	Sudbury sandy loam	21.8	15.1%
UD	Udorthents-Urban land complex	10.5	7.3%
Ur	Urban land	4.0	2.8%
W	Water	0.9	0.7%
WgA	Windsor loamy sand, 0 to 3 percent slopes	13.8	9.6%
Totals for Area of Interest		144.0	100.0%

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources

Site Evaluation Form
Part A - Soil Profile Description

Application Number DRAINAGE

Property Owner: 40 Wickes Way, LLC
Property Location: 50 Child Lane, AP 347 Lot 476, Warwick
Date of Test Hole: May 4, 2023
Soil Evaluator: Kevin Fetzer License Number: D-4029
Weather: Sunny Shaded: Yes ☐ No ☒ Time: 0900

TH D-1 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
^C	8 - 0	a	s	2.5Y 3/2			sl	1 sbk f	fr	1.02 0.0014
Bb	0 - 10	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
Bw	10 - 16	a	s	10YR 5/6			sl	1 sbk f	fr	1.02 0.0014
2C	16 - 84			10YR 5/4	7.5YR 5/8	c - m - p @ 24"	s	O - sg	loose	8.27 0.0115

TH D-2 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
^A	12 - 6	a	s	10YR 2/2			fsl	1 sbk f	fr	1.02 0.0014
^C	6 - 0	a	s	10YR 3/3			sl	1 sbk f	fr	1.02 0.0014
Ab	0 - 4	a	s	10YR 2/2			fsl	1 sbk f	fr	1.02 0.0014
Bw_1	4 - 12	c	s	10YR 5/6			sl	1 sbk f	fr	1.02 0.0014
Bw_2	12 - 20	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
2C	20-120			10YR 6/4			s	O - sg	loose	8.27 0.0115

Soil Class: HTM over Outwash
Depth to Groundwater Seepage: - -
Estimated Seasonal High Water Table: 24" - 96"
Total Depth of eachTest Hole: 84" - 120"
Depth to Impervious or Limiting Layer: No Ledge Encountered
Comments:

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources

Site Evaluation Form
Part A - Soil Profile Description

Application Number DRAINAGE

Property Owner: 40 Wickes Way, LLC
Property Location: 50 Child Lane, AP 347 Lot 476, Warwick
Date of Test Hole: May 4, 2023
Soil Evaluator: Kevin Fetzer License Number: D-4029
Weather: Sunny Shaded: Yes ☐ No ☒ Time: 0900

TH D-3 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
A	0 - 3	a	s	10YR 3/2			fsl	1 sbk f	fr	1.02 0.0014
Bw1	3 - 8	c	s	10YR 3/6			sl	1 sbk f	fr	1.02 0.0014
Bw2	8 - 16	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
C	16 - 108	a	s	10YR 5/4			s	O - sg	loose	8.27 0.0115
2C	108-120			2.5Y 5/2			fs	O - sg	loose	8.27 0.0115

TH D-4 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
Ap	0 - 6	a	s	10YR 4/3			fsl	1 sbk f	fr	1.02 0.0014
Bw1	6 - 12	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
C	12-108	a	s	10YR 6/4	7.5YR 5/6	c - m - p @84"	s	O - sg	loose	8.27 0.0115
2C	108-120			2.5Y 5/2			fs	O - sg	loose	8.27 0.0115

Soil Class: Outwash
Depth to Groundwater Seepage: - -
Estimated Seasonal High Water Table: 84" - 84"

Total Depth of eachTest Hole: 120" - 120"
Depth to Impervious or Limiting Layer: No Ledge Encountered
Comments:

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources

Site Evaluation Form
Part A - Soil Profile Description

Application Number DRAINAGE

Property Owner: 40 Wickes Way, LLC
Property Location: 50 Child Lane, AP 347 Lot 476, Warwick
Date of Test Hole: May 4, 2023
Soil Evaluator: Kevin Fetzer License Number: D-4029
Weather: Sunny Shaded: Yes ☐ No ☒ Time: 0900

TH D-5 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
^A	8 - 0	a	s	10YR 2/2			sl	1 sbk f	fr	1.02 0.0014
Apb	0 - 8	a	s	10YR 3/2			sl	1 sbk f	fr	1.02 0.0014
Bw	8 - 18	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
C	18 - 72	c	s	10YR 6/4			s	O - sg	loose	8.27 0.0115
2C	72-120			2.5Y 6/2	7.5YR 5/6	c - m - p	fs	platy	loose	8.27 0.0115

TH D-6 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
Ap	0 - 5	a	s	10YR 3/2			sl	1 sbk f	fr	1.02 0.0014
Bw_1	5 - 10	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
Bw_2	10 - 16	c	s	10YR 5/6			sl	1 sbk f	fr	1.02 0.0014
C	16 - 36	a	s	10YR 6/4			s	O - sg	loose	8.27 0.0115
2C	36-120			2.5Y 5/2	7.5YR 5/8	c - m - p	s	O - sg	loose	8.27 0.0115

Soil Class: Outwash/Lacustrine
Depth to Groundwater Seepage: - 66"
Estimated Seasonal High Water Table: 72" - 36"
Total Depth of eachTest Hole: 120" - 120"
Depth to Impervious or Limiting Layer: No Ledge Encountered
Comments:

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources

Site Evaluation Form
Part A - Soil Profile Description

Application Number DRAINAGE

Property Owner: 40 Wickes Way, LLC
Property Location: 50 Child Lane, AP 347 Lot 476, Warwick
Date of Test Hole: May 4, 2023
Soil Evaluator: Kevin Fetzer License Number: D-4029
Weather: Sunny Shaded: Yes ☐ No ☒ Time: 0900

TH D-7 Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min
A	0 - 6	a	s	10YR 3/3			sl	1 sbk f	fr	1.02 0.0014
Bw_1	6 - 12	c	s	10YR 3/6			sl	1 sbk f	fr	1.02 0.0014
Bw_2	12 - 20	c	s	10YR 4/6			sl	1 sbk f	fr	1.02 0.0014
C	20 - 60	a	s	10YR 6/4			s	O - sg	loose	8.27 0.0115
2C	60 - 96			2.5Y 5/2	7.5YR 4/4	c - m - p	s	O - sg	loose	8.27 0.0115

TH Horizon	Depth	Horizon Boundaries Dist	Horizon Boundaries Topo	Soil Colors Matrix	Soil Colors Re-Dox Features	Re-Dox Description Ab. S. Con.	Texture	Structure	Consistence	in/hr ft/min

Soil Class: Outwash
Depth to Groundwater Seepage: 72"
Estimated Seasonal High Water Table: 60"
Total Depth of eachTest Hole: 96"
Depth to Impervious or Limiting Layer: No Ledge Encountered
Comments:

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).

[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

Table 2-2a Runoff curve numbers for urban areas [1]

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

[1] Average runoff condition, and $I_a = 0.2S$.

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

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

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

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

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 ***Poor:*** <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 ***Poor:*** <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 ***Poor:*** Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).

[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

Natural Resource Services, Inc.

June 15, 2022

Jeffrey Hanson, PE
Millstone Engineering, PC
250 Centerville Road, Building E12
Warwick, RI 02886

RE: Freshwater Wetland Delineation
50 Child Lane
Warwick, Rhode Island

Dear Mr. Hanson:

Natural Resource Services, Inc. (NRS) has completed the freshwater wetland delineation within the above referenced property. This fieldwork was performed by staff biologist Hannah Chace on June 14th 2022. The wetland delineation was established in accordance with the standards outlined in Appendix 3 of the Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act (250 RICR 150-15-3). These land-use regulations are administered by the RI Department of Environmental Management (DEM), Office of Water Resources (OWR). It is important to note that in accordance with Section 3.9.3 (D) of these regulations, all delineations performed by wetland consultants are not considered to be accurate for state regulatory purposes until the work is reviewed and verified by the DEM, OWR.

As part of our work, a hand-held GPS unit was used to locate the established wetland flagging. While this location work should not be construed as a professional survey, the data obtained is valuable for preliminary planning purposes. An aerial photograph is attached to this letter. The GPS data has been added as an overlay on the photo to provide a visual representation of the established wetland delineation.

The city tax assessor's database has the subject lot listed as approximately 10.38 acres in size. The property maintains road frontage along the southern terminus of Child Lane, the western side of Buttonwoods Avenue, and the northern side of Vera Street. The property is the site of an old school building, constructed in 1954 and now abandoned.

A new state freshwater wetlands law was enacted in July of 2015. This law made changes to the jurisdictional limits currently utilized in the regulations. The Department of Environmental Management (DEM) has written new regulations pursuant to this statute which will require buffer zones for all freshwater wetlands. These regulations take effect on July 1, 2022.

P.O. Box 311 Harrisville, RI 02830 401-568-7390 FAX 401-568-7490

Under these regulations, the Department will have jurisdiction over 200 feet from all rivers and streams, and a 100 foot jurisdictional area from all vegetated wetlands. This jurisdictional area is depicted as a dashed black line in the enclosed graphic.

The rules regulate wetlands based on their River Region, size, and vegetational composition. This property falls in the Urban region. NRS delineated the easternmost edge of a swamp that falls along the western border of the property. This would receive a 25 foot buffer zone under the new regulations. Additionally, due to the presence of a stream within 50 feet of the delineated wetland edge from flag A1-A15, the regulations apply an additional 25 feet to the edge of the wetland buffer (50 feet total). The stream itself receives a 50 foot buffer zone under the regulations. The buffer zone is depicted in yellow where the buffer will be 25 feet and green where the buffer zone is 50 feet from the wetland or stream edge.

It should be noted that in the case of and new development, the wetlands will have setback standards in addition to the buffer standards outlined above. Any primary structure shall require an additional 20 feet of setback from the buffer zone, and 5 feet of setback for any secondary structures proposed. If any work is proposed within the jurisdictional area, buffer zone, construction setback, or wetlands, a permit is required from the Department.

Additionally, a number of trails were found within the wooded portions of the property, some of which occur within the wetlands or their corresponding buffer zones. These may not be allowed to remain if the trails were created after the original freshwater wetland regulations went into effect in 1971 and no permits were received to clear and maintain these paths.

Please do not hesitate to contact me if you have any questions regarding the information presented in this letter of findings.

Very truly yours,

Scott P. Rabideau, PWS
Principal

Enclosures

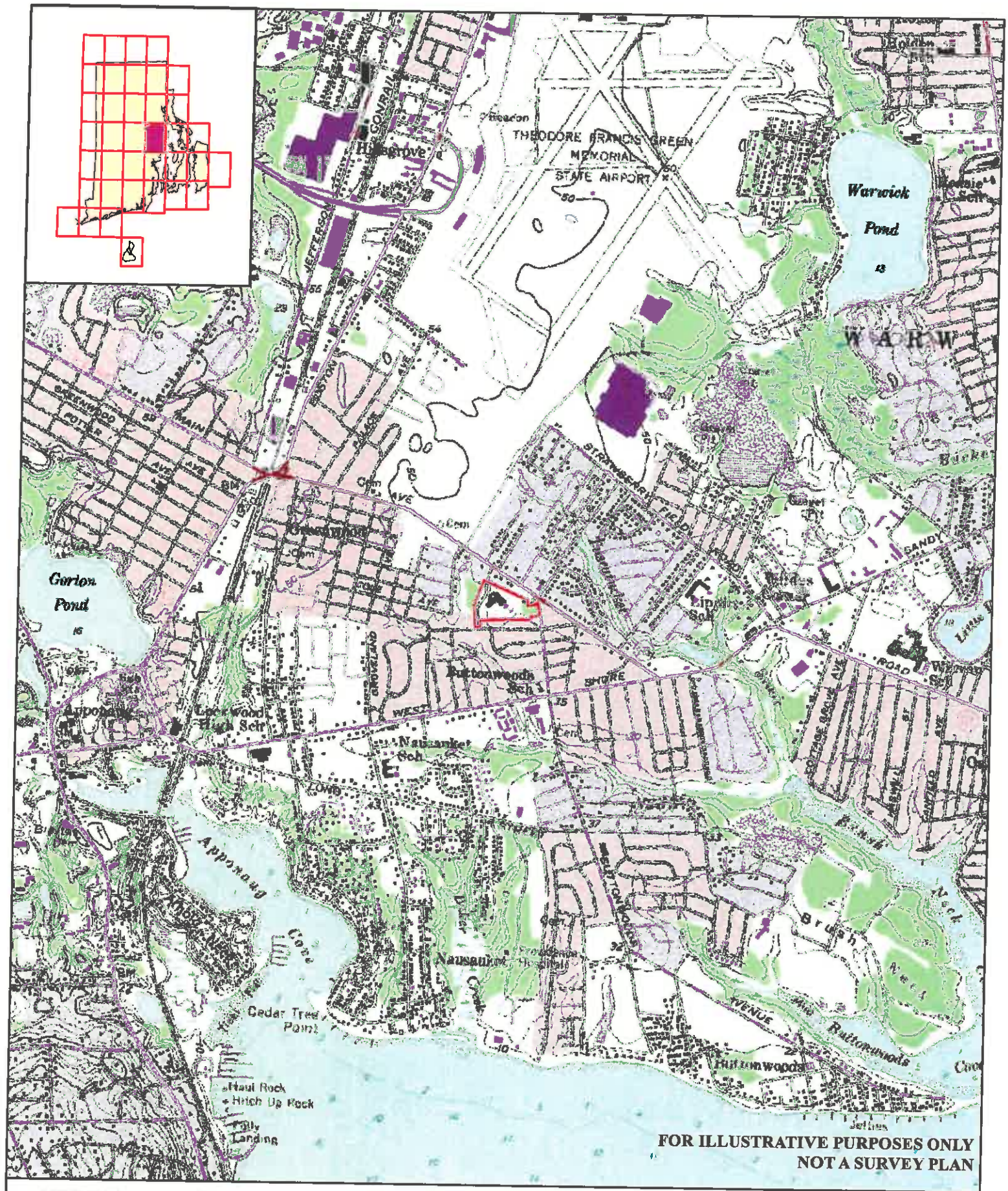
Cc: Ben Caito, PE

Site Sketch Depicting
Approximate Wetland Delineation
50 Child Lane
A.P. 347, Lot 476
Warwick, RI

Performed by:
Staff biologist Hannah Chace - 6/14/2022
Located using a hand-held Trimble GeoXH

April 2021 aerial
RI DEM Mapping

Natural Resource Services, Inc.
PO Box 311
160 Tinkham Lane
Harrisville, RI 02830
p: (401) 568-7980



USGS Topographic Map
50 Child Lane
A.P. 347, Lot 476
Warwick, RI

East Greenwich Quad Map

Approximate Site Location

USGS Topographic Series
Contour Interval 10 Feet
National Geodetic Vertical Datum of 1929

0 1,000 2,000 4,000 Feet

N W E S

RIGIS
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Wetland Edge Delineation Data Form (WETLAND)

Applicant:

Wetland No.

Project: 50 Child Lane

Flag No. Sequence: A1-A27

City/Town: Warwick

Date: 6/14/2022

Vegetation: List the three dominant species in each vegetative strata along with their NWI status:

Tree	Indicator Status	Herbs	Indicator Status
1. Acer rubrum	FAC	1. Symplocarpus foetidus	OBL
2.		2.	
3.		3.	
Saplings/Shrubs		**Woody Vines**	
1. Clethra alnifolia	FAC	1. Smilax rotundifolia	FAC
2. Lindera benzoin	FACW	2.	
3.		3.	

List other vegetative species noted which may have affected determination of the wetland edge: _____.

Soil: SCS Soil Survey Mapping Unit: Sb

On Hydric Soils List? (Y/N) Y

Soil Profile (Note wetland flag no. nearest soil test pit): A12

Horizon	Depth	Matrix Color	Mottling Description	Depth to Saturation	Depth to Free Water
Ap	0-20"	10YR 2/1		Surface	

Other hydrological indicators (e.g. water marks, drainage patterns, root rhizospheres, etc.; see Appendix 4(A)(4) of the Rules): Water stained leaves and surface staining

Landscape position: Depression

Altered/atypical situation? (describe)

Comments:

Wetland Edge Delineation Data Form (UPLAND)

Applicant:

Wetland No.

Project: 50 Child Lane

Flag No. Sequence: A1-A27

City/Town: Warwick

Date: 6/14/2022

Vegetation: List the three dominant species in each vegetative strata along with their NWI status:

Tree	Indicator Status
1. Sassafras albidum	FACU
2. Betula papyrifera	FACU
3.	

Herbs	Indicator Status
1. Osmundastrum cinnamomea	FACW
2.	
3.	

Saplings/Shrubs	
1. Lindera benzoin	FACW
2. Frangula alnus	FAC
3. Euonymus alatus	

Woody Vines	
1. Parthenocissus quinquefolia	FACU
2. Toxicodendron radicans	FAC
3. Smilax rotundifolia	FAC

List other vegetative species noted which may have affected determination of the wetland edge: _____.

Soil: SCS Soil Survey Mapping Unit: Ss

On Hydric Soils List? (Y/N) N

Soil Profile (Note wetland flag no. nearest soil test pit): A12

Horizon	Depth	Matrix Color	Mottling Description	Depth to Saturation	Depth to Free Water
A	0-2"	10YR 2/1			
Bw	2-12"	2.5Y 4/3			

Other indicators exhibiting an absence of wetland hydrology (e.g. absence of water marks, lack of redoximorphic features, lack of oxidized rhizospheres, etc.):

Landscape position: Footslope

Altered/atypical situation? (describe)

Comments: