Harper
Houf Peterson
Righellis Inc.

Raleigh Hills School

DLR-09

Preliminary Stormwater Management Report

August 2023

Prepared For:

Beaverton School District
16550 SW Merlo Road
Beaverton, Oregon 97006

Prepared By:

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ENGINEERS ◆ PLANNERS
LANDSCAPE ARCHITECTS ◆ SURVEYORS

Raleigh Hills School Stormwater Management Report

Prepared by:	Harper Houf Peterson Righellis, Inc.
Date:	August 30, 2023
Job No:	DLR-09
Permit No:	TBD
Site Address:	5225 SW Scholls Ferry Road Portland, OR 97225
Owner/Developer:	Beaverton School District

Designer's Certification and Statement

I hereby certify that this Stormwater Management Report for Raleigh Hills School has been prepared by me or under my supervision and meets minimum standards of the Clean Water Services, City of Beaverton, and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

EXPIRES: 12/31/2024

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Project Overview

The Raleigh Hills School project involves demolition of an existing school building and removal of portable structures, construction of a new school building, and redevelopment of the southern portion of the site on SW Scholls Ferry Road in Beaverton, Oregon (See App. 1 for Vicinity Map). An existing baseball field and surrounding track at the north end of the site will be preserved.

The new school construction includes a school structure, parking lots, plaza/open spaces, hard surface play areas, and landscaping. The stormwater improvements include pipes for conveyance, installation of water quality filtration vaults, installation of stormwater detention chamber systems, and installation of flow-control manholes. Off-site improvements are included in this project; this includes frontage improvements along SW Scholls Ferry Road consisting of roadway widening, curb construction, replacement sidewalk construction, driveway construction, landscape improvements, and the installation of a traffic signal at the intersection with SW Montclair Drive. Additionally, a property line adjustment or permanent easement along the east side of the property will occur to allow for reconstruction of an asphalt driveway serving two neighboring lots.

The purpose of this drainage report is to present stormwater best management practices (BMP) for conveyance, hydromodification/detention, and water quality treatment to be installed as part of this school construction project, designed to comply with City of Beaverton (COB) Stormwater Standards and Clean Water Services (CWS) Design and Construction Standards per CWS R&O 19-5 as amended by R&O 19-22. **Table 1** below summarizes these requirements.

Table 1. CWS R&O 19-5 (As Amended by R&O 19-22) and COB Requirements

Design Requirement	CWS & COB Governing Criteria
Risk Level	Moderate
Development Class	Developed Area
Project Size	Large (>80,000 sf)
Project Category	Category 2
Hydromodification	Peak-Flow Matching Detention with LIDA per CWS design section 4.03.5b(2)
Treatment Area	New Impervious Area + 3 x (Modified Impervious – Permanently Removed Impervious) per CWS (up to 100% of site impervious area)
Treatment Storm	0.36 inches of precipitation falling in 3 hours with an average storm return period of 96 hours per CWS & COB
Hydromodification / Detention	Match post-development 2-year, 24-hour storm to pre-developed discharge rates for one-half the 2-year, 24-hour storm per CWS & COB Match post-development 5-year and 10-year, 24-hour storm to pre-developed discharge rates for the 5-year and 10-year, 24-hour storm per CWS & COB
Conveyance	25-Year; 24-hour SBUH Method for Pipe
Downstream Analysis	Analysis extends downstream to the point where the additional flow constitutes 10 percent or less than the total contributing flow. Then, the analysis continues the lesser of ¼ of a mile or the additional flow constitutes 5 percent or less of the total flow

Table 2 below summaries the design storm events and associated precipitation rates.

Table 2. Precipitation Frequency Estimates

CWS/COB Precipitation Events	
Event	**Precip (in/hr)**
WQ:	0.36" in 3 hrs (100% impervious)
2-yr:	2.5
5-yr:	3.1
10-yr:	3.45
25-yr:	3.90

Existing Conditions / Methodology

The Raleigh Hills School project site is located in a developed area within the City of Beaverton. The existing on-site conditions consist of a main school building and portable structures, asphalt parking lots, curb, sidewalk, driveways, and landscaping. A detention pond stormwater facility exists on site also.

Stormwater runoff for the site generally flows to the north-northwest. Impervious areas are collected in catch basins, areas drains, or roof drains, and piped to the north to an existing public sewer manhole within an easement on site. The public storm main follows a variously piped and open channel route to the northwest, with a connection to Beaverton Creek.

Stormwater runoff for the public right of way generally flows to the existing curbline, then flows west to catch basins that are connected to the public storm system. These public storm sewer lines outfall to Fanno Creek to the south of the site.

The Natural Resource Conservation Service (NRCS) Soil Survey of Washington County, Oregon describes the soils onsite as Silt Loam with a Hydrologic Soil Group C classification (See Appendix 2 for Soil Survey Map and Hydrologic Grouping Table). Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

A curve number of 74 (good conditions open space) was used for pervious areas and 98 for impervious areas (see Appendix 2 for TR55 Curve Numbers).

Table 3. Assumed Curve Numbers

Condition	Curve Number
Impervious Areas	98
Proposed Landscape Areas (Good Condition, Soil C&D)	74
Existing Impervious Areas per CWS 4.08.6.d	75
Existing Pervious Areas	74

Proposed Conditions

On-site improvements include a new school building, parking lots, bus and vehicle loading areas, plaza/open spaces, and play fields (See Appendix 1 for Proposed Basin Map). Stormwater runoff management consists of trapped catch basins, new site stormwater piping for conveyance, installation of water quality vaults and catch basins to meet current stormwater management water quality standards, and installation of stormwater detention chamber systems to meet water quantity standards.

Runoff for the proposed site generally flows to the north. Impervious areas are collected in catch basins, areas drains, or roof drains, and piped to new stormwater management facilities on site. Eventually, the treated and detained stormwater is routed to the north to the existing public sewer manhole within an easement on site. This will continue on to Beaverton Creek as previously noted.

Runoff for the redeveloped public right of way will flow to new catch basins, which will outfall to a new storm system in Scholl Ferry Road, which will then connect to the existing storm-only system. The public storm sewer line will continue to outfall to Fanno Creek to the south of the site.

Table 4 below summarizes the post-development storm basins. Note that Basin G encompasses the right of way runoff.

Table 4. Post-Development Basin Summary Table

Basin	Total Area (ac)	Pervious Area (ac)	Impervious Area (ac)	Water Quality Flow (cfs)	Proposed Treatment Method
A	2.63	2.26	0.37	0.044	None
B	2.87	0.48	2.60	0.315	Stormfilter A / Chambers
B1	0.15	0.02	0.13	0.015	Stormfilter CB
C	2.51	0.85	1.66	0.200	Stormfilter B / Chambers
D	0.97	0.96	<0.01	<0.001	None
E	0.09	0.09	<0.01	<0.001	None
F	0.07	0.07	0	0	Stormfilter B / Chambers
G	0.69	0.09	0.60	0.073	None

Modeling was completed using the Santa Barbara 24-hour Urban Hydrograph method. Hydraflow software was used to analyze the storm events. TR-55 methodology was used to determine time of concentrations and curve numbers for basin analysis.

Water Quality

Water quality treatment is required on projects which create or modify 1,000 square feet or greater of impervious area. The Raleigh Hills School project is required to include water quality treatment based on this standard.

The CWS water quality approach, modified by the City of Beaverton, requires the treatment of a storm event totaling 0.36 inches of precipitation falling in 3 hours. The calculated Water Quality Flow Rate is based on the following equation:

$$Water\ Quality\ Flow\ (cfs) = \frac{0.36\ (in) \times Area\ (sf)}{12\ (in/ft)\ \times 3\ (hr) \times 60\ (min/hr)\ \times 60\ (sec/min)}$$

Per CWS Design and Construction Standards Section 4.05.5, the required stormwater treatment area for the Raleigh Hills School project is as follows: Treatment Area = New Impervious Area + 3x(Modified Impervious Area – Permanently Removed Impervious Area). This results in a treatment area larger than the actual basin area; therefore, the treatment areas will be equal to the basin area. Water quality requirements for the site will be met through the use of water quality vaults, which are described in the following section. Water quality for the right of way will be described under the Public Right of Way section.

The CWS pretreatment requirement will be met using trapped catch basins, trapped area drains, and trench drains used in conjunction with a trapped sump section outlets immediately after runoff is captured by the storm system. Treatment criteria will be met by conveying the runoff generated from proposed site improvements through proposed water quality vaults.

Water Quality Vaults

Water Quality Vault A treats runoff from proposed Basin B (See Appendix 1 for Basin Map). This facility is a new ADS Bayfilter vault constructed on the west side of the site in the parking lot drive aisle near the playground structure. The vault contains cartridges to treat runoff and a high-flow bypass structure, which can convey over 1.5 cfs during storm events.

Water Quality Vault B treats runoff from proposed Basin C and existing offsite Basin F (See Appendix 1 for Basin Map). This facility is a new ADS Bayfilter vault constructed on the east side of the site in the parking lot drive aisle. The vault contains cartridges to treat runoff and a high-flow bypass structure, which can convey over 1.5 cfs during storm events.

Outfall from the proposed vaults is conveyed to their respective proposed stormwater detention chamber systems.

Table 5. Water Quality Summary

Stormfilter ID	Contributing Basin	Stormfilter Size	Number of Stormfilter Cartridges	Cartridge Treatment Rate (cfs)	Total Treatment Flow Capacity (cfs)	CWS WQ Flow (cfs)
A	B	6'x8' vault	4	0.10	0.40	0.315
B	C, F	6'x8' vault	2	0.10	0.20	0.200
CB	B1	2.5'x4.7' Catch Basin	1	0.10	0.10	0.015

(See Appendix 3 for Water Quality Details)

Water Quantity & Hydromodification

New developments, including reconstruction projects, are required to incorporate techniques to mitigate their impact on the public stormwater system and downstream reaches. Water quantity facility design requires that the post-developed runoff rates do not exceed the pre-development runoff rates for 50% of the 2-year and 100% of the 5 and 10-year runoff events. Hydromodification of the downstream reaches for the outfall from the site is also required to be studied.

A CWS hydromodification assessment has been conducted per CWS DCS section 4.03.3. Given the two separate outfalls basin, two studies were performed:

- *Site*: Following the point of discharge to the receiving reach determines the site is located within the "Beaverton Creek" reach. This basin is considered "low risk". The development class lists the site within an "Developed" area. The total site and right of way redeveloped impervious area is more than 80,000 sf, which per CWS DCS 4.03.3.c.2 is a "large" project. Finally, using the above information, CWS DCS 4.03.5 and CWS Table 4-2, the project is listed as hydromodification Category 2.
- *Right of Way*: Following the point of discharge to the receiving reach determines the site is located within the "Fanno Creek" reach. This basin is considered "moderate risk". The development class lists the right of way within an "Developed" area. The total site and right of way redeveloped impervious area is more than 80,000 sf, which per CWS DCS 4.03.3.c.2 is a "large" project. Finally, using the above information, CWS DCS 4.03.5 and CWS Table 4-2, the project is listed as hydromodification Category 2.

Projects in Category 2 represent those with a moderate anticipated hydromodification risk. Per CWS DCS section 4.03.5.b, any of the following approaches may be used to address hydromodification:

- Infiltration Facilities using the Standard Sizing described in Section 4.08.5
- Peak-Flow Matching Detention, using design criteria described in Section 4.08.6

Considering the site's space constraints, the Santa-Barbara Hydrograph Peak-Flow Matching Detention approach was used to size the proposed stormwater facilities on site. For this project, it is proposed that chambered systems will provide stormwater detention and downstream flow-control manholes will provide the desired water release rate to the public storm system. The pre-developed flow used for comparison is the existing site runoff conveyed towards the

public storm in Laurelwood Court. This is shown as existing Basins 1, 2, 5, and 6. The result is a net reduction in peak flows reaching the public systems for the 2, 5, and 10-year storm events.

For the public right of way redevelopment area, this project proposes an exception to the Category 2 hydromodification requirements and requests to pay a hydromodification fee-in-lieu. Under a preliminary Washington County review of the school development project, it was noted that street side planters are not preferred to be used within the Washington County right-of-way along roadways; further, site area adjacent to the right-of-way is not conducive for use of constructing public stormwater facilities given the existing and proposed topography. Given the aforementioned reasons and the fact that the impervious area with runoff outfalling to the Fanno Creek reach (see Appendix A Existing and Proposed Basin Map) will decrease with this development, payment of a hydromodification fee-in-lieu for the right-of-way portion of the redevelopment is proposed under CWS DCS 4.03.7.a sections 3 & 5.

Documentation to be provided showing basin areas and impervious area calculations for use in calculating the proposed fee-in-lieu.

Stormtech Chambers & Flow-Control Manholes

Detention and flow-control for proposed Basins B&C and offsite Basin F (See Appendix 1 for Basin Map) will be provided via ADS Stormtech Chambers and flow-control manholes (See Appendix 5 for details). The Stormtech Chambers will cover an approximate area of 44’ x 108’ on the west side of the site and an approximate area of 30’ x 90’ on the east side of the site.

The chambers in the west parking lot will have a maximum capacity of 15,165 cf of storage. Downstream of the chambers will be the flow-control manhole with a 1.5 inch orifice and overflow weir, which will provide a stormwater release rate as shown in **Table 6** below.

Table 6. **Water Quantity Summary – West Parking Lot**

Storm Event	Pre-Development Flow (cfs)	Allowable Release Rate (cfs)	Post-Development Flow (cfs)	Provided Detention Volume (cf)
2-yr, 24-hr	0.256	0.128	0.123	14,446
5-yr, 24-hr	0.521	0.521	0.331	14,678
10-yr, 24-hr	0.695	0.695	0.462	14,728

The chambers in the east parking lot will have a maximum capacity of 10,732 cf of storage. Downstream of the chambers will be the flow-control manhole with a 1.5 inch orifice and overflow weir, which will provide a stormwater release rate as shown in **Table 7** below.

Table 7. Water Quantity Summary – East Parking Lot

Storm Event	Pre-Development Flow (cfs)	Allowable Release Rate (cfs)	Post-Development Flow (cfs)	Provided Detention Volume (cf)
2-yr, 24-hr	0.277	0.138	0.118	7,645
5-yr, 24-hr	0.537	0.537	0.223	9,743
10-yr, 24-hr	0.705	0.705	0.301	9,760

Conveyance

Stormwater pipes and stormwater facilities are designed to convey the full build out 25-year 24-hour Santa Barbara Method storm event flows. Storm pipes were analyzed at critical locations depending on size, slope, and upstream basin size (See Appendix 6 for Pipe Conveyance Spreadsheet, Hydrographs, and Pipe Conveyance Map).

Downstream Analysis

The conveyance system downstream of the stormwater detention chamber systems' discharge locations (existing storm line in easement at northwest area of site) was analyzed for downstream conveyance deficiencies for runoff from the site. For flow analysis purposes to public storm, the 25-year flow from the detention chambers was used. The result is that the post-development flow rate leaving the site is less than the pre-development flow rate leaving the site. Per CWS Section 2.02.4(m)(3)(D), because the site does not produce 'additional flow' in the public sewer system, the downstream conveyance system will be visually inspected for a distance of ¼ mile. See Appendix 6 for the CWS Sewer Map.

For the public right of way, the conveyance system downstream of the school's frontage discharge location (existing storm catch basin near southwest corner of site) was analyzed for downstream conveyance deficiencies. For flow analysis purposes to public storm, the 25-year flow from roadway was used. The result is that the post-development flow rate leaving the affected basin is less than the pre-development flow rate leaving the basin, because a portion of the existing site that flowed to the ROW has been redirected towards the site stormwater improvements. Per CWS Section 2.02.4(m)(3)(D), because the basin does not produce 'additional flow' in the public sewer system, the downstream conveyance system will be visually inspected for a distance of ¼ mile. See Appendix 6 for the CWS Sewer Map.

Future full build out undetained flow was calculated using the Santa Barbara 24-hour Urban Hydrograph method. Hydraflow software was used to analyze the storm events. Documentation is located in Appendix 6.

Operations and Maintenance

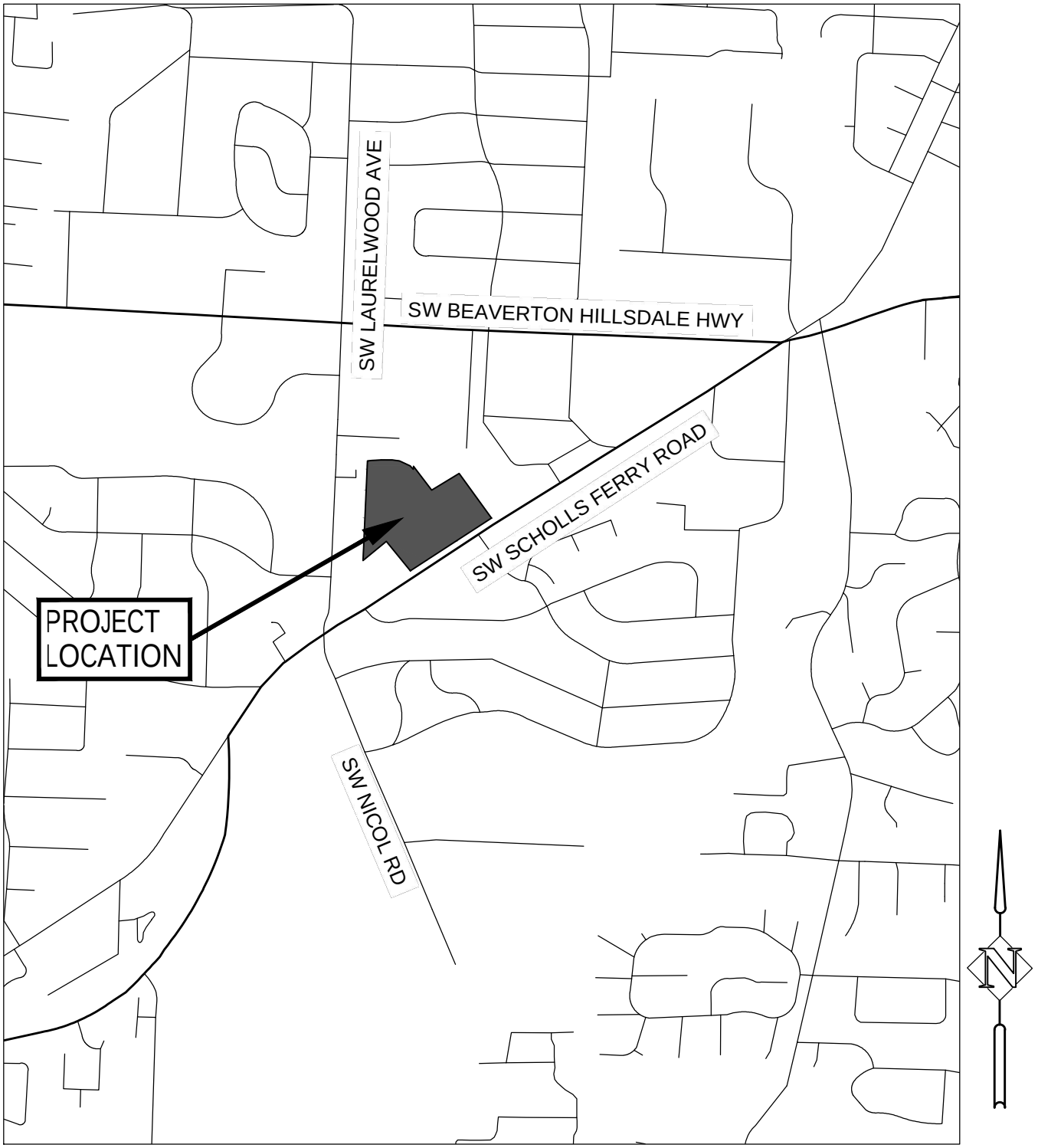
Proposed Bayfilter water quality vaults, a Bayfilter water quality catch basin, and StormTech chambered detention systems are proposed to treat and detain the runoff from a majority of the impervious surfaces on the site. The developer, Beaverton School District, will enter a private stormwater maintenance agreement with CWS, which identifies Beaverton School District as the party responsible for O&M of the private facilities. Mike Ali and can be reached at 503-591-4391 and Michael_Ali@beaverton.k12.or.us.

All facilities shall be maintained per the O&M plan included in Appendix 7. Also, refer to CWS Standards for guidance.

Conclusion

The proposed stormwater management plan will achieve pollutant removal to the maximum extent practicable via water quality vaults designed to target pollutants expected with a commercial development. Stormwater quantity requirements will be met with the installation of stormwater detention chamber systems. These proposed private facilities satisfy the City of Beaverton and CWS water quality and water quantity requirements. As designed, this project shall not create any adverse impacts to the downstream storm system.

Appendix 1 – Maps



VICINITY MAP

N.T.S.

SHEET NO. 1			DESIGNED: KJO
			DRAWN: KJO
			CHECKED: RDP
JOB NO. DLR-09	DATE	NO.	DESCRIPTION
	R E V I S I O N S		DATE: AUGUST 2023

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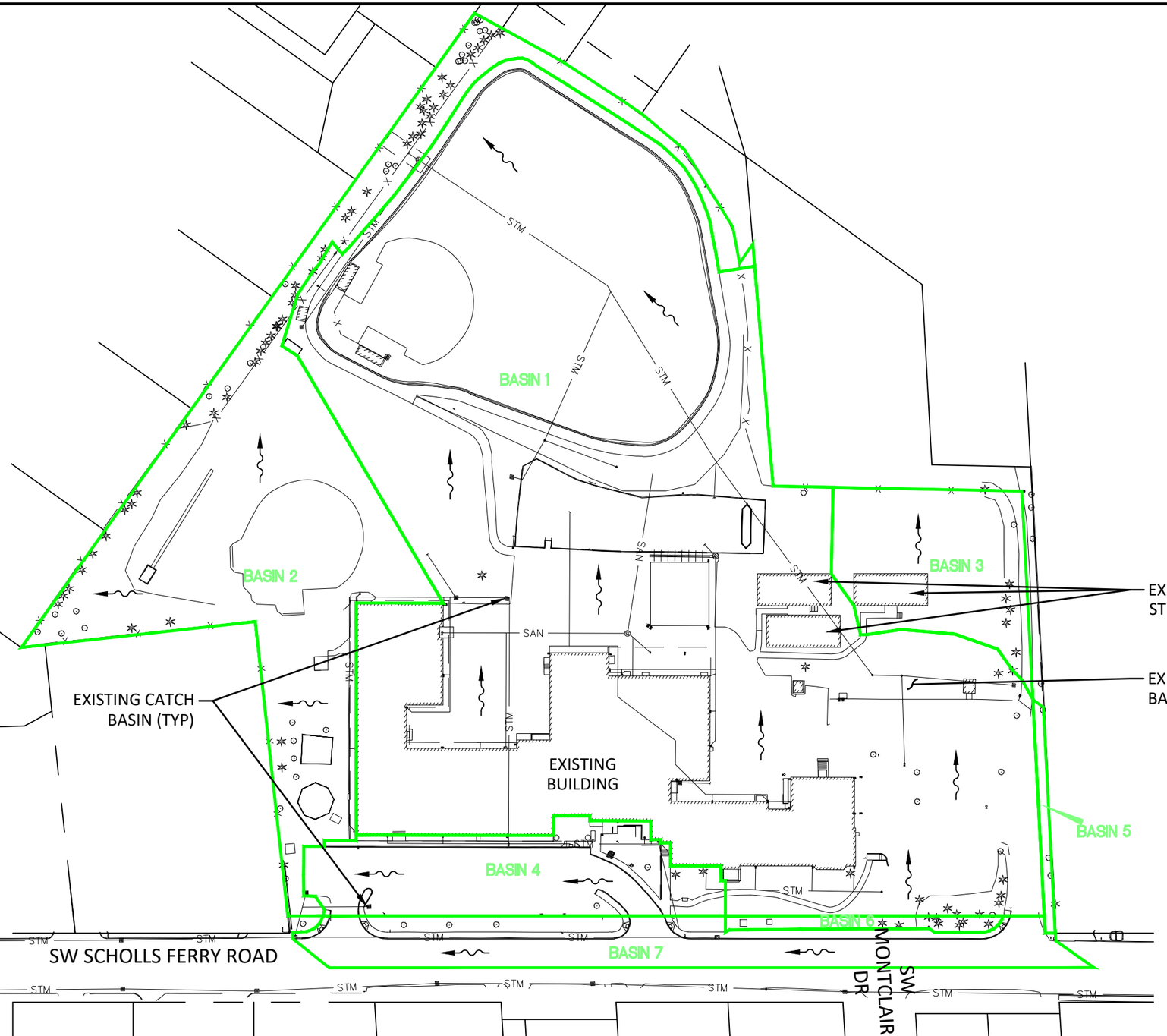
VICINITY MAP

RALEIGH HILLS SCHOOL

BEAVERTON, OREGON



BASIN	PERVIOUS AREA	IMPERVIOUS AREA	ROUTED TO
1	149,690 sf	132,917 sf	Ex. Public Storm
2	78,527 sf	2,224 sf	Overland to Neighbors
3	19,354 sf	2,091 sf	Overland to Neighbors
4	4,685 sf	20,260 sf	ROW Storm
5	1,751 sf	0 sf	Ex. Public Storm
6	2,868 sf	0 sf	Ex. Public Storm
7	3,822 sf	22,782 sf	ROW Storm

0 50 100 200

SCALE: 1" = 100'

DATE	NO.	DESCRIPTION

REVISIONS

DESIGNED: KJO
DRAWN: KJO
CHECKED: RDP
DATE: AUGUST 2023

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EXISTING BASIN MAP

RALEIGH HILLS SCHOOL

BEAVERTON, OREGON

SHEET NO. 2

JOB NO. DLR-09

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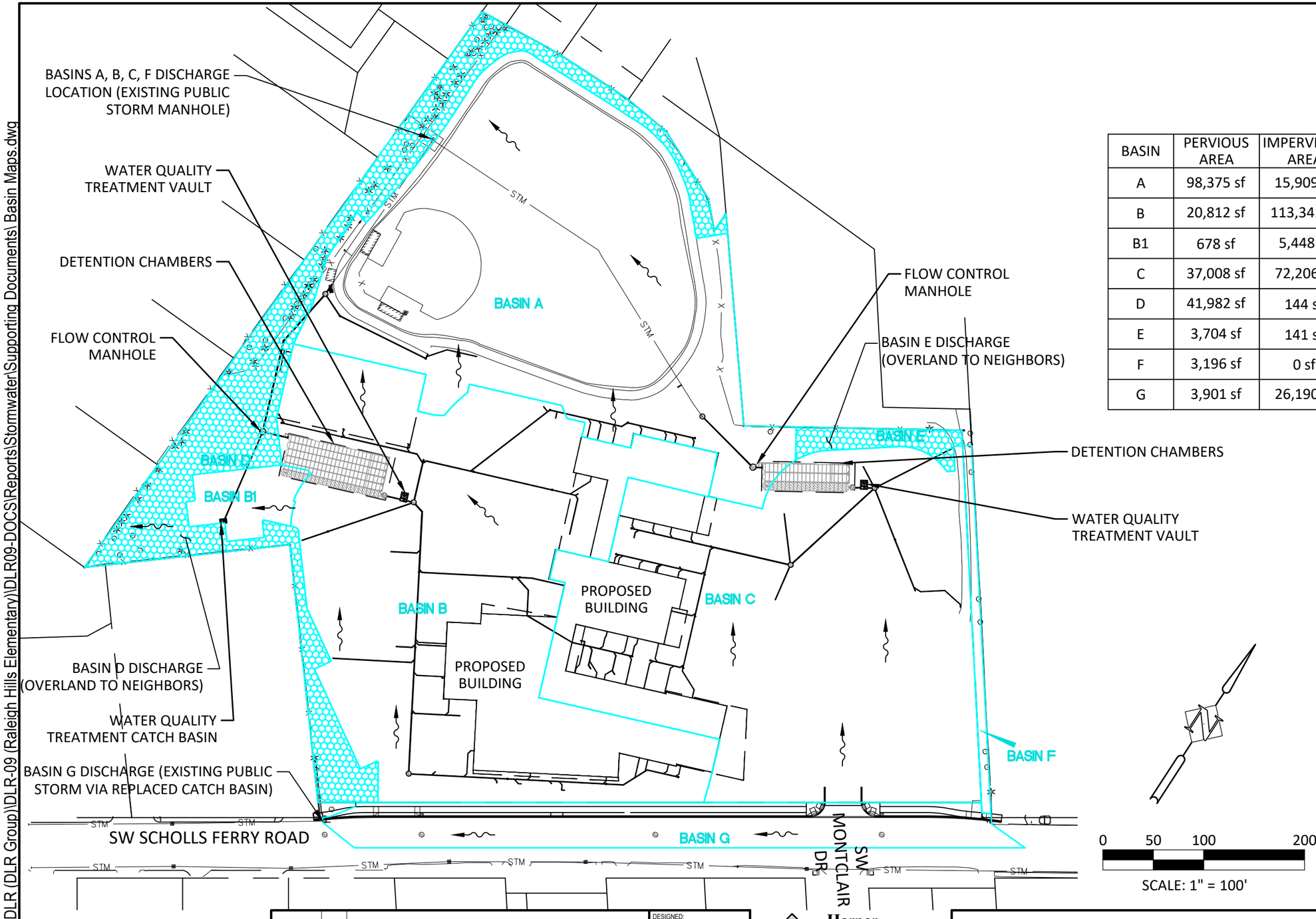

BASIN	PERVIOUS AREA	IMPERVIOUS AREA	ROUTED TO
A	98,375 sf	15,909 sf	Ex. Public Storm
B	20,812 sf	113,341 sf	Stormfilter A
B1	678 sf	5,448 sf	Stormfilter CB
C	37,008 sf	72,206 sf	Stormfilter B
D	41,982 sf	144 sf	Overland to Neighbors
E	3,704 sf	141 sf	Overland to Neighbors
F	3,196 sf	0 sf	Stormfilter B
G	3,901 sf	26,190 sf	ROW Storm

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DATE	NO.	DESCRIPTION

REVISIONS

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PROPOSED BASIN MAP

RALEIGH HILLS SCHOOL

BEAVERTON, OREGON

SHEET NO. 3

JOB NO. DLR-09

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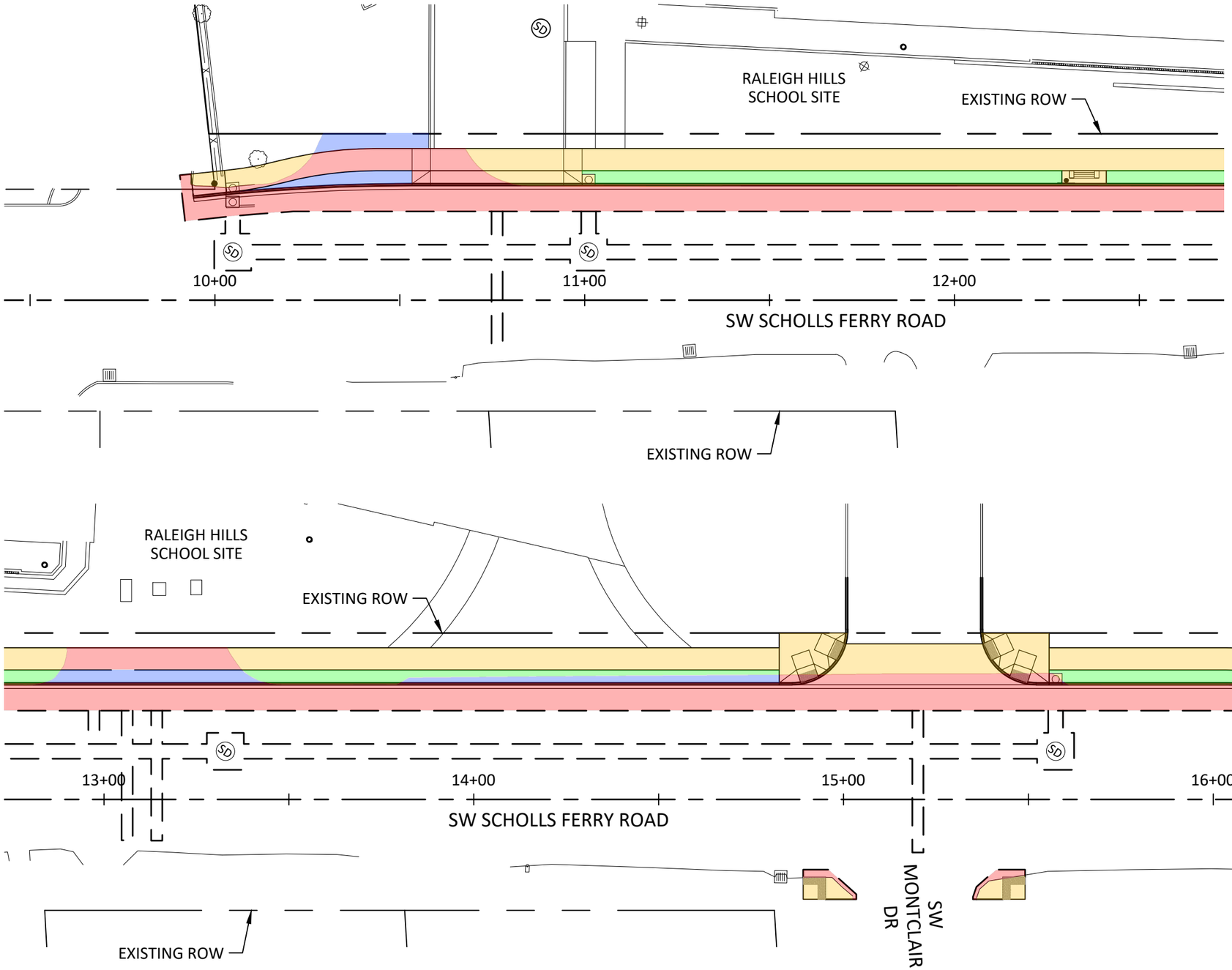

LEGEND

NEW IMPERVIOUS AREA

Pervious to Impervious	3,944 SF

MODIFIED IMPERVIOUS AREA

Impervious to Impervious	6,138 SF
Impervious to Pervious	657 SF
TOTAL Impervious Area	10,739 SF

LANDSCAPE AREA

Pervious to Pervious	1,103 SF

0 15 30 60

SCALE: 1" = 30'

DATE	NO.	DESCRIPTION

REVISIONS

DESIGNED: KJO
DRAWN: KJO
CHECKED: RDP
DATE: AUGUST 2023

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RIGHT-OF-WAY IMPERVIOUS AREAS

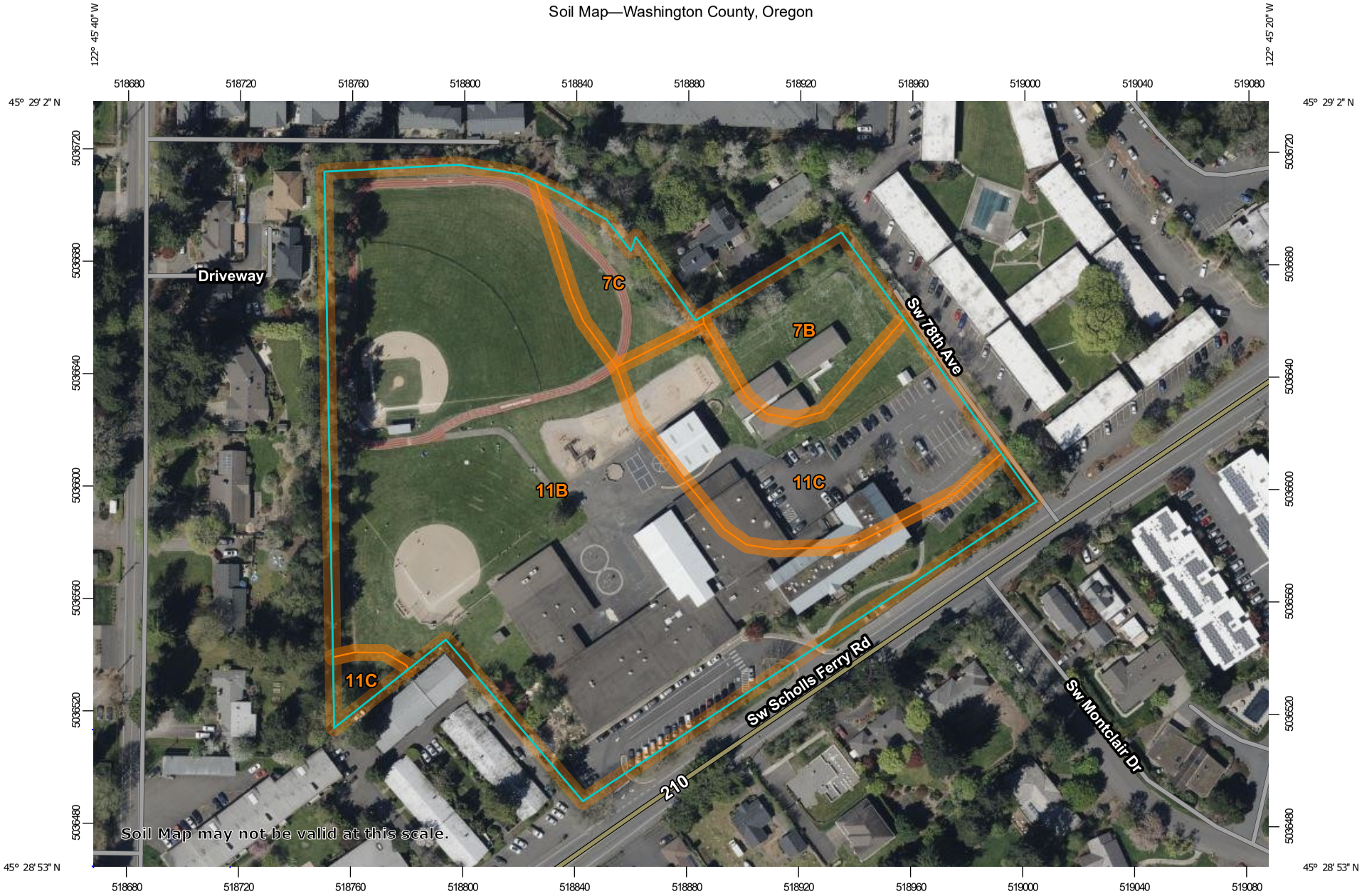
RALEIGH HILLS SCHOOL

BEAVERTON, OREGON

SHEET NO. 4

JOB NO. DLR-09

Appendix 2 – Basin Characteristics



Map Scale: 1:1,920 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Washington County, Oregon
Survey Area Data: Version 22, Sep 14, 2022

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

Date(s) aerial images were photographed: Apr 16, 2021—Apr 18, 2021

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
7B	Cascade silt loam, 3 to 7 percent slopes	0.7	7.5%
7C	Cascade silt loam, 7 to 12 percent slopes	0.4	4.6%
11B	Cornelius and Kinton silt loams, 2 to 7 percent slopes	6.3	69.4%
11C	Cornelius and Kinton silt loams, 7 to 12 percent slopes	1.7	18.5%
Totals for Area of Interest		**9.1**	**100.0%**

Table 9–5 Runoff curve numbers for urban areas [1/]

Cover description cover type and hydrologic condition	Average percent impervious area [2/]	- - CN for hydrologic soil group - - 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)		77	86	91	94

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

2/ The average percent impervious area shown was used to develop the composite CNs. 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.

3/ CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space type.

4/ Composite CNs for natural desert landscaping should be computed using figures 9–3 or 9–4 based on the impervious area percentage (CN=98) and the pervious area CN. The pervious area CNs are assumed equivalent to desert shrub in poor hydrologic condition.

Appendix 3 – Water Quality

WQ Facility A

Project No.
DLR-09

Raleigh Hills School - WQ Facility A
Proposed Conditions

Water Quality Area

Total Impervious = 2.600 ac

Water Quality Flow

WQ Volume (cf) = $\frac{0.36 \text{ in} \times \text{Impervious Area (sf)}}{12 \text{ (in/ft)}}$

WQ Flow (cfs) = $\frac{\text{WQ Volume (cf)}}{(3 \text{ hr})(60 \text{ min/hr})(60 \text{ sec/min})}$

= $\frac{\text{Impervious Area (sf)}}{360{,}000 \text{ sec/ft}}$

= $\frac{\text{ac} \times 43{,}560 \text{ sf/ac}}{360{,}000 \text{ sec/ft}}$

= 0.315 cfs

WQ Facility B

Project No.
DLR-09

Raleigh Hills School - WQ Facility B
Proposed Conditions

Water Quality Area

Total Impervious = 1.657 ac

Water Quality Flow

WQ Volume (cf) = $\frac{0.36 \text{ in} \times \text{Impervious Area (sf)}}{12 \text{ (in/ft)}}$

WQ Flow (cfs) = $\frac{\text{WQ Volume (cf)}}{(3 \text{ hr})(60 \text{ min/hr})(60 \text{ sec/min})}$

= $\frac{\text{Impervious Area (sf)}}{360{,}000 \text{ sec/ft}}$

= $\frac{\text{ac} \times 43{,}560 \text{ sf/ac}}{360{,}000 \text{ sec/ft}}$

= 0.200 cfs

WQ Facility CB

Project No.
DLR-09

Raleigh Hills School - WQ Facility CB
Proposed Conditions

Water Quality Area

Total Impervious = 0.125 ac

Water Quality Flow

WQ Volume (cf) = $\frac{0.36 \text{ in} \times \text{Impervious Area (sf)}}{12 \text{ (in/ft)}}$

WQ Flow (cfs) = $\frac{\text{WQ Volume (cf)}}{(3 \text{ hr})(60 \text{ min/hr})(60 \text{ sec/min})}$

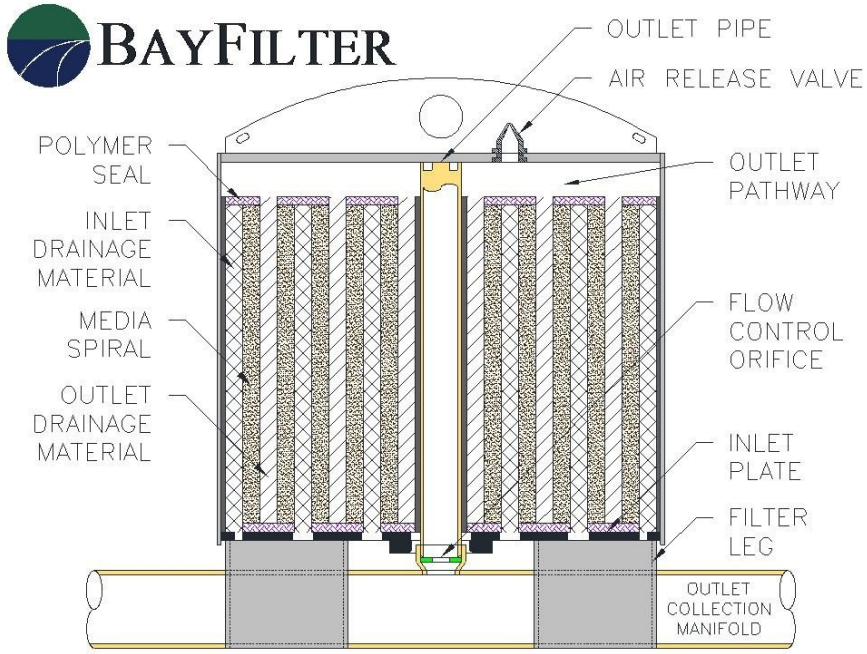
= $\frac{\text{Impervious Area (sf)}}{360{,}000 \text{ sec/ft}}$

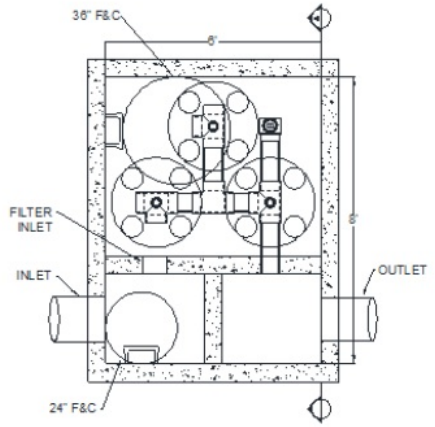
= $\frac{\text{ac} \times 43{,}560 \text{ sf/ac}}{360{,}000 \text{ sec/ft}}$

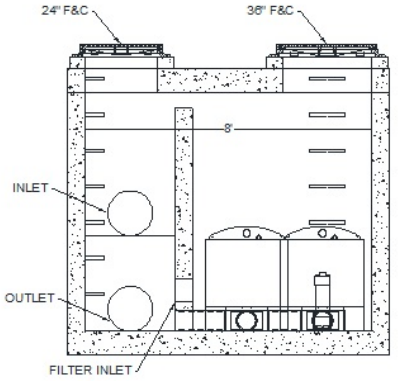
= 0.015 cfs

6'x8' Internal Bypass Vault

Creation Date:	11/17/2022 6:23:07 AM
Treatment Flow Rate:	0.315 cfs
Cartridge Type:	BayFilter™ 545
# of Cartridges:	4
Model Number:	BF-6-8-3
Rim Elevation:	297.14 ft.
Inlet Elevation:	292.46 ft.
Outlet Elevation:	289.63 ft.
Drop:	34 in.
Top of Weir Elevation:	292.46 ft.





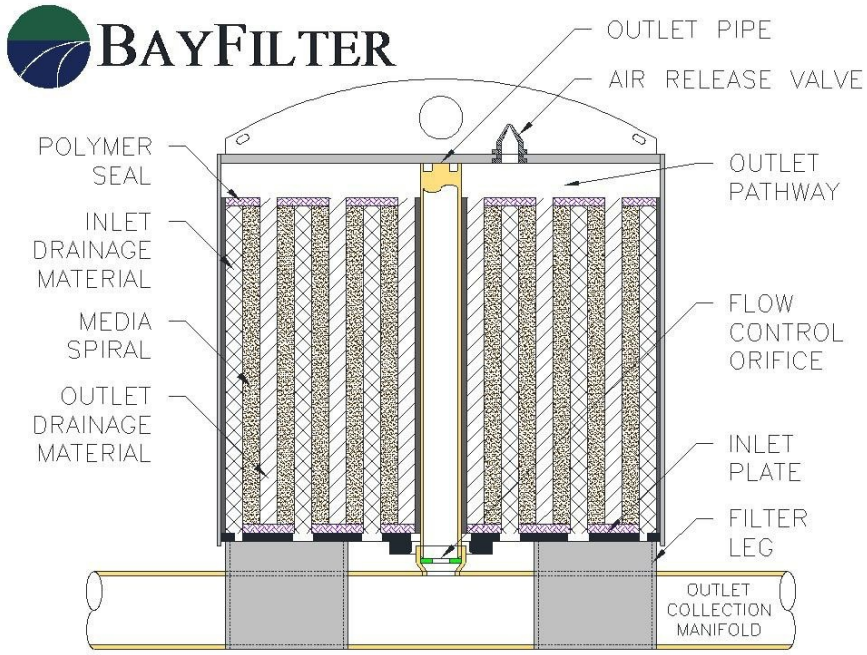


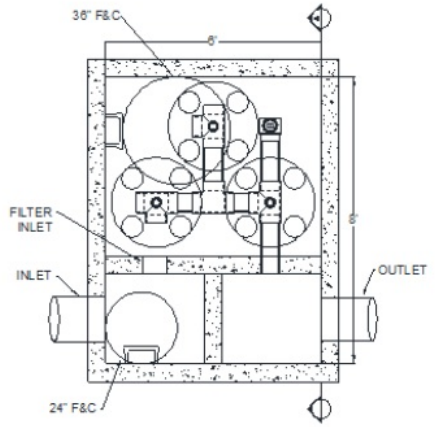
BAYSAVER TECHNOLOGIES®

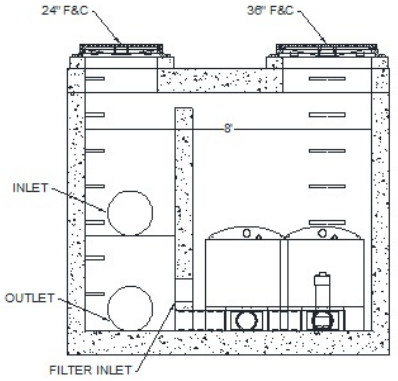
ADS

6'x8' Internal Bypass Vault

Creation Date:	11/17/2022 6:28:01 AM
Treatment Flow Rate:	0.200 cfs
Cartridge Type:	BayFilter™ 545
# of Cartridges:	2
Model Number:	BF-6-8-3
Rim Elevation:	298.21 ft.
Inlet Elevation:	292.79 ft.
Outlet Elevation:	289.86 ft.
Drop:	35 in.







BAYSAVER TECHNOLOGIES®

ADS

Advanced Drainage Systems, Inc.

Raleigh Hills School

Beaverton- OR

BAYSAVER BAYFILTER SPECIFICATIONS

PRODUCTS

A. INTERNAL COMPONENTS: ALL COMPONENTS INCLUDING CONCRETE STRUCTURE(S), PVC MANIFOLD PIPING AND FILTER CARTRIDGES, SHALL BE PROVIDED BY BAYSAVER TECHNOLOGIES LLC, 1030 DEER HOLLOW DRIVE, MOUNT AIRY, MD (800.229.7283).

B. PVC MANIFOLD PIPING: ALL INTERNAL PVC PIPE AND FITTINGS SHALL MEET ASTM D1785. MANIFOLD PIPING SHALL BE PROVIDED TO THE CONTRACTOR PARTIALLY PRE-CUT AND PRE-ASSEMBLED.

C. FILTER CARTRIDGES: EXTERNAL SHELL OF THE FILTER CARTRIDGES SHALL BE SUBSTANTIALLY CONSTRUCTED OF POLYETHYLENE OR EQUIVALENT MATERIAL ACCEPTABLE TO THE MANUFACTURER. FILTRATION MEDIA SHALL BE ARRANGED IN A SPIRAL LAYERED FASHION TO MAXIMIZE AVAILABLE FILTRATION AREA. AN ORIFICE PLATE SHALL BE SUPPLIED WITH EACH CARTRIDGE TO RESTRICT THE FLOW RATE TO A MAXIMUM OF 45 GPM.

D. FILTER MEDIA: FILTER MEDIA SHALL BE BY BAYSAVER TECHNOLOGIES LLC AND SHALL CONSIST OF THE FOLLOWING MIX: A BLEND OF ZEOLITE, PERLITE AND ACTIVATED ALUMINA.

E. PRECAST CONCRETE VAULT: CONCRETE STRUCTURES SHALL BE PROVIDED ACCORDING TO ASTM C. THE MATERIALS AND STRUCTURAL DESIGN OF THE DEVICES SHALL BE PER ASTM C478, C857 AND C858. PRECAST CONCRETE SHALL BE PROVIDED BY BAYSAVER TECHNOLOGIES, LLC.

PERFORMANCE

A. THE STORMWATER FILTER SYSTEM SHALL BE AN OFFLINE DESIGN CAPABLE OF TREATING 100% OF THE REQUIRED TREATMENT FLOW AT FULL SEDIMENT LOAD CONDITIONS.
B. THE STORMWATER FILTER SYSTEM'S CARTRIDGES SHALL HAVE NO MOVING PARTS.
C. THE STORMWATER TREATMENT UNIT SHALL BE DESIGNED TO REMOVE AT LEAST 85% OF SUSPENDED SOLIDS, 65% OF TOTAL PHOSPHORUS, 65% OF TURBIDITY, 40% OF TOTAL COPPER, AND 40% OF TOTAL ZINC BASED ON FIELD DATA COLLECTED IN COMPLIANCE WITH THE TECHNOLOGY ACCEPTANCE RECIPROCITY PARTNERSHIP TIER II TEST PROTOCOL.
D. THE STORMWATER FILTRATION SYSTEM SHALL REDUCE INCOMING TURBIDITY (MEASURED AS NTUs) BY 50% OR MORE AND SHALL NOT HAVE ANY COMPONENTS THAT LEACH NITRATES OR PHOSPHATES.
E. THE STORMWATER FILTRATION CARTRIDGE SHALL BE EQUIPPED WITH A HYDRODYNAMIC BACKWASH MECHANISM TO EXTEND THE FILTER'S LIFE AND OPTIMIZE ITS PERFORMANCE.
F. THE STORMWATER FILTRATION SYSTEM SHALL BE DESIGNED TO REMOVE A MINIMUM OF 65% OF THE INCOMING TOTAL PHOSPHORUS (TP) LOAD.
G. THE STORMWATER FILTRATION SYSTEM'S CARTRIDGES SHALL HAVE A TREATED SEDIMENT CAPACITY FOR 80% TSS REMOVAL BETWEEN 150-350 LBS.

BAYFILTER MAINTENANCE

THE BAYFILTER SYSTEM REQUIRES PERIODIC MAINTENANCE TO CONTINUE OPERATING AT ITS PEAK EFFICIENCY DESIGN. THE MAINTENANCE PROCESS COMPRISES THE REMOVAL AND REPLACEMENT OF EACH BAYFILTER CARTRIDGE AND THE CLEANING OF THE VAULT OR MANHOLE WITH A VACUUM TRUCK. FOR BEST RESULTS, BAYFILTER MAINTENANCE SHOULD BE PERFORMED BY A CERTIFIED MAINTENANCE CONTRACTOR. A QUICK CALL TO AN ADS ENGINEER OR CUSTOMER SERVICE REPRESENTATIVE WILL PROVIDE YOU WITH A LIST OF RELIABLE CONTRACTORS IN YOUR AREA.

WHEN BAYFILTER IS INITIALLY INSTALLED, WE RECOMMEND THAT AN INSPECTION BE PERFORMED ON THE SYSTEM IN THE FIRST SIX (6) MONTHS. AFTER THAT, THE INSPECTION CYCLE TYPICALLY FALLS INTO A BIANNUAL PATTERN GIVEN NORMAL STORM OCCURRENCE AND ACTUAL SOLIDS LOADS.

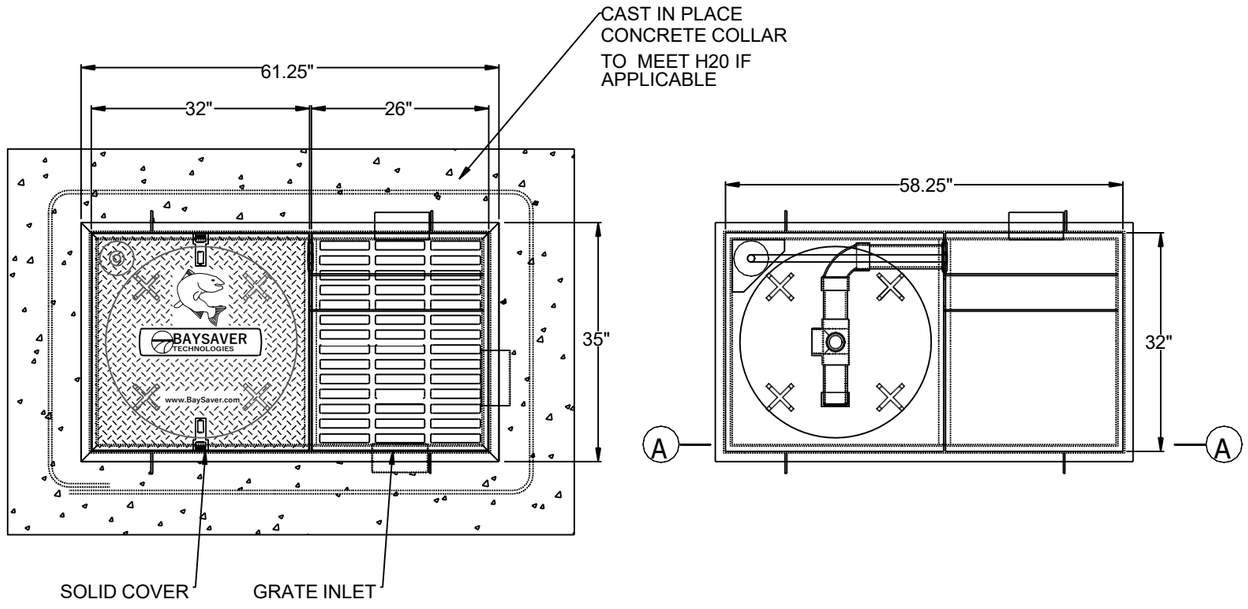
WHEN BAYFILTER EXHIBITS FLOWS BELOW DESIGN LEVELS, THE SYSTEM SHOULD BE INSPECTED AND MAINTAINED AS SOON AS PRACTICAL. REPLACING A BAYFILTER CARTRIDGE SHOULD BE CONSIDERED AT OR ABOVE THE LEVEL OF THE MANIFOLD.

MAINTENANCE PROCEDURES

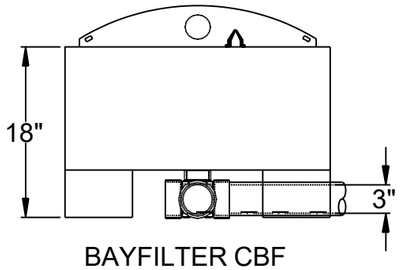
1. REMOVE THE MANHOLE COVERS AND OPEN ALL ACCESS HATCHES.
2. BEFORE ENTERING THE SYSTEM MAKE SURE THE AIR IS SAFE PER OSHA STANDARDS OR USE A BREATHING APPARATUS. USE LOW O2, HIGH CO, OR OTHER APPLICABLE WARNING DEVICES PER REGULATORY REQUIREMENTS.
3. USING A VACUUM TRUCK, REMOVE ANY LIQUID AND SEDIMENTS THAT CAN BE REMOVED PRIOR TO ENTRY.
4. USING A SMALL LIFT OR THE BOOM OF THE VACUUM TRUCK, REMOVE THE USED CARTRIDGES BY LIFTING THEM OUT.
5. ANY CARTRIDGES THAT CANNOT BE READILY LIFTED CAN BE EASILY SLID ALONG THE FLOOR TO A LOCATION THEY CAN BE LIFTED VIA A BOOM LIFT.
6. WHEN ALL THE CARTRIDGES HAVE BEEN REMOVED, IT IS NOW PRACTICAL TO REMOVE THE BALANCE OF THE SOLIDS AND WATER. LOOSEN THE STAINLESS CLAMPS ON THE FERNCO COUPLINGS FOR THE MANIFOLD AND REMOVE THE DRAINPIPES AS WELL. CAREFULLY CAP THE MANIFOLD AND THE FERNCO'S AND RINSE THE FLOOR, WASHING AWAY THE BALANCE OF ANY REMAINING COLLECTED SOLIDS.
7. CLEAN THE MANIFOLD PIPES, INSPECT, AND REINSTALL.
8. INSTALL THE EXCHANGE CARTRIDGES AND CLOSE ALL COVERS.
9. THE USED CARTRIDGES MUST BE SENT BACK TO ADS FOR EXCHANGE/RECYCLING AND CREDIT ON UNDAMAGED UNITS.

BAYFILTER INSTALLATION NOTES

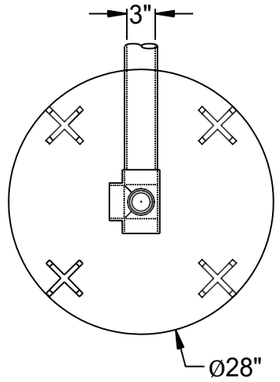
1. CONTACT UTILITY LOCATOR TO MARK ANY NEARBY UNDERGROUND UTILITIES AND MAKE SURE IT IS SAFE TO EXCAVATE.
2. REFERENCE THE SITE PLAN AND STAKE OUT THE LOCATION OF THE BAYFILTER VAULT.
3. EXCAVATE THE HOLE, PROVIDING ANY SHEETING AND SHORING NECESSARY TO COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY REGULATIONS.
4. LEVEL THE SUB—GRADE TO THE PROPER ELEVATION. VERIFY THE ELEVATION AGAINST THE MANHOLE DIMENSIONS, THE INVERT ELEVATIONS, AND THE SITE PLANS. ADJUST THE BASE AGGREGATE, IF NECESSARY.
5. HAVE THE SOIL BEARING CAPACITY VERIFIED BY A LICENSED/ENGINEER FOR THE REQUIRED LOAD BEARING CAPACITY. ON SOLID SUB—GRADE, SET THE FIRST SECTION OF THE BAYFILTER PRE--CAST VAULT.
6. CHECK THE LEVEL AND ELEVATION OF THE FIRST SECTION TO ENSURE IT IS CORRECT BEFORE ADDING ANY RISER SECTIONS.
7. IF ADDITIONAL SECTION(S) ARE REQUIRED, ADD A WATERTIGHT SEAL TO THE FIRST SECTION OF THE BAYFILTER VAULT. SET ADDITIONAL SECTION(S) OF THE VAULT, ADDING A WATERTIGHT SEAL TO EACH JOINT.
8. INSTALL THE PVC OUTLET MANIFOLD.
9. INSTALL THE PVC OUTLET PIPE IN BAYFILTER VAULT.
10. INSTALL THE INLET PIPE TO THE BAYFILTER VAULT.
11. AFTER THE SITE IS STABILIZED, REMOVE ANY ACCUMULATED SEDIMENT OR DEBRIS FROM THE VAULT AND INSTALL THE FLOW DISKS, DRAINDOWN MODULES (IF APPLICABLE), AND THE BAYFILTER CARTRIDGES.
12. PLACE FULL SET OF HOLD DOWN BARS AND BRACKETS INTO PLACE.

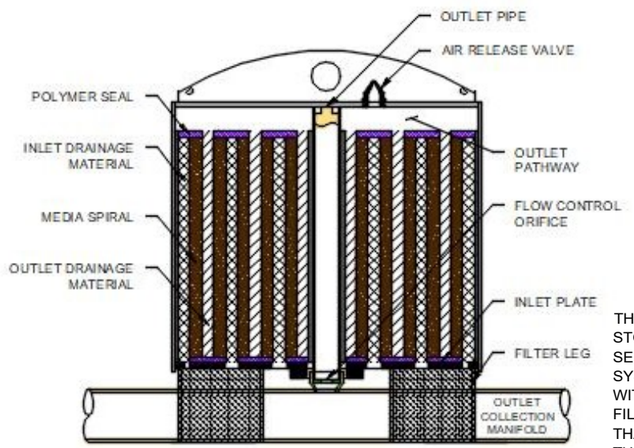


PLAN VIEW



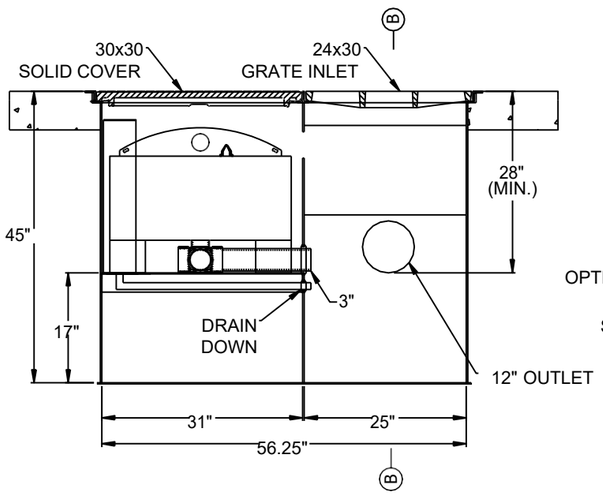
BAYFILTER CBF



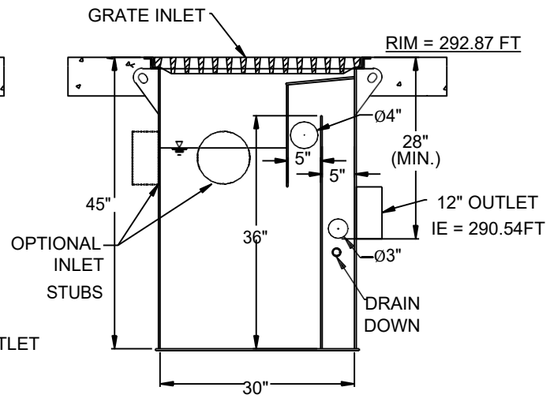


STREAMFILTER™	WQU-1
WATER QUALITY FLOW RATE	0.05 cfs
DRAINAGE AREA	
CARTRIDGE DESIGN FLOW RATE	22.5GPM
# BAYFILTER CARTRIDGES	1
TREATED SEDIMENT CAPACITY	175 LBS

THE BAYFILTER STORMWATER MANAGEMENT SYSTEM IS A STORMWATER FILTRATION DEVICE DESIGNED TO REMOVE FINE SEDIMENTS, HEAVY METALS, AND PHOSPORUS. THE BAYFILTER SYSTEM RELIES ON A SPIRAL WOUND MEDIA FILTER CARTRIDGE WITH APPROXIMATELY 45 SQUARE FEET OF FILTRATION AREA. THE FILTER CARTRIDGES ARE HOUSED IN A CONCRETE STRUCTURE THAT EVENLY DISTRIBUTES THE FLOW BETWEEN CARTRIDGES. THE SYSTEM IS OFFLINE WITH AN EXTERNAL BYPASS THAT ROUTES HIGH INTENSITY STORMS AROUND THE SYSTEM. THE FILTER CARTRIDGES REMOVE POLLUTANTS FROM RUNOFF BY FILTRATION (INTERCEPTION/ATTACHMENT) AND ADSORPTION.



SECTION A-A



SECTION B-B

Raleigh Hills School
Beaverton - OR

DATE: 3/21/23 | DRAWN:
PROJECT #: | CHECKED:

DATE	DRWN	CHKD	DESCRIPTION

Bayfilter®
Stormwater Media Filters

1-800-229-7283|WWW.BAYSAVER.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

AS NOTED

SHEET
2 OF 2

Appendix 4 –Water Quantity

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	Raleigh Hills School - West
Engineer:	Kelly Ota
Project Location:	Oregon
Measurement Type:	Imperial
Required Storage Volume:	16605 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(44 ft. x 100 ft.)

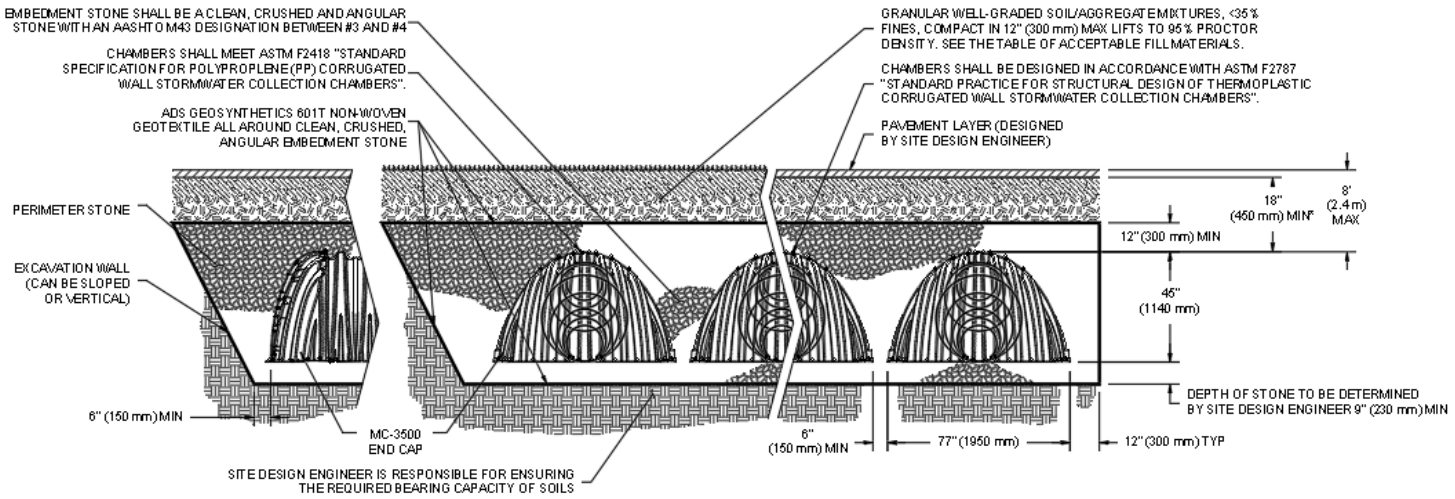
Results

System Volume and Bed Size

Installed Storage Volume:	15164.76 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	78
Number Of End Caps Required:	12
Chamber Rows:	6
Maximum Length:	107.18 ft.
Maximum Width:	43.60 ft.
Approx. Bed Size Required:	4506.44 square ft.

System Components

Amount Of Stone Required:	594 cubic yards
Volume Of Excavation (Not Including Fill):	918 cubic yards
Total Non-woven Geotextile Required:	1423 square yards
Woven Geotextile Required (excluding Isolator Row):	67 square yards
Woven Geotextile Required (Isolator Row):	114 square yards
Total Woven Geotextile Required:	180 square yards
Impervious Liner Required:	0 square yards



User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	Raleigh Hills School - East
Engineer:	Kelly Ota
Project Location:	Oregon
Measurement Type:	Imperial
Required Storage Volume:	9963 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(30 ft. x 88 ft.)

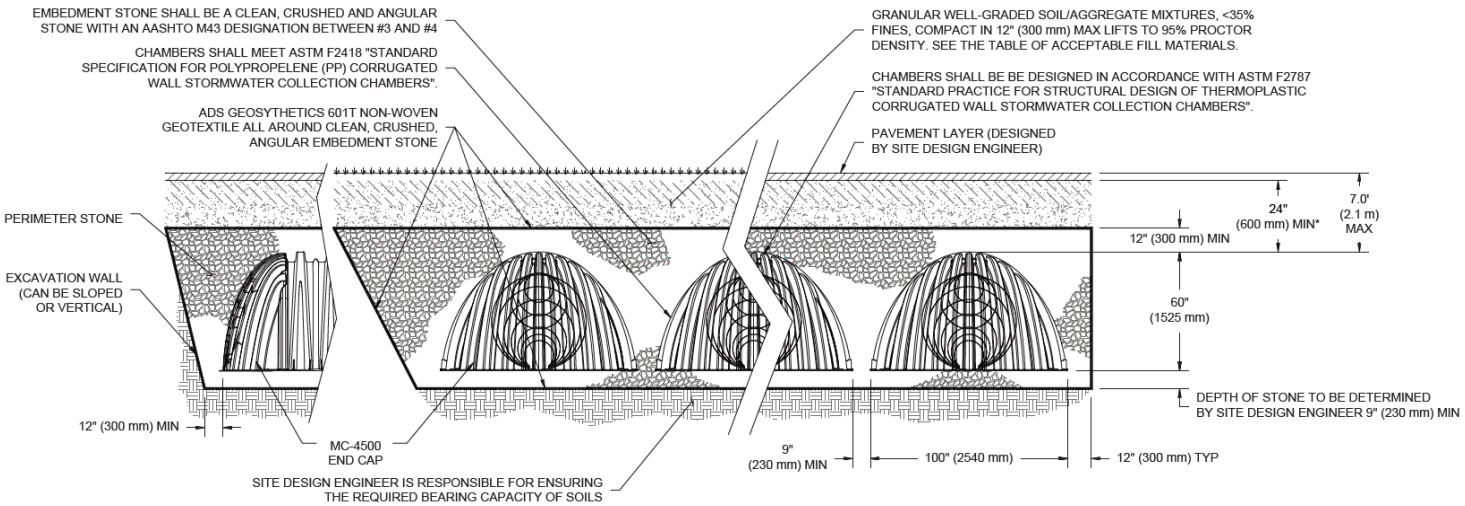
Results

System Volume and Bed Size

Installed Storage Volume:	10732.19 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	34
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	90.70 ft.
Maximum Width:	29.10 ft.
Approx. Bed Size Required:	2593.20 square ft.

System Components

Amount Of Stone Required:	419 cubic yards
Volume Of Excavation (Not Including Fill):	649 cubic yards
Total Non-woven Geotextile Required:	908 square yards
Woven Geotextile Required (excluding Isolator Row):	43 square yards
Woven Geotextile Required (Isolator Row):	198 square yards
Total Woven Geotextile Required:	240 square yards
Impervious Liner Required:	0 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	LEROY LUCERO 971-235-1569 LEROY.LUCERO@ADS-PIPE.COM
ADS SALES REP:	JOSEPH COTTON 360-601-2790 JOSEPH.COTTON@ADS-PIPE.COM
PROJECT NO:	S124306

ADVANCED DRAINAGE SYSTEMS, INC.

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RALEIGH HILLS SCHOOL - BEAVERTON SCHOOL DISTRICT

BEAVERTON, OR

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

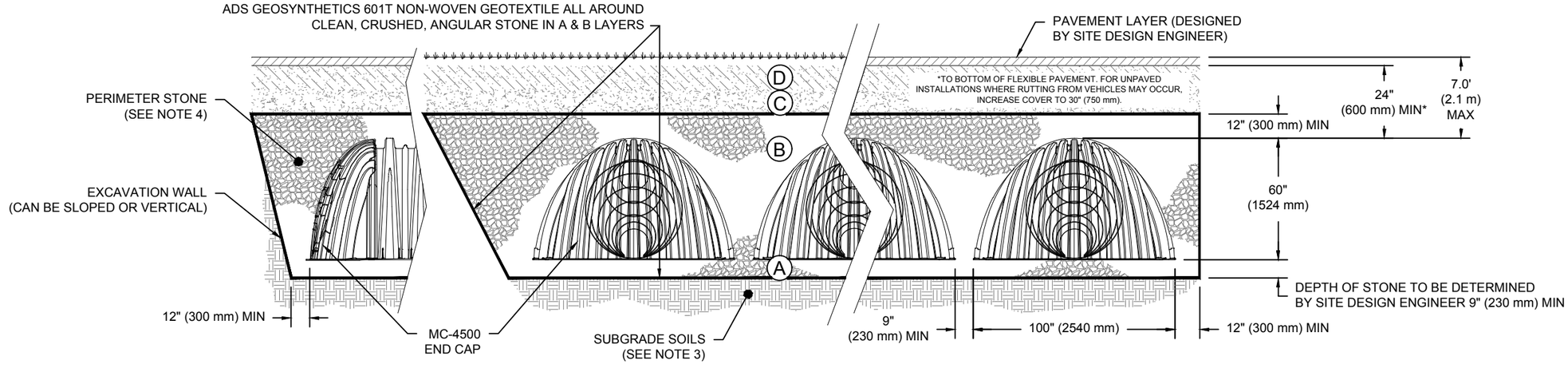
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

DESCRIPTION | CHKD | DRWN | DATE

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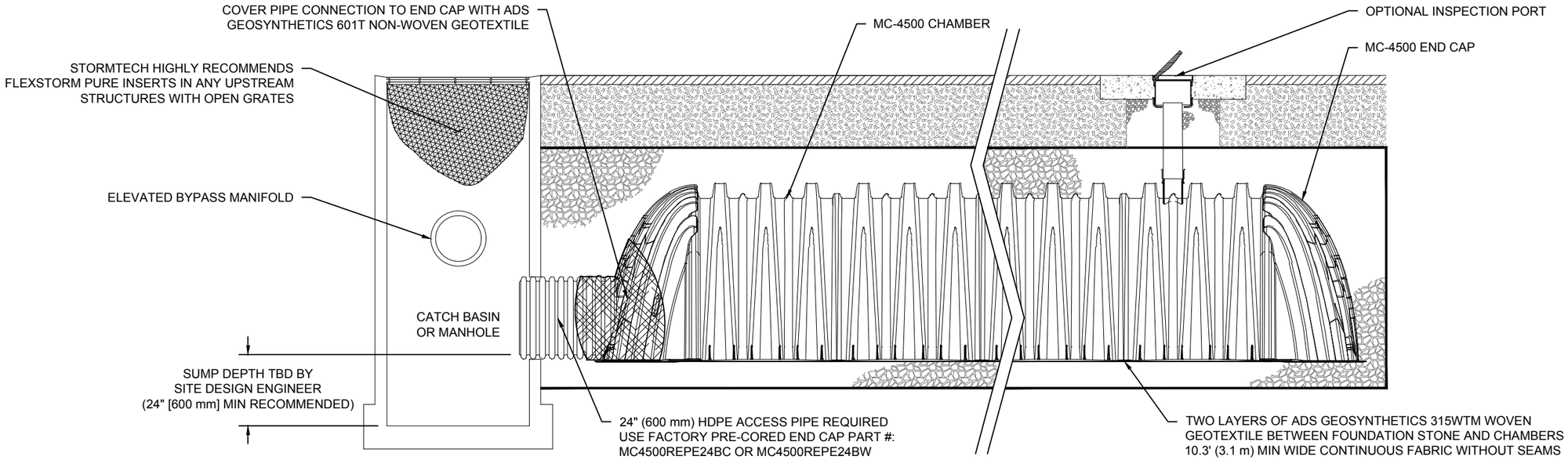


MC-4500 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

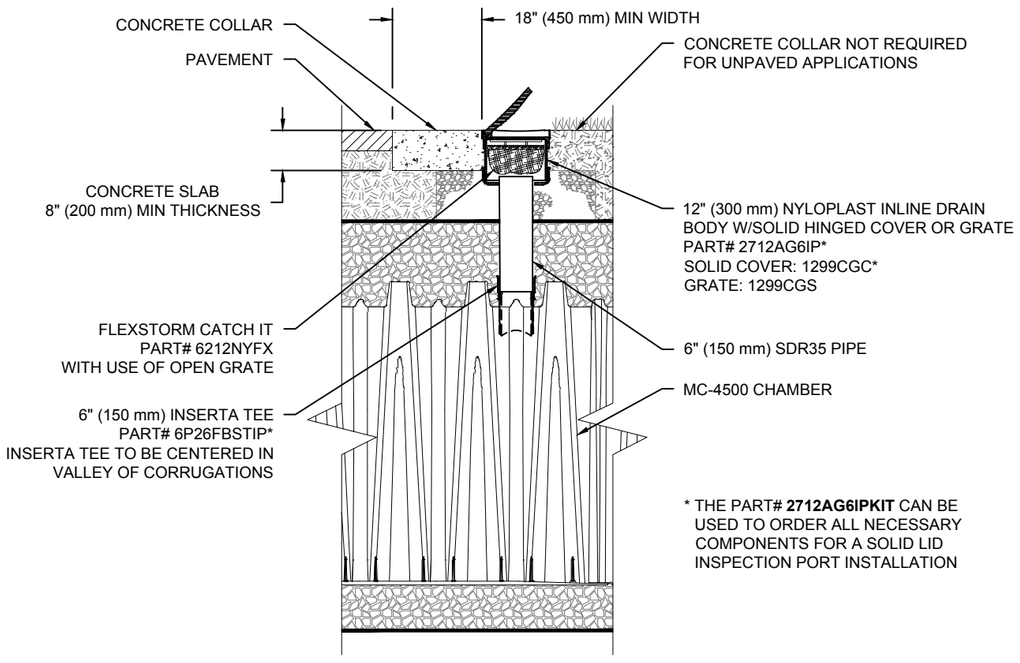
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



MC-4500 6" (150 mm) INSPECTION PORT DETAIL
NTS

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MC-4500 TECHNICAL SPECIFICATION

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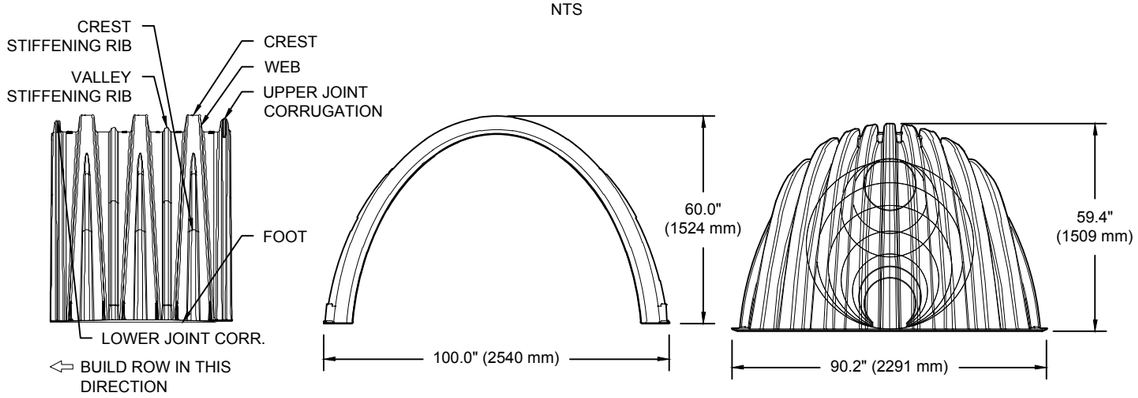


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT	130.0 lbs.	(59.0 kg)

NOMINAL END CAP SPECIFICATIONS

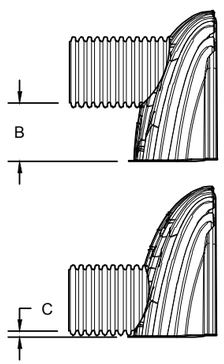
SIZE (W X H X INSTALLED LENGTH)	90.2" X 59.4" X 30.7"	(2291 mm X 1509 mm X 781 mm)
END CAP STORAGE	35.7 CUBIC FEET	(1.01 m³)
MINIMUM INSTALLED STORAGE*	108.7 CUBIC FEET	(3.08 m³)
WEIGHT	135.0 lbs.	(61.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500REPE06T	6" (150 mm)	42.54" (1.081 m)	---
MC4500REPE06B		---	0.86" (22 mm)
MC4500REPE08T	8" (200 mm)	40.50" (1.029 m)	---
MC4500REPE08B		---	1.01" (26 mm)
MC4500REPE10T	10" (250 mm)	38.37" (975 mm)	---
MC4500REPE10B		---	1.33" (34 mm)
MC4500REPE12T	12" (300 mm)	35.69" (907 mm)	---
MC4500REPE12B		---	1.55" (39 mm)
MC4500REPE15T	15" (375 mm)	32.72" (831 mm)	---
MC4500REPE15B		---	1.70" (43 mm)
MC4500REPE18TC	18" (450 mm)	29.36" (746 mm)	---
MC4500REPE18TW			
MC4500REPE18BC		---	1.97" (50 mm)
MC4500REPE18BW			
MC4500REPE24TC	24" (600 mm)	23.05" (585 mm)	---
MC4500REPE24TW			
MC4500REPE24BC		---	2.26" (57 mm)
MC4500REPE24BW			
MC4500REPE30BC	30" (750 mm)	---	2.95" (75 mm)
MC4500REPE36BC	36" (900 mm)	---	3.25" (83 mm)
MC4500REPE42BC	42" (1050 mm)	---	3.55" (90 mm)

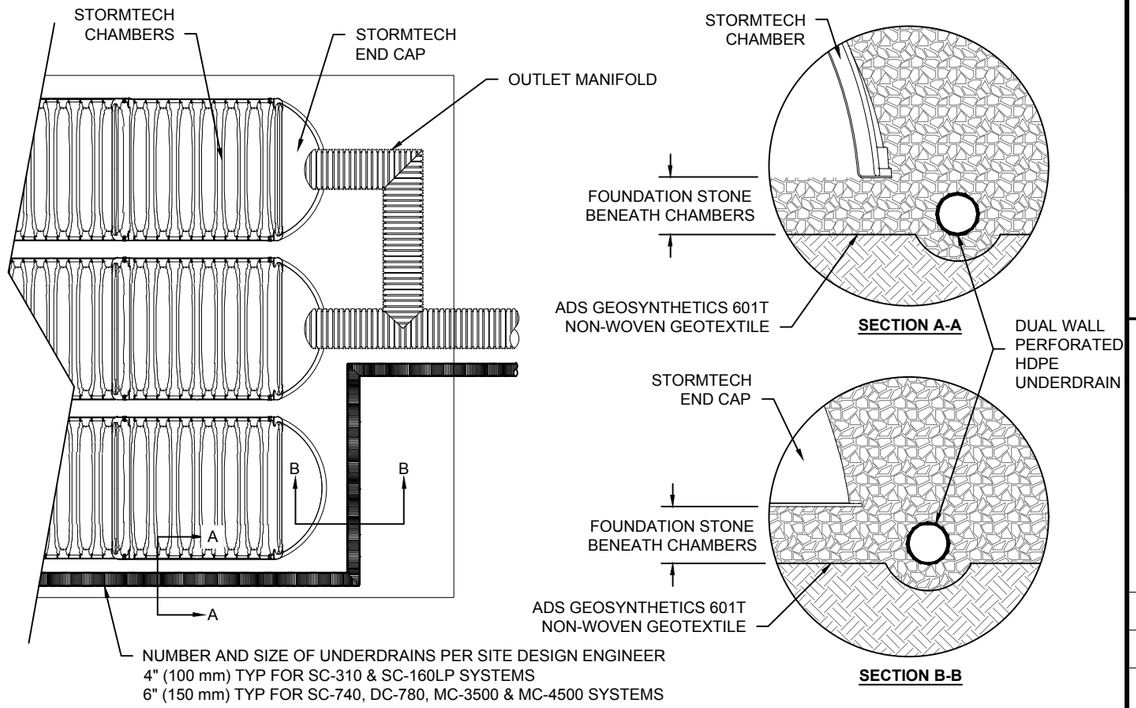
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

UNDERDRAIN DETAIL

NTS



MC-SERIES END CAP INSERTION DETAIL

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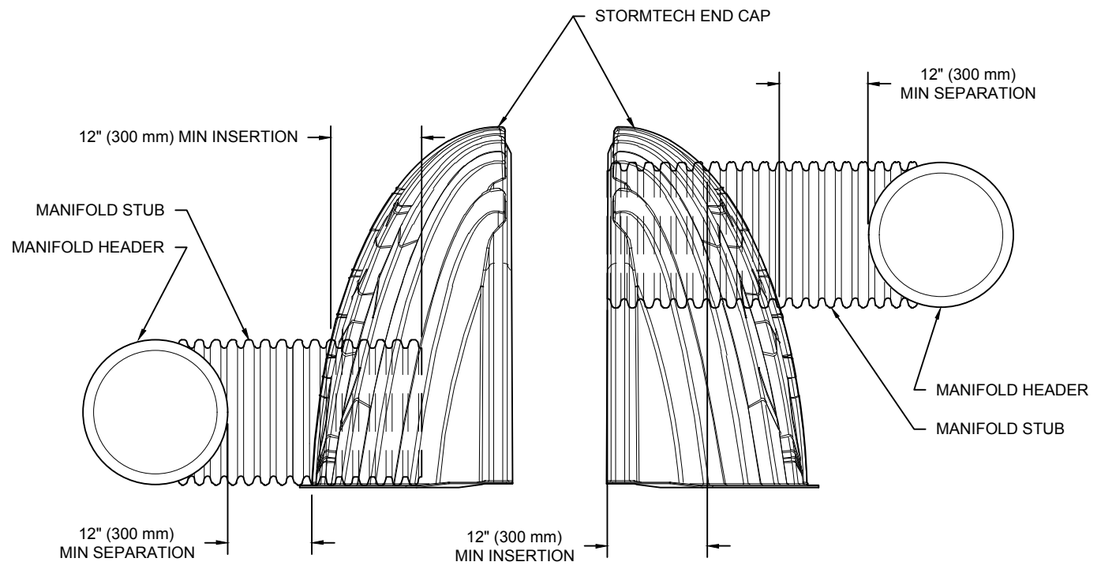

NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

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HP MANHOLE INSTALLATION

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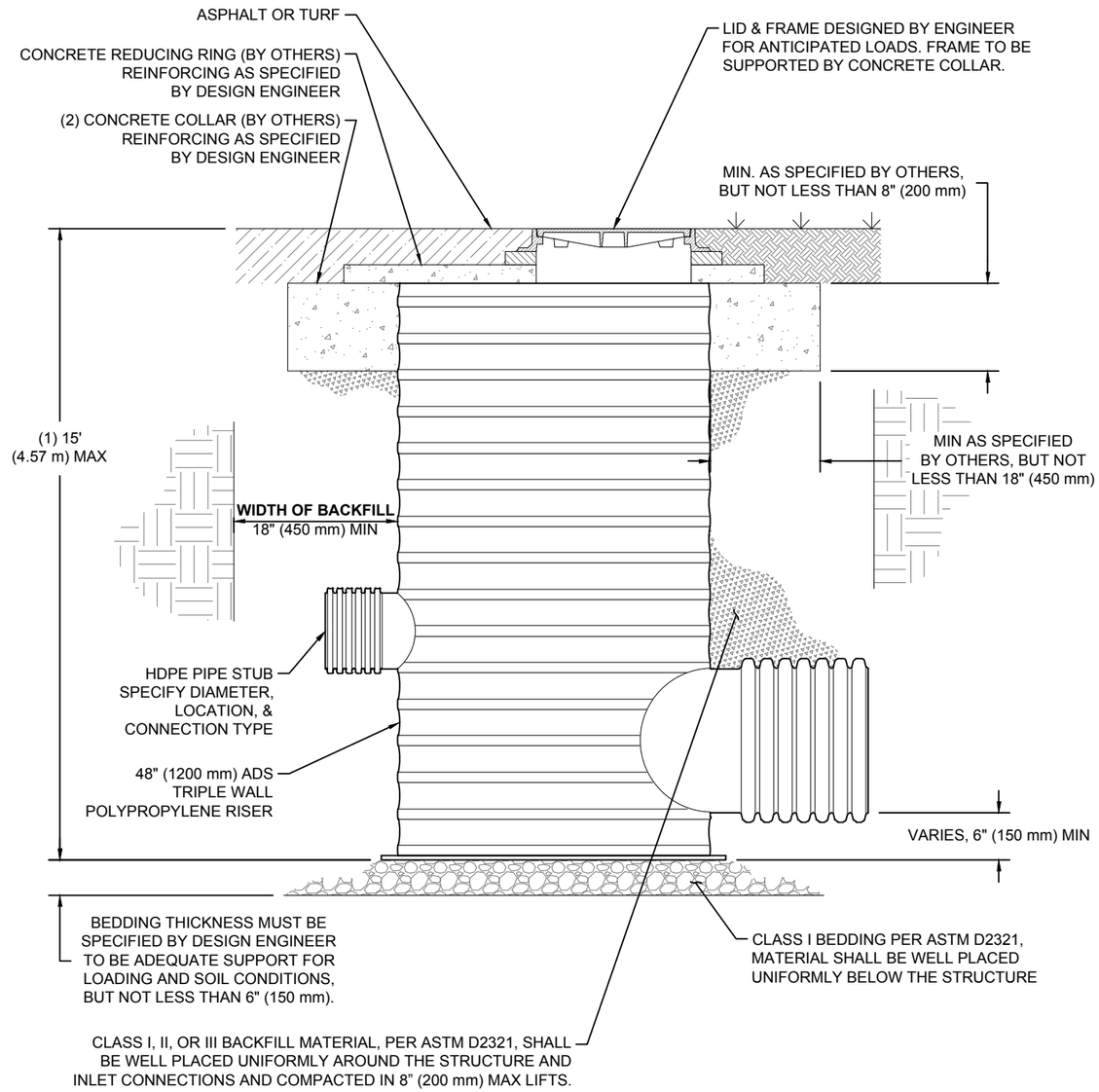
NOTES:
1. FOR BURIAL DEPTHS GREATER THAN 15' (4.57 m), OR WHERE GROUND WATER WILL BE ENCOUNTERED, CONTACT ADS ENGINEERING SERVICES.
2. AVOID CONSTRUCTION LOADING ON STRUCTURE PRIOR TO CONCRETE COLLAR INSTALLATION.



DATE	DRWN	CHKD	DESCRIPTION

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BUFORD, GA 30518
PHN (770) 932-2443
FAX (770) 932-2490
www.nyloplast-us.com

Nyloplast

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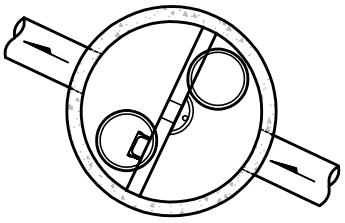
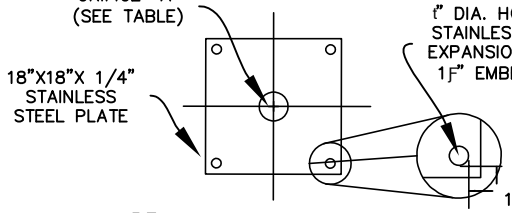
NOTES:

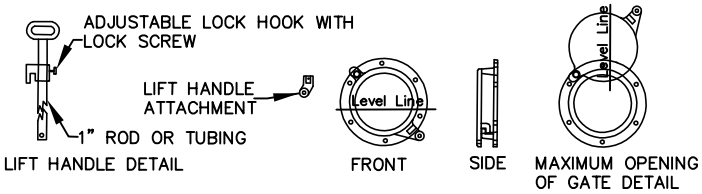
1. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.
2. WATER TIGHT SEAL OF THE CONCRETE BAFFLE WALL AND MANHOLE WALL/FLOOR VIA INTEGRALLY CAST CONSTRUCTION BY THE MANHOLE MANUFACTURER OR EQUIVALENT.
3. UPPER FLOW ORIFICE SHALL BE ALUMINUM, ALUMINIZED STEEL OR TREATMENT 1 GALVANIZED STEEL.
4. FRAME AND LADDER OR STEPS ARE TO BE OFFSET SO THAT SHEAR GATE IS VISIBLE FROM THE TOP; CLIMB-DOWN SPACE IS CLEAR OF RISER AND GATE; FRAME IS CLEAR OF CURB.
5. MULTI-ORIFICE ELBOWS SHALL BE PRE-INSTALLED TO INSURE LADDER CLEARANCE.
6. RESTRICTOR PLATE WITH ORIFICE AS SPECIFIED IN THE CONTRACT. OPENING IS TO BE CUT ROUND AND SMOOTH. NEOPRENE GASKET SHALL BE INSTALLED BETWEEN THE ORIFICE PLATE AND CONCRETE BAFFLE TO PROVIDE A WATERTIGHT SEAL.
7. SHEAR GATE SHALL BE MADE OF ALUMINUM ALLOY IN ACCORDANCE WITH ASTM B 26M AND ASTM B 275, DESIGNATION Zg32A OR CAST IRON IN ACCORDANCE WITH ASTM A 48, CLASS 30B. LIFT HANDLE MAY BE SOLID ROD OR HOLLOW TUBING WITH ADJUSTABLE HOOK AS REQUIRED. NEOPRENE RUBBER GASKET REQUIRED BETWEEN RISER MOUNTING FLANGE AND GATE FLANGE. MATING SURFACES OF LID AND BODY SHALL BE MACHINED FOR PROPER FIT. FLANGE MOUNTING BOLTS SHALL BE....."DIAMETER STAINLESS STEEL.
8. SHEAR GATE MAXIMUM OPENING SHALL BE CONTROLLED BY LIMITED HINGE MOVEMENT, STOP TAB OR SOME OTHER DEVISE.
9. ALTERNATE SHEAR GATES DESIGNS ARE ACCEPTABLE, IF MATERIAL SPECIFICATIONS ARE MET AND FLANGE BOLT PATTERN MATCHES.
10. MANHOLE CERTIFICATION REQUIRED FOR TRAFFIC LOADING.



PLAN



RESTRICTOR PLATE, ORIFICE



LIFT HANDLE DETAIL | FRONT | SIDE | MAXIMUM OPENING OF GATE DETAIL

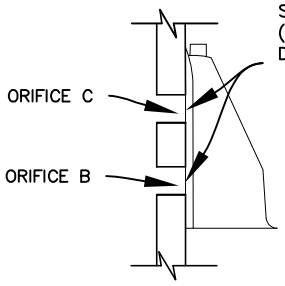
SHEAR GATE
MANUFACTURED BY KENNEDY VALVE OR EQUAL

INSTALLATION NOTE:

POSITION HOOD SUCH THAT BOTTOM FLANGE IS MIN 2" BELOW THE ORIFICE B INVERT.

ONE SNOUT MAY BE USE FOR BOTH ORIFICE C AND B.

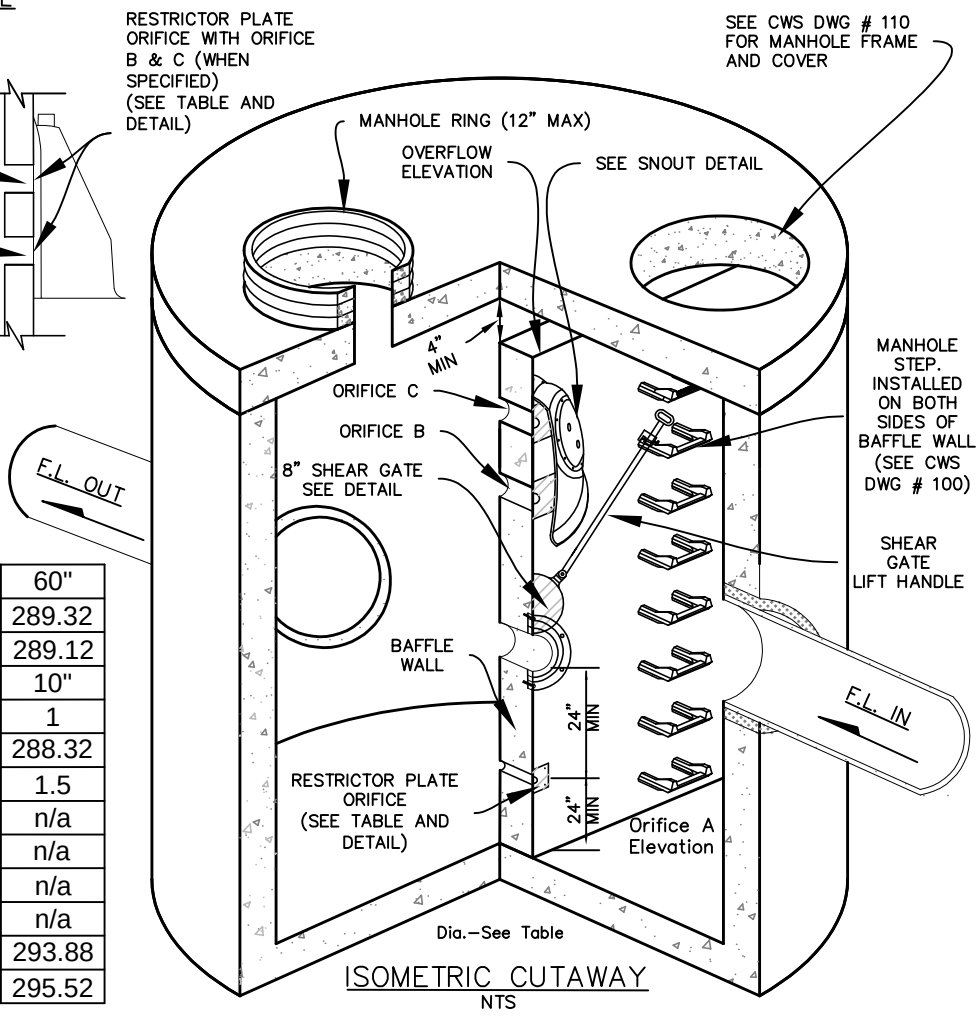
IT MAY NEED BE NECESSARY TO USE TWO SNOUTS AND OFF SET ORIFICES TO MEET PLAN ELEVATION.



SNOUT DETAIL

FLOW CONTROL STRUCTURE TABLE

Diameter Of Manhole (In.) 60" MIN	60"
F.L. (In)	289.32
F.L. (Out)	289.12
Outlet Pipe Diameter (In.)	10"
Number Of Orifice	1
Orifice A Elevation	288.32
Diameter Of Orifice A (In.)	1.5
Orifice B Elevation	n/a
Diameter Of Orifice B (In.)	n/a
Orifice C Elevation	n/a
Diameter Of Orifice C (In)	n/a
Overflow Elevation	293.88
Rim Elevation	295.52



ISOMETRIC CUTAWAY
NTS

Beaverton ENGINEERING	**CWS FLOW CONTROL STRUCTURE WITH C.O.B. MODIFICATIONS**	**SCALE: NONE** **DATE: JUNE 2018**	**360**

FILENAME: 360.dwg

NOTES:

1. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.
2. WATER TIGHT SEAL OF THE CONCRETE BAFFLE WALL AND MANHOLE WALL/FLOOR VIA INTEGRALLY CAST CONSTRUCTION BY THE MANHOLE MANUFACTURER OR EQUIVALENT.
3. UPPER FLOW ORIFICE SHALL BE ALUMINUM, ALUMINIZED STEEL OR TREATMENT 1 GALVANIZED STEEL.
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5. MULTI–ORIFICE ELBOWS SHALL BE PRE–INSTALLED TO INSURE LADDER CLEARANCE.
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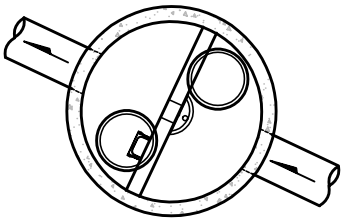
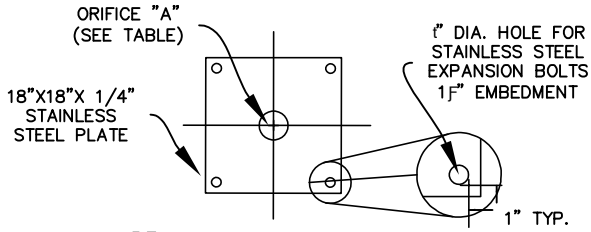
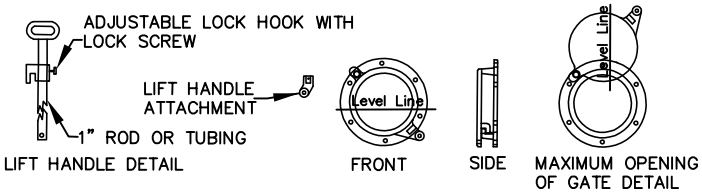


PLAN



RESTRICTOR PLATE, ORIFICE



LIFT HANDLE DETAIL FRONT SIDE MAXIMUM OPENING OF GATE DETAIL

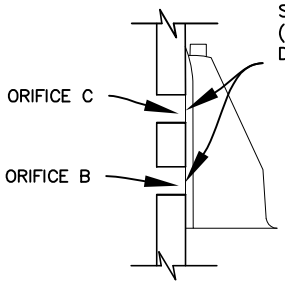
SHEAR GATE
MANUFACTURED BY KENNEDY VALVE OR EQUAL

INSTALLATION NOTE:

POSITION HOOD SUCH THAT BOTTOM FLANGE IS MIN 2" BELOW THE ORIFICE B INVERT.

ONE SNOUT MAY BE USE FOR BOTH ORIFICE C AND B.

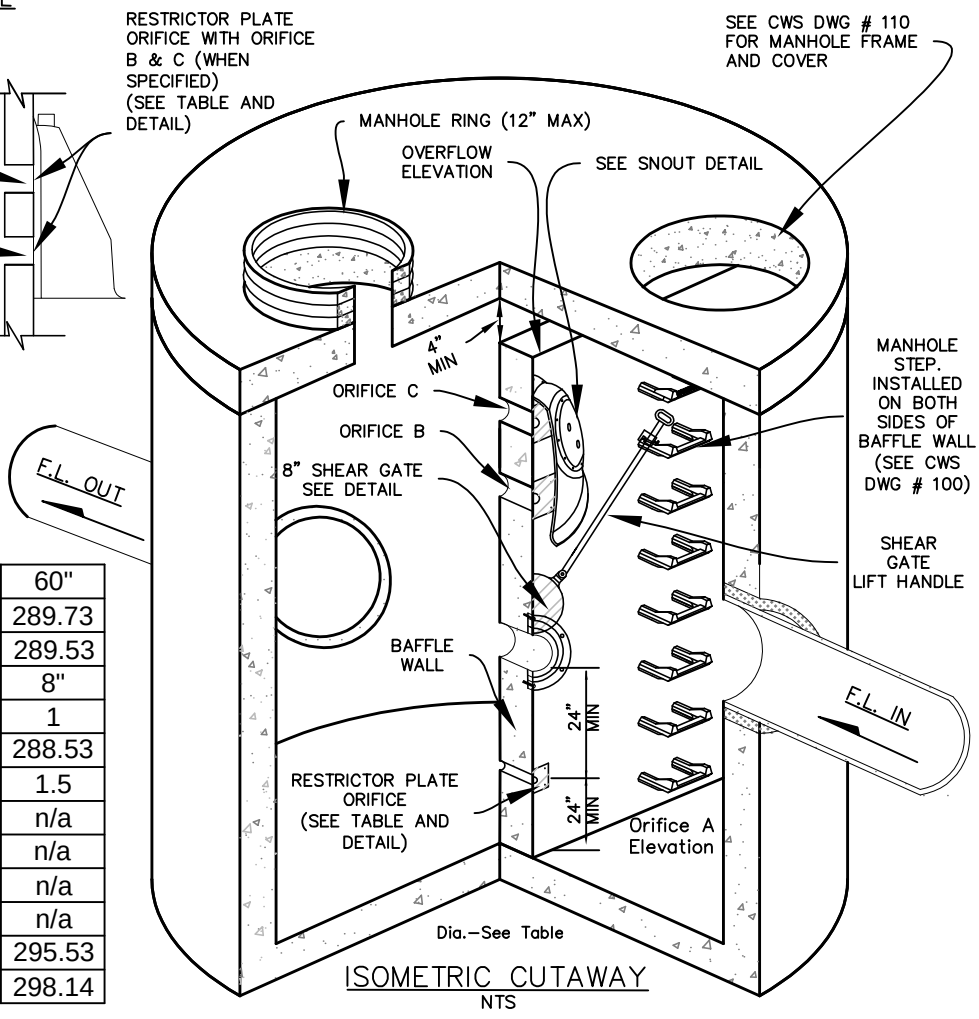
IT MAY NEED BE NECESSARY TO USE TWO SNOUTS AND OFF SET ORIFICES TO MEET PLAN ELEVATION.



SNOUT DETAIL

FLOW CONTROL STRUCTURE TABLE

Diameter Of Manhole (In.) 60" MIN	60"
F.L. (In)	289.73
F.L. (Out)	289.53
Outlet Pipe Diameter (In.)	8"
Number Of Orifice	1
Orifice A Elevation	288.53
Diameter Of Orifice A (In.)	1.5
Orifice B Elevation	n/a
Diameter Of Orifice B (In.)	n/a
Orifice C Elevation	n/a
Diameter Of Orifice C (In)	n/a
Overflow Elevation	295.53
Rim Elevation	298.14



ISOMETRIC CUTAWAY
NTS

Beaverton ENGINEERING	**CWS FLOW CONTROL STRUCTURE WITH C.O.B. MODIFICATIONS**	**SCALE: NONE** **DATE: JUNE 2018**	**360**

FILENAME: 360.dwg

Hydraflow Table of Contents

2 - Year

5 - Year

10 - Year

25 - Year

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	SBUH Runoff	0.256	2	480	6,447	------	------	------	Basin B Pre-Developed
2	SBUH Runoff	1.485	2	476	20,900	------	------	------	Basin B Post-Developed
4	Reservoir	0.123	2	1442	19,928	2	293.82	14,466	UG Pipes A
6	SBUH Runoff	0.275	2	480	6,423	------	------	------	Basin C Pre-Developed
7	SBUH Runoff	0.955	2	478	13,949	------	------	------	Basin C Post-Developed
9	SBUH Runoff	0.002	2	480	44	------	------	------	Basin F Post-Developed
10	SBUH Runoff	0.006	2	480	155	------	------	------	Basin F Post-Developed
12	Combine	0.277	2	480	6,467	6, 9,	------	------	Basins C & F Pre-Developed
13	Combine	0.961	2	478	14,104	7, 10,	------	------	Basins C & F Post-Developed
15	Reservoir	0.118	2	1374	13,735	13	293.70	7,645	UG Pipes B

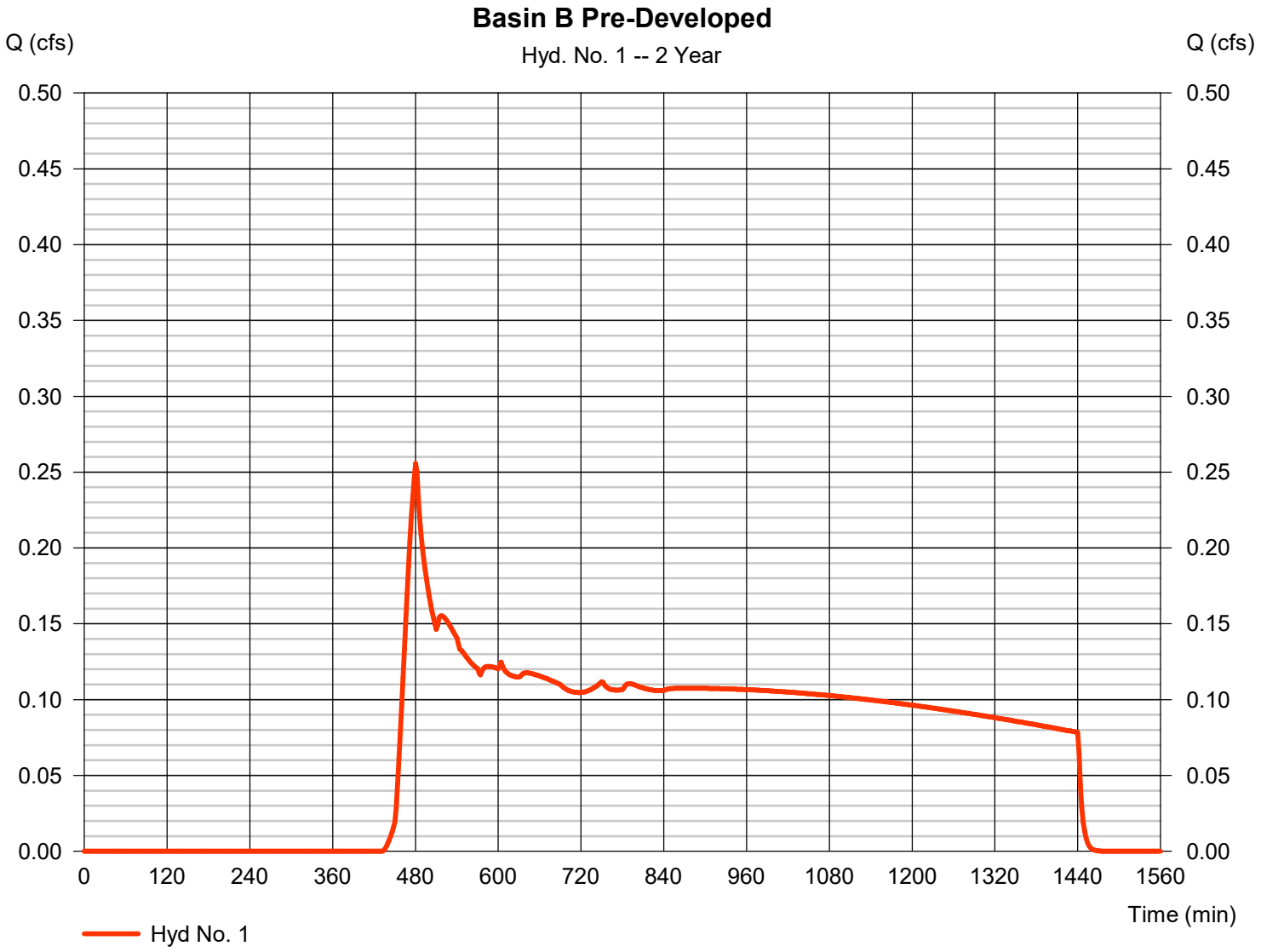
Hydrograph Report

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.256 cfs
Storm frequency	=	2 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	6,447 cuft
Drainage area	=	2.920 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.410 x 75) + (1.510 x 74)] / 2.920



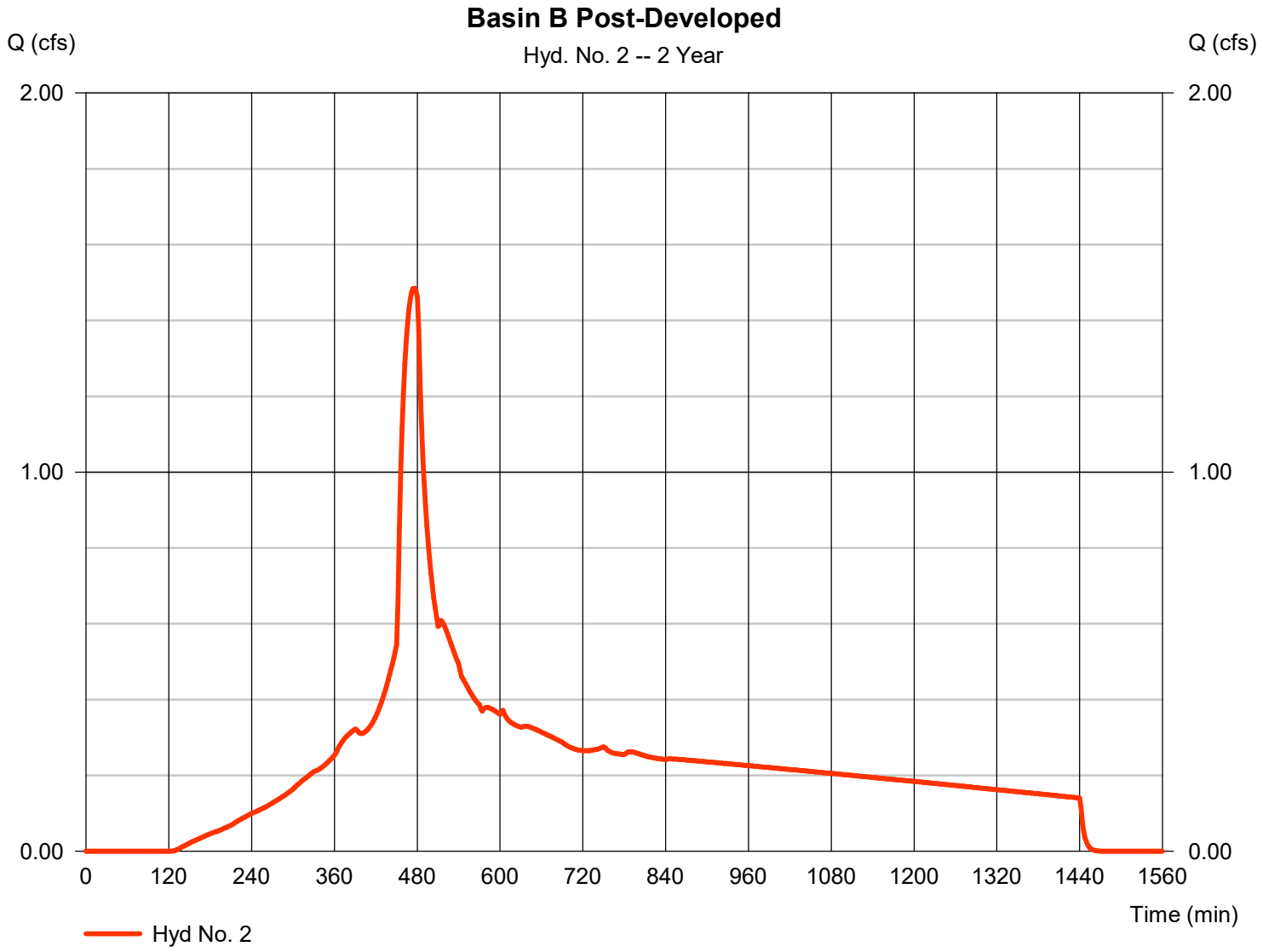
Hydrograph Report

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	1.485 cfs
Storm frequency	=	2 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	20,900 cuft
Drainage area	=	3.080 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(2.602 x 98) + (0.478 x 74)] / 3.080



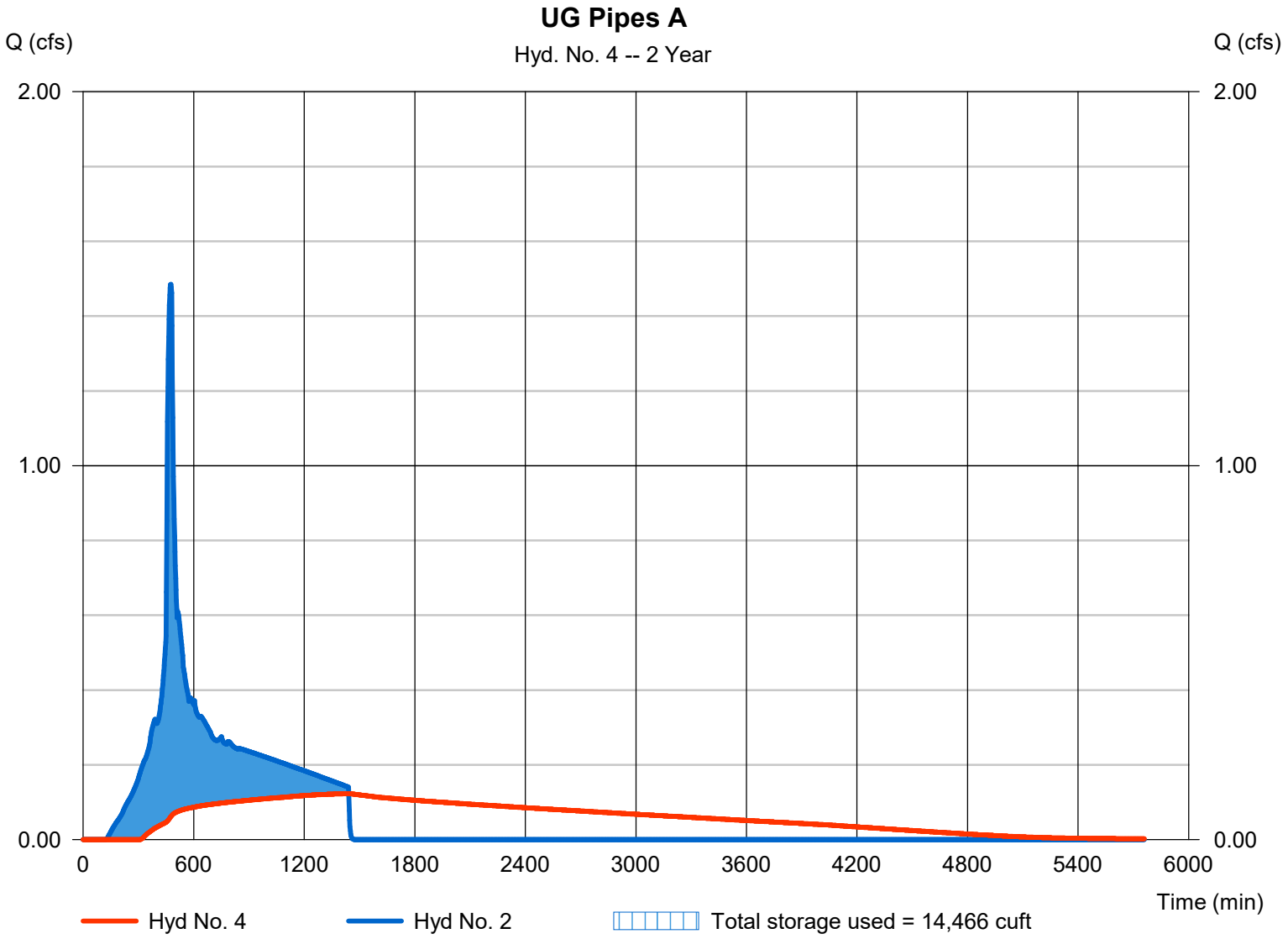
Hydrograph Report

Hyd. No. 4

UG Pipes A

Hydrograph type	=	Reservoir	Peak discharge	=	0.123 cfs
Storm frequency	=	2 yrs	Time to peak	=	1442 min
Time interval	=	2 min	Hyd. volume	=	19,928 cuft
Inflow hyd. No.	=	2 - Basin B Post-Developed	Max. Elevation	=	293.82 ft
Reservoir name	=	UG Pipes A	Max. Storage	=	14,466 cuft

Storage Indication method used.



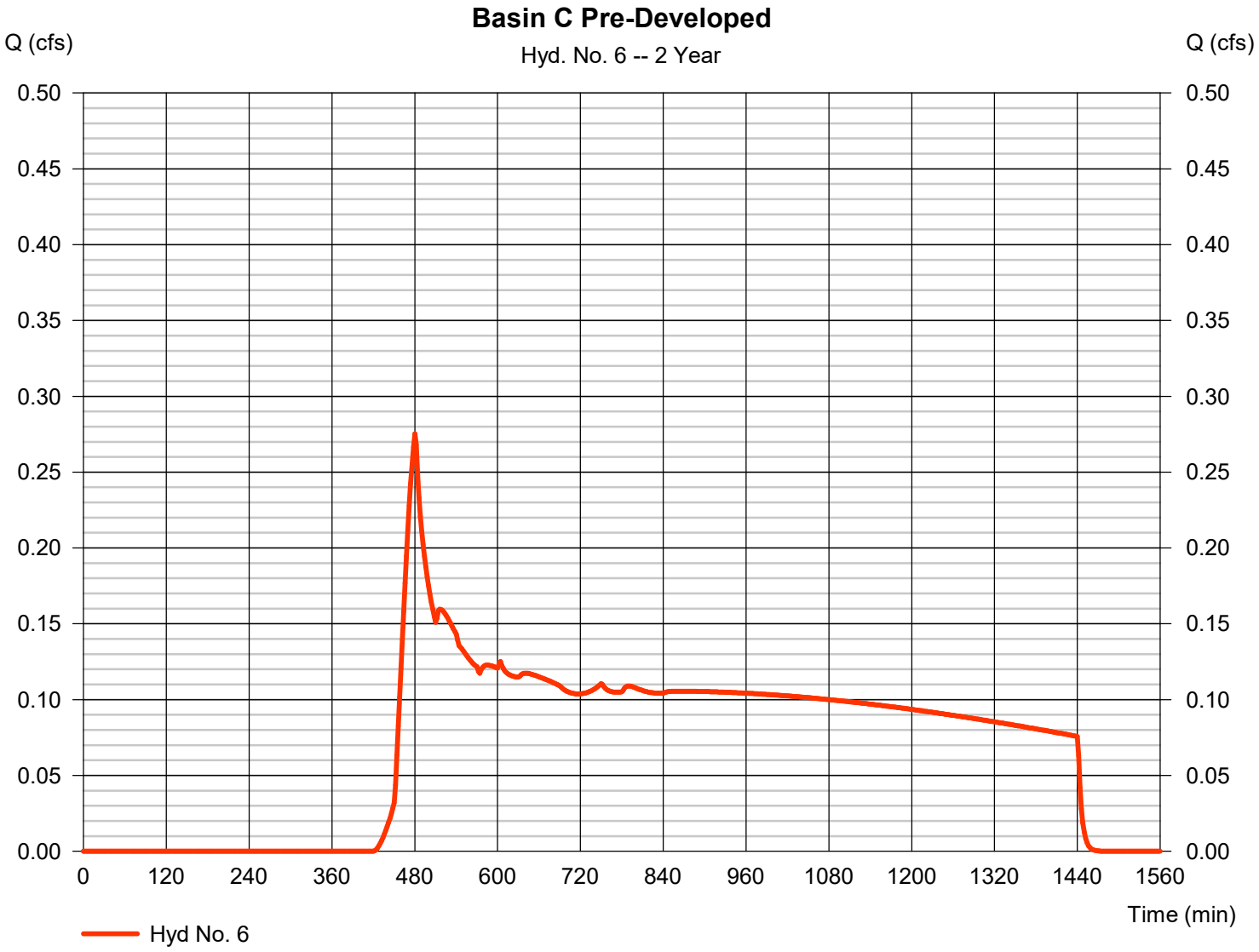
Hydrograph Report

Hyd. No. 6

Basin C Pre-Developed

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.275 cfs
Storm frequency	= 2 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 6,423 cuft
Drainage area	= 2.720 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(1.852 x 75) + (0.868 x 74)] / 2.720



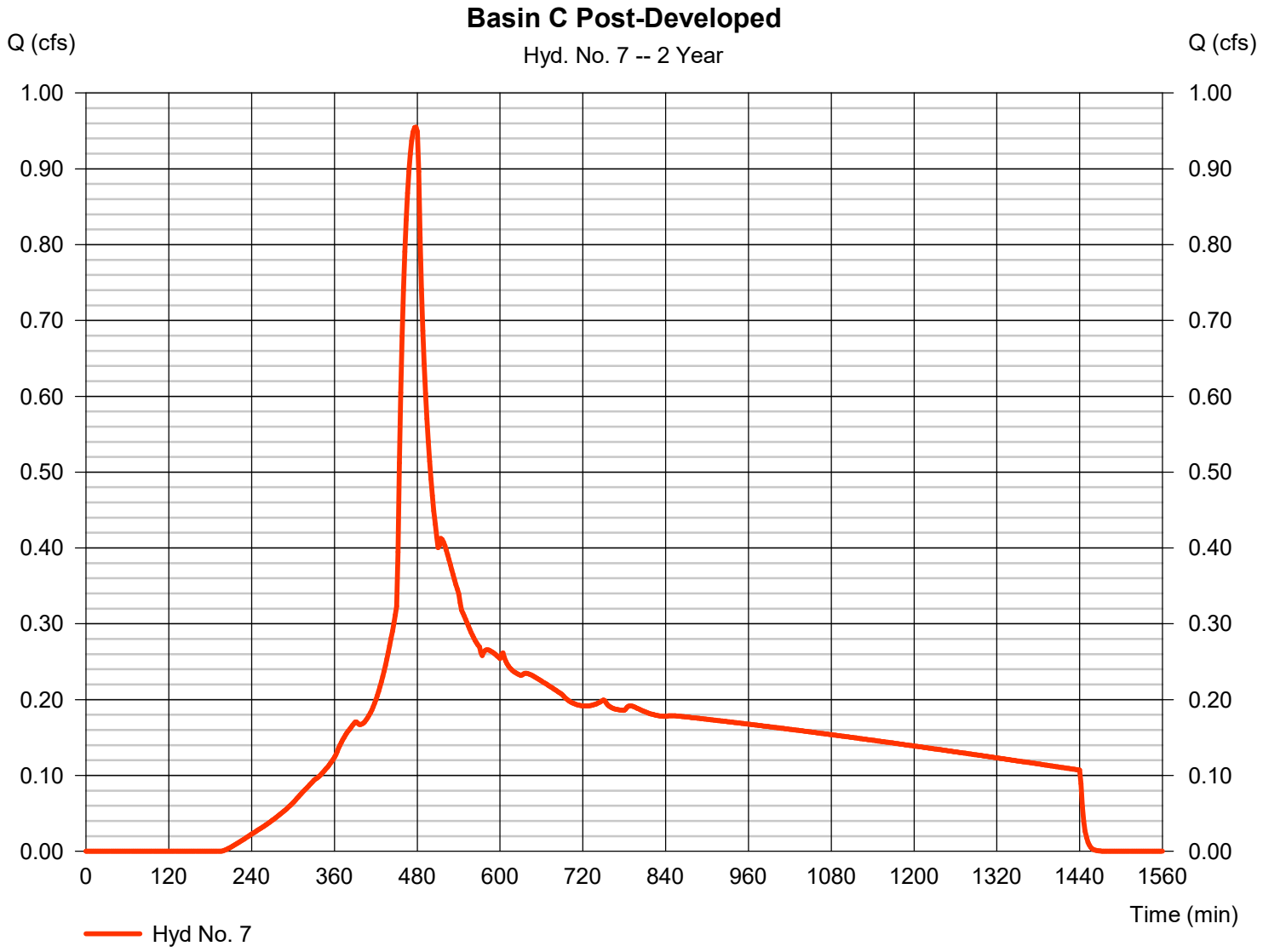
Hydrograph Report

Hyd. No. 7

Basin C Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.955 cfs
Storm frequency	=	2 yrs	Time to peak	=	478 min
Time interval	=	2 min	Hyd. volume	=	13,949 cuft
Drainage area	=	2.510 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.658 x 98) + (0.850 x 74)] / 2.510



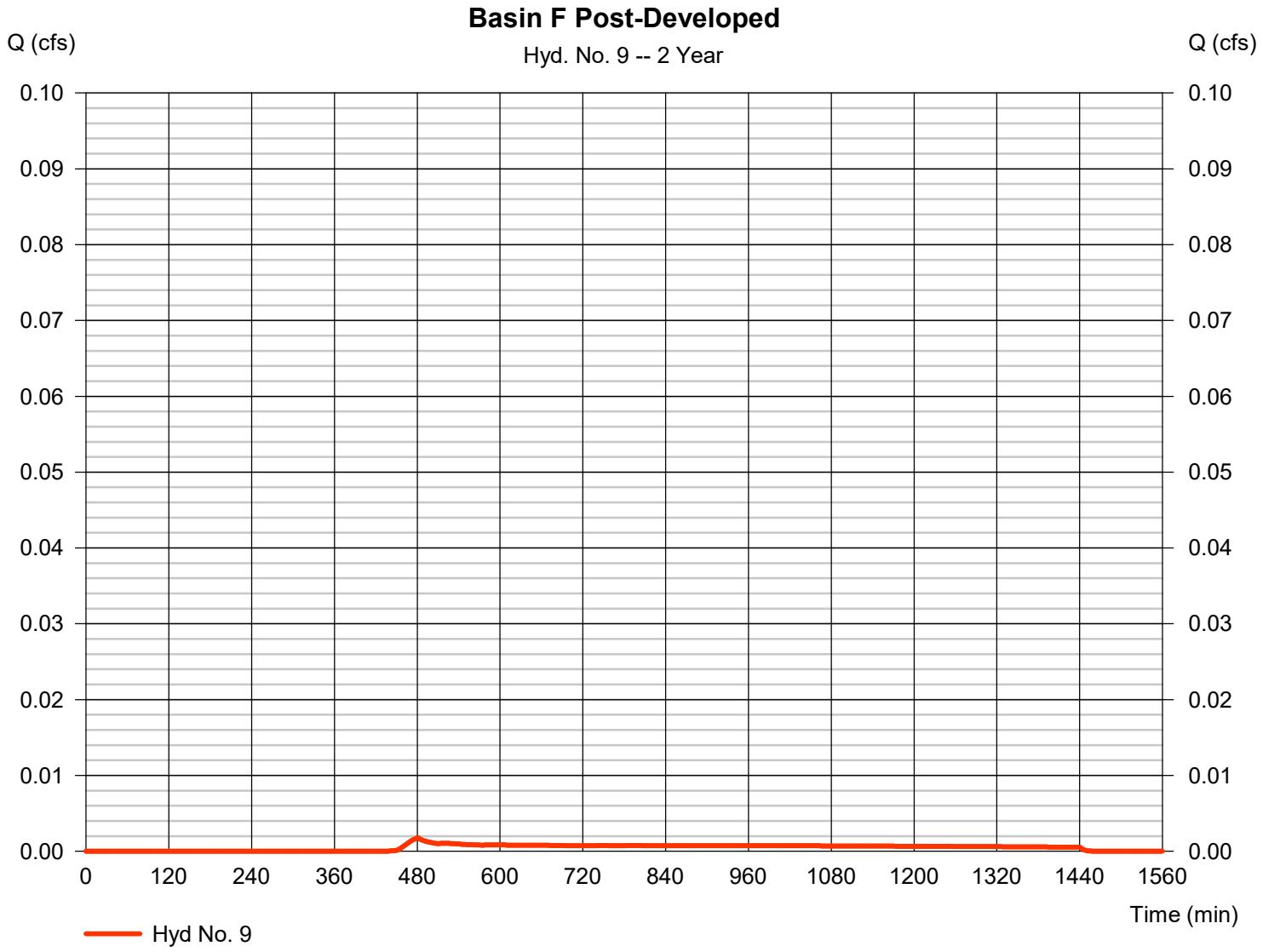
Hydrograph Report

Hyd. No. 9

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.002 cfs
Storm frequency	=	2 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	44 cuft
Drainage area	=	0.020 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.024 x 74)] / 0.020



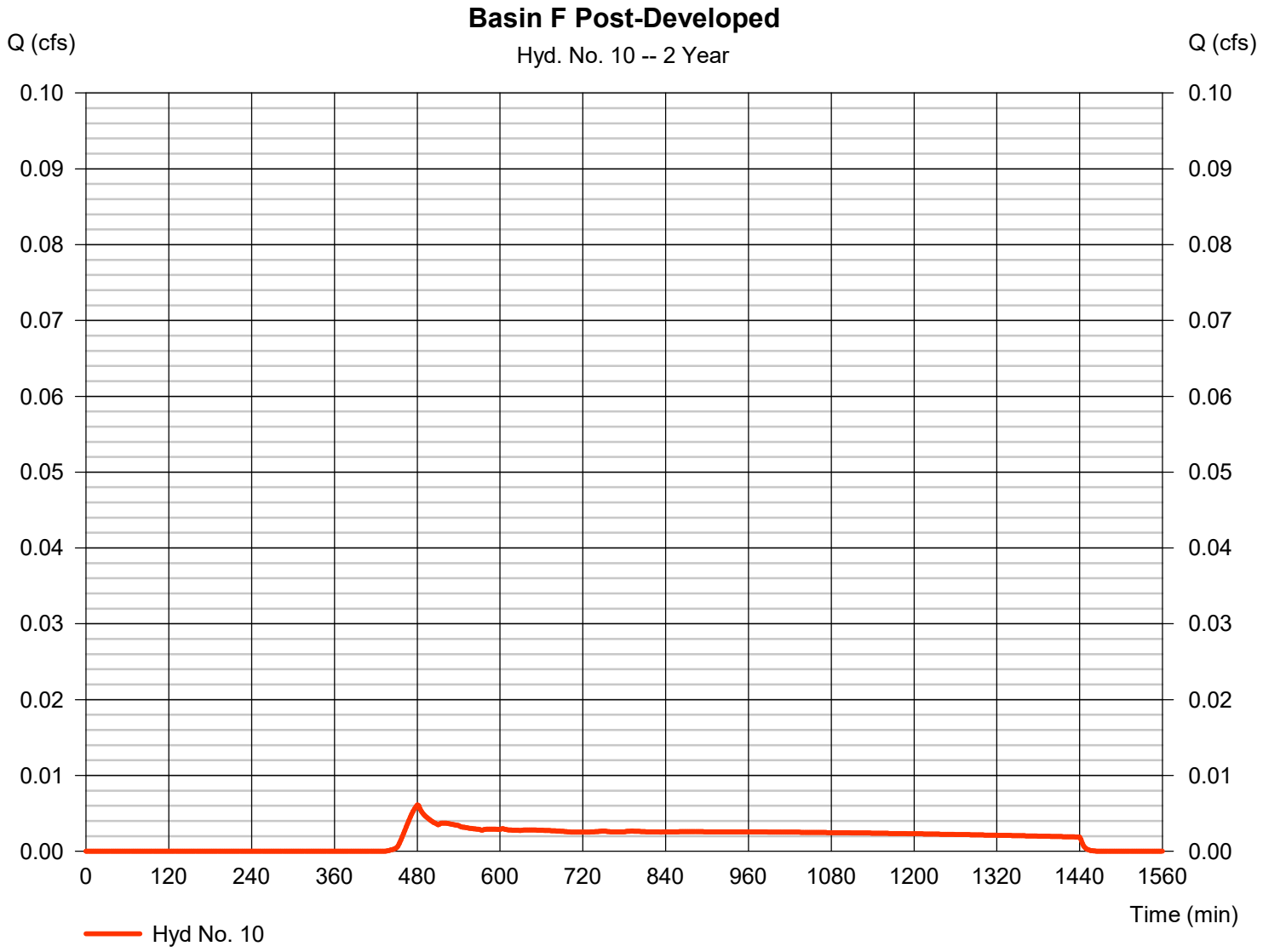
Hydrograph Report

Hyd. No. 10

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.006 cfs
Storm frequency	=	2 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	155 cuft
Drainage area	=	0.070 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.073 x 74)] / 0.070

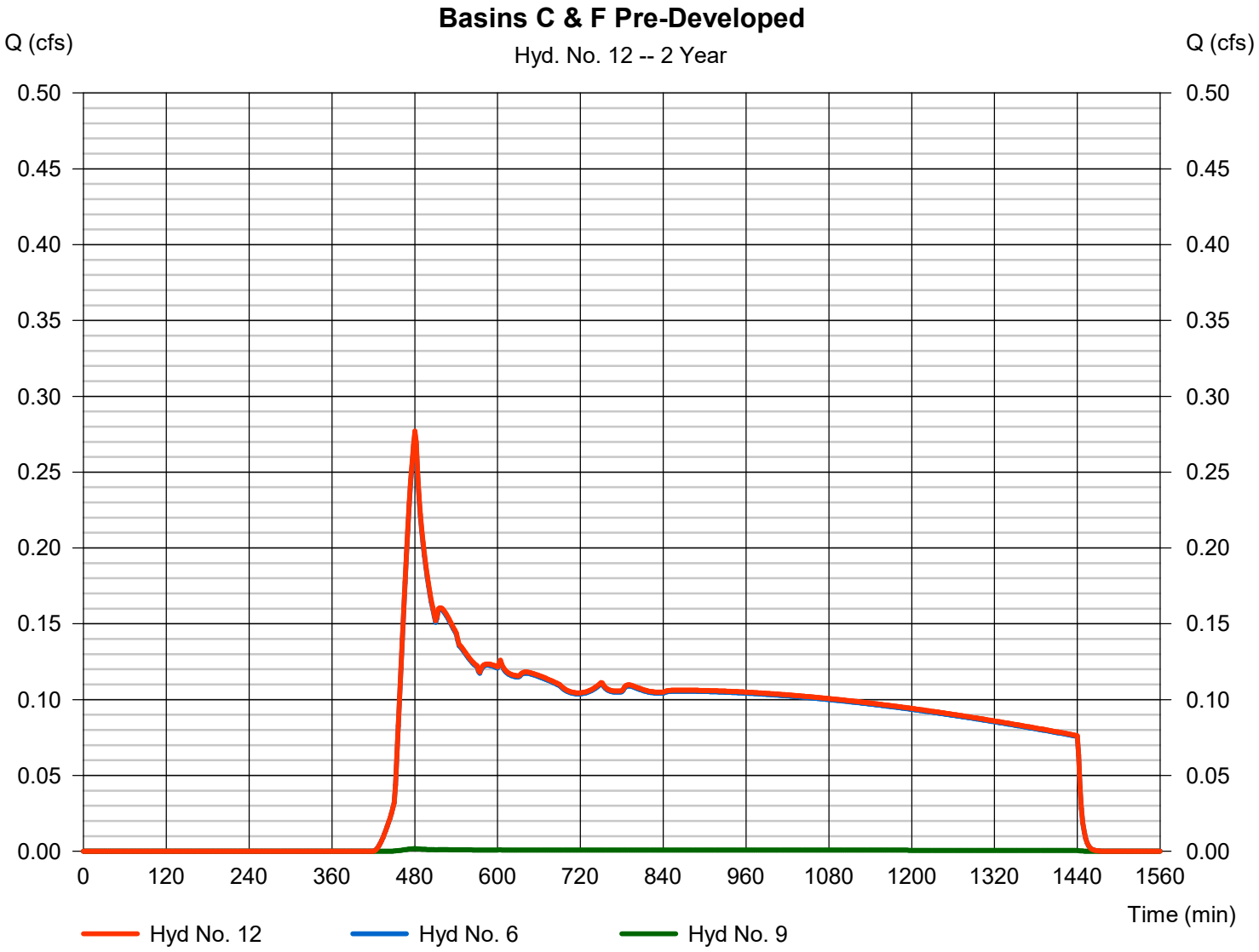


Hydrograph Report

Hyd. No. 12

Basins C & F Pre-Developed

Hydrograph type	= Combine	Peak discharge	= 0.277 cfs
Storm frequency	= 2 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 6,467 cuft
Inflow hyds.	= 6, 9	Contrib. drain. area	= 2.740 ac

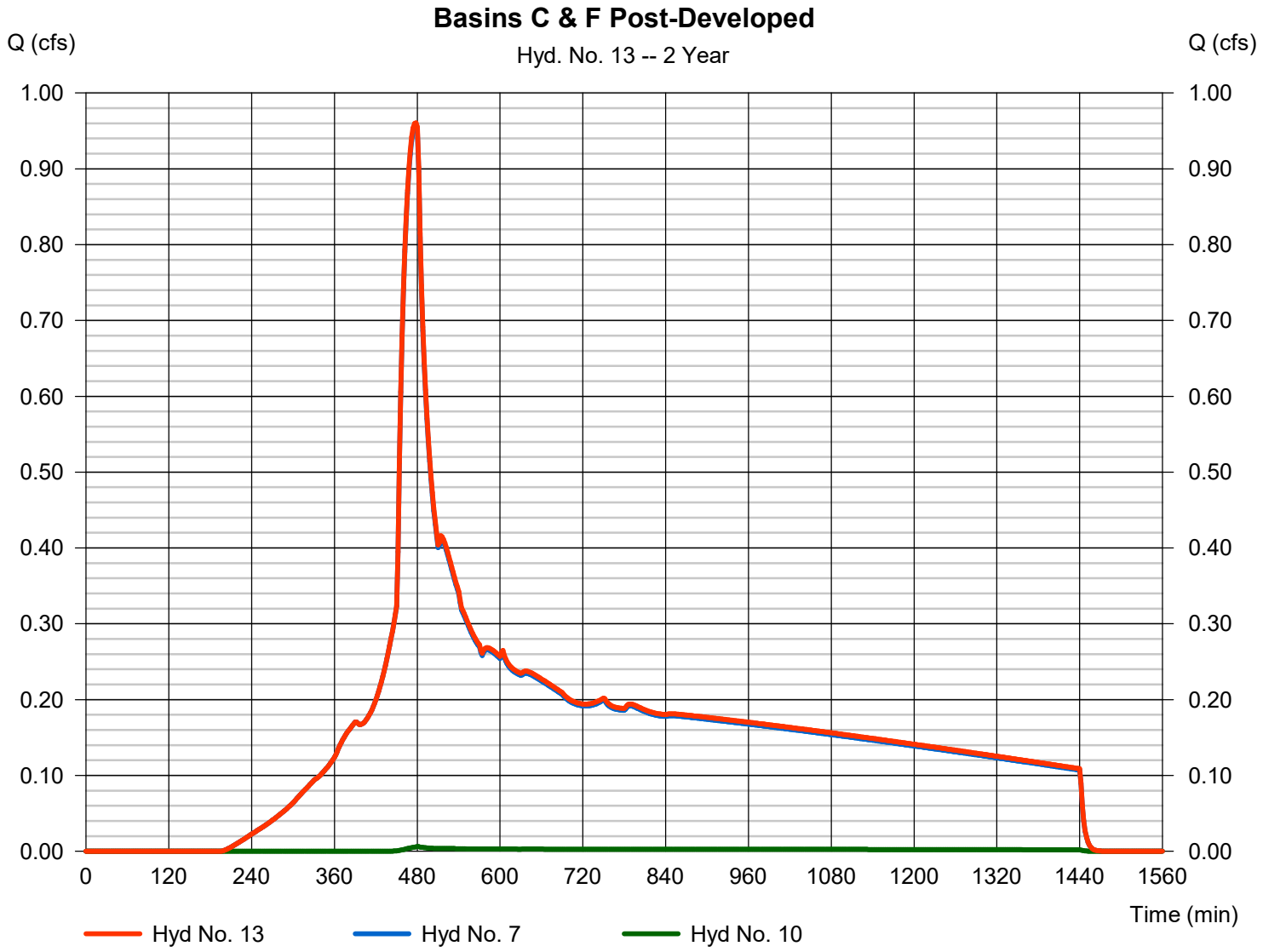


Hydrograph Report

Hyd. No. 13

Basins C & F Post-Developed

Hydrograph type	= Combine	Peak discharge	= 0.961 cfs
Storm frequency	= 2 yrs	Time to peak	= 478 min
Time interval	= 2 min	Hyd. volume	= 14,104 cuft
Inflow hyds.	= 7, 10	Contrib. drain. area	= 2.580 ac



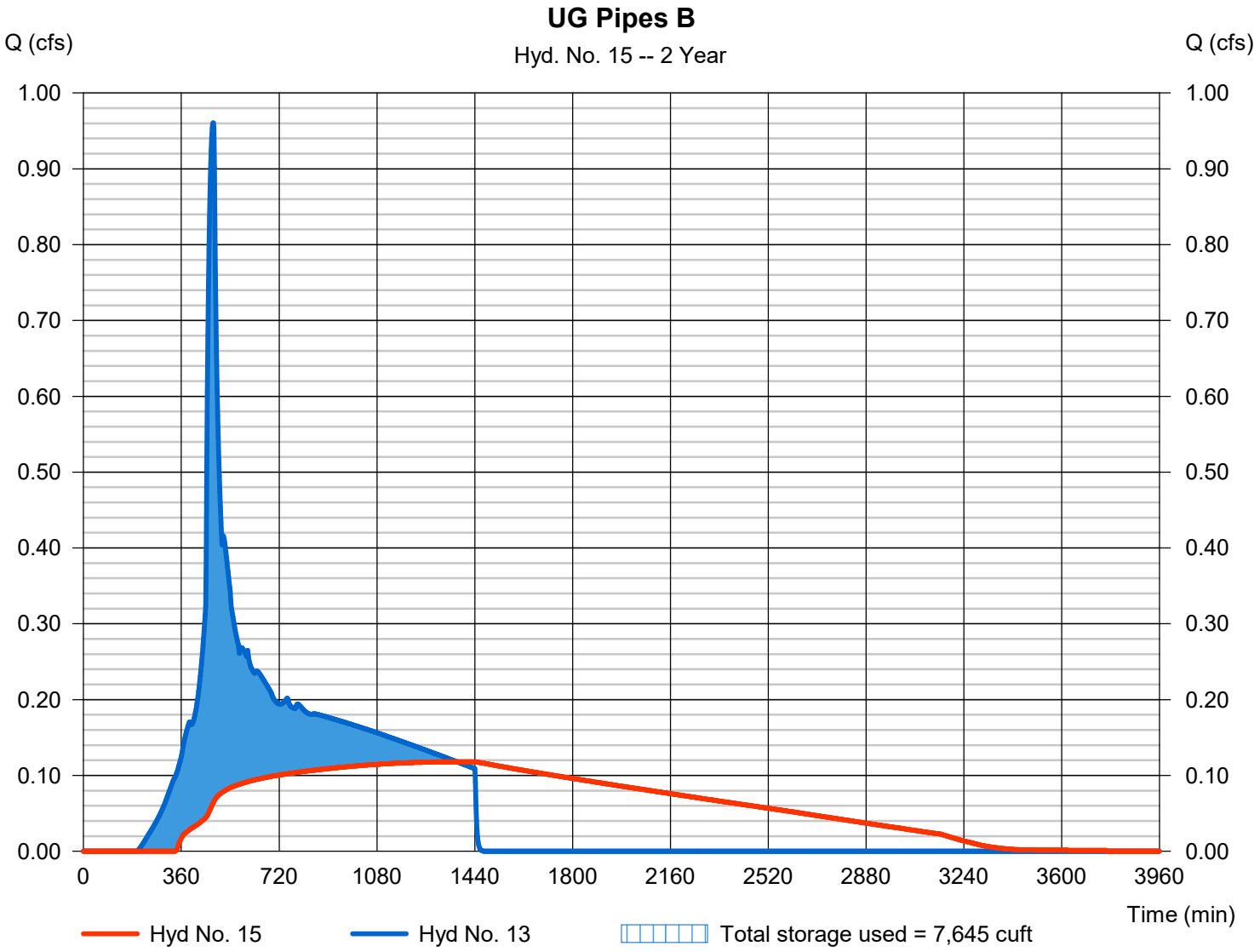
Hydrograph Report

Hyd. No. 15

UG Pipes B

Hydrograph type	=	Reservoir	Peak discharge	=	0.118 cfs
Storm frequency	=	2 yrs	Time to peak	=	1374 min
Time interval	=	2 min	Hyd. volume	=	13,735 cuft
Inflow hyd. No.	=	13 - Basins C & F Post-Developed	Max. Elevation	=	293.70 ft
Reservoir name	=	UG Pipes B	Max. Storage	=	7,645 cuft

Storage Indication method used.



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	SBUH Runoff	0.521	2	480	10,306	------	------	------	Basin B Pre-Developed
2	SBUH Runoff	1.951	2	474	27,357	------	------	------	Basin B Post-Developed
4	Reservoir	0.331	2	796	26,382	2	293.95	14,678	UG Pipes A
6	SBUH Runoff	0.533	2	480	10,138	------	------	------	Basin C Pre-Developed
7	SBUH Runoff	1.322	2	476	18,917	------	------	------	Basin C Post-Developed
9	SBUH Runoff	0.004	2	480	71	------	------	------	Basin F Post-Developed
10	SBUH Runoff	0.012	2	480	247	------	------	------	Basin F Post-Developed
12	Combine	0.537	2	480	10,209	6, 9,	------	------	Basins C & F Pre-Developed
13	Combine	1.334	2	476	19,164	7, 10,	------	------	Basins C & F Post-Developed
15	Reservoir	0.223	2	950	18,795	13	295.57	9,743	UG Pipes B

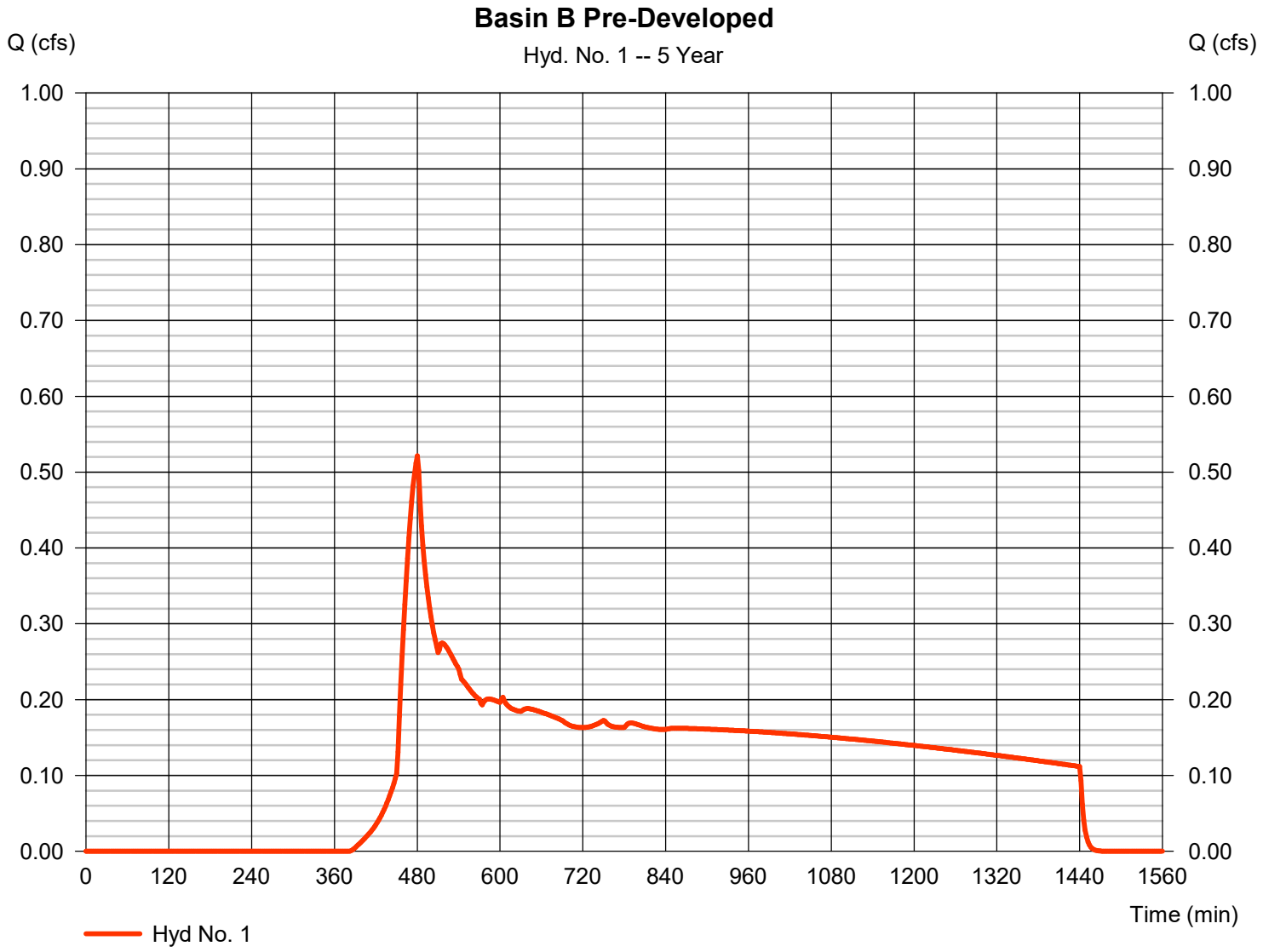
Hydrograph Report

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.521 cfs
Storm frequency	=	5 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	10,306 cuft
Drainage area	=	2.920 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.410 x 75) + (1.510 x 74)] / 2.920



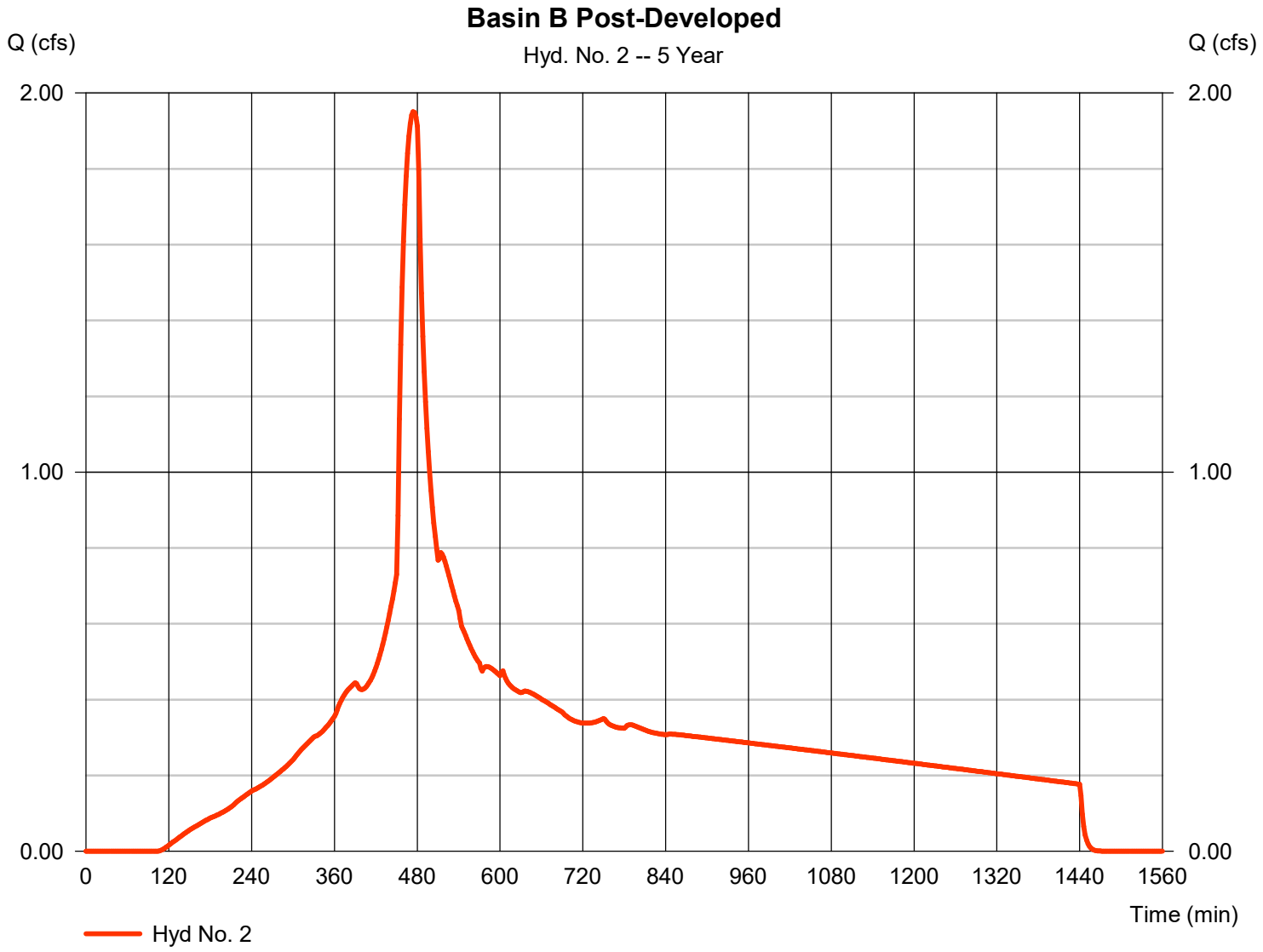
Hydrograph Report

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	1.951 cfs
Storm frequency	=	5 yrs	Time to peak	=	474 min
Time interval	=	2 min	Hyd. volume	=	27,357 cuft
Drainage area	=	3.080 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(2.602 x 98) + (0.478 x 74)] / 3.080



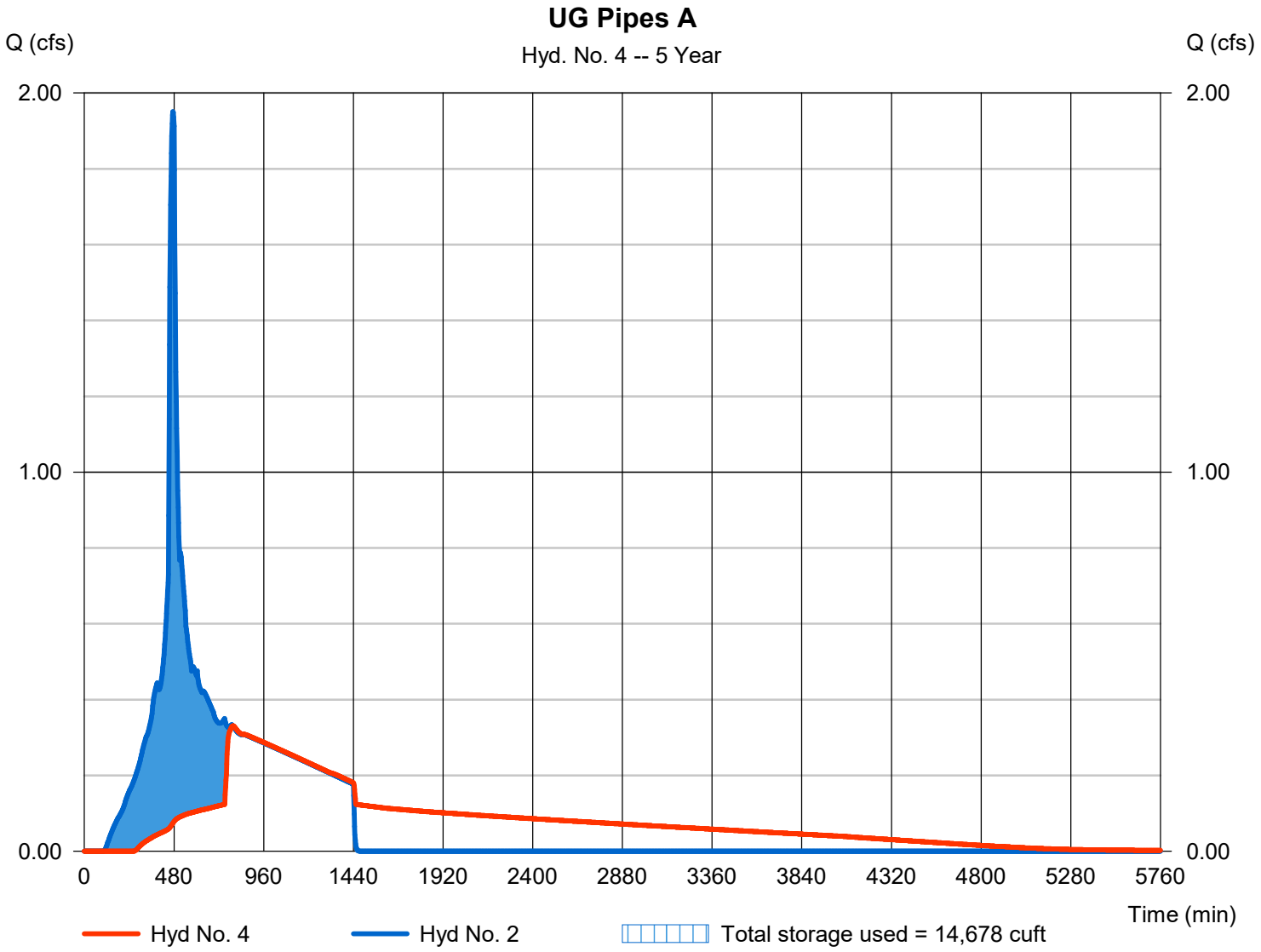
Hydrograph Report

Hyd. No. 4

UG Pipes A

Hydrograph type	=	Reservoir	Peak discharge	=	0.331 cfs
Storm frequency	=	5 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	26,382 cuft
Inflow hyd. No.	=	2 - Basin B Post-Developed	Max. Elevation	=	293.95 ft
Reservoir name	=	UG Pipes A	Max. Storage	=	14,678 cuft

Storage Indication method used.



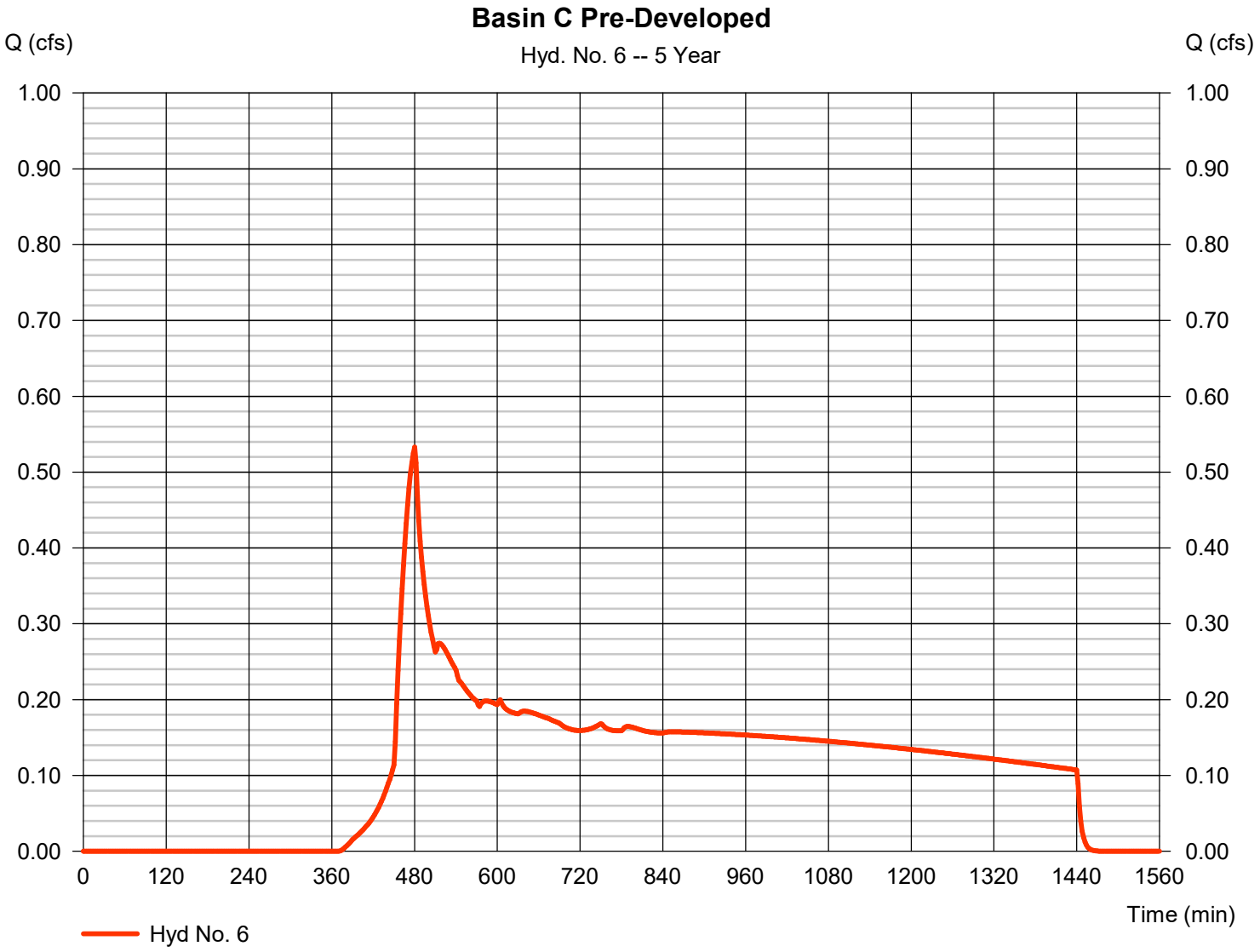
Hydrograph Report

Hyd. No. 6

Basin C Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.533 cfs
Storm frequency	=	5 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	10,138 cuft
Drainage area	=	2.720 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.852 x 75) + (0.868 x 74)] / 2.720



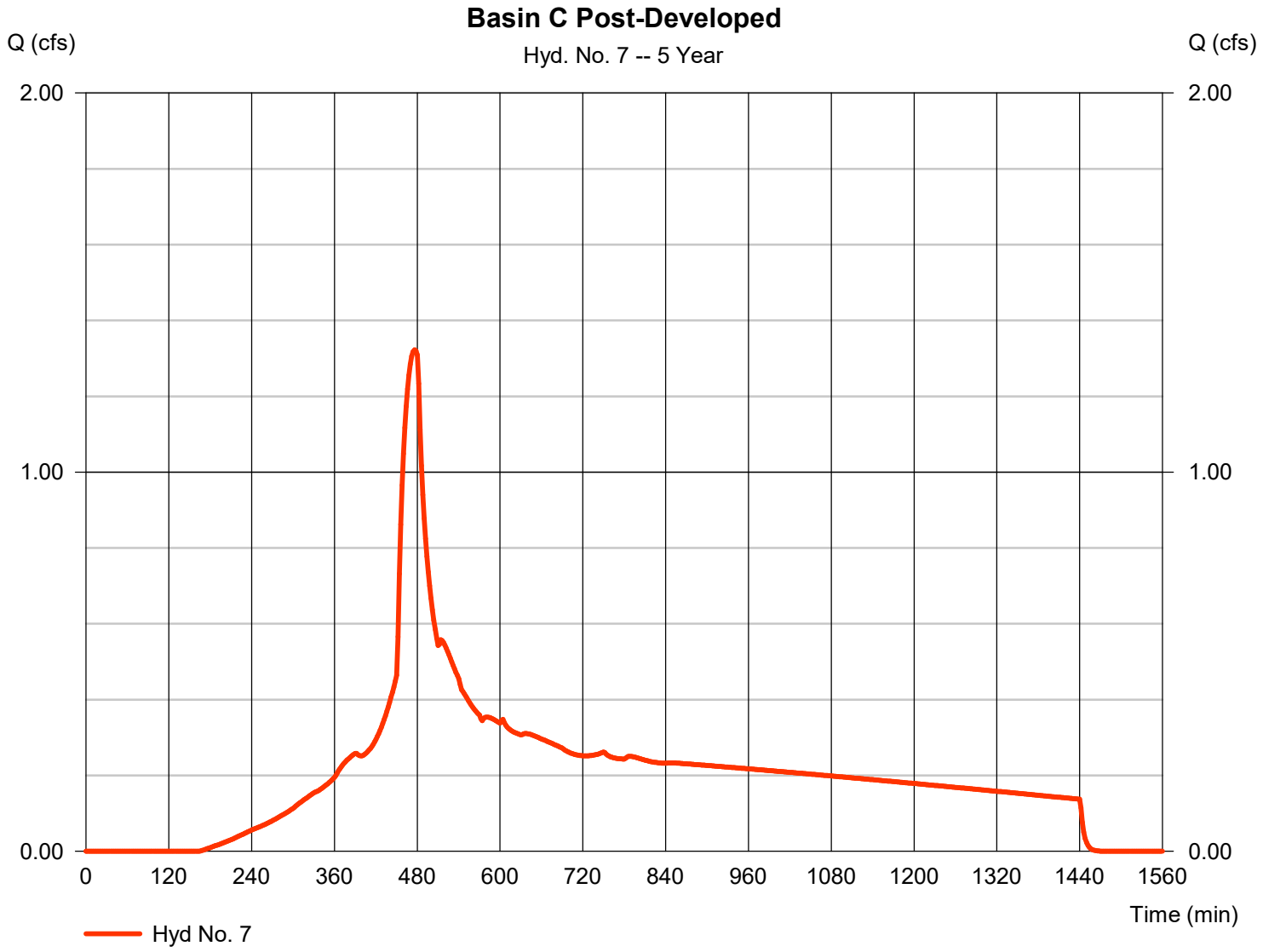
Hydrograph Report

Hyd. No. 7

Basin C Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	1.322 cfs
Storm frequency	=	5 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	18,917 cuft
Drainage area	=	2.510 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.658 x 98) + (0.850 x 74)] / 2.510



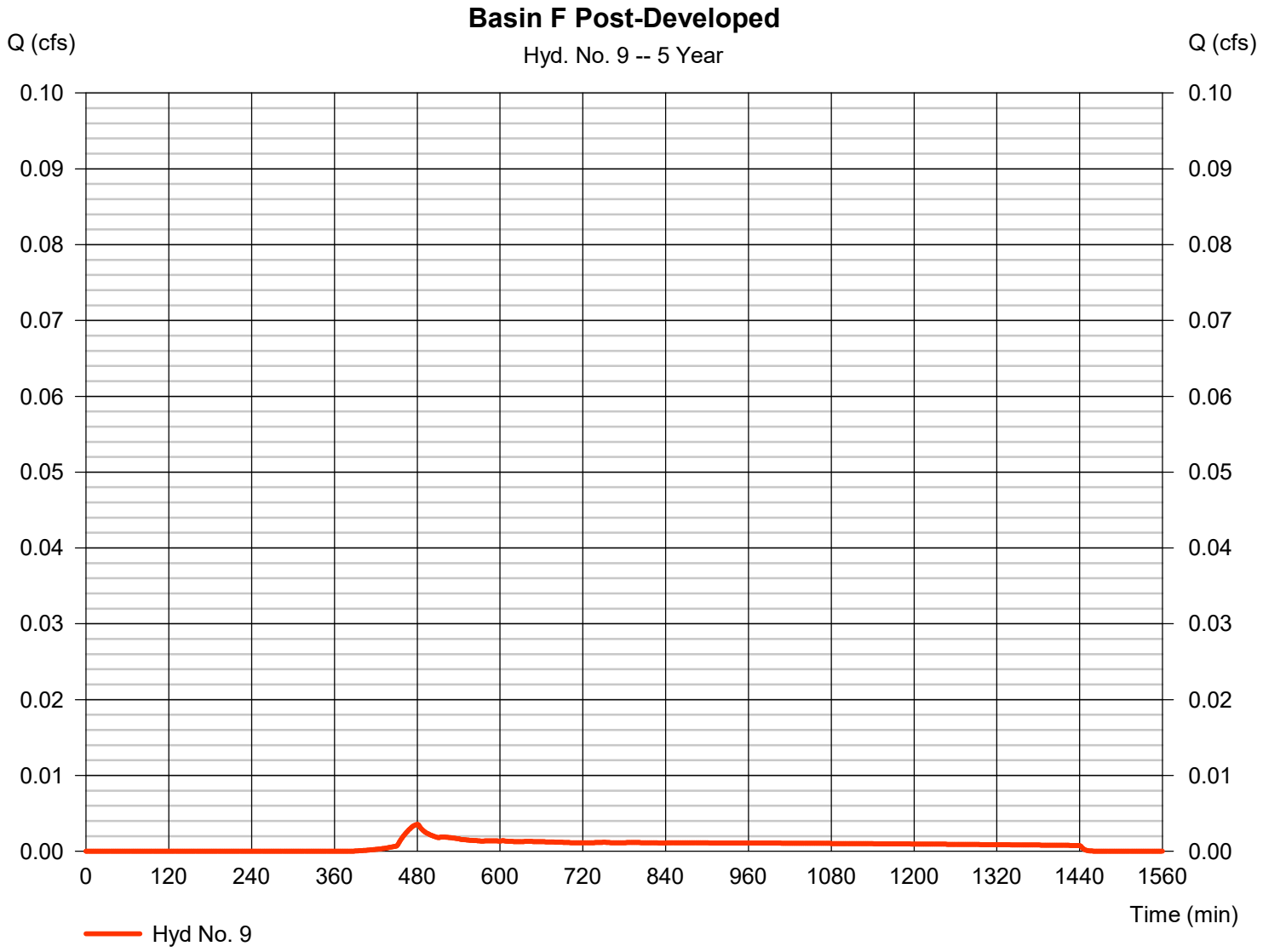
Hydrograph Report

Hyd. No. 9

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.004 cfs
Storm frequency	=	5 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	71 cuft
Drainage area	=	0.020 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.024 x 74)] / 0.020



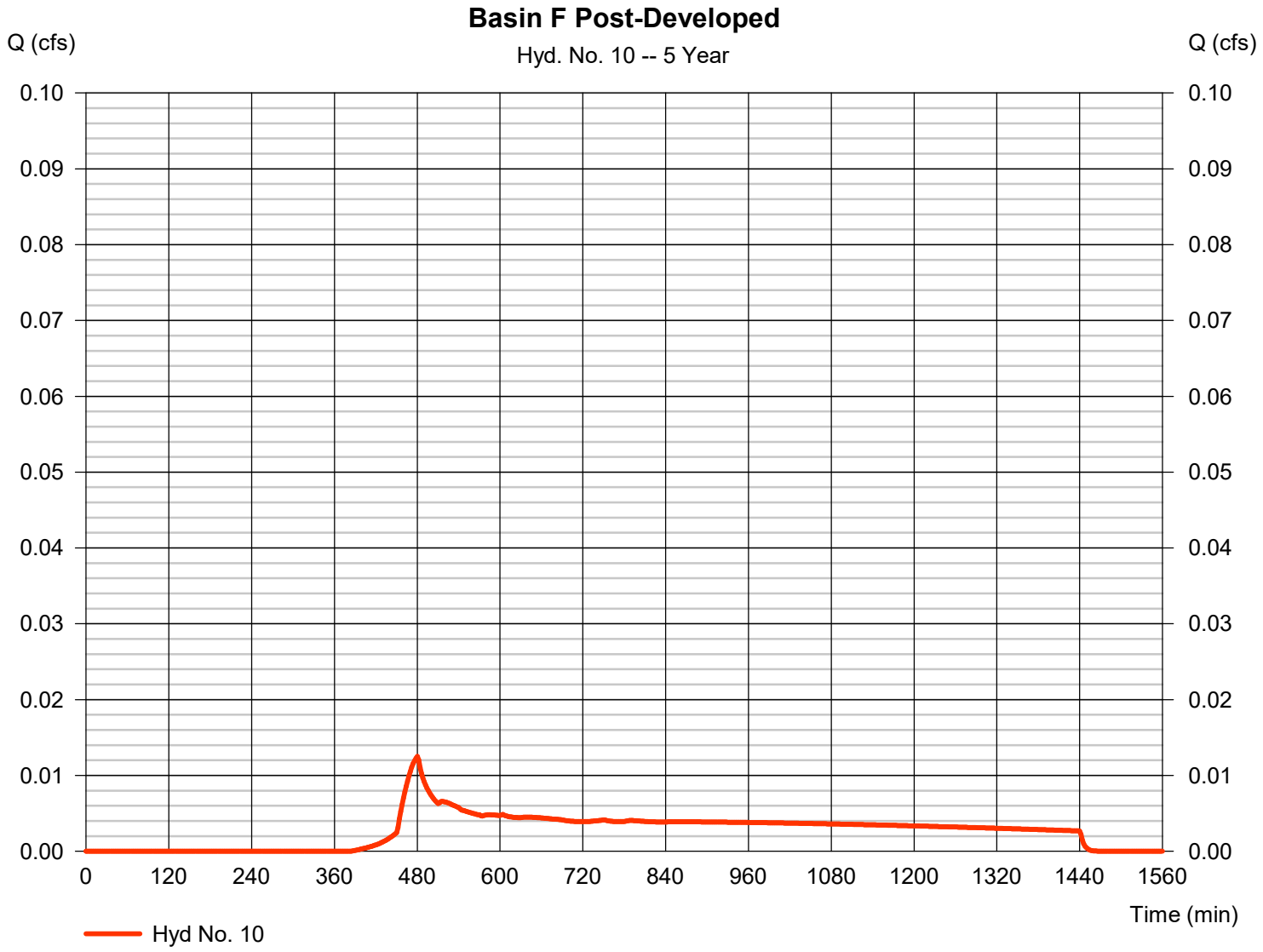
Hydrograph Report

Hyd. No. 10

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.012 cfs
Storm frequency	=	5 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	247 cuft
Drainage area	=	0.070 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.073 x 74)] / 0.070

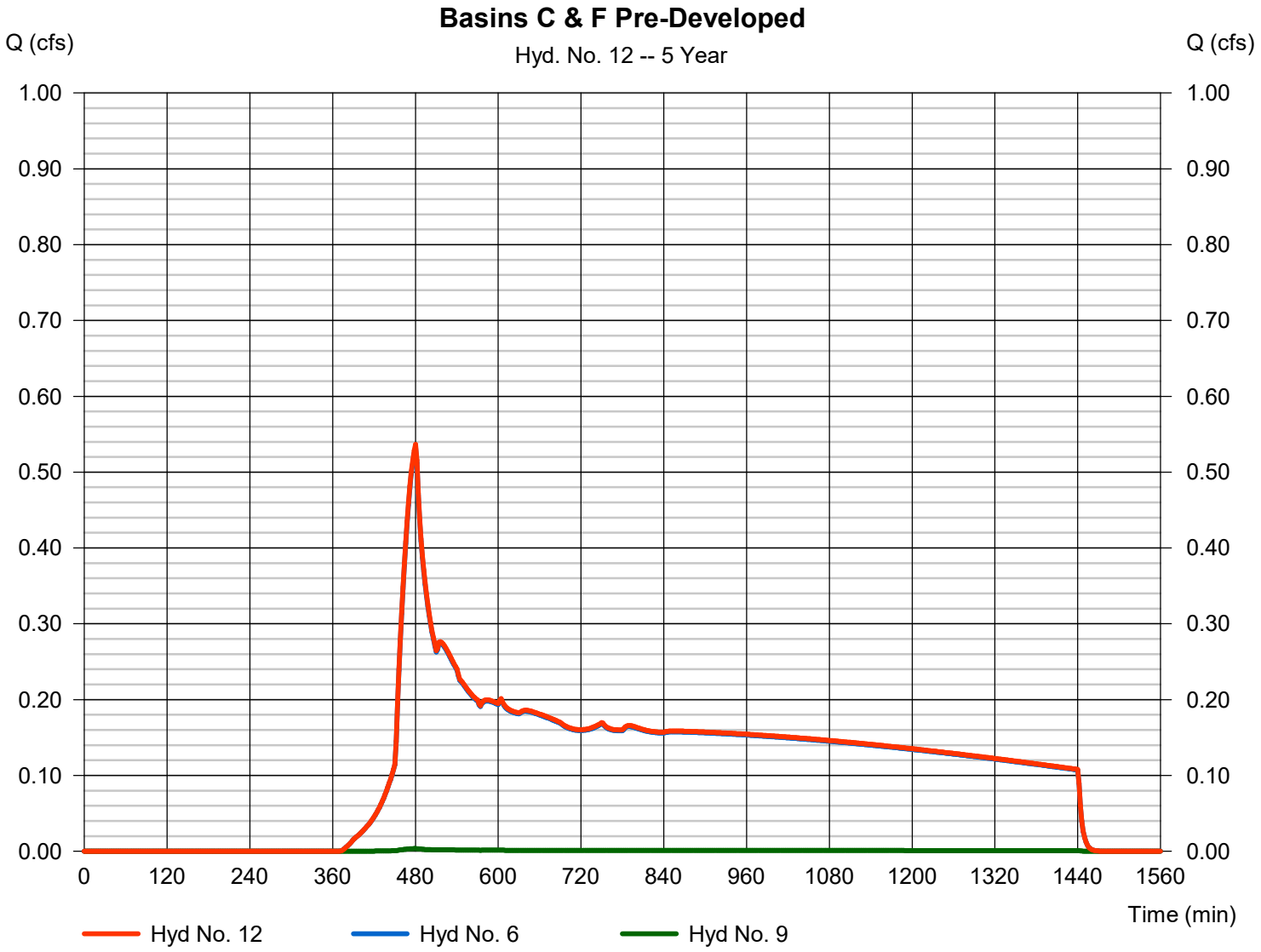


Hydrograph Report

Hyd. No. 12

Basins C & F Pre-Developed

Hydrograph type	= Combine	Peak discharge	= 0.537 cfs
Storm frequency	= 5 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 10,209 cuft
Inflow hyds.	= 6, 9	Contrib. drain. area	= 2.740 ac

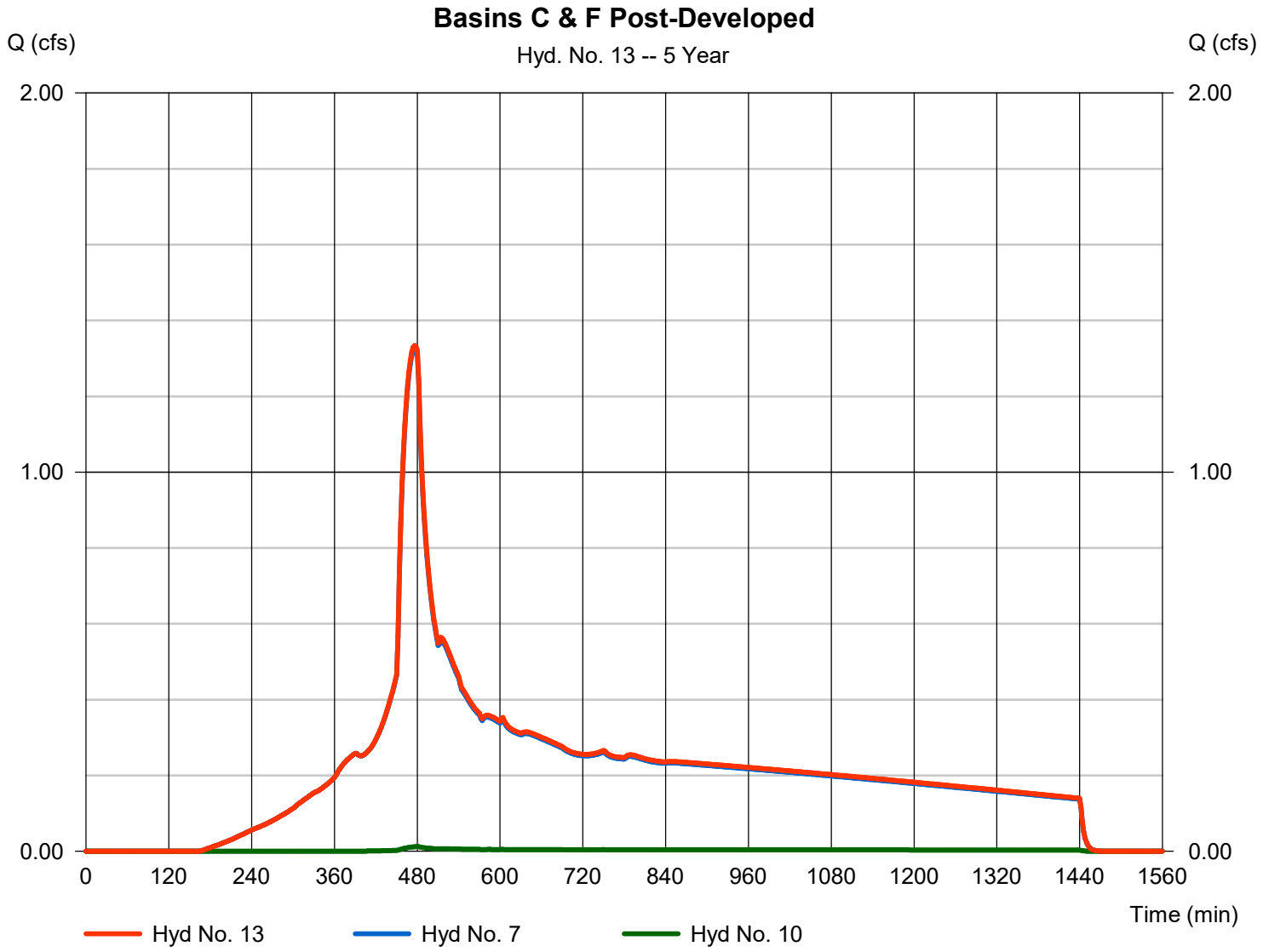


Hydrograph Report

Hyd. No. 13

Basins C & F Post-Developed

Hydrograph type	=	Combine	Peak discharge	=	1.334 cfs
Storm frequency	=	5 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	19,164 cuft
Inflow hyds.	=	7, 10	Contrib. drain. area	=	2.580 ac



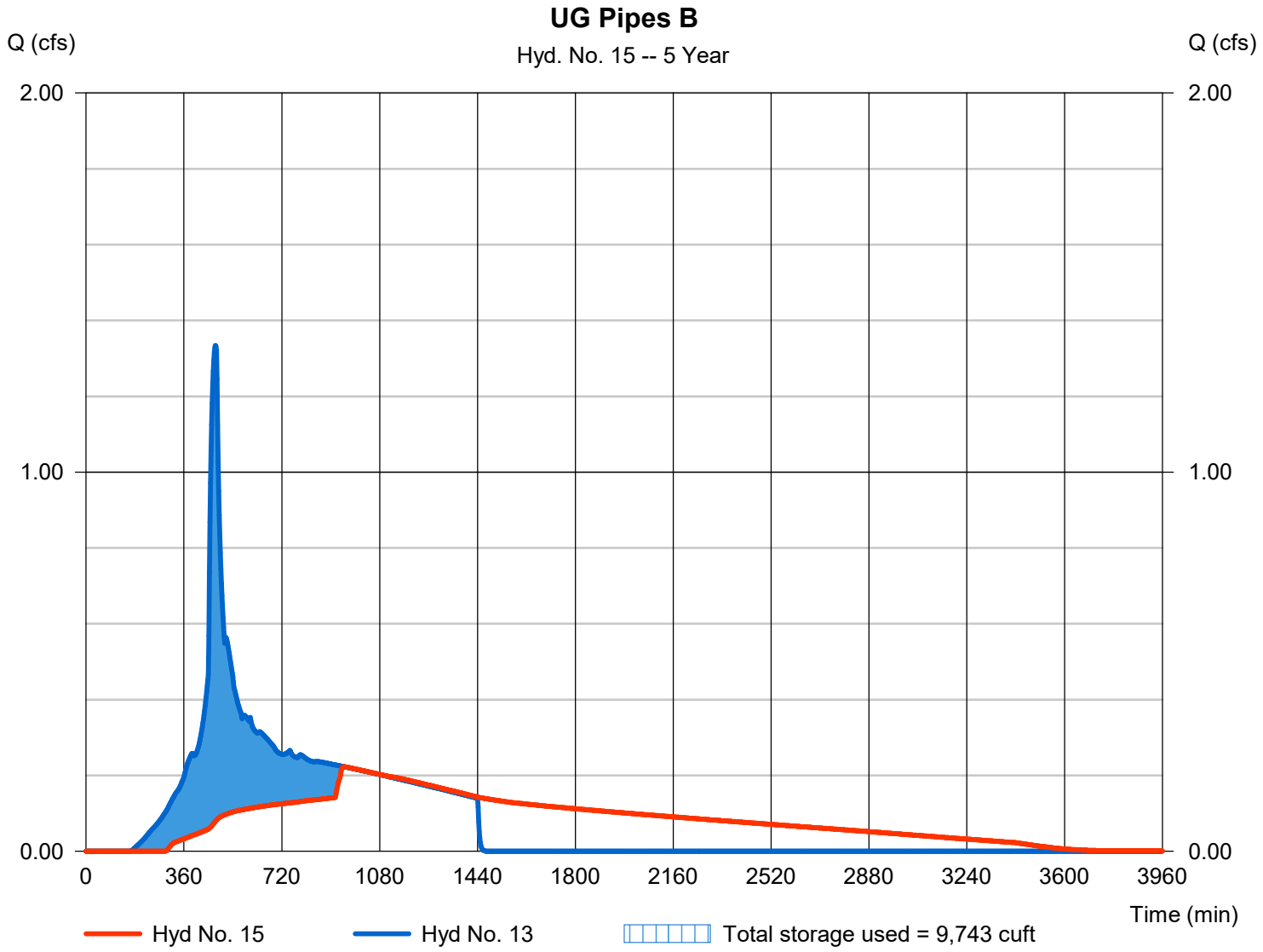
Hydrograph Report

Hyd. No. 15

UG Pipes B

Hydrograph type	=	Reservoir	Peak discharge	=	0.223 cfs
Storm frequency	=	5 yrs	Time to peak	=	950 min
Time interval	=	2 min	Hyd. volume	=	18,795 cuft
Inflow hyd. No.	=	13 - Basins C & F Post-Developed	Max. Elevation	=	295.57 ft
Reservoir name	=	UG Pipes B	Max. Storage	=	9,743 cuft

Storage Indication method used.



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	SBUH Runoff	0.695	2	480	12,778	------	------	------	Basin B Pre-Developed
2	SBUH Runoff	2.222	2	474	31,159	------	------	------	Basin B Post-Developed
4	Reservoir	0.462	2	652	30,184	2	293.98	14,728	UG Pipes A
6	SBUH Runoff	0.700	2	480	12,505	------	------	------	Basin C Pre-Developed
7	SBUH Runoff	1.541	2	476	21,878	------	------	------	Basin C Post-Developed
9	SBUH Runoff	0.005	2	480	88	------	------	------	Basin F Post-Developed
10	SBUH Runoff	0.017	2	480	306	------	------	------	Basin F Post-Developed
12	Combine	0.705	2	480	12,593	6, 9,	------	------	Basins C & F Pre-Developed
13	Combine	1.557	2	476	22,184	7, 10,	------	------	Basins C & F Post-Developed
15	Reservoir	0.301	2	752	21,815	13	295.59	9,760	UG Pipes B

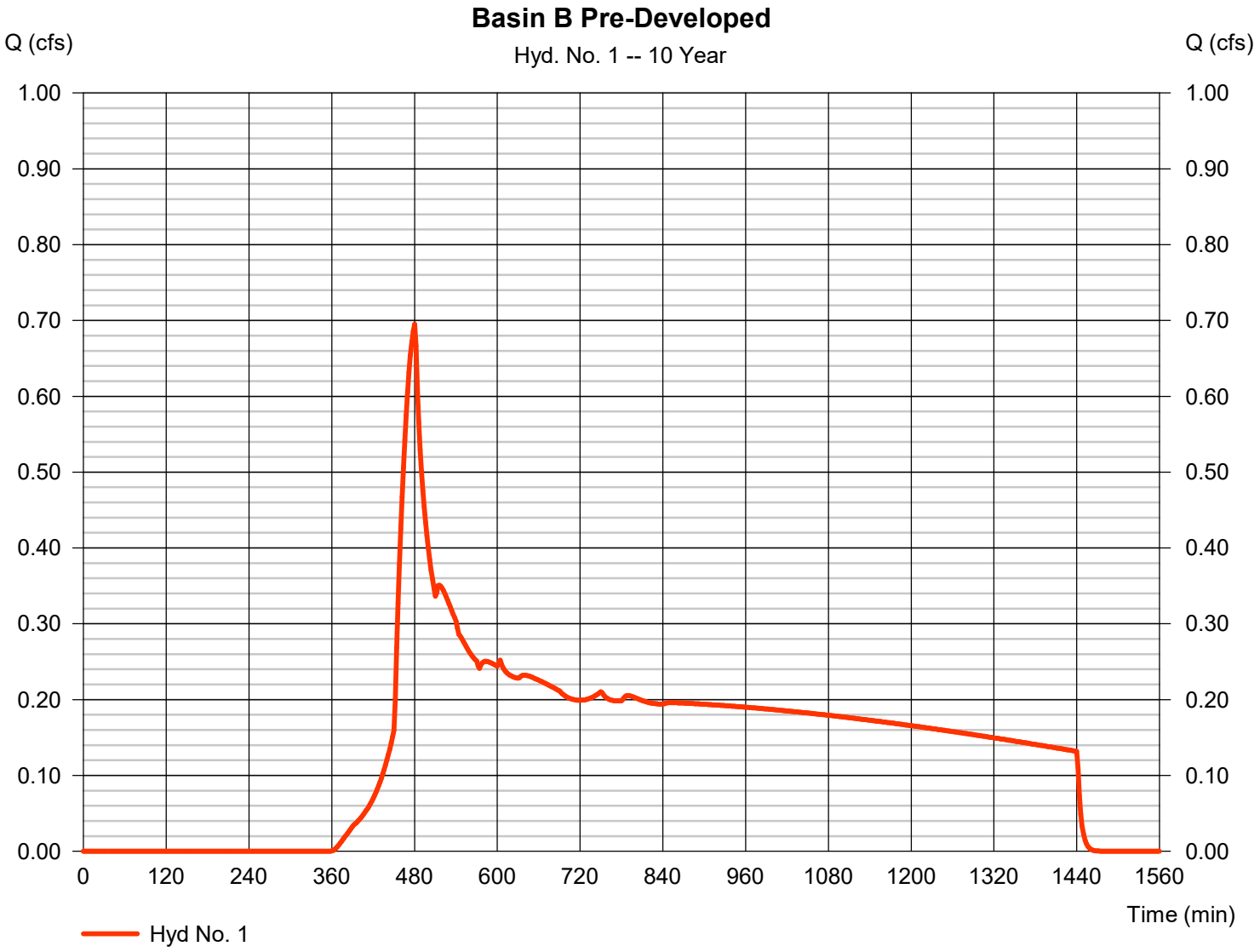
Hydrograph Report

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.695 cfs
Storm frequency	=	10 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	12,778 cuft
Drainage area	=	2.920 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.410 x 75) + (1.510 x 74)] / 2.920



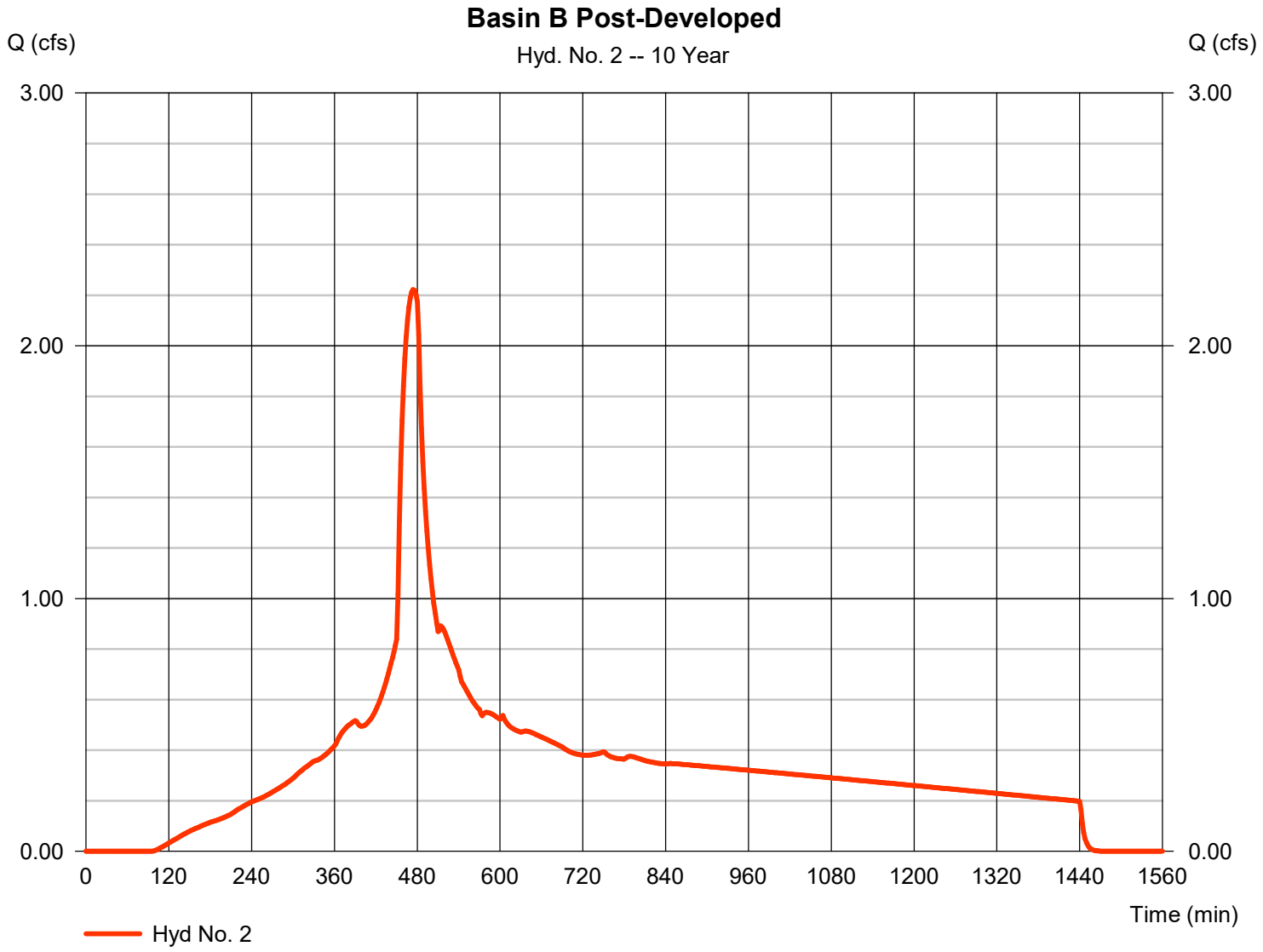
Hydrograph Report

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	2.222 cfs
Storm frequency	=	10 yrs	Time to peak	=	474 min
Time interval	=	2 min	Hyd. volume	=	31,159 cuft
Drainage area	=	3.080 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(2.602 x 98) + (0.478 x 74)] / 3.080



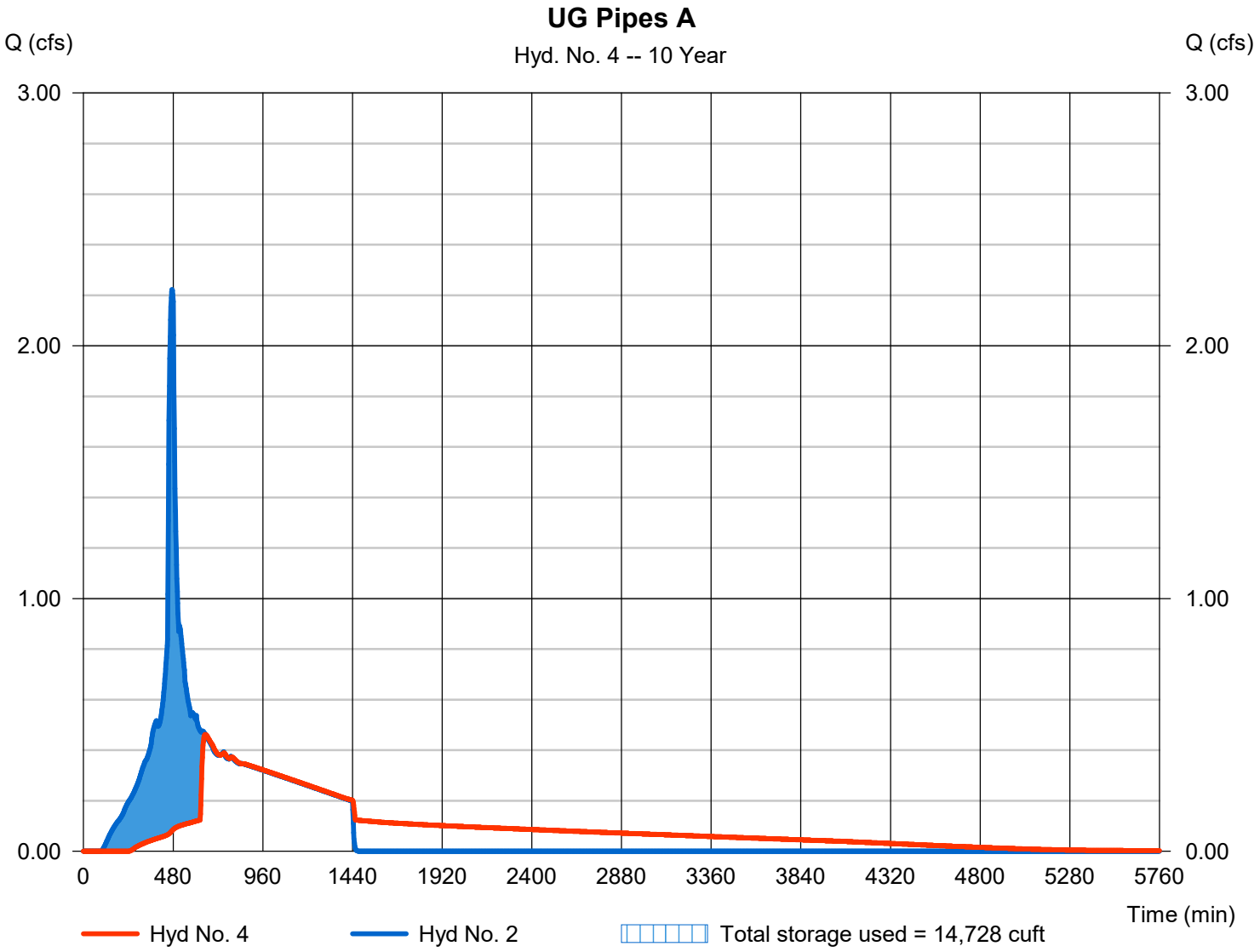
Hydrograph Report

Hyd. No. 4

UG Pipes A

Hydrograph type	=	Reservoir	Peak discharge	=	0.462 cfs
Storm frequency	=	10 yrs	Time to peak	=	652 min
Time interval	=	2 min	Hyd. volume	=	30,184 cuft
Inflow hyd. No.	=	2 - Basin B Post-Developed	Max. Elevation	=	293.98 ft
Reservoir name	=	UG Pipes A	Max. Storage	=	14,728 cuft

Storage Indication method used.



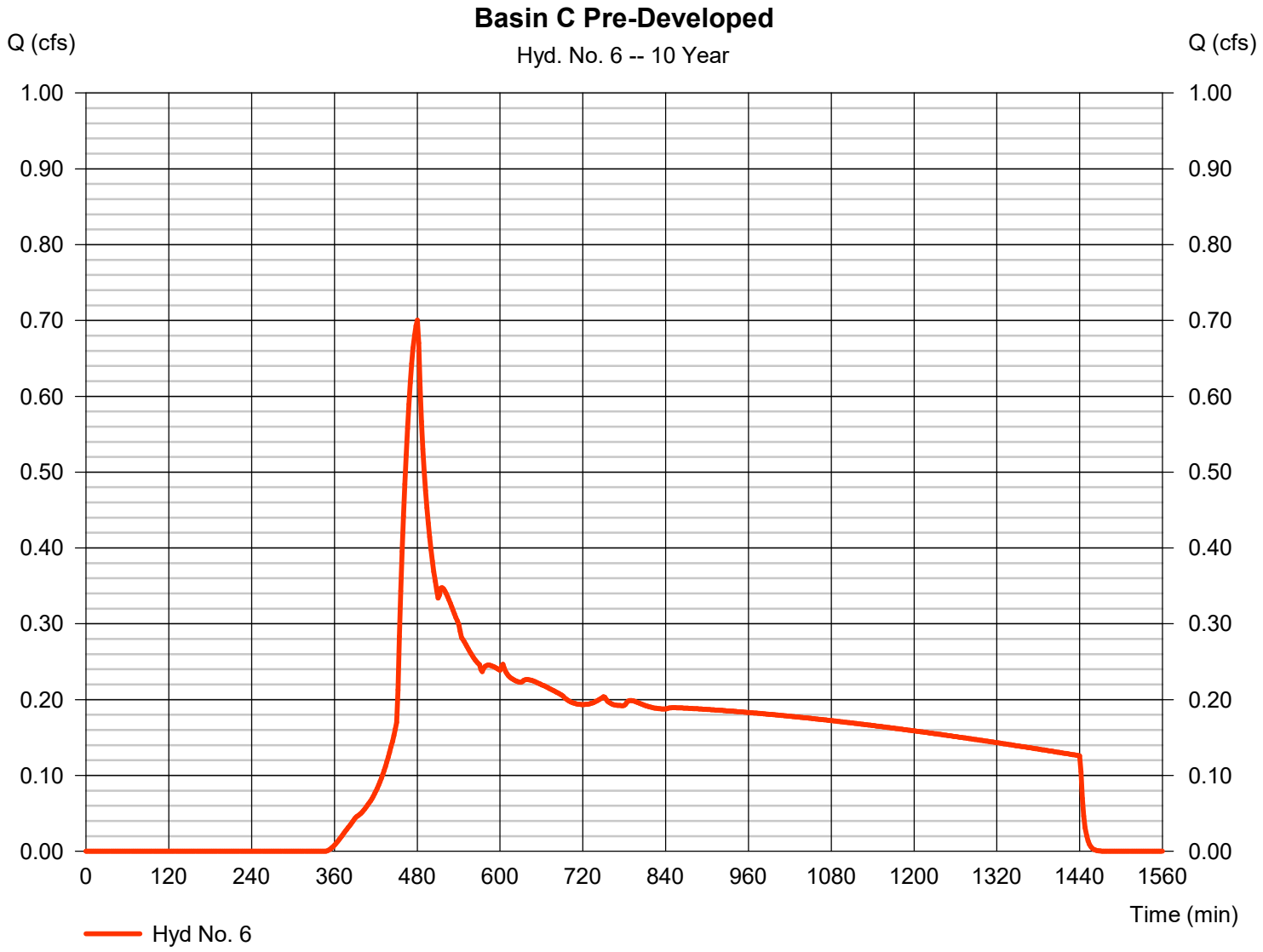
Hydrograph Report

Hyd. No. 6

Basin C Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.700 cfs
Storm frequency	=	10 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	12,505 cuft
Drainage area	=	2.720 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.852 x 75) + (0.868 x 74)] / 2.720



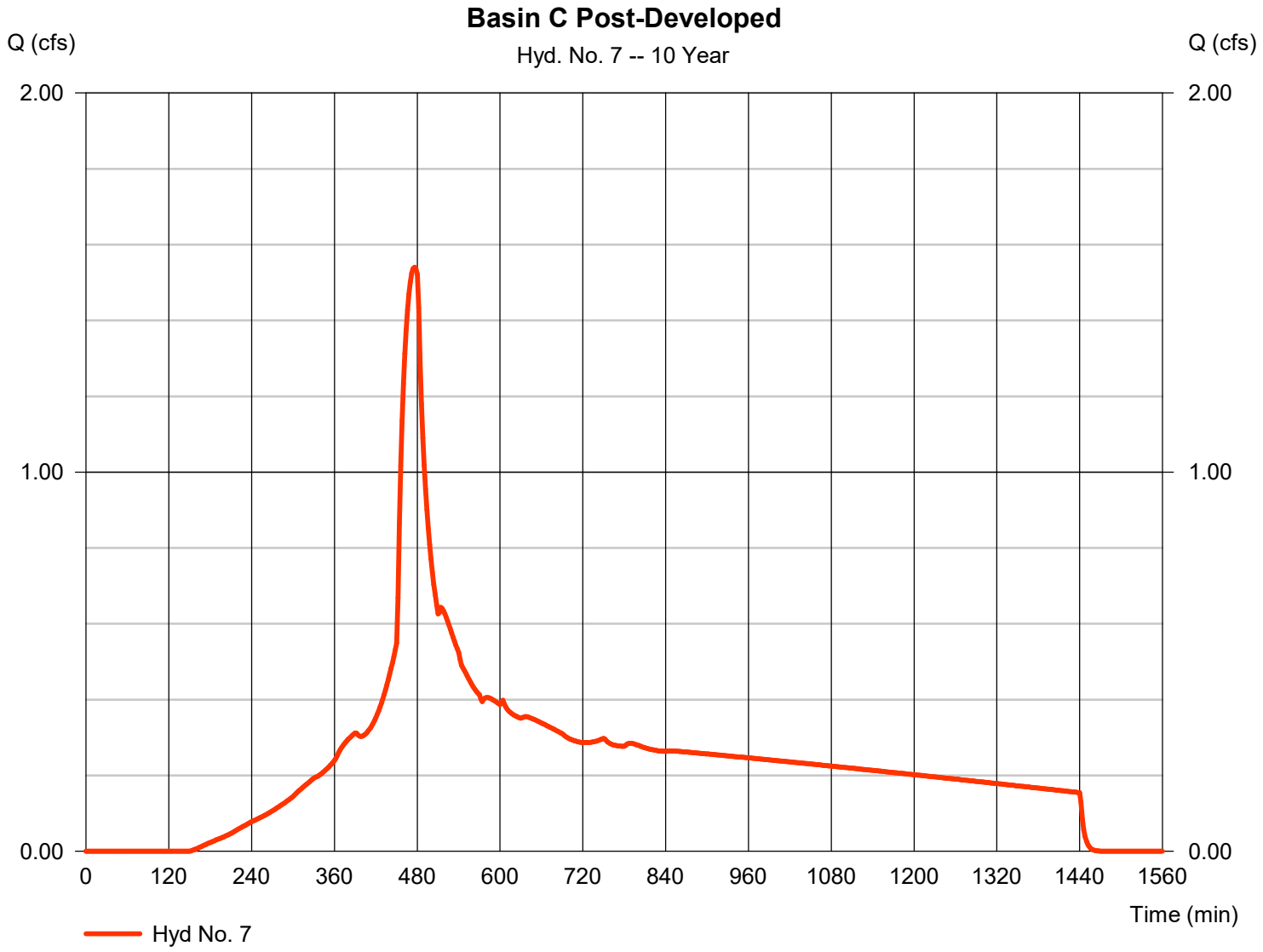
Hydrograph Report

Hyd. No. 7

Basin C Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	1.541 cfs
Storm frequency	=	10 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	21,878 cuft
Drainage area	=	2.510 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.658 x 98) + (0.850 x 74)] / 2.510



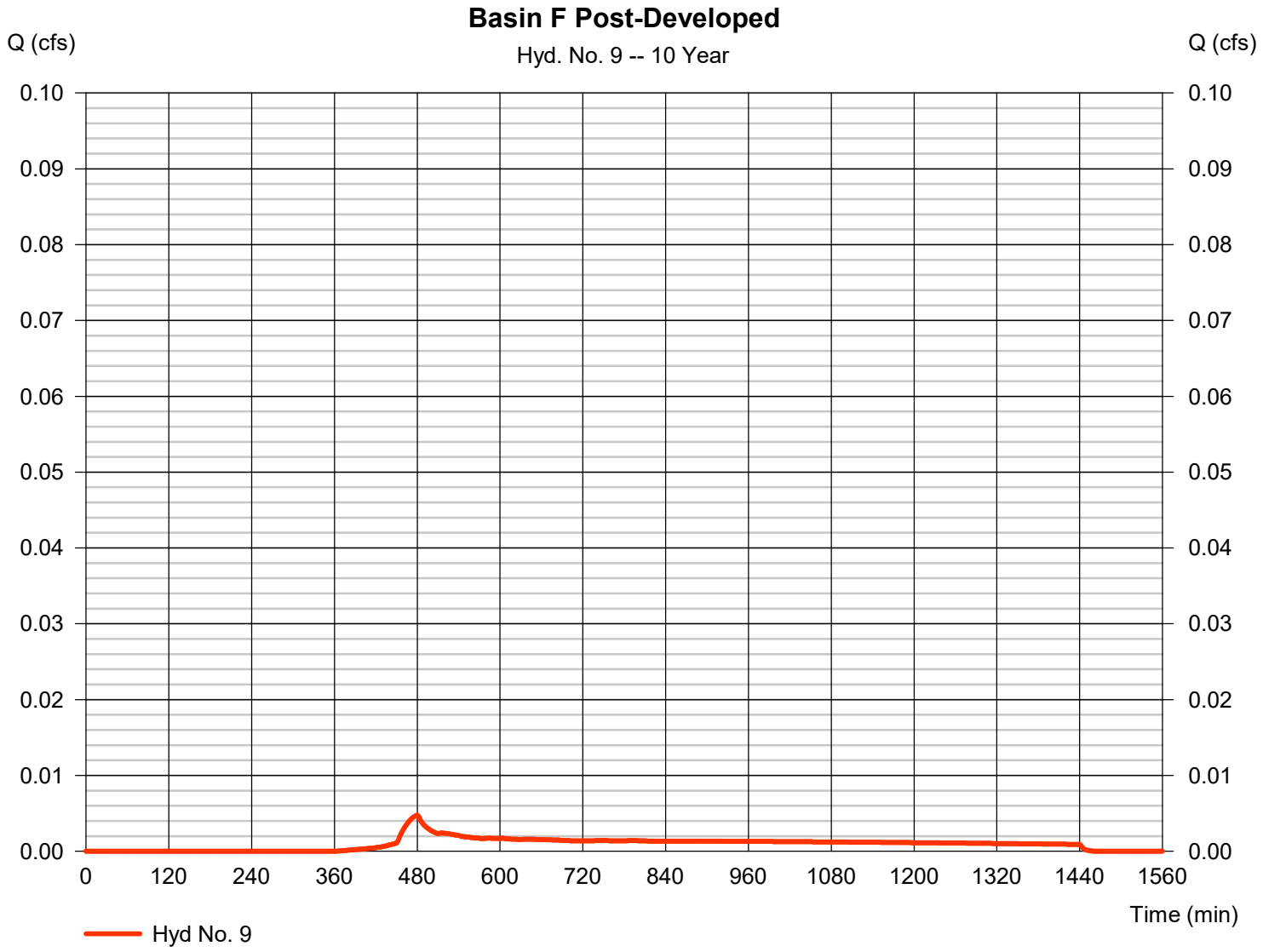
Hydrograph Report

Hyd. No. 9

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.005 cfs
Storm frequency	=	10 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	88 cuft
Drainage area	=	0.020 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.024 x 74)] / 0.020



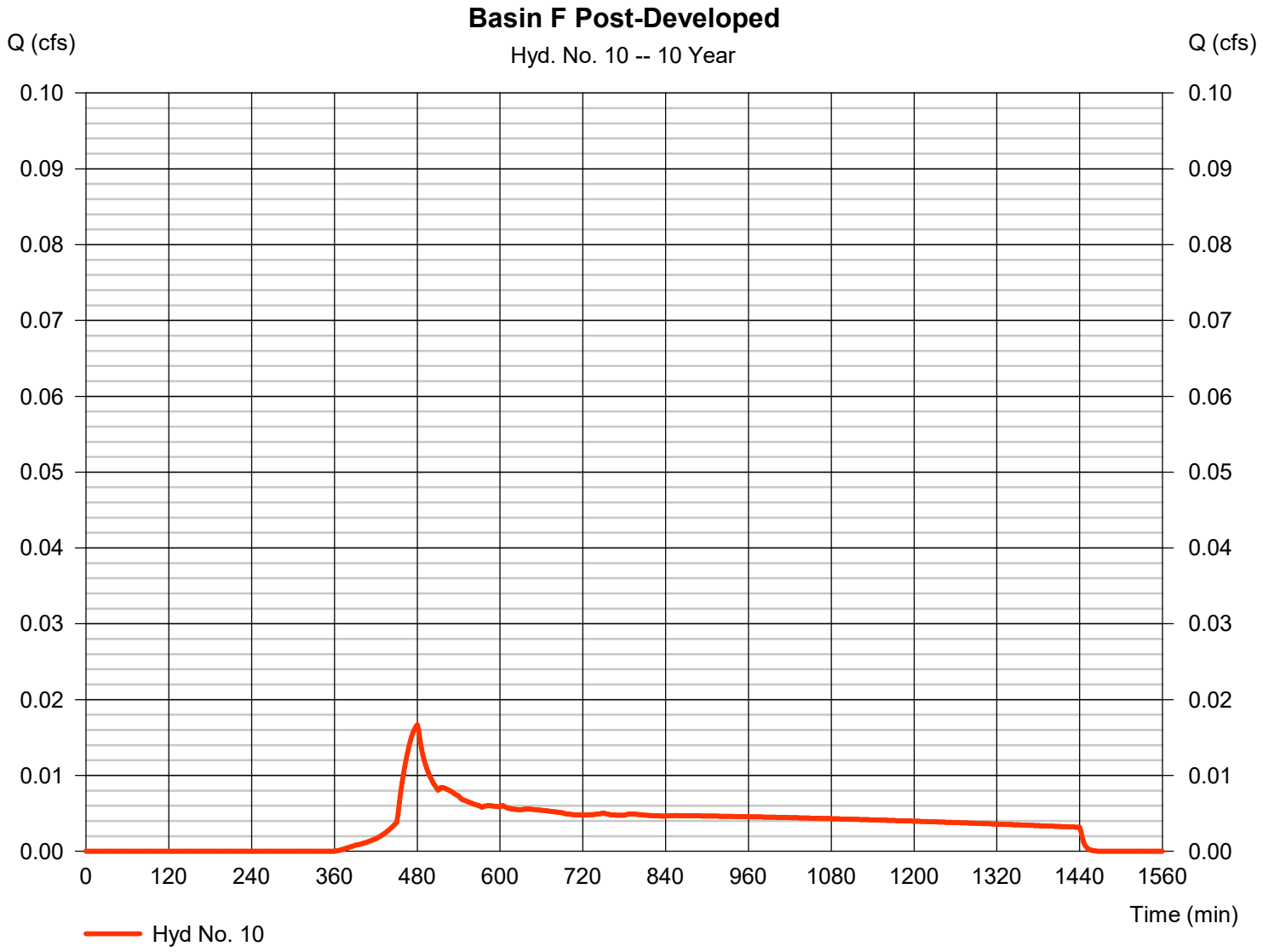
Hydrograph Report

Hyd. No. 10

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.017 cfs
Storm frequency	=	10 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	306 cuft
Drainage area	=	0.070 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.073 x 74)] / 0.070

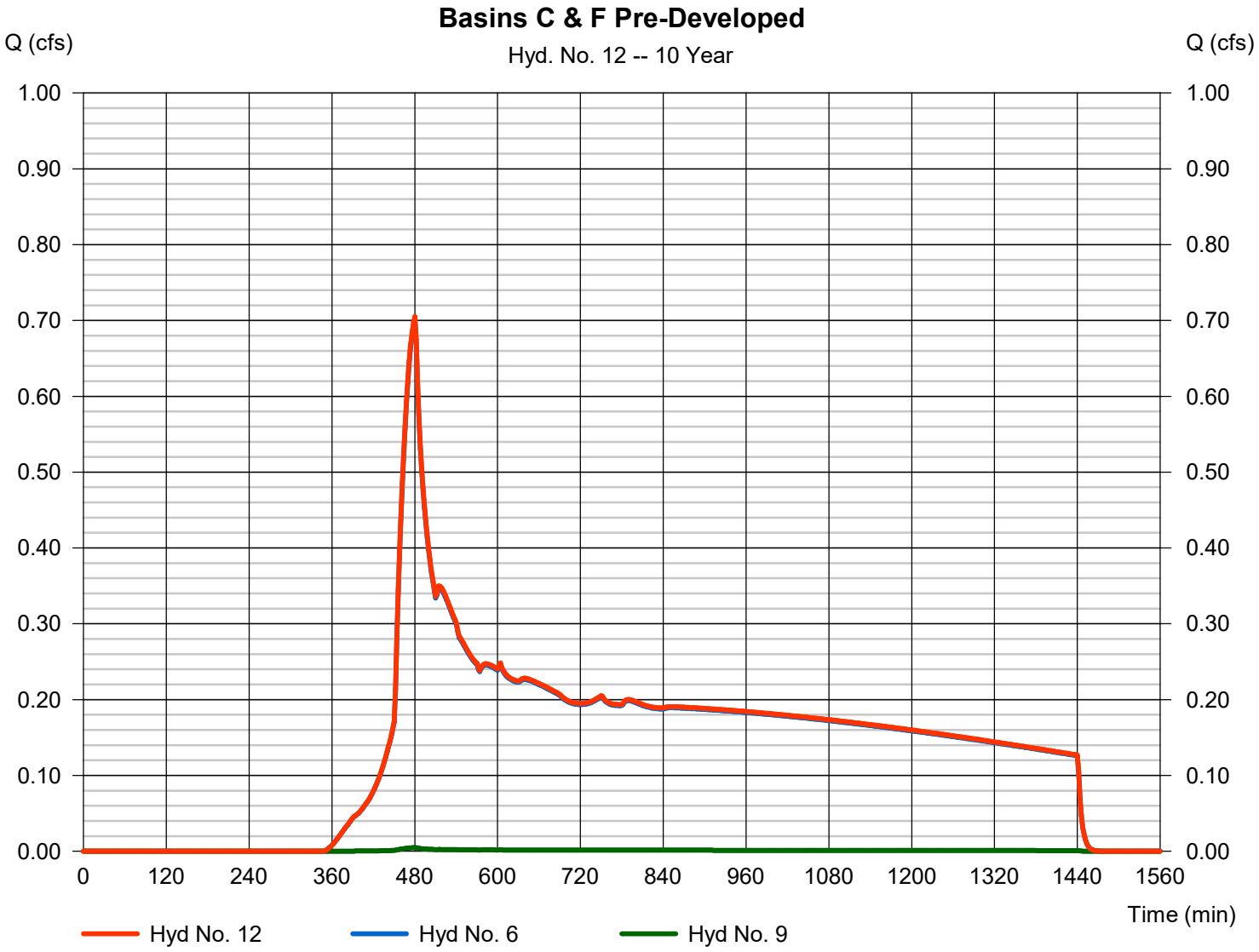


Hydrograph Report

Hyd. No. 12

Basins C & F Pre-Developed

Hydrograph type	= Combine	Peak discharge	= 0.705 cfs
Storm frequency	= 10 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 12,593 cuft
Inflow hyds.	= 6, 9	Contrib. drain. area	= 2.740 ac

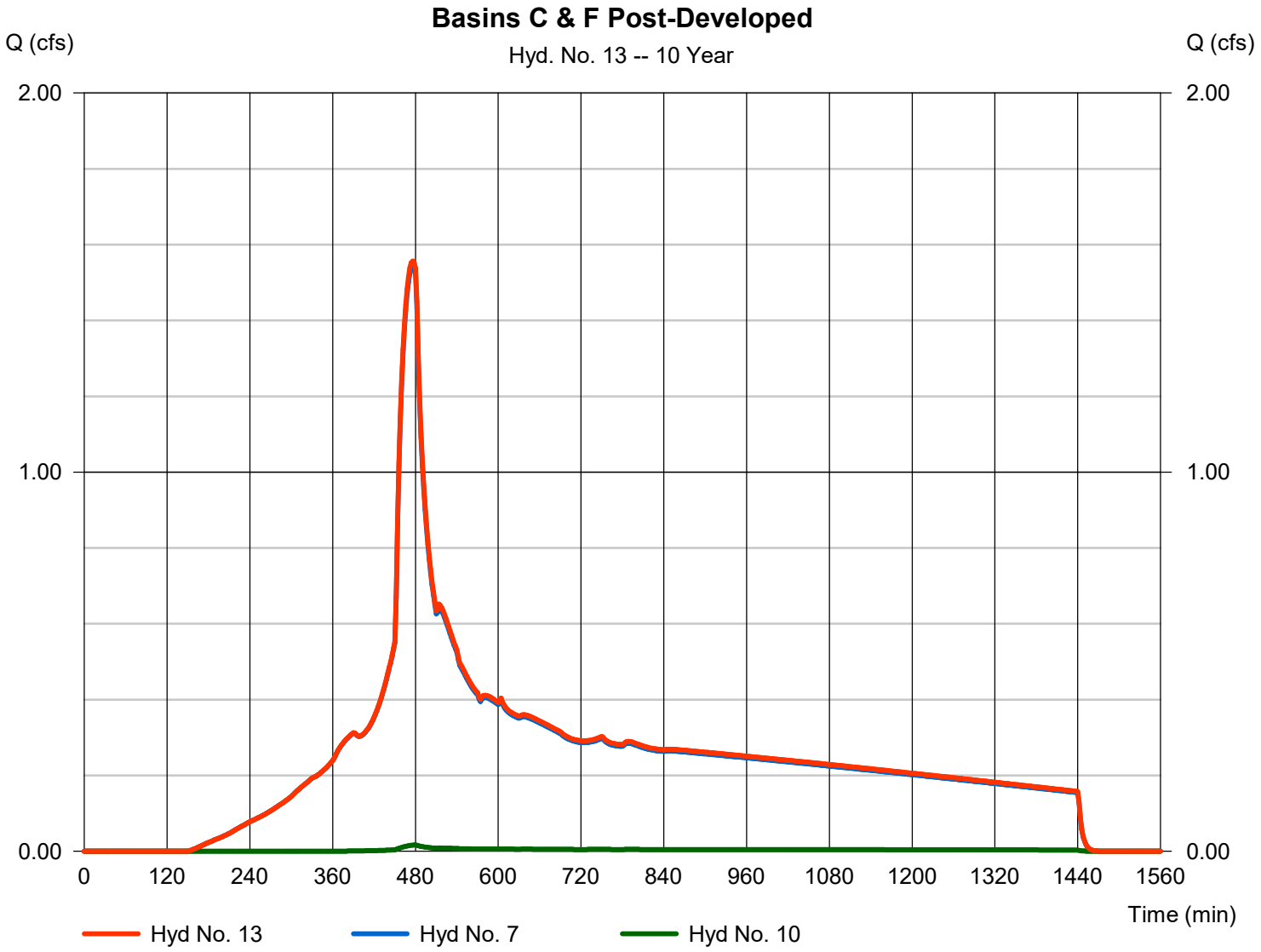


Hydrograph Report

Hyd. No. 13

Basins C & F Post-Developed

Hydrograph type	=	Combine	Peak discharge	=	1.557 cfs
Storm frequency	=	10 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	22,184 cuft
Inflow hyds.	=	7, 10	Contrib. drain. area	=	2.580 ac



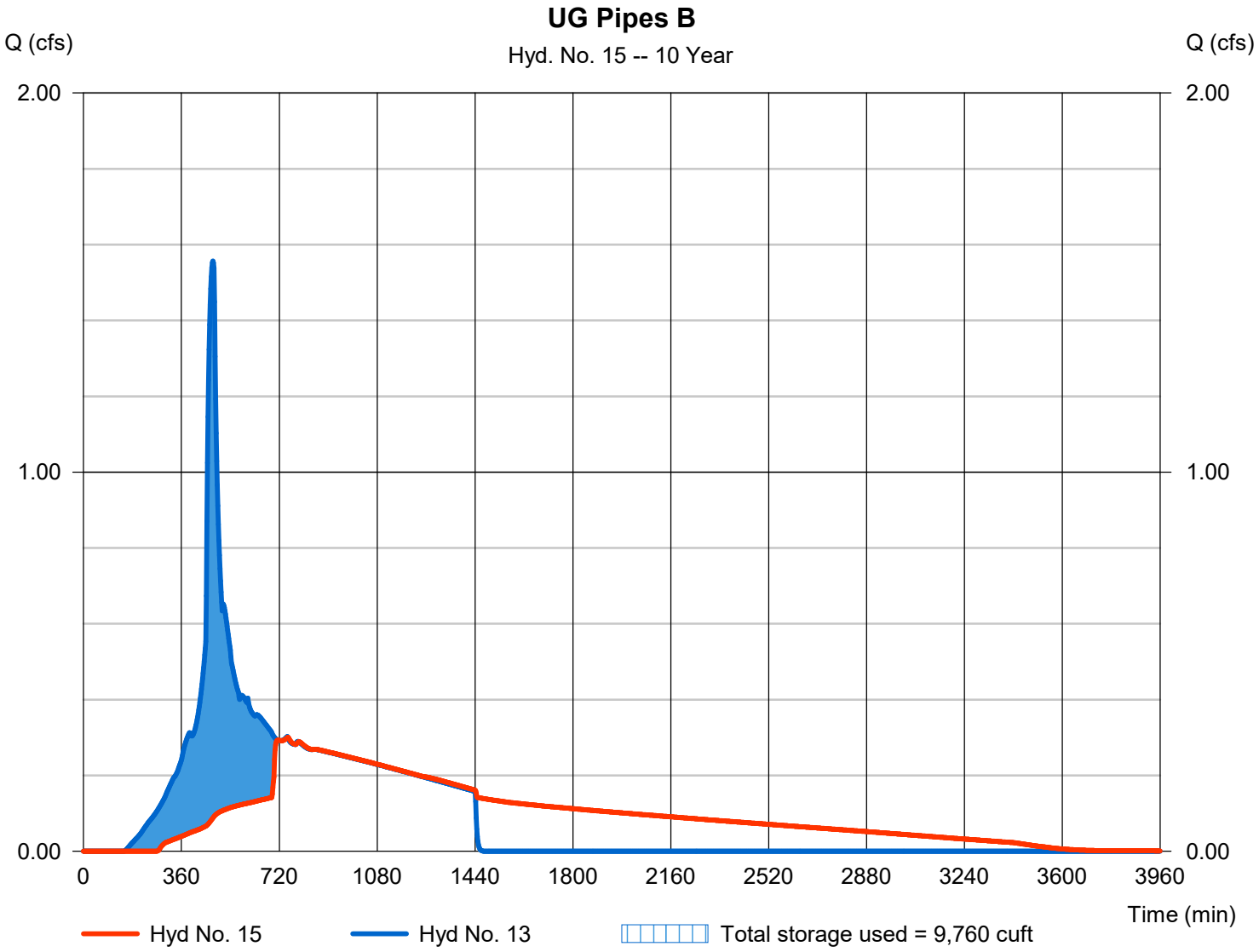
Hydrograph Report

Hyd. No. 15

UG Pipes B

Hydrograph type	=	Reservoir	Peak discharge	=	0.301 cfs
Storm frequency	=	10 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	21,815 cuft
Inflow hyd. No.	=	13 - Basins C & F Post-Developed	Max. Elevation	=	295.59 ft
Reservoir name	=	UG Pipes B	Max. Storage	=	9,760 cuft

Storage Indication method used.



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	SBUH Runoff	0.935	2	480	16,147	------	------	------	Basin B Pre-Developed
2	SBUH Runoff	2.570	2	474	36,073	------	------	------	Basin B Post-Developed
4	Reservoir	0.687	2	560	35,098	2	294.02	14,795	UG Pipes A
6	SBUH Runoff	0.930	2	480	15,719	------	------	------	Basin C Pre-Developed
7	SBUH Runoff	1.823	2	476	25,735	------	------	------	Basin C Post-Developed
9	SBUH Runoff	0.006	2	480	111	------	------	------	Basin F Post-Developed
10	SBUH Runoff	0.022	2	480	387	------	------	------	Basin F Post-Developed
12	Combine	0.937	2	480	15,830	6, 9,	------	------	Basins C & F Pre-Developed
13	Combine	1.845	2	476	26,122	7, 10,	------	------	Basins C & F Post-Developed
15	Reservoir	0.474	2	588	25,753	13	295.63	9,796	UG Pipes B

Hydrograph Report

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.935 cfs
Storm frequency	=	25 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	16,147 cuft
Drainage area	=	2.920 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.410 x 75) + (1.510 x 74)] / 2.920

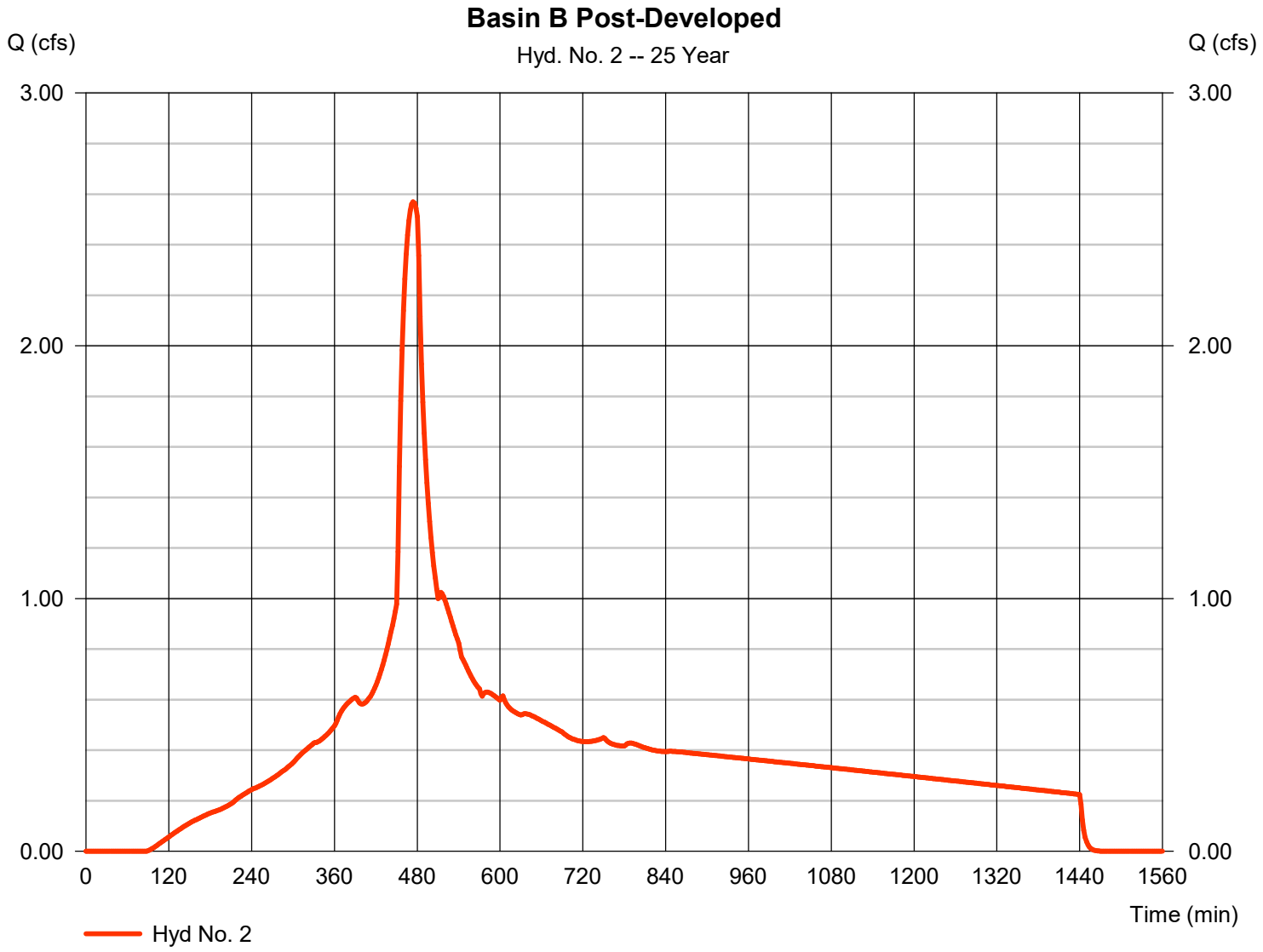
Hydrograph Report

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	2.570 cfs
Storm frequency	=	25 yrs	Time to peak	=	474 min
Time interval	=	2 min	Hyd. volume	=	36,073 cuft
Drainage area	=	3.080 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(2.602 x 98) + (0.478 x 74)] / 3.080



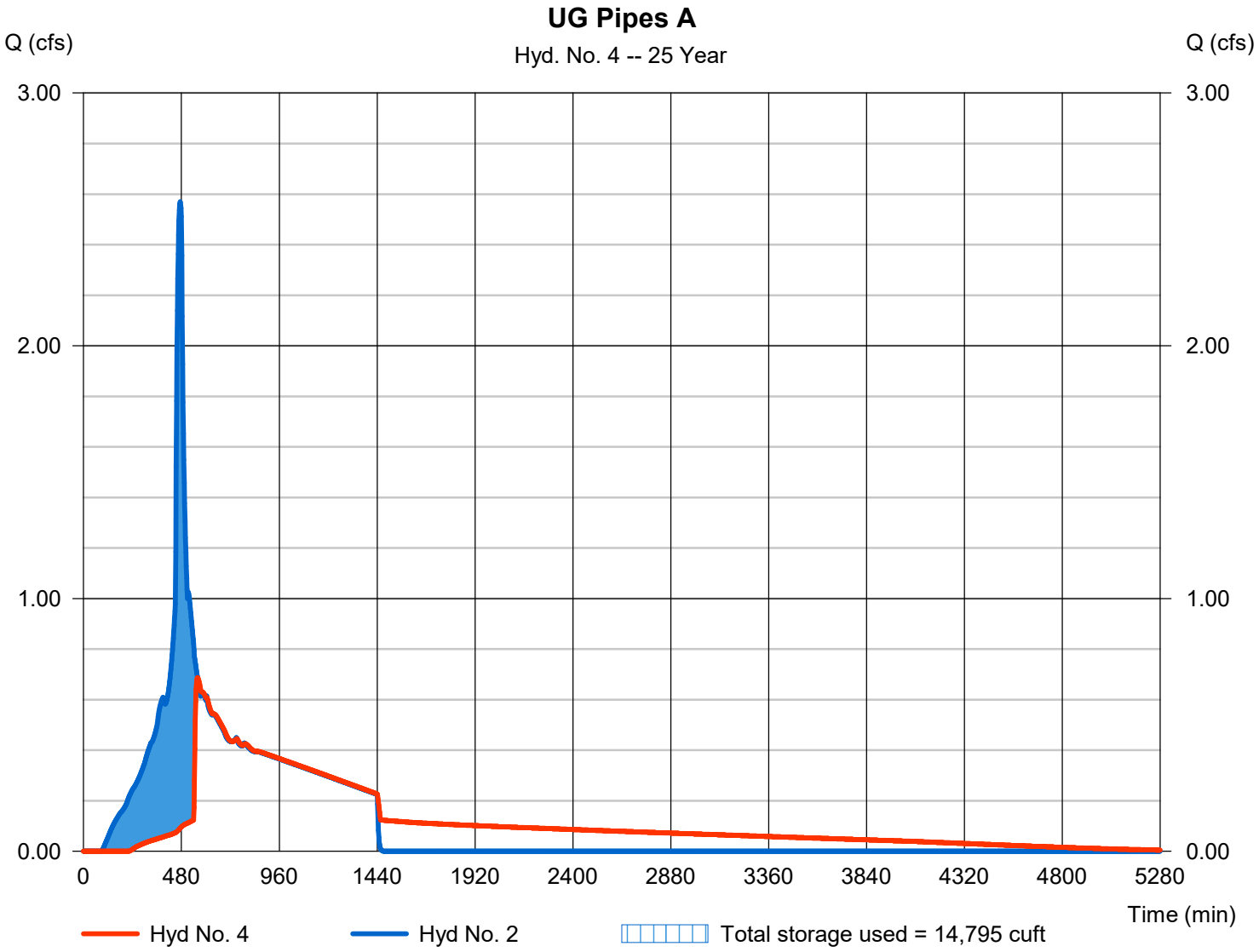
Hydrograph Report

Hyd. No. 4

UG Pipes A

Hydrograph type	=	Reservoir	Peak discharge	=	0.687 cfs
Storm frequency	=	25 yrs	Time to peak	=	560 min
Time interval	=	2 min	Hyd. volume	=	35,098 cuft
Inflow hyd. No.	=	2 - Basin B Post-Developed	Max. Elevation	=	294.02 ft
Reservoir name	=	UG Pipes A	Max. Storage	=	14,795 cuft

Storage Indication method used.



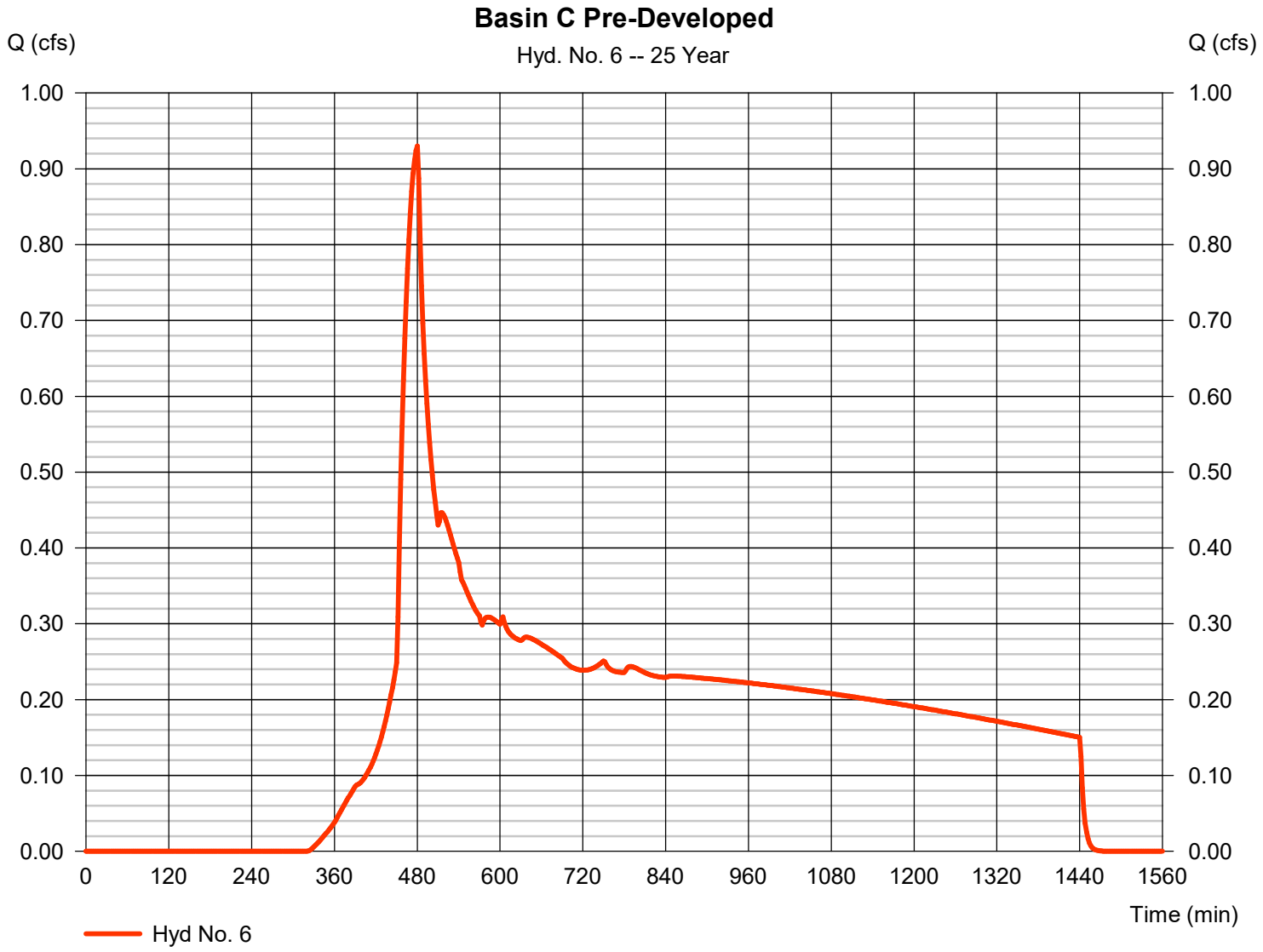
Hydrograph Report

Hyd. No. 6

Basin C Pre-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.930 cfs
Storm frequency	=	25 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	15,719 cuft
Drainage area	=	2.720 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.852 x 75) + (0.868 x 74)] / 2.720



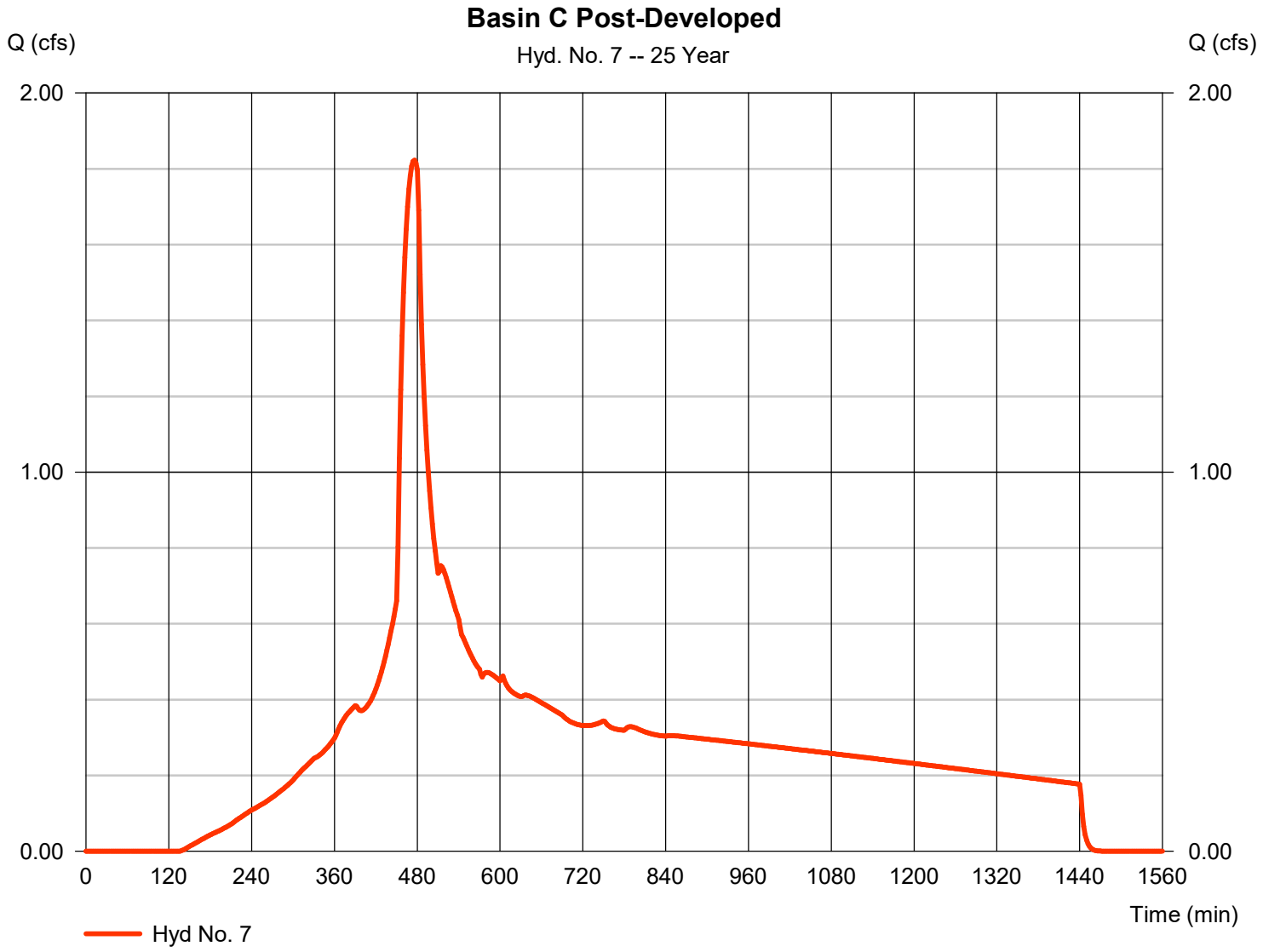
Hydrograph Report

Hyd. No. 7

Basin C Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	1.823 cfs
Storm frequency	=	25 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	25,735 cuft
Drainage area	=	2.510 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = [(1.658 x 98) + (0.850 x 74)] / 2.510



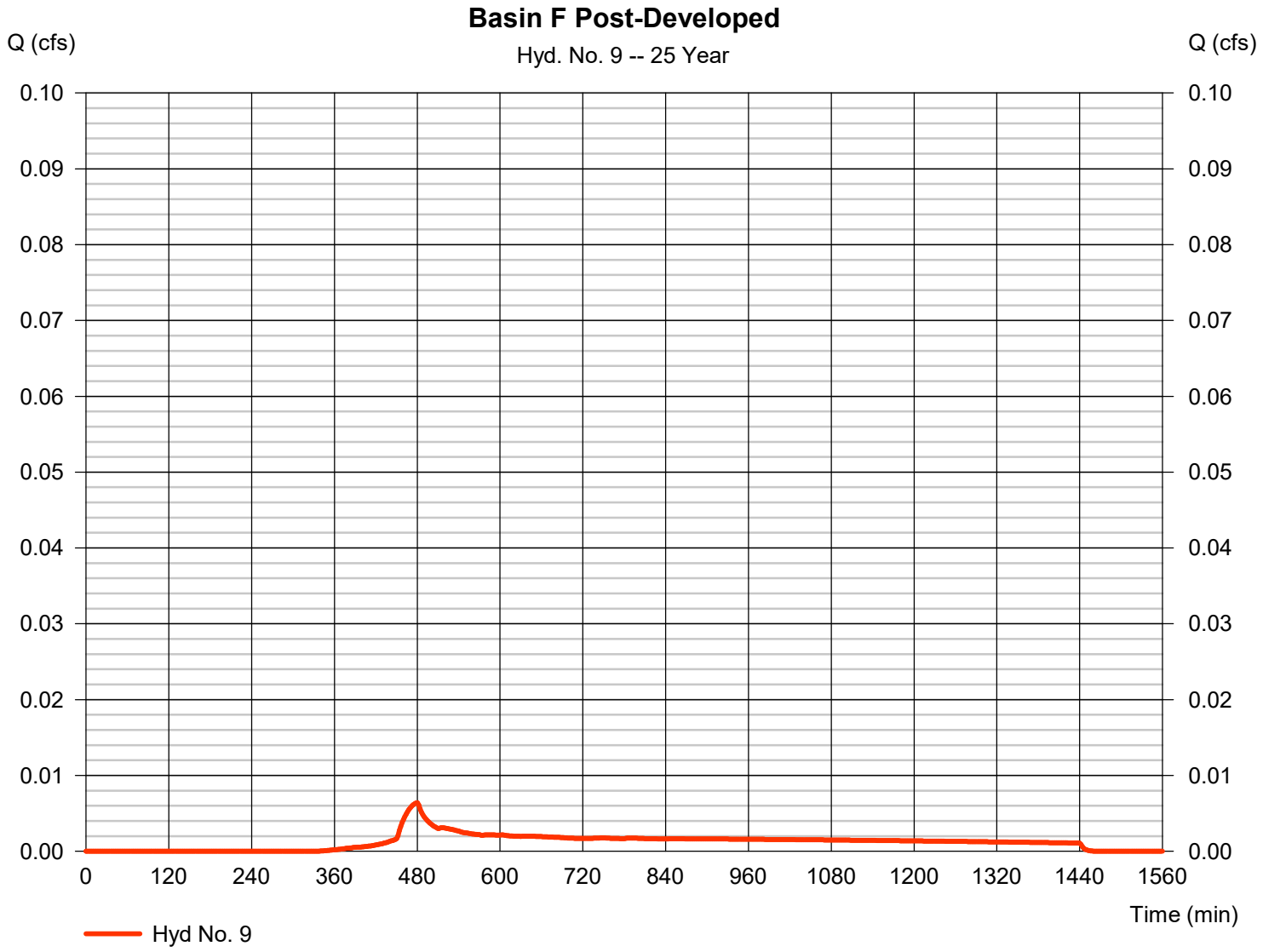
Hydrograph Report

Hyd. No. 9

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.006 cfs
Storm frequency	=	25 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	111 cuft
Drainage area	=	0.020 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.024 x 74)] / 0.020



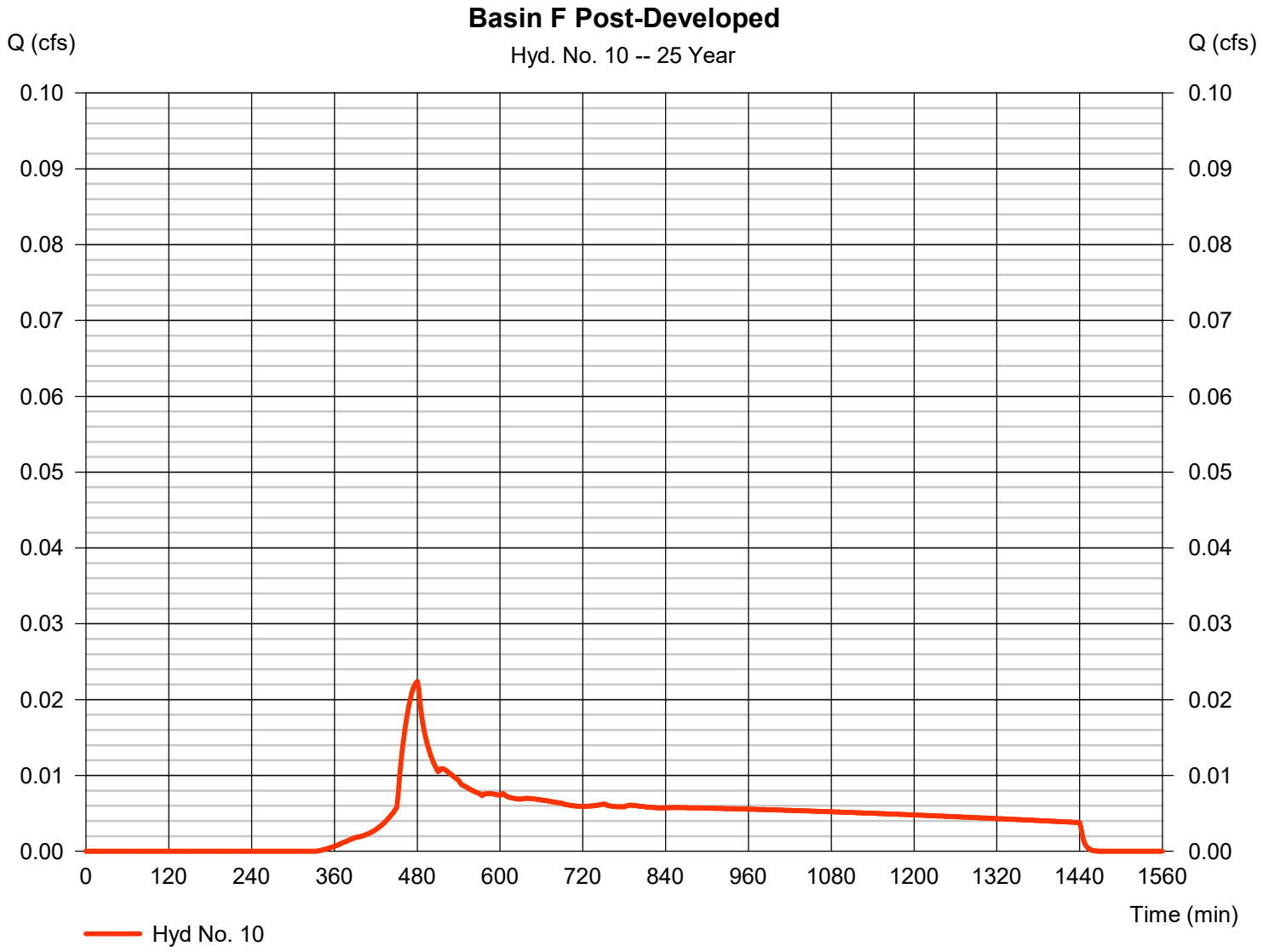
Hydrograph Report

Hyd. No. 10

Basin F Post-Developed

Hydrograph type	=	SBUH Runoff	Peak discharge	=	0.022 cfs
Storm frequency	=	25 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	387 cuft
Drainage area	=	0.070 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

* Composite (Area/CN) = + (0.073 x 74)] / 0.070

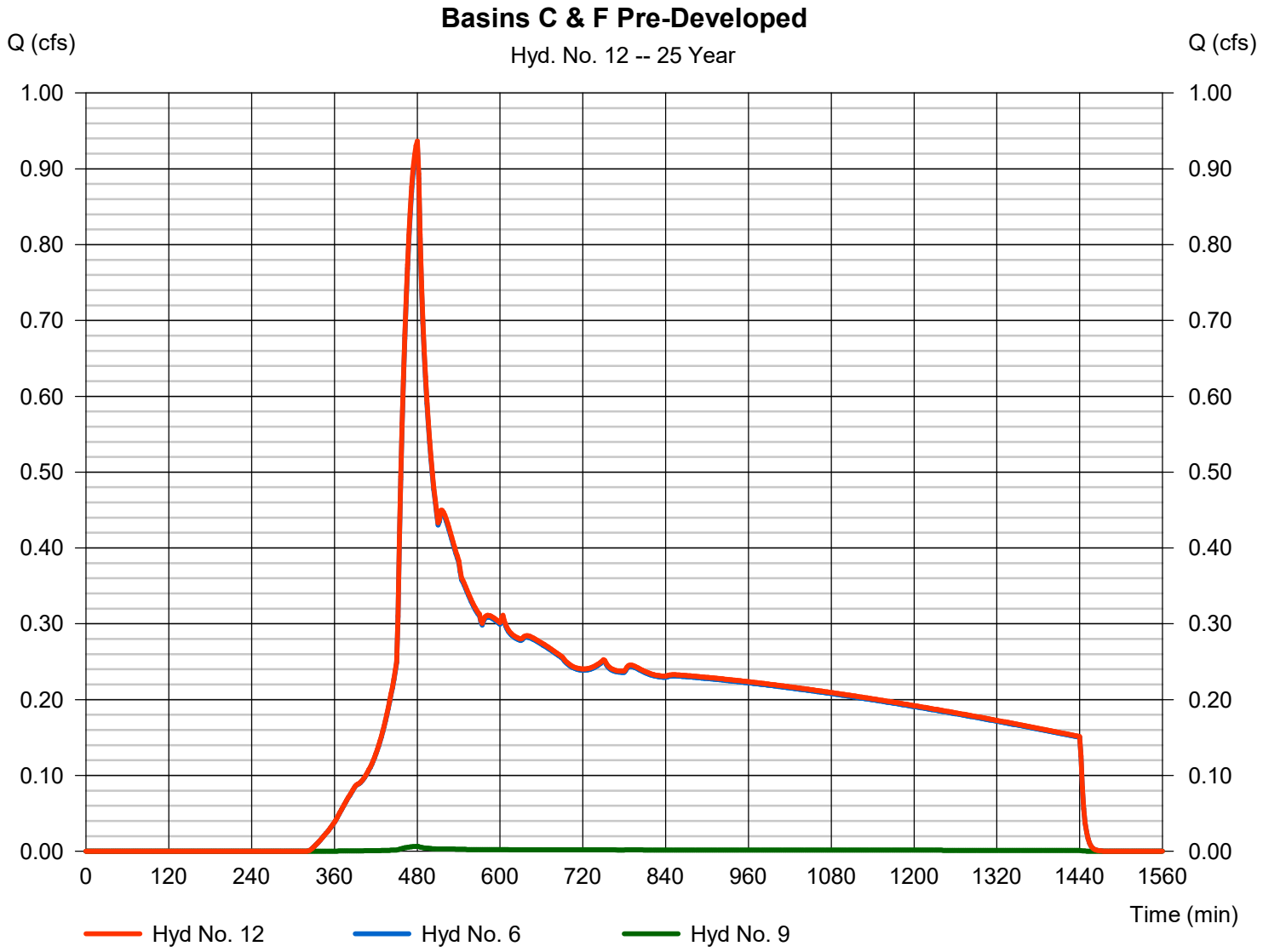


Hydrograph Report

Hyd. No. 12

Basins C & F Pre-Developed

Hydrograph type	=	Combine	Peak discharge	=	0.937 cfs
Storm frequency	=	25 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	15,830 cuft
Inflow hyds.	=	6, 9	Contrib. drain. area	=	2.740 ac

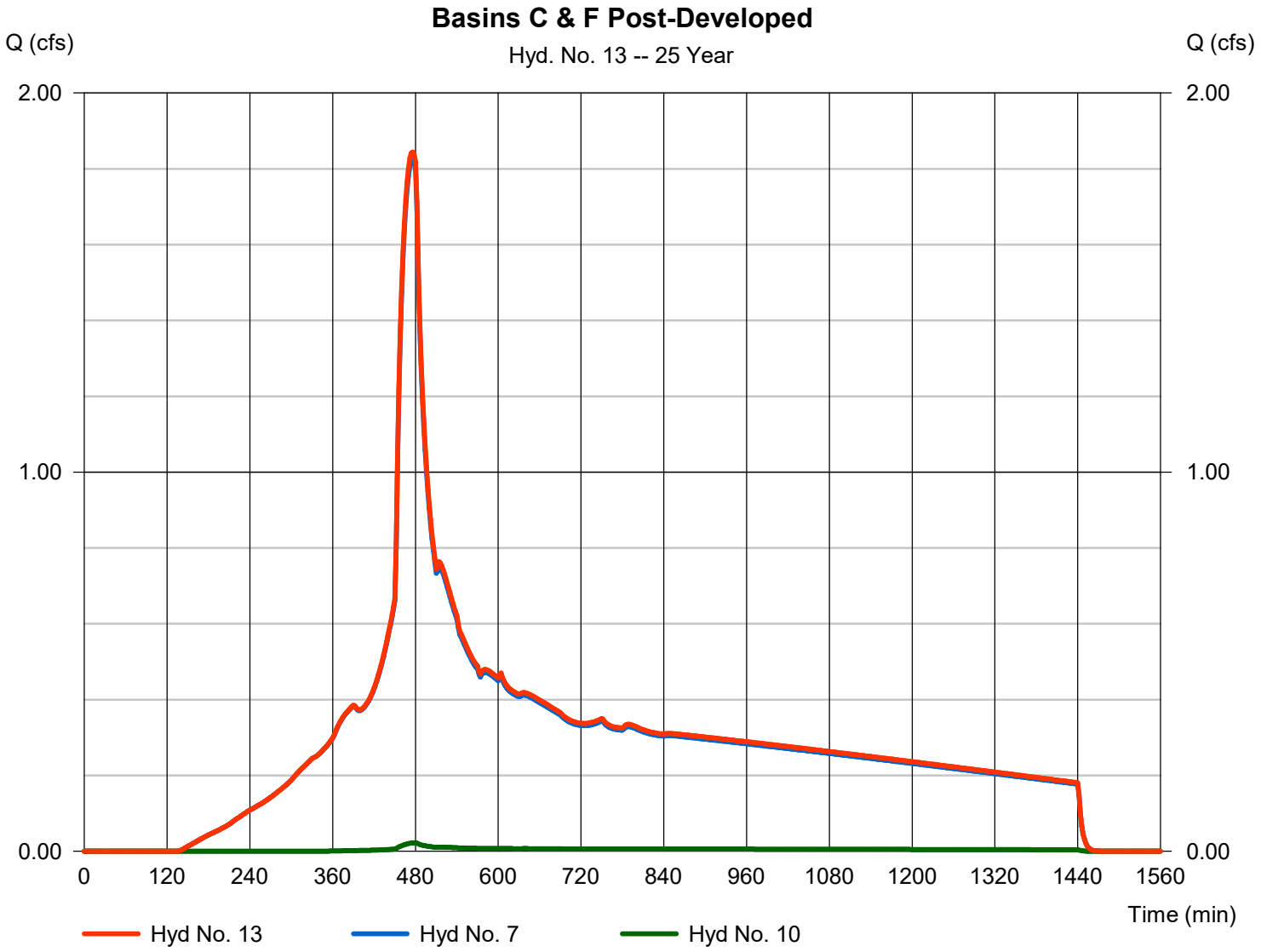


Hydrograph Report

Hyd. No. 13

Basins C & F Post-Developed

Hydrograph type	=	Combine	Peak discharge	=	1.845 cfs
Storm frequency	=	25 yrs	Time to peak	=	476 min
Time interval	=	2 min	Hyd. volume	=	26,122 cuft
Inflow hyds.	=	7, 10	Contrib. drain. area	=	2.580 ac



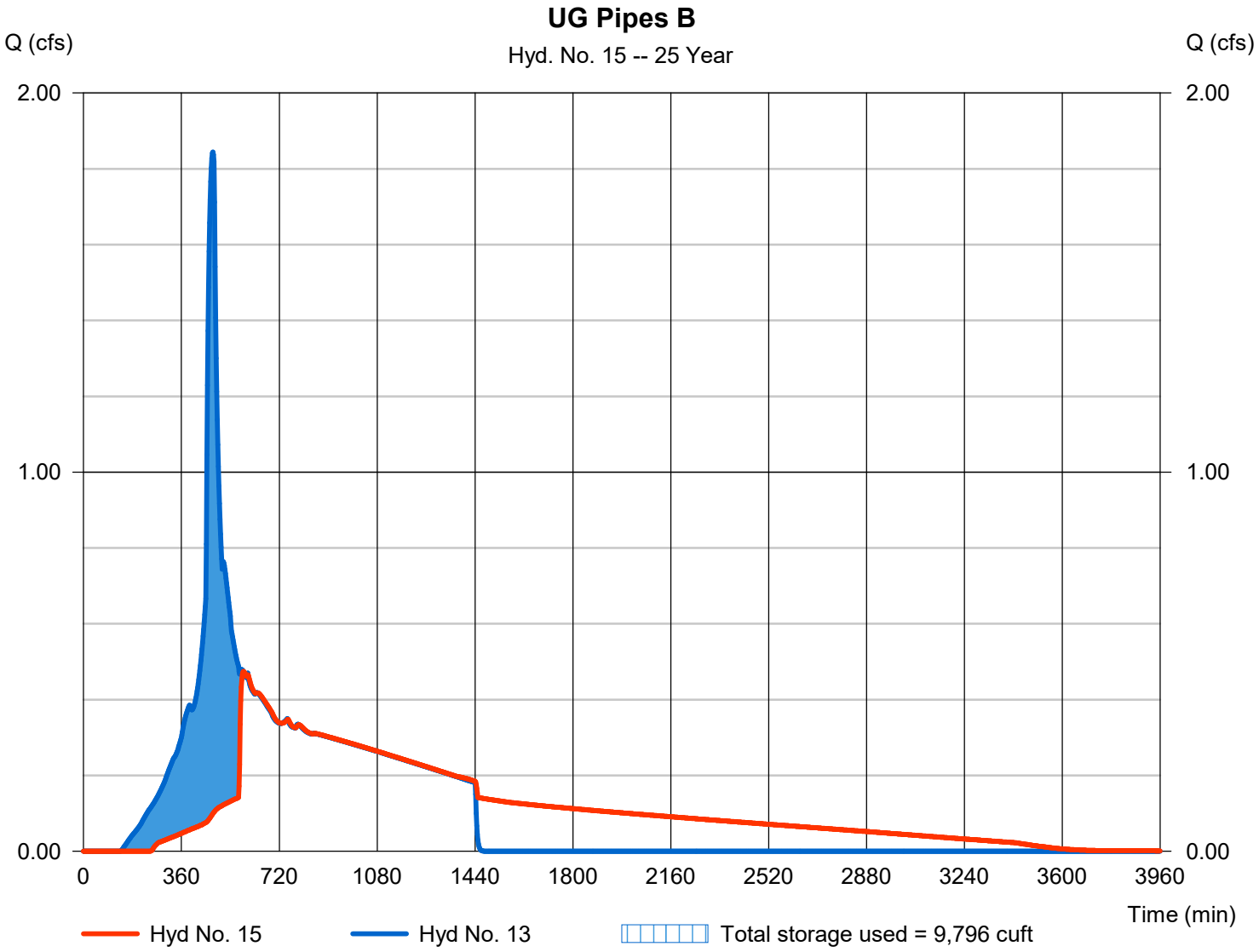
Hydrograph Report

Hyd. No. 15

UG Pipes B

Hydrograph type	=	Reservoir	Peak discharge	=	0.474 cfs
Storm frequency	=	25 yrs	Time to peak	=	588 min
Time interval	=	2 min	Hyd. volume	=	25,753 cuft
Inflow hyd. No.	=	13 - Basins C & F Post-Developed	Max. Elevation	=	295.63 ft
Reservoir name	=	UG Pipes B	Max. Storage	=	9,796 cuft

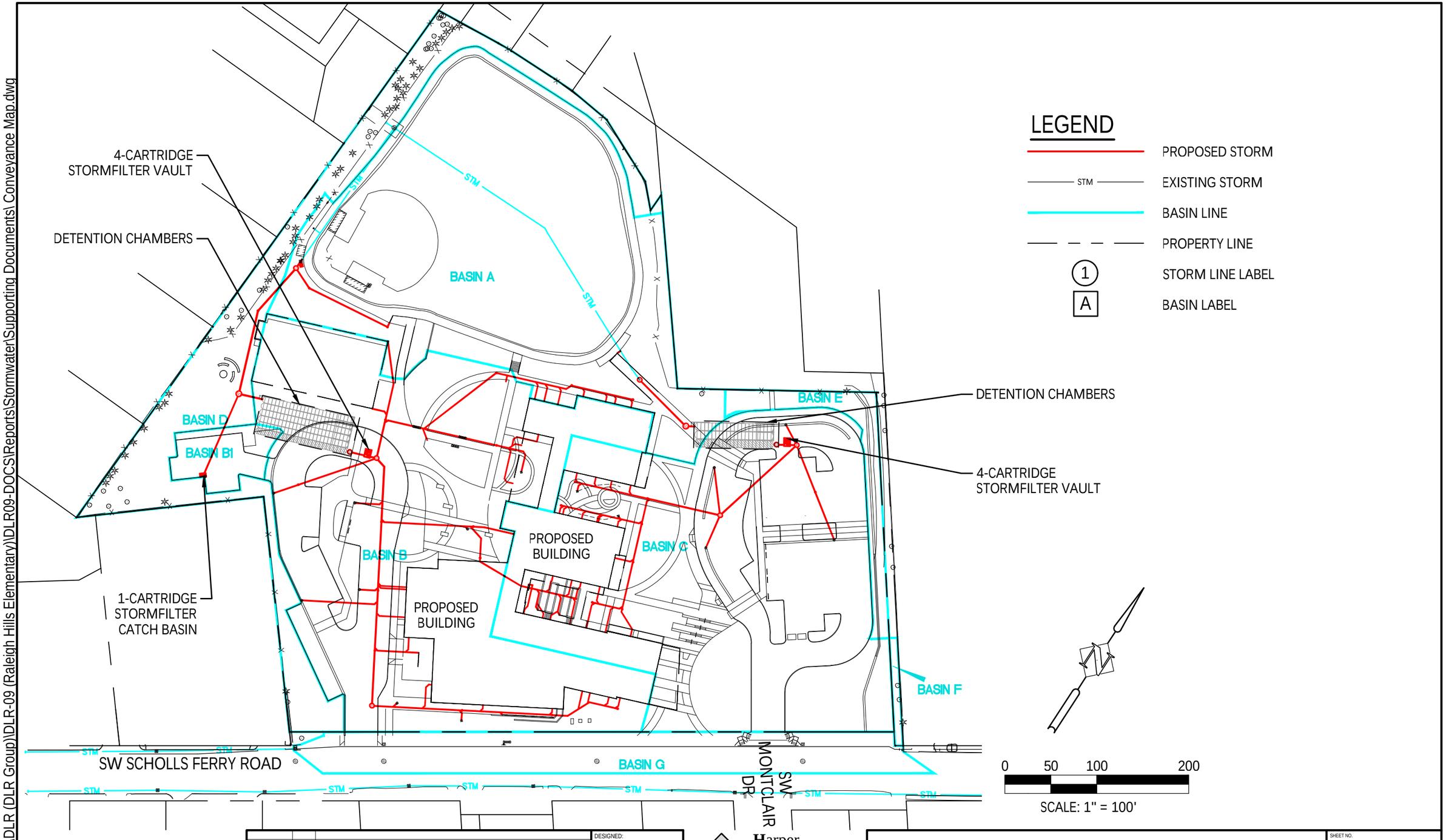
Storage Indication method used.



Appendix 5 – Conveyance

MORE INFORMATION TO BE
PROVIDED AS DESIGN DEVELOPS

P:\01-Portland\DLR (DLR Group)\DLR-09 (Raleigh Hills Elementary)\DLR09-DOCS\Reports\Stormwater\Supporting Documents\ Conveyance Map.dwg



LEGEND

- PROPOSED STORM
- STM — EXISTING STORM
- BASIN LINE
- PROPERTY LINE
- (1) STORM LINE LABEL
- [A] BASIN LABEL

0 50 100 200

SCALE: 1" = 100'

DATE	NO.	DESCRIPTION

R E V I S I O N S

DESIGNED: KJO
DRAWN: KJO
CHECKED: RDP
DATE: MARCH 2023

HHPR Harper Houf Peterson Righellis Inc.
ENGINEERS ♦ PLANNERS
LANDSCAPE ARCHITECTS ♦ SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

CONVEYANCE BASIN MAP

RALEIGH HILLS SCHOOL

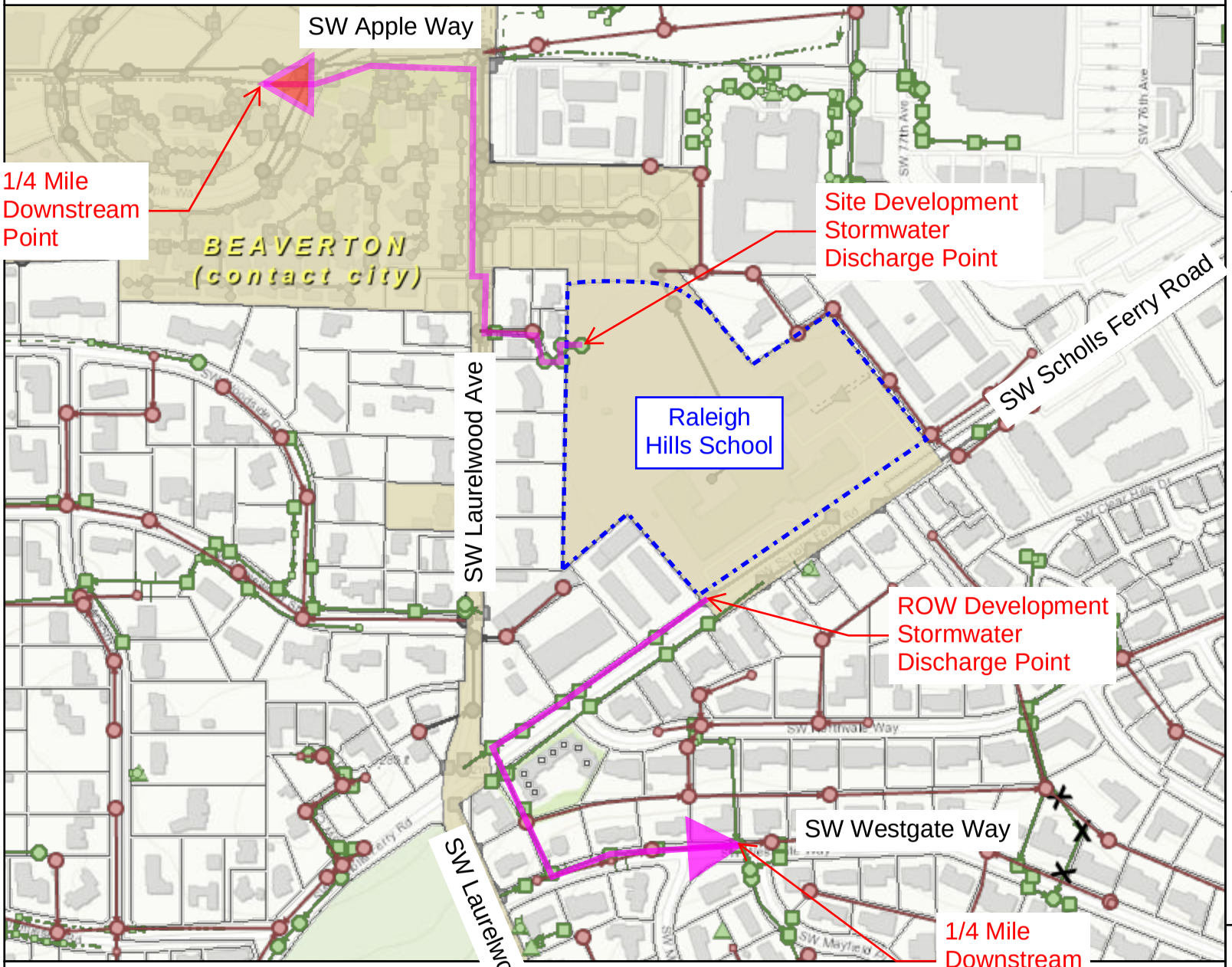
BEAVERTON, OREGON

SHEET NO. 1

JOB NO. DLR-09

Appendix 6 – Downstream Analysis

PrintServiceTemplate



Legend

- Cleanout
- Fitting
- Valve
- Manhole
- Inlet
- Pond
- Vault
- Treatment Plant
- Pump Station
- Gravity Line
- Pressure Line
- Open Channel
- Virtual Flow
- Pond Outline
- CWS Boundary
- County Boundary
- Urban Growth Boundary
- Abandoned
- CWS Sani
- CWS Storm
- Partner Sani
- Partner Storm

N

0 0.03 0.06 0.12 mi

Clean Water Services

Appendix 7 – Operations & Maintenance

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

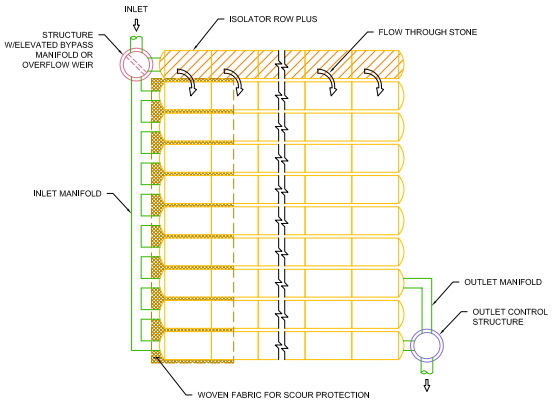
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

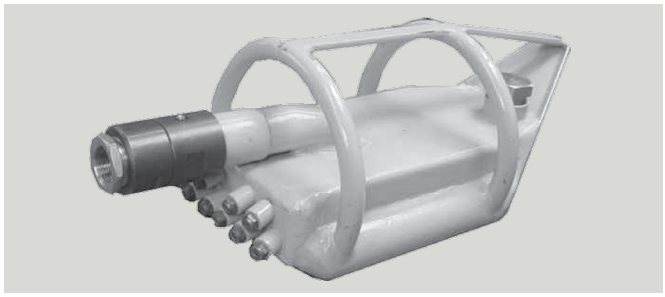
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

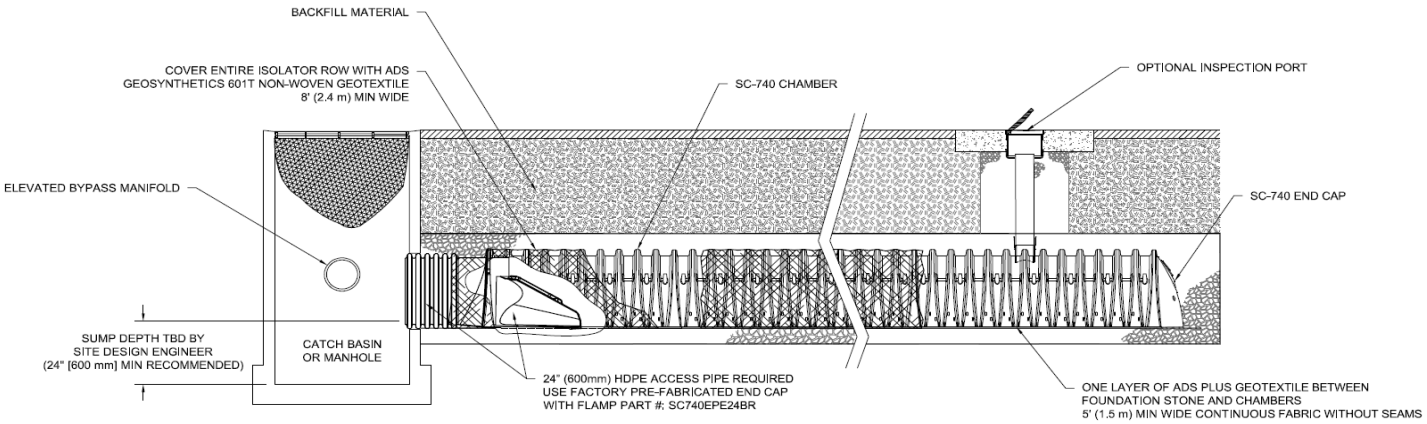
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
- i. Remove lid from floor box frame
- ii. Remove cap from inspection riser
- iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
- iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
- i. Remove cover from manhole at upstream end of Isolator Row Plus
- ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
  1. Mirrors on poles or cameras may be used to avoid a confined space entry
  2. Follow OSHA regulations for confined space entry if entering manhole
- iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
  If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

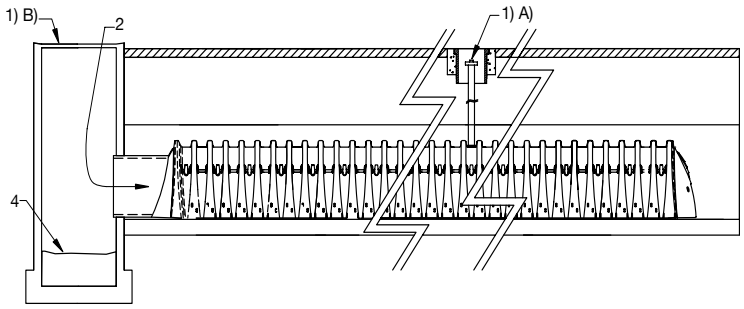
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi-ment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

adspipe.com
800-821-6710

BAYFILTER™ INSPECTION AND MAINTENANCE MANUAL

The BayFilter system requires periodic maintenance to continue operating at the design efficiency. The maintenance process is comprised of the removal and replacement of each BayFilter cartridge, vertical drain down module; and the cleaning of the vault or manhole with a vacuum truck.

The maintenance cycle of the BayFilter system will be driven mostly by the actual solids load on the filter. The system should be periodically monitored to be certain it is operating correctly. Since stormwater solids loads can be variable, it is possible that the maintenance cycle could be more or less than the projected duration.

BayFilter systems in volume-based applications are designed to treat the WQv in 24 to 48 hours initially. Late in the operational cycle of the BayFilter, the flow rate will diminish as a result of occlusion. When the drain down exceeds the regulated standard, maintenance should be performed.

When a BayFilter system is first installed, it is recommended that it be inspected every six (6) months. When the filter system exhibits flows below design levels the system should be maintained. Filter cartridge replacement should also be considered when sediment levels are at or above the level of the manifold system. Please contact the BaySaver Technologies Engineering Department for maintenance cycle estimations or assistance at **1.800.229.7283**.

BayFilter System Cleanout

Vactor Truck Maintenance

Jet Vactoring Through Access Hatch

Maintenance Procedures

1. Contact BaySaver Technologies for replacement filter cartridge pricing and availability at 1-800-229-7283.
2. Remove the manhole covers and open all access hatches.
3. Before entering the system make sure the air is safe per OSHA Standards or use a breathing apparatus. Use low O_2, high CO, or other applicable warning devices per regulatory requirements.
4. Using a vacuum truck remove any liquid and sediments that can be removed prior to entry.
5. Using a small lift or the boom of the vacuum truck, remove the used cartridges by lifting them out.
6. Any cartridges that cannot be readily lifted can be easily slid along the floor to a location they can be lifted via a boom lift.
7. When all the cartridges have been removed, it is not practical to remove the balance of the solids and water. Loosen the stainless clamps on the Fernco couplings for the manifold and remove the drain pipes as well. Carefully cap the manifold and the Ferncos and rinse the floor, washing away the balance of any remaining collected solids.
8. Clean the manifold pipes, inspect, and reinstall.
9. Install the exchange cartridgess and close all covers.
10. The used cartridges may be sent back to BaySaver Technologies for recycling.

Manifold Tee View of a Cleaned System

Cartridge Hoist Point

For more information please see the BaySaver website at www.baysaver.com or contact 1-800-229-7283.

*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

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