

DRESDNER ROBIN

STORMWATER MANAGEMENT AND ENGINEER'S REPORT

PUBLIC STORAGE NO. NJ20016

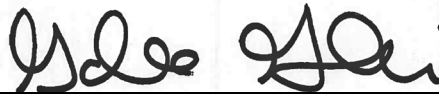
BLOCK 111 LOT 1.08

TOWNSHIP OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY

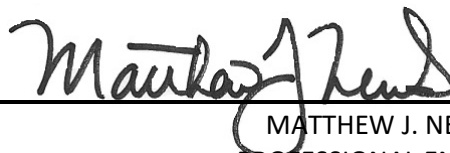
DRESDNER ROBIN PROJECT NO.: 10461-003

PREPARED FOR
PUBLIC STORAGE
701 WESTERN AVENUE
GLENDALE, CA 91201

PREPARED BY
DRESDNER ROBIN
1 EVERTRUST PLAZA, SUITE 901
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DATE
NOVEMBER 2020
REVISED JANUARY 2022

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1.0 INTRODUCTION

1.1 PURPOSE

This report has been prepared to accompany a Preliminary and Final Site Plan Application for the construction of a self-storage facility Lot 1.08 of Block 111 in the Township of West Orange, Essex County, New Jersey. This report should be reviewed in conjunction with a certain set of drawings titled "Preliminary Site Plan; Public Storage No. NJ20016; Lot 1.08, Block 111; Township of West Orange, County of Essex, New Jersey 07052" prepared by Dresdner Robin revised through December 6, 2021. This report has been prepared to demonstrate that the site improvements meet the criteria of the following standards effective as of the date of this report:

- New Jersey Residential Site Improvement Standards (N.J.A.C. 5:21) (published July 21, 2014)
- Stormwater Management Rules (N.J.A.C. 7:8) (amended June 20, 2016).
- Safe Drinking Water Act Rules (N.J.A.C. 7:10) (amended January 4, 2011).
- Pollutant Discharge Elimination System Rules (N.J.A.C. 7:14A) (amended January 5, 2009).
- General Ordinances of the Township of West Orange (25-29.4) (Effective: July 16, 2012)

1.2 PROJECT DESCRIPTION

1.2.1 Existing Conditions

The project site is located at 424 Eagle Rock Avenue (Essex County Route 611) in the Township of West Orange, Essex County, New Jersey. Generally, the project site is in the northern portion of the Township of West Orange, north of Route I-280. The site is located approximately 340 feet east of the intersection of Eagle Rock Avenue (Essex County Route 611) and Prospect Avenue (Essex County Route 577).

The property is bounded to Block 111, Lot 1.07 to the north, Block 111, Lot 1.01 to the west, Block 109, Lot 1.01 to the east and Block 107, Lot 1.06 to the south. The site is improved upon by a 25,000-square-feet, one-story, brick building. The project site is approximately 2.7 acres and has frontage along Eagle Rock Avenue. The site is a flag lot with an approximately 60' wide by 320' long entrance drive at the front (north) of the site, which opens up into the larger rectangular shaped portion of the lot in the rear (south) of the site.

1.2.2 Proposed Conditions

The proposed project involves the construction of a 3-story self-storage facility. The first floor will consist of the rental office space, the lobby, restrooms, elevators, and mechanical spaces, as well as storage units. The 2nd, and 3rd floors will consist of storage spaces. On the west side of the building will be 15 secure parking spaces within a vehicular gated area and 8 parking spaces for office use and visitors outside said gated area. An emergency access drive will encircle the building. Existing parking along the entrance drive will remain. New landscaping and buffers will be provided.

2.0 STORMWATER MANAGEMENT

2.1 PURPOSE AND NEED

The proposed development will disturb more than 1 acres of land; therefore, the project is defined as a “major development” in accordance with the Township of West Orange stormwater control ordinance and New Jersey’s Stormwater Rules at NJAC 7:8. As a result, these regulations mandate the proposed development incorporate measures to address groundwater recharge, stormwater quality, and stormwater quantity.

2.2 GROUNDWATER RECHARGE

The regulations cited above specify minimum design and performance standards for groundwater recharge; however, in accordance with N.J.A.C. 7:8-5.4(a)2.ii., the groundwater recharge requirement does not apply to previously disturbed project sites within the “Metropolitan Planning Area PA-1 Zone”, which includes the project site, which formally operated as a landfill, therefore, groundwater recharge is not required for the project.

2.3 WATER QUALITY

Per NJDEP, “Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site.” (N.J.A.C. 7:8-5.5). The development will not be increasing the impervious surface area of the site. The existing site is approximately 84% impervious; we are proposing to reduce this to 72.3%. As such, stormwater management measures for water quality control are not required. However,

permeable pavement is proposed along the emergency access drive. While not required, this will improve the water quality of runoff leaving the site.

2.4 WATER QUANTITY

In order to control stormwater runoff, we are required to reduce the runoff rates for the 2-year, 10-year and 100-year storm to 50%, 75% and 80% of existing rates for the 2-year, 10-year and 100-year storm events respectively (NJAC 7:8-5.4 3i). To satisfy said requirements an underground detention basin system is being proposed under the surface parking lots west to the proposed building. We will be implementing R-Tank-XDs detention chambers as a in our method. Table 1 summarizes the existing and proposed stormwater analysis. Stormwater runoff calculations can be found in Appendix E and are summarized below.

2.4.1 PRESENT CONDITIONS

Presently, the site contains 84% impervious surface, with the remaining 16% being made up of dense vegetated areas and a small section of rock cropping to the south. There is minimal drainage infrastructure on site which generally overland flows to Crystal Lake to the west. The front portion of the site contains an inlet which is piped offsite.

2.4.2 DEVELOPED CONDITIONS

The development includes a facility designed to manage stormwater runoff by reducing the peak flow rates. Runoff from the building will be collected and conveyed via roof leaders to the detention system. A portion of the runoff from the parking areas will be conveyed to the detention basins by a series of catch basins located along a proposed curb surrounding the site and approximately 600-lf, 12-inch ductile-iron pipes. In addition to the proposed network of catch basins and ductile-iron pipes, a series of 6-inch perforated PVC underdrain pipes will work to collect runoff from sections of pervious, open graded asphalt. This system of pervious pavement and perforated PVC pipes is intended to supplement the collection of stormwater runoff, and ties in to the main storm drainage system at various catch basin locations throughout the site. A portion of the landscaped areas will be allowed to sheet flow to Crystal Lake, located west of the site. Both undetained flow as well as the detention basin discharge are contributory to the "Proposed Peak Runoff Rate" presented in Table 1 below. Full calculations are included at the end

of this report in Appendix E. The front (north) portion of the site, which is piped off site, will remained unchanged.

TABLE 1 – PRESENT AND DEVELOPED RUNOFF SUMMARY					
STORM EVENT	PRESENT RUNOFF RATE (cfs)	REQUIRED RUNOFF RATE REDUCTION FACTOR*	ALLOWABLE RUNOFF RATE (cfs)	DEVELOPED PEAK RUNOFF RATE (cfs)	MEETS REQUIREMENTS
2-yr	9.47	50%	4.74	4.11	YES
10-yr	12.65	25%	9.49	7.15	YES
100-yr	16.50	20%	13.20	10.11	YES

*Per N.J.A.C. 7:8-5.4.3

2.5 PIPE CONVEYANCE

The proposed on-site storm sewer collection system has been designed to collect runoff from the proposed building and surface parking areas. The proposed on-site storm sewer conveyance system will connect to the respective detention basins. The storm system will connect downstream of the detention basins to a single outfall which will discharge to Crystal Lake, west of the site, which is consistent with the existing drainage pattern for the site. Permanent soil erosion measures consistent with the New Jersey Standards for Soil Erosion and Sediment Control will be proposed at the outfall location. On-site storm sewer piping systems have been designed based upon a 25-year storm and detailed storm sewer pipe sizing calculations are located in Appendix D of this report. The on-site perforated pipe system has been designed based upon the 2-year Water Quality Storm and detailed storm sewer pipe sizing calculations are also located in Appendix D of this report.

2.6 CONCLUSION

In conclusion, the proposed drainage pattern for the subject site is generally in keeping with the existing drainage pattern. The project includes a detention basin to meet the requirements of Township of West Orange's stormwater control ordinance described above. The proposed on-site storm sewer conveyance system is sized appropriately to handle the 25-year storm for the

subject site. The project is not anticipated to have any negative impacts on the drainage patterns of the site, neighboring properties, or the area as a whole.

3.0 WATER AND SEWER DEMAND

3.1 SANITARY SEWER

Survey information indicates the presence of a 6" VCP sanitary service on site which ties into a sanitary main on Eagle Rock Avenue. The project proposes to video inspect and reuse this sanitary service for the proposed development to the extent possible. The projected sanitary flow can be found in Appendix A, which was developed based upon the New Jersey Technical Requirements for Treatment Works Approvals at N.J.A.C. 7:14A-23.3.

Because the anticipated flow to be generated by the development is less than 8,000 gallons per day, a Treatment Works Approval will not be required from the New Jersey Department of Environmental Protection (NJDEP).

3.2 WATER SERVICE

Water service to the project site is provided by New Jersey American Water. Survey information indicates the presence of water service on site, which ties into a water main in Eagle Rock Avenue. This project proposes to reuse the water service to the extent practical, and extend this service as necessary to the water location in the proposed building. The proposed connections, valve enclosure and other related improvements and will be designed to be consistent with Suez details and standards and coordinated with the utility.

The estimated average-daily and peak water demand for the development can be found in Appendix B, which was calculated in accordance with Table 5.1 and 5.2 of the New Jersey Residential Site Improvements Standards (N.J.A.C. 5:21-5.1) and the Safe Drinking Water Act Rules (N.J.A.C. 7:10-12.6, Table 1: Average Daily Water Demand).

APPENDIX A

SANITARY SEWER DEMAND CALCULATIONS

SANITARY SEWER CALCULATIONS

424 EAGLE ROCK AVENUE

BLOCK 111, LOT 1.08

TOWNSHIP OF WEST ORANGE, NEW JERSEY

DR PROJECT NO. 10461-003

Type of Establishment	Measurement	# Units	GPD/Unit	GPD
Warehouse	Employee	3	25	75
Projected Estimates per N.J.A.C. 7:14A-23.3			Flow Received	100%
			Total Flow (GPD) ($Q_{\text{projected}}$)	75
			Total Flow (CFS) ($Q_{\text{projected}}$)	0.000

Pipe	Length (ft)	n*	Slope	Diameter (in)
8 inch PVC		0.013	2.00%	8

Half Flow Pipe Capacity	
Depth of Flow, h (in)	4
h/D	0.500
Pipe Radius, r (ft)	0.333
Circ. Segment Height, h (ft)	0.333
Central Angle, θ (radians)	3.142
Cross-Sectional Area, A (ft^2)	0.175
Wetted Perimeter, P (ft)	1.047
Hydraulic Radius, R (ft)	0.167
Discharge, Q (cfs)	0.857
$Q_{\text{projected}} \times 2$ (cfs)	0.000
Pipe % Full $[(A/A_{\text{full}}) \times 100\%]$	50.00%
Average Velocity, V (ft/sec)	4.909
$Q_{\text{pipe}} > 2 \times Q_{\text{projected}}$	TRUE
$V \geq 2.2 \text{ ft/sec}$	TRUE
Therefore, design is	ADEQUATE

Actual Pipe Velocity	
**Depth of Flow, h (in)	0.100
Pipe Radius, r (ft)	0.333
Circ. Segment Height, h (ft)	0.008
Central Angle, θ (radians)	0.448
Cross-Sectional Area, A (ft^2)	0.001
Wetted Perimeter, P (ft)	0.149
Hydraulic Radius, R (ft)	0.006
Pipe % Full $[(A/A_{\text{full}}) \times 100\%]$	0.24%
Actual Velocity, V (ft/sec)	0.506

**Must have $h < r$

Compare	
Discharge, Q (cfs)	0.000
$Q_{\text{projected}}$ (cfs)	0.000

Equations used for calculations:

Manning's Formula:

$$Q = \left(\frac{1.49}{n} \right) A R^{2/3} \sqrt{S}$$

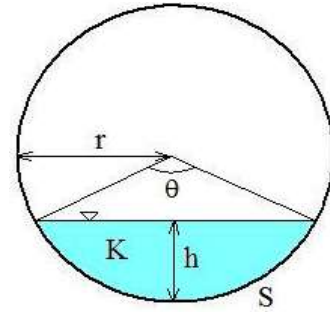
Q = Flow Rate, (ft³/s)

n = Manning's Coefficient

A = Flow Area, (ft²)

R = Hydraulic Radius, (ft)

S = Channel Slope, (ft/ft)



$$\theta = 2 \arccos \left(\frac{r-h}{r} \right)$$

$$A = \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = r\theta$$

APPENDIX B

WATER SERVICE DEMAND CALCULATIONS

WATER DEMAND CALCULATIONS 424 EAGLE ROCK AVENUE BLOCK 111, LOT 1.08 TOWNSHIP OF WEST ORANGE, NEW JERSEY DR PROJECT NO. 10461-003								
Non-Residential Demand ²								
Type of Establishment	Measurement	# Units	GPD/Unit	Daily Demand (GPD)	Daily Demand (MGD)	Peaking Factor	Peak Daily Demand (GPD)	Peak Daily Demand (MGD)
Industrial Facility	Per Person	3	25	75	0.000	3	225	0.000
Total Site Demand				Daily Demand (GPD)	Daily Demand (MGD)		Peak Daily Demand (GPD)	Peak Daily Demand (MGD)
				75	0		225	0

Notes:

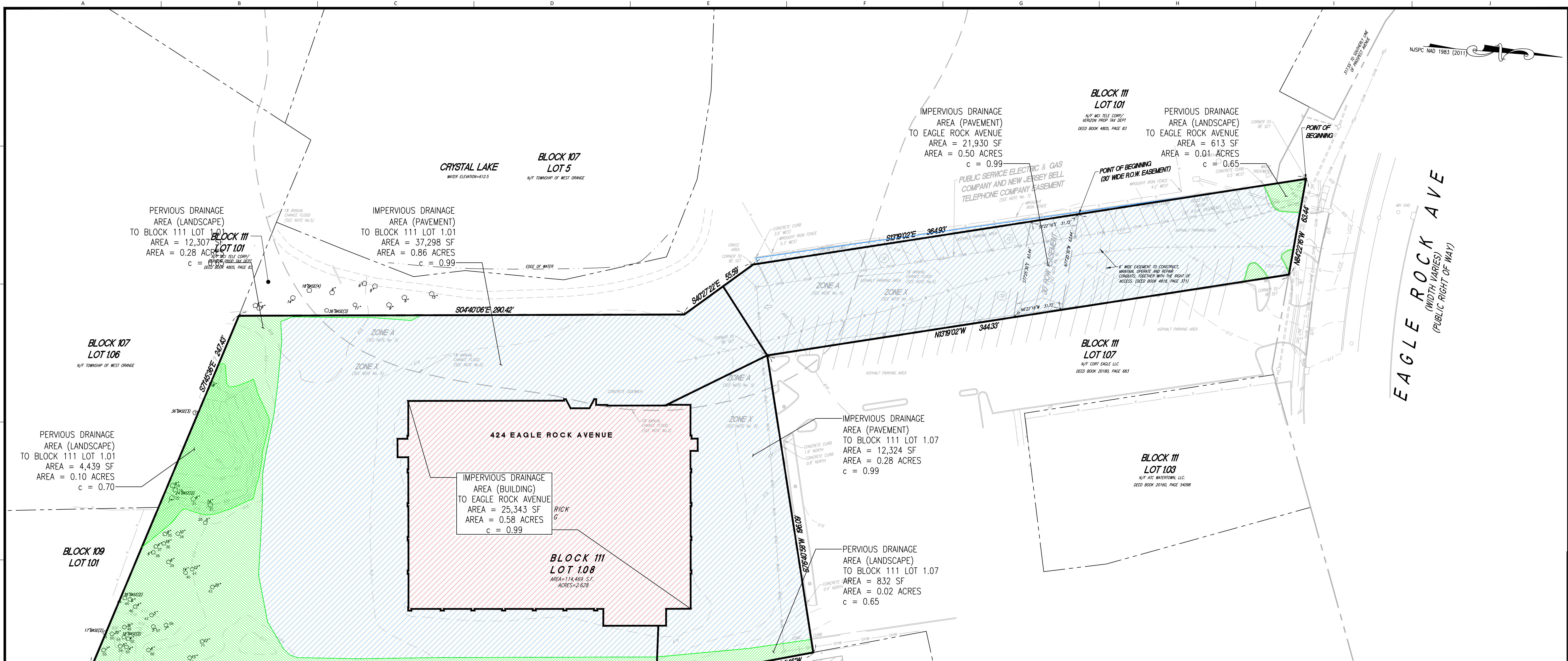
¹ Residential demand as per N.J.A.C. 5:21-5.2

² Non-residential demand as per N.J.A.C. 7:10-12.6 (Table 1)

APPENDIX C

PRESENT / DEVELOPED

DRAINAGE AREA MAPS



TOTAL SITE AREA: 115,101 SF (2.64 ACRES)	
TO EAGLE ROCK AVENUE	
EXISTING PERVIOUS COVERAGE – LANDSCAPE:	613 SF (0.01 ACRES)
EXISTING IMPERVIOUS COVERAGE – BUILDING:	25,343 SF (0.58 ACRES)
EXISTING IMPERVIOUS COVERAGE:	21,930 SF (0.50 ACRES)
TO BLOCK 111, LOT 1.01	
EXISTING PERVIOUS COVERAGE (GOOD CONDITION):	12,307 SF (0.28 ACRES)
EXISTING PERVIOUS COVERAGE (POOR CONDITION):	4,339 SF (0.10 ACRES)
EXISTING IMPERVIOUS COVERAGE:	37,298 SF (0.86 ACRES)
TO BLOCK 111, LOT 1.07	
EXISTING PERVIOUS COVERAGE – LANDSCAPE:	832 SF (0.02 ACRES)
EXISTING IMPERVIOUS COVERAGE:	12,324 SF (0.28 ACRES)
TOTAL EXISTING IMPERVIOUS:	71,552 SF (1.64 AC)
TOTAL EXISTING PERVIOUS:	18,190 SF (0.42 AC)
TOTAL EXISTING BUILDING:	25,343 SF (0.58 AC)
% IMPERVIOUS:	62%
% PERVIOUS:	16%
% BUILDING:	22%

EXISTING COVERAGE AREA LEGEND

- EXISTING IMPERVIOUS COVERAGE
- EXISTING ROOF COVERAGE
- EXISTING PERVIOUS COVERAGE – GOOD CONDITION
- EXISTING PERVIOUS COVERAGE – POOR CONDITION

DRESDNER
ROBIN

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TEL: 201.217.9300 FAX: 201.217.9607
NJ CERTIFICATE OF AUTHORIZATION: 24GA27926000
JERSEY CITY • FAIRFIELD • ASBURY PARK • CHERRY HILL

FOR REVIEW
MATTHEW J. NEULS
PROFESSIONAL ENGINEER
NJ LICENSE NUMBER 24GE04313300

NO	DATE	DESCRIPTION	BY
REVISIONS:			

OWNER / APPLICANT:



PUBLIC
STORAGE
701 WESTERN AVENUE
GLENDALE, CA 91201

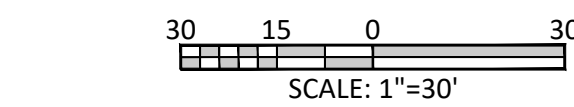
DRAWING TITLE:

EXISTING DRAINAGE
PLAN

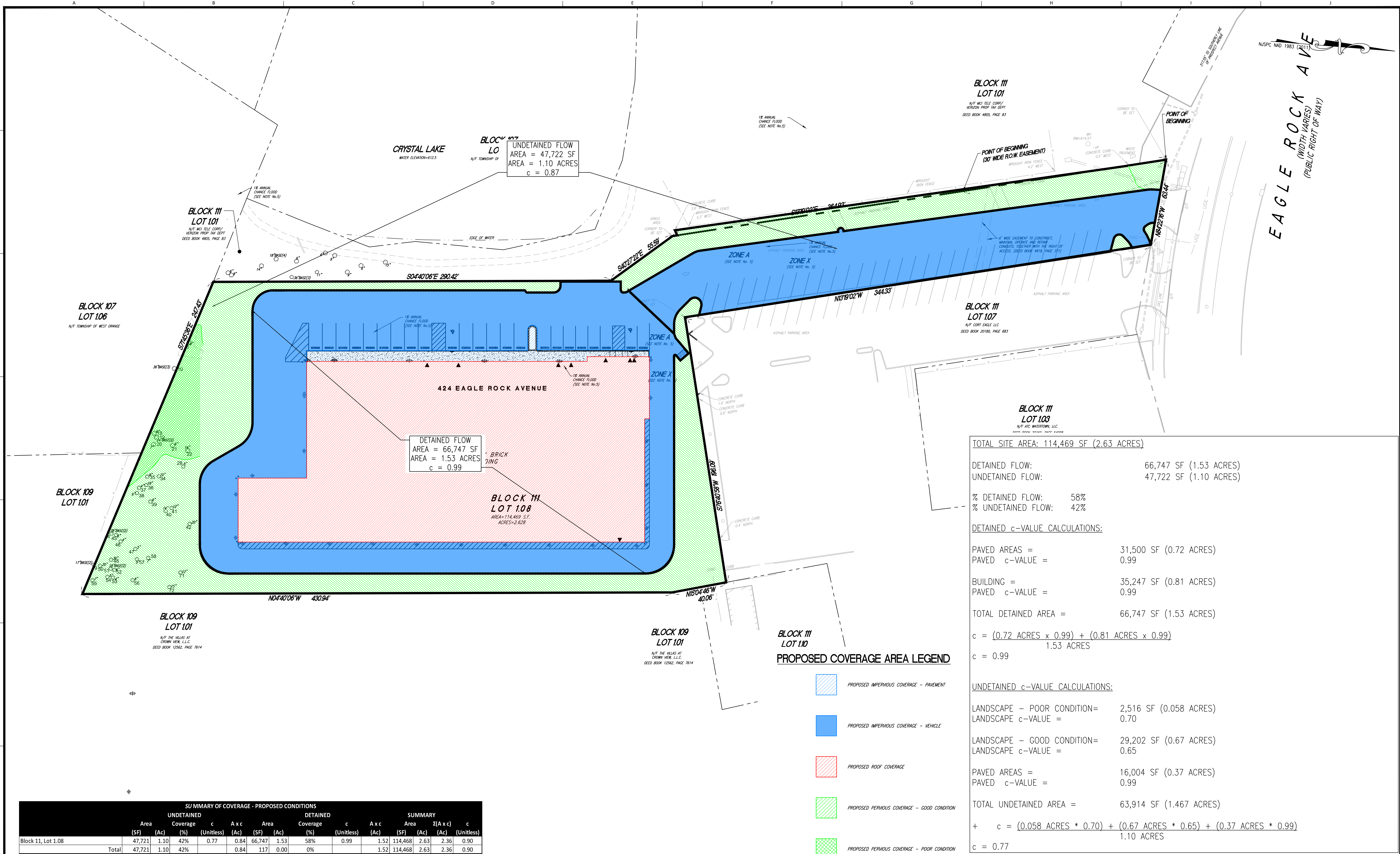
PROJECT:

PUBLIC STORAGE NO. NJ20016
424 EAGLE ROCK AVENUE
LOT 1.08, BLOCK 111
TOWNSHIP OF WEST ORANGE
ESSEX COUNTY, NEW JERSEY

SCALE:



DRAWN BY: MR	CHECKED BY: MUN	DRAWING NUMBER: DA-101
SCALE: 1"=30'	DATE: 11-XX-2020	
JOB NO: 10461-003	SHEET 01	OF 02



DRESDNER
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JERSEY CITY • FAIRFIELD • ASBURY PARK • CHERRY HILL

FOR REVIEW

MATTHEW J. NEULS
PROFESSIONAL ENGINEER
NJ LICENSE NUMBER 24GE04313300

OWNER / APPLICANT:

Public Storage

PUBLIC STORAGE
701 WESTERN AVENUE
GLENDALE, CA 91201

DRAWING TITLE:

PROPOSED DRAINAGE PLAN

DRAWING NUMBER:

PUBLIC STORAGE NO. NJ20016
424 EAGLE ROCK AVENUE
LOT 1.08, BLOCK 111
TOWNSHIP OF WEST ORANGE
ESSEX COUNTY, NEW JERSEY

SCALE:

30 15 0 30
SCALE: 1"=30'

DRAWN BY: JCQ

CHECKED BY: MJN

SCALE: 1"=30'

DATE: 11-XX-2020

JOB No: 10461-003

DRAWING NUMBER:

DA-102

SHEET 02 OF 02

C:\P\10461-003 PublicStorage\10461-003 PROP DRNG.dwg DA-102 12/10/2021 9:26 AM GJorrell

DATE: 11-XX-2020

APPENDIX D

STORM PIPE CONVEYANCE CALCULATIONS

DRESDNER ROBIN DRAINAGE CALCULATIONS

MADE BY: GG
REV. BY: BJZ

DATE: 11/1/20
DATE: 1/7/22

RAINFALL CURVE: RSIS Standard

PROJECT: Public Storage No. NJ20016
PROJECT NO.: 10461-003

Pervious Pipe																	
		INLET				DES.				PIPE	Mannings	VELOCITY		FLOW	CAPACITY	% Full	
FROM	TO	AREA	"C"	CA	TC	STORM	"I"	"Qa"	SLOPE	DIAM	Number	(fps)	LENGTH	TIME (min)	Qf (cfs)	(Qa/Qf)	REMARKS
See Planset	See Planset	0.41	1.00	0.41	10	WQ	1.25	0.51	0.0100	6	0.012	3.09	655	3.5	0.6	84%	

Run No.1																	
		INLET				DES.				PIPE	Mannings	VELOCITY		FLOW	CAPACITY	% Full	
FROM	TO	AREA	"C"	CA	TC	STORM	"I"	"Qa"	SLOPE	DIAM	Number	(fps)	LENGTH	TIME (min)	Qf (cfs)	(Qa/Qf)	REMARKS
Type-B Inlet #104	Type-B Inlet #103	0.12	0.99	0.11	10	25	6.44	0.74	0.0030	12	0.012	2.69	330	2.0	2.1	35%	DIP
Type-B Inlet #103	Type-B Inlet #102	0.09	0.99	0.09	10	25	6.44	1.31	0.0030	12	0.012	2.69	78	0.5	2.1	62%	DIP
Type-B Inlet #102	Type-A Inlet #101	0.12	0.99	0.12	10	25	6.44	2.05	0.0030	14	0.012	2.98	78	0.4	3.2	64%	DIP
Type-A Inlet #101	RX-Tank XD	0.00	0.99	0.00	10	25	6.44	2.05	0.0030	14	0.012	2.98	100	0.6	3.2	64%	DIP

Run No. 2																	
		INLET				DES.				PIPE	Mannings	VELOCITY		FLOW	CAPACITY	% Full	
FROM	TO	AREA	"C"	CA	TC	STORM	"I"	"Qa"	SLOPE	DIAM	Number	(fps)	LENGTH	TIME (min)	Qf (cfs)	(Qa/Qf)	REMARKS
Type-B Inlet #201	RX-Tank XD	0.30	0.99	0.29	10	25	6.44	1.89	0.0050	12	0.012	3.47	85	0.4	2.7	69%	DIP

Roof Run																	
		INLET				DES.				PIPE	Mannings	VELOCITY		FLOW	CAPACITY	% Full	
FROM	TO	AREA	"C"	CA	TC	STORM	"I"	"Qa"	SLOPE	DIAM	Number	(fps)	LENGTH	TIME (min)	Qf (cfs)	(Qa/Qf)	REMARKS
Down Spout 1	Down Spout 2	0.19	0.95	0.18	10	25	6.44	1.15	2.0000	10	0.012	61.51	123	0.0	33.5	3%	DIP
Down Spout 2	Down Spout 3	0.19	0.95	0.18	10	25	6.44	2.30	0.0200	10	0.012	6.15	68	0.2	3.4	69%	DIP
Down Spout 3	RX--Tank XD	0.19	0.95	0.18	10	25	6.44	5.75	0.0300	12	0.012	8.51	14	0.0	6.7	86%	DIP
Down Spout 4	Down Spout 3	0.19	0.95	0.18	10	25	6.44	2.30	0.0200	10	0.012	6.15	68	0.2	3.4	69%	DIP
Down Spout 5	Down Spout 4	0.19	0.95	0.18	10	25	6.44	1.15	0.0200	10	0.012	6.15	123	0.3	3.4	34%	DIP

To basin																	
		INLET				DES.				PIPE	Mannings	VELOCITY		FLOW	CAPACITY	% Full	
FROM	TO	AREA	"C"	CA	TC	STORM	"I"	"Qa"	SLOPE	DIAM	Number	(fps)	LENGTH	TIME (min)	Qf (cfs)	(Qa/Qf)	REMARKS
RX--Tank XD	Crystal Lake	0.00	0.00	0.00	10	25	6.44	9.69	0.0050	20	0.012	4.88	2	0.0	10.7	91%	DIP

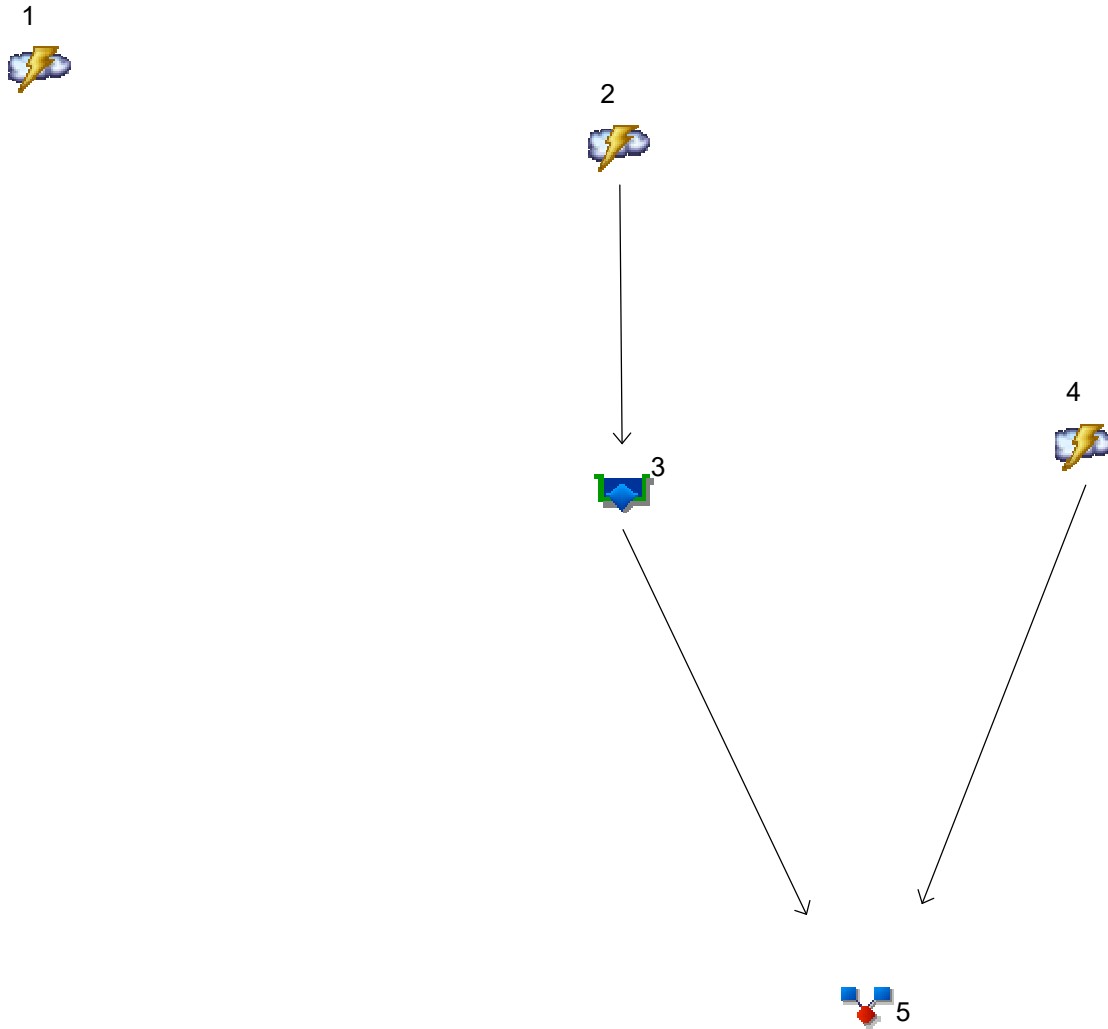
* The Qa from the RX-Tank XD to Crystl Lake is the summation of Run No. 1, Run No. 2, and To basin (2.05 CFS + 1.89 CFS + 5.75 CFS = 9.69 CFS)

APPENDIX E

DETENTION BASIN CALCULATIONS

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12



Legend

Hyd.	Origin	Description
1	Rational	Existing
2	Mod. Rational	Proposed Detained
3	Reservoir	Detention Basin
4	Rational	Proposed Undetained
5	Combine	Proposed

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	11.19	1	6	4,029	-----	-----	-----	Existing
2	Mod. Rational	1.221	1	6	8,573	-----	-----	-----	Proposed Detained
3	Reservoir	1.187	1	56	6,622	2	0.68	426	Detention Basin
4	Rational	3.849	1	6	1,386	-----	-----	-----	Proposed Undetained
5	Combine	4.106	1	6	8,007	3, 4	-----	-----	Proposed
10461-003 SWM.gpw					Return Period: 2 Year			Monday, 12 / 6 / 2021	

Hydrograph Report

Hyd. No. 1

Existing

Hydrograph type	= Rational	Peak discharge	= 11.19 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 4,029 cuft
Drainage area	= 2.620 ac	Runoff coeff.	= 0.94
Intensity	= 4.544 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

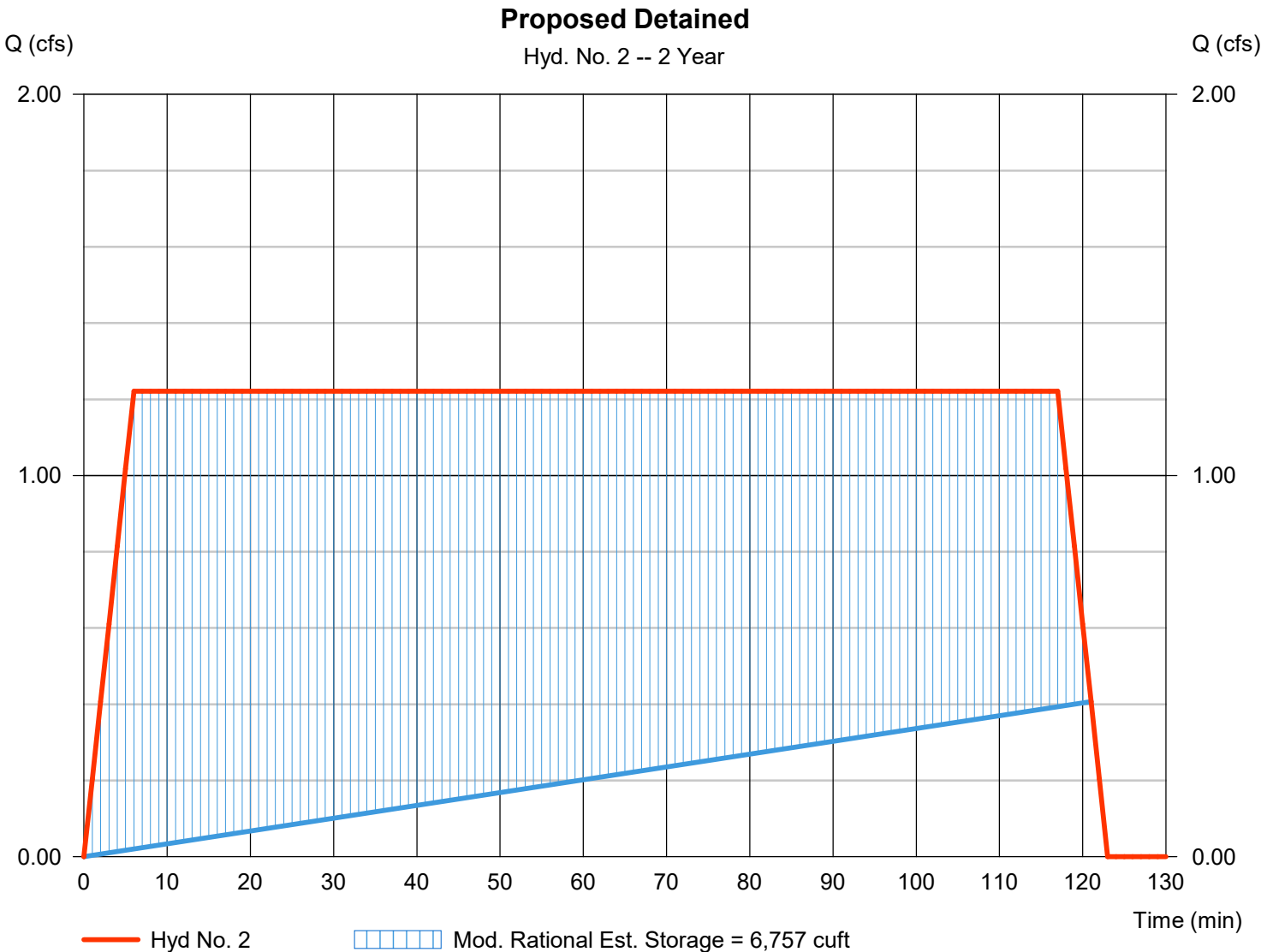
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 2

Proposed Detained

Hydrograph type	= Mod. Rational	Peak discharge	= 1.221 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 8,573 cuft
Drainage area	= 1.530 ac	Runoff coeff.	= 0.99
Intensity	= 0.806 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Storm duration	= 19.5 x Tc
Target Q	=0.490 cfs	Est. Req'd Storage	=6,757 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

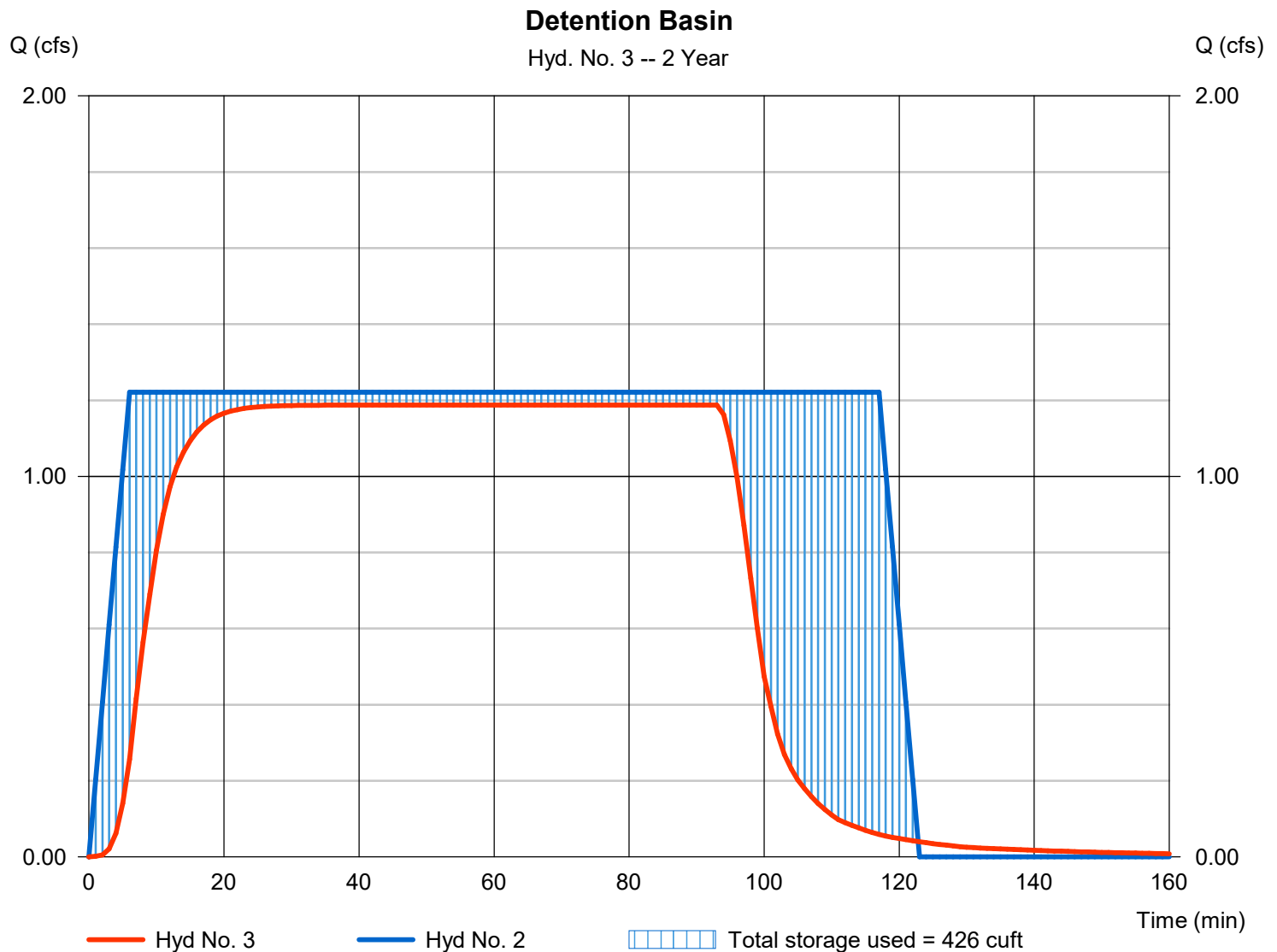
Monday, 12 / 6 / 2021

Hyd. No. 3

Detention Basin

Hydrograph type	= Reservoir	Peak discharge	= 1.187 cfs
Storm frequency	= 2 yrs	Time to peak	= 56 min
Time interval	= 1 min	Hyd. volume	= 6,622 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 0.68 ft
Reservoir name	= Detetion Basin	Max. Storage	= 426 cuft

Storage Indication method used.



Pond Report

7

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Pond No. 1 - Detention Basin

Pond Data

Trapezoid -Bottom L x W = 40.0 x 65.0 ft, Side slope = 0.00:1, Bottom elev. = 0.50 ft, Depth = 1.25 ft, Voids = 90.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	0.50	2,600	0	0
0.13	0.63	2,600	293	293
0.25	0.75	2,600	293	585
0.38	0.88	2,600	293	878
0.50	1.00	2,600	293	1,170
0.63	1.13	2,600	293	1,463
0.75	1.25	2,600	293	1,755
0.88	1.38	2,600	293	2,048
1.00	1.50	2,600	293	2,340
1.13	1.63	2,600	293	2,633
1.25	1.75	2,600	293	2,925

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	6.00	0.00	0.00
Span (in)	= 12.00	6.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 613.81	613.81	0.00	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.20	0.00	0.00	0.00
Crest El. (ft)	= 614.20	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	0.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.01	29	0.51	0.00	0.00	---	---	0.00	---	---	---	---	---	0.007
0.03	59	0.52	0.00	0.00	---	---	0.00	---	---	---	---	---	0.025
0.04	88	0.54	0.00	0.00	---	---	0.00	---	---	---	---	---	0.056
0.05	117	0.55	0.00	0.00	---	---	0.00	---	---	---	---	---	0.097
0.06	146	0.56	0.00	0.00	---	---	0.00	---	---	---	---	---	0.156
0.08	176	0.57	0.00	0.00	---	---	0.00	---	---	---	---	---	0.215
0.09	205	0.59	0.00	0.00	---	---	0.00	---	---	---	---	---	0.288
0.10	234	0.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.388
0.11	263	0.61	0.00	0.00	---	---	0.00	---	---	---	---	---	0.477
0.13	293	0.63	0.00	0.00	---	---	0.00	---	---	---	---	---	0.593
0.14	322	0.64	0.00	0.00	---	---	0.00	---	---	---	---	---	0.701
0.15	351	0.65	0.00	0.00	---	---	0.00	---	---	---	---	---	0.833
0.16	380	0.66	0.00	0.00	---	---	0.00	---	---	---	---	---	0.973
0.17	410	0.68	0.00	0.00	---	---	0.00	---	---	---	---	---	1.107
0.19	439	0.69	0.00	0.00	---	---	0.00	---	---	---	---	---	1.250
0.20	468	0.70	0.00	0.00	---	---	0.00	---	---	---	---	---	1.446
0.21	497	0.71	0.00	0.00	---	---	0.00	---	---	---	---	---	1.613
0.22	527	0.72	0.00	0.00	---	---	0.00	---	---	---	---	---	1.785
0.24	556	0.74	0.00	0.00	---	---	0.00	---	---	---	---	---	1.961
0.25	585	0.75	0.00	0.00	---	---	0.00	---	---	---	---	---	2.141
0.26	614	0.76	0.00	0.00	---	---	0.00	---	---	---	---	---	2.366
0.28	644	0.77	0.00	0.00	---	---	0.00	---	---	---	---	---	2.550
0.29	673	0.79	0.00	0.00	---	---	0.00	---	---	---	---	---	2.766
0.30	702	0.80	0.00	0.00	---	---	0.00	---	---	---	---	---	2.993
0.31	731	0.81	0.00	0.00	---	---	0.00	---	---	---	---	---	3.242
0.32	761	0.82	0.00	0.00	---	---	0.00	---	---	---	---	---	3.433
0.34	790	0.84	0.00	0.00	---	---	0.00	---	---	---	---	---	3.659
0.35	819	0.85	0.00	0.00	---	---	0.00	---	---	---	---	---	3.923
0.36	848	0.86	0.00	0.00	---	---	0.00	---	---	---	---	---	4.121
0.38	878	0.88	0.00	0.00	---	---	0.00	---	---	---	---	---	4.378
0.39	907	0.89	0.00	0.00	---	---	0.00	---	---	---	---	---	4.649
0.40	936	0.90	0.00	0.00	---	---	0.00	---	---	---	---	---	4.842

Continues on next page...

Detention Basin

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.41	965	0.91	0.00	0.00	---	---	0.00	---	---	---	---	---	5.131
0.43	995	0.93	0.00	0.00	---	---	0.00	---	---	---	---	---	5.328
0.44	1,024	0.94	0.00	0.00	---	---	0.00	---	---	---	---	---	5.583
0.45	1,053	0.95	0.00	0.00	---	---	0.00	---	---	---	---	---	5.815
0.46	1,082	0.96	0.00	0.00	---	---	0.00	---	---	---	---	---	6.032
0.47	1,112	0.97	0.00	0.00	---	---	0.00	---	---	---	---	---	6.292
0.49	1,141	0.99	0.00	0.00	---	---	0.00	---	---	---	---	---	6.487
0.50	1,170	1.00	0.00	0.00	---	---	0.00	---	---	---	---	---	6.671
0.51	1,199	1.01	0.00	0.00	---	---	0.00	---	---	---	---	---	6.840
0.52	1,229	1.02	0.00	0.00	---	---	0.00	---	---	---	---	---	7.009
0.54	1,258	1.04	0.00	0.00	---	---	0.00	---	---	---	---	---	7.179
0.55	1,287	1.05	0.00	0.00	---	---	0.00	---	---	---	---	---	7.323
0.56	1,316	1.06	0.00	0.00	---	---	0.00	---	---	---	---	---	7.465
0.57	1,346	1.08	0.00	0.00	---	---	0.00	---	---	---	---	---	7.606
0.59	1,375	1.09	0.00	0.00	---	---	0.00	---	---	---	---	---	7.764
0.60	1,404	1.10	0.00	0.00	---	---	0.00	---	---	---	---	---	7.930
0.61	1,433	1.11	0.00	0.00	---	---	0.00	---	---	---	---	---	8.094
0.63	1,463	1.13	0.00	0.00	---	---	0.00	---	---	---	---	---	8.236
0.64	1,492	1.14	0.00	0.00	---	---	0.00	---	---	---	---	---	8.365
0.65	1,521	1.15	0.00	0.00	---	---	0.00	---	---	---	---	---	8.503
0.66	1,550	1.16	0.00	0.00	---	---	0.00	---	---	---	---	---	8.663
0.68	1,580	1.17	0.00	0.00	---	---	0.00	---	---	---	---	---	8.823
0.69	1,609	1.19	0.00	0.00	---	---	0.00	---	---	---	---	---	8.944
0.70	1,638	1.20	0.00	0.00	---	---	0.00	---	---	---	---	---	9.063
0.71	1,667	1.21	0.00	0.00	---	---	0.00	---	---	---	---	---	9.220
0.72	1,697	1.23	0.00	0.00	---	---	0.00	---	---	---	---	---	9.375
0.74	1,726	1.24	0.00	0.00	---	---	0.00	---	---	---	---	---	9.491
0.75	1,755	1.25	0.00	0.00	---	---	0.00	---	---	---	---	---	9.610
0.76	1,784	1.26	0.00	0.00	---	---	0.00	---	---	---	---	---	9.764
0.77	1,814	1.27	0.00	0.00	---	---	0.00	---	---	---	---	---	9.901
0.79	1,843	1.29	0.00	0.00	---	---	0.00	---	---	---	---	---	10.01
0.80	1,872	1.30	0.00	0.00	---	---	0.00	---	---	---	---	---	10.15
0.81	1,901	1.31	0.00	0.00	---	---	0.00	---	---	---	---	---	10.29
0.82	1,931	1.33	0.00	0.00	---	---	0.00	---	---	---	---	---	10.40
0.84	1,960	1.34	0.00	0.00	---	---	0.00	---	---	---	---	---	10.52
0.85	1,989	1.35	0.00	0.00	---	---	0.00	---	---	---	---	---	10.67
0.86	2,018	1.36	0.00	0.00	---	---	0.00	---	---	---	---	---	10.78
0.88	2,048	1.38	0.00	0.00	---	---	0.00	---	---	---	---	---	10.89
0.89	2,077	1.39	0.00	0.00	---	---	0.00	---	---	---	---	---	11.03
0.90	2,106	1.40	0.00	0.00	---	---	0.00	---	---	---	---	---	11.15
0.91	2,135	1.41	0.00	0.00	---	---	0.00	---	---	---	---	---	11.25
0.93	2,165	1.42	0.00	0.00	---	---	0.00	---	---	---	---	---	11.39
0.94	2,194	1.44	0.00	0.00	---	---	0.00	---	---	---	---	---	11.51
0.95	2,223	1.45	0.00	0.00	---	---	0.00	---	---	---	---	---	11.61
0.96	2,252	1.46	0.00	0.00	---	---	0.00	---	---	---	---	---	11.74
0.97	2,282	1.48	0.00	0.00	---	---	0.00	---	---	---	---	---	11.86
0.99	2,311	1.49	0.00	0.00	---	---	0.00	---	---	---	---	---	11.95
1.00	2,340	1.50	0.00	0.00	---	---	0.00	---	---	---	---	---	12.08
1.01	2,369	1.51	0.00	0.00	---	---	0.00	---	---	---	---	---	12.20
1.02	2,399	1.52	0.00	0.00	---	---	0.00	---	---	---	---	---	12.29
1.04	2,428	1.54	0.00	0.00	---	---	0.00	---	---	---	---	---	12.42
1.05	2,457	1.55	0.00	0.00	---	---	0.00	---	---	---	---	---	12.53
1.06	2,486	1.56	0.00	0.00	---	---	0.00	---	---	---	---	---	12.62
1.08	2,516	1.58	0.00	0.00	---	---	0.00	---	---	---	---	---	12.74
1.09	2,545	1.59	0.00	0.00	---	---	0.00	---	---	---	---	---	12.86
1.10	2,574	1.60	0.00	0.00	---	---	0.00	---	---	---	---	---	12.95
1.11	2,603	1.61	0.00	0.00	---	---	0.00	---	---	---	---	---	13.07
1.13	2,633	1.63	0.00	0.00	---	---	0.00	---	---	---	---	---	13.18
1.14	2,662	1.64	0.00	0.00	---	---	0.00	---	---	---	---	---	13.27
1.15	2,691	1.65	0.00	0.00	---	---	0.00	---	---	---	---	---	13.38
1.16	2,720	1.66	0.00	0.00	---	---	0.00	---	---	---	---	---	13.49
1.17	2,750	1.67	0.00	0.00	---	---	0.00	---	---	---	---	---	13.58
1.19	2,779	1.69	0.00	0.00	---	---	0.00	---	---	---	---	---	13.69
1.20	2,808	1.70	0.00	0.00	---	---	0.00	---	---	---	---	---	13.80
1.21	2,837	1.71	0.00	0.00	---	---	0.00	---	---	---	---	---	13.89
1.23	2,867	1.73	0.00	0.00	---	---	0.00	---	---	---	---	---	13.99
1.24	2,896	1.74	0.00	0.00	---	---	0.00	---	---	---	---	---	14.10
1.25	2,925	1.75	0.00	0.00	---	---	0.00	---	---	---	---	---	14.20

...End

Hydrograph Report

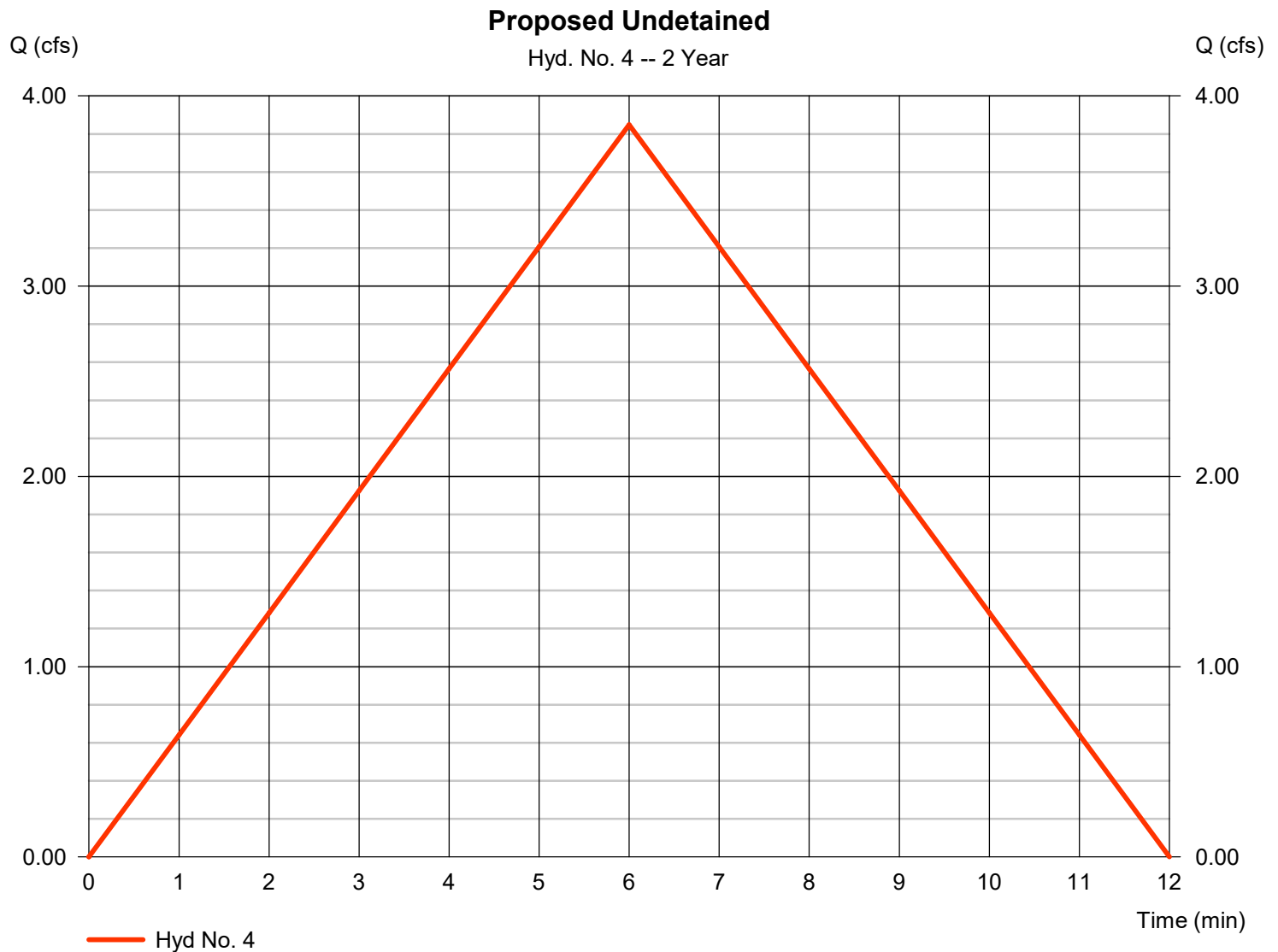
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 4

Proposed Undetained

Hydrograph type	= Rational	Peak discharge	= 3.849 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 1,386 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.77
Intensity	= 4.544 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Asc/Rec limb fact	= 1/1

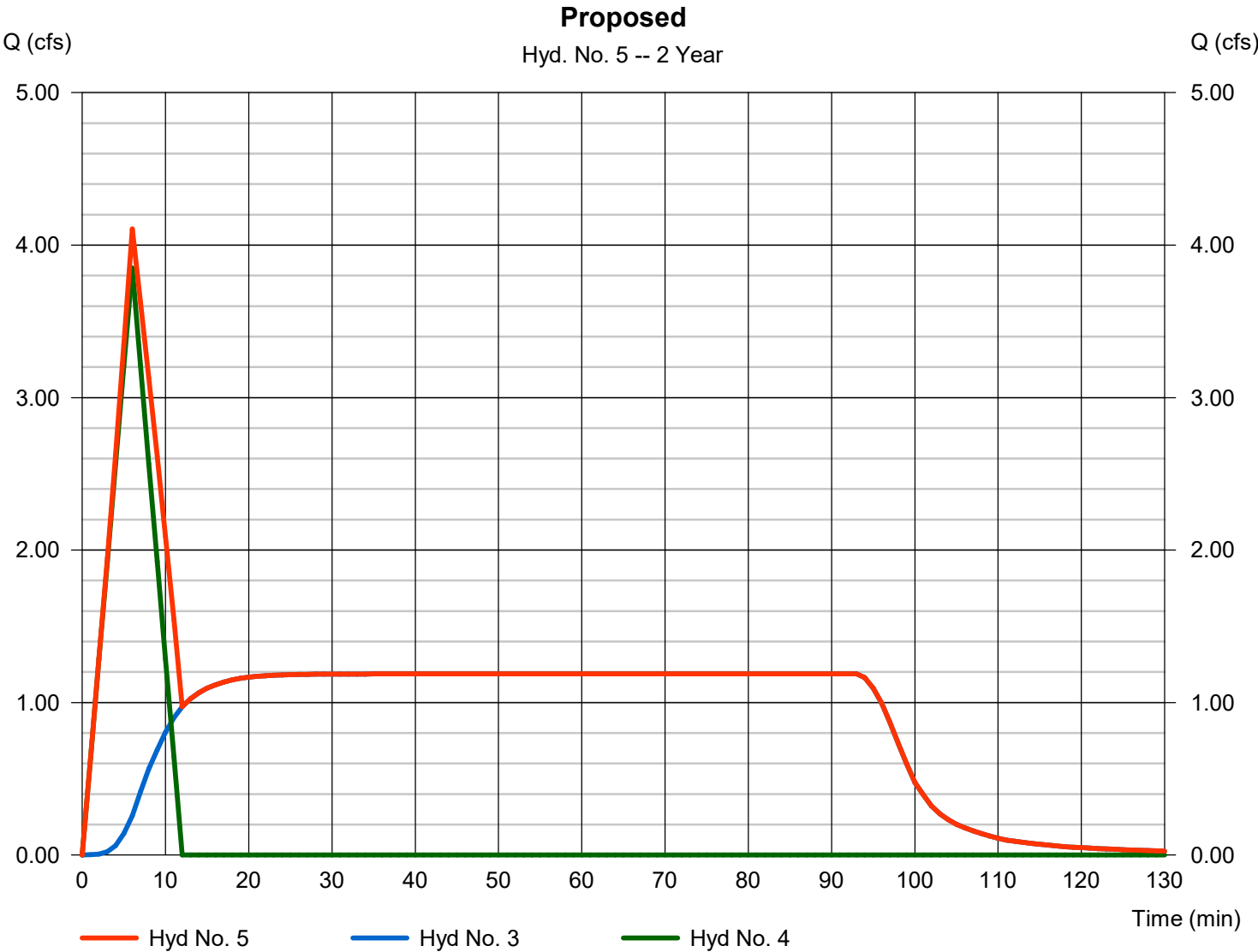


Hydrograph Report

Hyd. No. 5

Proposed

Hydrograph type	= Combine	Peak discharge	= 4.106 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 8,007 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 1.100 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	14.90	1	6	5,362	-----	-----	-----	Existing
2	Mod. Rational	4.327	1	6	8,567	-----	-----	-----	Proposed Detained
3	Reservoir	4.194	1	24	6,035	2	0.87	857	Detention Basin
4	Rational	5.123	1	6	1,844	-----	-----	-----	Proposed Undetained
5	Combine	7.150	1	6	7,879	3, 4	-----	-----	Proposed
10461-003 SWM.gpw					Return Period: 10 Year			Monday, 12 / 6 / 2021	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 1

Existing

Hydrograph type	= Rational	Peak discharge	= 14.90 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 5,362 cuft
Drainage area	= 2.620 ac	Runoff coeff.	= 0.94
Intensity	= 6.048 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Asc/Rec limb fact	= 1/1

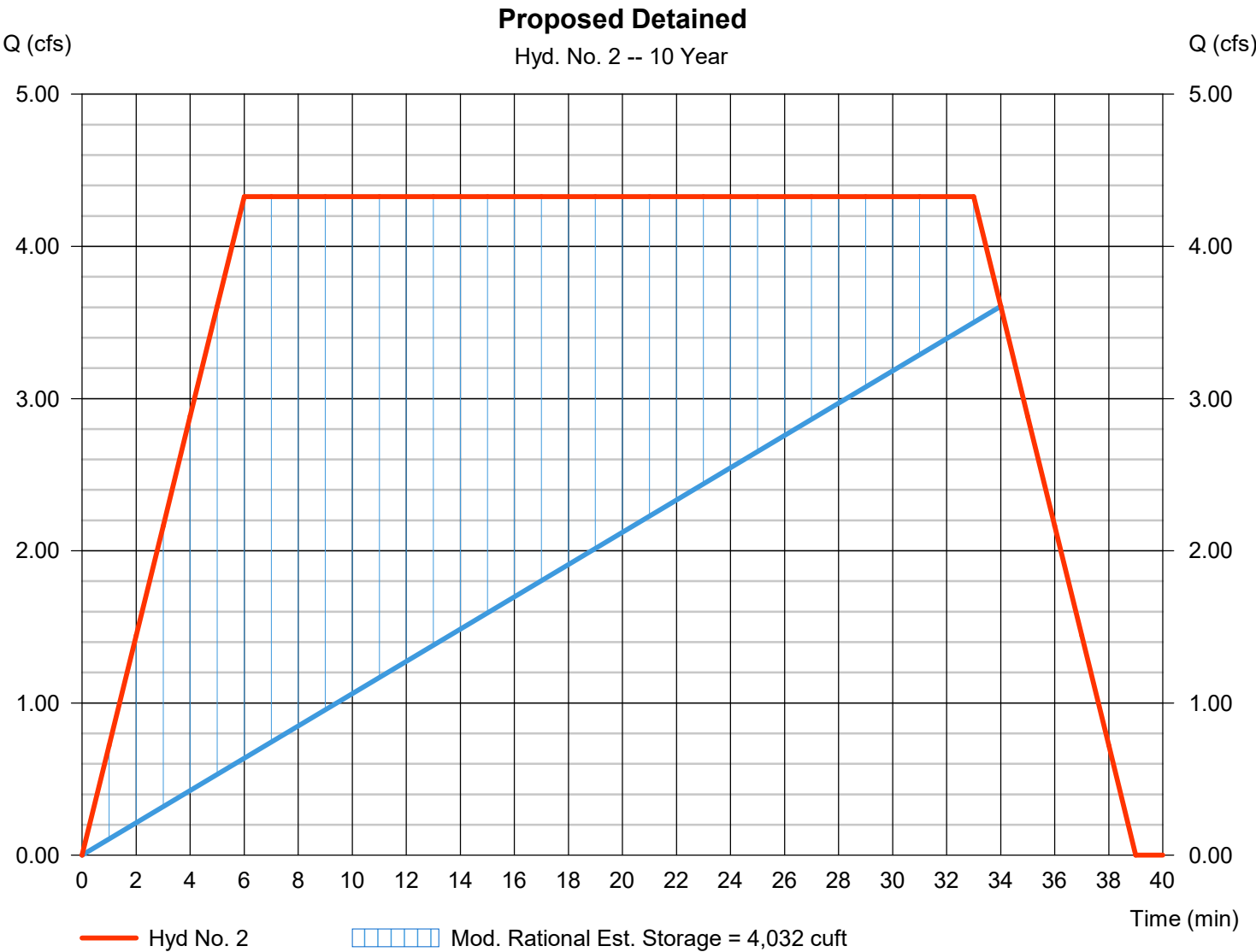


Hydrograph Report

Hyd. No. 2

Proposed Detained

Hydrograph type	= Mod. Rational	Peak discharge	= 4.327 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 8,567 cuft
Drainage area	= 1.530 ac	Runoff coeff.	= 0.99
Intensity	= 2.857 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Storm duration	= 5.5 x Tc
Target Q	=3.810 cfs	Est. Req'd Storage	=4,032 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

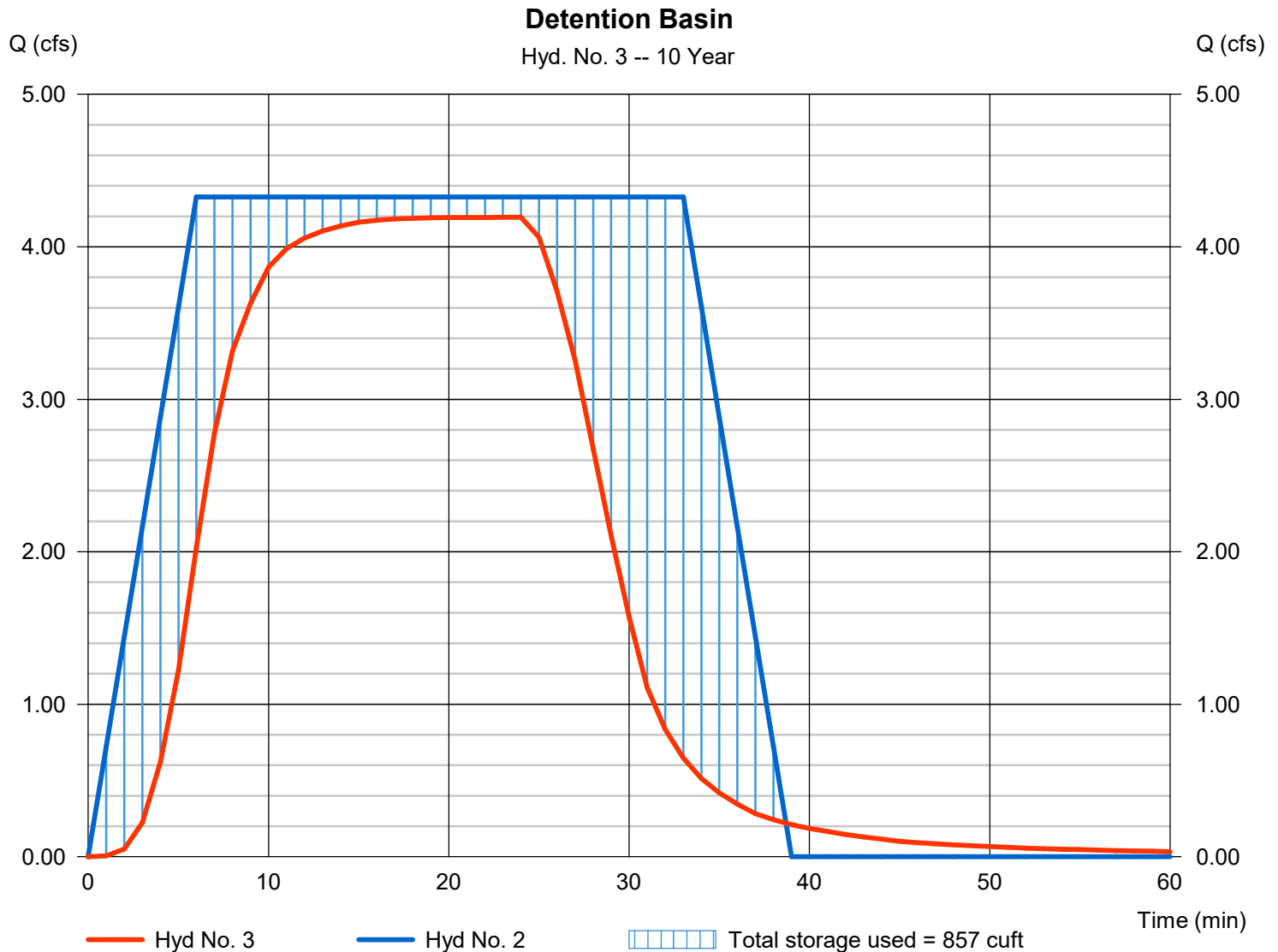
Monday, 12 / 6 / 2021

Hyd. No. 3

Detention Basin

Hydrograph type	= Reservoir	Peak discharge	= 4.194 cfs
Storm frequency	= 10 yrs	Time to peak	= 24 min
Time interval	= 1 min	Hyd. volume	= 6,035 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 0.87 ft
Reservoir name	= Detetion Basin	Max. Storage	= 857 cuft

Storage Indication method used.



Hydrograph Report

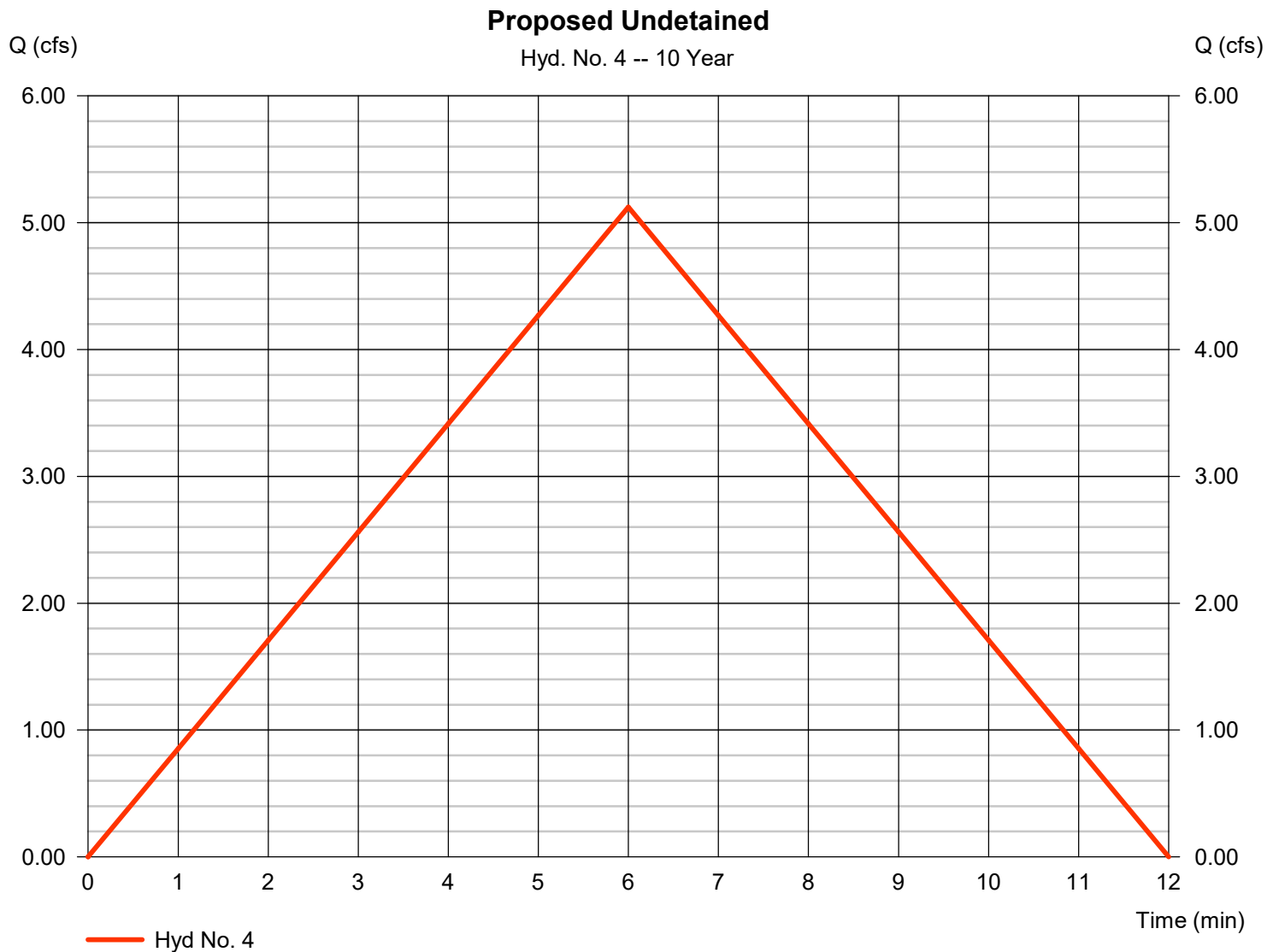
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 4

Proposed Undetained

Hydrograph type	= Rational	Peak discharge	= 5.123 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 1,844 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.77
Intensity	= 6.048 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

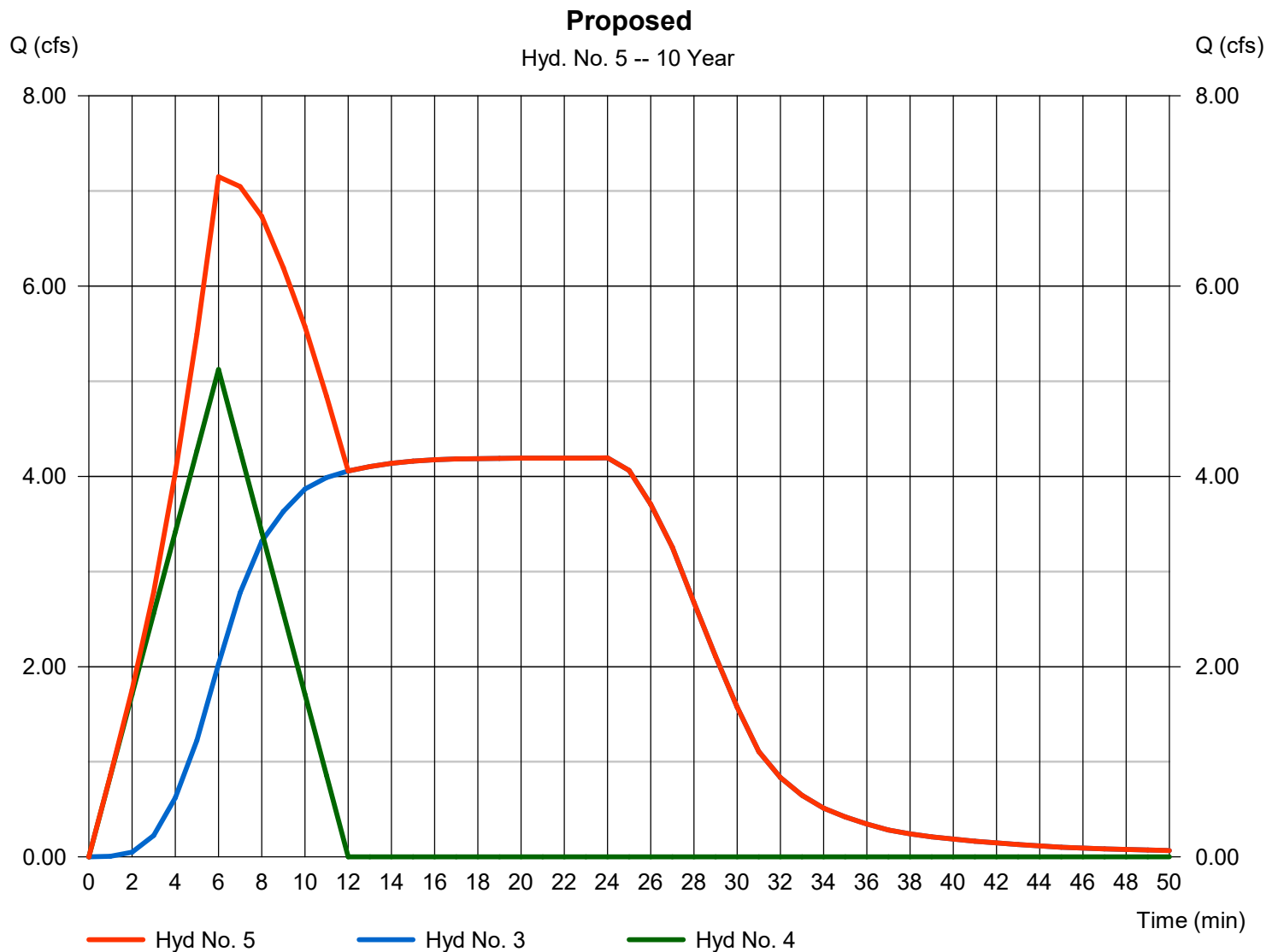
Monday, 12 / 6 / 2021

Hyd. No. 5

Proposed

Hydrograph type = Combine
 Storm frequency = 10 yrs
 Time interval = 1 min
 Inflow hyds. = 3, 4

Peak discharge = 7.150 cfs
 Time to peak = 6 min
 Hyd. volume = 7,879 cuft
 Contrib. drain. area = 1.100 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	19.67	1	6	7,081	-----	-----	-----	Existing
2	Mod. Rational	6.423	1	6	11,191	-----	-----	-----	Proposed Detained
3	Reservoir	5.969	1	22	7,877	2	0.96	1,074	Detention Basin
4	Rational	6.764	1	6	2,435	-----	-----	-----	Proposed Undetained
5	Combine	10.11	1	6	10,312	3, 4	-----	-----	Proposed
10461-003 SWM.gpw					Return Period: 100 Year			Monday, 12 / 6 / 2021	

Hydrograph Report

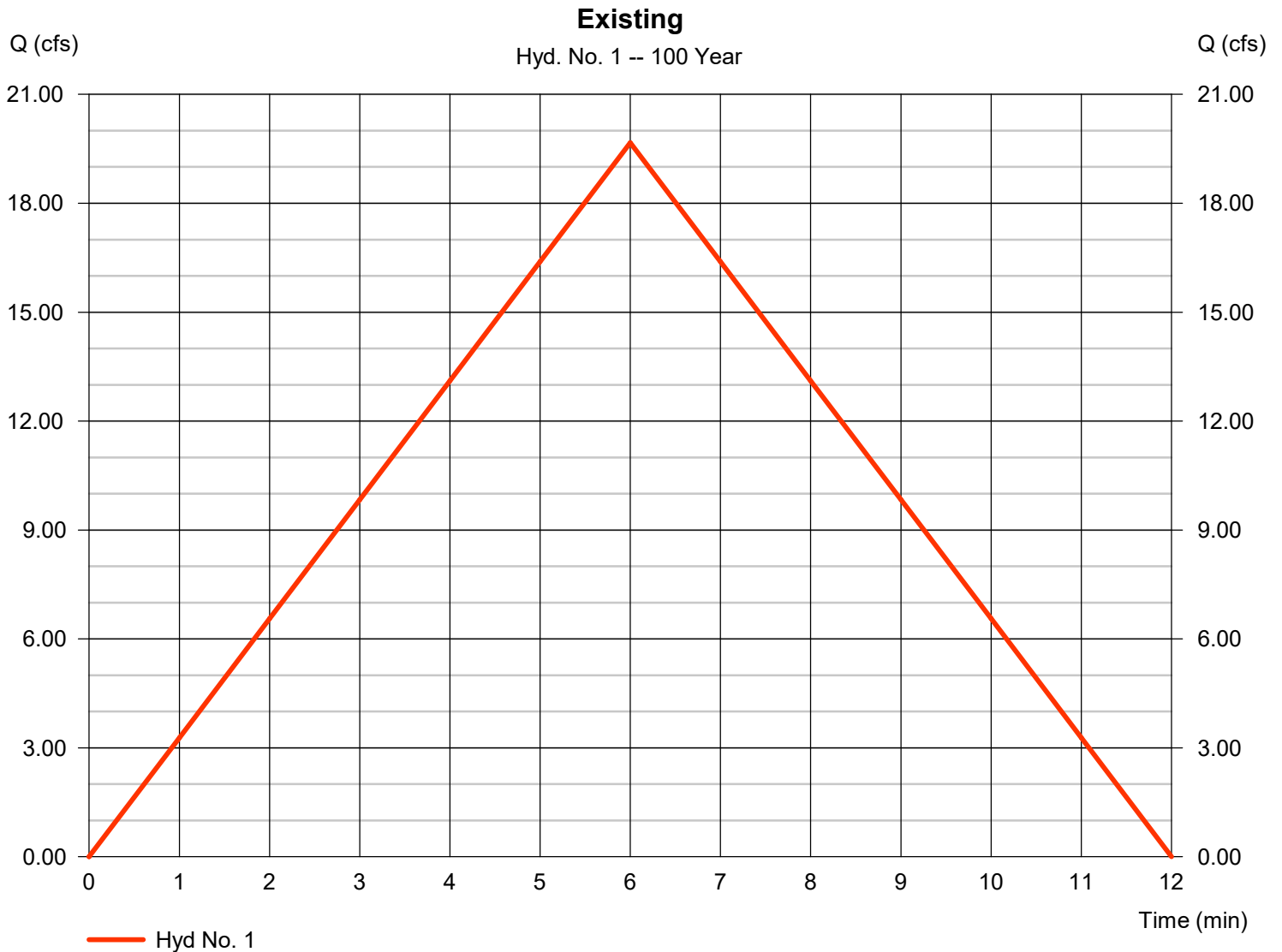
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 1

Existing

Hydrograph type	= Rational	Peak discharge	= 19.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 7,081 cuft
Drainage area	= 2.620 ac	Runoff coeff.	= 0.94
Intensity	= 7.986 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

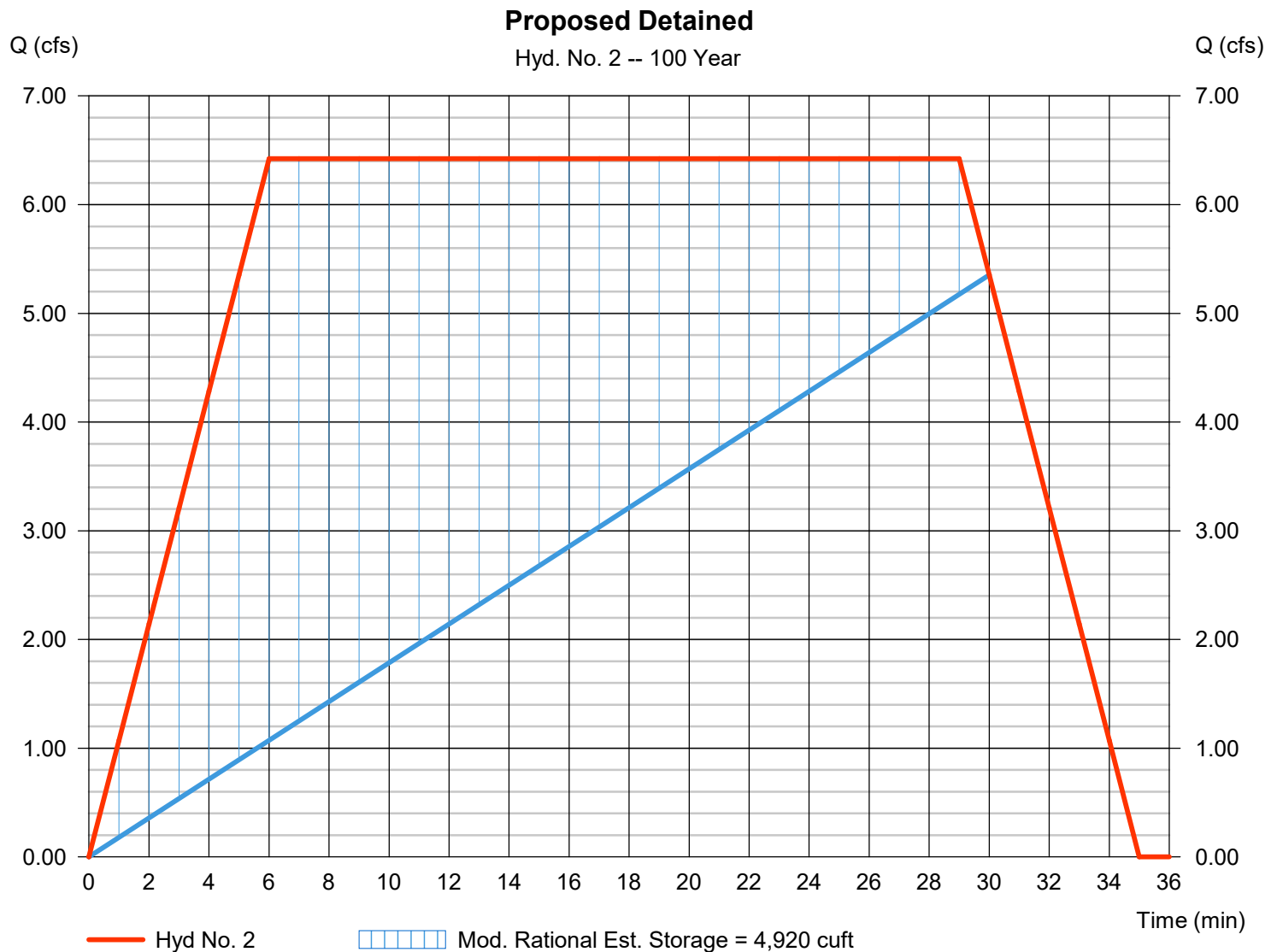
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 2

Proposed Detained

Hydrograph type	= Mod. Rational	Peak discharge	= 6.423 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 11,191 cuft
Drainage area	= 1.530 ac	Runoff coeff.	= 0.99
Intensity	= 4.240 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Storm duration	= 4.8 x Tc
Target Q	=5.880 cfs	Est. Req'd Storage	=4,920 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

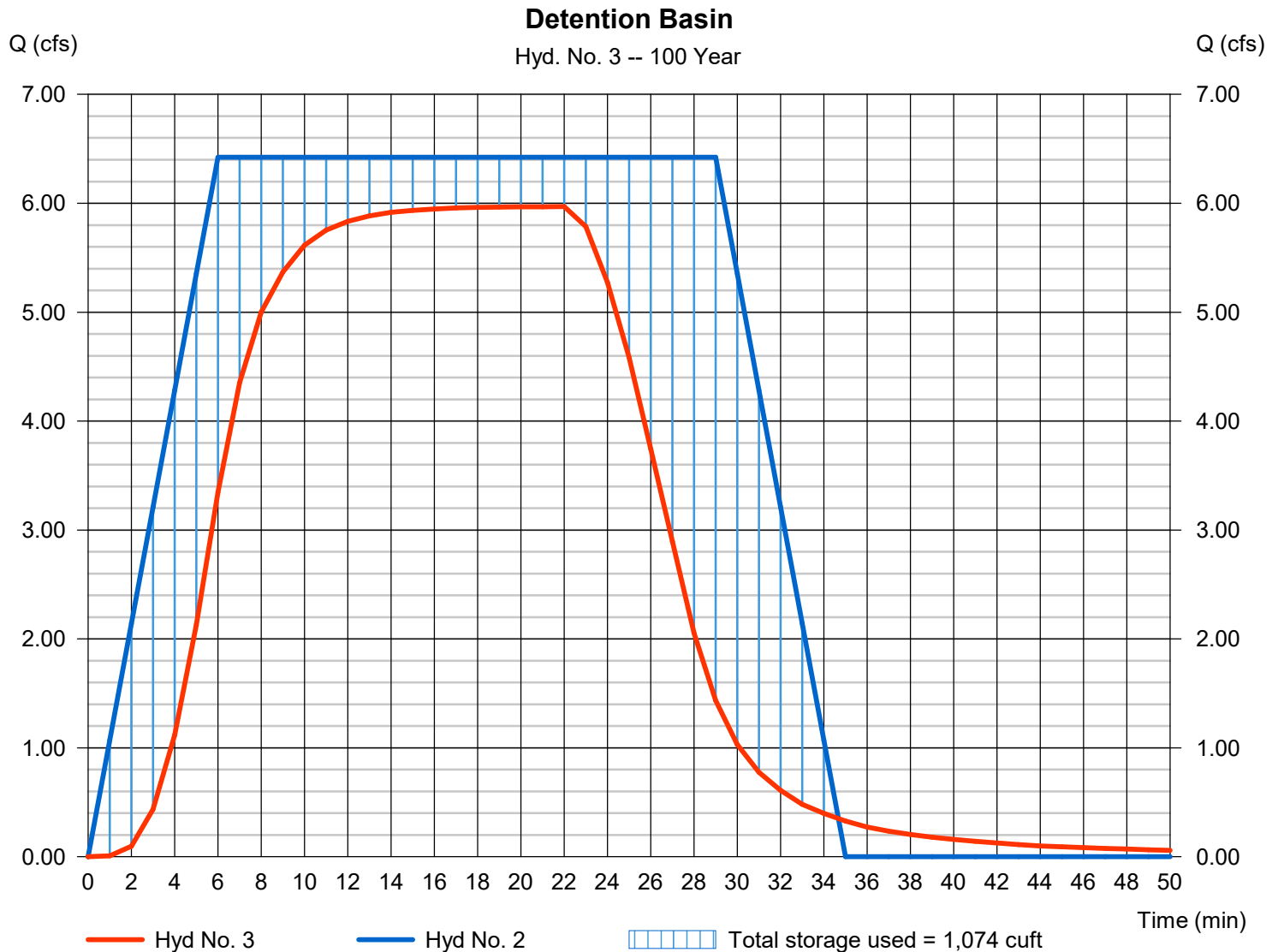
Monday, 12 / 6 / 2021

Hyd. No. 3

Detention Basin

Hydrograph type	= Reservoir	Peak discharge	= 5.969 cfs
Storm frequency	= 100 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 7,877 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 0.96 ft
Reservoir name	= Detetion Basin	Max. Storage	= 1,074 cuft

Storage Indication method used.



Hydrograph Report

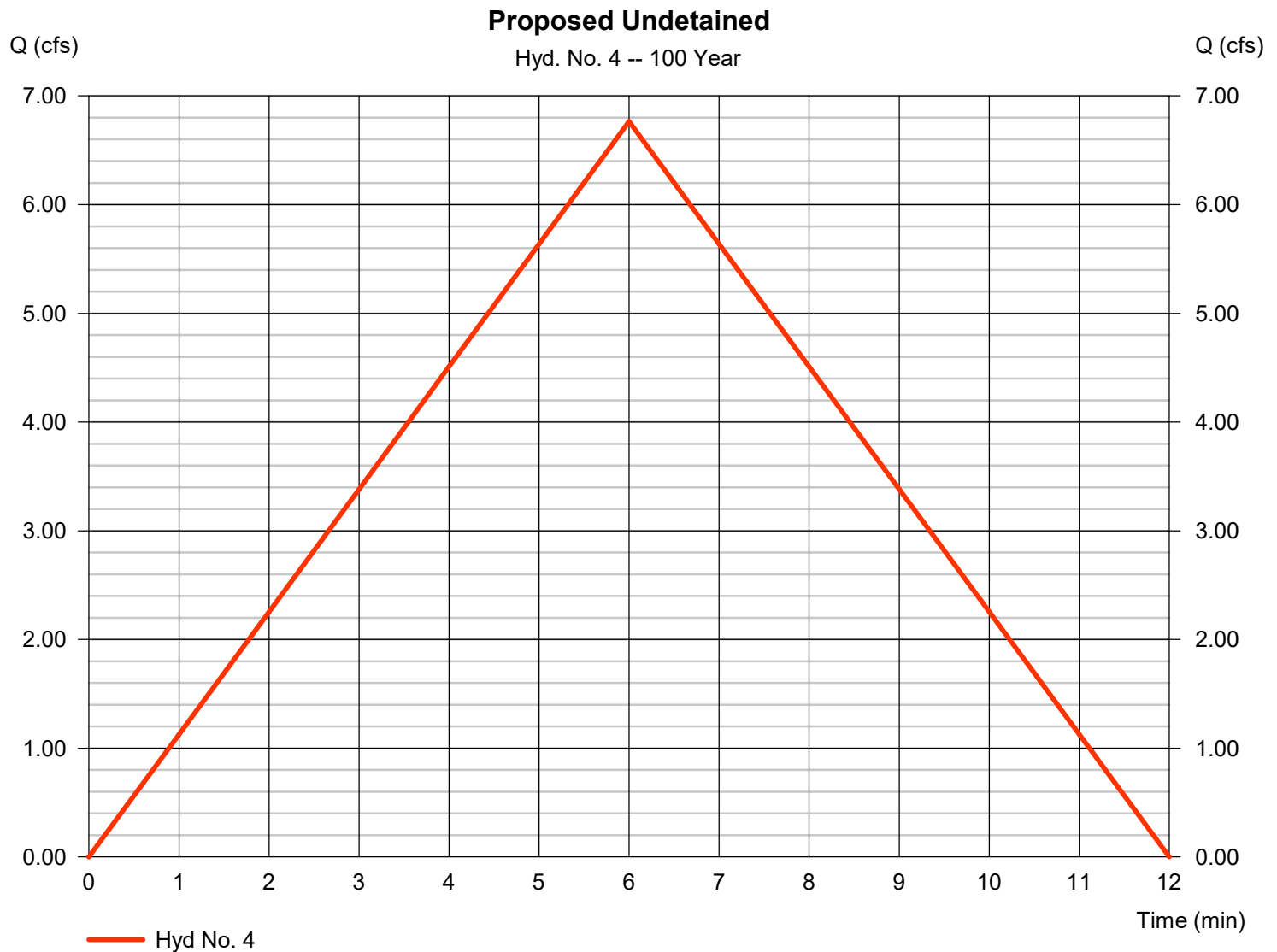
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 12 / 6 / 2021

Hyd. No. 4

Proposed Undetained

Hydrograph type	= Rational	Peak discharge	= 6.764 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 2,435 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.77
Intensity	= 7.986 in/hr	Tc by User	= 6.00 min
IDF Curve	= JerseyCityIDF.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

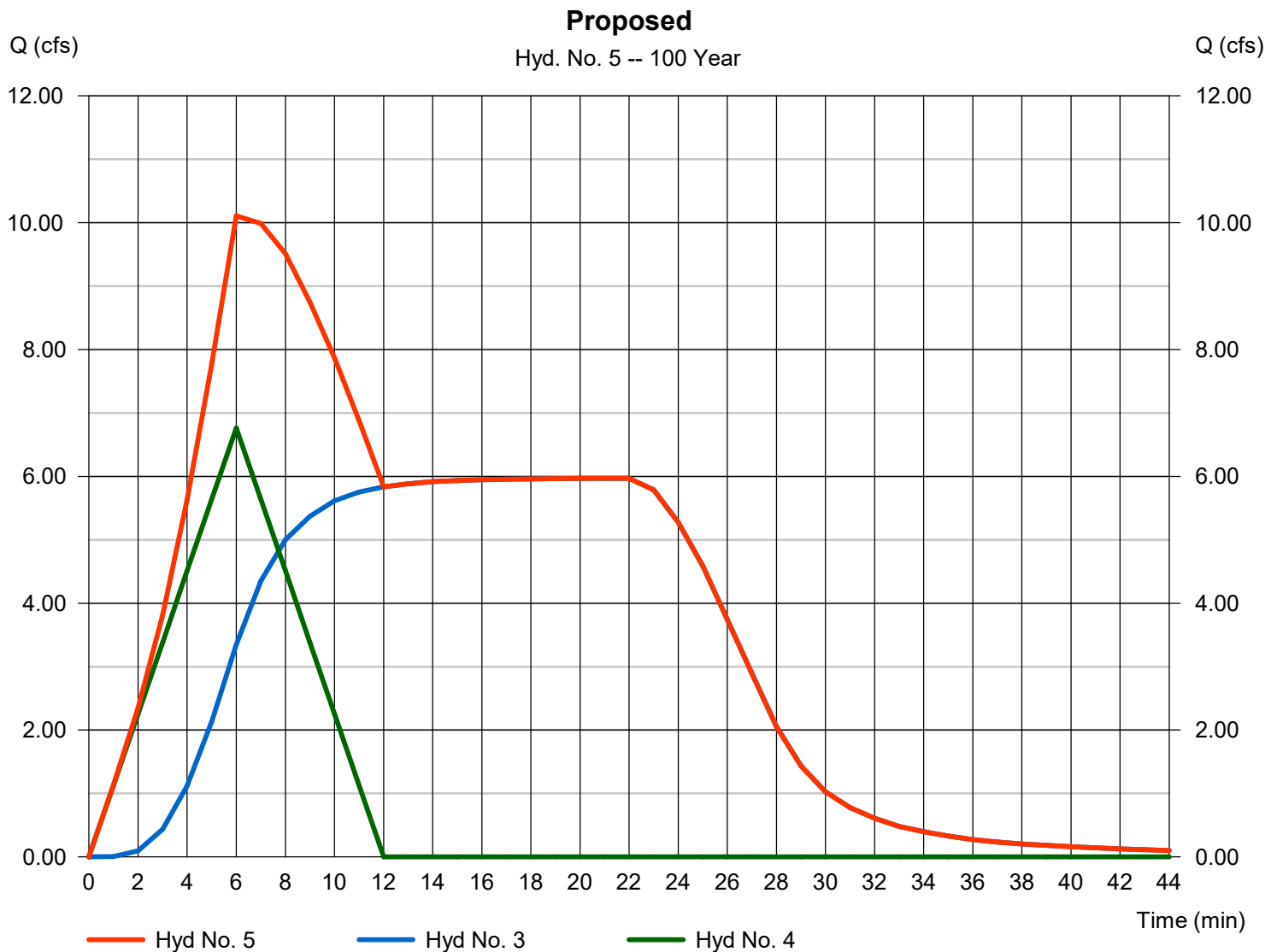
Monday, 12 / 6 / 2021

Hyd. No. 5

Proposed

Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 1 min
 Inflow hyds. = 3, 4

Peak discharge = 10.11 cfs
 Time to peak = 6 min
 Hyd. volume = 10,312 cuft
 Contrib. drain. area = 1.100 ac



Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	48.3994	11.8000	0.8833	-----
2	60.7517	12.5000	0.8887	-----
3	0.0000	0.0000	0.0000	-----
5	58.4111	11.8000	0.8276	-----
10	55.7872	10.9000	0.7858	-----
25	53.7394	10.2000	0.7402	-----
50	46.8492	8.8000	0.6852	-----
100	45.6025	8.2000	0.6566	-----

File name: JerseyCityIDF.IDF

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

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.00	3.18	2.65	2.28	2.00	1.79	1.62	1.48	1.37	1.27	1.18	1.11
2	4.77	3.82	3.19	2.75	2.43	2.17	1.97	1.80	1.66	1.54	1.44	1.35
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.66	4.56	3.84	3.34	2.96	2.66	2.42	2.23	2.06	1.92	1.80	1.70
10	6.35	5.12	4.32	3.76	3.35	3.02	2.76	2.54	2.36	2.21	2.08	1.96
25	7.17	5.81	4.93	4.31	3.85	3.49	3.20	2.96	2.76	2.59	2.44	2.31
50	7.76	6.28	5.34	4.69	4.20	3.82	3.52	3.26	3.05	2.87	2.72	2.58
100	8.38	6.79	5.79	5.09	4.57	4.17	3.85	3.58	3.35	3.16	3.00	2.85

Tc = time in minutes. Values may exceed 60.

me: Q:\Eng\PROJECTS\10320-003 Journal Squared Phase 2\Design Data\SWM\HydraFlow Model\RainfallDataJC.pcp

[illegible]

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APPENDIX F

RIPRAP CALCULATIONS

DRESDNER ROBIN RIPRAP CALCULATIONS

Length of riprap

$$La = 1.8\left(\frac{q}{Do^{0.5}}\right) + 7Do$$

$$La = 1.8\left(\frac{1.50}{2^{0.5}}\right) + 7(2) = 15.9'$$

$$La = 15.9'$$

Width of riprap

$$Wo = 3Do + La$$

$$Wo = 3(2) + 15.9 = 21.9'$$

$$Wo = 21.9'$$

Stone size of riprap

$$q = \frac{Q}{Do}$$

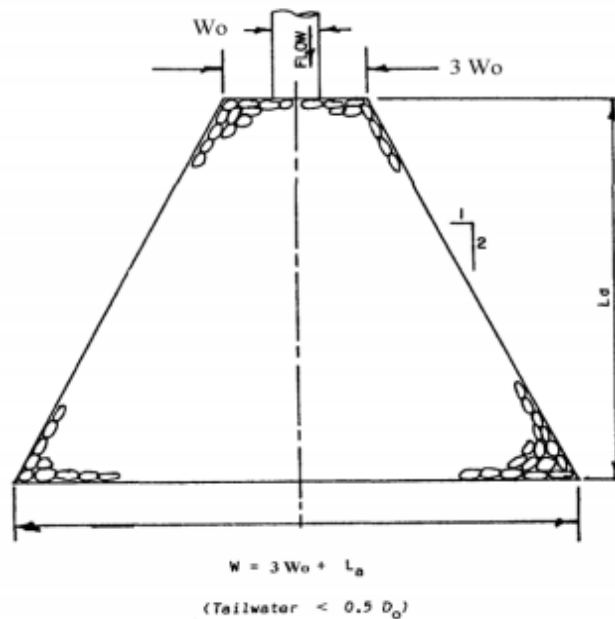
$$q = \frac{2.99 \text{ CFS}}{2'} = 1.50$$

$$d_{50} = \left(\frac{0.02}{Tw}\right) q^{1.33}$$

$$d_{50} = \left(\frac{0.02}{0.2}\right) 2.99^{1.33} = 0.43' = 5.17''$$

$$d_{50} = 5.17''$$

Detail of riprap



APPENDIX G

LOW IMPACT DESIGN CHECKLIST

New Jersey Stormwater Best Management Practices Manual

February 2004

A P P E N D I X A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: Township of West Orange

County: Essex County Date: 7/23/2021

Review board or agency: CME Associates on behalf of West Orange Zoning Board

Proposed land development name: Public Storage No. NJ20016

Lot(s): 1.08 Block(s): 111

Project or application number: ZB-20-16

Applicant's name: Public Storage Atlantic Coast, LLC

Applicant's address: 701 Western Avenue, Glendale, CA 91201

Telephone: 818-244-8080 Fax: _____

Email address: CArealestate@publicstorage.com

Designer's name: Dresdner Robin

Designer's address: 1 Evertrust Plaza, Suite 901, Jersey City, New Jersey, 07302

Telephone: 201-297-4205 Fax: _____

Email address: MNeuls@DresdnerRobin.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

[illegible]

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

New Jersey's Stormwater Rules at NJAC 7:8; Last Amended March 02, 2021

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: Project site is consider a major development, therefore ground water recharge,
water quality and water quantity will need to be addressed. The site is decreasing the impervious surface
on the site, which will decrease the runoff generated by the site.

List LID-BMPs prohibited by local regulations: N/A

Pre-design meeting held? Yes: _____ Date: _____ No: X

Meeting held with: _____

Pre-design site walk held? Yes: _____ Date: _____ No: X

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: N/A

Required approval: N/A

Name: N/A

Required approval: N/A

Name: N/A

Required approval: N/A

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No: _____

If yes, was this inventory a factor in the site's layout and design? Yes: X No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: _____ If yes, specify % of site: _____

Native ground cover? Yes: _____ No: X If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: X If yes, specify % of site: _____

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: X If yes, specify % of site: _____

Native ground cover? Yes: _____ No: X If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: X If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: _____ No: N/A

Reduce runoff pollutant loads through runoff treatment: Yes: _____ No: N/A

Maintain groundwater recharge by preserving natural areas: Yes: _____ No: N/A

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: _____ No: X

If yes, were these inventories factors in the site's layout and design? Yes: _____ No: N/A

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: _____ No: X

If yes, how: N/A

Restrict temporary site disturbance during construction? Yes: _____ No: X

If yes, how: N/A

Consider soils and slopes in selecting disturbance limits? Yes: _____ No: X

If yes, how: N/A

C. Specify percentage of site to be cleared: 8% Regraded: 1%

D. Specify percentage of cleared areas done so for buildings: 0%

For driveways and parking: 0%; Reducing impervious For roadways: 0%

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

Landscaped area are being increased on the northern portion of the site.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: 0% HSG B: 0% HSG C: 0% HSG D: 0%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: 0% HSG B: 0% HSG C: 0% HSG D: 0%

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

The USDA classified the soil as HSG (Unranked).

I. Does the site include Karst topography? Yes: _____ No: X

If yes, discuss measures taken to limit Karst impacts:

N/A

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 82% Proposed: 72%

B. Specify maximum site impervious coverage allowed by regulations: 60%

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity	N/A	N/A
Residential access – medium intensity	N/A	N/A
Residential access – high intensity with parking	N/A	N/A
Residential access – high intensity without parking	N/A	N/A
Neighborhood	N/A	N/A
Minor collector – low intensity without parking	N/A	N/A
Minor collector – with one parking lane	N/A	N/A
Minor collector – with two parking lanes	60	36
Minor collector – without parking	N/A	N/A
Major collector	N/A	N/A

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9x18 Regulations: 9x18

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 93 Regulations: 6

F. Specify percentage of total site impervious cover created by buildings:

By driveways and parking: 5,200 sf By roadways: 25,400 sf

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

Storm water quantity will be reduced with the use of an below grade-detention-system.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 114,465 Buildings: 0 Driveways and parking: 41,010 Roads: 0

I. Specify percentage of total impervious area that will be porous:

Total site: 114,465 Buildings: 40,830 Driveways and parking: 10,357 Roads: 0

J. Specify percentage of total building roof area that will be vegetated: 0

K. Specify percentage of total parking area located beneath buildings: 0

L. Specify percentage of total parking located within multi-level parking deck: 0

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 680 Vegetated swale: 0 Natural channel: 0

Stormwater management facility: R-Tank-XD Other: _____

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

N/A

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: N/A

Increase overland flow roughness: N/A

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: 1

Specify the spacing between the trash receptacles: 0

Compare trash receptacles proposed with those required by regulations:

Proposed: 1 Regulations: 0

B. Pet Waste Stations

Specify the number of pet waste stations provided: N/A

Specify the spacing between the pet waste stations: N/A

Compare pet waste stations proposed with those required by regulations:

Proposed: N/A Regulations: N/A

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: N/A

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: N/A Regulations: N/A

Litter collection: Proposed: N/A Regulations: N/A

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

N/A

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.		X
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.		X
4.	Minimize the decrease in the pre-construction time of concentration.	X	
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.		X
9.	Provide preventative source controls.		X

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

N/A
