

Stormwater Management Narrative

501-503 Station Avenue

Block 25, Lots 16 & 17.01
Borough of Haddon Heights,
Camden County, New Jersey



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A handwritten signature in blue ink, appearing to read "Clifton W. Quay", written over a horizontal line.

Clifton W. Quay, PE, PP
NJ P.E. License #42670

February 13, 2024

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1.0 Chapter 1 – DESIGN NOTES

1.1 DESIGN NOTES

1.1.1 PRE-DEVELOPMENT VS. POST-DEVELOPMENT ANALYSIS

- A. Stormwater Runoff: Modified Rational Method was used for hydrograph computations.
- B. Time of Concentration: 10 Minutes
- C. 'c' values: Impervious = 0.95
 Lawn = 0.35
- D. Storm analyzed with rainfall amounts for NJDEP IDF curves:

| | |
|-----------------|------------------|
| Storm Frequency | 60 Min. Rainfall |
| 25 Year | 2.42 in/hr |

1.1.2 COLLECTION SYSTEM DESIGN-

- A. PVC Roof Leaders: Sized per National Standard Plumbing Code-NJ

1.1.3 AREA CALCULATIONS

| | Impervious Area | Pervious Area | Total Area |
|------------------|---------------------|---------------------|---------------------|
| Pre Development | 6,281 sf or 0.14 ac | 2,201 sf or 0.05 ac | 8,482 sf or 0.19 ac |
| Post Development | 8,004 sf or 0.18 ac | 478 sf or 0.01 ac | 8,482 sf or 0.19 ac |

2.0 Chapter 2 – DESIGN NARRATIVE

2.1 DESIGN OVERVIEW

2.1.1 EXISTING CONDITIONS

The existing site consists of a one-story flower shop and a two-story flex building. The site is bounded to the south by Station Avenue, to the east by White Horse Pike, and to the west, and north by commercial properties. The front of the site drains towards Station Ave and the rear drains west towards the neighboring properties.

The stormwater runoff calculations are based on the runoff from multiple durations of the 25-year storm event. The results are shown in Section 2.1.2.

A test pit and infiltration testing were completed on site on November 30, 2023. The soil log indicates a seasonal high water table was not encountered in the 10 ft deep test pit. Three infiltration tests were performed via tube permeameter testing 6.5 feet below surface at an elevation of 95.65. The tests achieved rates of 0.50 inches/hour, 0.71 inches/hour and 0.60 inches/hour.

2.1.2 PROPOSED CONDITIONS

The proposed development includes demolishing the existing site and constructing a new building with first floor commercial and second and third floor apartments, along with parking in the rear.

The maximum allowed impervious area for the site is 6,786 sf. The proposed site contains 8,004 sf of impervious coverage. This is a 1,218 sf increase from pre-development conditions. The site is designed to contain the increase in runoff from the 25-year storm event. An underground basin is proposed to capture the runoff from the proposed building. The roof drains are collected and directed into the basin along with two inlets located in the parking lot. The collected area (8,304 sf) is greater than the increase in impervious area for the site.

The runoff from the building will be collected via roof leaders and directed into an underground basin situated in the rear parking lot. The capacity of the system totals 1,115 cf. This available volume in the system is greater than the volume increase in the stormwater runoff from the proposed development. The table below displays multiple storm durations for the 25-year storm.

Pre vs Post Development Watershed Volumes

| Storm Duration (min) | 60 | 80 | 100 |
|-------------------------------------|----------|----------|----------|
| Pre Development WS1A Runoff Volume | 1,022 cf | 1,142 cf | 1,233 cf |
| Post Development WS1A Runoff Volume | 1,190 cf | 1,330 cf | 1,436 cf |
| Difference in Runoff Volume | 168 cf | 188 cf | 203 cf |
| Basin Storage Volume | 1,085 cf | 1,109 cf | 1,106 cf |

The impervious area detained and infiltrated by the storm basin is greater than the increase in impervious from the existing conditions.

3.0 Chapter 3 – POST-DEVELOPMENT RUNOFF CALCULATIONS

HYDROGRAPH PLAN VIEW – POST-DEVELOPMENT CALCULATIONS

HYDROGRAPH SUMMARY REPORT

3.1 PRE-DEVELOPMENT WATERSHED OVERALL

3.1.1 HYDROGRAPH NO. 1, 5 & 9 (25 YEAR STORM EVENTS)

3.2 POST DEVELOPMENT RUNOFF AREA TO BASIN

3.2.1 HYDROGRAPH NO. 2, 6 & 10, (25 YEAR STORM EVENTS)

3.2.2 HYDROGRAPH NO. 3, 7 & 11, (BASIN ROUTING)

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

| 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 | Mod. Rational | 0.568 | 1 | 5 | 1,022 | ----- | ----- | ----- | Pre Devel WS - 60 min |
| 2 | Mod. Rational | 0.661 | 1 | 5 | 1,190 | ----- | ----- | ----- | Post Devel WS - 60 min |
| 3 | Reservoir | 0.356 | 1 | 32 | 173 | 2 | 101.40 | 1,085 | UG pipes |
| 5 | Mod. Rational | 0.476 | 1 | 5 | 1,142 | ----- | ----- | ----- | Pre Devel WS - 80 min |
| 6 | Mod. Rational | 0.554 | 1 | 5 | 1,330 | ----- | ----- | ----- | Post Devel WS - 80 min |
| 7 | Reservoir | 0.455 | 1 | 41 | 306 | 6 | 101.48 | 1,109 | UG pipes |
| 9 | Mod. Rational | 0.411 | 1 | 5 | 1,233 | ----- | ----- | ----- | Pre Devel WS - 100 min |
| 10 | Mod. Rational | 0.479 | 1 | 5 | 1,436 | ----- | ----- | ----- | Post Devel WS - 100 min |
| 11 | Reservoir | 0.445 | 1 | 50 | 406 | 10 | 101.47 | 1,106 | UG pipes |

Hydrograph Report

Hyd. No. 1

Pre Devel WS - 60 min

| | | | |
|-----------------|----------------------|--------------------|--------------|
| Hydrograph type | = Mod. Rational | Peak discharge | = 0.568 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 5 min |
| Time interval | = 1 min | Hyd. volume | = 1,022 cuft |
| Drainage area | = 0.190 ac | Runoff coeff. | = 0.79* |
| Intensity | = 3.783 in/hr | Tc by User | = 5.00 min |
| IDF Curve | = njidf 03-23-06.idf | Storm duration | = 6.0 x Tc |
| Target Q | =n/a | Est. Req'd Storage | =n/a |

* Composite (Area/C) = [(0.140 x 0.95) + (0.050 x 0.35)] / 0.190



Hydrograph Report

Hyd. No. 2

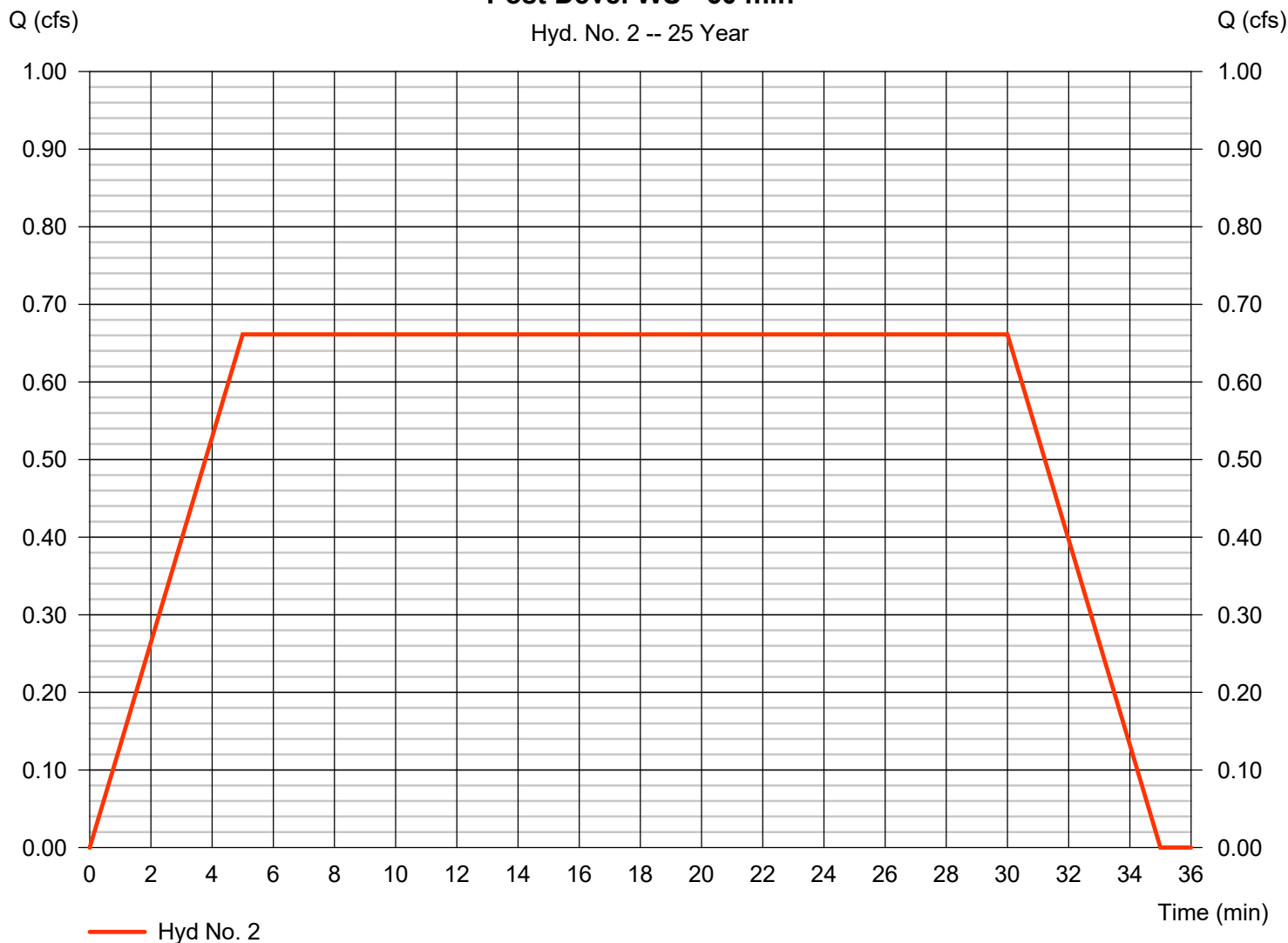
Post Devel WS - 60 min

| | | | |
|-----------------|----------------------|--------------------|--------------|
| Hydrograph type | = Mod. Rational | Peak discharge | = 0.661 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 5 min |
| Time interval | = 1 min | Hyd. volume | = 1,190 cuft |
| Drainage area | = 0.190 ac | Runoff coeff. | = 0.92* |
| Intensity | = 3.783 in/hr | Tc by User | = 5.00 min |
| IDF Curve | = njidf 03-23-06.idf | Storm duration | = 6.0 x Tc |
| Target Q | =n/a | Est. Req'd Storage | =n/a |

* Composite (Area/C) = [(0.180 x 0.95) + (0.010 x 0.35)] / 0.190

Post Devel WS - 60 min

Hyd. No. 2 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

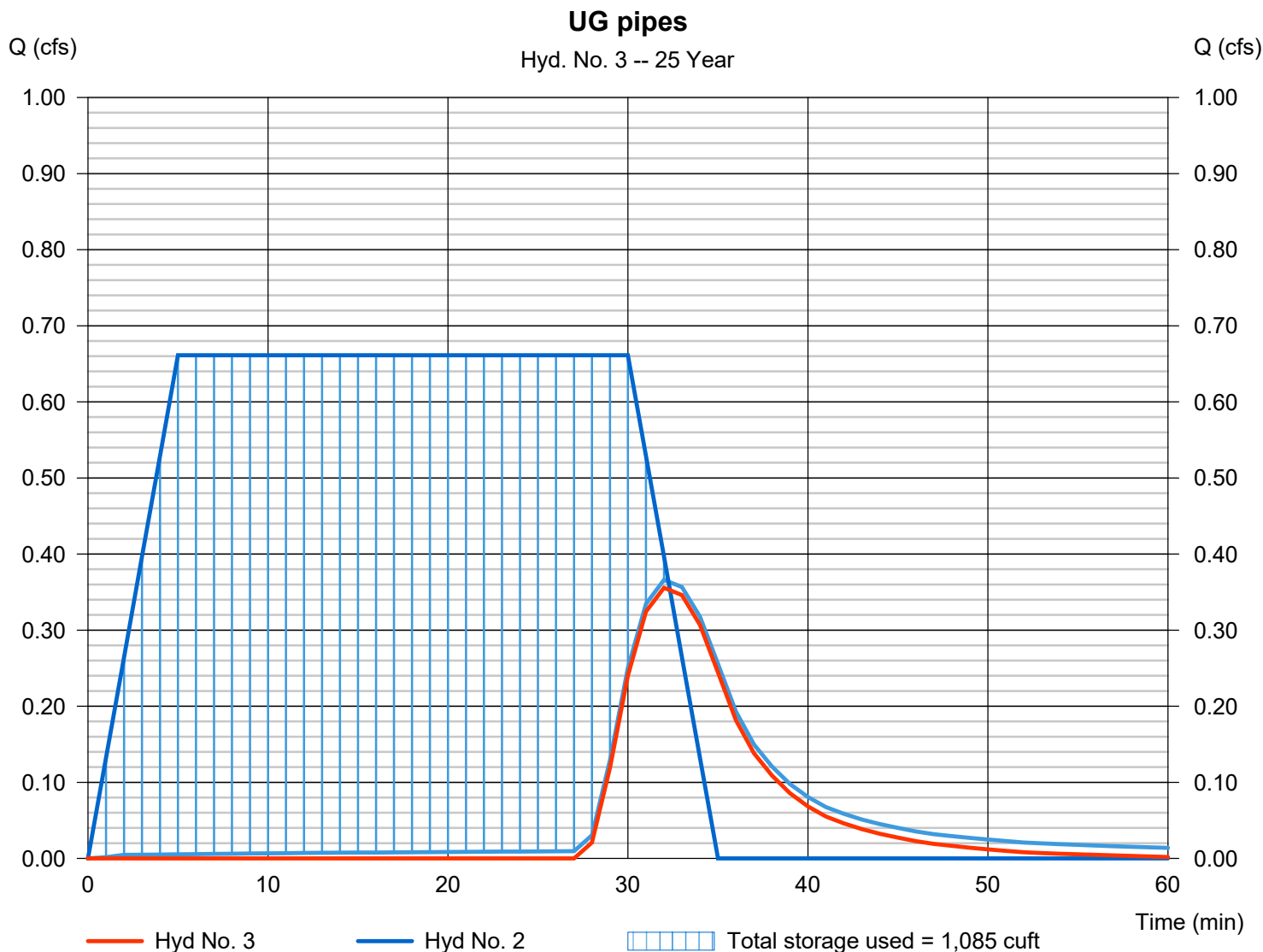
Thursday, 01 / 18 / 2024

Hyd. No. 3

UG pipes

| | | | |
|-----------------|------------------------------|----------------|--------------|
| Hydrograph type | = Reservoir | Peak discharge | = 0.356 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 32 min |
| Time interval | = 1 min | Hyd. volume | = 173 cuft |
| Inflow hyd. No. | = 2 - Post Devel WS - 60 min | Max. Elevation | = 101.40 ft |
| Reservoir name | = UG Pipes | Max. Storage | = 1,085 cuft |

Storage Indication method used. Exfiltration extracted from Outflow.



Pond No. 1 - UG Pipes

Pond Data

UG Chambers -Invert elev. = 99.25 ft, Rise x Span = 1.50 x 1.50 ft, Barrel Len = 80.00 ft, No. Barrels = 3, Slope = 0.00%, Headers = No

Encasement -Invert elev. = 98.50 ft, Width = 3.33 ft, Height = 3.00 ft, Voids = 35.00%

Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|------------|----------------|---------------------|----------------------|----------------------|
| 0.00 | 98.50 | n/a | 0 | 0 |
| 0.30 | 98.80 | n/a | 84 | 84 |
| 0.60 | 99.10 | n/a | 84 | 168 |
| 0.90 | 99.40 | n/a | 98 | 266 |
| 1.20 | 99.70 | n/a | 139 | 405 |
| 1.50 | 100.00 | n/a | 152 | 558 |
| 1.80 | 100.30 | n/a | 152 | 710 |
| 2.10 | 100.60 | n/a | 139 | 849 |
| 2.40 | 100.90 | n/a | 98 | 947 |
| 2.70 | 101.20 | n/a | 84 | 1,031 |
| 3.00 | 101.50 | n/a | 84 | 1,115 |

Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|-----------------|---------|--------|------|----------|
| Rise (in) | = 18.00 | 6.00 | 0.00 | 0.00 |
| Span (in) | = 18.00 | 6.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 1 | 0 | 0 |
| Invert El. (ft) | = 99.25 | 101.00 | 0.00 | 0.00 |
| Length (ft) | = 0.50 | 0.50 | 0.00 | 0.00 |
| Slope (%) | = 0.50 | 0.50 | 0.00 | n/a |
| N-Value | = .013 | .013 | .013 | n/a |
| Orifice Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | Yes | No | No |

Weir Structures

| | [A] | [B] | [C] | [D] |
|----------------|-----------------------|------|------|------|
| Crest Len (ft) | = 16.00 | 0.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 103.00 | 0.00 | 0.00 | 0.00 |
| Weir Coeff. | = 3.33 | 3.33 | 3.33 | 3.33 |
| Weir Type | = 1 | --- | --- | --- |
| Multi-Stage | = Yes | No | No | No |
| Exfil.(in/hr) | = 0.250 (by Wet area) | | | |
| TW Elev. (ft) | = 0.00 | | | |

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

Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|----------|--------------|--------------|-----------|-----------|-----------|------------|----------|----------|----------|----------|-----------|----------|-----------|
| 0.00 | 0 | 98.50 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.000 | --- | 0.000 |
| 0.30 | 84 | 98.80 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.005 | --- | 0.005 |
| 0.60 | 168 | 99.10 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.006 | --- | 0.006 |
| 0.90 | 266 | 99.40 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.007 | --- | 0.007 |
| 1.20 | 405 | 99.70 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.008 | --- | 0.008 |
| 1.50 | 558 | 100.00 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.009 | --- | 0.009 |
| 1.80 | 710 | 100.30 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.010 | --- | 0.010 |
| 2.10 | 849 | 100.60 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.010 | --- | 0.010 |
| 2.40 | 947 | 100.90 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.011 | --- | 0.011 |
| 2.70 | 1,031 | 101.20 | 0.12 oc | 0.11 ic | --- | --- | 0.00 | --- | --- | --- | 0.012 | --- | 0.126 |
| 3.00 | 1,115 | 101.50 | 0.48 oc | 0.47 ic | --- | --- | 0.00 | --- | --- | --- | 0.013 | --- | 0.486 |

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

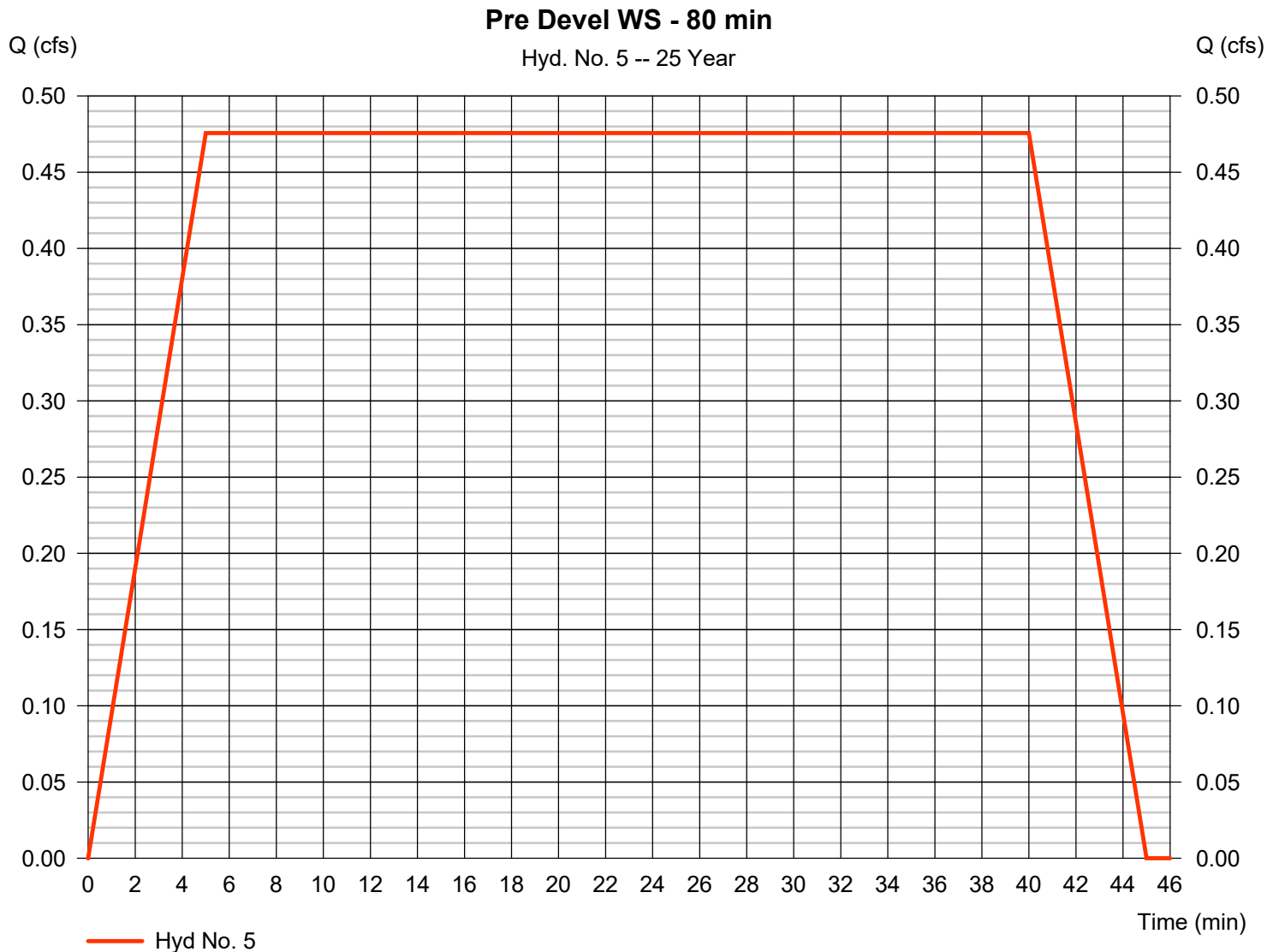
Thursday, 01 / 18 / 2024

Hyd. No. 5

Pre Devel WS - 80 min

| | | | |
|-----------------|----------------------|--------------------|--------------|
| Hydrograph type | = Mod. Rational | Peak discharge | = 0.476 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 5 min |
| Time interval | = 1 min | Hyd. volume | = 1,142 cuft |
| Drainage area | = 0.190 ac | Runoff coeff. | = 0.79* |
| Intensity | = 3.169 in/hr | Tc by User | = 5.00 min |
| IDF Curve | = njidf 03-23-06.idf | Storm duration | = 8.0 x Tc |
| Target Q | =n/a | Est. Req'd Storage | =n/a |

* Composite (Area/C) = [(0.140 x 0.95) + (0.050 x 0.35)] / 0.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

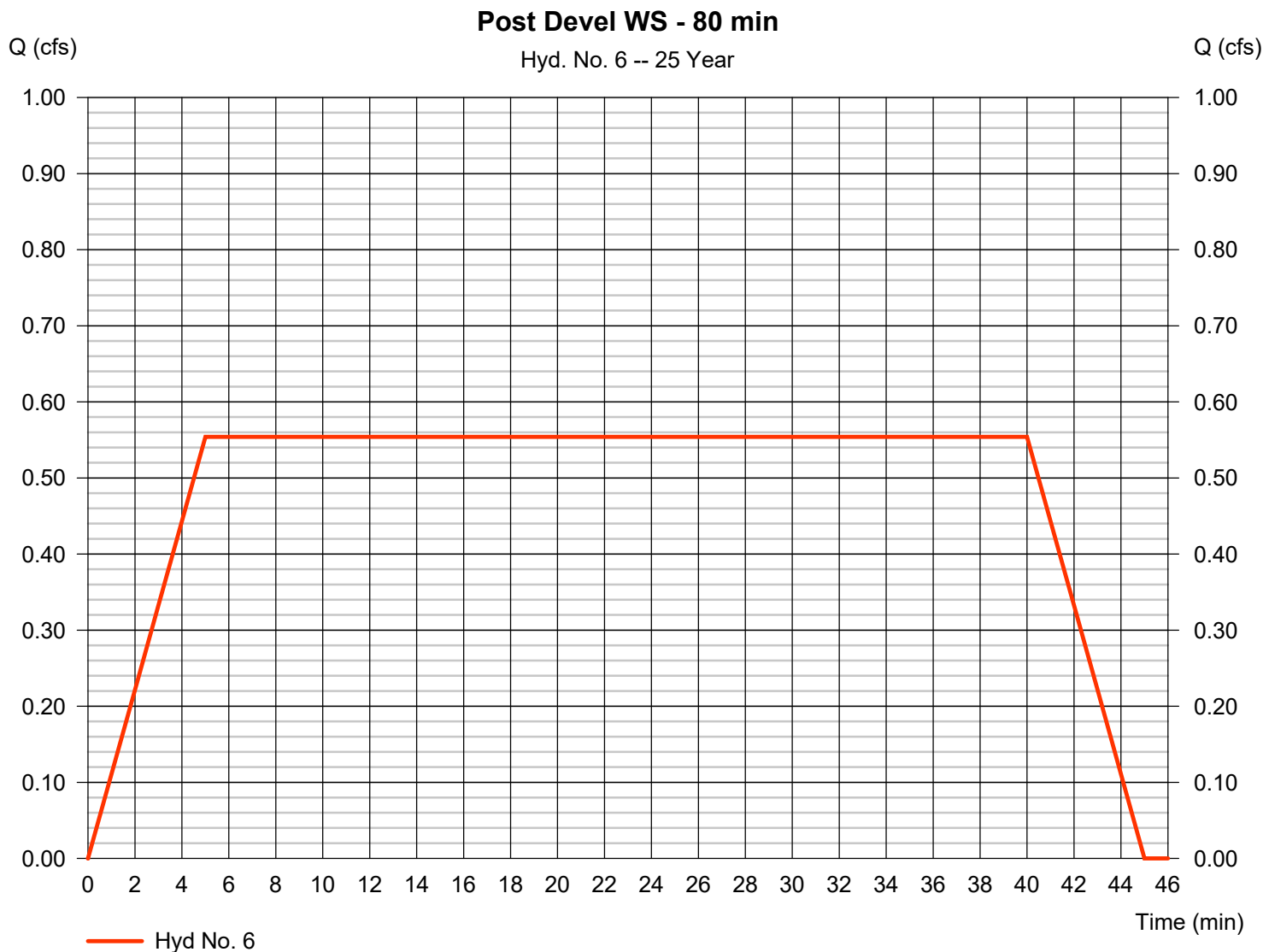
Thursday, 01 / 18 / 2024

Hyd. No. 6

Post Devel WS - 80 min

| | | | |
|-----------------|----------------------|--------------------|--------------|
| Hydrograph type | = Mod. Rational | Peak discharge | = 0.554 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 5 min |
| Time interval | = 1 min | Hyd. volume | = 1,330 cuft |
| Drainage area | = 0.190 ac | Runoff coeff. | = 0.92* |
| Intensity | = 3.169 in/hr | Tc by User | = 5.00 min |
| IDF Curve | = njidf 03-23-06.idf | Storm duration | = 8.0 x Tc |
| Target Q | =n/a | Est. Req'd Storage | =n/a |

* Composite (Area/C) = [(0.180 x 0.95) + (0.010 x 0.35)] / 0.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

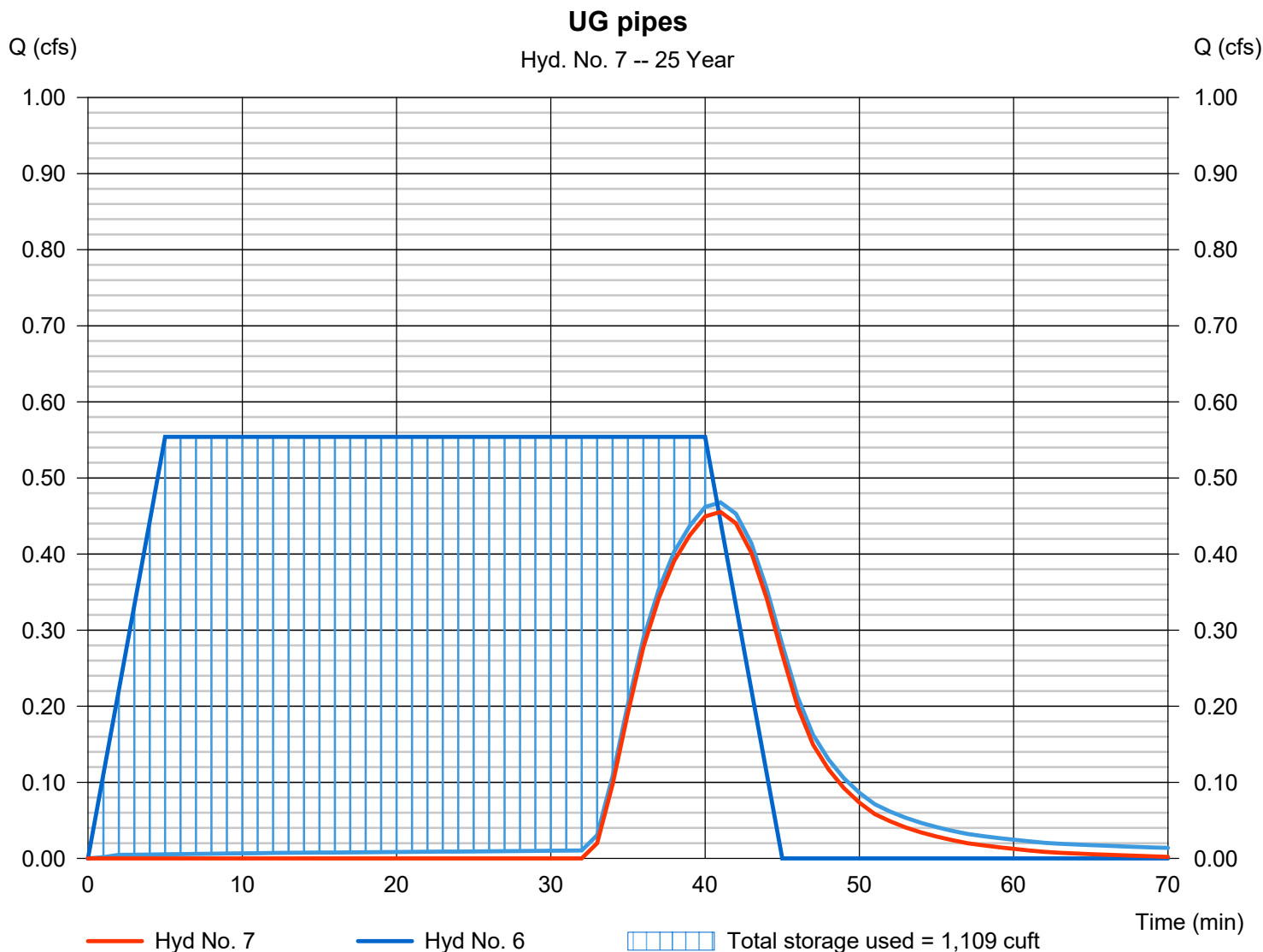
Thursday, 01 / 18 / 2024

Hyd. No. 7

UG pipes

| | | | |
|-----------------|------------------------------|----------------|--------------|
| Hydrograph type | = Reservoir | Peak discharge | = 0.455 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 41 min |
| Time interval | = 1 min | Hyd. volume | = 306 cuft |
| Inflow hyd. No. | = 6 - Post Devel WS - 80 min | Max. Elevation | = 101.48 ft |
| Reservoir name | = UG Pipes | Max. Storage | = 1,109 cuft |

Storage Indication method used. Exfiltration extracted from Outflow.



Pond No. 1 - UG Pipes

Pond Data

UG Chambers -Invert elev. = 99.25 ft, Rise x Span = 1.50 x 1.50 ft, Barrel Len = 80.00 ft, No. Barrels = 3, Slope = 0.00%, Headers = No

Encasement -Invert elev. = 98.50 ft, Width = 3.33 ft, Height = 3.00 ft, Voids = 35.00%

Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|------------|----------------|---------------------|----------------------|----------------------|
| 0.00 | 98.50 | n/a | 0 | 0 |
| 0.30 | 98.80 | n/a | 84 | 84 |
| 0.60 | 99.10 | n/a | 84 | 168 |
| 0.90 | 99.40 | n/a | 98 | 266 |
| 1.20 | 99.70 | n/a | 139 | 405 |
| 1.50 | 100.00 | n/a | 152 | 558 |
| 1.80 | 100.30 | n/a | 152 | 710 |
| 2.10 | 100.60 | n/a | 139 | 849 |
| 2.40 | 100.90 | n/a | 98 | 947 |
| 2.70 | 101.20 | n/a | 84 | 1,031 |
| 3.00 | 101.50 | n/a | 84 | 1,115 |

Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|-----------------|---------|--------|------|----------|
| Rise (in) | = 18.00 | 6.00 | 0.00 | 0.00 |
| Span (in) | = 18.00 | 6.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 1 | 0 | 0 |
| Invert El. (ft) | = 99.25 | 101.00 | 0.00 | 0.00 |
| Length (ft) | = 0.50 | 0.50 | 0.00 | 0.00 |
| Slope (%) | = 0.50 | 0.50 | 0.00 | n/a |
| N-Value | = .013 | .013 | .013 | n/a |
| Orifice Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | Yes | No | No |

Weir Structures

| | [A] | [B] | [C] | [D] |
|----------------|-----------------------|------|------|------|
| Crest Len (ft) | = 16.00 | 0.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 103.00 | 0.00 | 0.00 | 0.00 |
| Weir Coeff. | = 3.33 | 3.33 | 3.33 | 3.33 |
| Weir Type | = 1 | --- | --- | --- |
| Multi-Stage | = Yes | No | No | No |
| Exfil.(in/hr) | = 0.250 (by Wet area) | | | |
| TW Elev. (ft) | = 0.00 | | | |

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

Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|----------|--------------|--------------|-----------|-----------|-----------|------------|----------|----------|----------|----------|-----------|----------|-----------|
| 0.00 | 0 | 98.50 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.000 | --- | 0.000 |
| 0.30 | 84 | 98.80 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.005 | --- | 0.005 |
| 0.60 | 168 | 99.10 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.006 | --- | 0.006 |
| 0.90 | 266 | 99.40 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.007 | --- | 0.007 |
| 1.20 | 405 | 99.70 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.008 | --- | 0.008 |
| 1.50 | 558 | 100.00 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.009 | --- | 0.009 |
| 1.80 | 710 | 100.30 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.010 | --- | 0.010 |
| 2.10 | 849 | 100.60 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.010 | --- | 0.010 |
| 2.40 | 947 | 100.90 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.011 | --- | 0.011 |
| 2.70 | 1,031 | 101.20 | 0.12 oc | 0.11 ic | --- | --- | 0.00 | --- | --- | --- | 0.012 | --- | 0.126 |
| 3.00 | 1,115 | 101.50 | 0.48 oc | 0.47 ic | --- | --- | 0.00 | --- | --- | --- | 0.013 | --- | 0.486 |

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

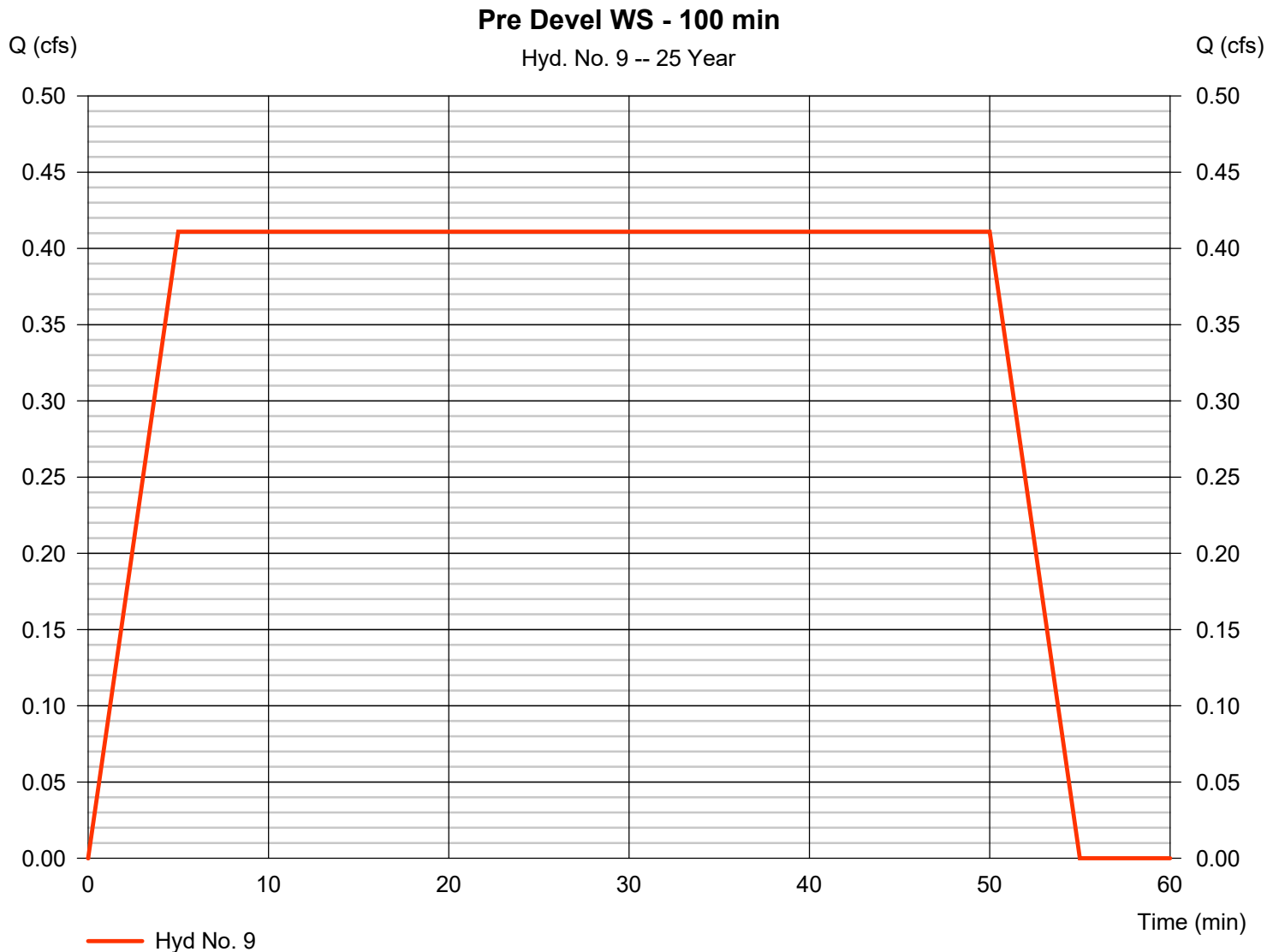
Thursday, 01 / 18 / 2024

Hyd. No. 9

Pre Devel WS - 100 min

| | | | |
|-----------------|----------------------|--------------------|--------------|
| Hydrograph type | = Mod. Rational | Peak discharge | = 0.411 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 5 min |
| Time interval | = 1 min | Hyd. volume | = 1,233 cuft |
| Drainage area | = 0.190 ac | Runoff coeff. | = 0.79* |
| Intensity | = 2.738 in/hr | Tc by User | = 5.00 min |
| IDF Curve | = njidf 03-23-06.idf | Storm duration | = 10.0 x Tc |
| Target Q | =n/a | Est. Req'd Storage | =n/a |

* Composite (Area/C) = [(0.140 x 0.95) + (0.050 x 0.35)] / 0.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

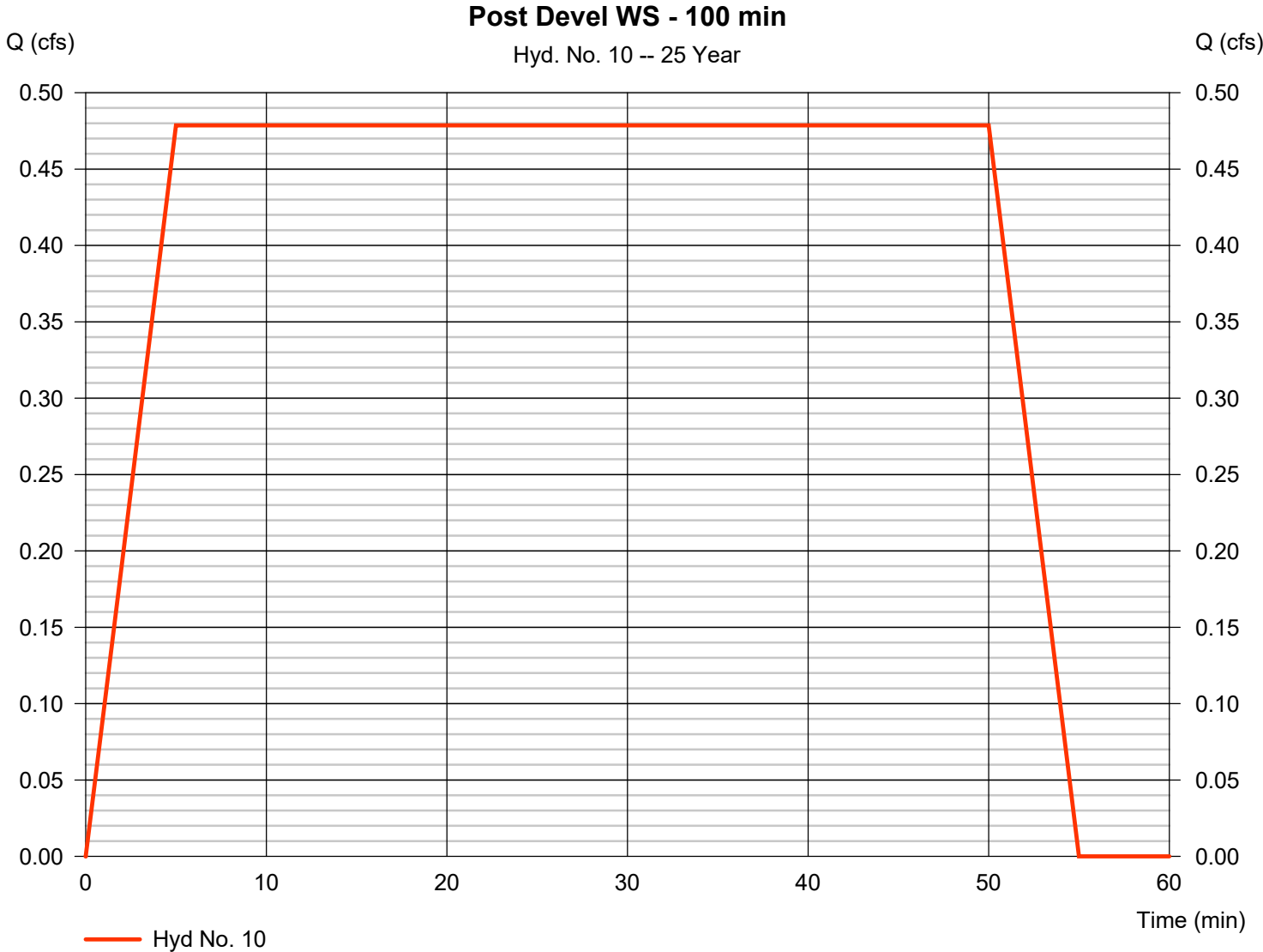
Thursday, 01 / 18 / 2024

Hyd. No. 10

Post Devel WS - 100 min

| | | | |
|-----------------|----------------------|--------------------|--------------|
| Hydrograph type | = Mod. Rational | Peak discharge | = 0.479 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 5 min |
| Time interval | = 1 min | Hyd. volume | = 1,436 cuft |
| Drainage area | = 0.190 ac | Runoff coeff. | = 0.92* |
| Intensity | = 2.738 in/hr | Tc by User | = 5.00 min |
| IDF Curve | = njidf 03-23-06.idf | Storm duration | = 10.0 x Tc |
| Target Q | =n/a | Est. Req'd Storage | =n/a |

* Composite (Area/C) = [(0.180 x 0.95) + (0.010 x 0.35)] / 0.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

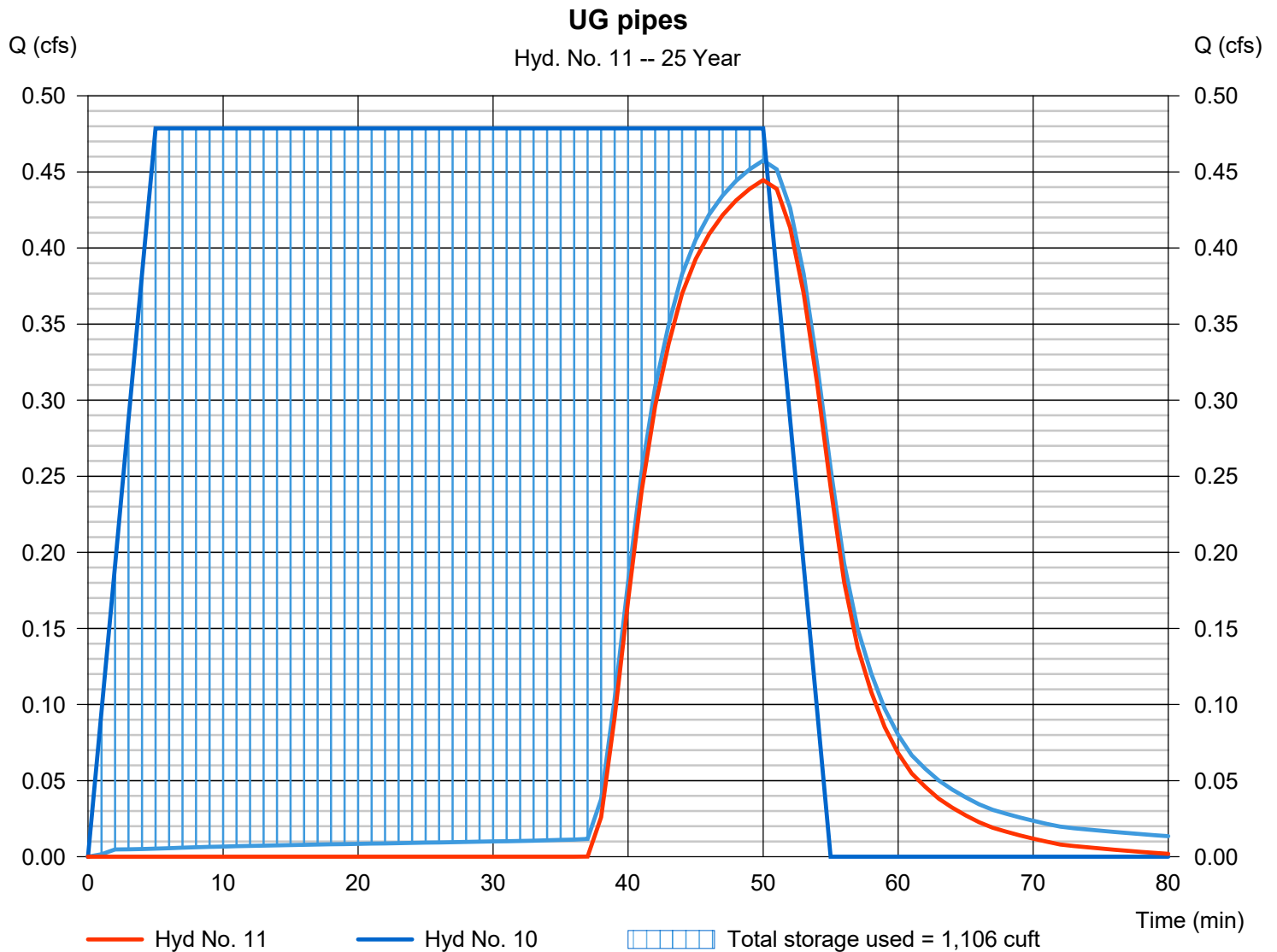
Thursday, 01 / 18 / 2024

Hyd. No. 11

UG pipes

| | | | |
|-----------------|--------------------------------|----------------|--------------|
| Hydrograph type | = Reservoir | Peak discharge | = 0.445 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 50 min |
| Time interval | = 1 min | Hyd. volume | = 406 cuft |
| Inflow hyd. No. | = 10 - Post Devel WS - 100 min | Max. Elevation | = 101.47 ft |
| Reservoir name | = UG Pipes | Max. Storage | = 1,106 cuft |

Storage Indication method used. Exfiltration extracted from Outflow.



Pond No. 1 - UG Pipes

Pond Data

UG Chambers -Invert elev. = 99.25 ft, Rise x Span = 1.50 x 1.50 ft, Barrel Len = 80.00 ft, No. Barrels = 3, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 98.50 ft, Width = 3.33 ft, Height = 3.00 ft, Voids = 35.00%

Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|------------|----------------|---------------------|----------------------|----------------------|
| 0.00 | 98.50 | n/a | 0 | 0 |
| 0.30 | 98.80 | n/a | 84 | 84 |
| 0.60 | 99.10 | n/a | 84 | 168 |
| 0.90 | 99.40 | n/a | 98 | 266 |
| 1.20 | 99.70 | n/a | 139 | 405 |
| 1.50 | 100.00 | n/a | 152 | 558 |
| 1.80 | 100.30 | n/a | 152 | 710 |
| 2.10 | 100.60 | n/a | 139 | 849 |
| 2.40 | 100.90 | n/a | 98 | 947 |
| 2.70 | 101.20 | n/a | 84 | 1,031 |
| 3.00 | 101.50 | n/a | 84 | 1,115 |

Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|-----------------|---------|--------|------|----------|
| Rise (in) | = 18.00 | 6.00 | 0.00 | 0.00 |
| Span (in) | = 18.00 | 6.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 1 | 0 | 0 |
| Invert El. (ft) | = 99.25 | 101.00 | 0.00 | 0.00 |
| Length (ft) | = 0.50 | 0.50 | 0.00 | 0.00 |
| Slope (%) | = 0.50 | 0.50 | 0.00 | n/a |
| N-Value | = .013 | .013 | .013 | n/a |
| Orifice Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | Yes | No | No |

Weir Structures

| | [A] | [B] | [C] | [D] |
|----------------|-----------------------|------|------|------|
| Crest Len (ft) | = 16.00 | 0.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 103.00 | 0.00 | 0.00 | 0.00 |
| Weir Coeff. | = 3.33 | 3.33 | 3.33 | 3.33 |
| Weir Type | = 1 | --- | --- | --- |
| Multi-Stage | = Yes | No | No | No |
| Exfil.(in/hr) | = 0.250 (by Wet area) | | | |
| TW Elev. (ft) | = 0.00 | | | |

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

Stage / Storage / Discharge Table

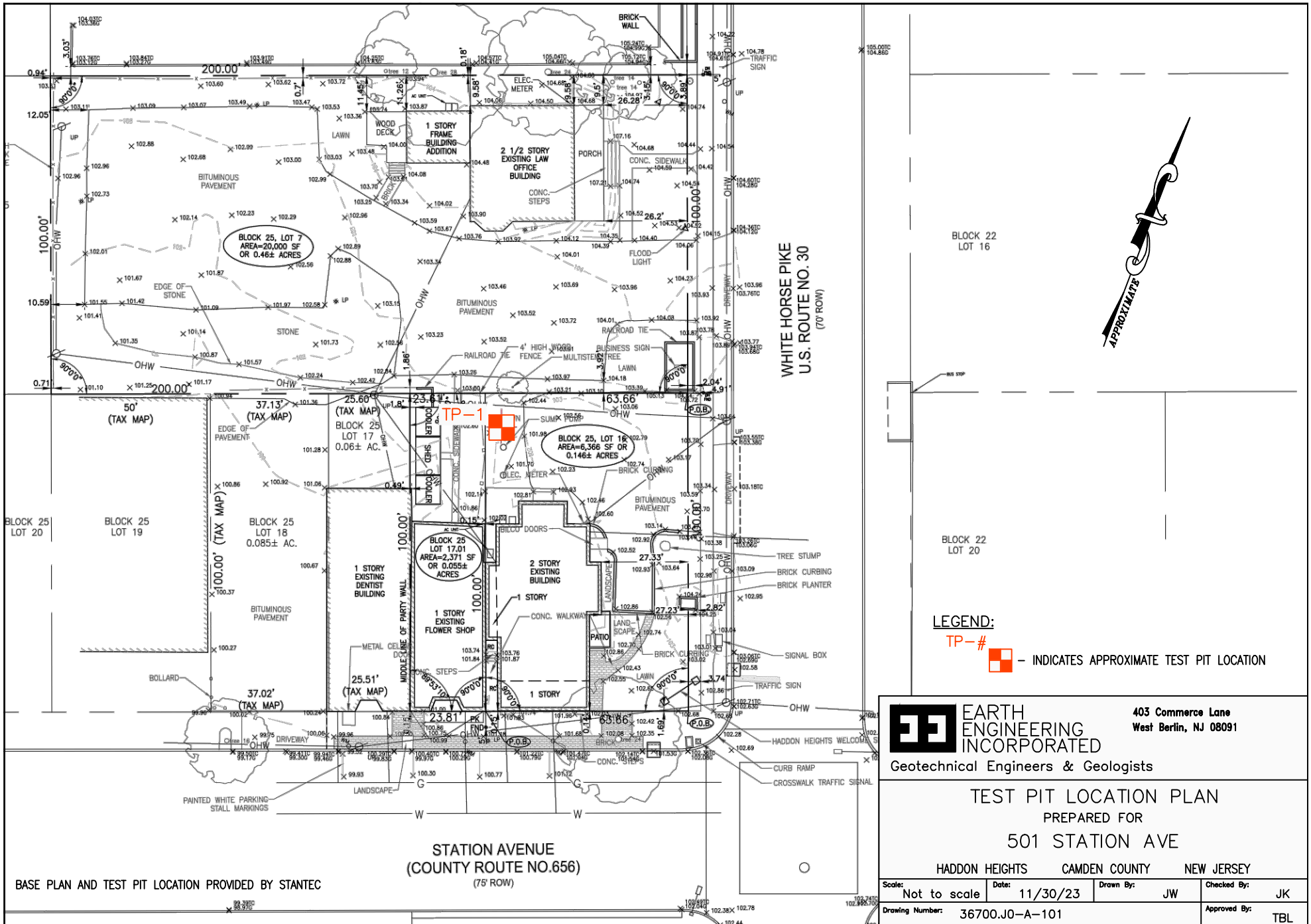
| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|----------|--------------|--------------|-----------|-----------|-----------|------------|----------|----------|----------|----------|-----------|----------|-----------|
| 0.00 | 0 | 98.50 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.000 | --- | 0.000 |
| 0.30 | 84 | 98.80 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.005 | --- | 0.005 |
| 0.60 | 168 | 99.10 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.006 | --- | 0.006 |
| 0.90 | 266 | 99.40 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.007 | --- | 0.007 |
| 1.20 | 405 | 99.70 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.008 | --- | 0.008 |
| 1.50 | 558 | 100.00 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.009 | --- | 0.009 |
| 1.80 | 710 | 100.30 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.010 | --- | 0.010 |
| 2.10 | 849 | 100.60 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.010 | --- | 0.010 |
| 2.40 | 947 | 100.90 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | 0.011 | --- | 0.011 |
| 2.70 | 1,031 | 101.20 | 0.12 oc | 0.11 ic | --- | --- | 0.00 | --- | --- | --- | 0.012 | --- | 0.126 |
| 3.00 | 1,115 | 101.50 | 0.48 oc | 0.47 ic | --- | --- | 0.00 | --- | --- | --- | 0.013 | --- | 0.486 |

Stantec

501-503 STATION AVENUE
Appendix A – REFERENCE DOCUMENTS
February 13, 2024

Appendix A – REFERENCE DOCUMENTS

- Soil Description Log from Earth Engineering Incorporated, dated November 30, 2023.



LEGEND:
 TP-#  - INDICATES APPROXIMATE TEST PIT LOCATION

EARTH ENGINEERING INCORPORATED
 Geotechnical Engineers & Geologists
 403 Commerce Lane
 West Berlin, NJ 08091

TEST PIT LOCATION PLAN
 PREPARED FOR
 501 STATION AVE

HADDON HEIGHTS CAMDEN COUNTY NEW JERSEY

| | | | |
|--------------------------------|------------------|--------------|----------------|
| Scale: Not to scale | Date: 11/30/23 | Drawn By: JW | Checked By: JK |
| Drawing Number: 36700.J0-A-101 | Approved By: TBL | | |

BASE PLAN AND TEST PIT LOCATION PROVIDED BY STANTEC

Soil Description Log

Test Pit Location: TP-1

Ground Cover / Land Use: Grass / Side Lawn Area

Surface Elevation: 102.0'

Limiting Zone: Fine Grained Soils from 2.6' - 5.2'

Equipment Used: Bobcat E-50 Mini-Excavator

Initial Water Depth: Dry

Time: 0.25 Hrs.

Date: 11/30/2023

Excavating Company: Deerfield Dirt Works, LLC

Subsequent Water Depth: Dry

Time: 4.00 Hrs.

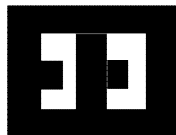
Date: 11/30/2023

Total Depth: 10.0'

Additional Notes: Collected Soil Sample @ 6.5' for Gradation Analysis and Tube Permeameter Test

Profile Description

| | Depth (ft.) | Boundary | Matrix Color | Redox Mottles | Mottle Color | Texture | Structure | Consistence | Remarks |
|---|-------------|----------------|-----------------------------|---------------|--------------|---------------------|-------------------|--------------|---|
| 1 | 0.0 - 0.4 | Clear Smooth | 10YR 3/3 Dark Brown | --- | --- | Loamy Sand | Granular | Very Friable | Topsoil, Many Fine Roots |
| 2 | 0.4 - 2.6 | Clear Smooth | 10YR 5/2 Grayish Brown | --- | --- | Stony Sandy Loam | Subangular Blocky | Very Friable | FILL - 35% Rock Fragments |
| 3 | 2.6 - 3.3 | Clear Smooth | 10YR 5/3 Brown | --- | --- | Loam | Subangular Blocky | Friable | FILL - Moist, Slightly Tacky, 10% Gravel, Trace Brick, Terra Cotta, & Metal Fragments |
| 4 | 3.3 - 5.2 | Gradual Smooth | 10YR 5/6 Yellowish Brown | --- | --- | Clay Loam | Subangular Blocky | Friable | Moist, Slightly Tacky, Slightly Plastic |
| 5 | 5.2 - 6.5 | Gradual Smooth | 10YR 5/8 Yellowish Brown | --- | --- | Gravelly Loamy Sand | Subangular Blocky | Very Friable | 25% Gravel |
| 6 | 6.5 - 10.0 | --- | 10YR 6/6 Brownish Yellow | --- | --- | Sand | Subangular Blocky | Very Friable | ~7.8% Silt and Clay, Repeated Sidewall Collapse |
| 7 | | | | | | | | | End of Test Pit @ 10.0' Due to Max Reach of Machine |
| 8 | | | | | | | | | |



**EARTH
ENGINEERING
INCORPORATED**

Geotechnical Engineers & Geologists

403 Commerce Lane, West Berlin, NJ 08091

PHONE 856-768-1001

FAX 856-778-1144

Project Name: 501 Station Avenue, Haddon Heights, NJ

Project Number: 36700.J0

Date of Testing: 11/30/2023

EI Representative: J. Kochenberger

Compiled by: J. Kochenberger

Date Compiled: 11/30/2023

Sheet Number: 1

Tube Permeameter Testing Data Sheet

| Test Number | Height of Sampling Tube (in.) | Empty Space in Tube (in) | Height of Soil Column (in.) (L) | Initial Water Level Height (in.) (H ₁) | Run #1 | | | Run #2 | | | Run #3 | | | Permeability | |
|-------------|-------------------------------|--------------------------|---------------------------------|--|-------------------------------------|-------------------|---------------------------|-------------------------------------|-------------------|---------------------------|-------------------------------------|-------------------|---------------------------|--------------|-------|
| | | | | | Subsequent Water Level Height (in.) | | Time Interval @ (min:sec) | Subsequent Water Level Height (in.) | | Time Interval @ (min:sec) | Subsequent Water Level Height (in.) | | Time Interval @ (min:sec) | | |
| | | | | | Drop | (H ₂) | (T) | Drop | (H ₂) | (T) | Drop | (H ₂) | (T) | rate | class |
| TP-1A | 10.00 | 4.13 | 5.88 | 8.00 | 0.65 | 7.35 | 60.00 | 0.65 | 7.35 | 60.00 | 0.65 | 7.35 | 60.00 | 0.50 in/hr | K1 |
| TP-1B | 10.00 | 4.00 | 6.00 | 7.88 | 0.88 | 7.00 | 60.00 | 0.88 | 7.00 | 60.00 | 0.88 | 7.00 | 60.00 | 0.71 in/hr | K2 |
| TP-1C | 10.00 | 4.00 | 6.00 | 7.88 | 0.75 | 7.13 | 60.00 | 0.75 | 7.13 | 60.00 | 0.75 | 7.13 | 60.00 | 0.60 in/hr | K2 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

Notes: Depth of Test Pit TP-1 is 6.5'

- : ENTERED VALUES
- : FILLED VALUES
- : CALCULATED VALUES

Radius of Standpipe, $r^2 = 0.0039$ "; Radius of Shelby Tube, $R^2 = 2.25$ "
 ** r^2/R^2 is omitted from equation when standpipe is not used

Permeability Rate Determination: $K(\text{in/hr}) = 60 \text{ min/1hr} * L(\text{in.})/T(\text{min}) * r^2/R^2 * \ln(H_1/H_2)$

Project Information



403 Commerce Lane
Phone: 856-768-1001

West Berlin, NJ 08091
Fax: 856-768-1144

Project Name: 501 Station Avenue, Haddon Heights, NJ

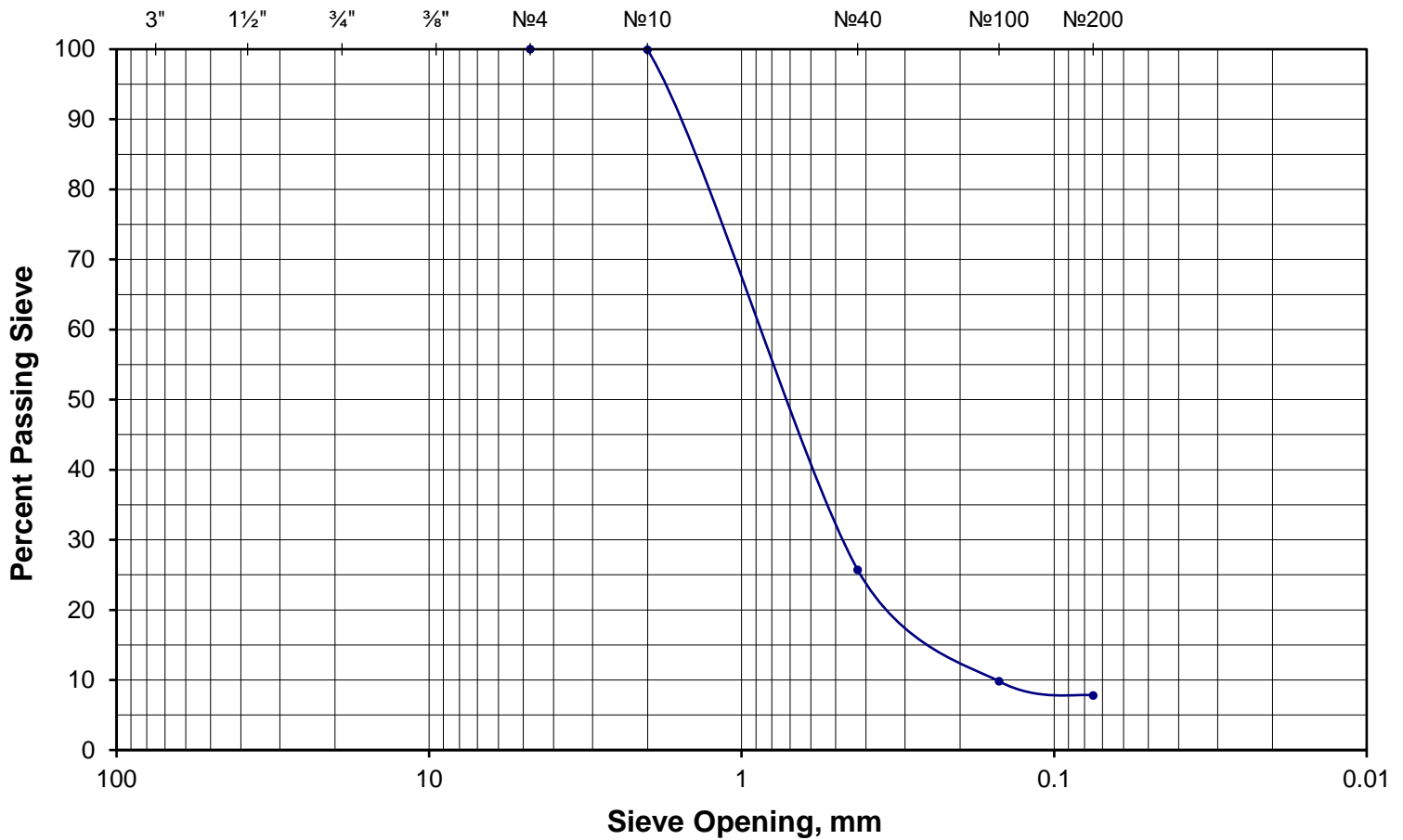
Project Number: 36700.J0

Date of Testing: 12/5/2023

Location of Testing: Laboratory

EI Representative: C. Lang

Particle Size Analysis of Soils



| | | | | | | |
|---|-------------|------------------|------------|--|-----------------------|----------------------|
| As-rec'd water content: 11.6 moist | | Odor: NR | | Particle Size | | |
| % Gravel: 0.0 | Coarse: 0.0 | Fine: 0.0 | | US Standard Sieve Size | | Diameter, % Finer |
| % Sand: 92.2 | Coarse: 0.1 | Medium: 74.2 | Fine: 17.9 | GRAVEL | Coarse | 3" 75 |
| Gravel description: gray, subrounded | | | SAND | | Fine | 1 1/2" 38.1 |
| Sand description: light brown, subrounded | | | | | Coarse | 3/4" 19.0 |
| Consistency: firm | | | | | Medium | 3/8" 9.5 |
| Cementation: NR | | Hardness: NR | | Fine | No. 4 4.75 | 100.0 |
| Structure: homogeneous | | Dry Strength: NR | | Coarse | No. 10 2.00 | 99.9 |
| Reaction to HCl: NR | | Dilatancy: NR | | Medium | No. 40 0.425 | 25.7 |
| | | Toughness: NR | | Fine | No. 100 0.150 | 9.8 |
| | | | | Fine | No. 200 0.075 | 7.8 |
| | | | | Hydrometer Analysis | | Clay Size 0.005 NR |
| | | | | | | Colloids 0.001 NR |
| | | | | G _s : NR | C _u : 5.14 | C _c : 1.5 |
| Project: 36700.J0 - 501 Station Avenue | | | | EARTH ENGINEERING INCORPORATED <i>Geotechnical Engineers & Geologists</i> 403 Commerce Lane West Berlin, NJ 08091 tel 856-768-1001 fax 856-768-1144 | | |
| Client: Broken Ground Properties, LLC | | | | | | |
| Sample: TP-1 | | | | | | |
| Depth: 6.5' | | | | | | |
| Description: Brownish yellow sand | | | | | | |
| Remarks: | | | | | | |

East Norriton PA
610-277-0880

Central PA
717-697-5701

Lehigh Valley
610-967-4540