



*Engineering beyond.™*

November 2023

# Stormwater Report

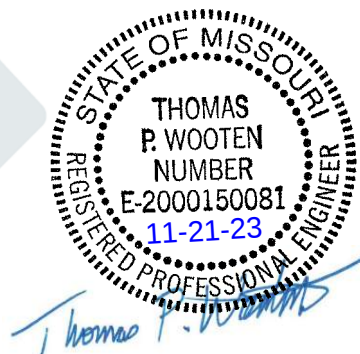
## Client

Townsend Summit, LLC  
230 Shilling Court, Suite 120  
Hunt Valley, Maryland 21031

## Project

Summit Technology Campus  
Summit Orchards North  
Jackson County, MO

P.N. 23CO10012



## Report Prepared By:

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## Introduction

This report details the preliminary design of the storm sewer system supporting the Summit Orchards North Preliminary Development Plan (PDP), a mixed-use development, at the Summit Technology Campus (STC) located in Lee's Summit, Missouri. See Figure 1 for a site location map.

## Project Description

The Summit Technology Campus is located southeast of the Interstate-470/SW Blue Parkway interchange. The entire development covers approximately 367 acres, and is bordered to the south by Chipman Road, to the north by I-470, to the west by Blue Parkway, and to the east by the Union Pacific Railroad. The Summit Technology Campus is split by Ward Road which was opened to traffic in October 2008.

Townsend Summit LLC proposes improvements to the existing Summit Technology Campus, including the addition of a variety of mixed business commercial and residential uses along Ward Road. In this report, the site for these improvements will be referred to as "Summit Orchards North", and consists of Lot 1A (17.01 acres) and Lot 1B (20.89 acres), of Summit Innovation Center, Lot 1A & 1B. The current proposed building layout, grading plan, and storm sewer system drawings for Summit Orchards North can be found in the PDP.

## Existing Conditions

The existing drainage on lots 1A and 1B is split between 2 primary outfall locations. The majority of lot 1A drains to the west to a drainageway that ultimately crosses under 470 and continues westerly ("West Outfall"). The eastern part of lot 1A and all of lot 1B drain to the regional detention facility at the northeast corner of the Summit Technology Campus development ("East Outfall"). The regional detention basin was established as part of a Stormwater Master Plan that was approved by the City in 2007. These improvements were constructed in 2008 and the facility has been in operation since that time.

In addition to the on-site flows generated from lots 1A and 1B, there are offsite flows currently conveyed to and across both lots. There is an existing 72" RCP near the southwest corner of lot 1A that extends partly in to the lot then drains into an existing channel that exits the lot on the west boundary, draining into a channel that runs along the east edge of the 470 on ramp. There is an existing 6'x7' RCB entering lot 1B at the southwest corner, that drains into an existing channel that runs along the west edge of lot 1B, ultimately draining to the regional detention basin. Both the 72" RCP and the 6'x7' RCB convey flows from other parts of the Summit Technology Campus development. These existing facilities will be discussed as part of Proposed Improvements.

As part of the approved 2007 stormwater study, drainage from areas east of the regional detention basin were allowed to drain to the basin, in exchange for only diverting a portion of the development on the west side of the Summit Technology Campus to the basin. This area



is referred to as the “Red Development” area, evaluated in a previous drainage study by Olsson Engineering.

## Proposed Improvements

This project develops portions of subbasins 4 and 5, as modeled for the regional detention facility in the 2007 study. The proposed improvements as reflected on the PDP utilize the same East and West outfalls as discussed in Existing Conditions, with a larger portion of lot 1A being directed to the east outfall and hence being detained in the regional basin. The 2007 study utilized an SCS curve number of 94 for both subbasins 4 and 5, for projected future conditions at that time. Curve numbers were computed for the currently proposed improvements, resulting in the same curve number of 94 for the 2 proposed drainage areas tributary to the East and West outfalls. Therefore, the proposed development is within the parameters of the original study and we do not propose a revision to the hydraulic study for the regional detention basin.

The proposed improvements will extend the existing 72” RCP on lot 1A across the lot to the west boundary adjacent to the 470 on ramp, following the alignment of the existing drainageway. The existing 6’x7’ RCB on lot 1B will be extended a short distance, to accommodate an access drive between lots 1A and 1B.

Within each lot, we will provide site storm sewers and piping to collect and convey surface flows to their respective outfall. The drainage areas and drainage structures and piping layout are depicted on the PDP. The peak flows generated for the 2 outfall locations are:

### West Outfall:

|              | Pre-Development Q (cfs) | Post Development Q (cfs) |
|--------------|-------------------------|--------------------------|
| 1-yr storm   | 8.47                    | 20.04                    |
| 10-yr storm  | 25.40                   | 35.55                    |
| 100-yr storm | 54.14                   | 57.78                    |

### East Outfall – Regional Detention Basin:

|              | Pre-Development Q (cfs) | Post Development Q (cfs) |
|--------------|-------------------------|--------------------------|
| 1-yr storm   | 14.41                   | 75.70                    |
| 10-yr storm  | 43.22                   | 135.49                   |
| 100-yr storm | 92.11                   | 221.75                   |

Hydrographs for the storm flows are in appendix at the end of this report.

## Design and Methodology

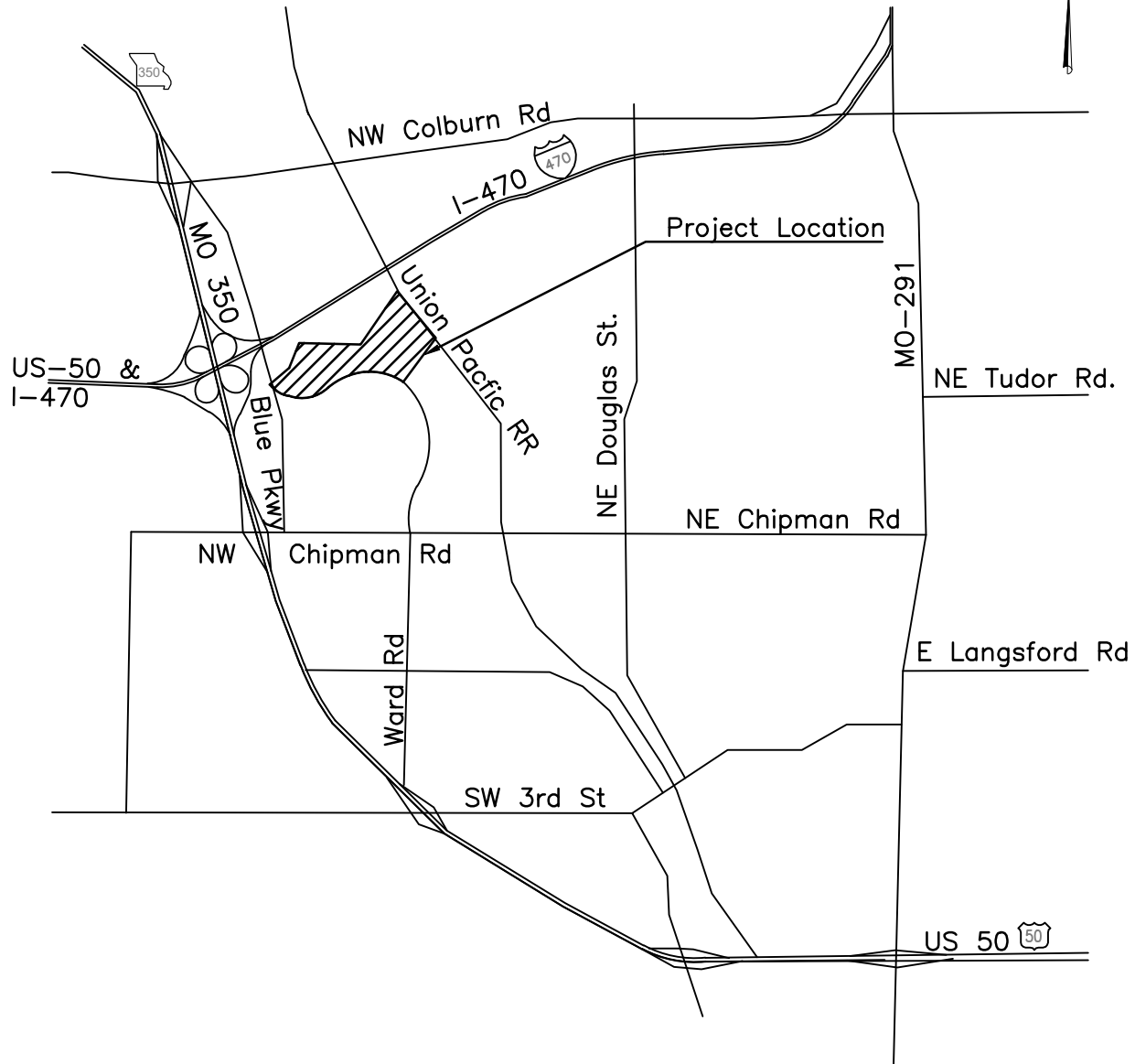
The hydrographs and peak flows were calculated using Hydroflow Hydrograph Extension to AutoCAD Civil 3D 2020. Site storm calculations and preliminary system sizing was prepared using the Rational Formula and manning’s equation.



## **Results of Analysis**

The preliminary layout of system and system sizing is depicted on the PDP.

## SITE LOCATION MAP



4240 Philips Farm Road, Suite 101  
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TOWNSEND - SUMMIT ORCHARDS NORTH PDP

1201 & 1151 NW WARD RD.,  
LEE'S SUMMIT, MO

DRAWN BY:  
CVM  
DATE:  
11-15-2023



## APPENDIX

Hydrographs

Pages  
12

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

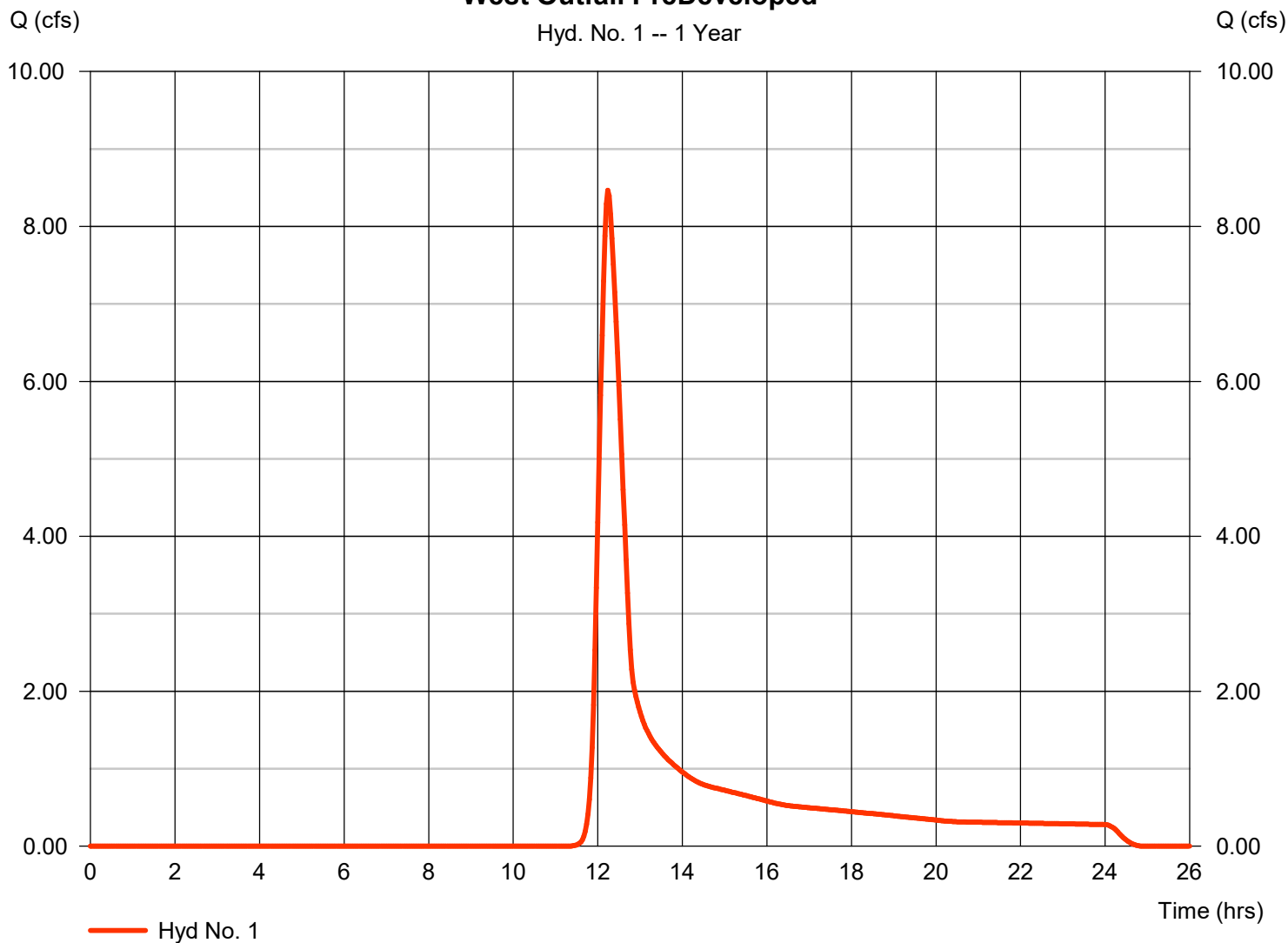
Monday, 11 / 20 / 2023

## Hyd. No. 1

West Outfall PreDeveloped

|                 |              |                    |               |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge     | = 8.467 cfs   |
| Storm frequency | = 1 yrs      | Time to peak       | = 12.23 hrs   |
| Time interval   | = 2 min      | Hyd. volume        | = 41,073 cuft |
| Drainage area   | = 14.030 ac  | Curve number       | = 73          |
| Basin Slope     | = 0.0 %      | Hydraulic length   | = 0 ft        |
| Tc method       | = TR55       | Time of conc. (Tc) | = 31.90 min   |
| Total precip.   | = 2.90 in    | Distribution       | = Type II     |
| Storm duration  | = 24 hrs     | Shape factor       | = 484         |

### West Outfall PreDeveloped



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

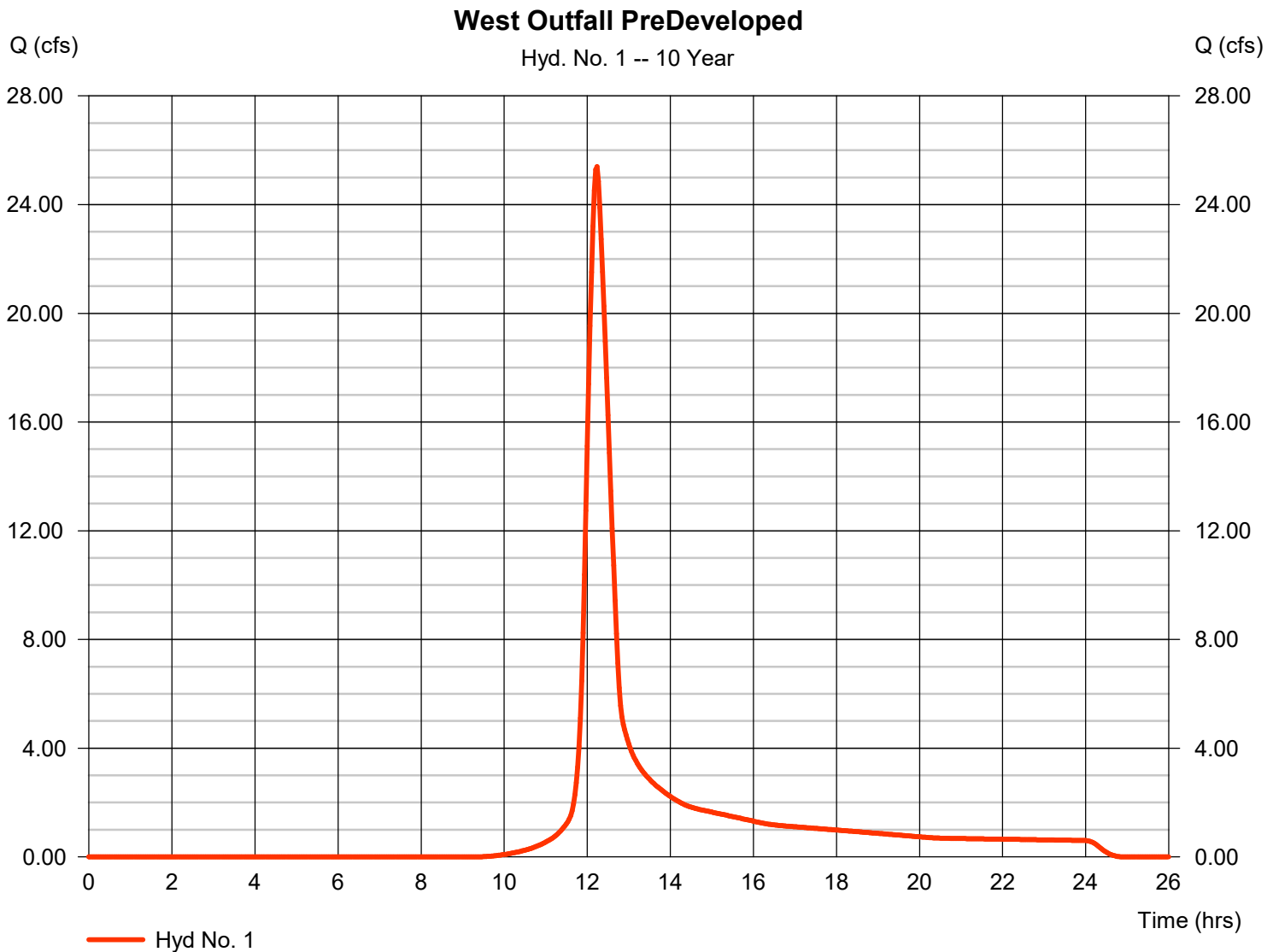
Monday, 11 / 20 / 2023

## Hyd. No. 1

West Outfall PreDeveloped

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 14.030 ac  
 Basin Slope = 0.0 %  
 Tc method = TR55  
 Total precip. = 4.85 in  
 Storm duration = 24 hrs

Peak discharge = 25.40 cfs  
 Time to peak = 12.23 hrs  
 Hyd. volume = 111,561 cuft  
 Curve number = 73  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 31.90 min  
 Distribution = Type II  
 Shape factor = 484

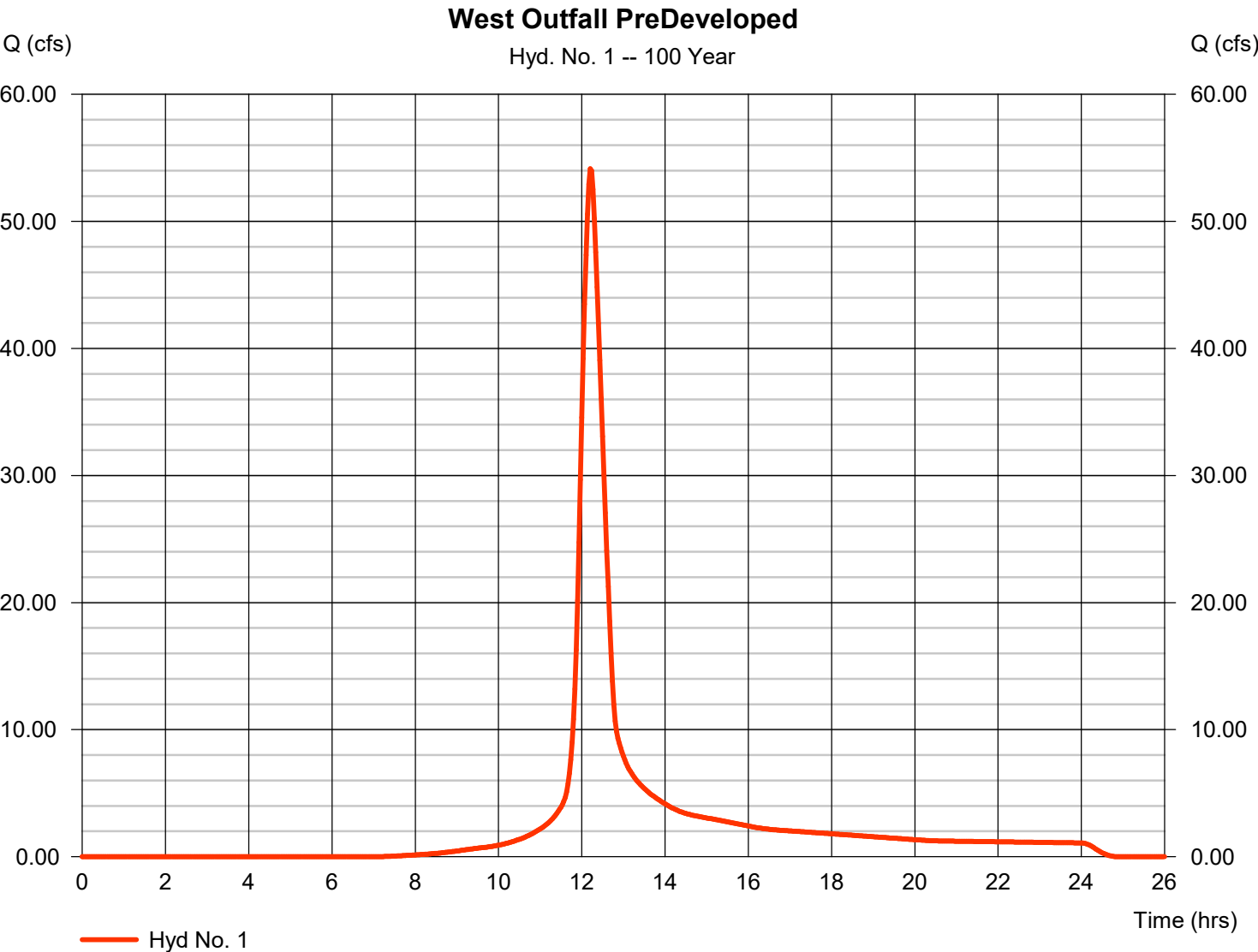


# Hydrograph Report

## Hyd. No. 1

West Outfall PreDeveloped

|                 |   |            |                    |   |              |
|-----------------|---|------------|--------------------|---|--------------|
| Hydrograph type | = | SCS Runoff | Peak discharge     | = | 54.14 cfs    |
| Storm frequency | = | 100 yrs    | Time to peak       | = | 12.20 hrs    |
| Time interval   | = | 2 min      | Hyd. volume        | = | 233,915 cuft |
| Drainage area   | = | 14.030 ac  | Curve number       | = | 73           |
| Basin Slope     | = | 0.0 %      | Hydraulic length   | = | 0 ft         |
| Tc method       | = | TR55       | Time of conc. (Tc) | = | 31.90 min    |
| Total precip.   | = | 7.69 in    | Distribution       | = | Type II      |
| Storm duration  | = | 24 hrs     | Shape factor       | = | 484          |



# Hydrograph Report

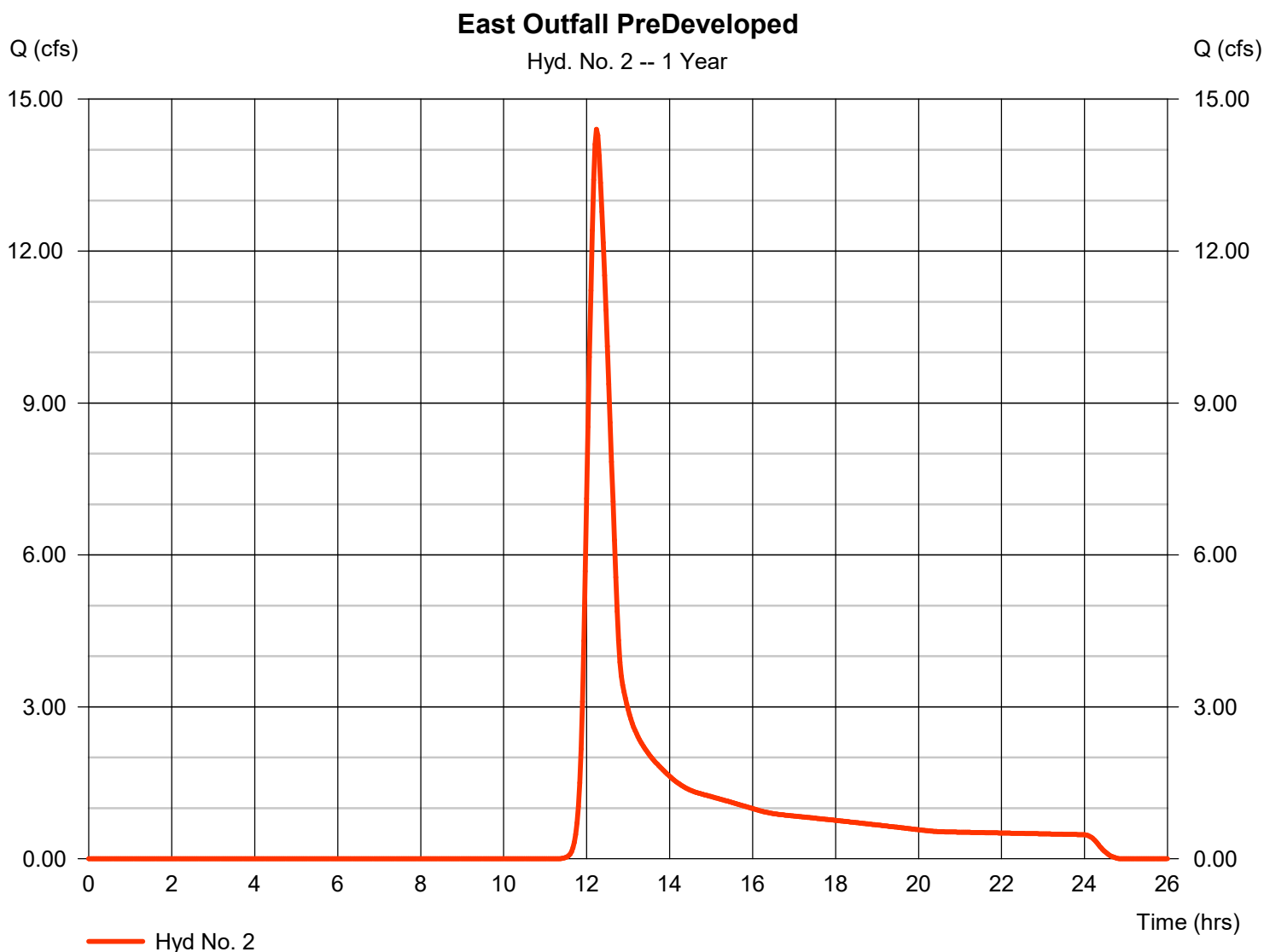
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## Hyd. No. 2

East Outfall PreDeveloped

|                 |              |                    |               |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge     | = 14.41 cfs   |
| Storm frequency | = 1 yrs      | Time to peak       | = 12.23 hrs   |
| Time interval   | = 2 min      | Hyd. volume        | = 69,880 cuft |
| Drainage area   | = 23.870 ac  | Curve number       | = 73          |
| Basin Slope     | = 0.0 %      | Hydraulic length   | = 0 ft        |
| Tc method       | = TR55       | Time of conc. (Tc) | = 30.30 min   |
| Total precip.   | = 2.90 in    | Distribution       | = Type II     |
| Storm duration  | = 24 hrs     | Shape factor       | = 484         |

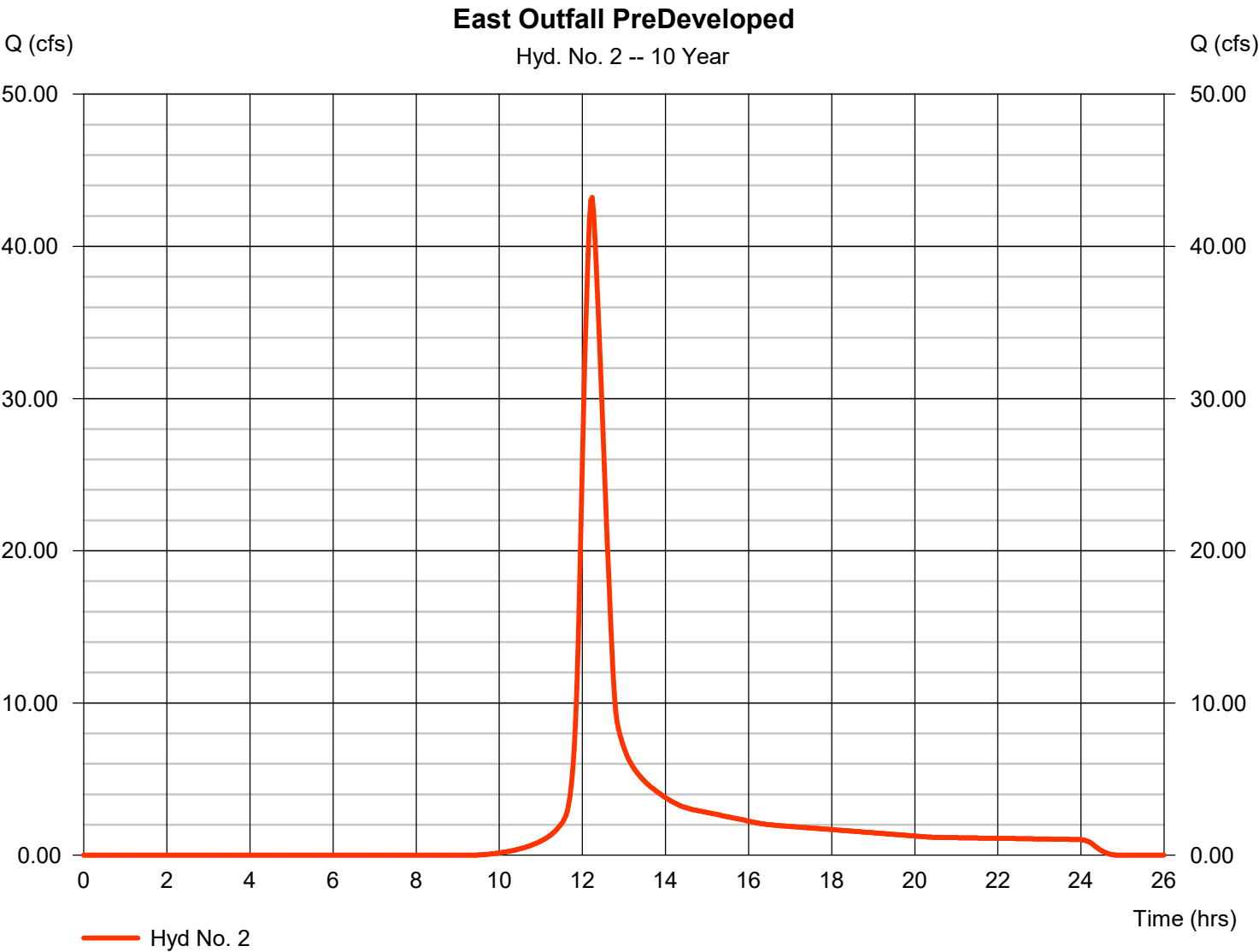


# Hydrograph Report

## Hyd. No. 2

East Outfall PreDeveloped

|                 |   |            |                    |   |              |
|-----------------|---|------------|--------------------|---|--------------|
| Hydrograph type | = | SCS Runoff | Peak discharge     | = | 43.22 cfs    |
| Storm frequency | = | 10 yrs     | Time to peak       | = | 12.23 hrs    |
| Time interval   | = | 2 min      | Hyd. volume        | = | 189,804 cuft |
| Drainage area   | = | 23.870 ac  | Curve number       | = | 73           |
| Basin Slope     | = | 0.0 %      | Hydraulic length   | = | 0 ft         |
| Tc method       | = | TR55       | Time of conc. (Tc) | = | 30.30 min    |
| Total precip.   | = | 4.85 in    | Distribution       | = | Type II      |
| Storm duration  | = | 24 hrs     | Shape factor       | = | 484          |



# Hydrograph Report

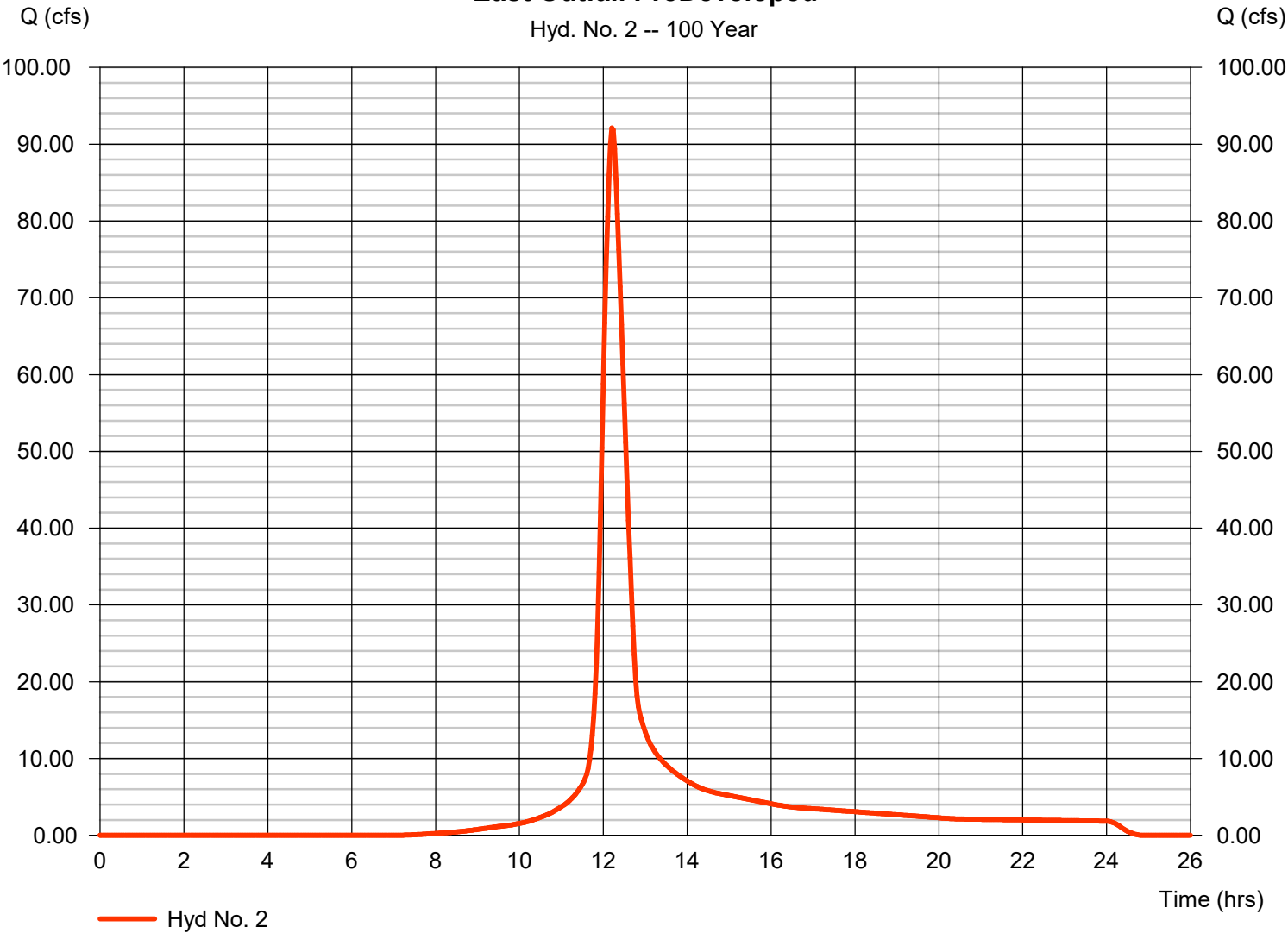
## Hyd. No. 2

East Outfall PreDeveloped

|                 |   |            |                    |   |              |
|-----------------|---|------------|--------------------|---|--------------|
| Hydrograph type | = | SCS Runoff | Peak discharge     | = | 92.11 cfs    |
| Storm frequency | = | 100 yrs    | Time to peak       | = | 12.20 hrs    |
| Time interval   | = | 2 min      | Hyd. volume        | = | 397,972 cuft |
| Drainage area   | = | 23.870 ac  | Curve number       | = | 73           |
| Basin Slope     | = | 0.0 %      | Hydraulic length   | = | 0 ft         |
| Tc method       | = | TR55       | Time of conc. (Tc) | = | 30.30 min    |
| Total precip.   | = | 7.69 in    | Distribution       | = | Type II      |
| Storm duration  | = | 24 hrs     | Shape factor       | = | 484          |

East Outfall PreDeveloped

Hyd. No. 2 -- 100 Year



# Hydrograph Report

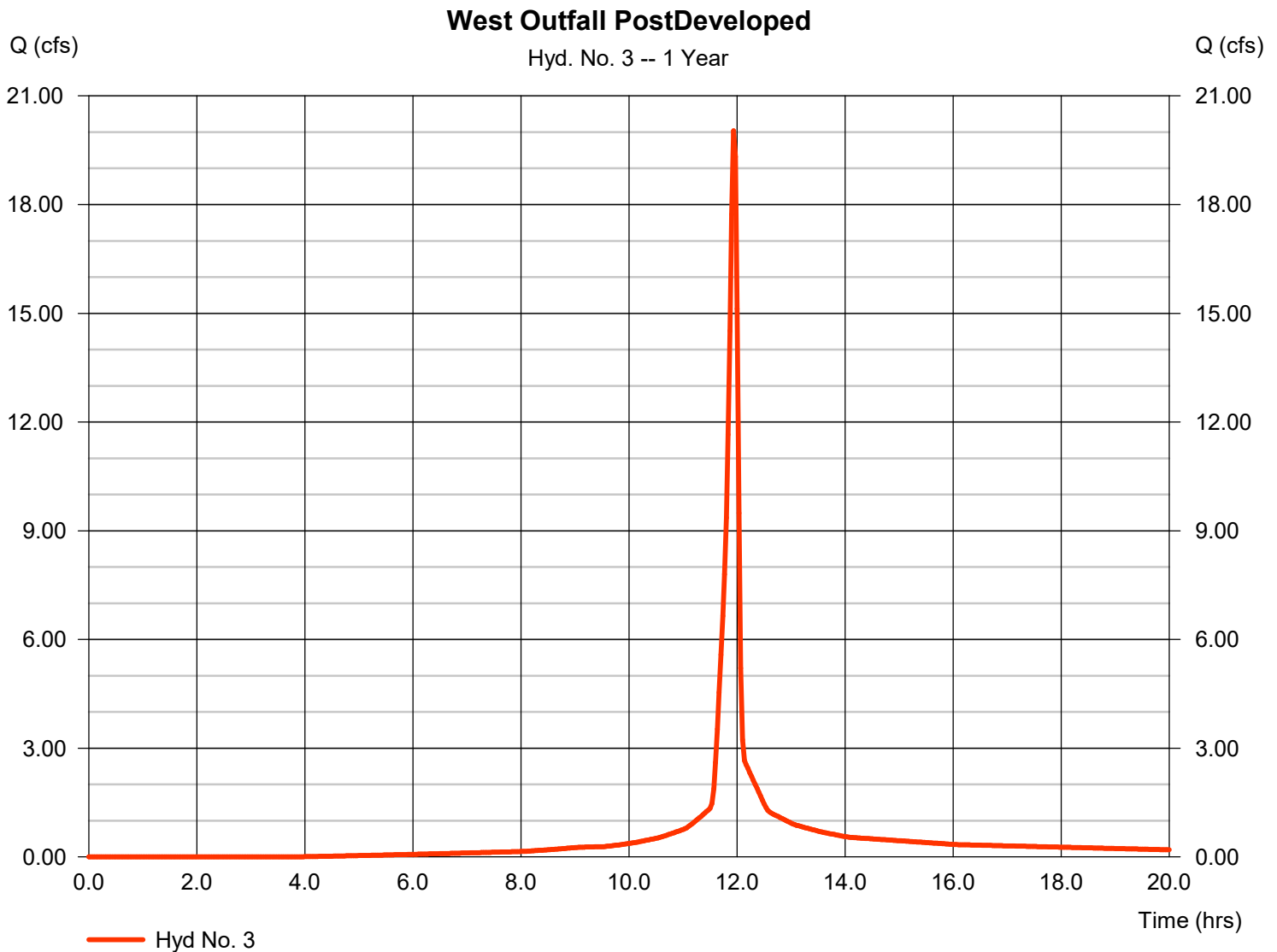
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## Hyd. No. 3

West Outfall PostDeveloped

|                 |              |                    |               |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge     | = 20.04 cfs   |
| Storm frequency | = 1 yrs      | Time to peak       | = 11.93 hrs   |
| Time interval   | = 2 min      | Hyd. volume        | = 43,023 cuft |
| Drainage area   | = 5.610 ac   | Curve number       | = 94          |
| Basin Slope     | = 0.0 %      | Hydraulic length   | = 0 ft        |
| Tc method       | = TR55       | Time of conc. (Tc) | = 3.20 min    |
| Total precip.   | = 2.90 in    | Distribution       | = Type II     |
| Storm duration  | = 24 hrs     | Shape factor       | = 484         |



# Hydrograph Report

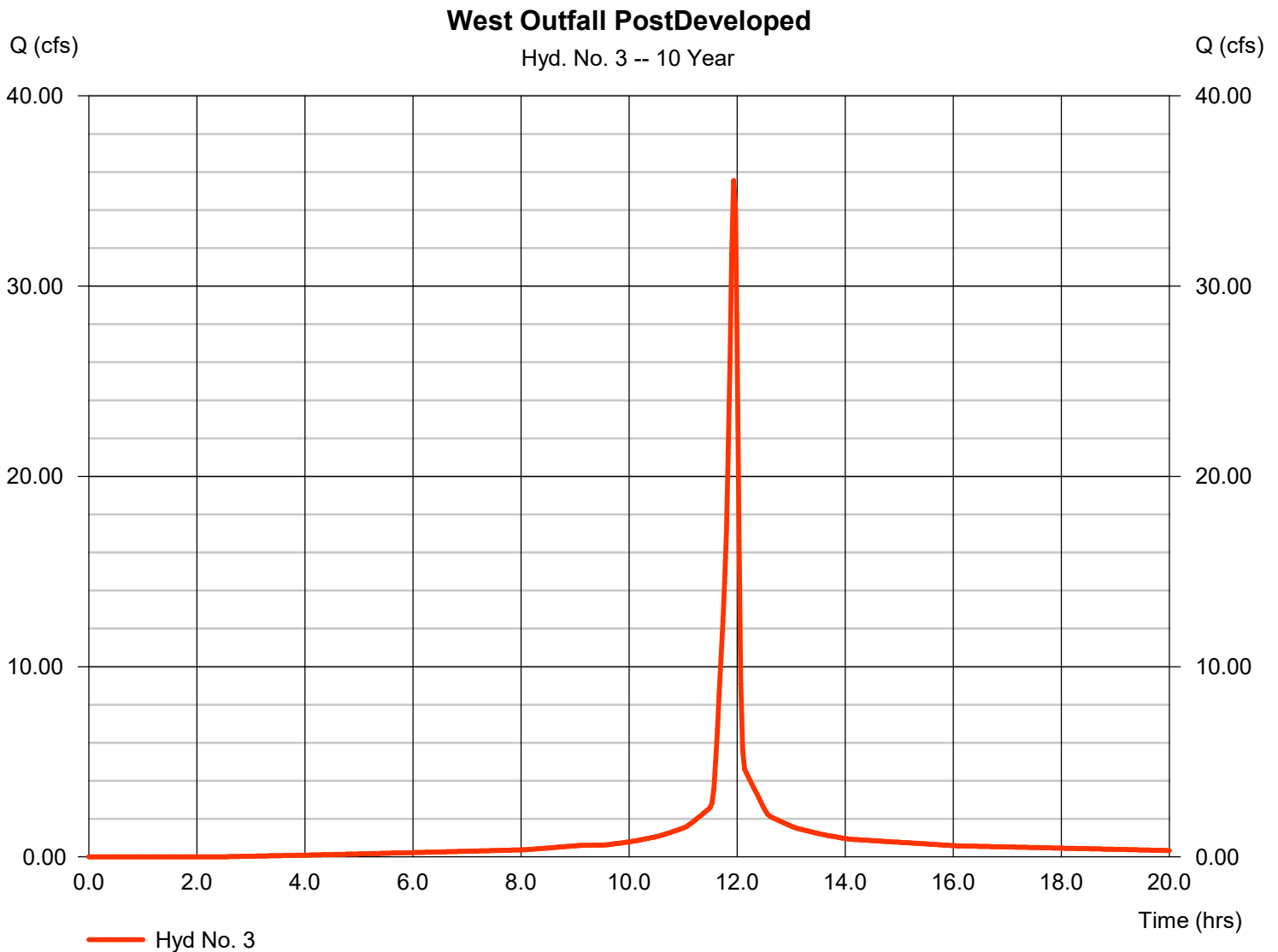
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Monday, 11 / 20 / 2023

## Hyd. No. 3

West Outfall PostDeveloped

|                 |              |                    |               |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge     | = 35.55 cfs   |
| Storm frequency | = 10 yrs     | Time to peak       | = 11.93 hrs   |
| Time interval   | = 2 min      | Hyd. volume        | = 79,422 cuft |
| Drainage area   | = 5.610 ac   | Curve number       | = 94          |
| Basin Slope     | = 0.0 %      | Hydraulic length   | = 0 ft        |
| Tc method       | = TR55       | Time of conc. (Tc) | = 3.20 min    |
| Total precip.   | = 4.85 in    | Distribution       | = Type II     |
| Storm duration  | = 24 hrs     | Shape factor       | = 484         |

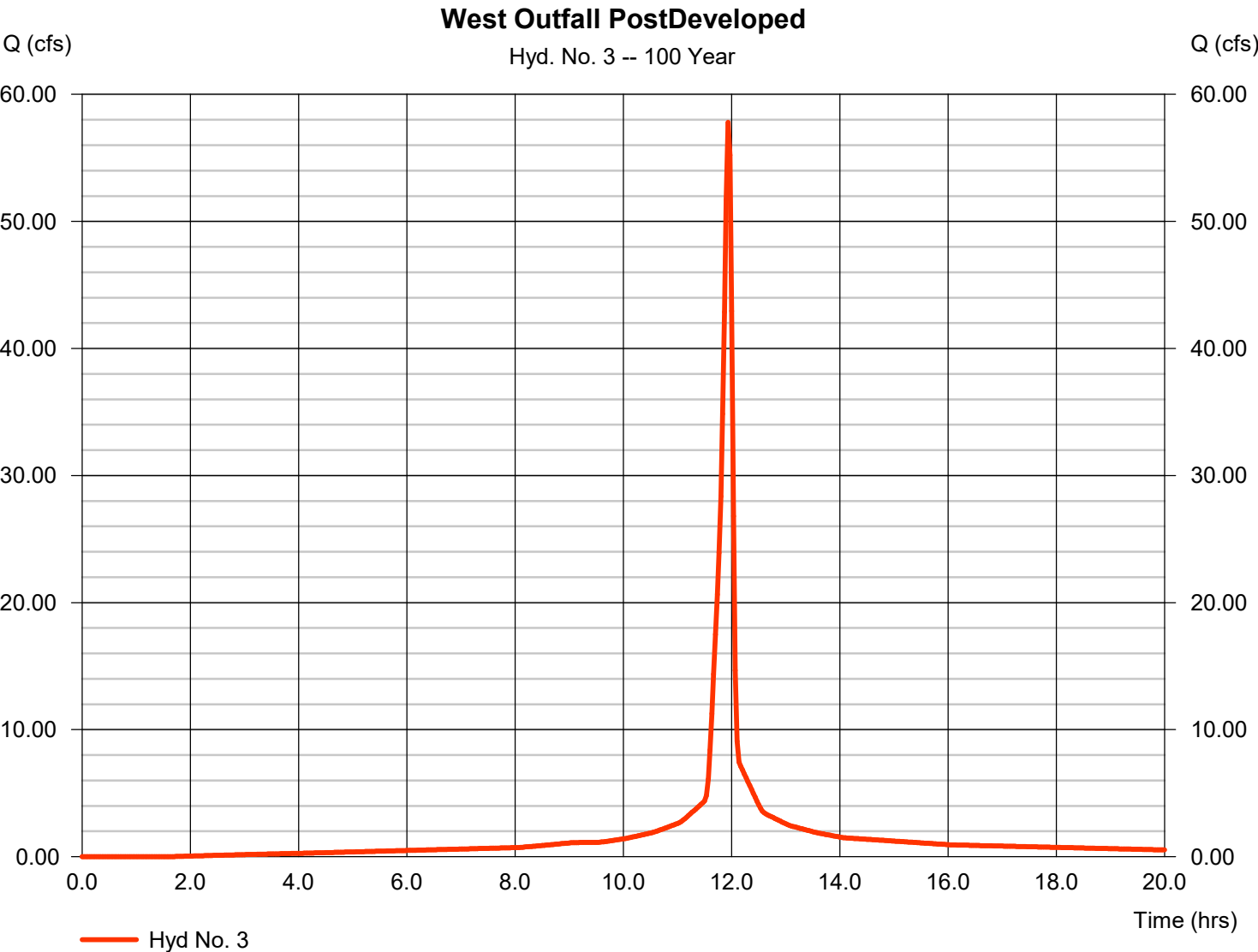


# Hydrograph Report

## Hyd. No. 3

West Outfall PostDeveloped

|                 |   |            |                    |   |              |
|-----------------|---|------------|--------------------|---|--------------|
| Hydrograph type | = | SCS Runoff | Peak discharge     | = | 57.78 cfs    |
| Storm frequency | = | 100 yrs    | Time to peak       | = | 11.93 hrs    |
| Time interval   | = | 2 min      | Hyd. volume        | = | 133,139 cuft |
| Drainage area   | = | 5.610 ac   | Curve number       | = | 94           |
| Basin Slope     | = | 0.0 %      | Hydraulic length   | = | 0 ft         |
| Tc method       | = | TR55       | Time of conc. (Tc) | = | 3.20 min     |
| Total precip.   | = | 7.69 in    | Distribution       | = | Type II      |
| Storm duration  | = | 24 hrs     | Shape factor       | = | 484          |



# Hydrograph Report

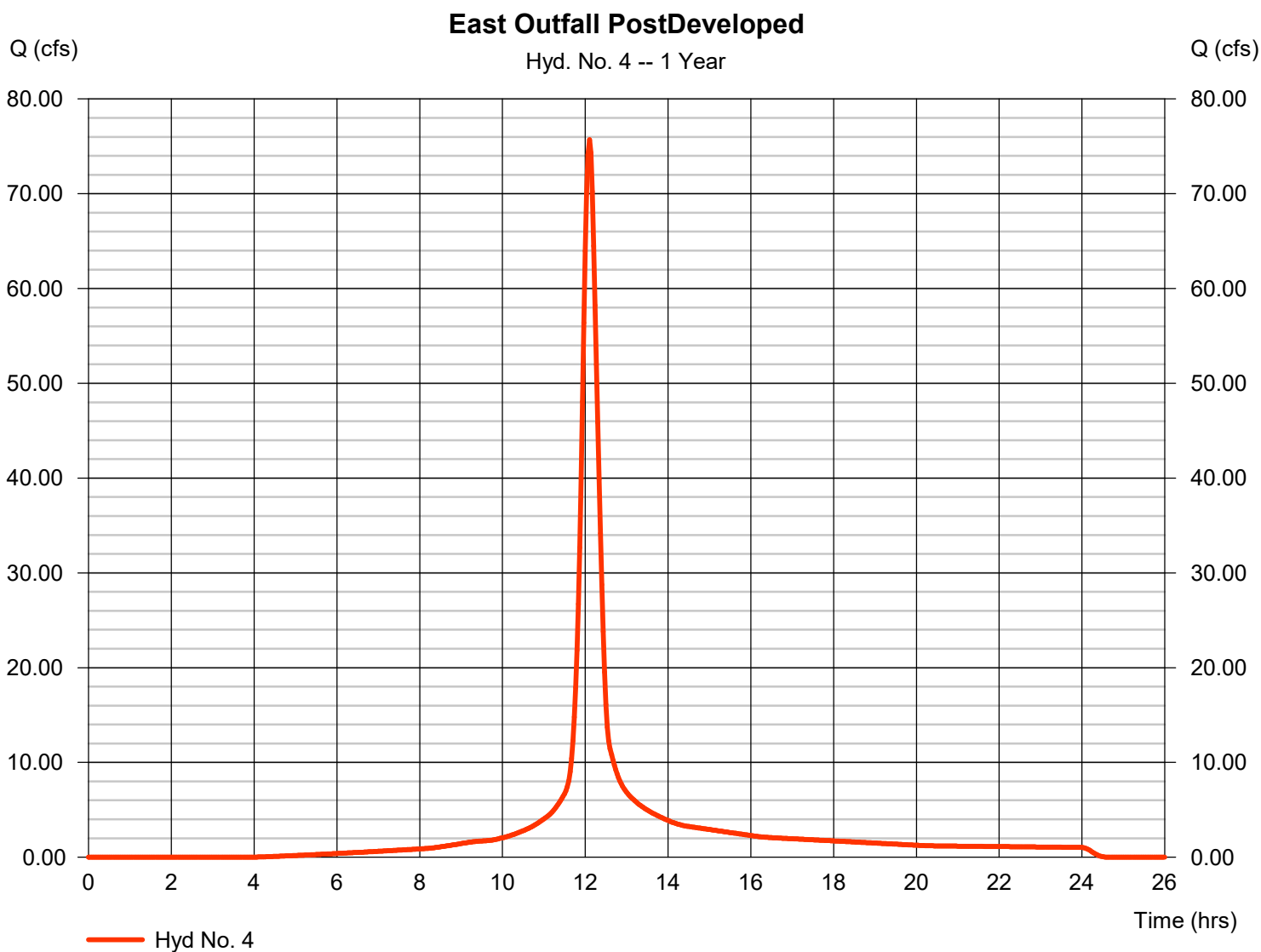
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## Hyd. No. 4

East Outfall PostDeveloped

|                 |              |                    |                |
|-----------------|--------------|--------------------|----------------|
| Hydrograph type | = SCS Runoff | Peak discharge     | = 75.70 cfs    |
| Storm frequency | = 1 yrs      | Time to peak       | = 12.10 hrs    |
| Time interval   | = 2 min      | Hyd. volume        | = 268,855 cuft |
| Drainage area   | = 32.290 ac  | Curve number       | = 94           |
| Basin Slope     | = 0.0 %      | Hydraulic length   | = 0 ft         |
| Tc method       | = TR55       | Time of conc. (Tc) | = 23.40 min    |
| Total precip.   | = 2.90 in    | Distribution       | = Type II      |
| Storm duration  | = 24 hrs     | Shape factor       | = 484          |

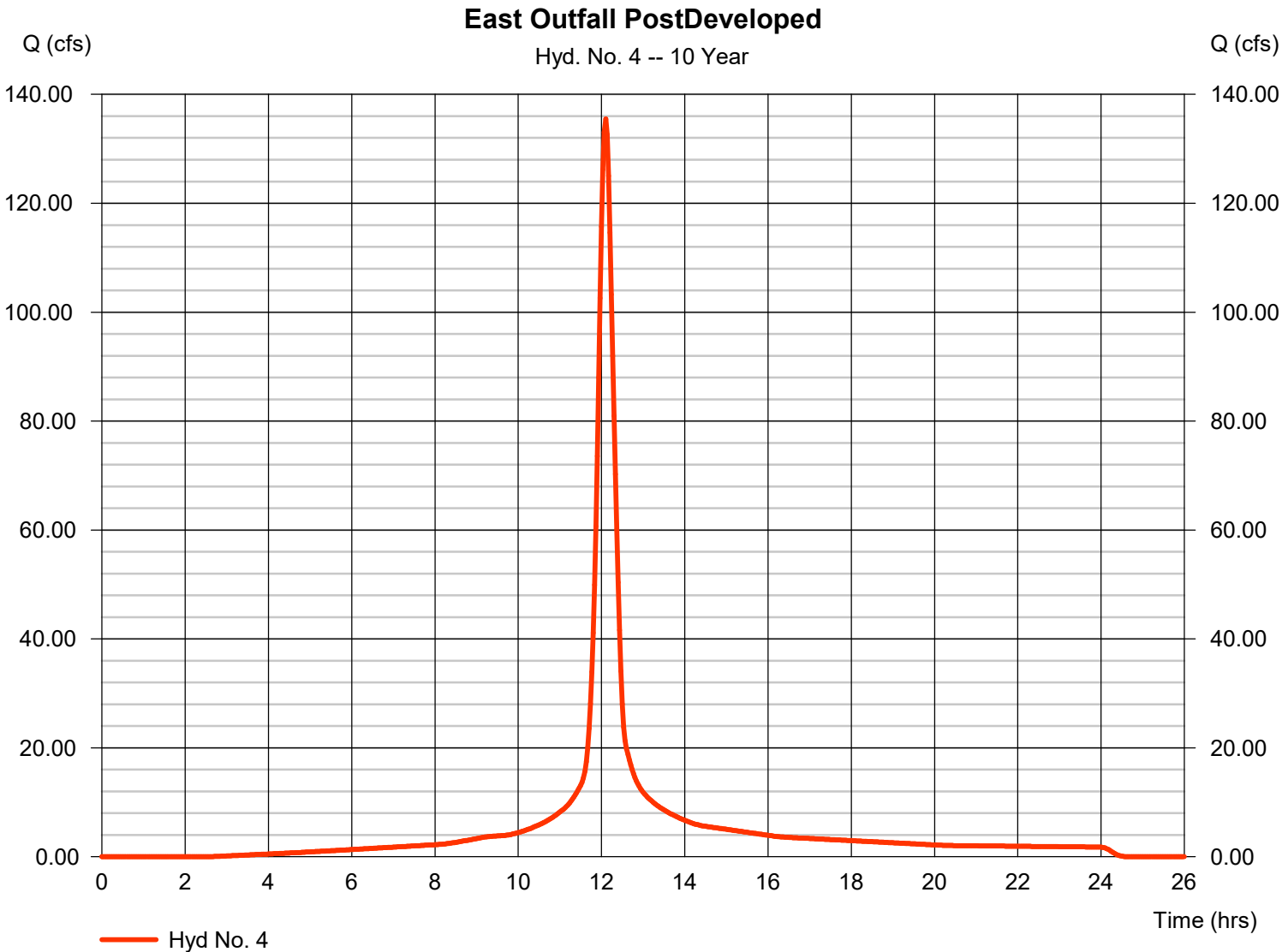


# Hydrograph Report

## Hyd. No. 4

East Outfall PostDeveloped

|                 |   |            |                    |   |              |
|-----------------|---|------------|--------------------|---|--------------|
| Hydrograph type | = | SCS Runoff | Peak discharge     | = | 135.49 cfs   |
| Storm frequency | = | 10 yrs     | Time to peak       | = | 12.10 hrs    |
| Time interval   | = | 2 min      | Hyd. volume        | = | 496,318 cuft |
| Drainage area   | = | 32.290 ac  | Curve number       | = | 94           |
| Basin Slope     | = | 0.0 %      | Hydraulic length   | = | 0 ft         |
| Tc method       | = | TR55       | Time of conc. (Tc) | = | 23.40 min    |
| Total precip.   | = | 4.85 in    | Distribution       | = | Type II      |
| Storm duration  | = | 24 hrs     | Shape factor       | = | 484          |



# Hydrograph Report

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## Hyd. No. 4

East Outfall PostDeveloped

|                 |              |                    |                |
|-----------------|--------------|--------------------|----------------|
| Hydrograph type | = SCS Runoff | Peak discharge     | = 221.15 cfs   |
| Storm frequency | = 100 yrs    | Time to peak       | = 12.10 hrs    |
| Time interval   | = 2 min      | Hyd. volume        | = 832,006 cuft |
| Drainage area   | = 32.290 ac  | Curve number       | = 94           |
| Basin Slope     | = 0.0 %      | Hydraulic length   | = 0 ft         |
| Tc method       | = TR55       | Time of conc. (Tc) | = 23.40 min    |
| Total precip.   | = 7.69 in    | Distribution       | = Type II      |
| Storm duration  | = 24 hrs     | Shape factor       | = 484          |

### East Outfall PostDeveloped

Hyd. No. 4 -- 100 Year

