

Post Construction Stormwater Management Analysis

Hamilton Properties Eagle Road

Radnor Township, Delaware County

Date: August 27, 2020

Plan Prepared For:

**Haverford Properties
551 W. Lancaster Avenue, Suite 307
Haverford, PA 19041**

Plan Prepared By:

**Site Engineering Concepts, LLC
P.O. Box 1992
Southeastern, PA 19399**



Executive Summary

The applicant proposes to construct 9 single family houses with a new road and walkways. The main entrance will be located on Eagle Road.

Two pipe storage stormwater management systems are proposed on each lot for a total of 19 Beds. The beds located at the front of the lots will take the proposed road and driveway. The bed at the rear will take the house and patio. The stormwater runoff rates are controlled per the township ordinance using different size orifices within the outlet structure at the outlet of each bed. the beds are used for storm water volume, quality and runoff rate control.

During construction erosion and sediment control will be accomplished through limited disturbance, immediate stabilization, a stabilized construction entrance and compost filter sock. Total limit of disturbance is approximately 3.4 acres.

EAGLE ROAD

Stormwater Management Summary-Post Construction

Radnor Township Stormwater District A

| Stormwater Management Summary - POI A | | | | | | | | |
|---------------------------------------|-----------------|--|-------------------------|--|---------------------------|--|------------|----------------------|
| Yr | Pre-Development | | | | Post Development | | Compliance | Percentage Reduction |
| | On-Site | | Allowable Release Rate* | | Total Post Developed Flow | | | |
| 1 | 0.275 | | 0.275 | | 0.000 | | -0.28 | -100% |
| 2 | 1.019 | | 0.275 | | 0.000 | | -0.28 | -100% |
| 5 | 2.722 | | 1.019 | | 0.000 | | -1.02 | -100% |
| 10 | 4.516 | | 2.722 | | 0.000 | | -2.72 | -100% |
| 25 | 7.394 | | 4.516 | | 0.000 | | -4.52 | -100% |
| 50 | 10.070 | | 7.394 | | 0.000 | | -7.39 | -100% |
| 100 | 13.110 | | 13.110 | | 0.000 | | -13.11 | -100% |

| | | |
|--|-----------|-------------------------------------|
| Design Storm Proposed Conditions | Reduce to | Design Storm Existing Conditions |
| 1yr | | 1 yr |
| 2 yr | | 1 yr |
| 5 yr | | 2 yr |
| 10 yr | | 5 yr |
| 25 yr | | 10 yr |
| 50 yr | | 25 yr |
| 100 yr | | 100 yr |

| INFILTRATION BED 1A-9A | | |
|---------------------------------|-------------|-----------------------|
| Pipe Diameter = | 48 | inches |
| Pipe Length = | 331 | ft |
| Stone Bed Length | 60 | ft |
| Stone Bed Width = | 51.0 | ft |
| Stone Depth = | 5.0 | ft |
| <hr/> | | |
| <i>Pipe Volume =</i> | <i>4159</i> | <i>ft²</i> |
| <i>+ Stone Voids Volume =</i> | <i>0</i> | <i>ft</i> |
| Provided V_t = | 4159 | ft³ |

Dead Storage Depth = 4.0
 Infiltration Bed Dead Storage Provided = 4,159

| INFILTRATION BED 1B-9B | | |
|---------------------------------|-------------|-----------------------|
| Pipe Diameter = | 48 | inches |
| Pipe Length = | 212 | ft |
| Stone Bed Length | 60 | ft |
| Stone Bed Width = | 21.0 | ft |
| Stone Depth = | 5.0 | ft |
| <hr/> | | |
| <i>Pipe Volume =</i> | <i>2664</i> | <i>ft²</i> |
| <i>+ Stone Voids Volume =</i> | <i>0</i> | <i>ft</i> |
| Provided V_t = | 2664 | ft³ |

Dead Storage Depth = 4.0
 Infiltration Bed Dead Storage Provided = 2,664

Watershed Model Schematic

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



Legend

| <u>Hyd.</u> | <u>Origin</u> | <u>Description</u> |
|--------------------|----------------------|---------------------------|
| 1 | SCS Runoff | Pre Dev |
| 2 | SCS Runoff | Post Lot-Front |
| 3 | SCS Runoff | Post Lot-Rear |

Hydrograph Return Period Recap

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

| Hyd. No. | Hydrograph type (origin) | Inflow hyd(s) | Peak Outflow (cfs) | | | | | | | | Hydrograph Description |
|----------|--------------------------|---------------|--------------------|-------|-------|-------|-------|-------|-------|--------|------------------------|
| | | | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 1 | SCS Runoff | ----- | 0.275 | 1.019 | ----- | 2.722 | 4.516 | 7.394 | 10.07 | 13.11 | Pre Dev |
| 2 | SCS Runoff | ----- | 0.344 | 0.502 | ----- | 0.756 | 0.982 | 1.322 | 1.615 | 1.933 | Post Lot-Front |
| 3 | SCS Runoff | ----- | 0.179 | 0.273 | ----- | 0.428 | 0.565 | 0.773 | 0.957 | 1.158 | Post Lot-Rear |

Hydrograph Summary Report

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

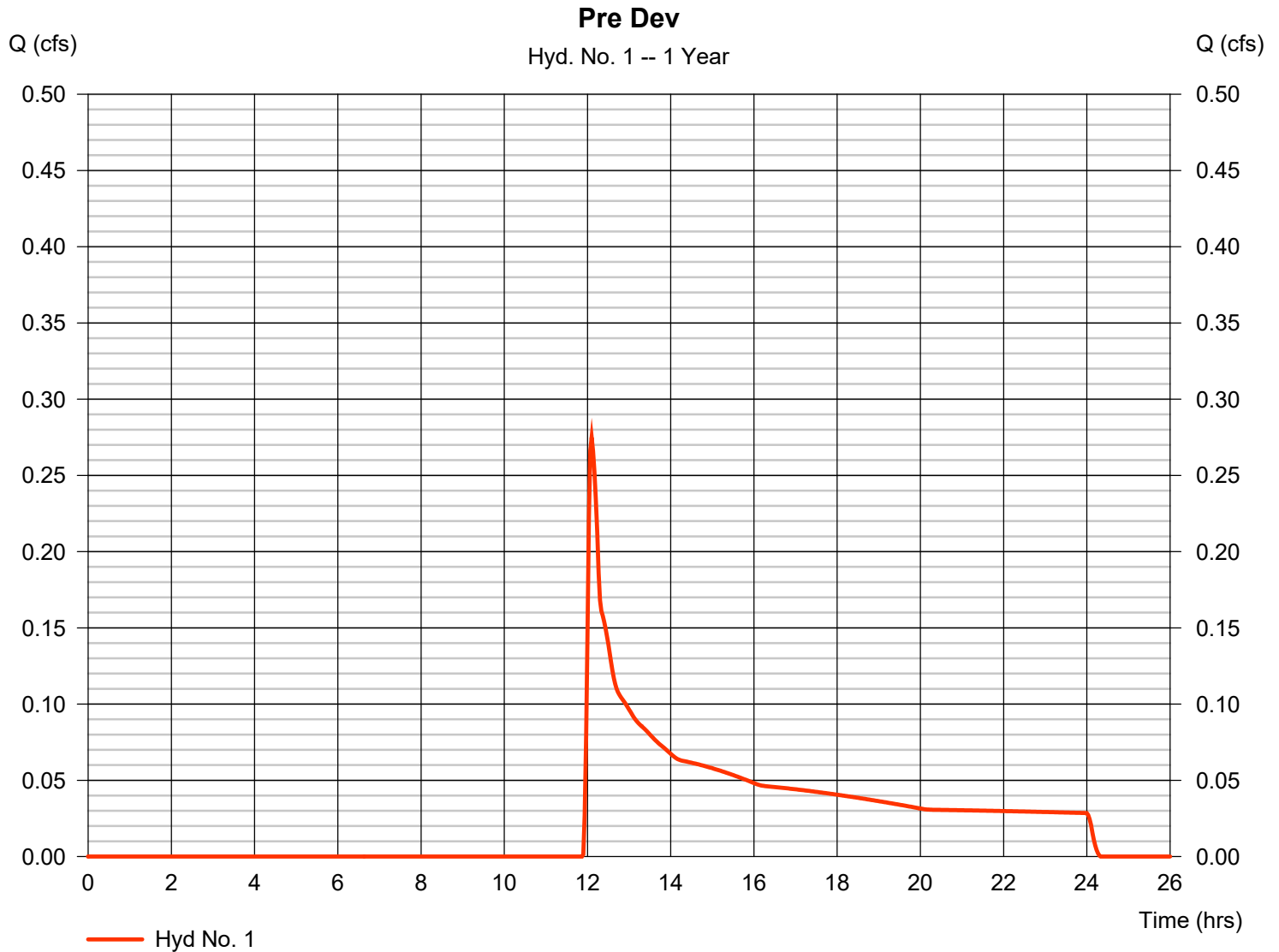
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|-----------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 0.275 | 2 | 726 | 2,306 | ----- | ----- | ----- | Pre Dev |
| 2 | SCS Runoff | 0.344 | 2 | 718 | 691 | ----- | ----- | ----- | Post Lot-Front |
| 3 | SCS Runoff | 0.179 | 2 | 718 | 367 | ----- | ----- | ----- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 1 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.275 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 12.10 hrs |
| Time interval | = 2 min | Hyd. volume | = 2,306 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 2.69 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



TR55 Tc Worksheet

Hyd. No. 1

Pre Dev

| <u>Description</u> | <u>A</u> | | <u>B</u> | | <u>C</u> | | <u>Totals</u> |
|------------------------------------|---------------|----------|-------------|----------|-------------|----------|------------------|
| Sheet Flow | | | | | | | |
| Manning's n-value | = 0.150 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 150.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 3.24 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 6.00 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 8.68 | + | 0.00 | + | 0.00 | = | 8.68 |
| Shallow Concentrated Flow | | | | | | | |
| Flow length (ft) | = 700.00 | | 0.00 | | 0.00 | | |
| Watercourse slope (%) | = 5.00 | | 0.00 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =3.61 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 3.23 | + | 0.00 | + | 0.00 | = | 3.23 |
| Channel Flow | | | | | | | |
| X sectional flow area (sqft) | = 0.00 | | 0.00 | | 0.00 | | |
| Wetted perimeter (ft) | = 0.00 | | 0.00 | | 0.00 | | |
| Channel slope (%) | = 0.00 | | 0.00 | | 0.00 | | |
| Manning's n-value | = 0.015 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =0.00 | | 0.00 | | 0.00 | | |
| Flow length (ft) | {{0}}0.0 | | 0.0 | | 0.0 | | |
| Travel Time (min) | = 0.00 | + | 0.00 | + | 0.00 | = | 0.00 |
| Total Travel Time, Tc | | | | | | | 11.90 min |

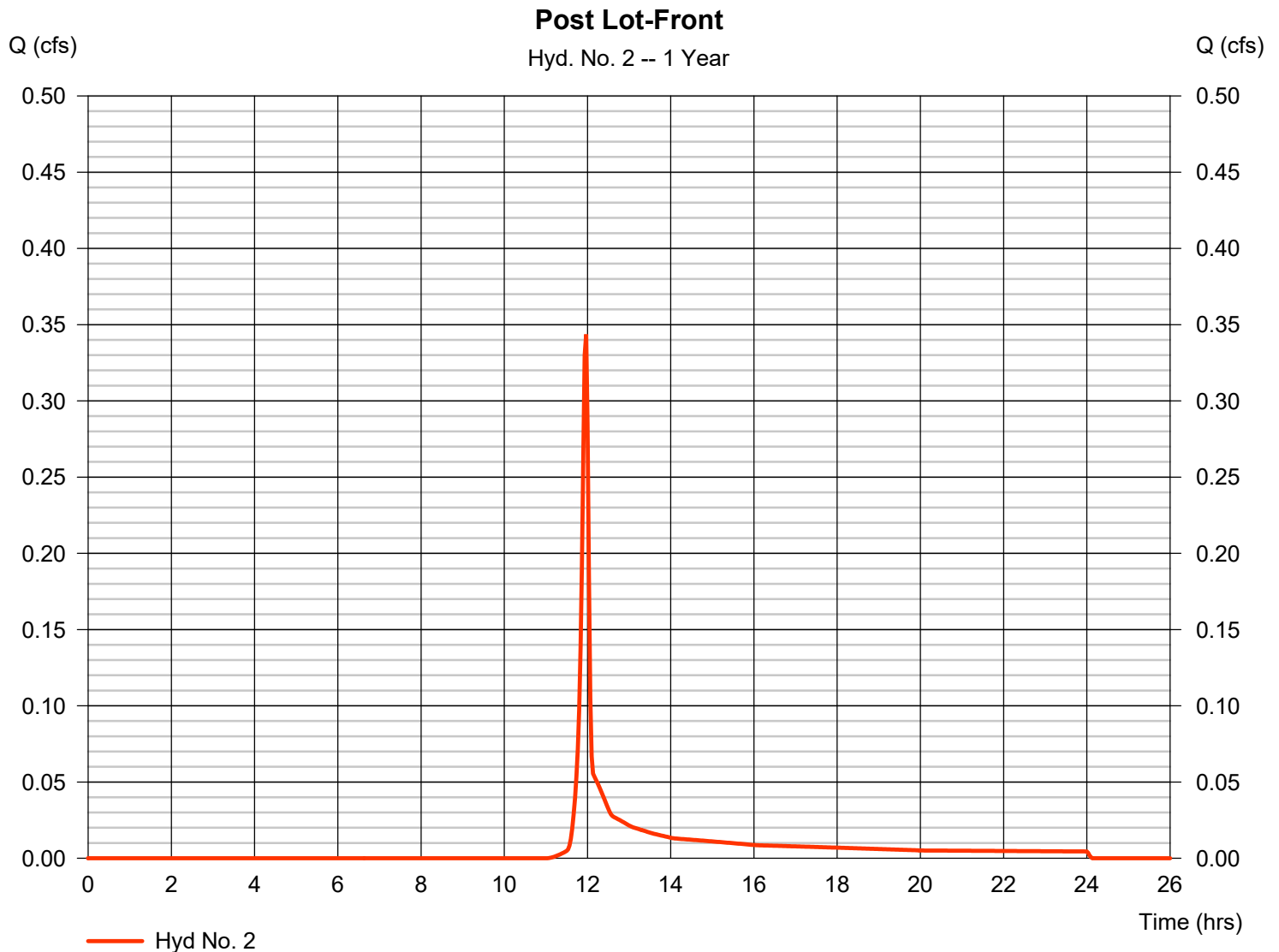
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.344 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 691 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 2.69 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



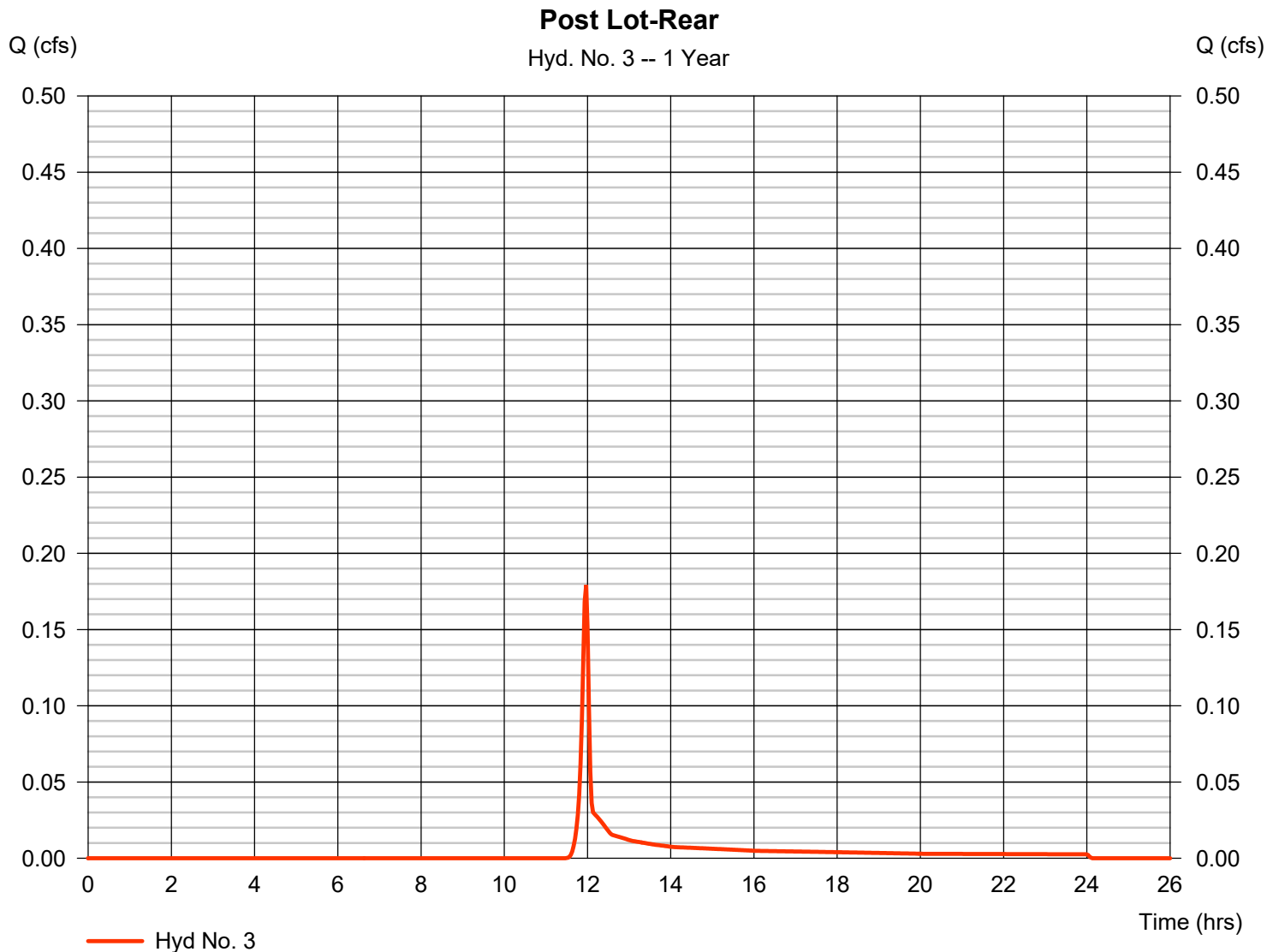
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.179 cfs |
| Storm frequency | = 1 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 367 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 2.69 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



Hydrograph Summary Report

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

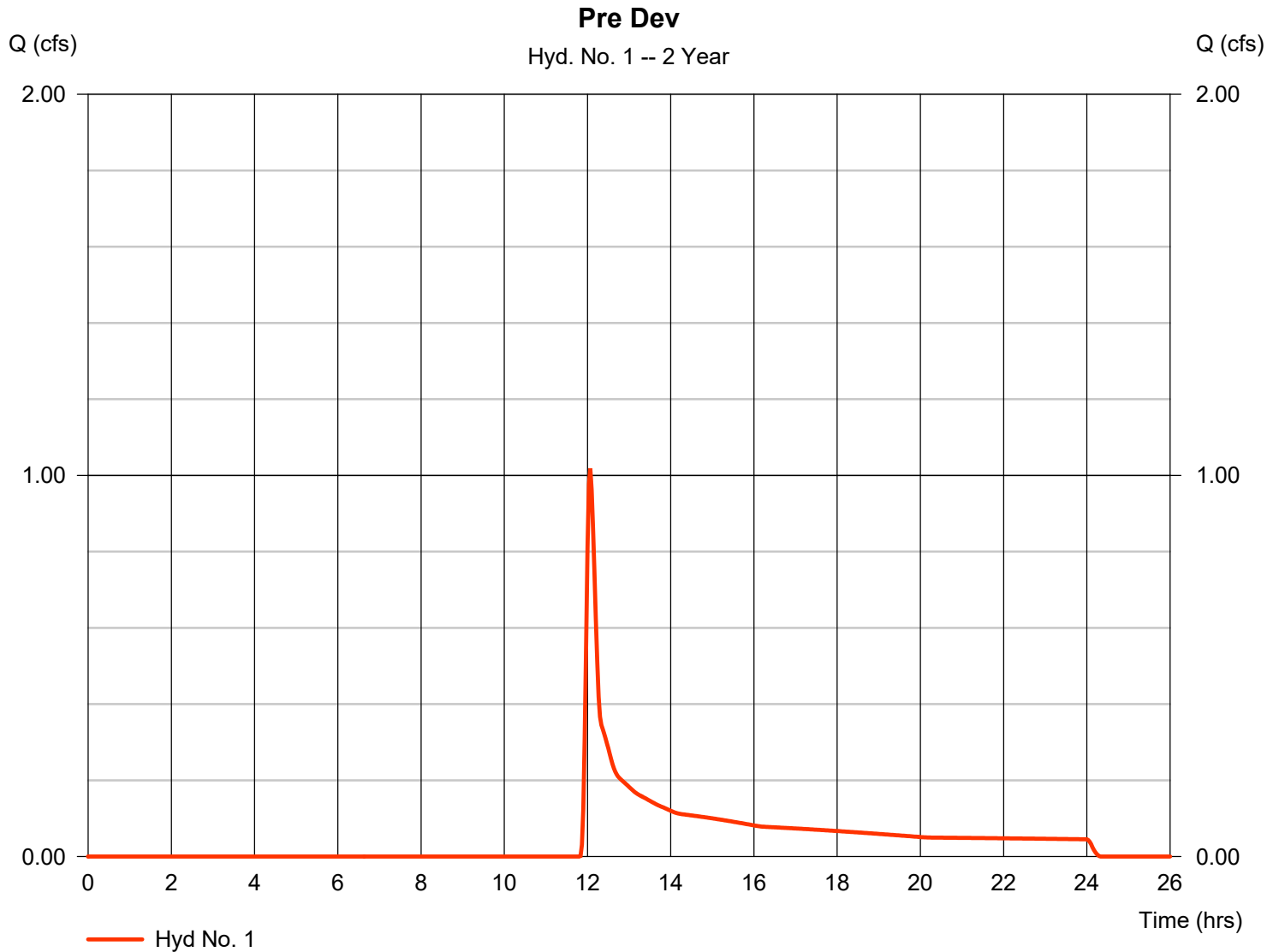
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|-----------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 1.019 | 2 | 724 | 4,518 | ----- | ----- | ----- | Pre Dev |
| 2 | SCS Runoff | 0.502 | 2 | 718 | 1,004 | ----- | ----- | ----- | Post Lot-Front |
| 3 | SCS Runoff | 0.273 | 2 | 718 | 549 | ----- | ----- | ----- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 2 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.019 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 12.07 hrs |
| Time interval | = 2 min | Hyd. volume | = 4,518 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 3.24 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



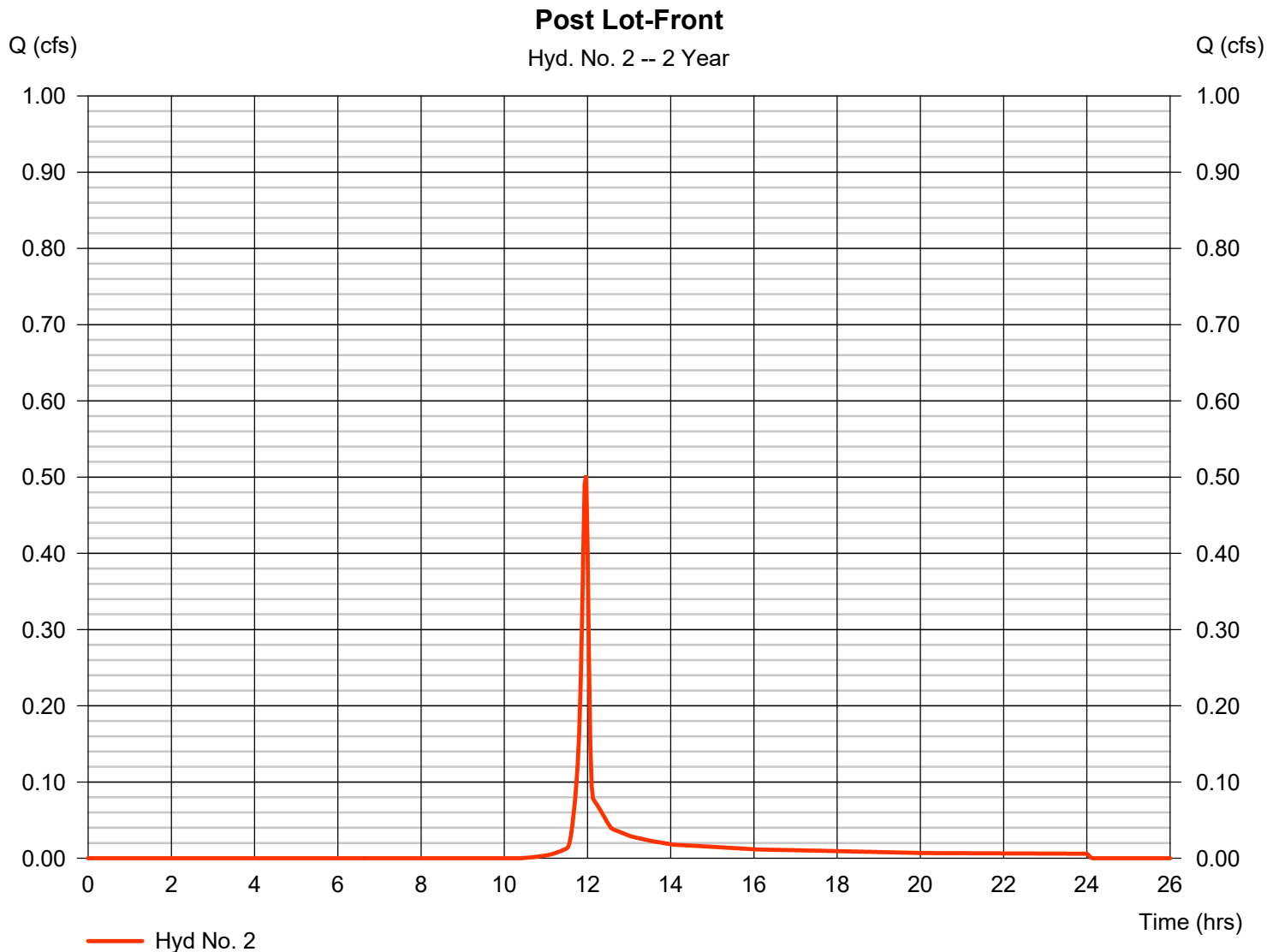
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.502 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 1,004 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 3.24 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



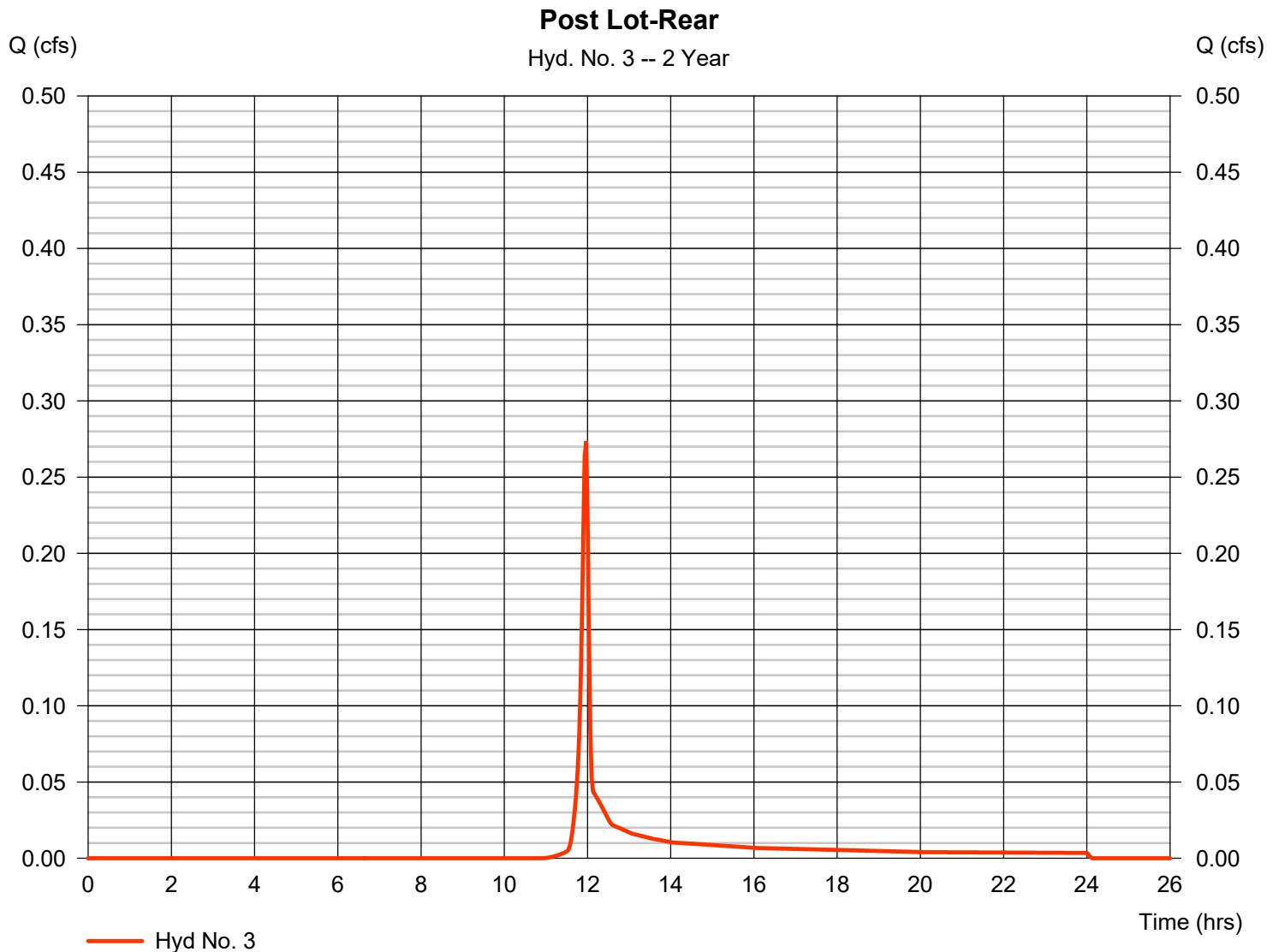
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.273 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 549 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 3.24 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



Hydrograph Summary Report

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

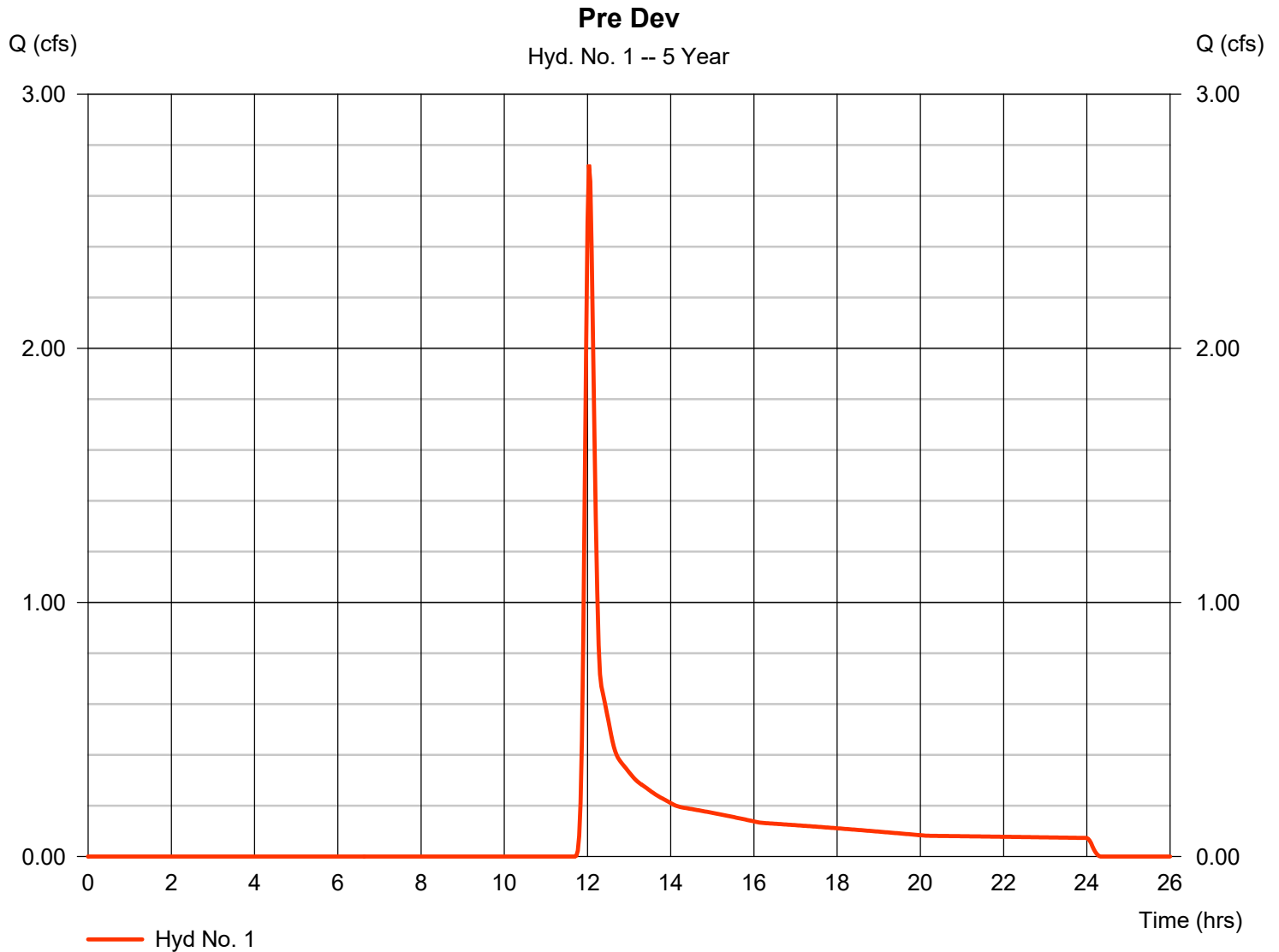
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|-----------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 2.722 | 2 | 722 | 8,811 | ---- | ---- | ---- | Pre Dev |
| 2 | SCS Runoff | 0.756 | 2 | 718 | 1,518 | ---- | ---- | ---- | Post Lot-Front |
| 3 | SCS Runoff | 0.428 | 2 | 718 | 855 | ---- | ---- | ---- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 5 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.722 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 12.03 hrs |
| Time interval | = 2 min | Hyd. volume | = 8,811 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 4.06 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



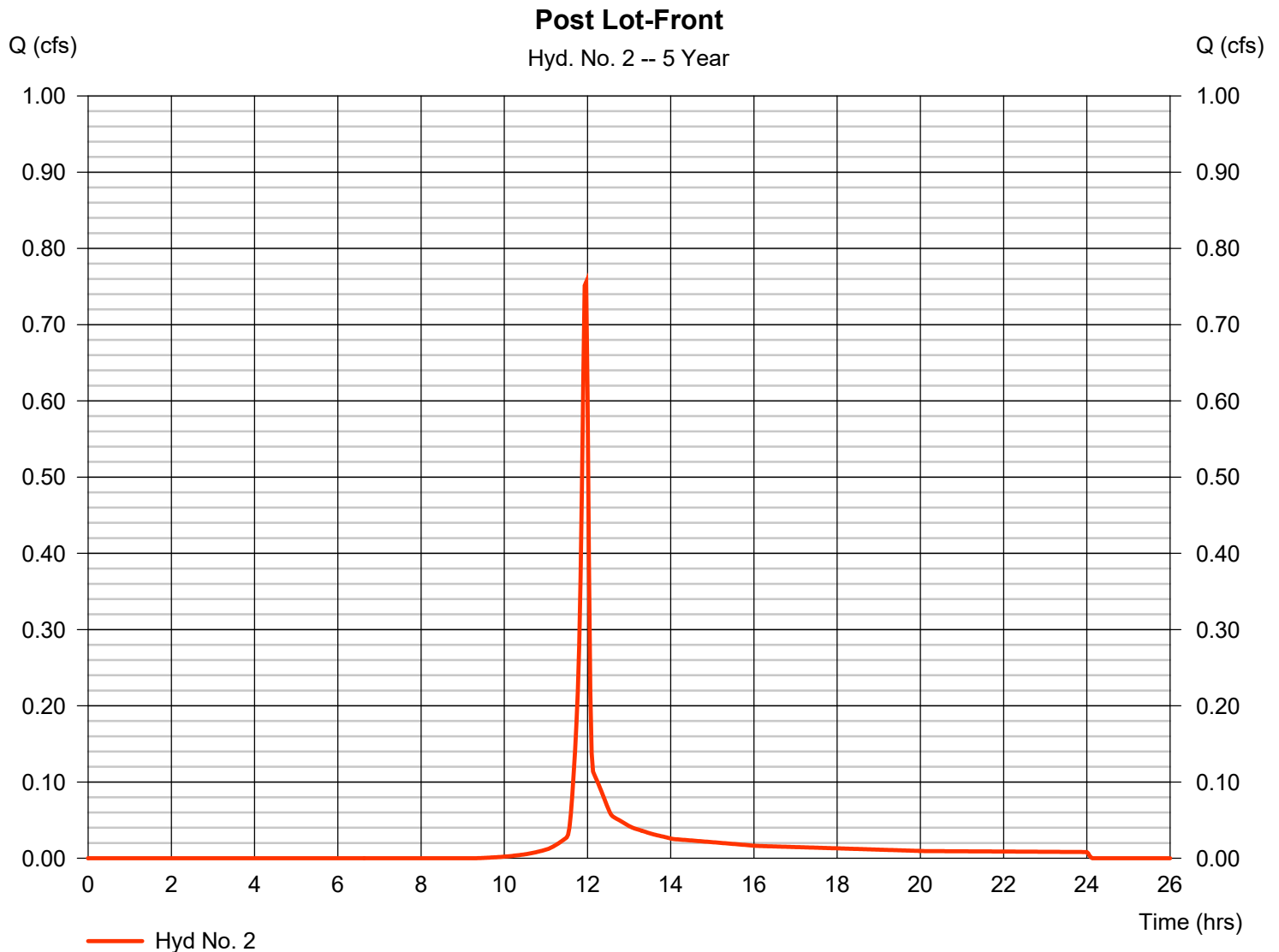
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.756 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 1,518 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 4.06 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



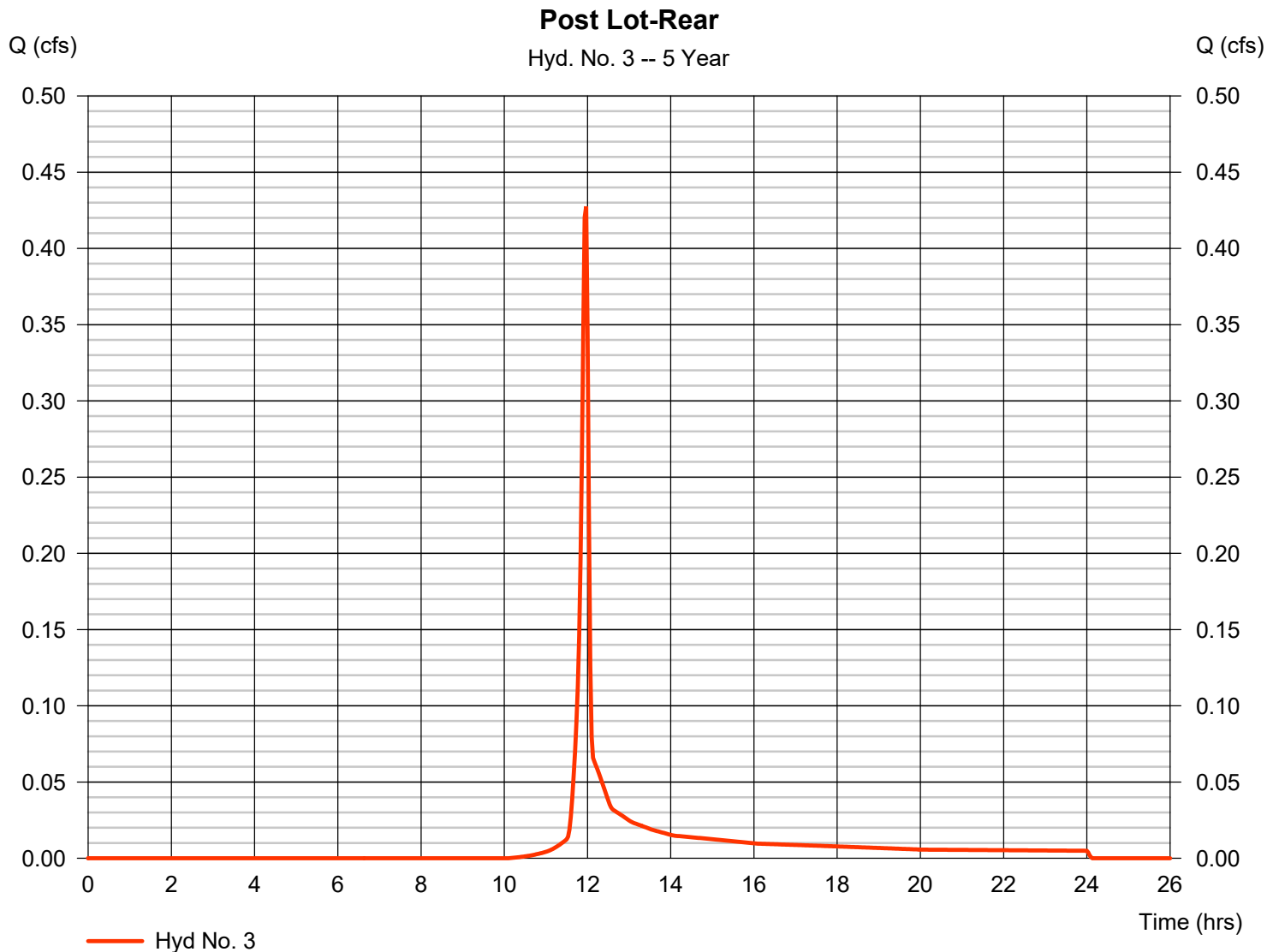
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.428 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 855 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 4.06 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



Hydrograph Summary Report

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

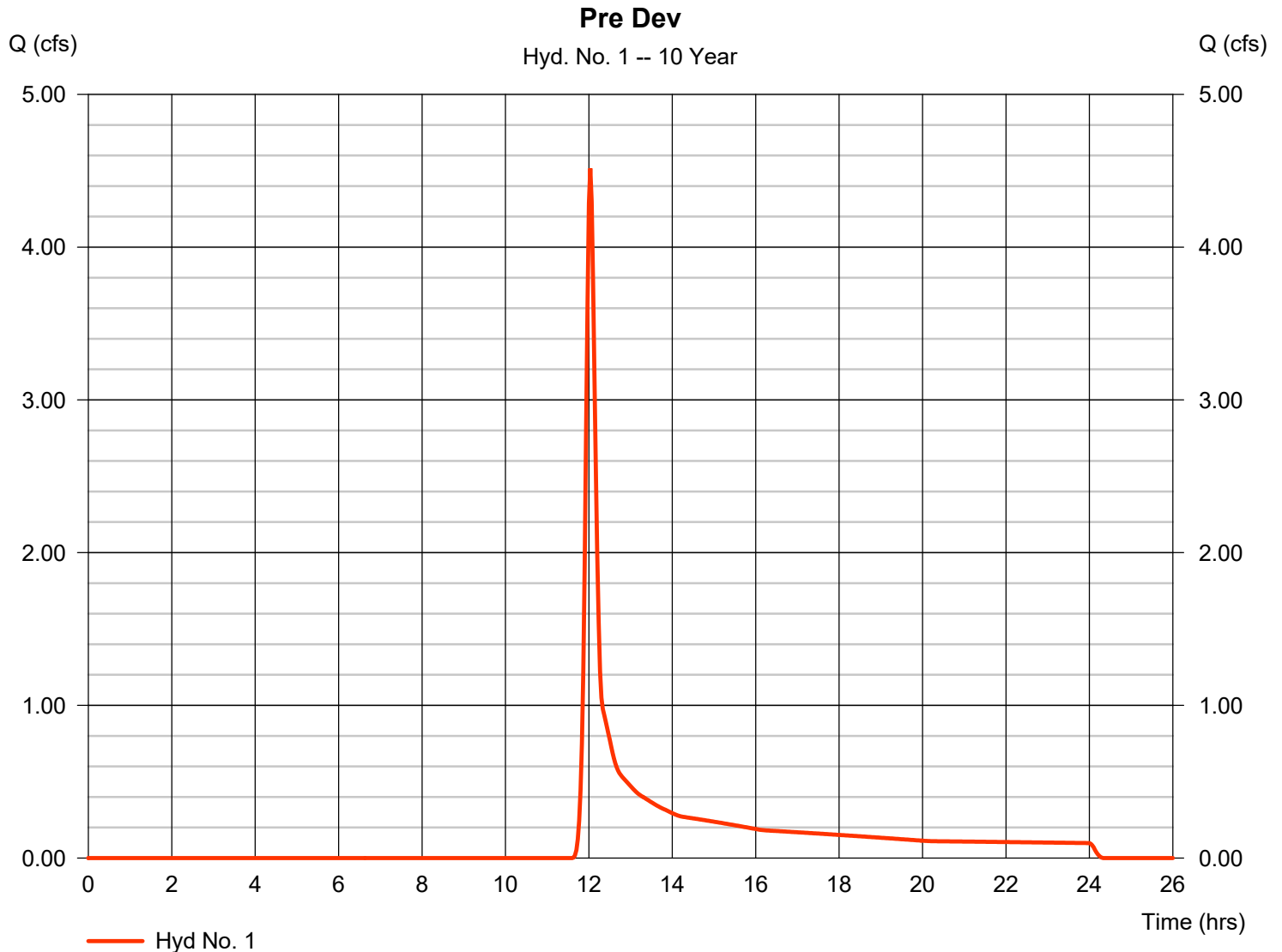
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|------------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 4.516 | 2 | 722 | 13,160 | ---- | ---- | ---- | Pre Dev |
| 2 | SCS Runoff | 0.982 | 2 | 716 | 1,983 | ---- | ---- | ---- | Post Lot-Front |
| 3 | SCS Runoff | 0.565 | 2 | 718 | 1,136 | ---- | ---- | ---- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 10 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.516 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 12.03 hrs |
| Time interval | = 2 min | Hyd. volume | = 13,160 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 4.75 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



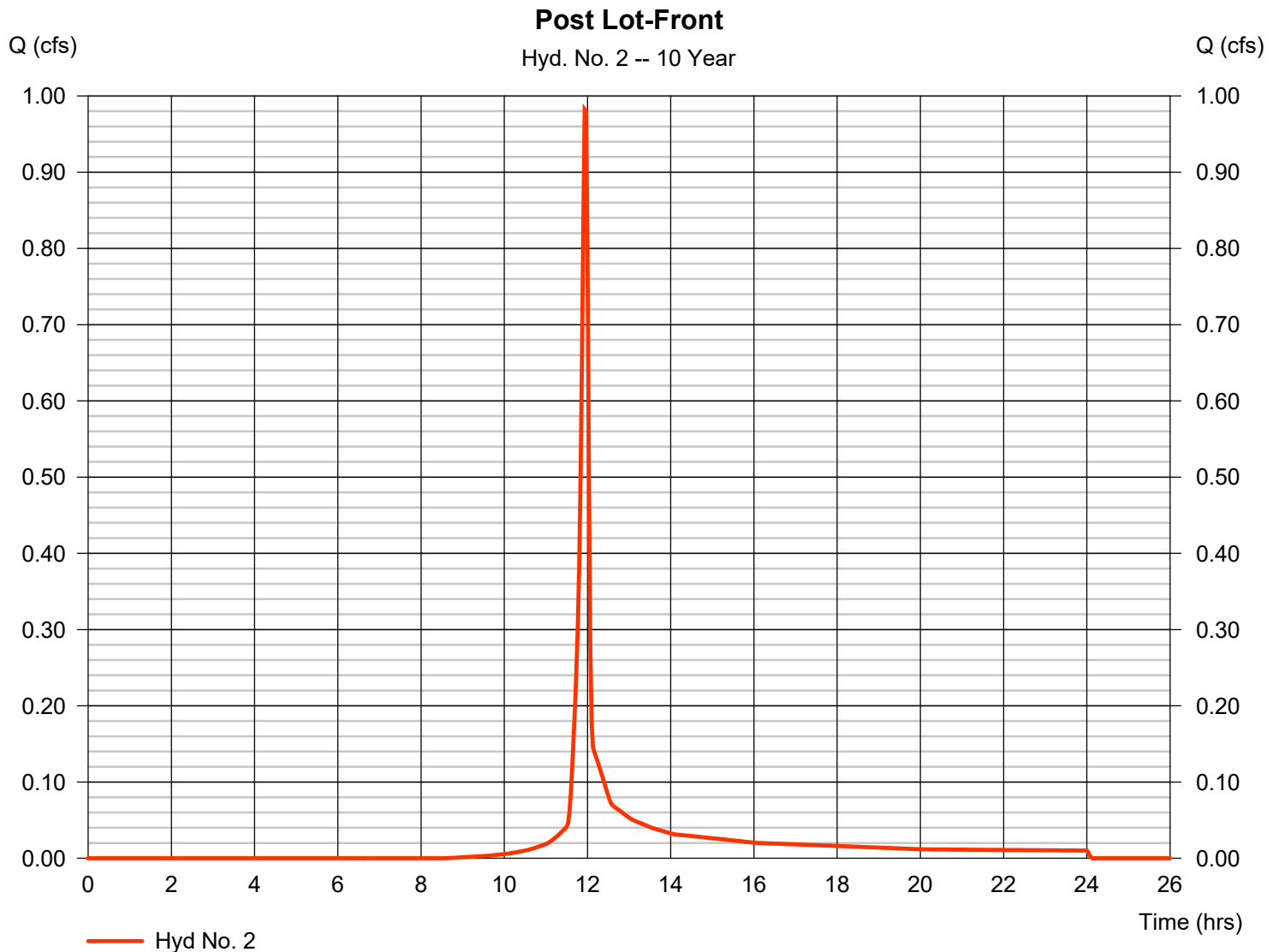
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.982 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 1,983 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 4.75 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



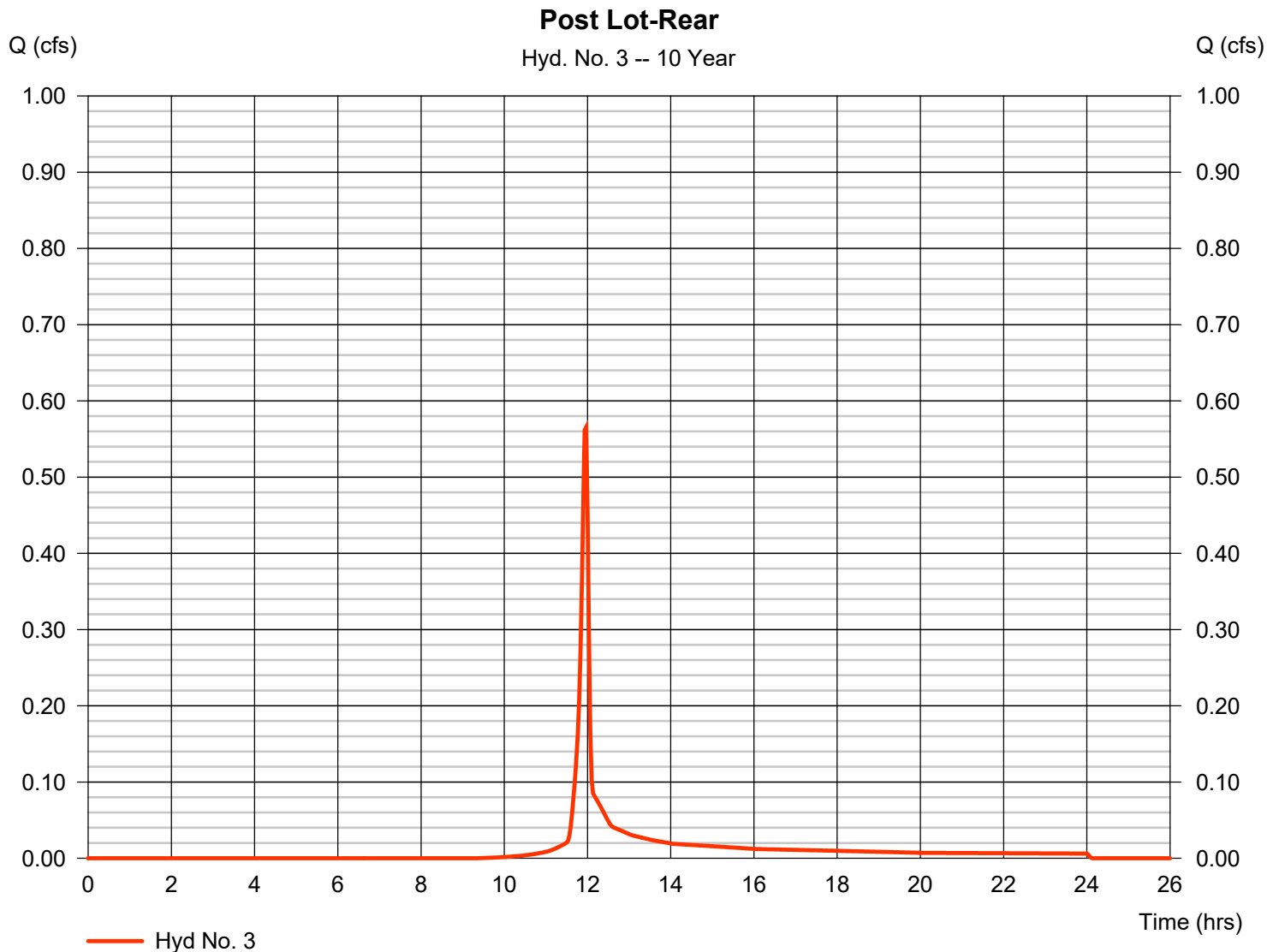
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.565 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 11.97 hrs |
| Time interval | = 2 min | Hyd. volume | = 1,136 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 4.75 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



Hydrograph Summary Report

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

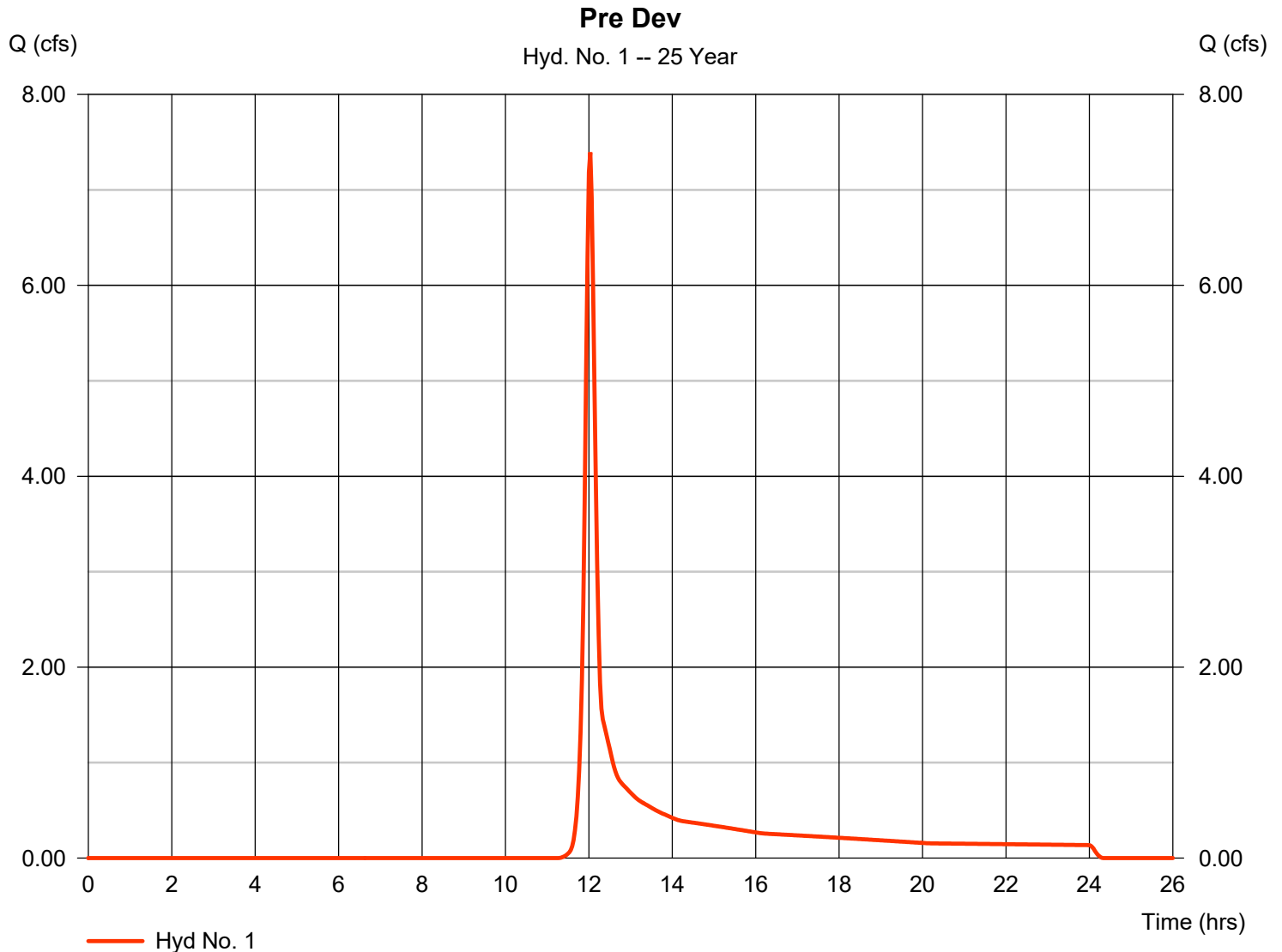
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|------------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 7.394 | 2 | 722 | 20,250 | ----- | ----- | ----- | Pre Dev |
| 2 | SCS Runoff | 1.322 | 2 | 716 | 2,679 | ----- | ----- | ----- | Post Lot-Front |
| 3 | SCS Runoff | 0.773 | 2 | 716 | 1,561 | ----- | ----- | ----- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 25 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.394 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 12.03 hrs |
| Time interval | = 2 min | Hyd. volume | = 20,250 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 5.73 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



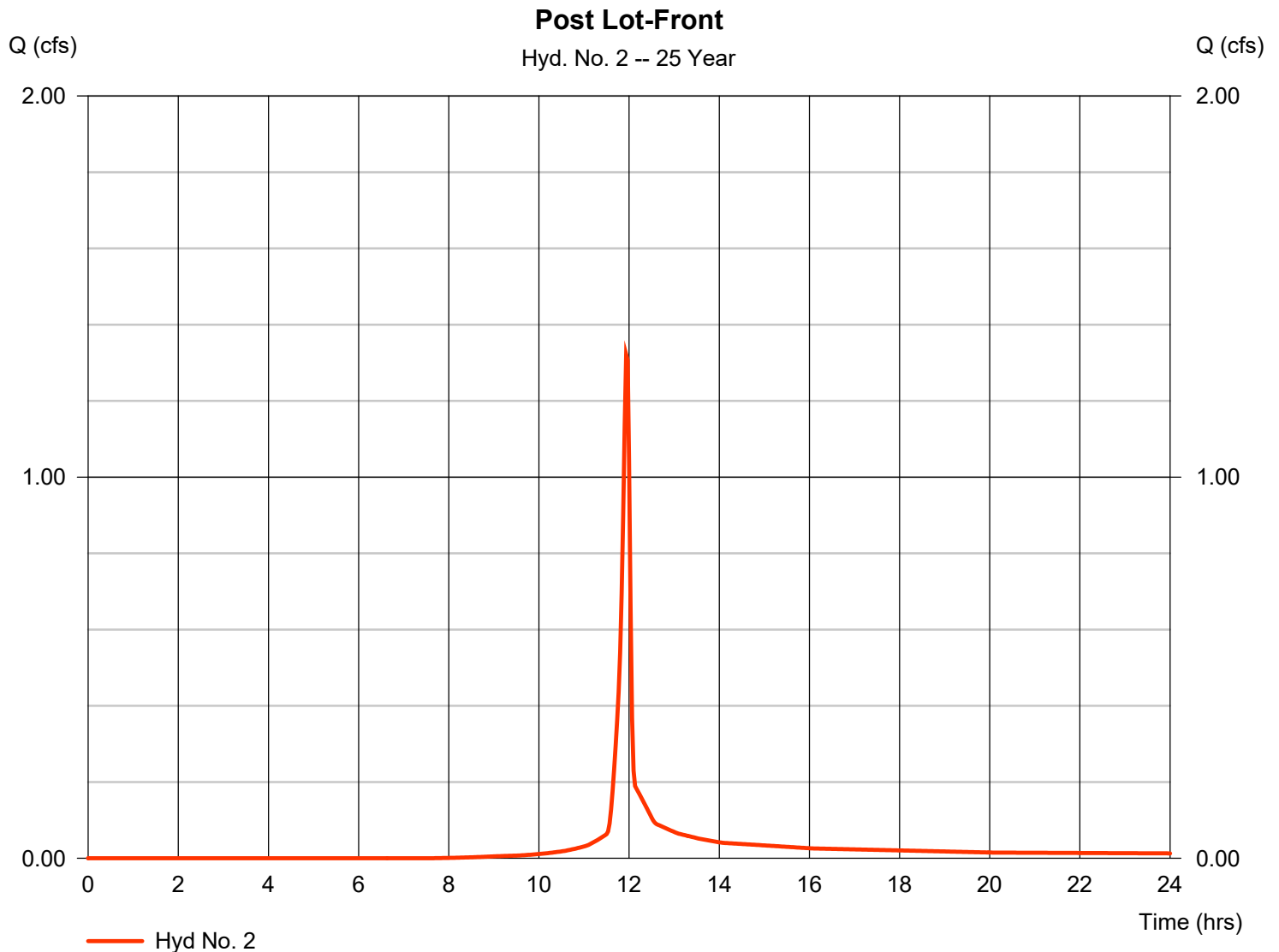
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.322 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 2,679 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 5.73 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



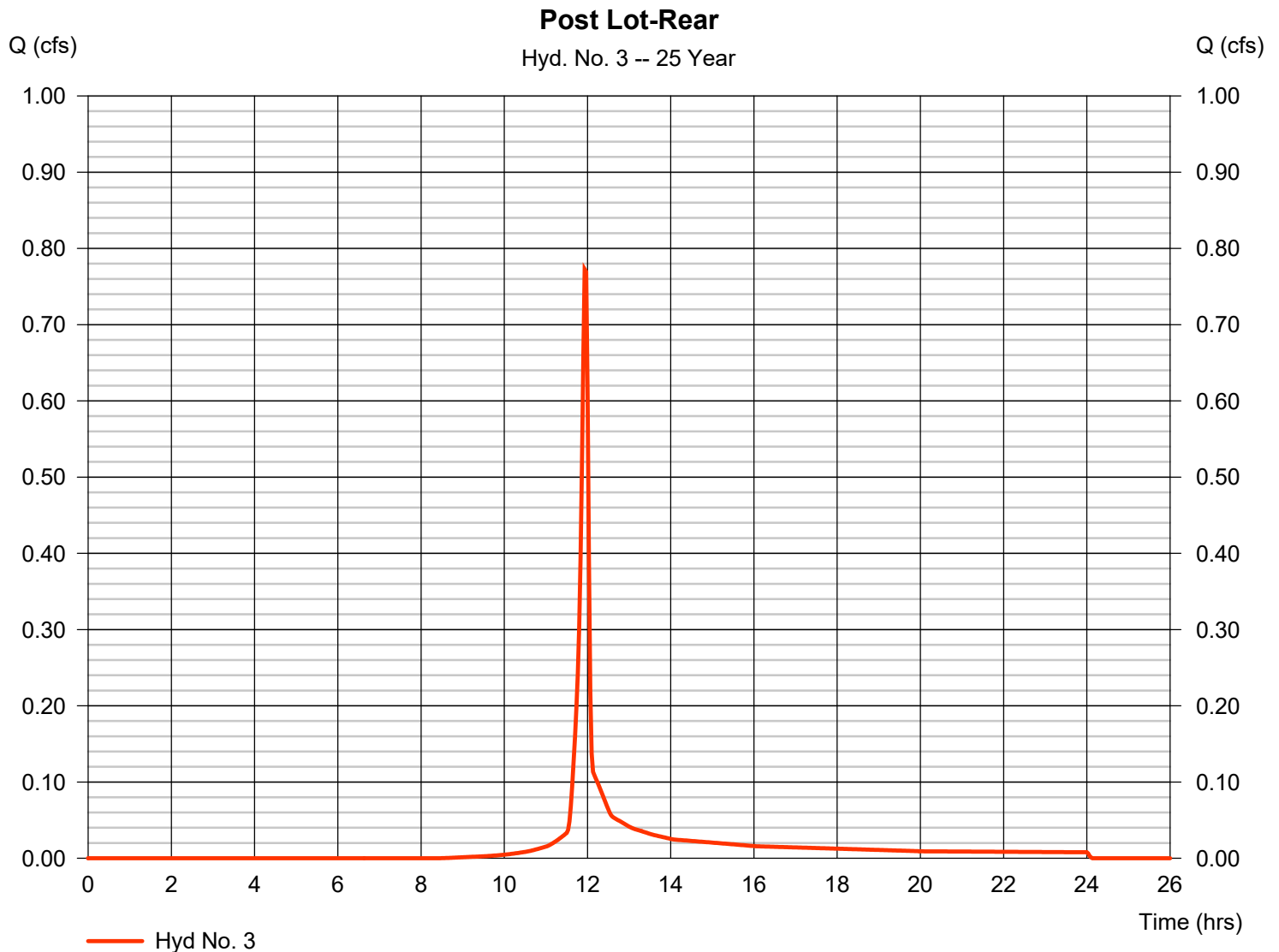
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.773 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 1,561 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 5.73 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



Hydrograph Summary Report

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

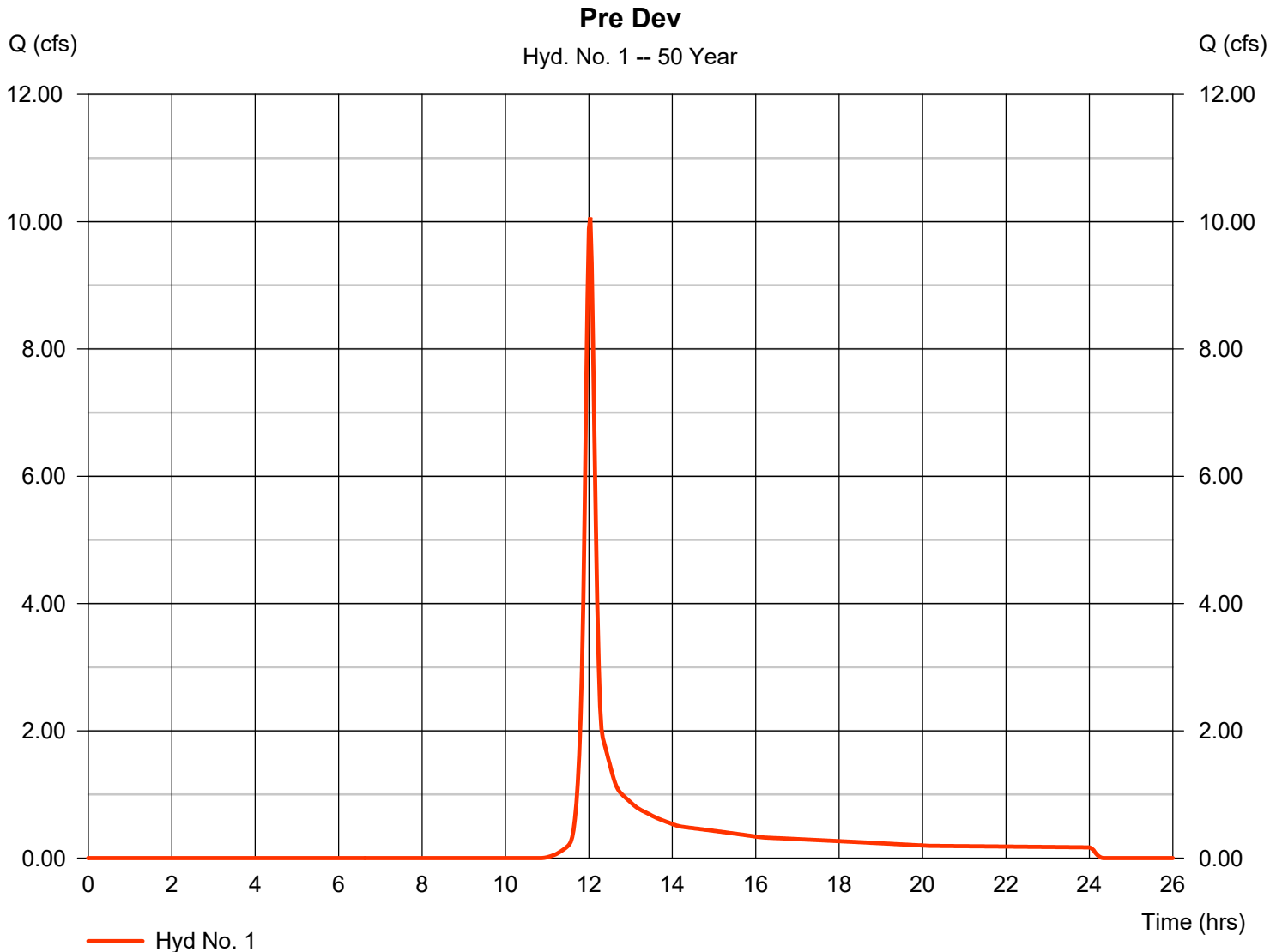
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|------------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 10.07 | 2 | 722 | 26,922 | ---- | ---- | ---- | Pre Dev |
| 2 | SCS Runoff | 1.615 | 2 | 716 | 3,291 | ---- | ---- | ---- | Post Lot-Front |
| 3 | SCS Runoff | 0.957 | 2 | 716 | 1,938 | ---- | ---- | ---- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 50 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 10.07 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 12.03 hrs |
| Time interval | = 2 min | Hyd. volume | = 26,922 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 6.56 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



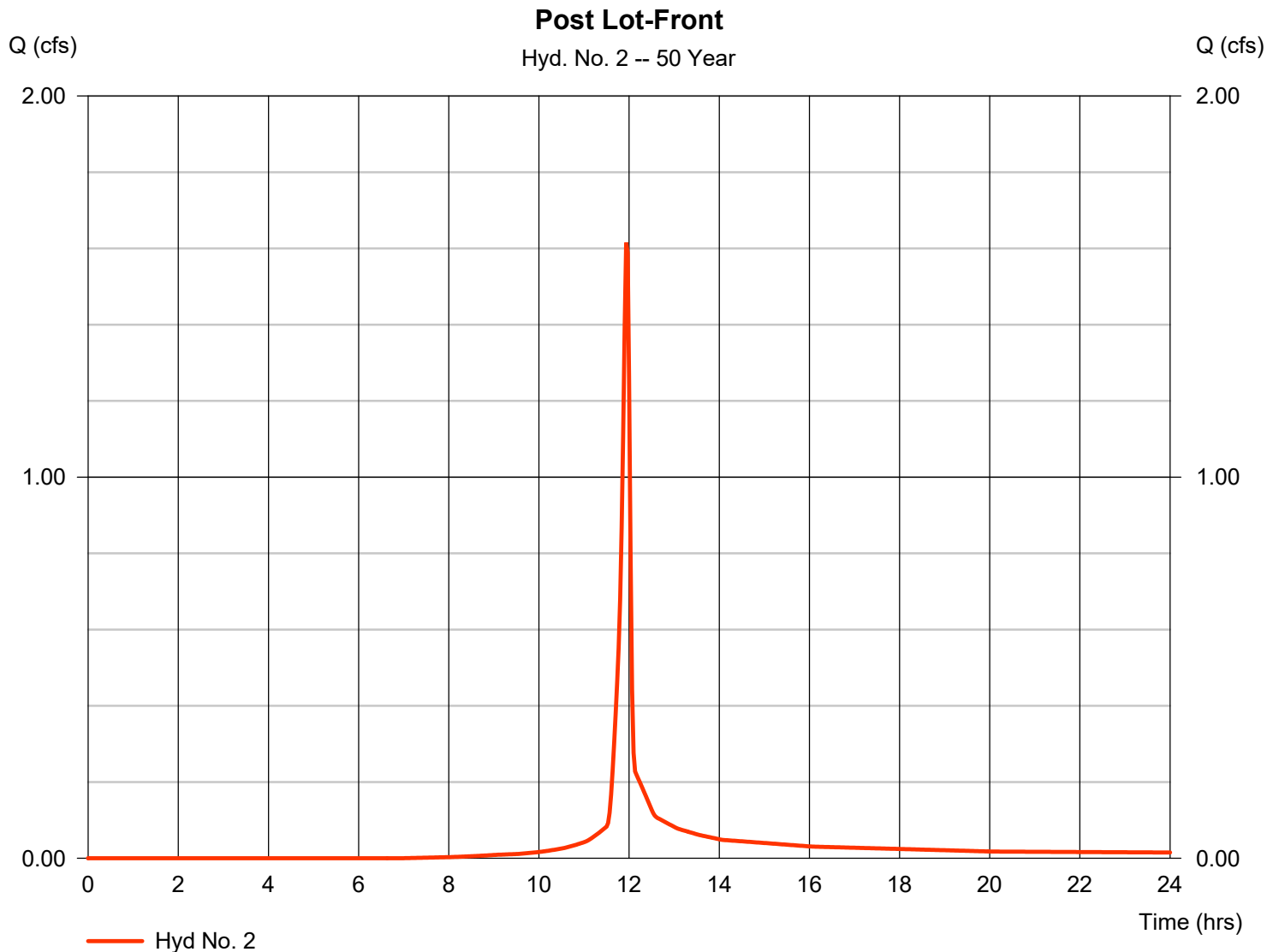
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.615 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 3,291 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 6.56 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



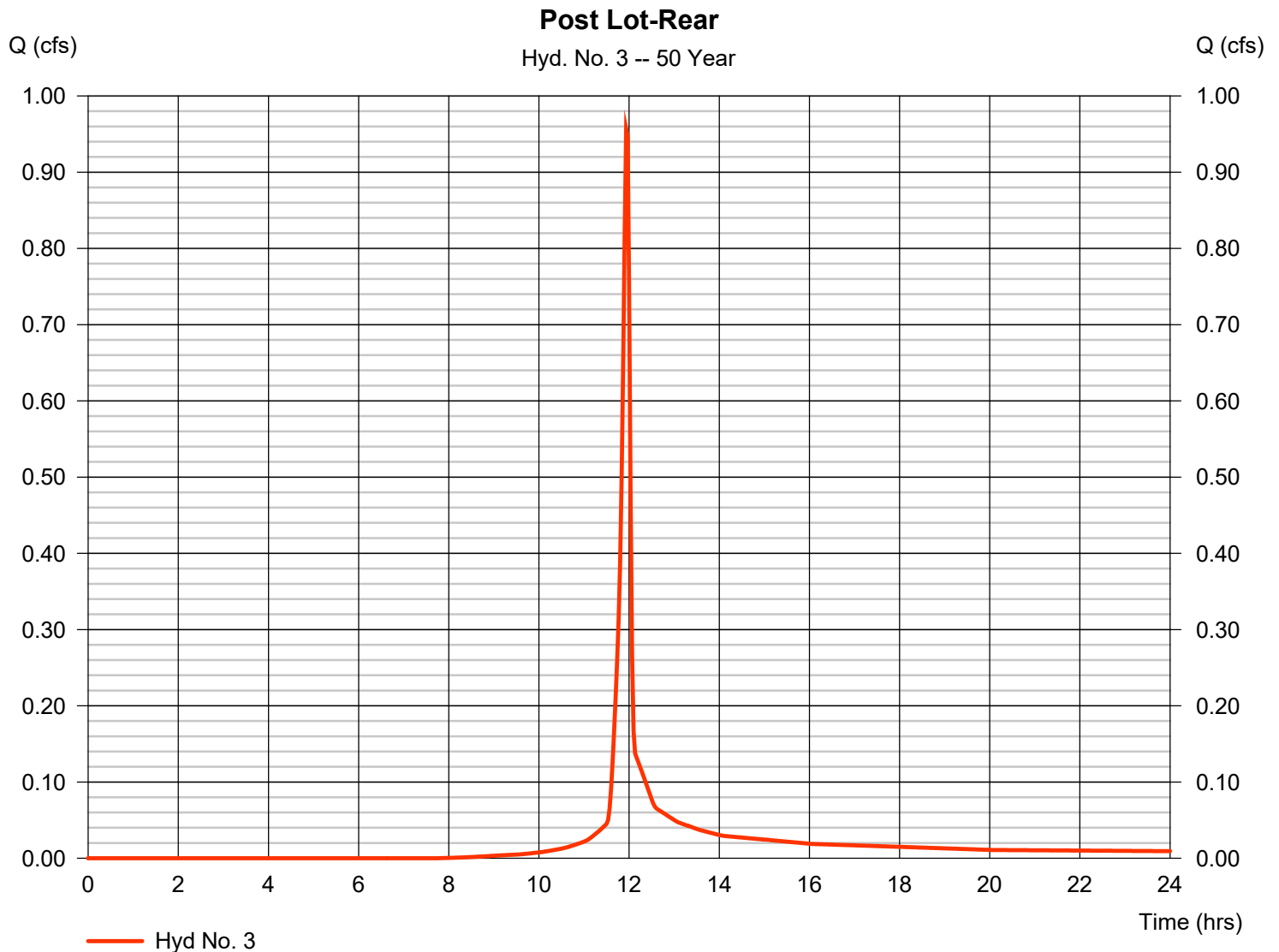
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.957 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 1,938 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 6.56 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



Hydrograph Summary Report

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

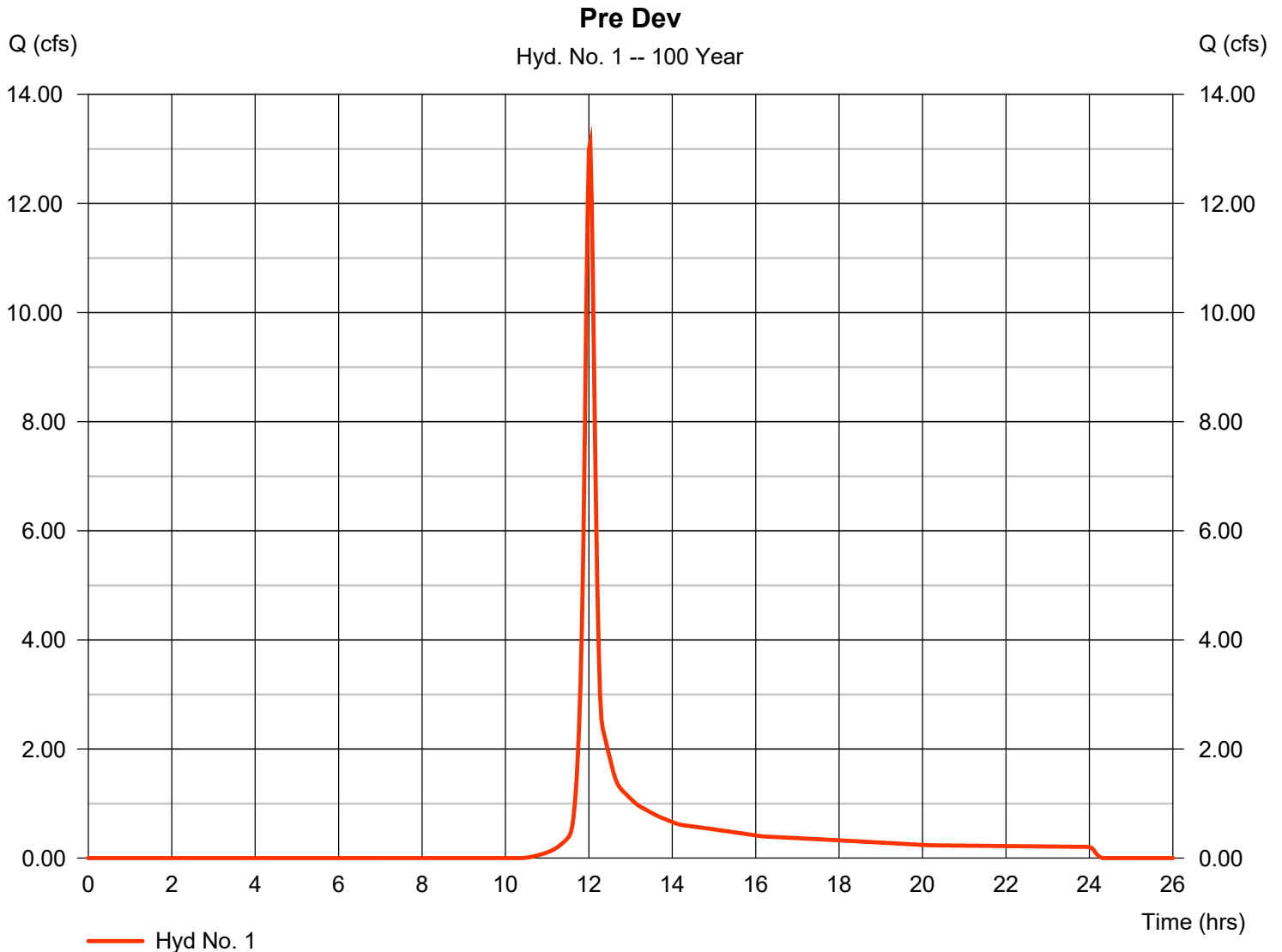
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|-----------|--------------------------|-----------------|---------------------|--------------------|-------------------------|---------------|------------------------|-------------------------|------------------------|
| 1 | SCS Runoff | 13.11 | 2 | 722 | 34,619 | ----- | ----- | ----- | Pre Dev |
| 2 | SCS Runoff | 1.933 | 2 | 716 | 3,965 | ----- | ----- | ----- | Post Lot-Front |
| 3 | SCS Runoff | 1.158 | 2 | 716 | 2,355 | ----- | ----- | ----- | Post Lot-Rear |
| Hydro.gpw | | | | | Return Period: 100 Year | | | Monday, 09 / 21 / 2020 | |

Hydrograph Report

Hyd. No. 1

Pre Dev

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 13.11 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 12.03 hrs |
| Time interval | = 2 min | Hyd. volume | = 34,619 cuft |
| Drainage area | = 3.400 ac | Curve number | = 58 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.90 min |
| Total precip. | = 7.45 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



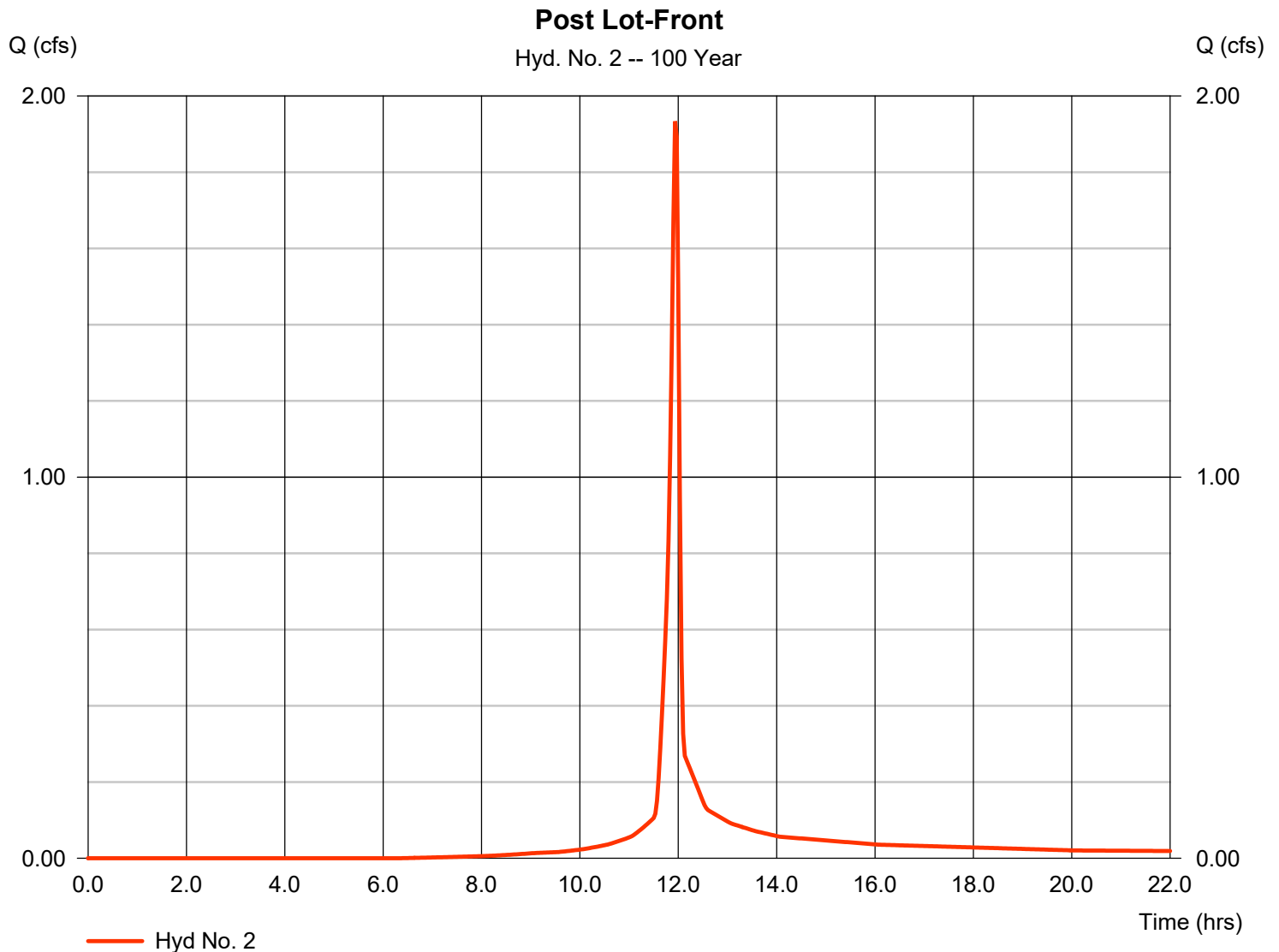
Hydrograph Report

Hyd. No. 2

Post Lot-Front

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.933 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 3,965 cuft |
| Drainage area | = 0.250 ac | Curve number | = 76* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 7.45 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.100 \times 98) + (0.150 \times 61)] / 0.250$



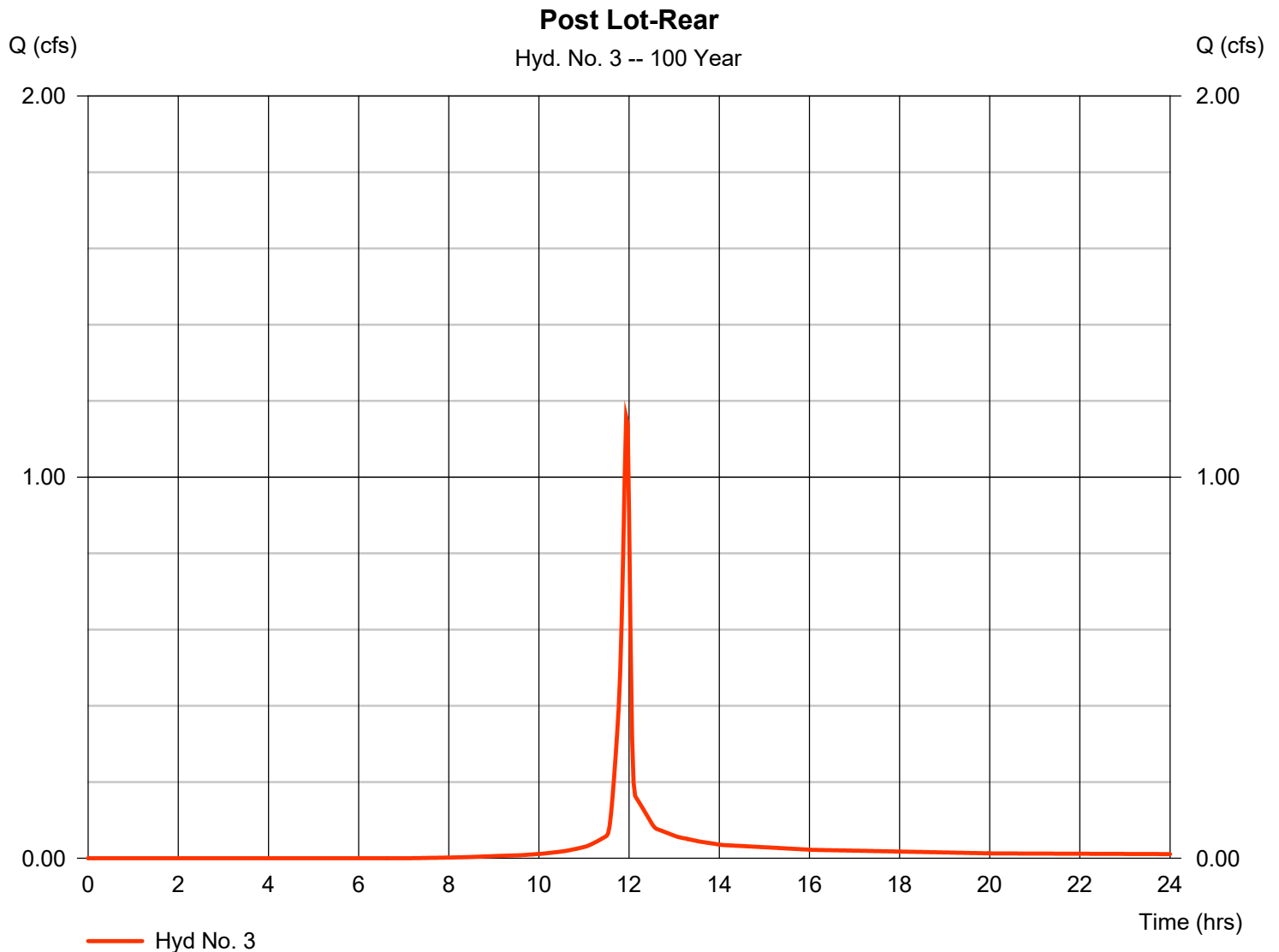
Hydrograph Report

Hyd. No. 3

Post Lot-Rear

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.158 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 11.93 hrs |
| Time interval | = 2 min | Hyd. volume | = 2,355 cuft |
| Drainage area | = 0.160 ac | Curve number | = 73* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 5.00 min |
| Total precip. | = 7.45 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = $[(0.050 \times 98) + (0.110 \times 61)] / 0.160$



HILBEC Engineering & Geosciences, LLC

26 Beaver Run Road, Downingtown, PA 19335-2257
Office: 610.873.6204 www.hilbec.com Fax: 610.873.6206

Wastewater * Stormwater * Hydrogeology * Environmental * Testing & Design

September 30, 2019

Site Engineering Concepts, LLC
Mr. David J. Sanders, P.E.
PO Box 1992
Southeastern, PA 19399

Re: Stormwater Soil Evaluation
Hamilton: Eagle Road
Radnor Township, Delaware County

Dear Mr. Sanders:

On September 18 & 19, 2019, I conducted soil evaluations for proposed stormwater management systems at the above noted property. A backhoe was used to excavate test pits to determine the most suitable depth to conduct permeability testing within the soil horizons. Test holes are typically excavated to the limits of the reach of the machine, bedrock, or a depth where water may be encountered entering the excavation.

Test #SWM-ER01 indicated redoximorphic features (formerly called mottles) from 32" to 108". However, the redox features are a result of a perched water table due to restricted drainage and somewhat moist soils at the base of the pit. Due to the extent of redox features, a 24-inch test for a rain garden was attempted but failed.

Test #SWM-ER02 was dug due to the results of test #SWM-ER01 and indicated redoximorphic features from 18" to 76". The soil below the redox features was a dark grey somewhat plastic soil. A permeability test conducted at 7 feet below the redox failed.

Test pit #SWM-ER04, had no observed limiting conditions to 10 feet. The soil was friable below 59" while above that the texture was a silty clay loam with slight plasticity.

Test #SWM-ER07 indicated redoximorphic features from 25" to 57". However, the redox features are a result of a textural discontinuity rather than an indication of a high-water table.

Test pit #SWM-ER09, had no observed limiting conditions to approximately 11.5 feet. The soil was friable below 30" while above that the texture was a silty clay loam with a friable to firm texture.

Test #SWM-ER010 indicated redoximorphic features from 24" to 52". However, the redox features are a result of a textural discontinuity rather than an indication of a high-water table.

A Guelph Permeameter was used to determine the permeability of the soil. The Guelph is a constant head borehole permeameter using the principle of the Mariotte Siphon to supply a constant level of water in the hole; unlike a percolation falling head test. The depth of the holes from existing grade level were adjusted to account for topographic variations.

The Guelph allows the Field Saturated Permeability (K_s) to be determined by running the test twice, at two different heads. Two tests are run at different heads or water elevations in order to provide the “gradient” portion of the required calculations. The gradient is used to measure the flux or water movement within the soil. A fluid bulb quickly forms and allows the stabilized hydraulic conductivity to be calculated. Errors inherent in other types of permeability tests that are minimized or eliminated by the Guelph Permeameter are soil fracturing, varying heads, silted in holes, estimated readings due to scale, and leaking clay seals.

Permeability tests assume that homogeneous soil conditions exist at and below the test zone, which is why the central portions of one soil horizon are typically chosen for the test depths. However, soil suitability, PA DEP guidelines, and proposed system design may alter that test parameter. Even within a consistent soil, unseen heterogeneous soil conditions can exist and may consist of:

1. Changing soil horizons across or near the test zone
2. Rock or stony soil beneath the bottom of the test hole
3. Roots, animal burrows
4. Soil fractures & thinly laminated soils

The consistency of the soil can be estimated by comparing the assumed and calculated alpha value. The alpha value is a soil parameter that depends primarily upon the soil texture and structure. By definition, it is the ratio of gravity to capillary soil-water forces. The value of typical fine to coarse-grained soils ranges between 0.01 and 0.5 cm^{-1} . Values considerably outside of this range (and negative values) suggest that heterogeneous soil conditions, such as in stony areas, may be encountered. Large alpha values suggest coarse textured or highly structured soils. Low alpha values suggest finer grained soils or a fine matrix. The geometric mean of the single head tests can be used in place of the two head approach to provide the permeability values if heterogeneous soil conditions cannot be avoided, such as in rocky areas.

A summary of the test results is noted in the table below. The base of all stormwater systems must adhere to the 24” isolation distance to any limiting horizon or pit base as required by the PA DEP guidance. Based on the observed soil in the test pits, the following tolerances are suggested:

| Test ID | Test Probe # | Test Depth (inches) | Result (in/hr) | Geometric Mean |
|----------|--------------|---------------------|----------------|----------------|
| ER-P1-A | SWM-ER01 | 24” | 0.0 | 0.0 |
| ER-P2-A | SWM-ER02 | 84” | 0.0 | 0.0 |
| ER-P4-A | SWM-ER04 | 102” | 2.30 | 0.78 |
| ER-P4-B | | 96” | 0.27 | |
| ER-P7-A | SWM-ER07 | 99” | 2.66 | 2.37 |
| ER-P7-B | | 96” | 2.11 | |
| ER-P9-A | SWM-ER09 | 114” | 0.44 | 0.74 |
| ER-P9-B | | 114” | 1.23 | |
| ER-P10-A | SWM-ER010 | 96” | 0.45 | 0.63 |
| ER-P10-A | | 84” | 0.88 | |

| Test Pit ID | Limiting Depth | Upper Installation Limit | Lower Installation Limit |
|-------------|-------------------|--------------------------|--------------------------|
| SWM-ER01 | 32" to 108" Redox | Perm test fails at 24" | na |
| SWM-ER02 | 18" to 76" Redox | Perm test fails at 84" | na |
| SWM-ER04 | 120" Pit Base | 59" | 96" |
| SWM-ER07 | 121" Pit Base | 57" | 97" |
| SWM-ER09 | 140" Pit Base | 37" | 116" |
| SWM-ER010 | 120" Pit Base | 52 | 96" |

The base of the stormwater systems should be kept between the upper and lower limits of the testing as measured from existing grade while using the respective permeability test results. The base of the system could vary due to design conditions but the base should be kept as close to the test depths as possible. The base of the excavation should be scarified so as not to clog the void spaces.

The permeability test data indicates that the soil can infiltrate the applied stormwater assuming that a properly dimensioned and constructed stormwater system is provided (except for test areas #SWM-ER01 & SWM-ER02). No safety factor needs to be applied to the test results as this is a true permeability test, other than any additional safety factor the designer may choose to add. The rock underlying this site and within the test probes is not a carbonate material.

I have directly performed and/or supervised the test procedures and preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty or guarantee that surface and sub-surface site conditions other than described herein, either natural or as altered by construction activities, may be different at some time in the future and thus may affect these findings.

Please refer to the attached test logs, permeability test data, and location map of the test areas. If you have any further questions, please contact our office.

Very truly yours,

For HILBEC Engineering & Geosciences, LLC



Kevin R. Sech, P.G., P.E.

SOIL DESCRIPTIONS

| | |
|--|---|
| Project Name: | Hamilton: Eagle Road |
| Municipality: | Radnor Township |
| Soil Profile Description Prepared By: | Kevin R. Sech, P.G., P.E. |
| General Location of the Test Pit: | North property corner, Lot 1 |
| Probe #: | SWM-ER01 |
| Test Date: | 9/18/2019 |
| Soil Profile Limitation: | Redox features due to a perched water table @ 32" to 108" No water or bedrock observed |

| Horizon | Up | Low | Color | Texture | Structure | | Consistence | CF% | Boundary | | Roots | Coats | Redox | | |
|---------|----|-----|--|-----------------|-----------|----------|---------------|-----------------------|----------------|--------|----------|-------|-------|------|-----------|
| | | | | | Medium | Moderate | | | Granular | Abrupt | | | | Wavy | |
| Ap | 0 | 8 | 10YR 3/3 Dark Brown | Loam | Medium | Moderate | Granular | Friable | Avg Moisture | <10% | Abrupt | Wavy | Yes | --- | --- |
| Bt 1 | 8 | 32 | 10YR 4/6 Dk Yellowish Brown | Silty Clay Loam | Medium | Moderate | SBK | Friable to SI Plastic | Avg Moisture | 10% | Clear | Wavy | Few | --- | --- |
| Bt 2 | 32 | 50 | 10YR 4/6 Dk Yellowish Brown | Silty Clay Loam | Medium | Moderate | SBK | Friable to SI Plastic | Avg Moisture | 10% | Clear | Wavy | No | --- | Com Dist |
| BC | 50 | 108 | 10YR 5/6 Variegated Yellowish Brown | Silty Clay Loam | --- | Massive | Structureless | Friable | Somewhat Moist | 20% | Pit Base | --- | No | Mn | Many Dist |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

| Method of Excavation: | Backhoe/Trackhoe | Remarks: | |
|-----------------------|------------------|----------|--|
| | | | |



PROJECT LIMITATIONS:
 I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech
 Kevin R. Sech, P.G., P.E.

| | |
|--|--|
| Project Name: | Hamilton: Eagle Road |
| Municipality: | Radnor Township |
| Soil Profile Description Prepared By: | Kevin R. Sech, P.G., P.E. |
| General Location of the Test Pit: | NW Property Corner, lot 2 |
| Probe #: | SWM-ER02 |
| Test Date: | 9/19/2019 |
| Soil Profile Limitation: | Redox features due to a perched water table @ 18" to 76" No water or bedrock observed |

| Horizon | Up | Low | Color | Texture | Structure | | Consistence | | CF% | Boundary | Roots | Coats | Redox |
|---------|----|-----|--|-----------------|-----------|---------------|-----------------------|--------------|------|----------|-----------|-------|-----------|
| | | | | | Moderate | Granular | Friable | Avg Moisture | | | | | |
| Ap | 0 | 7 | 10YR 3/3 Dark Brown | Loam | Moderate | Granular | Friable | Avg Moisture | <10% | Abrupt | Smooth | Yes | --- |
| Bt 1 | 7 | 18 | 10YR 5/8 Yellowish Brown | Silty Clay Loam | Moderate | SBK | SI Plastic | Avg Moisture | 10% | Clear | Wavy | Few | --- |
| Bt 2 | 18 | 37 | 10YR 5/8 Yellowish Brown | Silty Clay Loam | Moderate | SBK | SI Plastic | Avg Moisture | 10% | Clear | Wavy | No | Many Prom |
| BC | 37 | 76 | 10YR 5/6 Variegated Yellowish Brown | Silty Clay Loam | Fine | Weak SBK | Friable to SI Plastic | Avg Moisture | 10% | Clear | Irregular | No | Many Prom |
| C | 76 | 109 | Some rock at 57" to 64" (40%) 10YR 4/1 Dark Grey | Silty Clay Loam | --- | Massive | SI Plastic | Avg Moisture | 20% | Pit Base | --- | No | --- |
| | | | Slightly plastic to firm | | | Structureless | | | | | | | |

| Method of Excavation: | Backhoe/Trackhoe | Remarks: |
|-----------------------|------------------|----------|
| | | |

PROJECT LIMITATIONS:

I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech
Kevin R. Sech, P.G., P.E.



| | |
|---------------------------------|--------------------------------------|
| Probe #: | SWM-ER04 |
| Test Date: | 9/18/2019 |
| Soil Profile Limitation: | None No water or bedrock observed |

| | | |
|--|---------------------------|--|
| Project Name: | Hamilton: Eagle Road | |
| Municipality: | Radnor Township | |
| Soil Profile Description Prepared By: | Kevin R. Sech, P.G., P.E. | |
| General Location of the Test Pit: | Property Center, lot 4 | |

| Horizon | Up | Low | Color | Texture | Structure | | | Consistence | | | CF% | Boundary | Roots | Coats | Redox |
|------------------------------|------------------|-----|---|-----------------|-----------|----------|---------------|-----------------------|--------------|--------|----------|----------|-------|-------|-------|
| | | | | | Medium | Moderate | Granular | Friable | Avg Moisture | Abrupt | | | | | |
| Ap | 0 | 8 | 10YR 3/3 Dark Brown | Loam | Medium | Moderate | Granular | Friable | Avg Moisture | <10% | Abrupt | Smooth | Yes | --- | --- |
| Bt 1 | 8 | 41 | 10YR 5/8 Yellowish Brown | Silty Clay Loam | Medium | Moderate | SBK | SI Plastic | Avg Moisture | 10% | Clear | Wavy | Few | --- | --- |
| Bt 2 | 41 | 59 | 10YR 5/8 Yellowish Brown | Silty Clay Loam | Fine | Weak | SBK | Friable to SI Plastic | Avg Moisture | 10% | Clear | Wavy | No | --- | --- |
| C | 59 | 120 | 10YR 5/6 Variegated Yellowish Brown | Silt Loam | --- | Massive | Structureless | Friable | Avg Moisture | 30% | Pit Base | --- | No | --- | --- |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Method of Excavation: | Backhoe/Trackhoe | | Remarks: | | | | | | | | | | | | |

PROJECT LIMITATIONS:

I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech
 Kevin R. Sech, P.G., P.E.



| | |
|---------------------------------|--|
| Probe #: | SWM-ER07 |
| Test Date: | 9/18/2019 |
| Soil Profile Limitation: | Redox features due to a perched water table @ 25" to 57" No water or bedrock observed |

| | |
|--|---------------------------|
| Project Name: | Hamilton: Eagle Road |
| Municipality: | Radnor Township |
| Soil Profile Description Prepared By: | Kevin R. Sech, P.G., P.E. |
| General Location of the Test Pit: | Property Center, lot 7 |

| Horizon | Up | Low | Color | Texture | Structure | | Consistence | | CF% | Boundary | | Roots | Coats | Redox | | |
|---------|----|-----|---|----------------------------|-----------|----------|---------------|------------|-----|--------------|--------|--------------|-------|-------|--------|-----------|
| | | | | | Medium | Moderate | Granular | Friable | | Avg Moisture | Abrupt | | | | Smooth | Yes |
| Ap | 0 | 7 | 10YR 3/3 Dark Brown | Loam | Medium | Moderate | Granular | | | <10% | | Smooth | | Yes | --- | --- |
| Bt 1 | 7 | 25 | 10YR 5/8 Yellowish Brown | Clay Loam | Medium | Moderate | SBK | SI Plastic | | 10% | | Clear | | Few | --- | --- |
| Bt 2 | 25 | 43 | 10YR 5/8 Yellowish Brown | Clay Loam | Medium | Moderate | SBK | SI Plastic | | 10% | | Clear | | No | --- | Many Prom |
| BC | 43 | 57 | 10YR 5/6 Yellowish Brown | Silt Loam Heavy In-Part | Fine | Weak | SBK | Friable | | 20% | | Clear | | No | --- | Few Faint |
| C | 57 | 121 | 10YR 5/6 Variegated Yellowish Brown | Silt Loam | --- | Massive | Structureless | V Friable | | 40% | | Pit Base --- | | No | --- | --- |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

| | | |
|------------------------------|------------------|-----------------|
| Method of Excavation: | Backhoe/Trackhoe | Remarks: |
|------------------------------|------------------|-----------------|

PROJECT LIMITATIONS:

I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech
 Kevin R. Sech, P.G., P.E.



| | |
|--|--------------------------------------|
| Project Name: | Hamilton: Eagle Road |
| Municipality: | Radnor Township |
| Soil Profile Description Prepared By: | Kevin R. Sech, P.G., P.E. |
| General Location of the Test Pit: | Nearest Eagle Road, lot 9 |
| Probe #: | SWM-ER09 |
| Test Date: | 9/18/2019 |
| Soil Profile Limitation: | None No water or bedrock observed |

| | | | | | | | | | | | | | |
|----------------|-----------|------------|---|----------------------------|------------------|----------|--------------------|-----------------|-------------------|--------------|--------------|--------------|-----|
| Horizon | Up | Low | Color | Texture | Structure | | Consistence | CF% | Boundary | Roots | Coats | Redox | |
| Ap | 0 | 7 | 10YR 3/3 Dark Brown | Loam | Medium | Moderate | Granular | Friable | Avg Moisture <10% | Abrupt | Smooth | Yes | --- |
| Bt 1 | 7 | 30 | 10YR 5/8 Yellowish Brown | Silty Clay Loam | Medium | Moderate | SBK | Friable to Firm | Avg Moisture 10% | Clear | Wavy | Yes | Mn |
| Bt 2 | 30 | 37 | 10YR 5/8 Yellowish Brown | Silt Loam Heavy In-Part | Fine | Weak | SBK | Friable | Avg Moisture 15% | Clear | Irregular | Few | --- |
| C | 37 | 140 | 10YR 4/6 Variegated Dk Yellowish Brown | Sandy Loam Fine | --- | Massive | Structureless | V Friable | Avg Moisture 30% | Pit Base | --- | Few | --- |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|------------------------------|------------------|--|--|--|--|--|--|--|--|--|--|--|
| Method of Excavation: | Backhoe/Trackhoe | | | | | | | | | | | |
| Remarks: | | | | | | | | | | | | |

PROJECT LIMITATIONS:

I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech

 Kevin R. Sech, P.G., P.E.



| | |
|--|--------------------------------------|
| Project Name: | Hamilton: Eagle Road |
| Municipality: | Radnor Township |
| Soil Profile Description Prepared By: | Kevin R. Sech, P.G., P.E. |
| General Location of the Test Pit: | West side of property near NW corner |

| | |
|---------------------------------|--|
| Probe #: | SWM-ER010 |
| Test Date: | 9/18/2019 |
| Soil Profile Limitation: | Redox features due to a perched water table @ 24" to 52" No water or bedrock observed |

| Horizon | Up | Low | Color | Texture | Structure | | Consistence | | CF% | Boundary | Roots | Coats | Redox |
|---------|----|-----|---|--|-----------|----------|---------------|------------|------|----------|--------|-------|-------|
| | | | | | Medium | Moderate | Granular | Friable | | | | | |
| Ap | 0 | 8 | 10YR 3/3 Dark Brown | Loam | Medium | Moderate | Granular | Friable | <10% | Abrupt | Smooth | Yes | --- |
| Bt 1 | 8 | 24 | 10YR 4/6 Dk Yellowish Brown | Silty Clay Loam | Medium | Moderate | SBK | SI Plastic | 10% | Clear | Wavy | Few | --- |
| Bt 2 | 24 | 33 | 10YR 5/8 Yellowish Brown | Silty Clay Loam | Medium | Moderate | SBK | SI Plastic | 10% | Clear | Wavy | No | --- |
| BC | 33 | 52 | 10YR 5/6 Variegated Yellowish Brown | Silt Loam V Fine Silky Heavy In-Part | Thick | Moderate | Platy | Friable | 20% | Clear | Wavy | No | --- |
| C | 52 | 120 | 10YR 4/4 Variegated Dk Yellowish Brown | Silt Loam Micaceous | --- | Massive | Structureless | Friable | 40% | Pit Base | --- | No | --- |
| | | | | | | | | | | | | | |

| | | |
|------------------------------|------------------|-----------------|
| Method of Excavation: | Backhoe/Trackhoe | Remarks: |
|------------------------------|------------------|-----------------|

PROJECT LIMITATIONS:

I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech

Kevin R. Sech, P.G., P.E.



**PERMEABILITY TEST RESULTS
AND CALCULATIONS**

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton; Eagle Road TEST DATE: September 19, 2019

TEST ID: ER-PT-A WEATHER / TEMP: Sunny / 70 Degrees

TEST DEPTH: 24" HOLE DIAMETER: 6.0 cm or inch

NEAR SOIL PROBE #: SWM-ER01 SIDE OF TEST AREA: Southerly Side

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS

Guelph Permeameter

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)

0.36 cm-1
0.12 cm-1
0.04 cm-1
0.01 cm-1

Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
Structured Soils from Clays to Loams
Fine & Very Fine Textured Silts and Clay
Compacted and Structurlless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD

5 cm
35.22 cm²
600 seconds
0.0 cm
0.00E+00 cm/sec
0.00E+00 cm²/sec
0.00E+00 cm/sec
0.00 in/hr

First Applied Head (H)
Gross Sectional Area of Reservoir (35.22 or 2.15)
Time Interval Of Readings (I)
Stabilized Reading
Average Rate of Fall (R_f)
First Head Matric Flux Potential
First Head Kfs
First Head Kfs (in/hr)

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD

10 cm
35.22 cm²
600 seconds
0.0 cm
0.00E+00 cm/sec
0.00E+00 cm²/sec
0.00E+00 cm/sec
0.00 in/hr

Second Applied Head (H)
Gross Sectional Area of Reservoir (35.22 or 2.15)
Time Interval Of Readings (I)
Stabilized Reading
Average Rate of Fall (R_f)
Second Head Matric Flux Potential
Second Head Kfs
Second Head Kfs (in/hr)

HYDRAULIC CONDUCTIVITY ANALYSIS

#NUM1 cm²/sec
#NUM1 cm/sec
0.00E+00 cm²/sec
#DIV/0! cm-1
0.00E+00 cm/sec

Geometric Mean of Matric Flux Potential For Single Head Methods
Geometric Mean of Field Saturated Hydraulic
Calculated Matric Flux Potential Over Gradient (µm)
Calculated Alpha Value (α*)
Calculated Field Saturated Conductivity

#NUM1 inches/hour
0.00 inches/hour

Geometric Mean Conductivity For Single Head Analysis (Kfs)
Hydraulic Conductivity Over Gradient (Kfs)

The *Single Head Geometric Mean* is used when
1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogenous soil likely exists
2. The second rate is not greater than the first rate

0.00 inches/hour FINAL CONDUCTIVITY RATE

| 1st Level at 5 cm | | | 2nd Level at 10 cm | | | | | | |
|------------------------------|--------------------------|---------------------------|----------------------|--------------------------|------------------------------|--------------------------|---------------------------|----------------------|--------------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) | Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
| 600 | 0.8 | 0.8 | 0.0 | 2 | 600 | 4.0 | 4.0 | 0.0 | 2 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Stabilized At: 0.0 cm | | | | | Stabilized At: 0.0 cm | | | | |

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton: Eagle Road
 TEST ID: ER-P2-A
 TEST DEPTH: 84"
 NEAR SOIL PROBE #: SWM-ER02

TEST DATE: September 19, 2019
 WEATHER / TEMP: Sunny / 70 Degrees
 HOLE DIAMETER: 6.0 cm or inch 2.375
 SIDE OF TEST AREA: Southerly Side

| 1st Level at 5 cm | | | |
|--|--------------------------|---------------------------|----------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) |
| 600 | 5.9 | 5.9 | 0.0 |
| Stabilized with 3 consecutive equal readings | | | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | | | |
| Stabilized At: | | | 0.0 cm |

| 2nd Level at 10 cm | | | |
|--|--------------------------|---------------------------|----------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) |
| 600 | 9.1 | 9.1 | 0.0 |
| Stabilized with 3 consecutive equal readings | | | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | | | |
| Stabilized At: | | | 0.0 cm |

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS
 Guelph Permeameter

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H) 5 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 600 seconds
 Stabilized Reading 0.0 cm
 Average Rate of Fall (R_f) 0.00E+00 cm/sec
 First Head Matric Flux Potential 0.00E+00 cm²/sec
 First Head Kfs 0.00E+00 cm/sec
 First Head Kfs (in/hr) 0.00 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H) 10 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 600 seconds
 Stabilized Reading 0.0 cm
 Average Rate of Fall (R_f) 0.00E+00 cm/sec
 Second Head Matric Flux Potential 0.00E+00 cm²/sec
 Second Head Kfs 0.00E+00 cm/sec
 Second Head Kfs (in/hr) 0.00 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matric Flux Potential For Single Head Methods #NUM!
 Geometric Mean of Field Saturated Hydraulic #NUM!
 Calculated Matric Flux Potential Over Gradient (φm) 0.00E+00 cm²/sec
 Calculated Alpha Value (α*) #DIV/0!
 Calculated Field Saturated Conductivity 0.00E+00 cm/sec

Geometric Mean Conductivity For Single Head Analysis (Kfs)
Hydraulic Conductivity Over Gradient (Kfs)
 #NUM! inches/hour
 0.00 inches/hour

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

0.00 inches/hour FINAL CONDUCTIVITY RATE

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS

Guelph Permeameter

PROJECT NAME: Hamilton: Eagle Road
TEST ID: ER-P4-A
TEST DEPTH: 102"
NEAR SOIL PROBE #: SWM-ER04

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch 2.3/8
SIDE OF TEST AREA: Southerly Side

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H) 5 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 30 seconds
 Stabilized Reading 1.1 cm
 Average Rate of Fall (R₁) 3.67E-02 cm/sec
 First Head Matric Flux Potential 1.95E-02 cm²/sec
 First Head Kfs 2.34E-03 cm/sec
3.32 in/hr First Head Kfs (in/hr)

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H) 10 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 30 seconds
 Stabilized Reading 1.7 cm
 Average Rate of Fall (R₂) 5.67E-02 cm/sec
 Second Head Matric Flux Potential 2.94E-02 cm²/sec
 Second Head Kfs 2.15E-03 cm/sec
3.05 in/hr Second Head Kfs (in/hr)

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matric Flux Potential For Single Head Methods 2.39E-02 cm²/sec
 Geometric Mean of Field Saturated Hydraulic 2.24E-03 cm/sec
 Calculated Matric Flux Potential Over Gradient (µm) 2.36E-02 cm²/sec
 Calculated Alpha Value (α*) 0.07 cm-1
 Calculated Field Saturated Conductivity 1.62E-03 cm/sec

Geometric Mean Conductivity For Single Head Analysis (Kfs) 3.18 inches/hour
Hydraulic Conductivity Over Gradient (Kfs) 2.30 inches/hour

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

2.30 inches/hour FINAL CONDUCTIVITY RATE

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton: Eagle Road
TEST ID: ER-P4-A
TEST DEPTH: 102"
NEAR SOIL PROBE #: SWM-ER04

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch 2.3/8
SIDE OF TEST AREA: Southerly Side

| 1st Level at 5 cm | | | | 2nd Level at 10 cm | | | |
|------------------------------|--------------------------|---------------------------|----------------------|------------------------------|--------------------------|---------------------------|----------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) |
| 30 | 2.6 | 0.9 | 1.7 | 1 | 39.2 | 36.9 | 2.3 |
| 30 | 3.9 | 2.6 | 1.3 | 2 | 41.3 | 39.2 | 2.1 |
| 30 | 5.4 | 3.9 | 1.5 | 3 | 43.1 | 41.3 | 1.8 |
| 30 | 6.3 | 5.4 | 0.9 | 4 | 45.1 | 43.1 | 2.0 |
| 30 | 7.4 | 6.3 | 1.1 | 5 | 46.7 | 45.1 | 1.6 |
| 30 | 8.5 | 7.4 | 1.1 | 6 | 48.4 | 46.7 | 1.7 |
| 30 | 9.6 | 8.5 | 1.1 | 7 | 50.1 | 48.4 | 1.7 |
| | | | | 8 | 51.8 | 50.1 | 1.7 |
| | | | | 9 | | | |
| | | | | 10 | | | |
| | | | | 11 | | | |
| | | | | 12 | | | |
| | | | | 13 | | | |
| | | | | 14 | | | |
| | | | | 15 | | | |
| | | | | 16 | | | |
| | | | | 17 | | | |
| | | | | 18 | | | |
| | | | | 19 | | | |
| | | | | 20 | | | |
| | | | | 21 | | | |
| | | | | 22 | | | |
| | | | | 23 | | | |
| | | | | 24 | | | |
| | | | | 25 | | | |
| | | | | 26 | | | |
| | | | | 27 | | | |
| | | | | 28 | | | |
| Stabilized At: 1.1 cm | | | | Stabilized At: 1.7 cm | | | |

Stabilized with 3 consecutive equal readings

Stabilized with 3 consecutive equal readings

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS
Guelph Permeameter

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch 2 3/8
SIDE OF TEST AREA: Southerly Side

PROJECT NAME: Hamilton; Eagle Road
TEST ID: ER-P7-A
TEST DEPTH: 99"
NEAR SOIL PROBE #: SWM-ER07

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1
 0.12 cm-1
 0.04 cm-1
 0.01 cm-1

Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 Structured Soils from Clays to Loams
 Fine & Very Fine Textured Silts and Clay
 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H)
 5 cm
 Gross Sectional Area of Reservoir (35.22 or 2.15)
 35.22 cm²
 Time Interval Of Readings (I)
 30 seconds
 Stabilized Reading
 2.1 cm
 Average Rate of Fall (R_s)
 7.00E-02 cm²/sec
 First Head Matrix Flux Potential
 3.72E-02 cm²/sec
 4.47E-03 cm²/sec
 First Head Kfs
 6.33 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H)
 10 cm
 Gross Sectional Area of Reservoir (35.22 or 2.15)
 35.22 cm²
 Time Interval Of Readings (I)
 30 seconds
 Stabilized Reading
 3.0 cm
 Average Rate of Fall (R_s)
 1.00E-01 cm²/sec
 Second Head Matrix Flux Potential
 4.13E-02 cm²/sec
 3.80E-03 cm²/sec
 Second Head Kfs
 5.39 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matrix Flux Potential For Single Head Methods
 3.92E-02 cm²/sec
 Geometric Mean of Field Saturated Hydraulic
 4.12E-03 cm²/sec
 Calculated Matrix Flux Potential Over Gradient (µm)
 5.20E-02 cm²/sec
 Calculated Alpha Value (α*)
 0.04 cm-1
 Calculated Field Saturated Conductivity
 1.88E-03 cm/sec

Geometric Mean Conductivity For Single Head Analysis (Kfs)
Hydraulic Conductivity Over Gradient (Kfs)
 5.84 inches/hour
 2.66 inches/hour

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matrix Flux Potential For Single Head Methods
 3.92E-02 cm²/sec
 Geometric Mean of Field Saturated Hydraulic
 4.12E-03 cm²/sec
 Calculated Matrix Flux Potential Over Gradient (µm)
 5.20E-02 cm²/sec
 Calculated Alpha Value (α*)
 0.04 cm-1
 Calculated Field Saturated Conductivity
 1.88E-03 cm/sec

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

FINAL CONDUCTIVITY RATE
 2.66 inches/hour

CONSTANT HEAD PERMEAMETER TEST

1st Level at 5 cm

| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
|--|--------------------------|---------------------------|----------------------|--------------------------|
| Stabilized with 3 consecutive equal readings | | | | |
| 30 | 6.8 | 1.6 | 5.2 | 2 |
| 30 | 12.6 | 6.8 | 5.8 | 2 |
| 30 | 16.7 | 12.6 | 4.1 | 2 |
| 30 | 19.6 | 16.7 | 2.9 | 2 |
| 30 | 22.0 | 19.6 | 2.4 | 2 |
| 30 | 24.3 | 22.0 | 2.3 | 2 |
| 30 | 26.8 | 24.3 | 2.5 | 2 |
| 30 | 29.6 | 26.8 | 2.8 | 2 |
| 30 | 32.0 | 29.6 | 2.4 | 2 |
| 30 | 34.3 | 32.0 | 2.3 | 2 |
| 30 | 36.4 | 34.3 | 2.1 | 2 |
| 30 | 38.5 | 36.4 | 2.1 | 2 |
| 30 | 40.6 | 38.5 | 2.1 | 2 |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | | | | |
| 21 | | | | |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| 26 | | | | |
| 27 | | | | |
| 28 | | | | |
| Stabilized At: | | | | 2.1 cm |

2nd Level at 10 cm

| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
|--|--------------------------|---------------------------|----------------------|--------------------------|
| Stabilized with 3 consecutive equal readings | | | | |
| 30 | 47.6 | 43.9 | 3.7 | 2 |
| 30 | 50.6 | 47.6 | 3.0 | 2 |
| 30 | 54.0 | 50.6 | 3.4 | 2 |
| 30 | 57.1 | 54.0 | 3.1 | 2 |
| 30 | 59.9 | 57.1 | 2.8 | 2 |
| 30 | 63.2 | 59.9 | 3.3 | 2 |
| 30 | 66.4 | 63.2 | 3.2 | 2 |
| 30 | 69.4 | 66.4 | 3.0 | 2 |
| 30 | 72.4 | 69.4 | 3.0 | 2 |
| 30 | 75.4 | 72.4 | 3.0 | 2 |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | | | | |
| 21 | | | | |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| 26 | | | | |
| 27 | | | | |
| 28 | | | | |
| Stabilized At: | | | | 3.0 cm |

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton: Eagle Road
 TEST ID: ER-P7-B
 TEST DEPTH: 96"
 NEAR SOIL PROBE #: SWM-ER07

TEST DATE: September 19, 2019
 WEATHER / TEMP: Sunny / 70 Degrees
 HOLE DIAMETER: 6.0 cm or inch 2.378
 SIDE OF TEST AREA: Northerly Side

| 1st Level at 5 cm | | | | |
|--|--------------------------|---------------------------|----------------------|--------------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
| Stabilized with 3 consecutive equal readings | | | | |
| 60 | 2.1 | 1.1 | 1.0 | 2 |
| 60 | 2.9 | 2.1 | 0.8 | 2 |
| 60 | 3.8 | 2.9 | 0.9 | 2 |
| 60 | 4.6 | 3.8 | 0.8 | 2 |
| 60 | 5.4 | 4.6 | 0.8 | 2 |
| 60 | 6.3 | 5.4 | 0.9 | 2 |
| 60 | 7.1 | 6.3 | 0.8 | 2 |
| 60 | 7.6 | 7.1 | 0.5 | 2 |
| 60 | 8.8 | 7.6 | 1.2 | 2 |
| 60 | 9.7 | 8.8 | 0.9 | 2 |
| 60 | 10.5 | 9.7 | 0.8 | 2 |
| 60 | 11.3 | 10.5 | 0.8 | 2 |
| 60 | 12.1 | 11.3 | 0.8 | 2 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Stabilized At: | | | | 0.8 cm |

| 2nd Level at 10 cm | | | | |
|--|--------------------------|---------------------------|----------------------|--------------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
| Stabilized with 3 consecutive equal readings | | | | |
| 30 | 17.0 | 16.1 | 0.9 | 2 |
| 30 | 17.8 | 17.0 | 0.8 | 2 |
| 30 | 18.7 | 17.8 | 0.9 | 2 |
| 30 | 19.5 | 18.7 | 0.8 | 2 |
| 30 | 20.4 | 19.5 | 0.9 | 2 |
| 30 | 21.0 | 20.4 | 0.6 | 2 |
| 30 | 21.7 | 21.0 | 0.7 | 2 |
| 30 | 22.5 | 21.7 | 0.8 | 2 |
| 30 | 23.3 | 22.5 | 0.8 | 2 |
| 30 | 24.1 | 23.3 | 0.8 | 2 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Stabilized At: | | | | 0.8 cm |

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS
 Guelph Permeameter

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H) 5 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 60 seconds
 Stabilized Reading 0.8 cm
 Average Rate of Fall (R_f) 1.33E-02 cm²/sec
 First Head Matric Flux Potential 7.09E-03 cm²/sec
 First Head Kfs 8.51E-04 cm²/sec
 First Head Kfs (in/hr) 1.21 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H) 10 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 30 seconds
 Stabilized Reading 0.8 cm
 Average Rate of Fall (R_f) 2.67E-02 cm²/sec
 Second Head Matric Flux Potential 1.68E-02 cm²/sec
 Second Head Kfs 1.01E-03 cm²/sec
 Second Head Kfs (in/hr) 1.44 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matric Flux Potential For Single Head Methods 1.09E-02 cm²/sec
 Geometric Mean of Field Saturated Hydraulic 9.29E-04 cm²/sec
 Calculated Matric Flux Potential Over Gradient (φm) 3.45E-03 cm²/sec
 Calculated Alpha Value (α*) 0.43 cm-1
 Calculated Field Saturated Conductivity 1.49E-03 cm²/sec

1.32 inches/hour Geometric Mean Conductivity For Single Head Analysis (Kfs)
 2.11 inches/hour Hydraulic Conductivity Over Gradient (Kfs)

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

2.11 inches/hour FINAL CONDUCTIVITY RATE

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS**Guelph Permeameter**

PROJECT NAME: Hamilton: Eagle Road
TEST ID: ER-P9-B
TEST DEPTH: 114"
NEAR SOIL PROBE #: SWM-ER09

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch
SIDE OF TEST AREA: Southerly Side

| 1st Level at 5 cm | | | | | 2nd Level at 10 cm | | | | |
|--|--------------------------|---------------------------|----------------------|--------------------------|------------------------------|--------------------------|---------------------------|----------------------|--------------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) | Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
| Stabilized with 3 consecutive equal readings | | | | | | | | | |
| 30 | 9.9 | 9.9 | 9.0 | 2 | 30 | 19.8 | 18.9 | 0.9 | 2 |
| 30 | 10.6 | 9.9 | 0.7 | 2 | 30 | 20.6 | 19.8 | 0.8 | 2 |
| 30 | 11.3 | 10.6 | 0.7 | 2 | 30 | 21.3 | 20.6 | 0.7 | 2 |
| 30 | 11.8 | 11.3 | 0.5 | 2 | 30 | 22.1 | 21.3 | 0.8 | 2 |
| 30 | 12.4 | 11.8 | 0.6 | 2 | 30 | 22.7 | 22.1 | 0.6 | 2 |
| 30 | 12.8 | 12.4 | 0.4 | 2 | 30 | 23.5 | 22.7 | 0.8 | 2 |
| 30 | 13.4 | 12.8 | 0.6 | 2 | 30 | 31.5 | 23.5 | 8.0 | 2 |
| 30 | 13.9 | 13.4 | 0.5 | 2 | 30 | 32.3 | 31.5 | 0.8 | 2 |
| 30 | 14.4 | 13.9 | 0.5 | 2 | | | | | |
| 30 | 14.9 | 14.4 | 0.5 | 2 | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Stabilized At: 0.5 cm | | | | | Stabilized At: 0.8 cm | | | | |

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
0.36 cm-1 Sands, Gravels, Coarse Grained Sapropite, Soil Fractures
0.12 cm-1 Structured Soils from Clays to Loams
0.04 cm-1 Fine & Very Fine Textured Silts and Clay
0.01 cm-1 Compacted and Structurless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
First Applied Head (H) 5 cm
Gross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
Time Interval Of Readings (I) 30 seconds
Stabilized Reading 0.5 cm
Average Rate of Fall (R_f) 1.67E-02 cm/sec
First Head Matrix Flux Potential 8.86E-03 cm²/sec
First Head Kfs 1.06E-03 cm/sec
First Head Kfs (in/hr) 1.51 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
Second Applied Head (H) 10 cm
Gross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
Time Interval Of Readings (I) 30 seconds
Stabilized Reading 0.8 cm
Average Rate of Fall (R_f) 2.67E-02 cm/sec
Second Head Matrix Flux Potential 1.63E-02 cm²/sec
Second Head Kfs 1.01E-03 cm/sec
Second Head Kfs (in/hr) 1.44 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
Geometric Mean of Matrix Flux Potential For Single Head Methods 1.20E-02 cm²/sec
Geometric Mean of Field Saturated Hydraulic 1.04E-03 cm/sec
Calculated Matrix Flux Potential Over Gradient (qm) 9.96E-03 cm²/sec
Calculated Alpha Value (α*) 0.09 cm-1
Calculated Field Saturated Conductivity 8.71E-04 cm/sec

Geometric Mean Conductivity For Single Head Analysis (Kfs) 1.47 inches/hour
Hydraulic Conductivity Over Gradient (Kfs) 1.23 inches/hour

The Single Head Geometric Mean is used when
1. *The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists*
2. *The second rate is not greater than the first rate*

FINAL CONDUCTIVITY RATE 1.23 inches/hour

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS

Guelph Permeameter

PROJECT NAME: Hamilton: Eagle Road
TEST ID: ER-P10-A
TEST DEPTH: 96"
NEAR SOIL PROBE #: SWM-ER010

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch 2 3/8
SIDE OF TEST AREA: Southerly Side

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H) 5 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 2.15 cm²
 Time Interval Of Readings (T) 30 seconds
 Stabilized Reading 1.4 cm
 Average Rate of Fall (R_f) 4.67E-02 cm/sec
 First Head Matric Flux Potential 1.51E-03 cm²/sec
 First Head Kfs 1.82E-04 cm/sec
 First Head Kfs (in/hr) 0.26 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H) 10 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 2.15 cm²
 Time Interval Of Readings (T) 30 seconds
 Stabilized Reading 2.8 cm
 Average Rate of Fall (R_f) 9.33E-02 cm/sec
 Second Head Matric Flux Potential 2.74E-03 cm²/sec
 Second Head Kfs 2.17E-04 cm/sec
 Second Head Kfs (in/hr) 0.31 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matric Flux Potential For Single Head Methods 2.04E-03 cm²/sec
 Geometric Mean of Field Saturated Hydraulic 1.98E-04 cm/sec
 Calculated Matric Flux Potential Over Gradient (µm) 7.36E-04 cm²/sec
 Calculated Alpha Value (α*) 0.43 cm-1
 Calculated Field Saturated Conductivity 3.18E-04 cm/sec

Geometric Mean Conductivity For Single Head Analysis (Kfs) 0.28 inches/hour
Hydraulic Conductivity Over Gradient (Kfs) 0.45 inches/hour

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

FINAL CONDUCTIVITY RATE
0.45 inches/hour

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton: Eagle Road
TEST ID: ER-P10-A
TEST DEPTH: 96"
NEAR SOIL PROBE #: SWM-ER010

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch 2 3/8
SIDE OF TEST AREA: Southerly Side

| 1st Level at 5 cm | | | | 2nd Level at 10 cm | | | |
|-------------------------|--------------------------|---------------------------|----------------------|-------------------------|--------------------------|---------------------------|----------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) |
| 30 | 19.7 | 17.4 | 2.3 | 1 | 24.4 | 21.6 | 2.8 |
| 30 | 21.1 | 19.7 | 1.4 | 2 | 27.9 | 24.4 | 3.5 |
| 30 | 22.4 | 21.1 | 1.3 | 3 | 31.1 | 27.9 | 3.2 |
| 30 | 23.7 | 22.4 | 1.3 | 4 | 33.9 | 31.1 | 2.8 |
| 30 | 25.1 | 23.7 | 1.4 | 5 | 36.2 | 33.9 | 2.3 |
| 30 | 26.4 | 25.1 | 1.3 | 6 | 39.2 | 36.2 | 3.0 |
| 30 | 28.1 | 26.4 | 1.7 | 7 | 41.4 | 39.2 | 2.2 |
| 30 | 30.3 | 28.1 | 2.2 | 8 | 44.3 | 41.4 | 2.9 |
| 30 | 31.8 | 30.3 | 1.5 | 9 | 47.1 | 44.3 | 2.8 |
| 30 | 33.2 | 31.8 | 1.4 | 10 | 49.9 | 47.1 | 2.8 |
| 30 | 34.6 | 33.2 | 1.4 | 11 | 52.7 | 49.9 | 2.8 |
| 30 | 36.0 | 34.6 | 1.4 | 12 | | | |
| | | | | 13 | | | |
| | | | | 14 | | | |
| | | | | 15 | | | |
| | | | | 16 | | | |
| | | | | 17 | | | |
| | | | | 18 | | | |
| | | | | 19 | | | |
| | | | | 20 | | | |
| | | | | 21 | | | |
| | | | | 22 | | | |
| | | | | 23 | | | |
| | | | | 24 | | | |
| | | | | 25 | | | |
| | | | | 26 | | | |
| | | | | 27 | | | |
| | | | | 28 | | | |
| Stabilized At: | | | | 1.4 cm | | | |

| 1st Level at 5 cm | | | | 2nd Level at 10 cm | | | |
|-------------------------|--------------------------|---------------------------|----------------------|-------------------------|--------------------------|---------------------------|----------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) |
| 30 | 19.7 | 17.4 | 2.3 | 1 | 24.4 | 21.6 | 2.8 |
| 30 | 21.1 | 19.7 | 1.4 | 2 | 27.9 | 24.4 | 3.5 |
| 30 | 22.4 | 21.1 | 1.3 | 3 | 31.1 | 27.9 | 3.2 |
| 30 | 23.7 | 22.4 | 1.3 | 4 | 33.9 | 31.1 | 2.8 |
| 30 | 25.1 | 23.7 | 1.4 | 5 | 36.2 | 33.9 | 2.3 |
| 30 | 26.4 | 25.1 | 1.3 | 6 | 39.2 | 36.2 | 3.0 |
| 30 | 28.1 | 26.4 | 1.7 | 7 | 41.4 | 39.2 | 2.2 |
| 30 | 30.3 | 28.1 | 2.2 | 8 | 44.3 | 41.4 | 2.9 |
| 30 | 31.8 | 30.3 | 1.5 | 9 | 47.1 | 44.3 | 2.8 |
| 30 | 33.2 | 31.8 | 1.4 | 10 | 49.9 | 47.1 | 2.8 |
| 30 | 34.6 | 33.2 | 1.4 | 11 | 52.7 | 49.9 | 2.8 |
| 30 | 36.0 | 34.6 | 1.4 | 12 | | | |
| | | | | 13 | | | |
| | | | | 14 | | | |
| | | | | 15 | | | |
| | | | | 16 | | | |
| | | | | 17 | | | |
| | | | | 18 | | | |
| | | | | 19 | | | |
| | | | | 20 | | | |
| | | | | 21 | | | |
| | | | | 22 | | | |
| | | | | 23 | | | |
| | | | | 24 | | | |
| | | | | 25 | | | |
| | | | | 26 | | | |
| | | | | 27 | | | |
| | | | | 28 | | | |
| Stabilized At: | | | | 2.8 cm | | | |

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS
Guelph Permeameter

PROJECT NAME: Hamilton: Eagle Road
TEST ID: ER-P10-B
TEST DEPTH: 84"
NEAR SOIL PROBE #: SWM-ER010

TEST DATE: September 19, 2019
WEATHER / TEMP: Sunny / 70 Degrees
HOLE DIAMETER: 6.0 cm or inch 2 3/8
SIDE OF TEST AREA: Northside

CONSTANT HEAD PERMEAMETER TEST

| 1st Level at 5 cm | | | | | 2nd Level at 10 cm | | | | |
|--|--------------------------|---------------------------|----------------------|--------------------------|------------------------------|--------------------------|---------------------------|----------------------|--------------------------|
| Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) | Time Interval (seconds) | Water Level Reading (cm) | Previous Water Level (cm) | Change in Level (cm) | Number of Tubes (1 or 2) |
| Stabilized with 3 consecutive equal readings | | | | | | | | | |
| 30 | 29.3 | 28.6 | 0.7 | 2 | 30 | 37.0 | 36.1 | 0.9 | 2 |
| 30 | 29.6 | 29.3 | 0.3 | 2 | 30 | 37.5 | 37.0 | 0.5 | 2 |
| 30 | 30.0 | 29.6 | 0.4 | 2 | 30 | 38.1 | 37.5 | 0.6 | 2 |
| 30 | 30.5 | 30.0 | 0.5 | 2 | 30 | 38.5 | 38.1 | 0.4 | 2 |
| 30 | 30.9 | 30.5 | 0.4 | 2 | 30 | 39.1 | 38.5 | 0.6 | 2 |
| 30 | 31.3 | 30.9 | 0.4 | 2 | 30 | 39.5 | 39.1 | 0.4 | 2 |
| 30 | 31.8 | 31.3 | 0.5 | 2 | 30 | 39.9 | 39.5 | 0.4 | 2 |
| 30 | 32.1 | 31.8 | 0.3 | 2 | 30 | 40.5 | 39.9 | 0.6 | 2 |
| 30 | 32.4 | 32.1 | 0.3 | 2 | 30 | 41.0 | 40.5 | 0.5 | 2 |
| 30 | 32.7 | 32.4 | 0.3 | 2 | 30 | 41.4 | 41.0 | 0.4 | 2 |
| | | | | | 30 | 41.9 | 41.4 | 0.5 | 2 |
| | | | | | 30 | 42.4 | 41.9 | 0.5 | 2 |
| | | | | | 30 | 42.9 | 42.4 | 0.5 | 2 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Stabilized At: 0.3 cm | | | | | Stabilized At: 0.5 cm | | | | |

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 Structured Soils from Clays to Loams
 Fine & Very Fine Textured Silts and Clay
 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H)
 Cross Sectional Area of Reservoir (35.22 or 2.15)
 Time Interval Of Readings (T)
 Stabilized Reading
 Average Rate of Fall (R_f)
 First Head Matrix Flux Potential
 First Head Kfs
 First Head Kfs (in/hr)
0.90 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H)
 Cross Sectional Area of Reservoir (35.22 or 2.15)
 Time Interval Of Readings (T)
 Stabilized Reading
 Average Rate of Fall (R_f)
 Second Head Matrix Flux Potential
 Second Head Kfs
 Second Head Kfs (in/hr)
0.90 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matrix Flux Potential For Single Head Methods
 Geometric Mean of Field Saturated Hydraulic
 Calculated Matrix Flux Potential Over Gradient (gm)
 Calculated Alpha Value (α*)
 Calculated Field Saturated Conductivity

Geometric Mean Conductivity For Single Head Analysis (Kfs)
Hydraulic Conductivity Over Gradient (Kfs)
0.90 inches/hour
0.88 inches/hour

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

0.88 inches/hour FINAL CONDUCTIVITY RATE

TEST LOCATION PLAN

Test Pit #SWM-ER01

Permeability Test
#ER-P1-A @ 24"

Test Pit #SWM-ER04

Test Pit #SWM-ER10

Test Pit #SWM-ER02

Test Pit #SWM-ER09

Test Pit #SWM-ER07

Permeability Test
#ER-P9-A @ 114"

Permeability Test
#ER-P4-A @ 102"

Permeability Test
#ER-P7-A @ 99"

Permeability Test
#ER-P4-B @ 96"

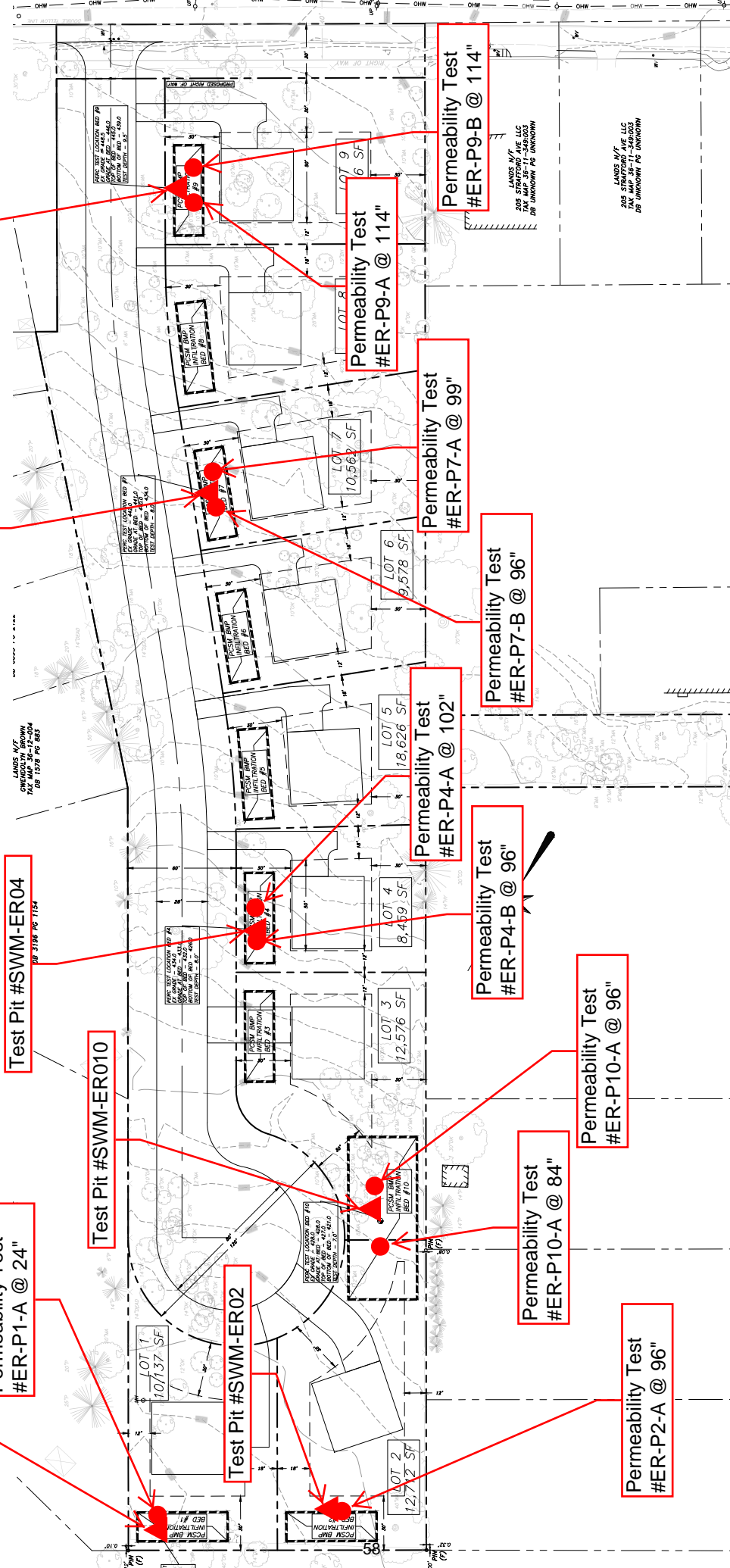
Permeability Test
#ER-P9-B @ 114"

Permeability Test
#ER-P10-A @ 84"

Permeability Test
#ER-P7-B @ 96"

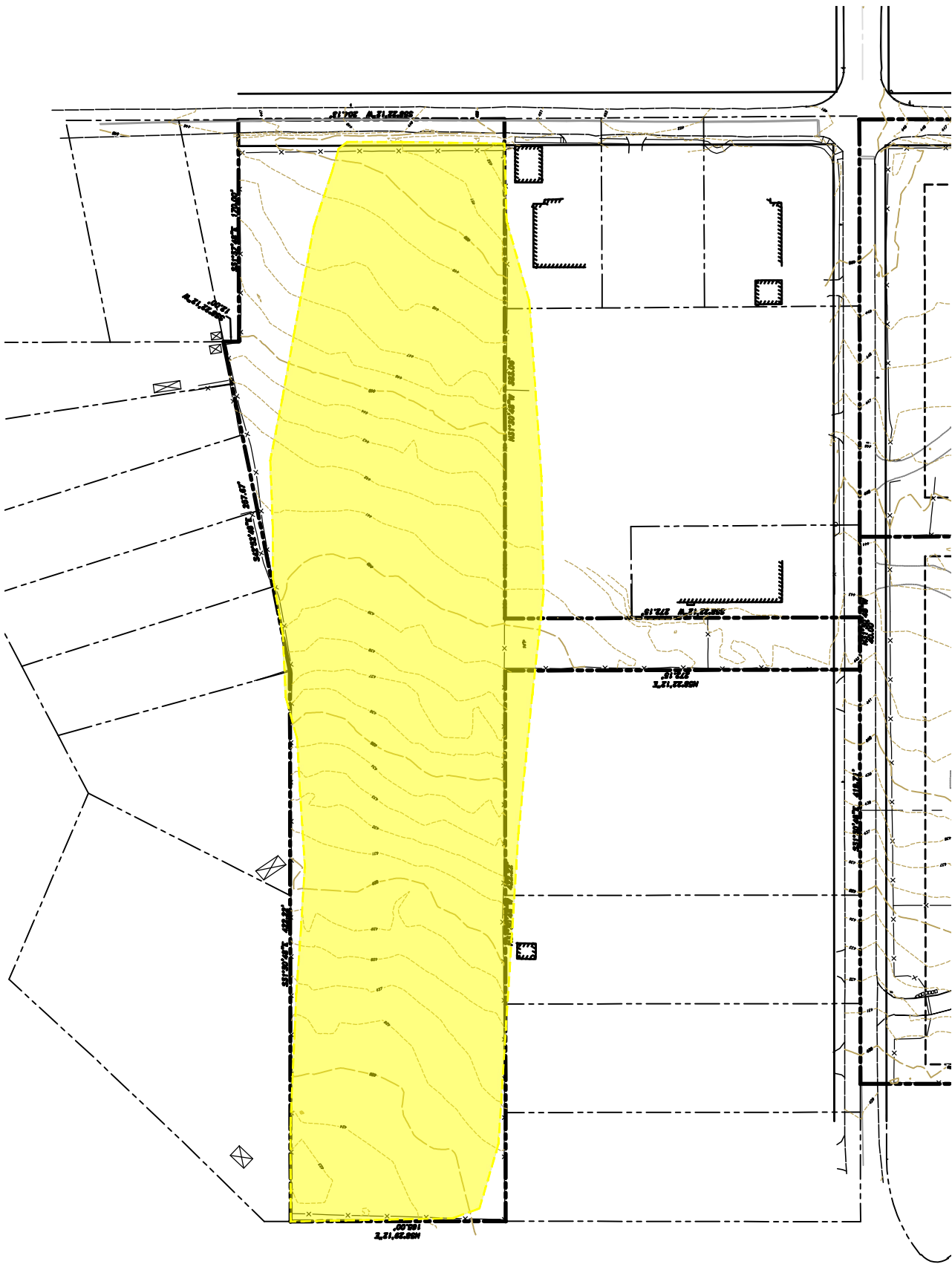
Permeability Test
#ER-P10-A @ 96"

Permeability Test
#ER-P2-A @ 96"

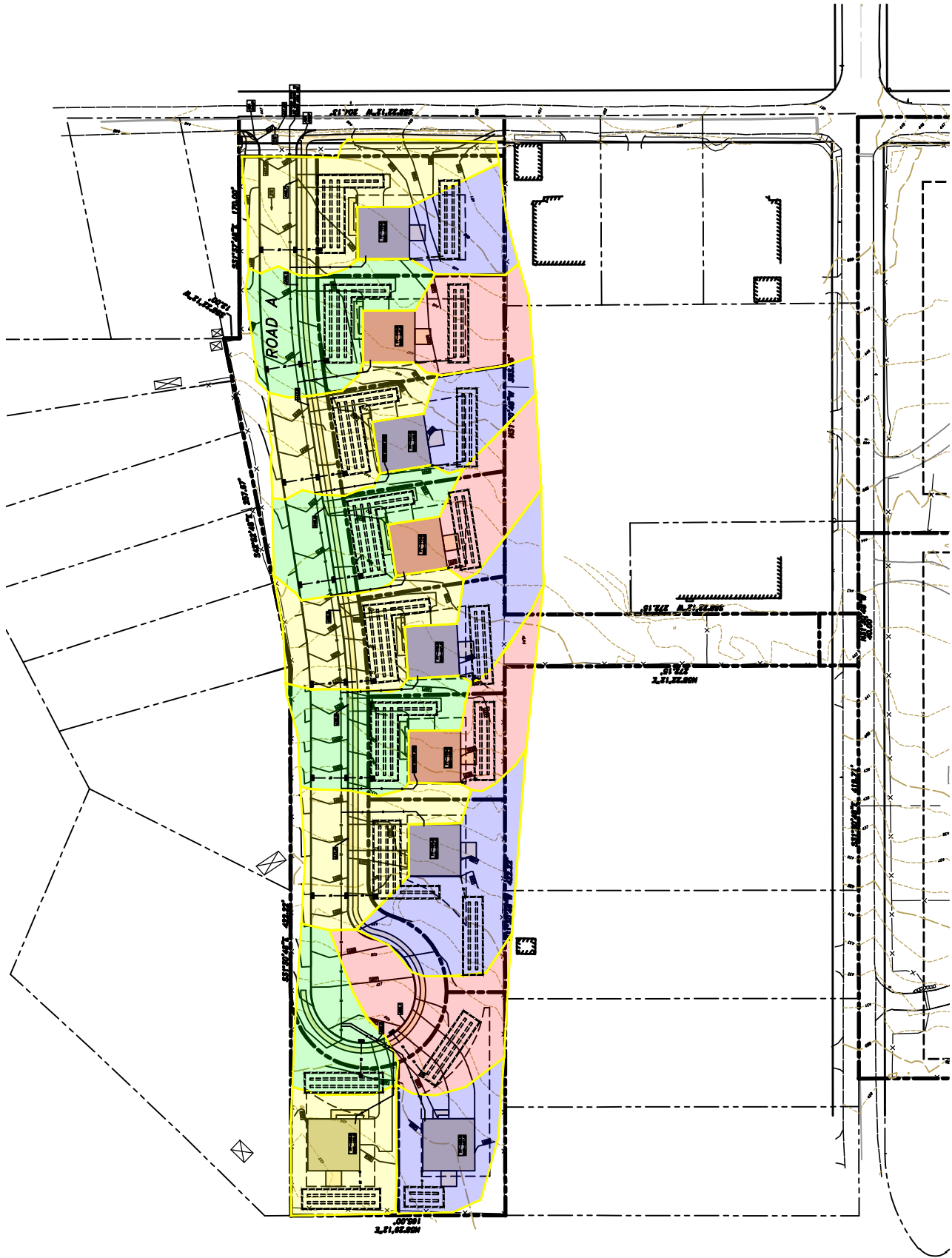


**HAMILTON: Eagle Road
Stormwater Test Locations**

September 18 & 19, 2019
Not To Scale



PRE DEVELOPED DRAINAGE PLAN



POST DEVELOPED DRAINAGE PLAN