LAKE COUNTRY ENGINEERING, INC.
Rob Davy, P.E.

**100 YEAR FLOOD ELEVATION REPORT**
**Portapainting 313 Travis Lane**
City of Waukesha, Waukesha County, WI

September 5, 2018

Project No. 18-3235

This report will have two parts to it, the first one will show the proposed storm sewer sizing calculations and compare the existing 100 storm elevations for the west side of the property

The parameters used to evaluate the site are:

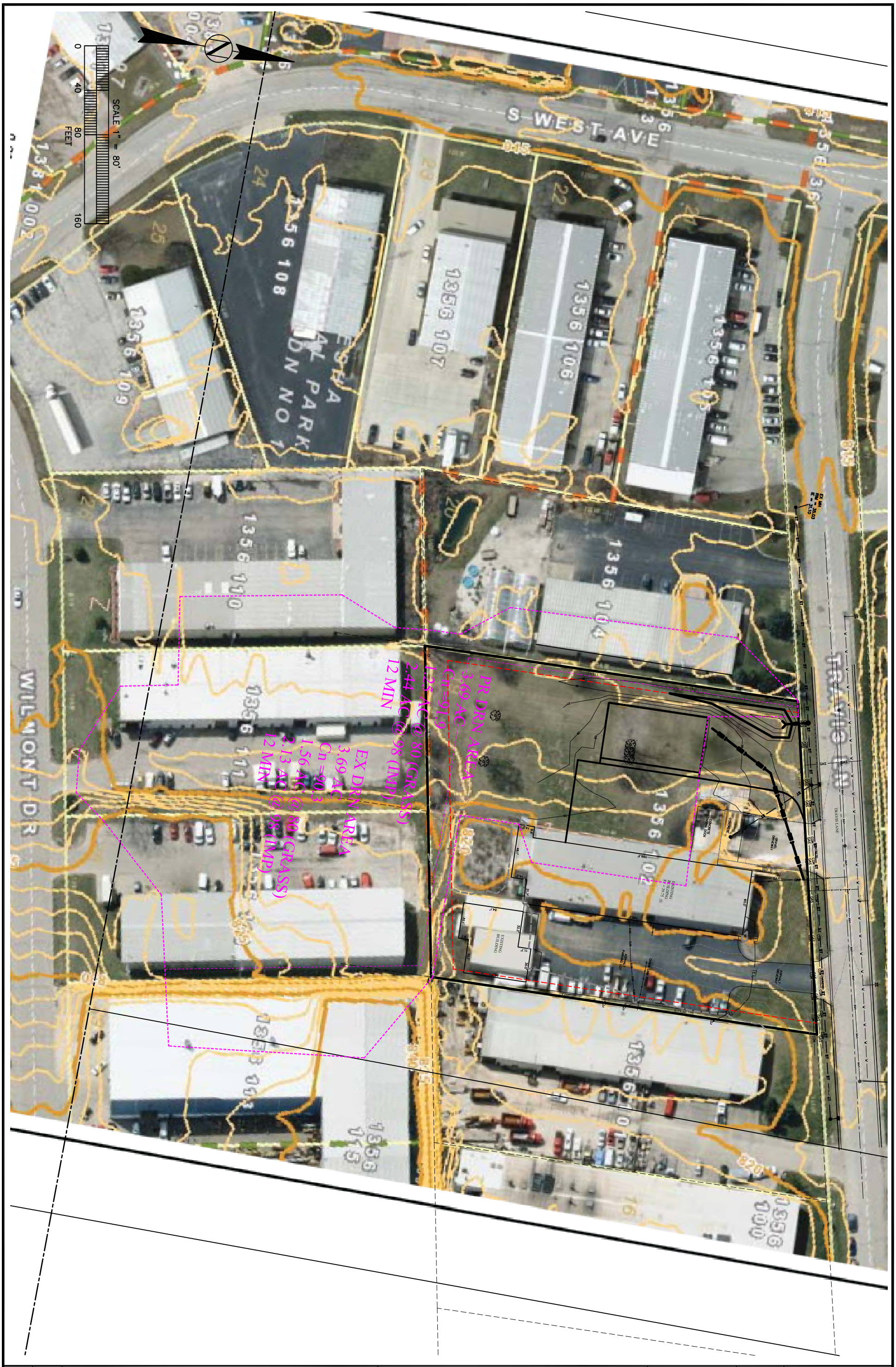
- The soils are hydrologic group D soils. ( Ph, HmB)
- Bed rock depth is > 5 feet below bottom of basin
- Rainfall events for 1-yr 24-hr storm = 2.40, 2-yr 24-hr storm = 2.70", 10-yr 24-hr storm = 3.81", and the 100-yr 24-hr storm = 6.18" of rain
- Storm distributions are Atlas 14 MSE type 3
- Hydrology calculations use Hydraflow TR-55 modeling
- Cn, Impervious surface = 98, and grass = 80

The flow rate calculated for a 10-year storm event is 12.46 cfs, and a 15" HDPE N12 sewer pipe with a slope of 2.0% has a maximum discharge rate of 12.77 cfs.

The second portion of this report compares the elevation storm water reaches when routing a 100 year storm event through the western portion of the site.

The existing conditions were evaluated using to scenarios, the first is routing the 21.59 cfs (100 reaf flow rate from the 3.69 acre drainage area through a swale at 0.5% slope, a 3' bottom width, 10:1 left side slope, and a 20:1 right side slope, the storm water is 0.76' deep in the ditch. With an over flow of 36.0 the 100 year storm elevation would be 36.76. The second routing is to model it a a storm water basin with a 1o' wide weir at an elevation of 35.96, this scenario calculates the 100 year storm elevation to be 36.75

The proposed conditions was just modeled as a storm water basin calculating the volume of the ditch and the first outlet being a 15" storm sewer pipe at 2.0% slope and a 6' wide weir with an elevation of 35.74, the calculated 100 year storm water elevations reaches 36.30, a drop of over 0.4' from the existing 100 year storm elevation.




| | | | | |
|---|---|---|---|---|
| SHEET # / PROJ. # 18-3235 | DRAINAGE MAP<br>OLIVER / PORTAPAINTING<br>313 TRAVIS LANE<br>SE 1/4 OF S.15,T.6N., R.19 E., CITY OF WAUKESHA | LAKE COUNTRY ENGINEERING, INC.<br>Consulting Engineers - Surveyors<br>970 S. Silver Lake Street, Suite 105, Oconomowoc, WI 53066<br>Phone (262) 569-9331 Fax (262) 569-9316 | SCALE: 1" = 80'<br>DRAFTED BY: RJDAVY<br>CHECKED BY: R.J.D.<br>DATE: 09/05/2018 | REVISION DATE / REMARKS |

# Hydrograph Return Period Recap

| 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 | ------- | 6.46 | 7.62 | ------- | ------- | 11.95 | ------- | ------- | 21.13 | EX DRN AREA |
| 2 | Reservoir | 1 | 4.95 | 6.01 | ------- | ------- | 9.89 | ------- | ------- | 18.22 | EX 100YR FOOLD |
| 4 | SCS Runoff | ------- | 6.97 | 8.14 | ------- | ------- | 12.46 | ------- | ------- | 21.59 | PROP AREA |
| 5 | Reservoir | 4 | 6.22 | 7.12 | ------- | ------- | 9.42 | ------- | ------- | 17.06 | pr 100 stm |

# Hydrograph Summary Report

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to peak (min) | Volume (acft) | Inflow hyd(s) | Maximum elevation (ft) | Maximum storage (acft) | Hydrograph description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 11.95 | 6 | 738 | 0.798 | ---- | ------ | ------ | EX DRN AREA |
| 2 | Reservoir | 9.89 | 6 | 744 | 0.796 | 1 | 36.48 | 0.118 | EX 100YR FOOLD |
| 4 | SCS Runoff | 12.46 | 6 | 738 | 0.843 | ---- | ------ | ------ | PROP AREA |
| 5 | Reservoir | 9.42 | 6 | 744 | 0.843 | 4 | 35.67 | 0.065 | pr 100 stm |

# Hydrograph Summary Report

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to peak (min) | Volume (acft) | Inflow hyd(s) | Maximum elevation (ft) | Maximum storage (acft) | Hydrograph description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 21.13 | 6 | 738 | 1.457 | ---- | ------ | ------ | EX DRN AREA |
| 2 | Reservoir | 18.22 | 6 | 744 | 1.455 | 1 | 36.75 | 0.181 | EX 100YR FOOLD |
| 4 | SCS Runoff | 21.59 | 6 | 738 | 1.509 | ---- | ------ | ------ | PROP AREA |
| 5 | Reservoir | 17.06 | 6 | 744 | 1.509 | 4 | 36.30 | 0.152 | pr 100 stm |

# Hydrograph Plot

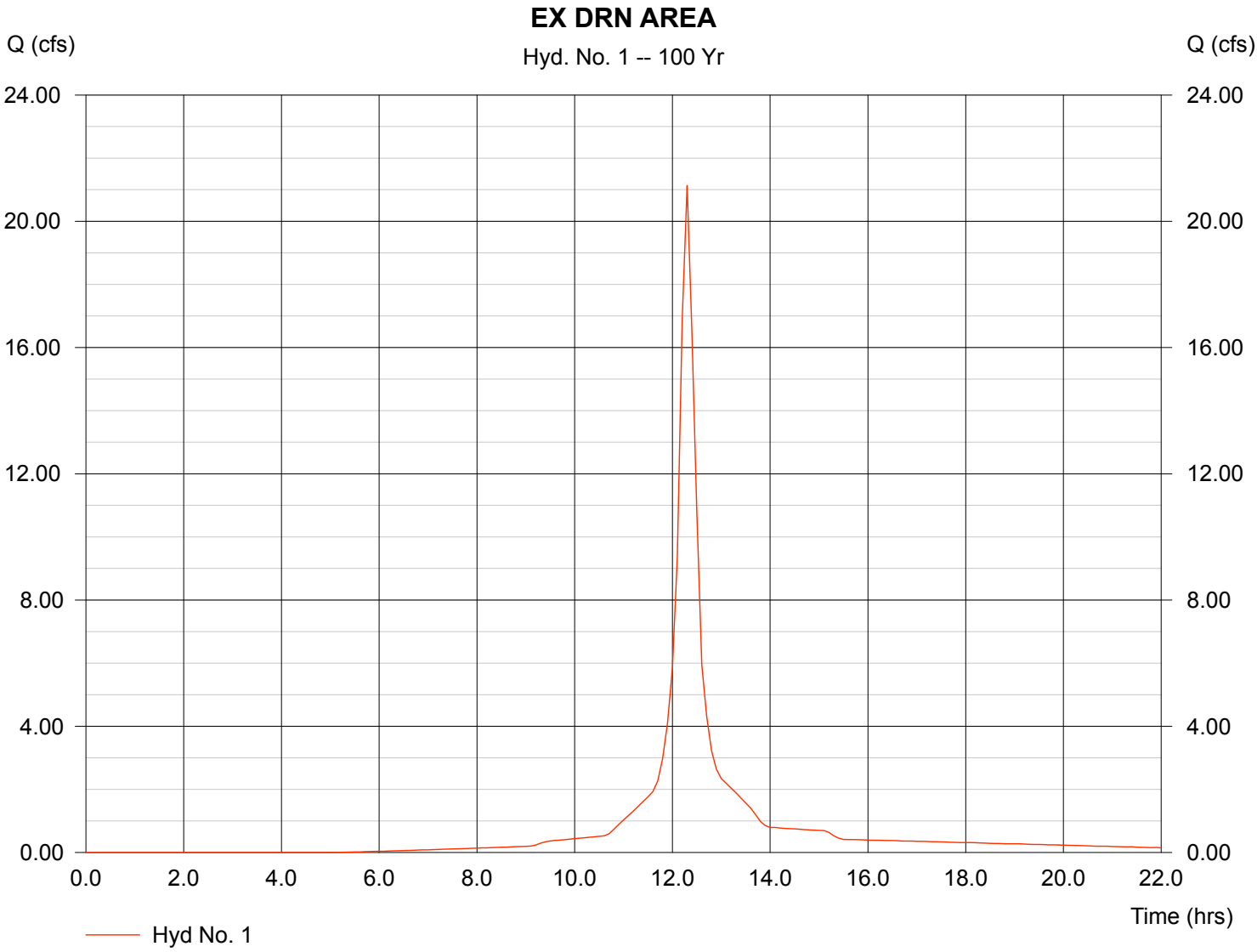
Hydraflow Hydrographs by Intelisolve | Wednesday, Sep 5 2018, 1:56 PM

## Hyd. No. 1

EX DRN AREA

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 21.13 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 6 min |
| Drainage area | = | 3.69 ac | Curve number | = | 90.3 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | USER | Time of conc. (Tc) | = | 12 min |
| Total precip. | = | 6.18 in | Distribution | = | Custom |
| Storm duration | = | atlas 14 area 3 distribution.cds | Shape factor | = | 484 |

Hydrograph Volume = 1.457 acft



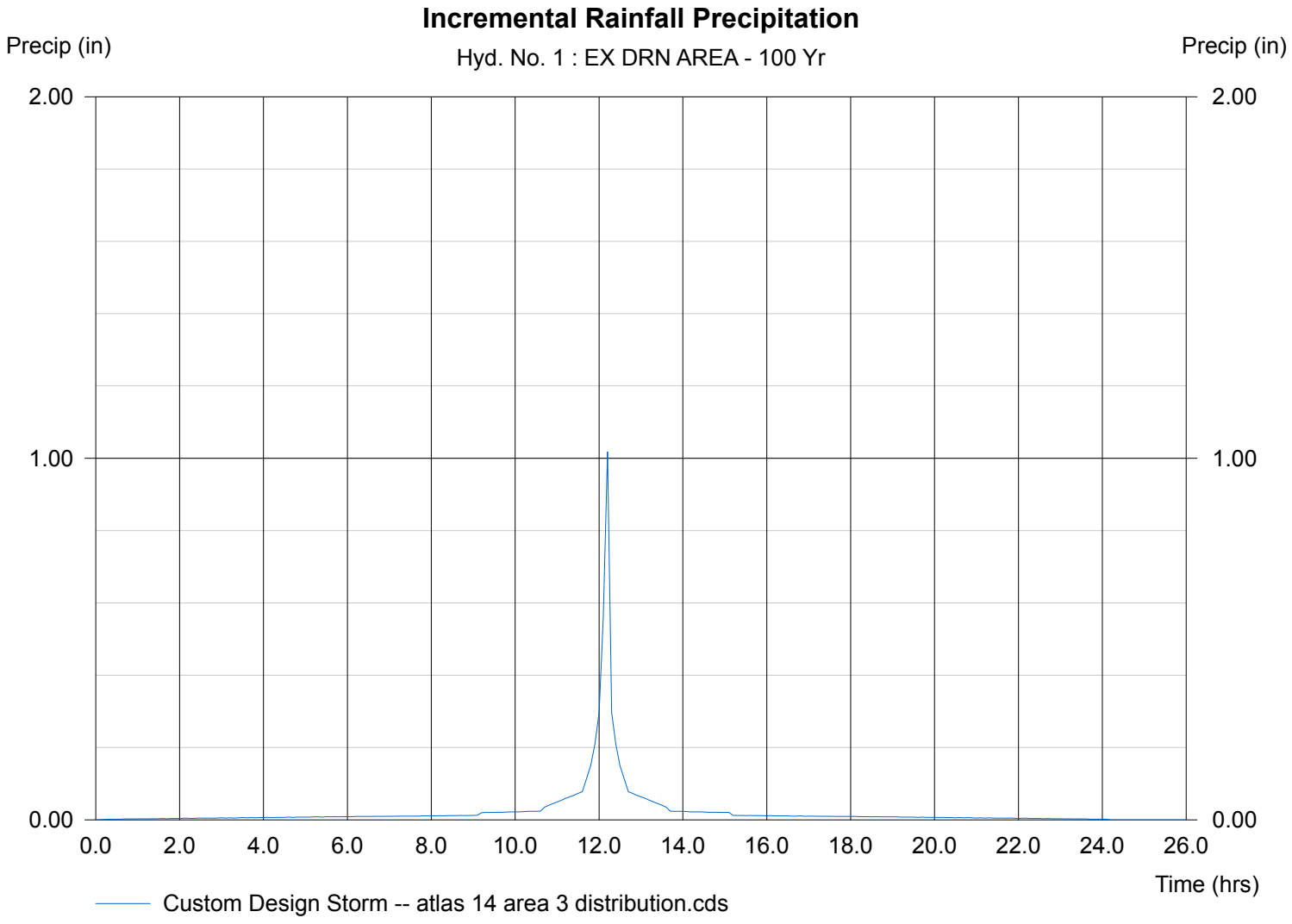
# Precipitation Report

Hydraflow Hydrographs by Intelisolve | Wednesday, Sep 5 2018, 1:56 PM

## Hyd. No. 1

EX DRN AREA

| | | | |
|---|---|---|---|
| Storm Frequency | = 100 yrs | Time interval | = 6 min |
| Total precip. | = 6.18 in | Distribution | = Custom |
| Storm duration | = atlas 14 area 3 distribution.cds | | |



# Hydrograph Plot

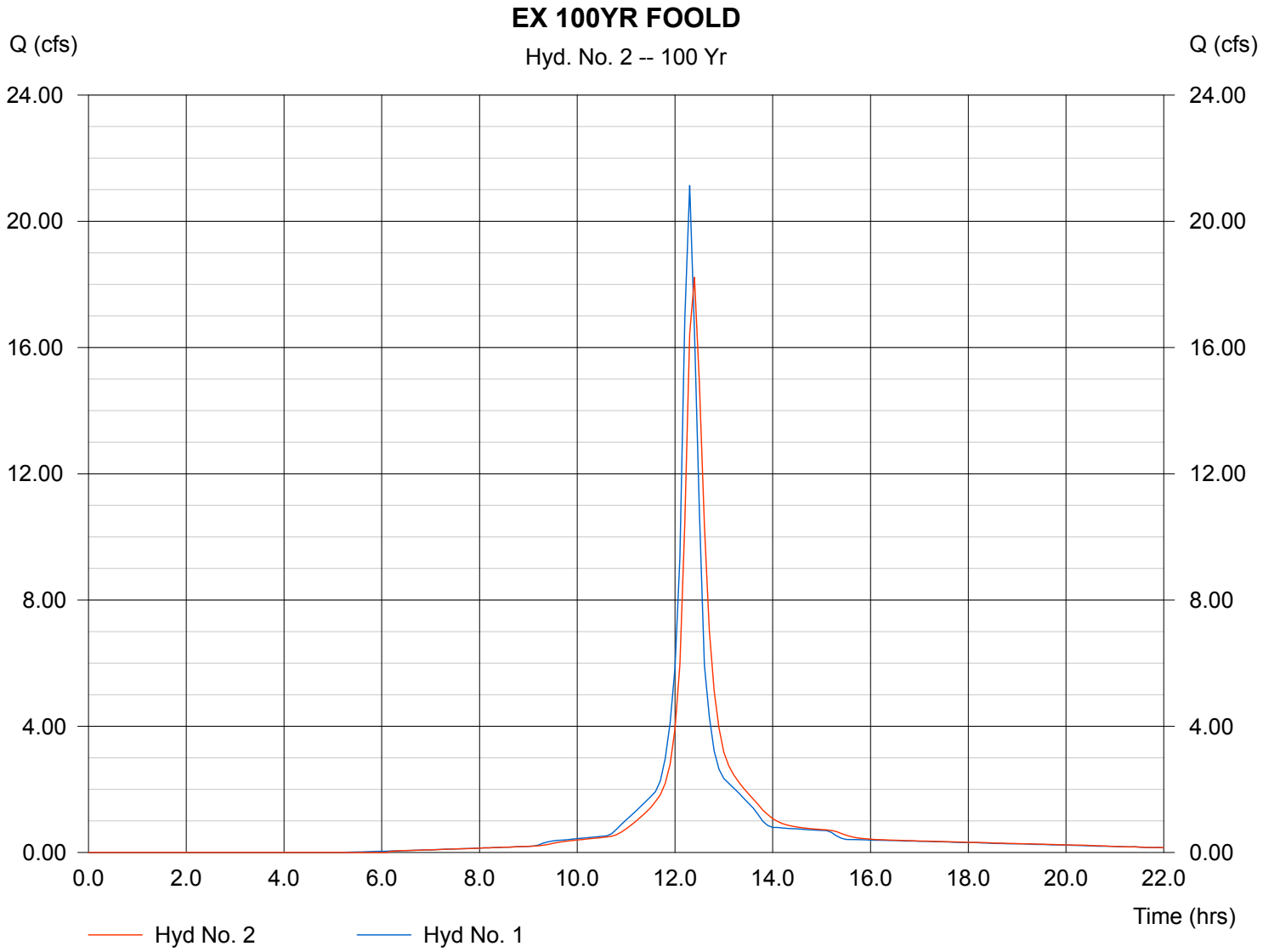
Hydraflow Hydrographs by Intelisolve | Wednesday, Sep 5 2018, 1:56 PM

## Hyd. No. 2

EX 100YR FOOLD

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 18.22 cfs |
| Storm frequency | = 100 yrs | Time interval | = 6 min |
| Inflow hyd. No. | = 1 | Max. Elevation | = 36.75 ft |
| Reservoir name | = ex swale | Max. Storage | = 0.181 acft |

Storage Indication method used. | Hydrograph Volume = 1.455 acft



# Pond Report



## Pond No. 2 - ex swale

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (acft) | Total storage (acft) |
|---|---|---|---|---|
| 0.00 | 35.75 | 50 | 0.000 | 0.000 |
| 0.25 | 36.00 | 740 | 0.002 | 0.002 |
| 1.25 | 37.00 | 20,128 | 0.240 | 0.242 |

### Culvert / Orifice Structures

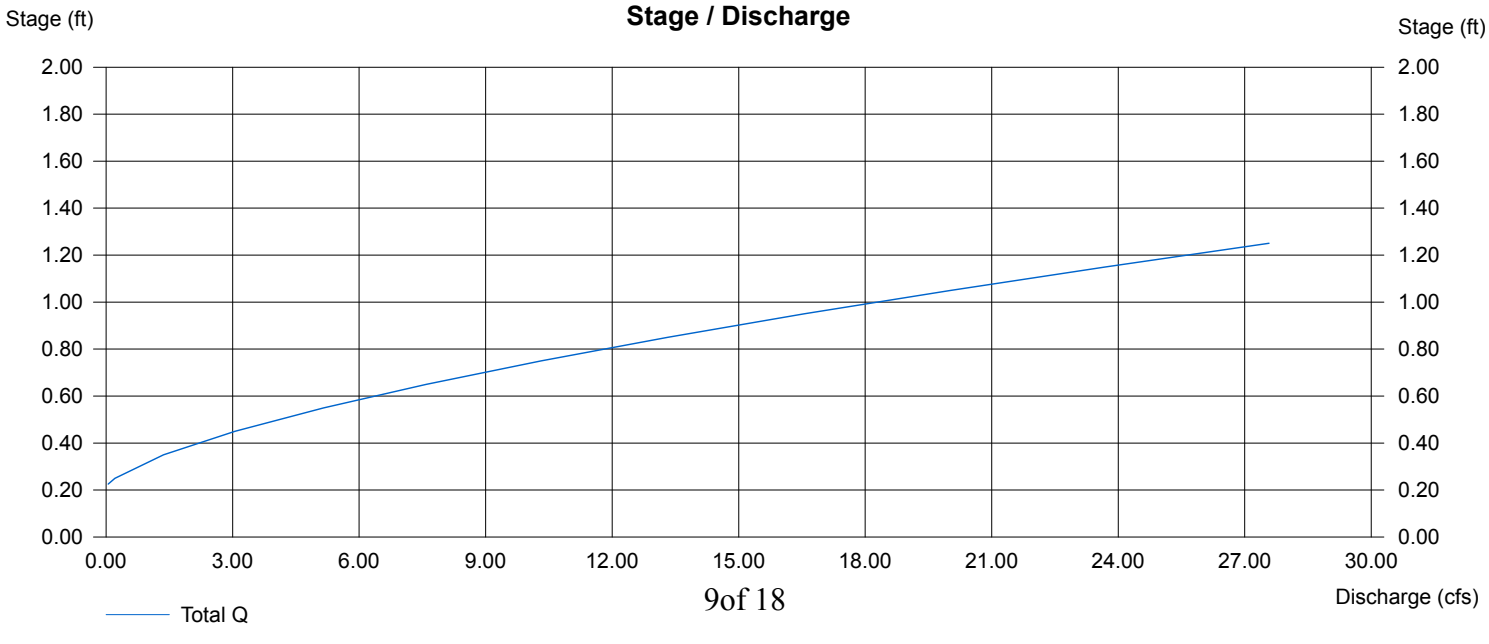
| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Rise (in)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Span (in)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **No. Barrels** | = 0 | 0 | 0 | 0 |
| **Invert El. (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Length (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **N-Value** | = .000 | .000 | .000 | .000 |
| **Orif. Coeff.** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 10.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 35.96 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.60 | 0.00 | 0.00 | 0.00 |
| **Weir Type** | = Broad | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfiltration =** 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



# Hydrograph Plot

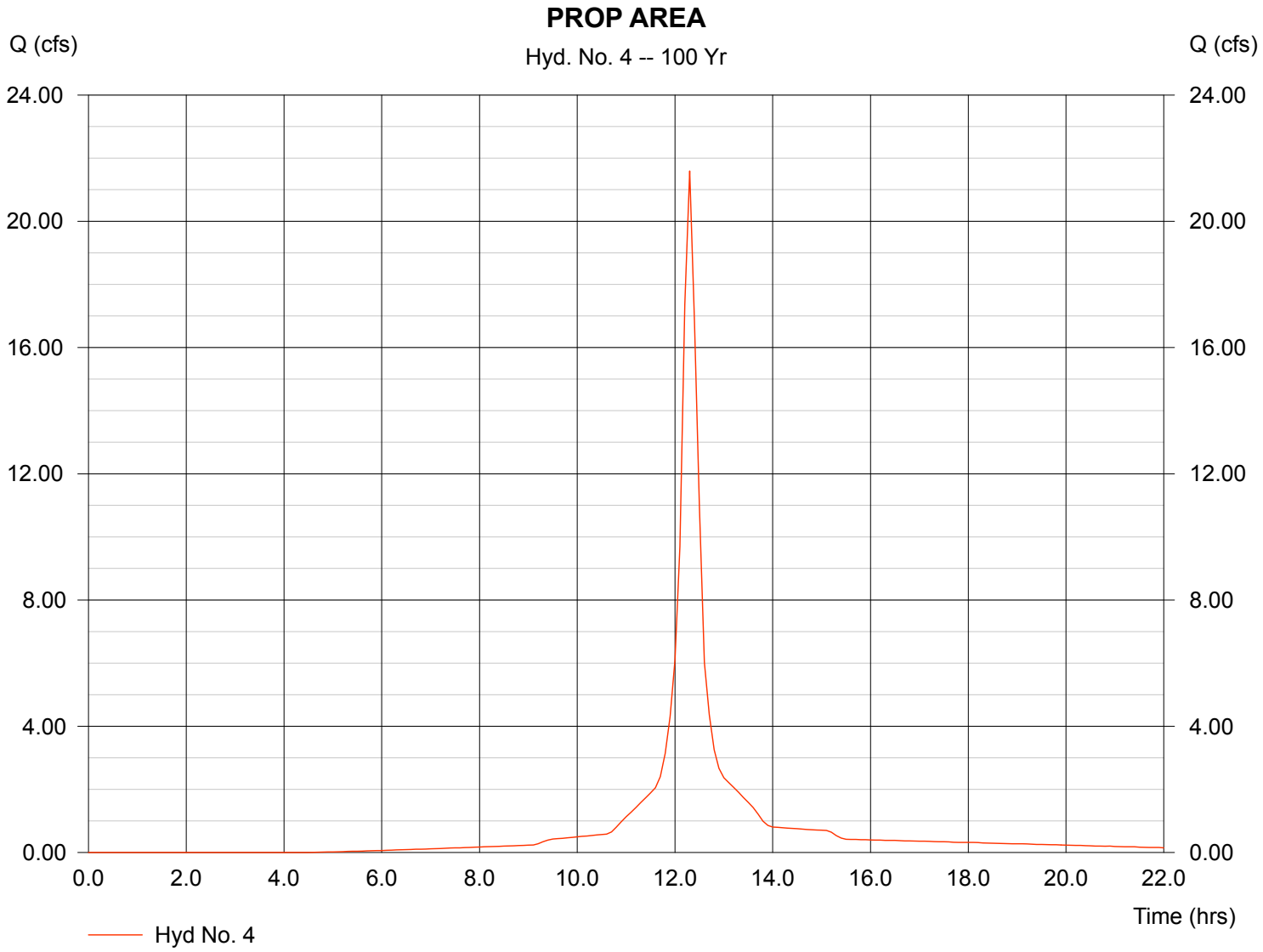
Hydraflow Hydrographs by Intelisolve | Wednesday, Sep 5 2018, 1:56 PM

## Hyd. No. 4

PROP AREA

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 21.59 cfs |
| Storm frequency | = | 100 yrs | Time interval | = | 6 min |
| Drainage area | = | 3.69 ac | Curve number | = | 91.9 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | USER | Time of conc. (Tc) | = | 12 min |
| Total precip. | = | 6.18 in | Distribution | = | Custom |
| Storm duration | = | atlas 14 area 3 distribution.cds | Shape factor | = | 484 |

Hydrograph Volume = 1.509 acft



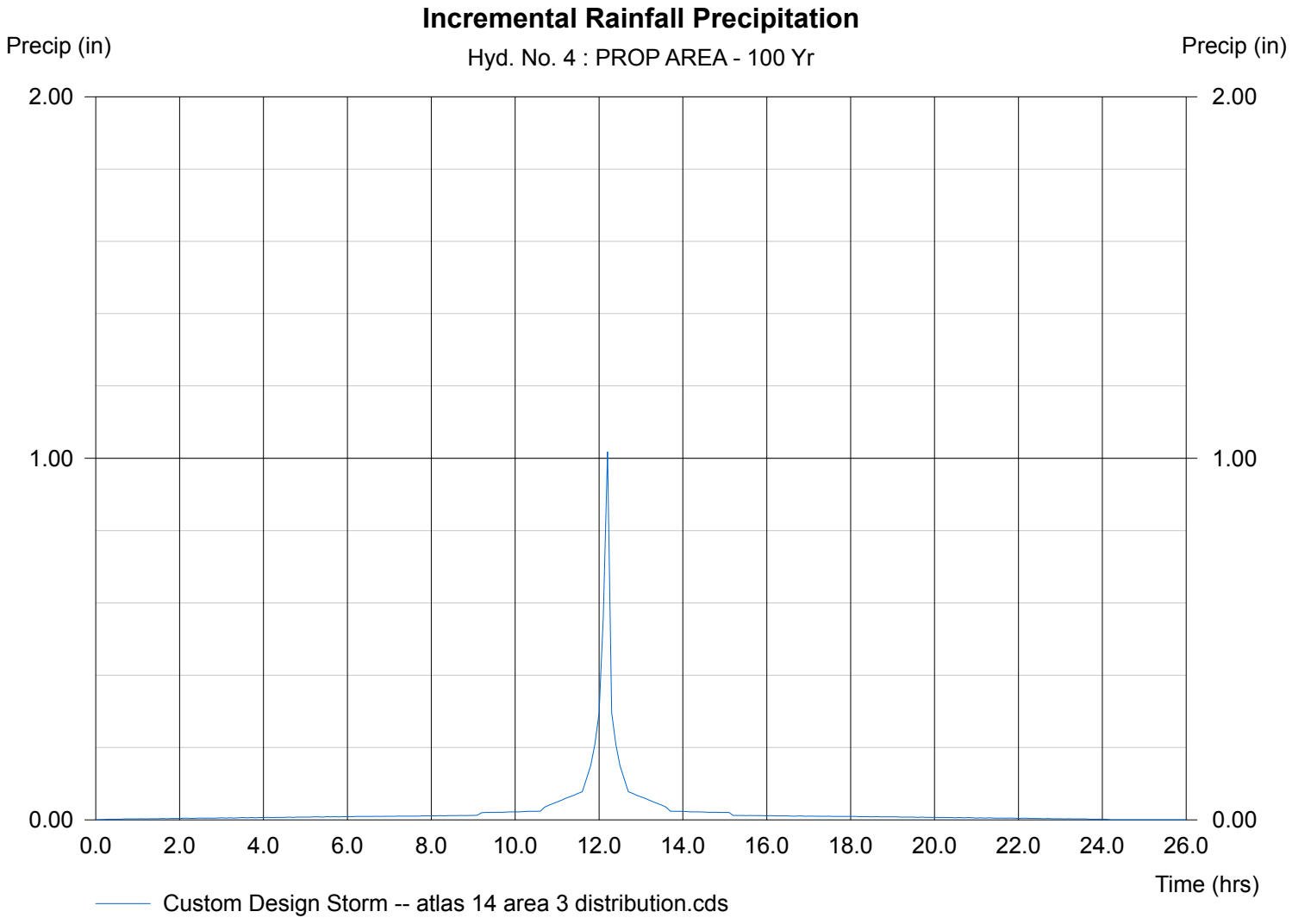
# Precipitation Report

Hydraflow Hydrographs by Intelisolve | Wednesday, Sep 5 2018, 1:56 PM

## Hyd. No. 4

PROP AREA

| | | | |
|---|---|---|---|
| Storm Frequency | = 100 yrs | Time interval | = 6 min |
| Total precip. | = 6.18 in | Distribution | = Custom |
| Storm duration | = atlas 14 area 3 distribution.cds | | |



# Hydrograph Plot

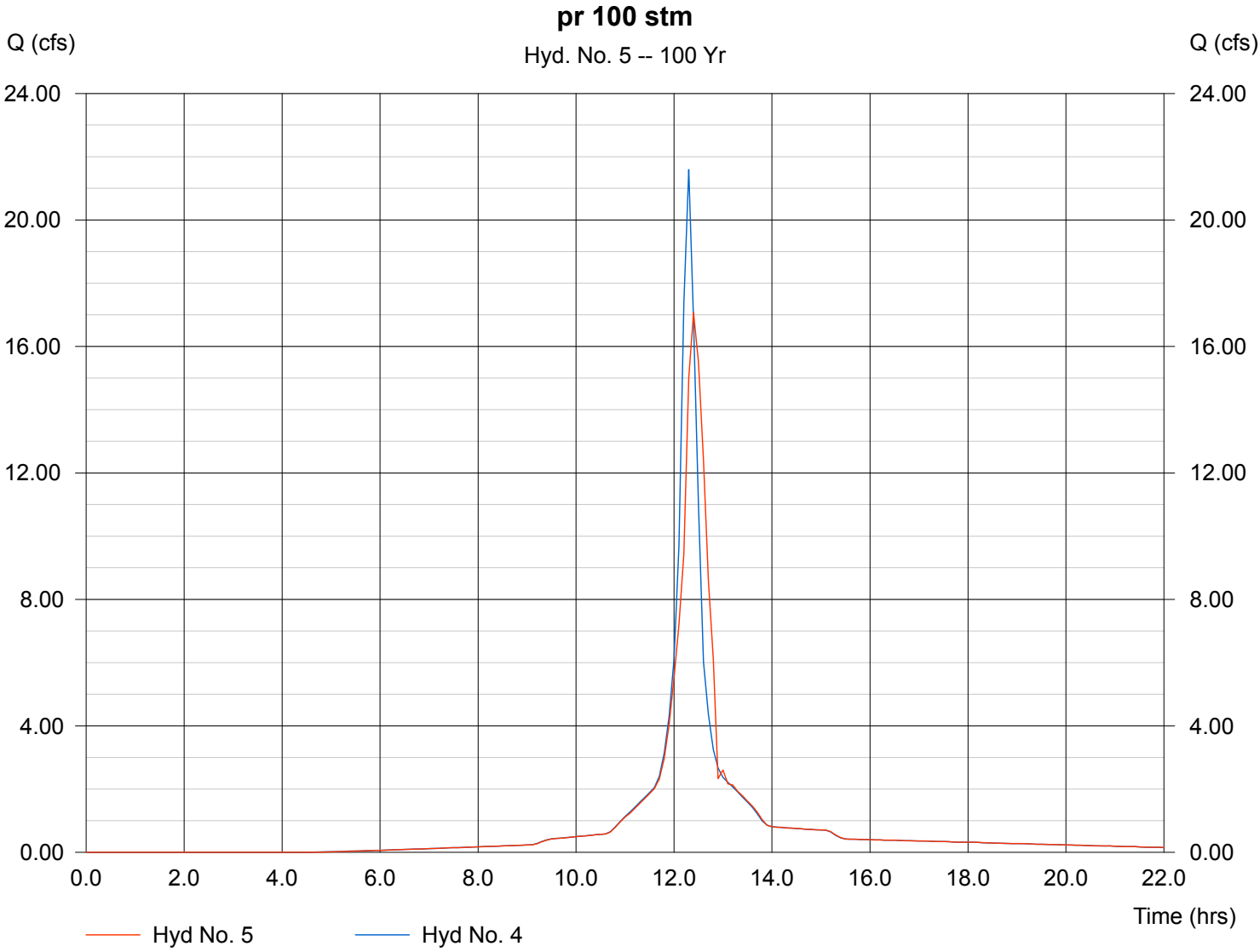
Hydraflow Hydrographs by Intelisolve | Wednesday, Sep 5 2018, 1:56 PM

## Hyd. No. 5

pr 100 stm

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 17.06 cfs |
| Storm frequency | = 100 yrs | Time interval | = 6 min |
| Inflow hyd. No. | = 4 | Max. Elevation | = 36.30 ft |
| Reservoir name | = PR SWALE | Max. Storage | = 0.152 acft |

Storage Indication method used. | Hydrograph Volume = 1.509 acft



# Pond Report



## Pond No. 1 - PR SWALE

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (acft) | Total storage (acft) |
|---|---|---|---|---|
| 0.00 | 32.50 | 70 | 0.000 | 0.000 |
| 0.50 | 33.00 | 179 | 0.001 | 0.001 |
| 1.50 | 34.00 | 566 | 0.009 | 0.010 |
| 2.50 | 35.00 | 1,255 | 0.021 | 0.031 |
| 3.50 | 36.00 | 3,223 | 0.051 | 0.082 |
| 4.50 | 37.00 | 17,000 | 0.232 | 0.314 |

### Culvert / Orifice Structures

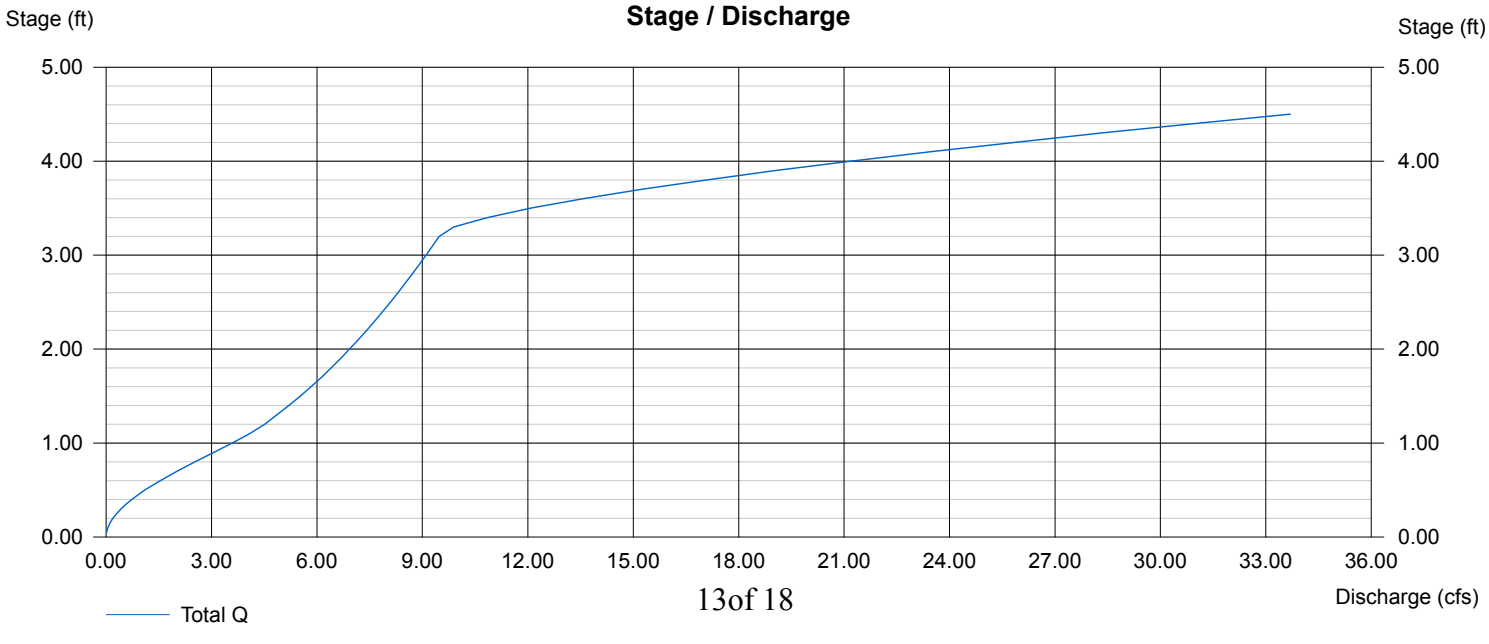
| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Rise (in)** | = 15.00 | 0.00 | 0.00 | 0.00 |
| **Span (in)** | = 15.00 | 0.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 0 | 0 | 0 |
| **Invert El. (ft)** | = 32.50 | 0.00 | 0.00 | 0.00 |
| **Length (ft)** | = 20.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 2.00 | 0.00 | 0.00 | 0.00 |
| **N-Value** | = .010 | .000 | .000 | .000 |
| **Orif. Coeff.** | = 0.60 | 0.00 | 0.00 | 0.00 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 6.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 35.74 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.60 | 0.00 | 0.00 | 0.00 |
| **Weir Type** | = Broad | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfiltration =** 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



# 313 TRAVIS LANE
## Worksheet for Circular Channel

| Project Description | |
|---|---|
| Worksheet | 18-3235 TRAVIS |
| Flow Element | Circular Channel |
| Method | Manning's Formu |
| Solve For | Discharge |

| Input Data | | |
|---|---|---|
| Mannings Coeffic | 0.010 | |
| Channel Slope | 020000 | ft/ft |
| Depth | 1.20 | ft |
| Diameter | 15.0 | in |

| Results | | |
|---|---|---|
| Discharge | 12.72 | cfs |
| Flow Area | 1.2 | ft² |
| Wetted Perime | 3.42 | ft |
| Top Width | 0.00 | ft |
| Critical Depth | 1.22 | ft |
| Percent Full | 96.0 | % |
| Critical Slope | 0.020509 | ft/ft |
| Velocity | 10.51 | ft/s |
| Velocity Head | 1.72 | ft |
| Specific Energy | 2.92 | ft |
| Froude Numbe | 1.18 | |
| Maximum Disc | 12.77 | cfs |
| Discharge Full | 11.88 | cfs |
| Slope Full | 0.022957 | ft/ft |
| Flow Type | Supercritical | |





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# 18-3235 olv travis lane
# Worksheet for Trapezoidal Channel

| Project Description | |
|---|---|
| Worksheet | travis lane west |
| Flow Element | Trapezoidal Cha |
| Method | Manning's Formu |
| Solve For | Channel Depth |

| Input Data | | |
|---|---|---|
| Mannings Coeffic | 0.030 | |
| Channel Slope | 005000 | ft/ft |
| Left Side Slope | 10.00 | H : V |
| Right Side Slope | 20.00 | H : V |
| Bottom Width | 3.00 | ft |
| Discharge | 21.59 | cfs |

| Results | | |
|---|---|---|
| Depth | 0.76 | ft |
| Flow Area | 10.9 | ft² |
| Wetted Perim | 25.84 | ft |
| Top Width | 25.79 | ft |
| Critical Depth | 0.57 | ft |
| Critical Slope | 0.019054 | ft/ft |
| Velocity | 1.97 | ft/s |
| Velocity Head | 0.06 | ft |
| Specific Energ | 0.82 | ft |
| Froude Numb | 0.53 | |
| Flow Type | Subcritical | |





Lake Country Engineering
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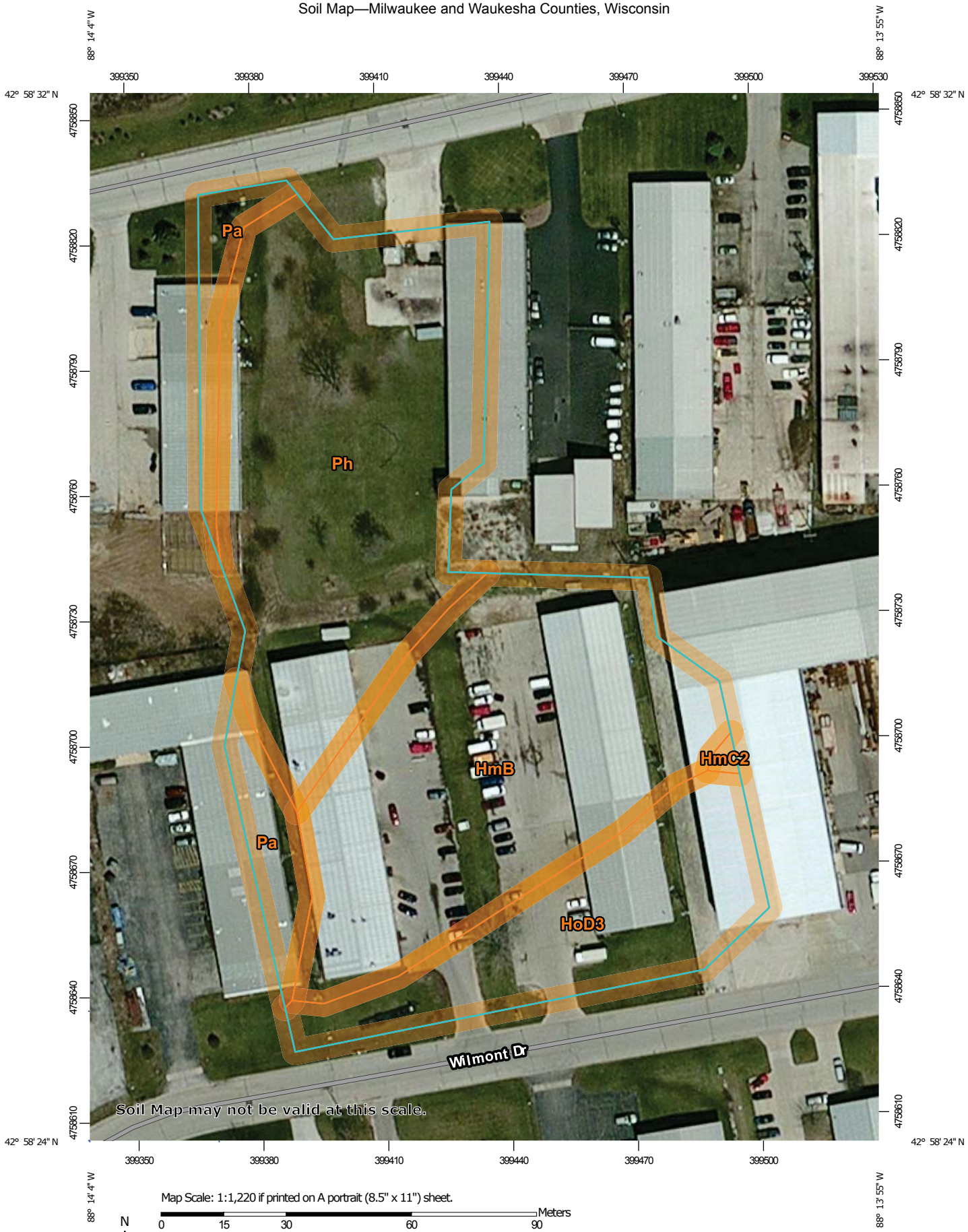


Map Scale: 1:1,220 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

## MAP LEGEND

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

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

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

**Water Features**
- Streams and Canals

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

**Background**
- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 13, Oct 6, 2017

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

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| HmB | Hochheim loam, 2 to 6 percent slopes | 1.6 | 36.1% |
| HmC2 | Hochheim loam, 6 to 12 percent slopes, eroded | 0.0 | 0.2% |
| HoD3 | Hochheim soils, 12 to 20 percent slopes, severely eroded | 0.7 | 17.1% |
| Pa | Palms muck, 0 to 2 percent slopes | 0.3 | 7.3% |
| Ph | Pella silt loam, 0 to 2 percent slopes | 1.7 | 39.3% |
| **Totals for Area of Interest** | | **4.4** | **100.0%** |