



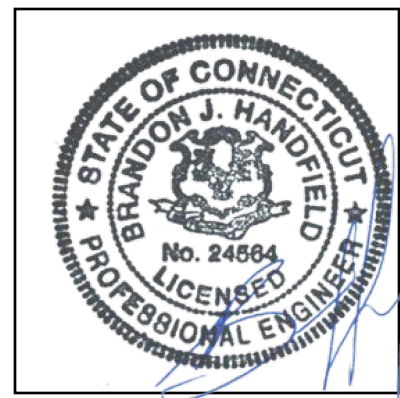
# STORMWATER MANAGEMENT REPORT

WATERFORD WOODS APARTMENTS PHASE 2  
384 & 394 WILLETTS AVE. EXT.  
WATERFORD, CT

PREPARED FOR

WATERFORD WOODS, LLC  
606 POST ROAD EAST #320  
WESTPORT, CT 06880

DATE: NOVEMBER 18, 2020  
REVISED: FEBRUARY 17, 2022







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## PROJECT DESCRIPTION

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Waterford Woods, LLC is constructing a residential multi-family development on two undeveloped parcels of land on the south side of Willetts Avenue Extension totaling 26.64 acres.

- 0.48-acre parcel located at 384 Willetts Avenue Extension identified as Map 140, Lot 9190 on the Town of Waterford Tax Assessor Mapping
- 26.16-acre parcel located at 394 Willetts Avenue Extension identified as Map 140, Lot 9192 on the Town of Waterford Tax Assessor Mapping

The combined parcels are hereinafter referred to as the Site.

The Site is in the Commercial Multi-Family District (C-MF). Phase 1 of the multi-family development received site plan approval PL-21-1 on March 9, 2021, per Section 16 & 18 of the Zoning Regulations. A site plan modification approval PL-21-12 was received on December 14, 2021, for a new Clubhouse and associated amenities to be constructed as part of Phase 1.

An application has been submitted to the Town for site plan modifications associated with Phase 2 of the multi-family development. Phase 2 will consist of the construction of three (3) additional apartment buildings with a total of 106 units with a mix of 68 one-bedroom and 38 two-bedroom dwelling units. Main access will utilize the Phase 1 access driveway approved with the original development with minor widening of the exit lane to allow for separate right and left turn movements. Phase 2 site modifications will include:

- Clearing and grubbing.
- Construction of Buildings D, E and F with an additional 106 residential units.
- Extension of the 24' wide main access drives to serve parking facilities adjacent to the new buildings.
- Outdoor recreation areas including community spaces.
- Additional paved parking spaces adjacent to the new buildings.
- Reduction of parking space quantity and size sitewide consistent with recently adopted Zoning Regulations to minimize impervious surfaces.
- Concrete pedestrian sidewalks connecting the apartment buildings to the adjacent parking areas and amenities.
- Reduction of pedestrian sidewalk widths sitewide consistent with recently adopted Zoning Regulations to minimize impervious surfaces and maintain a residential appearance.
- Drainage improvements including a stormwater collection network, subsurface infiltration, and detention ponds.
- Extension of private water, sewer, electric, gas and telecom mains.
- Landscaping including a mixture of street trees, shrubs, foundation plantings and planting beds
- Building and street lighting.
- Erosion and sedimentation control measures.

This stormwater management report has been prepared by a professional engineer and provides a comprehensive evaluation of the fully developed Site, including Phase 1 and Phase 2. The report concludes that there will be zero net increase in peak flow rates discharging to downgradient wetlands or private properties, general drainage patterns will be maintained, and stormwater will be treated in accordance with the CT DEEP 2004 Stormwater Quality Manual.

## **EXISTING SITE DESCRIPTION**

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Construction related to Site Plan Application PL-21-1 has commenced. Construction related to the Site Plan Modification PL-21-12 will commence in the spring. As the hydrologic evaluation considered pre-development conditions before construction activities, a description of the undeveloped Site is provided below.

The subject Site was undeveloped except for a small outbuilding along Willetts Avenue Extension. The Site was generally wooded with an internal network of gravel roads leading to stockpiles of construction and demolition debris, such as brick, concrete, timber, etc. There are also signs of historical rock quarrying at the southwest corner of the site.

**TOPOGRAPHY** – The existing topography generally consisted of gentle to moderately sloping terrain from the northeast along Willetts Avenue to the southwest towards two (2) wetland areas on Site and Fenger Brook. Existing slopes in the upland areas of the Site ranged from 4% to 7% with steeper slopes around the perimeter of the delineated inland wetland areas.

**SOILS** – The USDA NRCS Web Soil Survey indicated that the upland area of the Site contain Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky (73C) soils, which have a hydrologic soil group classification (HSG) of B. Inland wetland areas are designed as Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, very rocky, which have an HSG of D. Deep observation test holes were performed at the site, which generally confirmed the NRCS soil types within upland areas.

**DRAINAGE** – The Site drains from the northeast along Willetts Avenue towards wetland systems to the southwest and south. Three (3) existing drainage areas were delineated based upon topography and field observation.

- SITE-EX-01 is 8.182 acres and consists of the northern portion of the site, which drains to a wetland area along the westerly property line.
- SITE-EX-02 is 2.495 acres and consists of the southeastern corner of the site draining to a wetland area along the east and southern property line.
- SITE-EX-03 is 6.764 acres and consists of a peninsula of upland at the southeast corner of the site, which drains from a high point at the center to the perimeter wetlands.

Based upon CT DEEP mapping, the entire Site lies within the Southeast Shoreline subregional drainage basin 2000, which is part of the Southeast Coast major basin 2. However, based upon the “Jordan Brook Watershed Management Plan Final Report, Town of Waterford, Connecticut”, dated February 2000, prepared by Fuss & O’Neill, Inc., the Site is included within the Jordan Brook subregional basin 2201 (hereinafter JBWMP). A detailed review of the hydrologic conditions of the subregional watershed was not performed as part of this review, however the recommendations of the JBWMP were followed as a conservative measure.

## **PEAK FLOW CONTROL & FLOOD PROTECTION**

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Stormwater runoff from the proposed multi-family development will be collected through a series of rain gardens, swales, yard drains, catch basins, and drainage piping and discharged to a series of treatment, infiltration, and detention areas on the Site.

Peak flow rates for pre-development and post-development conditions were calculated using SCS TR-55 methodology. Hydrology Studio 2022 v.3.0.0.21 was used to generate peak flows from the watershed with the following parameters:

PRE-DEVELOPED CONDITIONS (Drainage Area Map DA-01A)

- **DRAINAGE AREAS:** As described above, the Site has three (3) existing drainage areas.
  - o SITE-EX-01 is 8.182 acres and consists of the northern portion of the site, which drains to a wetland area along the westerly property line.
  - o SITE-EX-02 is 2.495 acres and consists of the southeastern corner of the site draining to a wetland area along the east and southern property line.
  - o SITE-EX-03 is 6.764 acres and consists of a peninsula of upland at the southeast corner of the site, which drains from a high point at the center to the perimeter wetlands.
- **RAINFALL:** Precipitation frequency and depth estimates (rainfall data) were obtained from NOAA Atlas 14, Volume 10, Version 2 at Lat. 41.3376 Long. -72.1197, which corresponds with the geographic location of the Site.
- **RUNOFF COEFFICIENT:** Composite Curve Numbers (CN) were calculated based on the land cover types for the site for HSG B. Land cover types consist of impervious buildings and pavement, meadow/brush, open space vegetated areas, woods, and wetlands. Wetland areas were excluded from the drainage areas and calculations.
- **TIME OF CONCENTRATION:** Time of concentration (Tc) was estimated for the basin based on the SCS method, with sheet and shallow concentrated flow from the hydraulically most distant point of the watershed to the discharge point.

POST-DEVELOPED CONDITIONS (Drainage Area Map DA-02A)

- **DRAINAGE AREA:** For direct comparison with existing conditions, the same three design points were evaluated. Drainage area limits were updated to reflect Phase 2 improvements.
  - o SITE-PR-01 is 6.702 acres and consists of the north/northwest portion of the developed site.
  - o SITE-PR-02 is 3.902 acres and consists of the eastern portion of the developed site.
  - o SITE-PR-03 is 6.837 acres consists of a southwestern portion of the developed site.
- **RAINFALL:** Same as Pre-Developed Conditions.
- **CURVE NUMBER:** Same methodology as Pre-Developed Conditions. Composite Curve Numbers (CN) were calculated based on the land cover types for the proposed multi-family residential development for HSG B. Land cover types and areas were updated to reflect Phase 2 improvements, including the reduction of parking space quantities and areas throughout the development.
- **TIME OF CONCENTRATION:** Same methodology as Pre-Developed Conditions.

COMPARISON

A summary of flows for existing and proposed conditions, without consideration of infiltration or detention is provided below with a complete output provided in the enclosed Hydrology Studio Report.

| STORM<br>EVENT | AREA 01        |                |                 | AREA 02        |                |                 | AREA 03        |                |                 | TOTAL SITE  |             |                 |
|----------------|----------------|----------------|-----------------|----------------|----------------|-----------------|----------------|----------------|-----------------|-------------|-------------|-----------------|
|                | SITE-<br>EX-01 | SITE-<br>PR-01 | EX<br>vs.<br>PR | SITE-<br>EX-02 | SITE-<br>PR-02 | EX<br>vs.<br>PR | SITE-<br>EX-03 | SITE-<br>PR-03 | EX<br>vs.<br>PR | SITE-<br>EX | SITE-<br>PR | EX<br>vs.<br>PR |
| 2-yr           | 1.15           | 4.63           | 3.48            | 0.30           | 3.20           | 2.90            | 0.81           | 4.54           | 3.73            | 2.26        | 12.26       | 10.00           |
| 5-yr           | 3.09           | 7.68           | 4.59            | 0.86           | 5.18           | 4.32            | 2.34           | 7.79           | 5.46            | 6.29        | 20.47       | 14.18           |
| 10-yr          | 5.20           | 10.41          | 5.21            | 1.49           | 6.95           | 5.46            | 4.03           | 10.75          | 6.72            | 10.71       | 27.86       | 17.15           |
| 25-yr          | 8.63           | 14.45          | 5.82            | 2.52           | 9.53           | 7.01            | 6.83           | 15.14          | 8.31            | 17.98       | 38.74       | 20.76           |
| 50-yr          | 11.45          | 17.52          | 6.07            | 3.37           | 11.49          | 8.12            | 9.14           | 18.51          | 9.37            | 23.95       | 47.08       | 23.13           |
| 100-yr         | 14.69          | 20.89          | 6.20            | 4.36           | 13.64          | 9.28            | 11.82          | 22.24          | 10.42           | 30.85       | 56.24       | 25.39           |

TABLE 1: PHASE 2 PEAK FLOW COMPARISON - EXISTING VS. PROPOSED (NO DETENTION)

As shown in the tables above, the proposed multi-family development (SITE-PR) results in an increase in peak flow rates as compared to existing conditions (SITE-EX) without consideration of infiltration or detention. To attenuate peak flow rates, subsurface infiltration and detention ponds are proposed, which will collect runoff from the collection network and attenuate peak flow rates and volumes. Further discussion is provided below.

#### INFILTRATION & DETENTION (Drainage Area Map DA-03A)

The proposed stormwater network consists of a series of infiltration and detention methods to attenuate peak flow rates.

#### **PROPOSED AREA 01A (SITE-PR-01A)**

Stormwater runoff within PR-01A will discharge to the following structures:

- INF-01B – Stormtech SC-740 subsurface infiltration systems consisting of 40 units to promote treatment and infiltration.
- POND-01A – Wet extended detention pond used for peak runoff attenuation with a shallow 8” deep wet pool and filter bed to promote treatment and infiltration.
  - o POND-01A will discharge through outlet control structure 01A (OCS 01A) with staged outlets to regulate outflow, emergency overflow weir, and riprap plunge pool to dissipate energy and velocity before flowing towards the downstream wetlands.

#### **PROPOSED AREA 02A (SITE-PR-02A)**

Stormwater runoff within PR-02A will discharge to the following structures:

- POND-02A – Wet extended detention pond used for peak runoff attenuation with a shallow 12” deep wet pool and filter bed to promote treatment and infiltration from contributing area.
  - o POND-02A will discharge through outlet control structure 02A (OCS 02A) with staged outlets to regulate outflow, emergency overflow weir, and riprap plunge pool to dissipate energy and velocity before flowing towards the downstream wetlands.

#### **PROPOSED AREA 03A (SITE-PR-03A)**

Stormwater runoff within PR-03A will discharge to the following structures:

- POND-03A – Wet extended detention pond used for peak runoff attenuation with a shallow 9” deep wet pool and filter bed to promote treatment and infiltration from contributing area.



- o POND-03A will discharge through outlet control structure 03A (OCS 03A) with staged outlets to regulate outflow, emergency overflow weir, and riprap plunge pool to dissipate energy and velocity before flowing towards the downstream wetlands.
- INF-03A - Stormtech SC-740 subsurface infiltration systems consisting of 30 units to promote treatment and infiltration. Overflow from the subsurface system flows into POND-03A.
- POND-03B – Wet extended detention pond used for peak runoff attenuation with a shallow 9” deep wet pool and filter bed to promote treatment and infiltration from contributing area.
  - o POND-03B will discharge through outlet control structure 03B (OCS 03B) with staged outlets to regulate outflow, emergency overflow weir, and riprap plunge pool to dissipate energy and velocity before flowing towards the downstream wetlands.
- INF-03B - Stormtech SC-740 subsurface infiltration systems consisting of 40 units to promote treatment and infiltration. Overflow from the subsurface system flows into POND-03B.

The combination of subsurface infiltration systems and wet extended detention ponds have been sized to attenuate peak flow rates and volumes as compared to pre-development conditions for the 2-, 5-, 10-, 25-, 50-, and 100-year storm events.

| STORM<br>EVENT | AREA 01        |                     |                 | AREA 02        |                     |                 | AREA 03        |                     |                 | TOTAL SITE  |                           |                 |
|----------------|----------------|---------------------|-----------------|----------------|---------------------|-----------------|----------------|---------------------|-----------------|-------------|---------------------------|-----------------|
|                | SITE-<br>EX-01 | SITE-<br>PR-<br>01A | EX<br>vs.<br>PR | SITE-<br>EX-02 | SITE-<br>PR-<br>02A | EX<br>vs.<br>PR | SITE-<br>EX-03 | SITE-<br>PR-<br>03A | EX<br>vs.<br>PR | SITE-<br>EX | SITE-<br>PR-<br>DET-<br>A | EX<br>vs.<br>PR |
| 2-yr           | 1.15           | 1.15                | 0.00            | 0.30           | 0.37                | 0.07            | 0.81           | 0.81                | 0.00            | 2.26        | 2.24                      | -0.02           |
| 5-yr           | 3.09           | 2.53                | -0.56           | 0.86           | 0.75                | -0.11           | 2.34           | 2.21                | -0.13           | 6.29        | 4.96                      | -1.33           |
| 10-yr          | 5.20           | 3.89                | -1.31           | 1.49           | 1.62                | 0.13            | 4.03           | 4.38                | 0.35            | 10.71       | 8.91                      | -1.80           |
| 25-yr          | 8.63           | 5.89                | -2.74           | 2.52           | 3.34                | 0.82            | 6.83           | 7.76                | 0.93            | 17.98       | 16.56                     | -1.42           |
| 50-yr          | 11.45          | 7.83                | -3.62           | 3.37           | 4.33                | 0.96            | 9.14           | 11.17               | 2.03            | 23.95       | 22.90                     | -1.05           |
| 100-yr         | 14.69          | 10.00               | -4.69           | 4.36           | 5.31                | 0.95            | 11.82          | 14.23               | 2.41            | 30.85       | 28.81                     | -2.04           |

TABLE 2: PEAK FLOW COMPARISON - EXISTING VS. PROPOSED (WITH DETENTION)

As shown in Table 2 above, incorporation of the infiltration and detention systems into the proposed development results in a decrease in peak flow rates as compared to existing conditions for the entire Site. Although there are minor increases within with the individual subareas, these increases are eliminated for entire Site due to offsetting storage capacity and times to peak flow. The plan provides for zero net increase in peak flow rates and volumes for all storms up to the 100-year event.

## STORMWATER QUALITY & TREATMENT

The proposed development has been designed to reduce stormwater runoff and pollutant loads to the maximum extent possible and to treat the required water quality volume and flow per the CT DEEP 2004 Stormwater Quality Manual (2004 DEEP Manual). The proposed measures incorporated into the plan include:

- Maximize conservation and preservation of natural features. Impervious surfaces and buildings generally fall within historic limits of site disturbance activities. Stone walls, rock outcrops, and specimen trees have been preserved.
- Minimize clearing and grubbing maintain native vegetation on site. Where clearing of the mature tree vegetation is proposed within 50’ of the delineated inland wetlands, native shrubs

and/or conservation seed mixes are proposed to provide a minimum 50' upland protection zone as recommended in the JBWMP.

- Minimize building footprint. Buildings have been designed to accommodate site grades and unit areas were condensed to maximizing the number of units in a limit footprint area.
- Minimize impervious surfaces for roadways and parking. Curb cuts and access drives are the minimum required for adequate site access and the proposed parking quantity has been reduced to the minimum allowed per zoning requirements. Impervious area totals 21% of the total site, which is on the low end of the 18% to 30% impervious cover referenced in Section 3.1.2.3 of the JBWMP for “intermediate” level uses such as multi-family.
- Disconnect impervious areas where possible, such as sidewalks. Disconnected impervious areas were not subtracted from the treatment calculations as a conservative measure.
- Collect, treat, and infiltrate to encourage groundwater recharge including the incorporation of base level and secondary controls to improve water quality as recommended by the JBWMP.

#### WATER QUALITY VOLUME & FLOW (Drainage Area Map DA-03A)

Water quality volumes and flows were calculated for all proposed impervious surfaces for the driveway, parking and building areas in accordance with the 2004 DEEP Manual.

| AREA     | DA    | IA    | WQV     | WQF   | WQF  | PROPOSED TREATMENT |       |      |      |          |
|----------|-------|-------|---------|-------|------|--------------------|-------|------|------|----------|
| Label    | acre  | acre  | acre-ft | cfs   | sf   | Method             | Vol   | Flow | Area | Note     |
| POND 01A | 4.334 | 1.626 | 0.140   | 1.000 | N/A  | Sediment Forebay   | 0.16  | N/A  | N/A  | 116% WQV |
| POND 01A | 4.334 | 1.626 | 0.140   | 1.000 | 1043 | Filter Bed         | N/A   | N/A  | 1200 | 115% WQF |
| INF 01B  | 0.930 | 0.569 | 0.047   | 0.524 | N/A  | SC-740 Isolator    | N/A   | 1.2  | N/A  | 229% WQV |
| POND 02A | 2.877 | 1.454 | 0.121   | 0.953 | N/A  | Sediment Forebay   | 0.055 | N/A  | N/A  | 46% WQV  |
| POND 02A | 2.877 | 1.454 | 0.121   | 0.953 | 753  | Filter Bed         | N/A   | N/A  | 2100 | 278% WQF |
| POND 03A | 0.631 | 0.272 | 0.023   | 0.250 | N/A  | Sediment Forebay   | 0.041 | N/A  | N/A  | 179% WQV |
| POND 03A | 0.631 | 0.272 | 0.023   | 0.250 | 164  | Filter Bed         | N/A   | N/A  | 1000 | 610% WQF |
| INF 03A  | 0.823 | 0.628 | 0.051   | 0.483 | N/A  | SC-740 Isolator    | N/A   | 1.5  | N/A  | 310% WQV |
| POND 03B | 1.897 | 0.465 | 0.043   | 0.369 | N/A  | Sediment Forebay   | N/A   | N/A  | N/A  | N/A [1]  |
| POND 03B | 1.897 | 0.465 | 0.043   | 0.369 | 304  | Filter Bed         | N/A   | N/A  | 1400 | 461% WQF |
| INF 03B  | 0.750 | 0.601 | 0.048   | 0.542 | N/A  | SC-740 Isolator    | N/A   | 1.2  | N/A  | 221% WQV |

**TABLE 3: PROPOSED TREATMENT SUMMARY**

1. No Sediment Load from Building Roof or Patio. Runoff flows through vegetated filter swale to filter bed.

As shown in Table 3 above, the proposed treatment measures will adequately retain the calculated water quality volume and/or treat the calculated water quality flow, removing 80% or more of total suspended solids and floatable debris for the first inch of rainfall before discharging to the Site wetlands

#### GROUNDWATER RECHARGE VOLUME

Existing non-wetland soils are classified as Charlton-Chatfield complex (HSG B) and the wetland soils as Ridgebury, Leicester, and Whitman (HSG D). Required Groundwater Recharge Volumes (GRV) were calculated in accordance with 2004 DEEP Manual based upon the area of each Hydrologic Soil Group.

GRV (required) = 0.076 acre-feet



GRV (provided) = 0.272 acre-feet

The combination of sediment and filtration basins, subsurface infiltration systems, and shallow depressions within each wet extended detention pond provide adequate capacity to fully retain nearly 4 times the recommended groundwater recharge volume, thereby exceeding the GRV requirement.

## CONCLUSION

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There will be no increase in peak flow rates or volumes discharging to the downgradient wetlands or adjacent properties. The stormwater network will maintain approved drainage patterns and utilize a combination of subsurface infiltration and detention ponds to regulate any increase in run-off on site. Stormwater will be treated in accordance with the CT DEEP 2004 Stormwater Quality Manual.

No adverse impacts to the site, adjacent wetlands, or municipal systems are anticipated.





WATERFORD WOODS APARTMENTS PHASE 2  
384 & 394 WILLETTS AVENUE EXT.  
WATERFORD, CONNECTICUT

## **APPENDIX A DRAINAGE AREA MAPS**

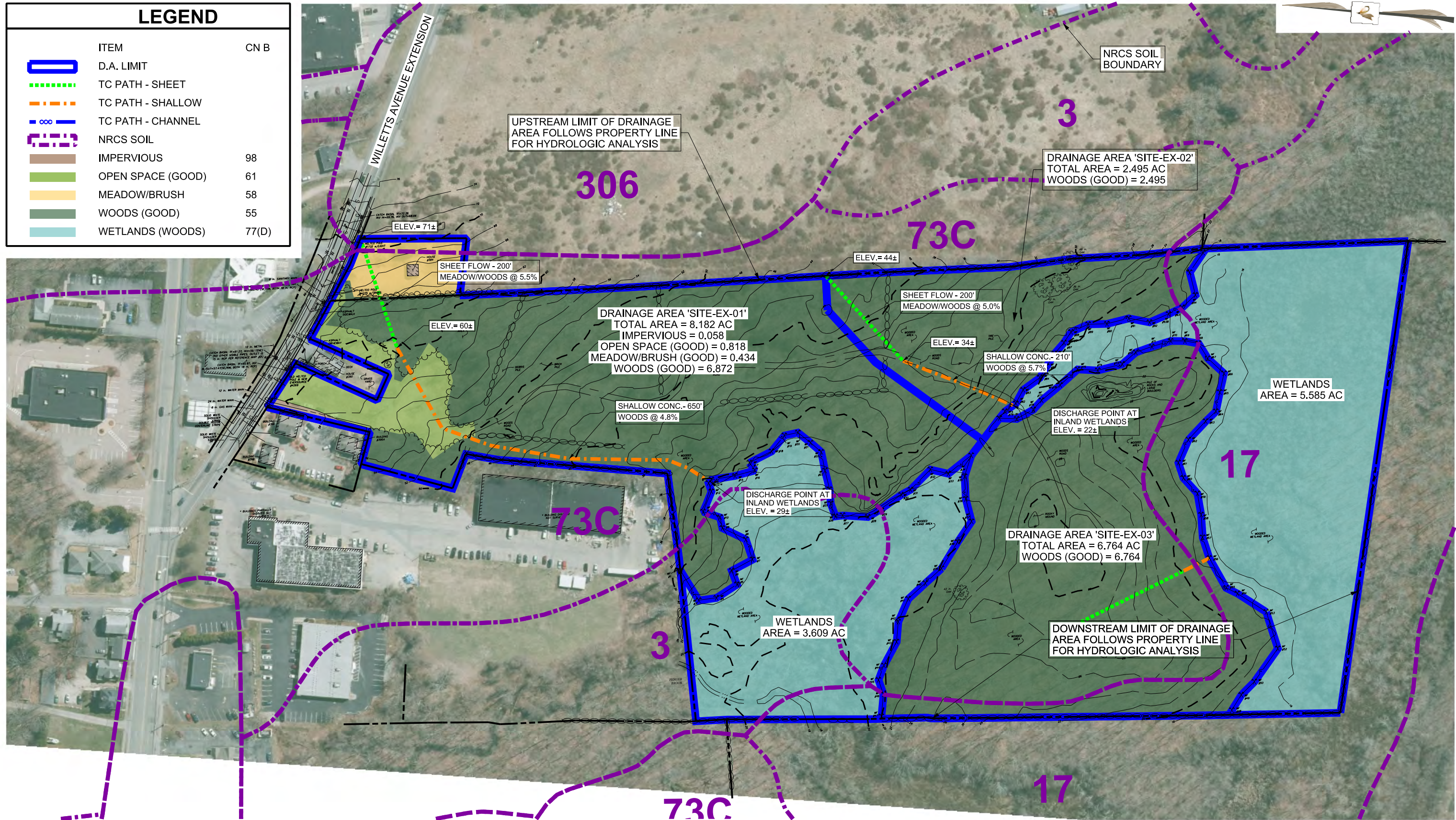
Existing Conditions DA-01A  
Proposed Conditions DA-02A  
Proposed Detention DA 03A





LEGEND

| ITEM | CN B                   |
|------|------------------------|
|      | D.A. LIMIT             |
|      | TC PATH - SHEET        |
|      | TC PATH - SHALLOW      |
|      | TC PATH - CHANNEL      |
|      | NRCS SOIL              |
|      | IMPERVIOUS 98          |
|      | OPEN SPACE (GOOD) 61   |
|      | MEADOW/BRUSH 58        |
|      | WOODS (GOOD) 55        |
|      | WETLANDS (WOODS) 77(D) |



SCALE: 1" = 160'

PROJECT NO:

00096 - 001

DATE:

11/18/20

SHEET NO:

DA-01A

CONTACT INFORMATION

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WATERFORD WOODS

PREPARED FOR SIG CON ASSOCIATES, LLC

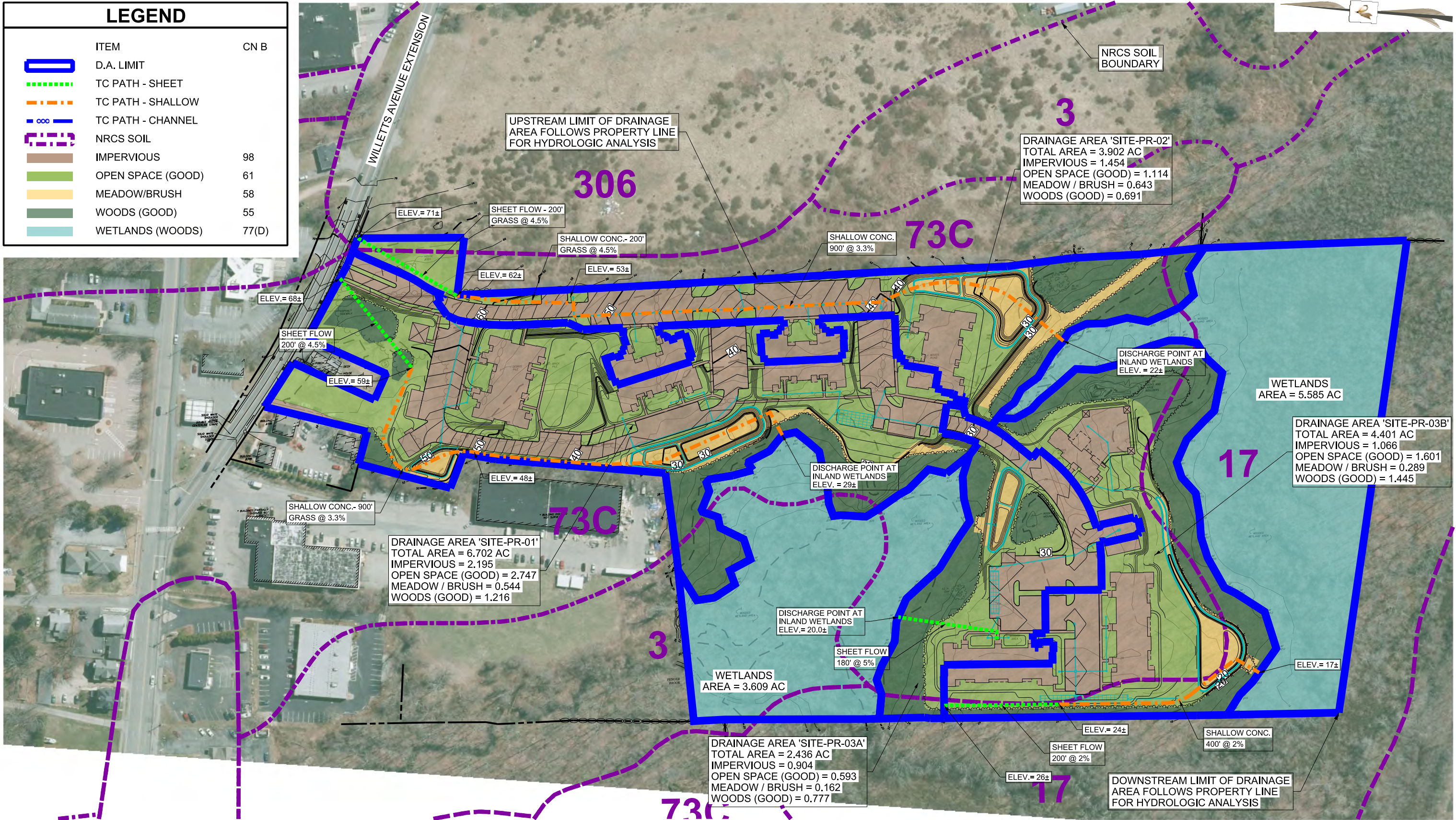
DRAINAGE MAP - EXISTING CONDITIONS SITE ONLY

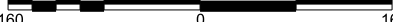
384 & 394 WILLETTS AVE. EXT.

WATERFORD, CT



| LEGEND                                                                            |                   |       |
|-----------------------------------------------------------------------------------|-------------------|-------|
| ITEM                                                                              |                   | CN B  |
|  | D.A. LIMIT        |       |
|  | TC PATH - SHEET   |       |
|  | TC PATH - SHALLOW |       |
|  | TC PATH - CHANNEL |       |
|  | NRCS SOIL         |       |
|  | IMPERVIOUS        | 98    |
|  | OPEN SPACE (GOOD) | 61    |
|  | MEADOW/BRUSH      | 58    |
|  | WOODS (GOOD)      | 55    |
|  | WETLANDS (WOODS)  | 77(D) |



|                                                                                     |                   |                     |
|-------------------------------------------------------------------------------------|-------------------|---------------------|
| SCALE: 1" = 160'                                                                    |                   |                     |
|  |                   |                     |
| PROJECT NO:<br>00096 - 001                                                          | DATE:<br>02/17/22 | SHEET NO:<br>DA-02A |



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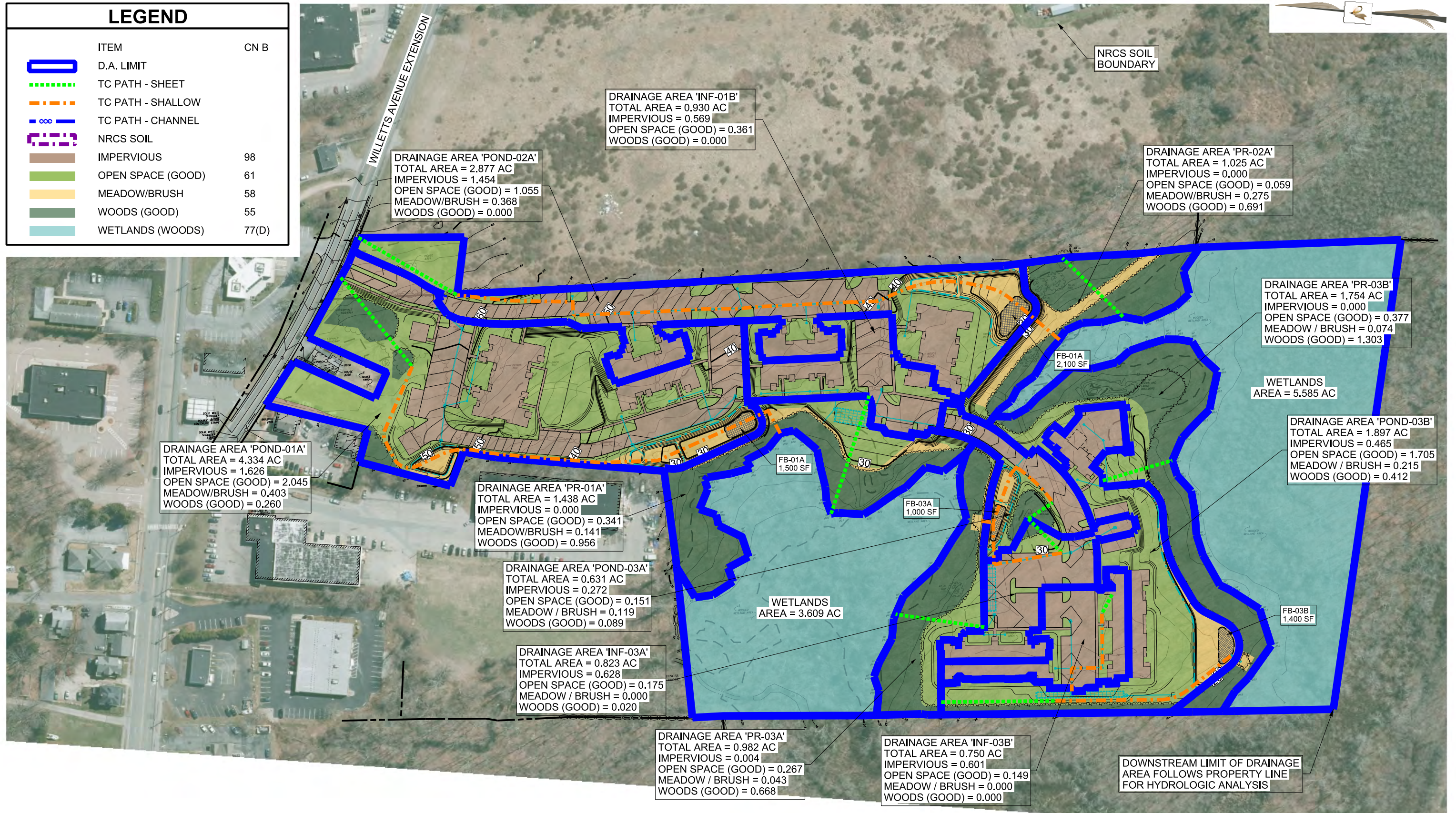
**WATERFORD WOODS**  
PREPARED FOR SIG CON ASSOCIATES, LLC

**DRAINAGE MAP - PROPOSED CONDITIONS SITE ONLY**

384 & 394 WILLETTS AVE. EXT. WATERFORD, CT



| LEGEND                                                                            |                   |       |
|-----------------------------------------------------------------------------------|-------------------|-------|
|                                                                                   | ITEM              | CN B  |
|  | D.A. LIMIT        |       |
|  | TC PATH - SHEET   |       |
|  | TC PATH - SHALLOW |       |
|  | TC PATH - CHANNEL |       |
|  | NRCS SOIL         |       |
|  | IMPERVIOUS        | 98    |
|  | OPEN SPACE (GOOD) | 61    |
|  | MEADOW/BRUSH      | 58    |
|  | WOODS (GOOD)      | 55    |
|  | WETLANDS (WOODS)  | 77(D) |



|                            |                   |                     |
|----------------------------|-------------------|---------------------|
| PROJECT NO:<br>00096 - 001 | DATE:<br>02/17/22 | SHEET NO:<br>DA-03A |
|----------------------------|-------------------|---------------------|



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PREPARED FOR SIG CON ASSOCIATES, LLC

## 384 &amp; 394 WILLETTS AVE. EXT.

WATERFORD, CT







WATERFORD WOODS APARTMENTS PHASE 2  
384 & 394 WILLETTS AVENUE EXT.  
WATERFORD, CONNECTICUT

## **APPENDIX B**

# **HYDROLOGIC COMPUTATIONS**

HYDROLOGY STUDIO REPORT





# Table of Contents

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

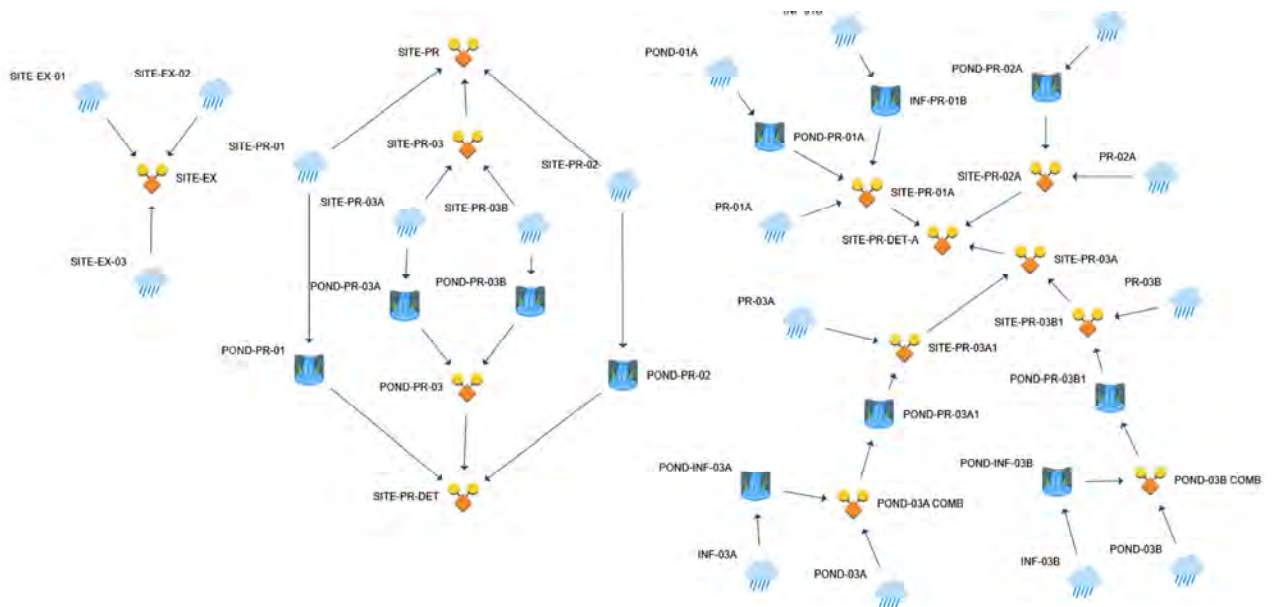
|                                          |           |
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# Basin Model

Hydrology Studio v 3.0.0.21

Project Name: Waterford Woods

02-17-2022





# Hydrograph by Return Period

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Outflow (cfs) |       |      |       |       |       |       |        |
|----------|-----------------|-----------------|--------------------|-------|------|-------|-------|-------|-------|--------|
|          |                 |                 | 1-yr               | 2-yr  | 3-yr | 5-yr  | 10-yr | 25-yr | 50-yr | 100-yr |
| 1        | NRCS Runoff     | EX-01           |                    | 9.328 |      | 20.10 | 30.75 | 47.38 | 60.64 | 75.64  |
| 2        | NRCS Runoff     | PR-01           |                    | 14.24 |      | 27.12 | 39.27 | 57.79 | 72.27 | 88.49  |
| 3        | NRCS Runoff     | SITE-EX-01      |                    | 1.146 |      | 3.092 | 5.196 | 8.632 | 11.45 | 14.69  |
| 4        | NRCS Runoff     | SITE-EX-02      |                    | 0.299 |      | 0.861 | 1.486 | 2.519 | 3.372 | 4.359  |
| 5        | NRCS Runoff     | SITE-EX-03      |                    | 0.811 |      | 2.335 | 4.028 | 6.830 | 9.141 | 11.82  |
| 6        | Junction        | SITE-EX         |                    | 2.256 |      | 6.287 | 10.71 | 17.98 | 23.95 | 30.85  |
| 7        | NRCS Runoff     | SITE-PR-01      |                    | 4.634 |      | 7.681 | 10.41 | 14.45 | 17.52 | 20.89  |
| 8        | NRCS Runoff     | SITE-PR-02      |                    | 3.195 |      | 5.181 | 6.945 | 9.530 | 11.49 | 13.64  |
| 9        | NRCS Runoff     | SITE-PR-03B     |                    | 2.527 |      | 4.488 | 6.291 | 8.999 | 11.08 | 13.41  |
| 10       | NRCS Runoff     | SITE-PR-03A     |                    | 2.047 |      | 3.352 | 4.515 | 6.224 | 7.521 | 8.942  |
| 11       | Junction        | SITE-PR-03      |                    | 4.535 |      | 7.786 | 10.75 | 15.14 | 18.51 | 22.24  |
| 12       | Junction        | SITE-PR         |                    | 12.26 |      | 20.47 | 27.86 | 38.74 | 47.08 | 56.24  |
| 13       | Pond Route      | POND-PR-01      |                    | 0.658 |      | 2.596 | 3.861 | 6.874 | 10.70 | 11.48  |
| 14       | Pond Route      | POND-PR-02      |                    | 0.309 |      | 0.594 | 1.644 | 3.227 | 4.024 | 4.722  |
| 15       | Pond Route      | POND-PR-03A     |                    | 0.426 |      | 1.489 | 2.099 | 4.050 | 4.912 | 5.457  |
| 16       | Pond Route      | POND-PR-03B     |                    | 0.293 |      | 1.286 | 2.246 | 4.199 | 4.719 | 6.880  |
| 17       | Junction        | POND-PR-03      |                    | 0.692 |      | 2.696 | 4.287 | 8.136 | 9.497 | 12.16  |
| 18       | Junction        | SITE-PR-DET     |                    | 1.584 |      | 5.633 | 9.657 | 17.16 | 23.97 | 28.20  |
| 19       | NRCS Runoff     | PR-01A          |                    | 0.280 |      | 0.744 | 1.248 | 2.063 | 2.723 | 3.483  |
| 20       | NRCS Runoff     | POND-01A        |                    | 3.479 |      | 5.561 | 7.405 | 10.09 | 12.11 | 14.33  |
| 21       | NRCS Runoff     | INF-01B         |                    | 1.894 |      | 2.703 | 3.384 | 4.346 | 5.055 | 5.817  |
| 22       | NRCS Runoff     | PR-02A          |                    | 0.175 |      | 0.478 | 0.809 | 1.352 | 1.795 | 2.302  |
| 23       | NRCS Runoff     | POND-02A        |                    | 3.280 |      | 4.919 | 6.330 | 8.342 | 9.840 | 11.46  |
| 24       | NRCS Runoff     | PR-03A          |                    | 0.184 |      | 0.474 | 0.783 | 1.285 | 1.693 | 2.162  |
| 25       | NRCS Runoff     | POND-03A        |                    | 0.836 |      | 1.312 | 1.728 | 2.329 | 2.781 | 3.272  |
| 26       | NRCS Runoff     | INF-03A         |                    | 1.671 |      | 2.272 | 2.768 | 3.457 | 3.961 | 4.502  |
| 27       | NRCS Runoff     | PR-03B          |                    | 0.326 |      | 0.880 | 1.486 | 2.472 | 3.272 | 4.192  |
| 28       | NRCS Runoff     | POND-03B        |                    | 1.613 |      | 3.010 | 4.310 | 6.283 | 7.814 | 9.517  |
| 29       | NRCS Runoff     | INF-03B         |                    | 1.978 |      | 2.651 | 3.204 | 3.971 | 4.533 | 5.135  |
| 30       | Pond Route      | INF-PR-01B      |                    | 0.719 |      | 1.637 | 2.399 | 3.112 | 4.145 | 4.975  |
| 31       | Pond Route      | POND-PR-01A     |                    | 0.404 |      | 1.262 | 2.605 | 3.890 | 4.633 | 7.649  |
| 32       | Junction        | SITE-PR-01A     |                    | 1.145 |      | 2.531 | 3.889 | 5.889 | 7.828 | 9.996  |
| 33       | Pond Route      | POND-PR-02A     |                    | 0.318 |      | 0.521 | 1.416 | 2.855 | 3.616 | 4.217  |
| 34       | Pond Route      | POND-INF-03A    |                    | 0.938 |      | 1.878 | 2.582 | 3.338 | 3.846 | 4.392  |
| 35       | Junction        | POND-03A COMB   |                    | 1.416 |      | 2.616 | 3.847 | 5.320 | 6.261 | 7.253  |
| 36       | Pond Route      | POND-PR-03A1    |                    | 0.310 |      | 0.856 | 1.427 | 2.080 | 3.058 | 4.137  |

## Hydrograph by Return Period

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]

# Hydrograph 2-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|----------|-----------------|-----------------|-----------------|--------------------|--------------------------|---------------|------------------------|------------------------|
| 1        | NRCS Runoff     | EX-01           | 9.328           | 12.65              | 78,149                   | ----          |                        |                        |
| 2        | NRCS Runoff     | PR-01           | 14.24           | 12.58              | 102,734                  | ----          |                        |                        |
| 3        | NRCS Runoff     | SITE-EX-01      | 1.146           | 12.60              | 10,688                   | ----          |                        |                        |
| 4        | NRCS Runoff     | SITE-EX-02      | 0.299           | 12.60              | 2,921                    | ----          |                        |                        |
| 5        | NRCS Runoff     | SITE-EX-03      | 0.811           | 12.60              | 7,918                    | ----          |                        |                        |
| 6        | Junction        | SITE-EX         | 2.256           | 12.60              | 21,526                   | 3, 4, 5       |                        |                        |
| 7        | NRCS Runoff     | SITE-PR-01      | 4.634           | 12.38              | 25,874                   | ----          |                        |                        |
| 8        | NRCS Runoff     | SITE-PR-02      | 3.195           | 12.32              | 16,236                   | ----          |                        |                        |
| 9        | NRCS Runoff     | SITE-PR-03B     | 2.527           | 12.35              | 13,751                   | ----          |                        |                        |
| 10       | NRCS Runoff     | SITE-PR-03A     | 2.047           | 12.27              | 9,917                    | ----          |                        |                        |
| 11       | Junction        | SITE-PR-03      | 4.535           | 12.32              | 23,668                   | 9, 10         |                        |                        |
| 12       | Junction        | SITE-PR         | 12.26           | 12.35              | 65,778                   | 7, 8, 11      |                        |                        |
| 13       | Pond Route      | POND-PR-01      | 0.658           | 14.10              | 20,126                   | 7             | 31.66                  | 12,091                 |
| 14       | Pond Route      | POND-PR-02      | 0.309           | 14.78              | 9,471                    | 8             | 29.21                  | 8,333                  |
| 15       | Pond Route      | POND-PR-03A     | 0.426           | 12.92              | 6,064                    | 10            | 22.25                  | 3,751                  |
| 16       | Pond Route      | POND-PR-03B     | 0.293           | 13.87              | 6,480                    | 9             | 18.71                  | 5,440                  |
| 17       | Junction        | POND-PR-03      | 0.692           | 12.98              | 12,544                   | 15, 16        |                        |                        |
| 18       | Junction        | SITE-PR-DET     | 1.584           | 13.95              | 42,140                   | 13, 14, 17    |                        |                        |
| 19       | NRCS Runoff     | PR-01A          | 0.280           | 12.37              | 2,009                    | ----          |                        |                        |
| 20       | NRCS Runoff     | POND-01A        | 3.479           | 12.38              | 18,977                   | ----          |                        |                        |
| 21       | NRCS Runoff     | INF-01B         | 1.894           | 12.10              | 6,085                    | ----          |                        |                        |
| 22       | NRCS Runoff     | PR-02A          | 0.175           | 12.40              | 1,326                    | ----          |                        |                        |
| 23       | NRCS Runoff     | POND-02A        | 3.280           | 12.30              | 16,018                   | ----          |                        |                        |
| 24       | NRCS Runoff     | PR-03A          | 0.184           | 12.45              | 1,396                    | ----          |                        |                        |
| 25       | NRCS Runoff     | POND-03A        | 0.836           | 12.12              | 2,945                    | ----          |                        |                        |
| 26       | NRCS Runoff     | INF-03A         | 1.671           | 12.18              | 6,959                    | ----          |                        |                        |
| 27       | NRCS Runoff     | PR-03B          | 0.326           | 12.37              | 2,384                    | ----          |                        |                        |
| 28       | NRCS Runoff     | POND-03B        | 1.613           | 12.23              | 7,848                    | ----          |                        |                        |
| 29       | NRCS Runoff     | INF-03B         | 1.978           | 12.08              | 6,483                    | ----          |                        |                        |
| 30       | Pond Route      | INF-PR-01B      | 0.719           | 12.35              | 3,842                    | 21            | 30.17                  | 1,806                  |
| 31       | Pond Route      | POND-PR-01A     | 0.404           | 14.38              | 13,603                   | 20            | 31.26                  | 9,262                  |
| 32       | Junction        | SITE-PR-01A     | 1.145           | 12.42              | 19,455                   | 19, 30, 31    |                        |                        |
| 33       | Pond Route      | POND-PR-02A     | 0.318           | 14.23              | 9,224                    | 23            | 29.24                  | 8,544                  |
| 34       | Pond Route      | POND-INF-03A    | 0.938           | 12.40              | 3,279                    | 26            | 24.53                  | 1,713                  |
| 35       | Junction        | POND-03A COMB   | 1.416           | 12.18              | 6,225                    | 25, 34        |                        |                        |
| 36       | Pond Route      | POND-PR-03A1    | 0.310           | 13.10              | 3,238                    | 35            | 22.07                  | 3,177                  |



## Hydrograph 2-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]

# Hydrograph 5-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|----------|-----------------|-----------------|-----------------|--------------------|--------------------------|---------------|------------------------|------------------------|
| 1        | NRCS Runoff     | EX-01           | 20.10           | 12.58              | 143,800                  | ----          |                        |                        |
| 2        | NRCS Runoff     | PR-01           | 27.12           | 12.53              | 177,649                  | ----          |                        |                        |
| 3        | NRCS Runoff     | SITE-EX-01      | 3.092           | 12.52              | 21,793                   | ----          |                        |                        |
| 4        | NRCS Runoff     | SITE-EX-02      | 0.861           | 12.50              | 6,121                    | ----          |                        |                        |
| 5        | NRCS Runoff     | SITE-EX-03      | 2.335           | 12.50              | 16,594                   | ----          |                        |                        |
| 6        | Junction        | SITE-EX         | 6.287           | 12.50              | 44,508                   | 3, 4, 5       |                        |                        |
| 7        | NRCS Runoff     | SITE-PR-01      | 7.681           | 12.37              | 41,240                   | ----          |                        |                        |
| 8        | NRCS Runoff     | SITE-PR-02      | 5.181           | 12.30              | 25,500                   | ----          |                        |                        |
| 9        | NRCS Runoff     | SITE-PR-03B     | 4.488           | 12.32              | 22,872                   | ----          |                        |                        |
| 10       | NRCS Runoff     | SITE-PR-03A     | 3.352           | 12.27              | 15,672                   | ----          |                        |                        |
| 11       | Junction        | SITE-PR-03      | 7.786           | 12.30              | 38,543                   | 9, 10         |                        |                        |
| 12       | Junction        | SITE-PR         | 20.47           | 12.32              | 105,283                  | 7, 8, 11      |                        |                        |
| 13       | Pond Route      | POND-PR-01      | 2.596           | 12.90              | 35,123                   | 7             | 32.22                  | 16,384                 |
| 14       | Pond Route      | POND-PR-02      | 0.594           | 14.02              | 18,205                   | 8             | 29.95                  | 13,149                 |
| 15       | Pond Route      | POND-PR-03A     | 1.489           | 12.62              | 11,505                   | 10            | 22.74                  | 5,239                  |
| 16       | Pond Route      | POND-PR-03B     | 1.286           | 12.85              | 14,806                   | 9             | 19.18                  | 8,265                  |
| 17       | Junction        | POND-PR-03      | 2.696           | 12.72              | 26,312                   | 15, 16        |                        |                        |
| 18       | Junction        | SITE-PR-DET     | 5.633           | 12.82              | 79,639                   | 13, 14, 17    |                        |                        |
| 19       | NRCS Runoff     | PR-01A          | 0.744           | 12.27              | 4,031                    | ----          |                        |                        |
| 20       | NRCS Runoff     | POND-01A        | 5.561           | 12.37              | 29,511                   | ----          |                        |                        |
| 21       | NRCS Runoff     | INF-01B         | 2.703           | 12.10              | 8,721                    | ----          |                        |                        |
| 22       | NRCS Runoff     | PR-02A          | 0.478           | 12.30              | 2,698                    | ----          |                        |                        |
| 23       | NRCS Runoff     | POND-02A        | 4.919           | 12.28              | 23,786                   | ----          |                        |                        |
| 24       | NRCS Runoff     | PR-03A          | 0.474           | 12.35              | 2,786                    | ----          |                        |                        |
| 25       | NRCS Runoff     | POND-03A        | 1.312           | 12.12              | 4,524                    | ----          |                        |                        |
| 26       | NRCS Runoff     | INF-03A         | 2.272           | 12.18              | 9,564                    | ----          |                        |                        |
| 27       | NRCS Runoff     | PR-03B          | 0.880           | 12.27              | 4,818                    | ----          |                        |                        |
| 28       | NRCS Runoff     | POND-03B        | 3.010           | 12.22              | 13,388                   | ----          |                        |                        |
| 29       | NRCS Runoff     | INF-03B         | 2.651           | 12.08              | 8,807                    | ----          |                        |                        |
| 30       | Pond Route      | INF-PR-01B      | 1.637           | 12.20              | 6,219                    | 21            | 30.55                  | 2,212                  |
| 31       | Pond Route      | POND-PR-01A     | 1.262           | 13.08              | 23,658                   | 20            | 31.86                  | 13,517                 |
| 32       | Junction        | SITE-PR-01A     | 2.531           | 12.23              | 33,908                   | 19, 30, 31    |                        |                        |
| 33       | Pond Route      | POND-PR-02A     | 0.521           | 13.92              | 16,512                   | 23            | 29.91                  | 12,890                 |
| 34       | Pond Route      | POND-INF-03A    | 1.878           | 12.28              | 5,334                    | 26            | 24.98                  | 2,037                  |
| 35       | Junction        | POND-03A COMB   | 2.616           | 12.27              | 9,858                    | 25, 34        |                        |                        |
| 36       | Pond Route      | POND-PR-03A1    | 0.856           | 12.83              | 6,468                    | 35            | 22.46                  | 4,381                  |

## Hydrograph 5-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]

# Hydrograph 10-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|----------|-----------------|-----------------|-----------------|--------------------|--------------------------|---------------|------------------------|------------------------|
| 1        | NRCS Runoff     | EX-01           | 30.75           | 12.55              | 207,139                  | ----          |                        |                        |
| 2        | NRCS Runoff     | PR-01           | 39.27           | 12.50              | 247,960                  | ----          |                        |                        |
| 3        | NRCS Runoff     | SITE-EX-01      | 5.196           | 12.47              | 32,965                   | ----          |                        |                        |
| 4        | NRCS Runoff     | SITE-EX-02      | 1.486           | 12.45              | 9,376                    | ----          |                        |                        |
| 5        | NRCS Runoff     | SITE-EX-03      | 4.028           | 12.45              | 25,418                   | ----          |                        |                        |
| 6        | Junction        | SITE-EX         | 10.71           | 12.47              | 67,759                   | 3, 4, 5       |                        |                        |
| 7        | NRCS Runoff     | SITE-PR-01      | 10.41           | 12.35              | 55,113                   | ----          |                        |                        |
| 8        | NRCS Runoff     | SITE-PR-02      | 6.945           | 12.30              | 33,804                   | ----          |                        |                        |
| 9        | NRCS Runoff     | SITE-PR-03B     | 6.291           | 12.30              | 31,278                   | ----          |                        |                        |
| 10       | NRCS Runoff     | SITE-PR-03A     | 4.515           | 12.25              | 20,846                   | ----          |                        |                        |
| 11       | Junction        | SITE-PR-03      | 10.75           | 12.28              | 52,123                   | 9, 10         |                        |                        |
| 12       | Junction        | SITE-PR         | 27.86           | 12.32              | 141,040                  | 7, 8, 11      |                        |                        |
| 13       | Pond Route      | POND-PR-01      | 3.861           | 12.85              | 48,730                   | 7             | 32.81                  | 21,212                 |
| 14       | Pond Route      | POND-PR-02      | 1.644           | 12.92              | 26,263                   | 8             | 30.27                  | 15,635                 |
| 15       | Pond Route      | POND-PR-03A     | 2.099           | 12.60              | 16,451                   | 10            | 23.19                  | 6,713                  |
| 16       | Pond Route      | POND-PR-03B     | 2.246           | 12.75              | 22,657                   | 9             | 19.60                  | 11,071                 |
| 17       | Junction        | POND-PR-03      | 4.287           | 12.72              | 39,108                   | 15, 16        |                        |                        |
| 18       | Junction        | SITE-PR-DET     | 9.657           | 12.80              | 114,101                  | 13, 14, 17    |                        |                        |
| 19       | NRCS Runoff     | PR-01A          | 1.248           | 12.23              | 6,053                    | ----          |                        |                        |
| 20       | NRCS Runoff     | POND-01A        | 7.405           | 12.35              | 38,906                   | ----          |                        |                        |
| 21       | NRCS Runoff     | INF-01B         | 3.384           | 12.08              | 10,980                   | ----          |                        |                        |
| 22       | NRCS Runoff     | PR-02A          | 0.809           | 12.25              | 4,077                    | ----          |                        |                        |
| 23       | NRCS Runoff     | POND-02A        | 6.330           | 12.28              | 30,558                   | ----          |                        |                        |
| 24       | NRCS Runoff     | PR-03A          | 0.783           | 12.32              | 4,174                    | ----          |                        |                        |
| 25       | NRCS Runoff     | POND-03A        | 1.728           | 12.12              | 5,923                    | ----          |                        |                        |
| 26       | NRCS Runoff     | INF-03A         | 2.768           | 12.18              | 11,757                   | ----          |                        |                        |
| 27       | NRCS Runoff     | PR-03B          | 1.486           | 12.23              | 7,258                    | ----          |                        |                        |
| 28       | NRCS Runoff     | POND-03B        | 4.310           | 12.20              | 18,555                   | ----          |                        |                        |
| 29       | NRCS Runoff     | INF-03B         | 3.204           | 12.08              | 10,755                   | ----          |                        |                        |
| 30       | Pond Route      | INF-PR-01B      | 2.399           | 12.18              | 8,338                    | 21            | 30.83                  | 2,486                  |
| 31       | Pond Route      | POND-PR-01A     | 2.605           | 12.87              | 32,813                   | 20            | 32.23                  | 16,412                 |
| 32       | Junction        | SITE-PR-01A     | 3.889           | 12.20              | 47,204                   | 19, 30, 31    |                        |                        |
| 33       | Pond Route      | POND-PR-02A     | 1.416           | 12.90              | 23,050                   | 23            | 30.21                  | 15,189                 |
| 34       | Pond Route      | POND-INF-03A    | 2.582           | 12.23              | 7,152                    | 26            | 25.07                  | 2,099                  |
| 35       | Junction        | POND-03A COMB   | 3.847           | 12.20              | 13,075                   | 25, 34        |                        |                        |
| 36       | Pond Route      | POND-PR-03A1    | 1.427           | 12.55              | 9,430                    | 35            | 22.71                  | 5,130                  |



# Hydrograph 10-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]

# Hydrograph 25-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|----------|-----------------|-----------------|-----------------|--------------------|--------------------------|---------------|------------------------|------------------------|
| 1        | NRCS Runoff     | EX-01           | 47.38           | 12.52              | 305,899                  | ----          |                        |                        |
| 2        | NRCS Runoff     | PR-01           | 57.79           | 12.48              | 355,425                  | ----          |                        |                        |
| 3        | NRCS Runoff     | SITE-EX-01      | 8.632           | 12.43              | 50,903                   | ----          |                        |                        |
| 4        | NRCS Runoff     | SITE-EX-02      | 2.519           | 12.42              | 14,640                   | ----          |                        |                        |
| 5        | NRCS Runoff     | SITE-EX-03      | 6.830           | 12.42              | 39,689                   | ----          |                        |                        |
| 6        | Junction        | SITE-EX         | 17.98           | 12.42              | 105,232                  | 3, 4, 5       |                        |                        |
| 7        | NRCS Runoff     | SITE-PR-01      | 14.45           | 12.35              | 75,721                   | ----          |                        |                        |
| 8        | NRCS Runoff     | SITE-PR-02      | 9.530           | 12.28              | 46,072                   | ----          |                        |                        |
| 9        | NRCS Runoff     | SITE-PR-03B     | 8.999           | 12.30              | 43,955                   | ----          |                        |                        |
| 10       | NRCS Runoff     | SITE-PR-03A     | 6.224           | 12.25              | 28,507                   | ----          |                        |                        |
| 11       | Junction        | SITE-PR-03      | 15.14           | 12.28              | 72,462                   | 9, 10         |                        |                        |
| 12       | Junction        | SITE-PR         | 38.74           | 12.30              | 194,255                  | 7, 8, 11      |                        |                        |
| 13       | Pond Route      | POND-PR-01      | 6.874           | 12.77              | 69,011                   | 7             | 33.61                  | 28,481                 |
| 14       | Pond Route      | POND-PR-02      | 3.227           | 12.75              | 38,240                   | 8             | 30.79                  | 19,764                 |
| 15       | Pond Route      | POND-PR-03A     | 4.050           | 12.50              | 23,840                   | 10            | 23.61                  | 8,276                  |
| 16       | Pond Route      | POND-PR-03B     | 4.199           | 12.67              | 34,612                   | 9             | 20.08                  | 14,417                 |
| 17       | Junction        | POND-PR-03      | 8.136           | 12.53              | 58,451                   | 15, 16        |                        |                        |
| 18       | Junction        | SITE-PR-DET     | 17.16           | 12.73              | 165,702                  | 13, 14, 17    |                        |                        |
| 19       | NRCS Runoff     | PR-01A          | 2.063           | 12.22              | 9,286                    | ----          |                        |                        |
| 20       | NRCS Runoff     | POND-01A        | 10.09           | 12.35              | 52,736                   | ----          |                        |                        |
| 21       | NRCS Runoff     | INF-01B         | 4.346           | 12.08              | 14,211                   | ----          |                        |                        |
| 22       | NRCS Runoff     | PR-02A          | 1.352           | 12.23              | 6,290                    | ----          |                        |                        |
| 23       | NRCS Runoff     | POND-02A        | 8.342           | 12.28              | 40,362                   | ----          |                        |                        |
| 24       | NRCS Runoff     | PR-03A          | 1.285           | 12.28              | 6,389                    | ----          |                        |                        |
| 25       | NRCS Runoff     | POND-03A        | 2.329           | 12.12              | 7,974                    | ----          |                        |                        |
| 26       | NRCS Runoff     | INF-03A         | 3.457           | 12.18              | 14,853                   | ----          |                        |                        |
| 27       | NRCS Runoff     | PR-03B          | 2.472           | 12.22              | 11,167                   | ----          |                        |                        |
| 28       | NRCS Runoff     | POND-03B        | 6.283           | 12.20              | 26,416                   | ----          |                        |                        |
| 29       | NRCS Runoff     | INF-03B         | 3.971           | 12.08              | 13,496                   | ----          |                        |                        |
| 30       | Pond Route      | INF-PR-01B      | 3.112           | 12.17              | 11,409                   | 21            | 31.28                  | 2,869                  |
| 31       | Pond Route      | POND-PR-01A     | 3.890           | 12.82              | 46,346                   | 20            | 32.83                  | 21,355                 |
| 32       | Junction        | SITE-PR-01A     | 5.889           | 12.38              | 67,040                   | 19, 30, 31    |                        |                        |
| 33       | Pond Route      | POND-PR-02A     | 2.855           | 12.73              | 32,584                   | 23            | 30.63                  | 18,517                 |
| 34       | Pond Route      | POND-INF-03A    | 3.338           | 12.20              | 9,809                    | 26            | 25.17                  | 2,156                  |
| 35       | Junction        | POND-03A COMB   | 5.320           | 12.17              | 17,782                   | 25, 34        |                        |                        |
| 36       | Pond Route      | POND-PR-03A1    | 2.080           | 12.50              | 13,815                   | 35            | 23.17                  | 6,650                  |

# Hydrograph 25-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]

# Hydrograph 50-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|----------|-----------------|-----------------|-----------------|--------------------|--------------------------|---------------|------------------------|------------------------|
| 1        | NRCS Runoff     | EX-01           | 60.64           | 12.52              | 384,652                  | ----          |                        |                        |
| 2        | NRCS Runoff     | PR-01           | 72.27           | 12.48              | 439,881                  | ----          |                        |                        |
| 3        | NRCS Runoff     | SITE-EX-01      | 11.45           | 12.42              | 65,512                   | ----          |                        |                        |
| 4        | NRCS Runoff     | SITE-EX-02      | 3.372           | 12.40              | 18,948                   | ----          |                        |                        |
| 5        | NRCS Runoff     | SITE-EX-03      | 9.141           | 12.40              | 51,370                   | ----          |                        |                        |
| 6        | Junction        | SITE-EX         | 23.95           | 12.40              | 135,830                  | 3, 4, 5       |                        |                        |
| 7        | NRCS Runoff     | SITE-PR-01      | 17.52           | 12.35              | 91,581                   | ----          |                        |                        |
| 8        | NRCS Runoff     | SITE-PR-02      | 11.49           | 12.28              | 55,476                   | ----          |                        |                        |
| 9        | NRCS Runoff     | SITE-PR-03B     | 11.08           | 12.30              | 53,822                   | ----          |                        |                        |
| 10       | NRCS Runoff     | SITE-PR-03A     | 7.521           | 12.25              | 34,389                   | ----          |                        |                        |
| 11       | Junction        | SITE-PR-03      | 18.51           | 12.27              | 88,211                   | 9, 10         |                        |                        |
| 12       | Junction        | SITE-PR         | 47.08           | 12.30              | 235,267                  | 7, 8, 11      |                        |                        |
| 13       | Pond Route      | POND-PR-01      | 10.70           | 12.68              | 84,683                   | 7             | 33.91                  | 31,234                 |
| 14       | Pond Route      | POND-PR-02      | 4.024           | 12.73              | 47,446                   | 8             | 31.20                  | 23,354                 |
| 15       | Pond Route      | POND-PR-03A     | 4.912           | 12.50              | 29,538                   | 10            | 23.91                  | 9,404                  |
| 16       | Pond Route      | POND-PR-03B     | 4.719           | 12.68              | 43,941                   | 9             | 20.50                  | 17,843                 |
| 17       | Junction        | POND-PR-03      | 9.497           | 12.53              | 73,479                   | 15, 16        |                        |                        |
| 18       | Junction        | SITE-PR-DET     | 23.97           | 12.63              | 205,608                  | 13, 14, 17    |                        |                        |
| 19       | NRCS Runoff     | PR-01A          | 2.723           | 12.22              | 11,910                   | ----          |                        |                        |
| 20       | NRCS Runoff     | POND-01A        | 12.11           | 12.35              | 63,309                   | ----          |                        |                        |
| 21       | NRCS Runoff     | INF-01B         | 5.055           | 12.08              | 16,629                   | ----          |                        |                        |
| 22       | NRCS Runoff     | PR-02A          | 1.795           | 12.23              | 8,092                    | ----          |                        |                        |
| 23       | NRCS Runoff     | POND-02A        | 9.840           | 12.28              | 47,765                   | ----          |                        |                        |
| 24       | NRCS Runoff     | PR-03A          | 1.693           | 12.27              | 8,185                    | ----          |                        |                        |
| 25       | NRCS Runoff     | POND-03A        | 2.781           | 12.12              | 9,536                    | ----          |                        |                        |
| 26       | NRCS Runoff     | INF-03A         | 3.961           | 12.18              | 17,150                   | ----          |                        |                        |
| 27       | NRCS Runoff     | PR-03B          | 3.272           | 12.22              | 14,345                   | ----          |                        |                        |
| 28       | NRCS Runoff     | POND-03B        | 7.814           | 12.20              | 32,573                   | ----          |                        |                        |
| 29       | NRCS Runoff     | INF-03B         | 4.533           | 12.08              | 15,526                   | ----          |                        |                        |
| 30       | Pond Route      | INF-PR-01B      | 4.145           | 12.15              | 13,726                   | 21            | 31.58                  | 3,070                  |
| 31       | Pond Route      | POND-PR-01A     | 4.633           | 12.82              | 56,718                   | 20            | 33.29                  | 25,444                 |
| 32       | Junction        | SITE-PR-01A     | 7.828           | 12.33              | 82,354                   | 19, 30, 31    |                        |                        |
| 33       | Pond Route      | POND-PR-02A     | 3.616           | 12.70              | 39,805                   | 23            | 30.98                  | 21,260                 |
| 34       | Pond Route      | POND-INF-03A    | 3.846           | 12.20              | 11,841                   | 26            | 25.23                  | 2,192                  |
| 35       | Junction        | POND-03A COMB   | 6.261           | 12.15              | 21,377                   | 25, 34        |                        |                        |
| 36       | Pond Route      | POND-PR-03A1    | 3.058           | 12.43              | 17,200                   | 35            | 23.43                  | 7,626                  |

# Hydrograph 50-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]



# Hydrograph 100-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

| Hyd. No. | Hydrograph Type | Hydrograph Name | Peak Flow (cfs) | Time to Peak (hrs) | Hydrograph Volume (cuft) | Inflow Hyd(s) | Maximum Elevation (ft) | Maximum Storage (cuft) |
|----------|-----------------|-----------------|-----------------|--------------------|--------------------------|---------------|------------------------|------------------------|
| 1        | NRCS Runoff     | EX-01           | 75.64           | 12.50              | 474,030                  | ----          |                        |                        |
| 2        | NRCS Runoff     | PR-01           | 88.49           | 12.47              | 534,803                  | ----          |                        |                        |
| 3        | NRCS Runoff     | SITE-EX-01      | 14.69           | 12.40              | 82,325                   | ----          |                        |                        |
| 4        | NRCS Runoff     | SITE-EX-02      | 4.359           | 12.38              | 23,924                   | ----          |                        |                        |
| 5        | NRCS Runoff     | SITE-EX-03      | 11.82           | 12.38              | 64,858                   | ----          |                        |                        |
| 6        | Junction        | SITE-EX         | 30.85           | 12.38              | 171,106                  | 3, 4, 5       |                        |                        |
| 7        | NRCS Runoff     | SITE-PR-01      | 20.89           | 12.35              | 109,157                  | ----          |                        |                        |
| 8        | NRCS Runoff     | SITE-PR-02      | 13.64           | 12.28              | 65,871                   | ----          |                        |                        |
| 9        | NRCS Runoff     | SITE-PR-03B     | 13.41           | 12.28              | 64,838                   | ----          |                        |                        |
| 10       | NRCS Runoff     | SITE-PR-03A     | 8.942           | 12.25              | 40,899                   | ----          |                        |                        |
| 11       | Junction        | SITE-PR-03      | 22.24           | 12.27              | 105,737                  | 9, 10         |                        |                        |
| 12       | Junction        | SITE-PR         | 56.24           | 12.30              | 280,765                  | 7, 8, 11      |                        |                        |
| 13       | Pond Route      | POND-PR-01      | 11.48           | 12.70              | 102,085                  | 7             | 34.40                  | 36,302                 |
| 14       | Pond Route      | POND-PR-02      | 4.722           | 12.73              | 57,639                   | 8             | 31.63                  | 27,604                 |
| 15       | Pond Route      | POND-PR-03A     | 5.457           | 12.52              | 35,853                   | 10            | 24.30                  | 11,014                 |
| 16       | Pond Route      | POND-PR-03B     | 6.880           | 12.63              | 54,435                   | 9             | 20.88                  | 21,044                 |
| 17       | Junction        | POND-PR-03      | 12.16           | 12.60              | 90,289                   | 15, 16        |                        |                        |
| 18       | Junction        | SITE-PR-DET     | 28.20           | 12.63              | 250,013                  | 13, 14, 17    |                        |                        |
| 19       | NRCS Runoff     | PR-01A          | 3.483           | 12.20              | 14,925                   | ----          |                        |                        |
| 20       | NRCS Runoff     | POND-01A        | 14.33           | 12.33              | 74,976                   | ----          |                        |                        |
| 21       | NRCS Runoff     | INF-01B         | 5.817           | 12.08              | 19,261                   | ----          |                        |                        |
| 22       | NRCS Runoff     | PR-02A          | 2.302           | 12.22              | 10,165                   | ----          |                        |                        |
| 23       | NRCS Runoff     | POND-02A        | 11.46           | 12.28              | 55,870                   | ----          |                        |                        |
| 24       | NRCS Runoff     | PR-03A          | 2.162           | 12.27              | 10,248                   | ----          |                        |                        |
| 25       | NRCS Runoff     | POND-03A        | 3.272           | 12.12              | 11,257                   | ----          |                        |                        |
| 26       | NRCS Runoff     | INF-03A         | 4.502           | 12.18              | 19,636                   | ----          |                        |                        |
| 27       | NRCS Runoff     | PR-03B          | 4.192           | 12.20              | 17,999                   | ----          |                        |                        |
| 28       | NRCS Runoff     | POND-03B        | 9.517           | 12.20              | 39,478                   | ----          |                        |                        |
| 29       | NRCS Runoff     | INF-03B         | 5.135           | 12.08              | 17,720                   | ----          |                        |                        |
| 30       | Pond Route      | INF-PR-01B      | 4.975           | 12.15              | 16,261                   | 21            | 31.83                  | 3,218                  |
| 31       | Pond Route      | POND-PR-01A     | 7.649           | 12.72              | 68,193                   | 20            | 33.65                  | 28,865                 |
| 32       | Junction        | SITE-PR-01A     | 9.996           | 12.20              | 99,379                   | 19, 30, 31    |                        |                        |
| 33       | Pond Route      | POND-PR-02A     | 4.217           | 12.70              | 47,725                   | 23            | 31.31                  | 24,451                 |
| 34       | Pond Route      | POND-INF-03A    | 4.392           | 12.20              | 14,096                   | 26            | 25.29                  | 2,228                  |
| 35       | Junction        | POND-03A COMB   | 7.253           | 12.15              | 25,353                   | 25, 34        |                        |                        |
| 36       | Pond Route      | POND-PR-03A1    | 4.137           | 12.38              | 20,980                   | 35            | 23.63                  | 8,367                  |

# Hydrograph 100-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.21

02-17-2022

[illegible]

# IDF Report

IDF filename: NOAA Willetts Avenue.idf

Hydrology Studio v 3.0.0.21

02-17-2022

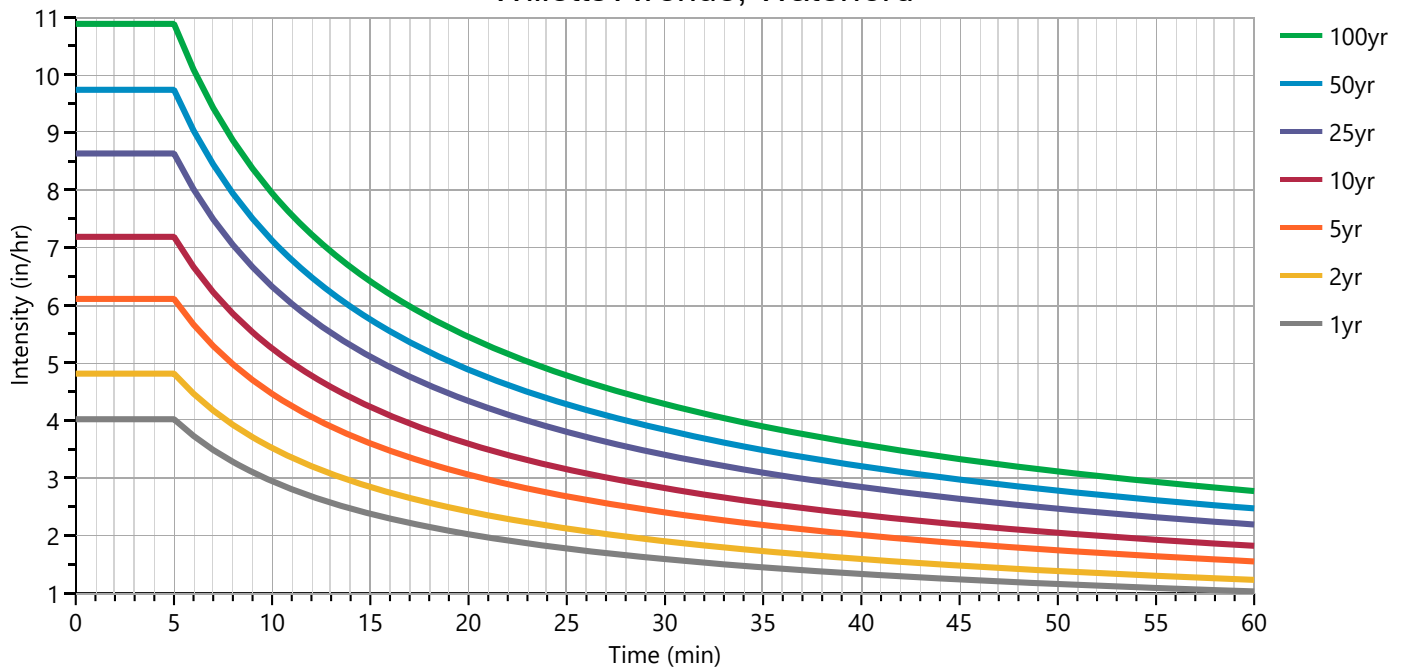
| Equation Coefficients | Intensity = B / (Tc + D)^E (in/hr) |         |        |         |         |         |         |         |  |
|-----------------------|------------------------------------|---------|--------|---------|---------|---------|---------|---------|--|
|                       | 1-yr                               | 2-yr    | 3-yr   | 5-yr    | 10-yr   | 25-yr   | 50-yr   | 100-yr  |  |
| <b>B</b>              | 17.3767                            | 20.8408 | 0.0000 | 26.6717 | 31.4579 | 38.9130 | 43.2178 | 46.6733 |  |
| <b>D</b>              | 3.6000                             | 3.6000  | 0.0000 | 3.6000  | 3.6000  | 3.8000  | 3.7000  | 3.5000  |  |
| <b>E</b>              | 0.6804                             | 0.6815  | 0.0000 | 0.6852  | 0.6863  | 0.6924  | 0.6890  | 0.6804  |  |

Minimum Tc = 5 minutes

| Tc (min)  | Intensity Values (in/hr) |      |      |      |       |       |       |        |  |
|-----------|--------------------------|------|------|------|-------|-------|-------|--------|--|
|           | 1-yr                     | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |  |
| <b>Cf</b> | 1.00                     | 1.00 | 1.00 | 1.00 | 1.00  | 1.00  | 1.00  | 1.00   |  |
| <b>5</b>  | 4.02                     | 4.81 | 0    | 6.11 | 7.18  | 8.63  | 9.74  | 10.88  |  |
| <b>10</b> | 2.94                     | 3.52 | 0    | 4.46 | 5.25  | 6.32  | 7.12  | 7.94   |  |
| <b>15</b> | 2.38                     | 2.84 | 0    | 3.60 | 4.23  | 5.10  | 5.75  | 6.41   |  |
| <b>20</b> | 2.02                     | 2.42 | 0    | 3.06 | 3.59  | 4.33  | 4.88  | 5.45   |  |
| <b>25</b> | 1.77                     | 2.12 | 0    | 2.68 | 3.15  | 3.80  | 4.28  | 4.78   |  |
| <b>30</b> | 1.59                     | 1.90 | 0    | 2.40 | 2.82  | 3.40  | 3.83  | 4.28   |  |
| <b>35</b> | 1.45                     | 1.73 | 0    | 2.18 | 2.56  | 3.09  | 3.48  | 3.89   |  |
| <b>40</b> | 1.33                     | 1.59 | 0    | 2.01 | 2.36  | 2.84  | 3.20  | 3.58   |  |
| <b>45</b> | 1.24                     | 1.48 | 0    | 1.86 | 2.19  | 2.64  | 2.97  | 3.33   |  |
| <b>50</b> | 1.16                     | 1.38 | 0    | 1.74 | 2.05  | 2.46  | 2.78  | 3.11   |  |
| <b>55</b> | 1.09                     | 1.30 | 0    | 1.64 | 1.93  | 2.32  | 2.61  | 2.93   |  |
| <b>60</b> | 1.03                     | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |  |

Cf = Correction Factor applied to Rational Method runoff coefficient.

## Willetts Avenue, Waterford



# Precipitation Report

Precipitation filename: NOAA Willetts Avenue.pcp

Hydrology Studio v 3.0.0.21 (Rainfall totals in Inches)

02-17-2022

|                    | Active                         | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
|--------------------|--------------------------------|------|------|------|------|-------|-------|-------|--------|
| Active             |                                |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | ✓      |
| SCS Storms         | > SCS Dimensionless Storms     |      |      |      |      |       |       |       |        |
| SCS 6hr            |                                | 1.98 | 2.37 | 0    | 2.99 | 3.51  | 4.22  | 4.76  | 5.32   |
| Type I, 24-hr      |                                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Type IA, 24-hr     |                                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Type II, 24-hr     |                                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Type II FL, 24-hr  |                                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Type III, 24-hr    | ✓                              | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Synthetic Storms   | > IDF-Based Synthetic Storms   |      |      |      |      |       |       |       |        |
| 1-hr               |                                | 1.03 | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |
| 2-hr               |                                | 1.31 | 1.56 | 0    | 1.97 | 2.31  | 2.77  | 3.13  | 3.52   |
| 3-hr               |                                | 1.50 | 1.79 | 0    | 2.25 | 2.64  | 3.16  | 3.57  | 4.04   |
| 6-hr               |                                | 1.89 | 2.25 | 0    | 2.82 | 3.30  | 3.94  | 4.46  | 5.07   |
| 12-hr              |                                | 2.36 | 2.81 | 0    | 3.51 | 4.12  | 4.89  | 5.56  | 6.35   |
| 24-hr              |                                | 2.95 | 3.52 | 0    | 4.38 | 5.13  | 6.06  | 6.90  | 7.94   |
| Huff Distribution  | > 1st Quartile (0 to 6 hrs)    |      |      |      |      |       |       |       |        |
| 1-hr               |                                | 1.03 | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |
| 2-hr               |                                | 1.35 | 1.61 | 0    | 2.04 | 2.39  | 2.88  | 3.25  | 3.64   |
| 3-hr               |                                | 1.56 | 1.87 | 0    | 2.36 | 2.78  | 3.35  | 3.77  | 4.22   |
| 6-hr               |                                | 1.98 | 2.37 | 0    | 2.99 | 3.51  | 4.22  | 4.76  | 5.32   |
| Huff Distribution  | > 2nd Quartile (>6 to 12 hrs)  |      |      |      |      |       |       |       |        |
| 8-hr               |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| 12-hr              |                                | 2.45 | 2.92 | 0    | 3.68 | 4.32  | 5.19  | 5.84  | 6.53   |
| Huff Distribution  | > 3rd Quartile (>12 to 24 hrs) |      |      |      |      |       |       |       |        |
| 18-hr              |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| 24-hr              |                                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Custom Storms      | > Custom Storm Distributions   |      |      |      |      |       |       |       |        |
| My Custom Storm 1  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 2  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 3  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 4  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 5  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 6  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 7  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 8  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 9  |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |
| My Custom Storm 10 |                                | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0      |

# Precipitation Report Cont'd

Precipitation filename: NOAA Willetts Avenue.pcp

Rainfall totals in Inches

02-17-2022

|              | Active         | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
|--------------|----------------|------|------|------|------|-------|-------|-------|--------|
| Active       |                |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | ✓      |
| Huff Indiana | > Indianapolis |      |      |      |      |       |       |       |        |
| 30-min       |                | 0.79 | 0.95 | 0    | 1.20 | 1.41  | 1.70  | 1.91  | 2.14   |
| 1-hr         |                | 1.03 | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |
| 2-hr         |                | 1.35 | 1.61 | 0    | 2.04 | 2.39  | 2.88  | 3.25  | 3.64   |
| 3-hr         |                | 1.56 | 1.87 | 0    | 2.36 | 2.78  | 3.35  | 3.77  | 4.22   |
| 6-hr         |                | 1.98 | 2.37 | 0    | 2.99 | 3.51  | 4.22  | 4.76  | 5.32   |
| 12-hr        |                | 2.45 | 2.92 | 0    | 3.68 | 4.32  | 5.19  | 5.84  | 6.53   |
| 24-hr        |                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Huff Indiana | > Evansville   |      |      |      |      |       |       |       |        |
| 30-min       |                | 0.79 | 0.95 | 0    | 1.20 | 1.41  | 1.70  | 1.91  | 2.14   |
| 1-hr         |                | 1.03 | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |
| 2-hr         |                | 1.35 | 1.61 | 0    | 2.04 | 2.39  | 2.88  | 3.25  | 3.64   |
| 3-hr         |                | 1.56 | 1.87 | 0    | 2.36 | 2.78  | 3.35  | 3.77  | 4.22   |
| 6-hr         |                | 1.98 | 2.37 | 0    | 2.99 | 3.51  | 4.22  | 4.76  | 5.32   |
| 12-hr        |                | 2.45 | 2.92 | 0    | 3.68 | 4.32  | 5.19  | 5.84  | 6.53   |
| 24-hr        |                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Huff Indiana | > Fort Wayne   |      |      |      |      |       |       |       |        |
| 30-min       |                | 0.79 | 0.95 | 0    | 1.20 | 1.41  | 1.70  | 1.91  | 2.14   |
| 1-hr         |                | 1.03 | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |
| 2-hr         |                | 1.35 | 1.61 | 0    | 2.04 | 2.39  | 2.88  | 3.25  | 3.64   |
| 3-hr         |                | 1.56 | 1.87 | 0    | 2.36 | 2.78  | 3.35  | 3.77  | 4.22   |
| 6-hr         |                | 1.98 | 2.37 | 0    | 2.99 | 3.51  | 4.22  | 4.76  | 5.32   |
| 12-hr        |                | 2.45 | 2.92 | 0    | 3.68 | 4.32  | 5.19  | 5.84  | 6.53   |
| 24-hr        |                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
| Huff Indiana | > South Bend   |      |      |      |      |       |       |       |        |
| 30-min       |                | 0.79 | 0.95 | 0    | 1.20 | 1.41  | 1.70  | 1.91  | 2.14   |
| 1-hr         |                | 1.03 | 1.23 | 0    | 1.55 | 1.82  | 2.19  | 2.47  | 2.77   |
| 2-hr         |                | 1.35 | 1.61 | 0    | 2.04 | 2.39  | 2.88  | 3.25  | 3.64   |
| 3-hr         |                | 1.56 | 1.87 | 0    | 2.36 | 2.78  | 3.35  | 3.77  | 4.22   |
| 6-hr         |                | 1.98 | 2.37 | 0    | 2.99 | 3.51  | 4.22  | 4.76  | 5.32   |
| 12-hr        |                | 2.45 | 2.92 | 0    | 3.68 | 4.32  | 5.19  | 5.84  | 6.53   |
| 24-hr        |                | 2.87 | 3.43 | 0    | 4.35 | 5.11  | 6.17  | 6.95  | 7.79   |
|              |                |      |      |      |      |       |       |       |        |
|              |                |      |      |      |      |       |       |       |        |
|              |                |      |      |      |      |       |       |       |        |
|              |                |      |      |      |      |       |       |       |        |



## Precipitation Report Cont'd

Precipitation filename: NOAA Willetts Avenue.pcp

Rainfall totals in Inches

02-17-2022

[illegible]



## **APPENDIX C**

### **STORMWATER TREATMENT CALCULATIONS**

Proposed Area POND-01A  
Proposed Area INF-01B  
Proposed Area POND-02A  
Proposed Area POND-03A  
Proposed Area INF-03A  
Proposed Area POND-03B  
Proposed Area INF-03B  
Groundwater Recharge Calculations



**STORMWATER TREATMENT CALCULATIONS [POND-01A]****Compute Water Quality Volume**

$$WQV = \frac{(I' \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **4.334** acresIA = **1.626** acres**Determine Percent Impervious Cover (I)**I = **38%****Calculate Volumetric Runoff Coefficient (R)**R = **0.39****Calculate Water Quality Volume**WQV = **0.140** acre-feet**Calculate Minimum Sediment Forebay Volume**V<sub>sed</sub> = WQV x 0.10 = **610** cf**Sediment Forebay Proposed**V<sub>sed</sub> = **7100** cf **116%****Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

Q<sub>(in)</sub> = **0.39** watershed inches**Determine NCRS Curve Number (CN)**Q<sub>(in)</sub> = **0.39** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **90****Determine Initial Abstraction (I<sub>a</sub>)**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#)I<sub>a</sub> = **0.222** inches**Determine Unit Peak Discharge (q<sub>u</sub>)**Time of Concentration (T<sub>c</sub>), referenced from Pipe Flow Calculation WorksheetT<sub>c</sub> = **0.50** hoursI<sub>a</sub>/P = **0.222**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#)q<sub>u</sub> = **380** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)

q<sub>u</sub> = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>)Q<sub>(in)</sub> = runoff depth (watershed inches)WQF = **0.998** cfs**Compute Required Filter Bed Area**

$$A = \frac{WQV \times d}{k \times t \times (h + d)}$$

A = Filter Bed Surface Area (sf)

WQV = Water Quality Volume (cf)

d = Filter Media Depth (ft)

k = Filter Media Permeability (ft/day)

t = Time (day)

h = Depth to Outlet (ft)

6099 cf

1 ft

3.5 ft/day

1 day

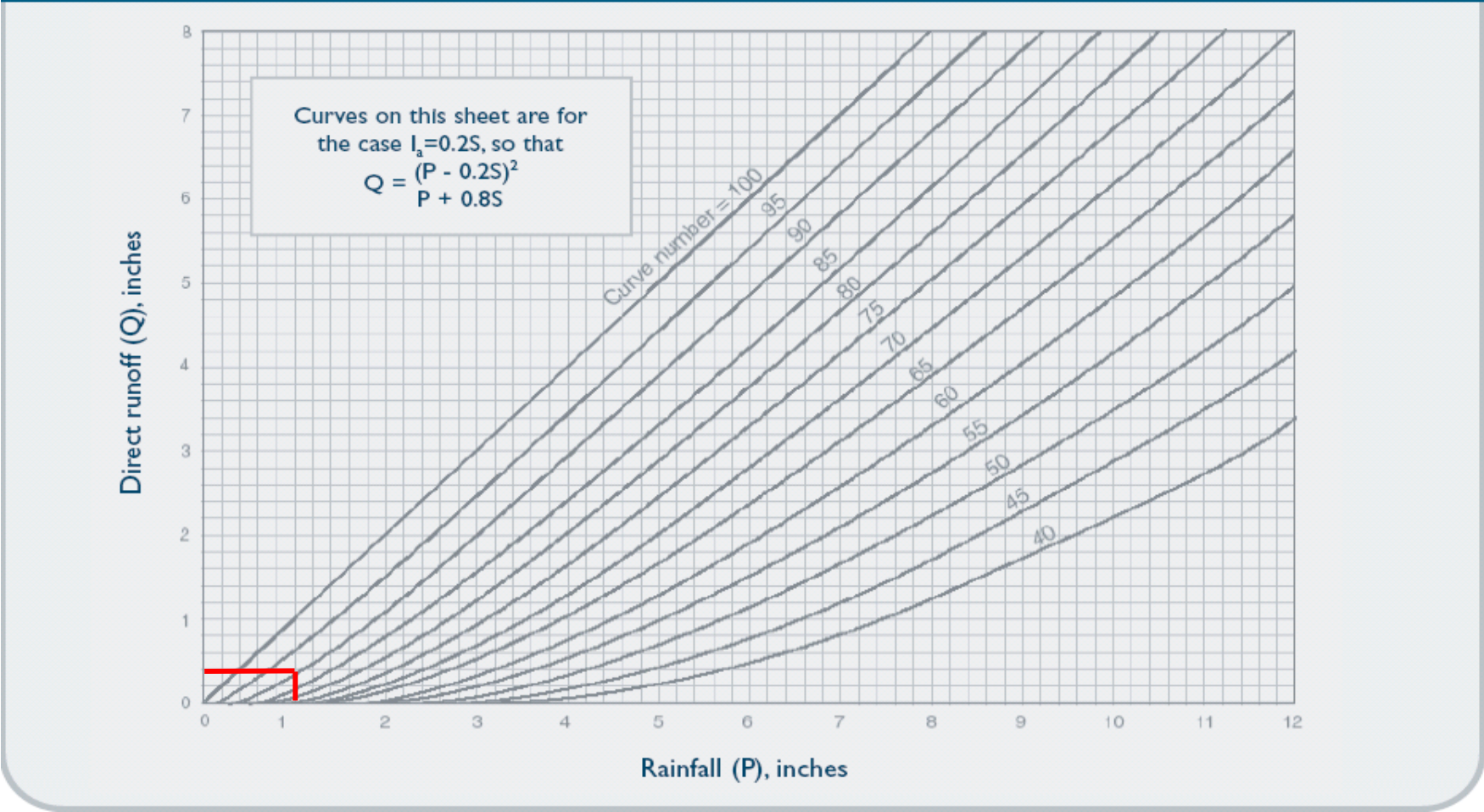
0.67 feet

A = **1043** square feet required

1200

square feet provided in Detention Pond 01A

## Figure 2-1 Solution of Runoff Equation

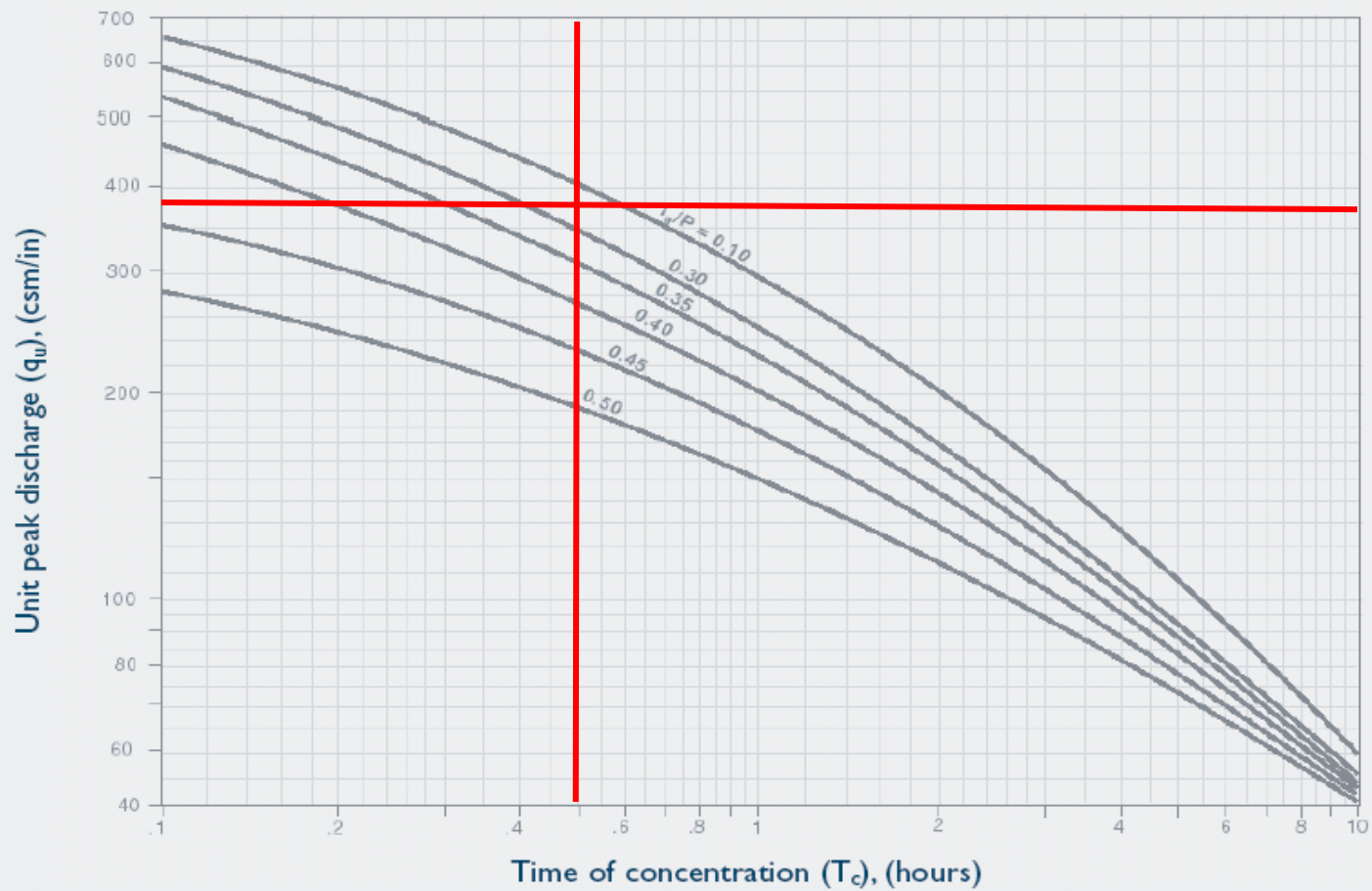


**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |



## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)

**STORMWATER TREATMENT CALCULATIONS [INF-01B]****Compute Water Quality Volume**

$$WQV = \frac{(I \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **0.930** acresIA = **0.569** acres**Determine Percent Impervious Cover (I)**I = **61%****Calculate Volumetric Runoff Coefficient (R)**R = **0.60****Calculate Water Quality Volume**WQV = **0.047** acre-feet**Calculate Minimum Sediment Forebay Volume**Vsed = WQV x 0.10 = **203** cf**Sediment Forebay Proposed**Vsed = **cf****Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

 $Q_{(in)}$  = **0.60** watershed inches**Determine NCRS Curve Number (CN)** $Q_{(in)}$  = **0.60** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **95****Determine Initial Abstraction ( $I_a$ )**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#) $I_a$  = **0.105** inches**Determine Unit Peak Discharge ( $q_u$ )**Time of Concentration ( $T_c$ ), referenced from Pipe Flow Calculation Worksheet $T_c$  = **0.13** hours $I_a/P$  = **0.105**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#) $q_u$  = **600** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

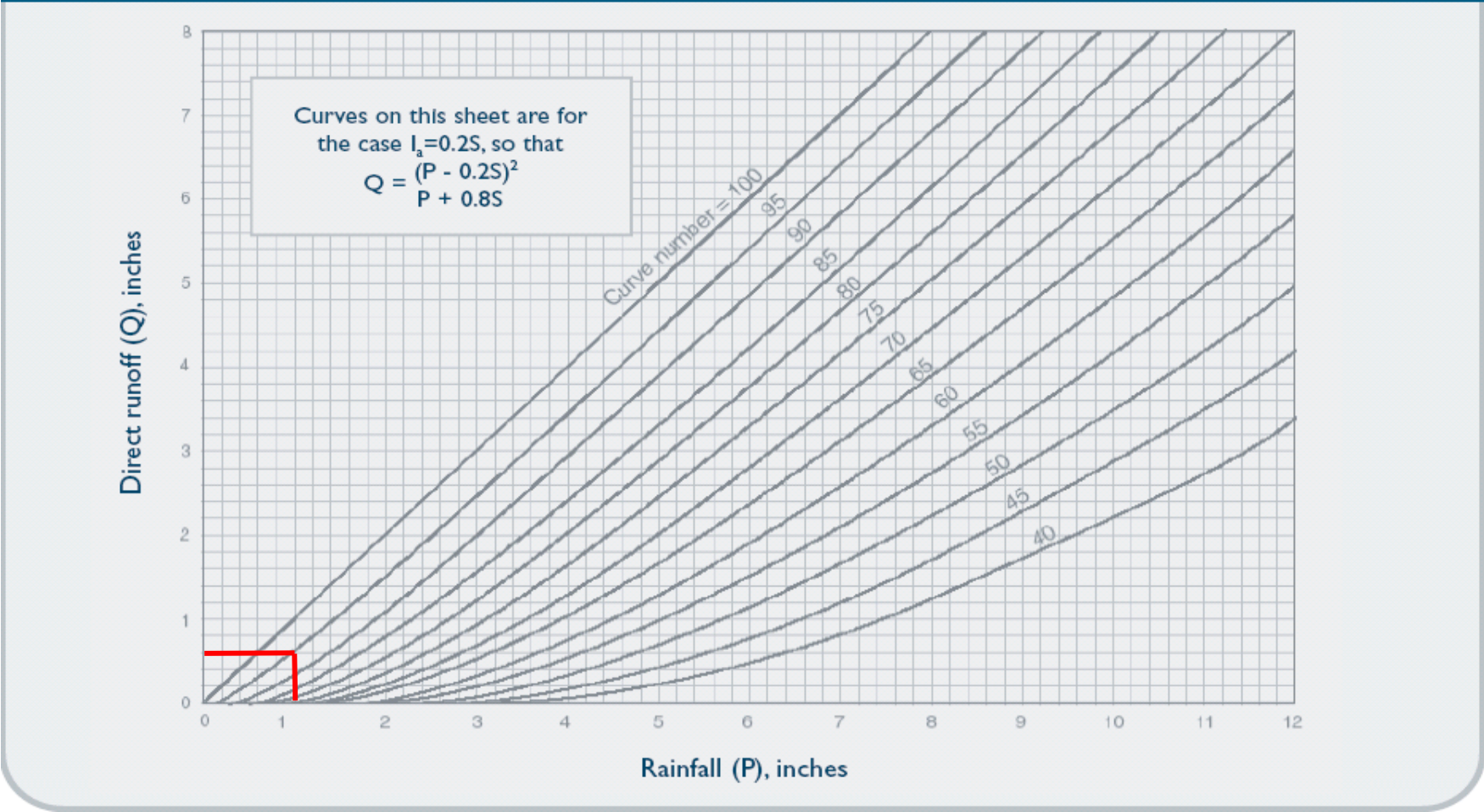
WQF = Water Quality Flow (cfs)

 $q_u$  = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>) $Q_{(in)}$  = runoff depth (watershed inches)WQF = **0.524** cfs**Compute Required Isolator Row Length**

| Model    | WQF Each | Chambers |
|----------|----------|----------|
| SC-160LP | 0.06     | 9.52     |
| SC-310   | 0.11     | 4.76     |
| SC-740   | 0.15     | 3.49     |
| DC-780   | 0.15     | 3.49     |
| MC-3500  | 0.24     | 2.18     |
| MC-4500  | 0.17     | 3.08     |

8 Proposed 229%

### Figure 2-1 Solution of Runoff Equation

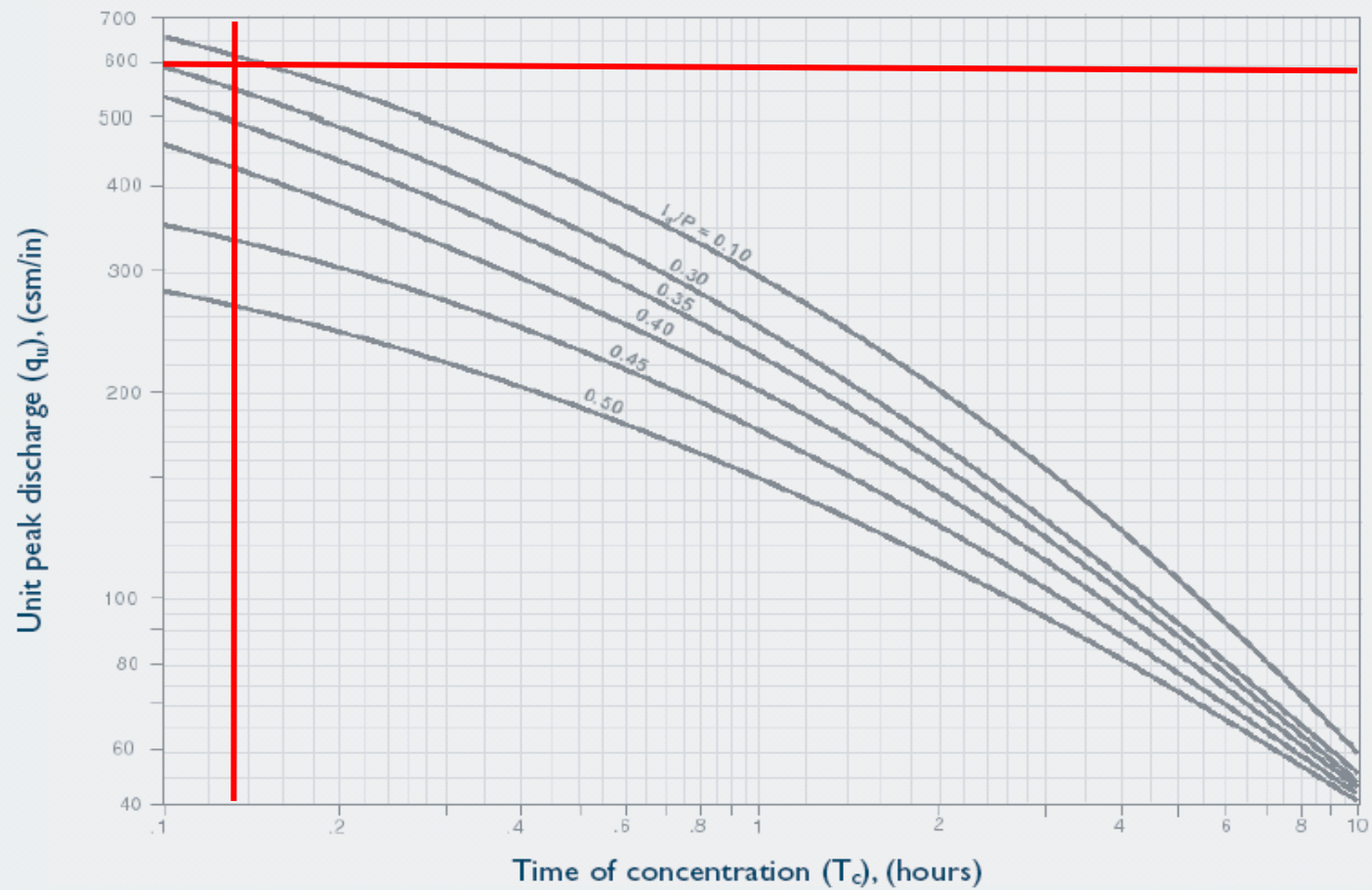


**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |



## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)



### STORMTECH ISOLATOR ROW SIZING CHART

|                                     | SC-160LP | SC-310 | SC-740 | DC-780 | MC-3500 | MC-4500 |
|-------------------------------------|----------|--------|--------|--------|---------|---------|
| Chamber Area (Sq.Ft.)               | 11.4     | 20     | 27.8   | 27.8   | 43.2    | 30.1    |
| Treated Flow Rate per chamber (CFS) | 0.055    | 0.11   | 0.15   | 0.15   | 0.24    | 0.17    |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |

**NOTE:** Testing of the Isolator Row verified by NJCAT. It has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250. MASTEP verification of up to 83% TSS of the OK-110.

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

### ISOLATOR ROW SIZING (MIN. # CHAMBERS)

| MODEL    | WQF  | # CHAMBERS |
|----------|------|------------|
| SC-160LP | 0.52 | 9.52       |
| SC-310   | 0.52 | 4.76       |
| SC-740   | 0.52 | 3.49       |
| DC-780   | 0.52 | 3.49       |
| MC-3500  | 0.52 | 2.18       |
| MC-4500  | 0.52 | 3.08       |





**STORMWATER TREATMENT CALCULATIONS [POND-02A]****Compute Water Quality Volume**

$$WQV = \frac{(I' \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **2.877** acresIA = **1.454** acres**Determine Percent Impervious Cover (I)**I = **51%****Calculate Volumetric Runoff Coefficient (R)**R = **0.50****Calculate Water Quality Volume**WQV = **0.121** acre-feet**Calculate Minimum Sediment Forebay Volume**Vsed = WQV x 0.10 **527** cf**Sediment Forebay Proposed**Vsed = **2400** cf **46%****Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

Q<sub>(in)</sub> = **0.50** watershed inches**Determine NCRS Curve Number (CN)**Q<sub>(in)</sub> = **0.50** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **93****Determine Initial Abstraction (I<sub>a</sub>)**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#)I<sub>a</sub> = **0.151** inches**Determine Unit Peak Discharge (q<sub>u</sub>)**Time of Concentration (T<sub>c</sub>), referenced from Pipe Flow Calculation WorksheetT<sub>c</sub> = **0.42** hoursI<sub>a</sub>/P = **0.151**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#)q<sub>u</sub> = **420** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)

q<sub>u</sub> = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>)Q<sub>(in)</sub> = runoff depth (watershed inches)WQF = **0.953** cfs**Compute Required Filter Bed Area**

$$A = \frac{WQV \times d}{k \times t \times (h + d)}$$

A = Filter Bed Surface Area (sf)

WQV = Water Quality Volume (cf)

d = Filter Media Depth (ft)

k = Filter Media Permeability (ft/day)

t = Time (day)

h = Depth to Outlet (ft)

5272 cf

1 ft

3.5 ft/day

1 day

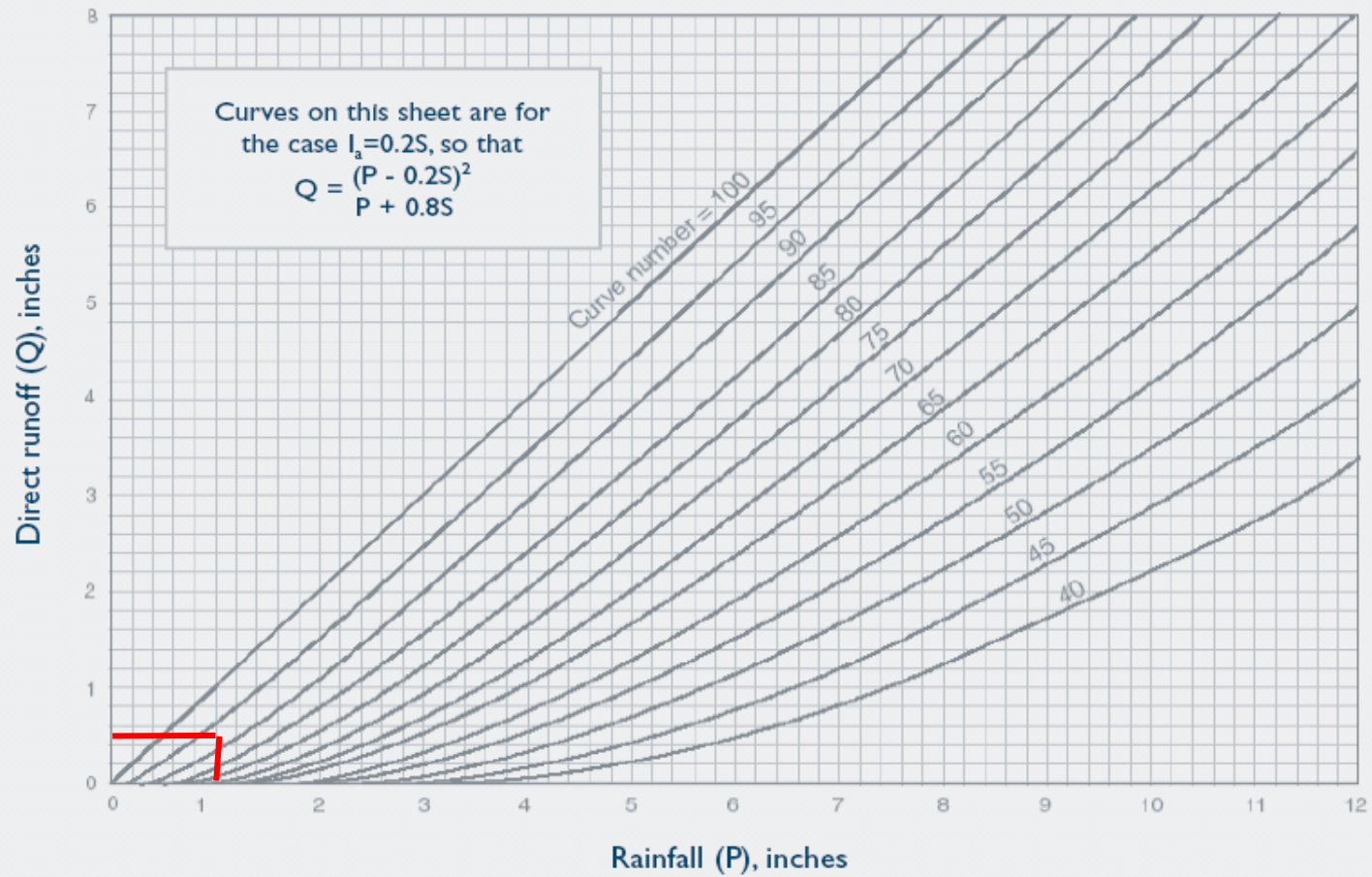
1 feet

A = **753** square feet required

2100

square feet provided in Detention Pond 02A

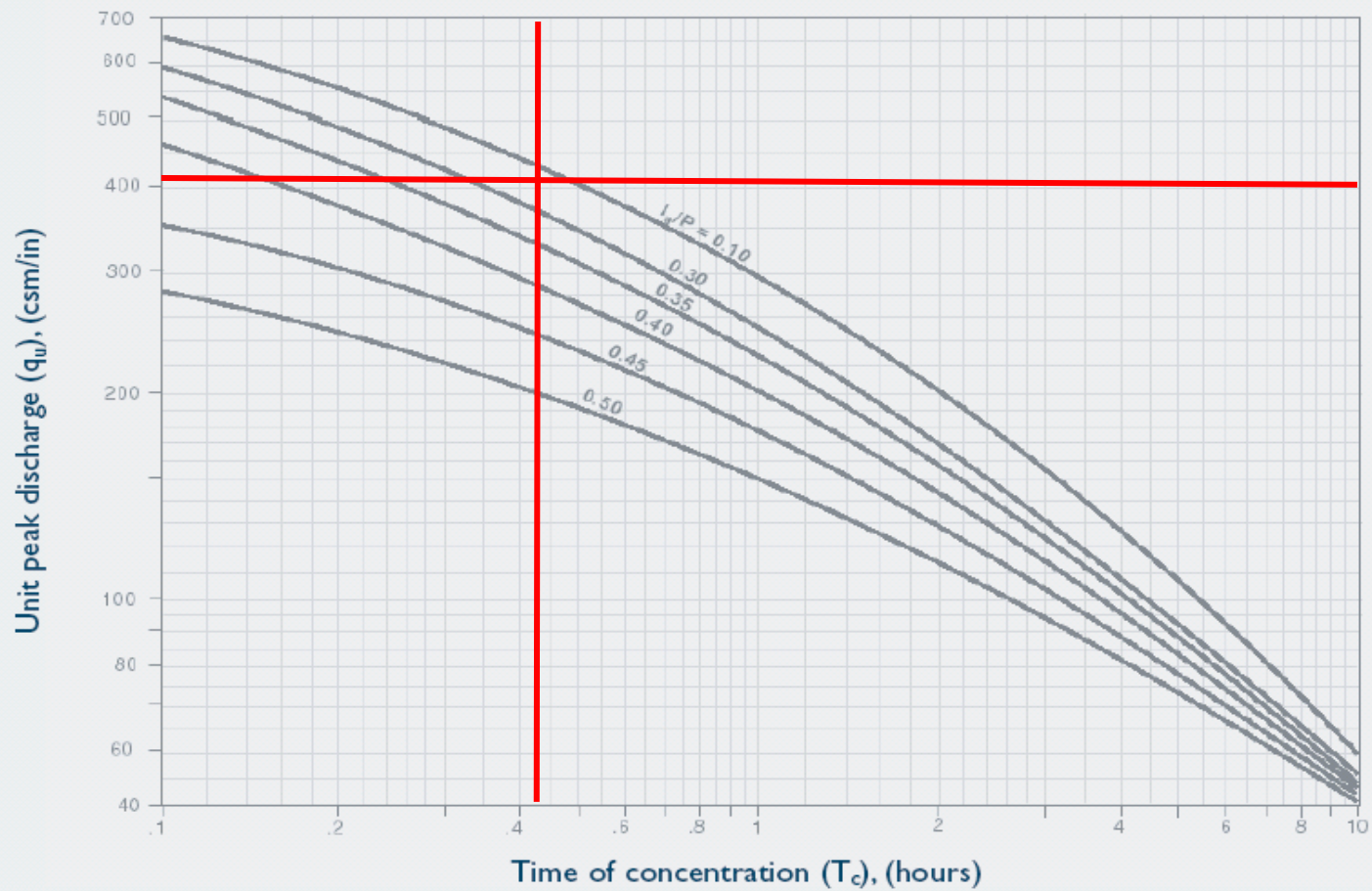
**Figure 2-1 Solution of Runoff Equation**



**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |

## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)

**STORMWATER TREATMENT CALCULATIONS [POND-03A]****Compute Water Quality Volume**

$$WQV = \frac{(I' \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **0.631** acresIA = **0.272** acres**Determine Percent Impervious Cover (I)**I = **43%****Calculate Volumetric Runoff Coefficient (R)**R = **0.44****Calculate Water Quality Volume**WQV = **0.023** acre-feet**Calculate Minimum Sediment Forebay Volume**

Vsed = WQV x 0.10 100 cf

**Sediment Forebay Proposed**

Vsed = 1800 cf 179%

**Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

Q<sub>(in)</sub> = **0.44** watershed inches**Determine NCRS Curve Number (CN)**Q<sub>(in)</sub> = **0.44** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **93****Determine Initial Abstraction (I<sub>a</sub>)**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#)I<sub>a</sub> = **0.151** inches**Determine Unit Peak Discharge (q<sub>u</sub>)**Time of Concentration (T<sub>c</sub>), referenced from Pipe Flow Calculation WorksheetT<sub>c</sub> = **0.15** hoursI<sub>a</sub>/P = **0.151**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#)q<sub>u</sub> = **580** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)

q<sub>u</sub> = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>)Q<sub>(in)</sub> = runoff depth (watershed inches)WQF = **0.250** cfs**Compute Required Filter Bed Area**

$$A = \frac{WQV \times d}{k \times t \times (h + d)}$$

A = Filter Bed Surface Area (sf)

WQV = Water Quality Volume (cf)

d = Filter Media Depth (ft)

k = Filter Media Permeability (ft/day)

t = Time (day)

h = Depth to Outlet (ft)

1003 cf

1 ft

3.5 ft/day

1 day

0.75 feet

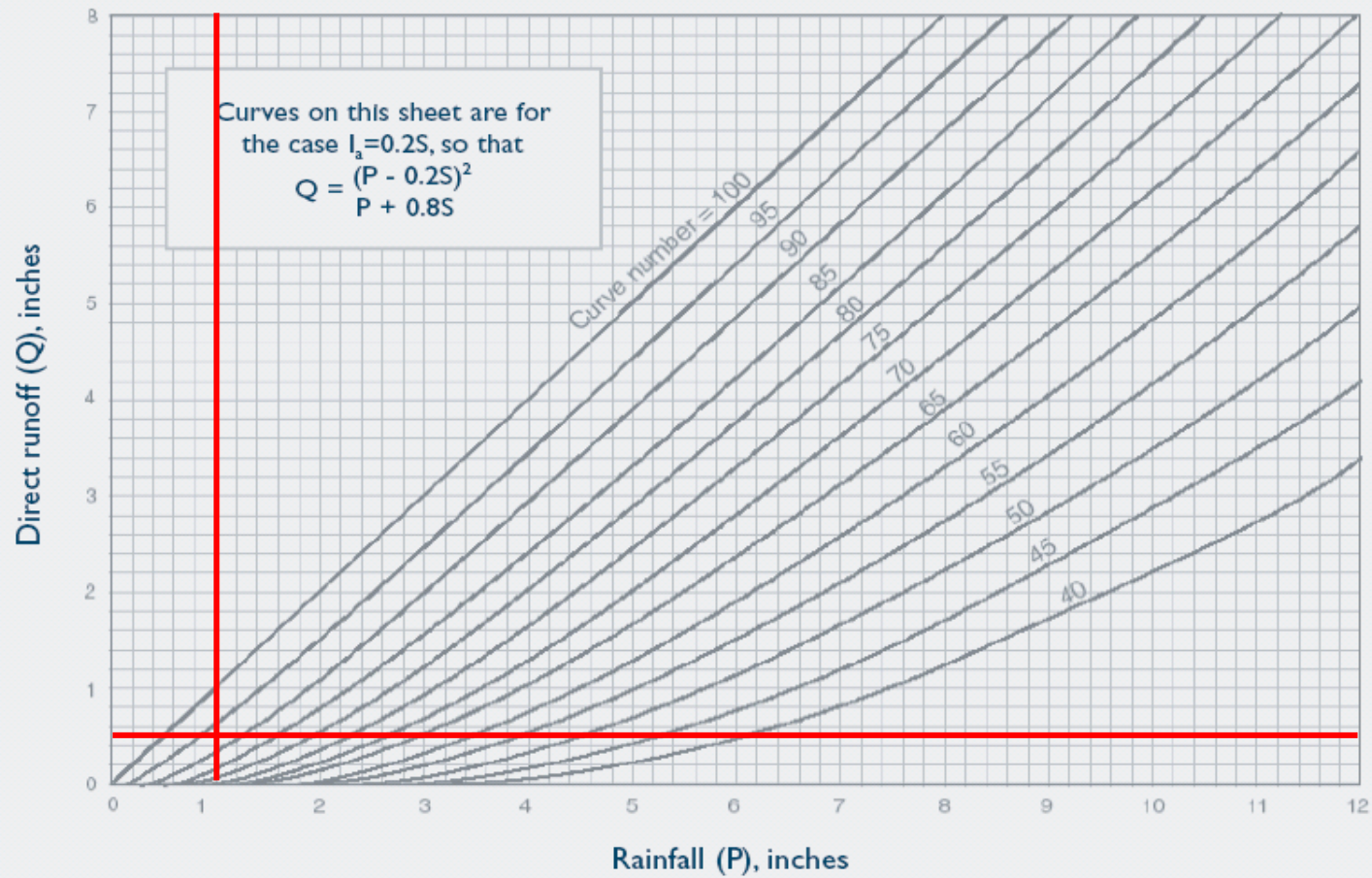
A = **164** square feet required

1000

square feet provided in Detention Pond 03A



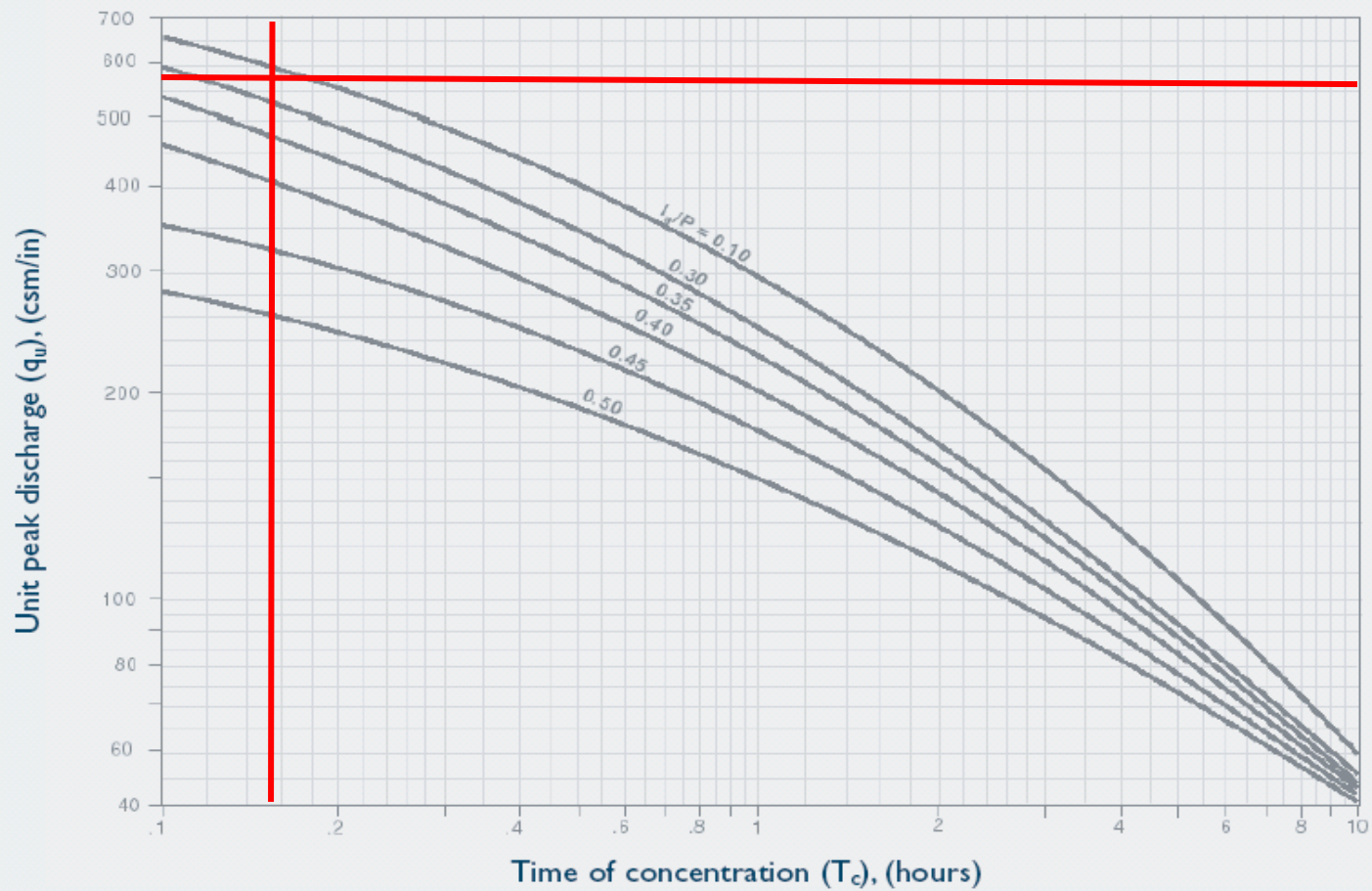
**Figure 2-1 Solution of Runoff Equation**



**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |

## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)

**STORMWATER TREATMENT CALCULATIONS [INF-03A]****Compute Water Quality Volume**

$$WQV = \frac{(I \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **0.823** acresIA = **0.628** acres**Determine Percent Impervious Cover (I)**I = **76%****Calculate Volumetric Runoff Coefficient (R)**R = **0.74****Calculate Water Quality Volume**WQV = **0.051** acre-feet**Calculate Minimum Sediment Forebay Volume**Vsed = WQV x 0.10 = **220** cf**Sediment Forebay Proposed**Vsed = **cf****Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

 $Q_{(in)}$  = **0.74** watershed inches**Determine NCRS Curve Number (CN)** $Q_{(in)}$  = **0.74** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **96****Determine Initial Abstraction ( $I_a$ )**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#) $I_a$  = **0.083** inches**Determine Unit Peak Discharge ( $q_u$ )**Time of Concentration ( $T_c$ ), referenced from Pipe Flow Calculation Worksheet $T_c$  = **0.25** hours $I_a/P$  = **0.083**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#) $q_u$  = **510** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)

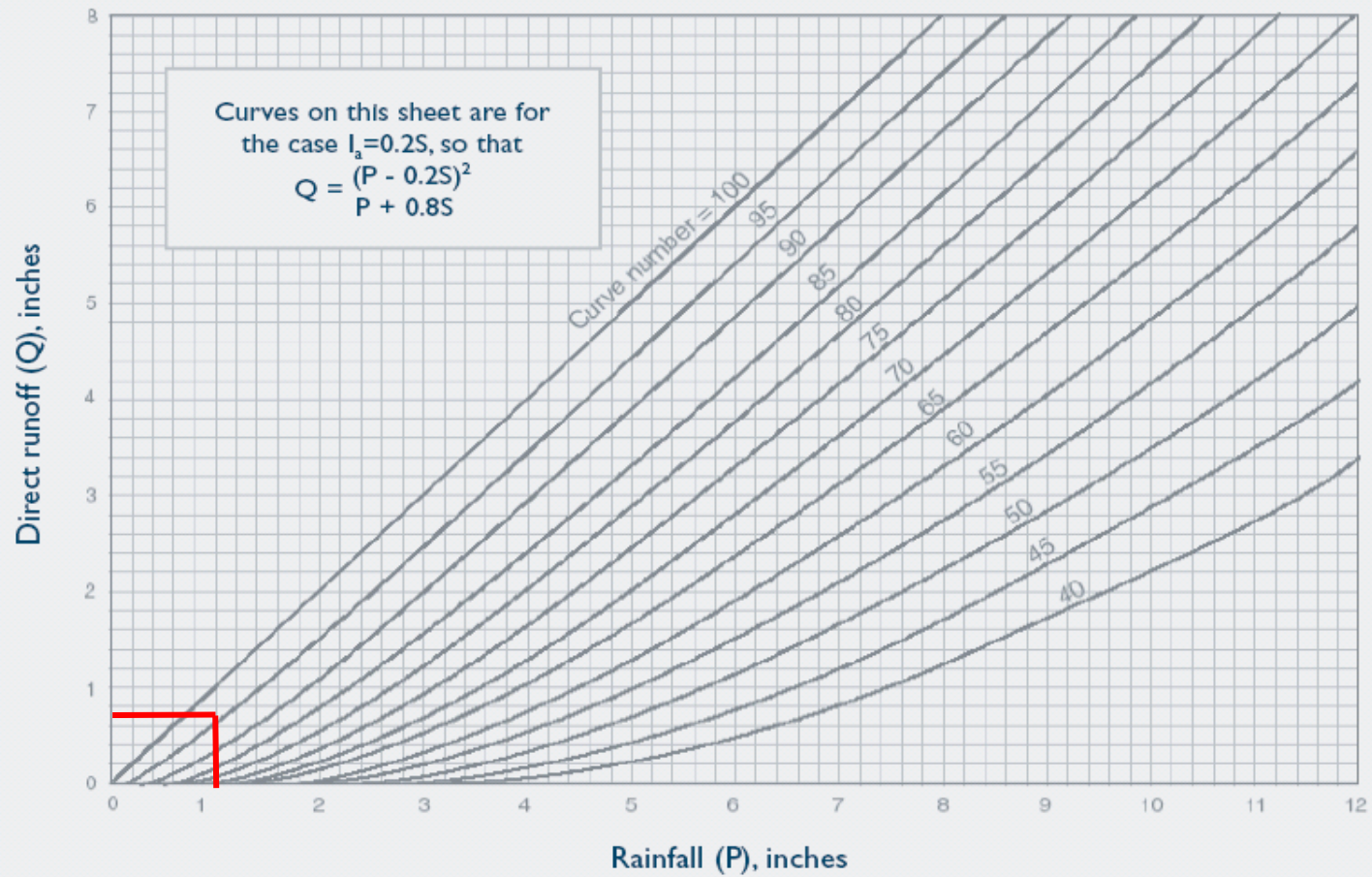
 $q_u$  = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>) $Q_{(in)}$  = runoff depth (watershed inches)WQF = **0.483** cfs**Compute Required Isolator Row Length**

| Model    | WQF Each | Chambers |
|----------|----------|----------|
| SC-160LP | 0.06     | 8.79     |
| SC-310   | 0.11     | 4.39     |
| SC-740   | 0.15     | 3.22     |
| DC-780   | 0.15     | 3.22     |
| MC-3500  | 0.24     | 2.01     |
| MC-4500  | 0.17     | 2.84     |

10 Proposed 310%



**Figure 2-1 Solution of Runoff Equation**

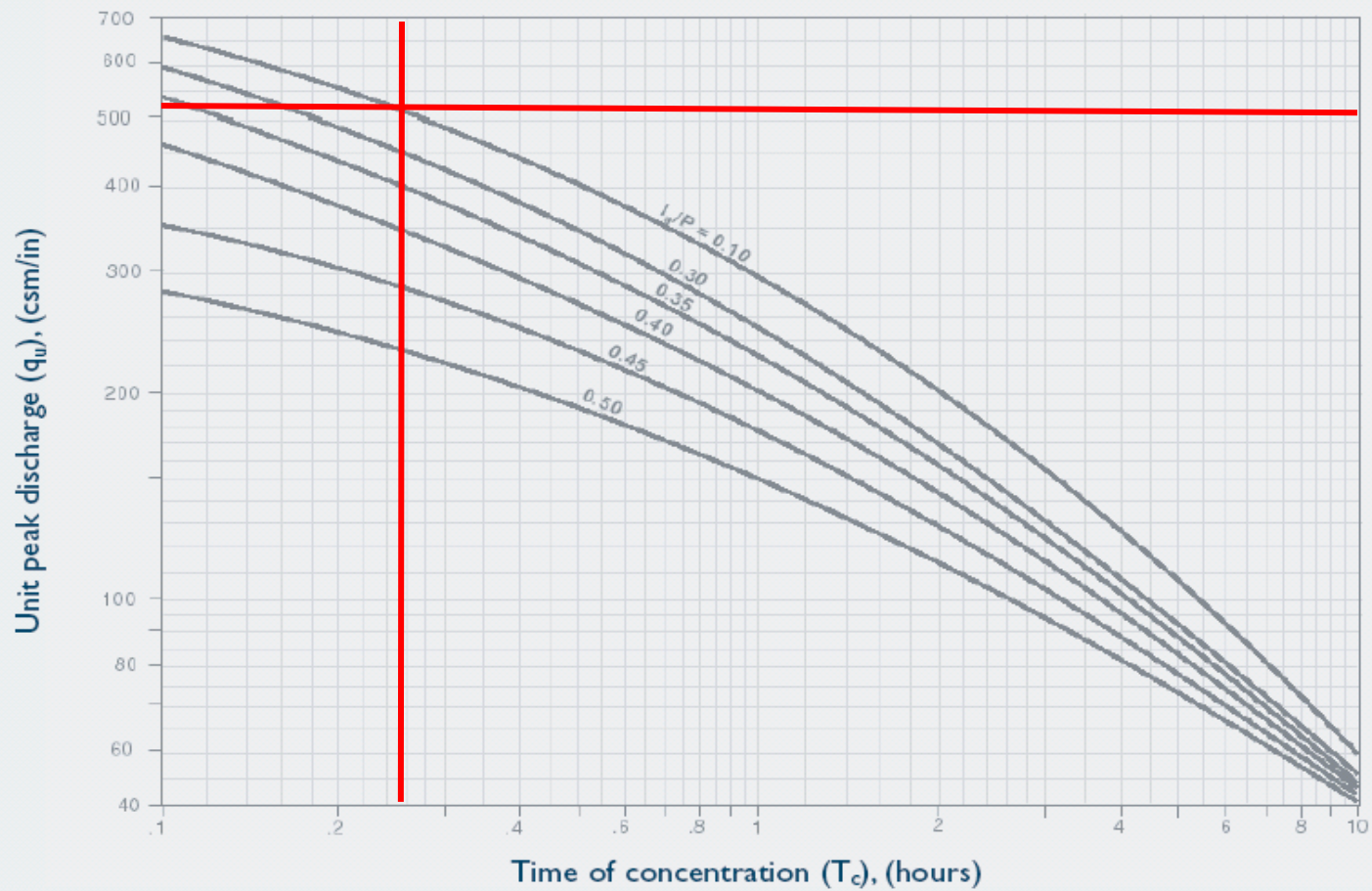


**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |



## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)



### STORMTECH ISOLATOR ROW SIZING CHART

|                                     | SC-160LP | SC-310 | SC-740 | DC-780 | MC-3500 | MC-4500 |
|-------------------------------------|----------|--------|--------|--------|---------|---------|
| Chamber Area (Sq.Ft.)               | 11.4     | 20     | 27.8   | 27.8   | 43.2    | 30.1    |
| Treated Flow Rate per chamber (CFS) | 0.055    | 0.11   | 0.15   | 0.15   | 0.24    | 0.17    |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |

**NOTE:** Testing of the Isolator Row verified by NJCAT. It has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250. MASTEP verification of up to 83% TSS of the OK-110.

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

### ISOLATOR ROW SIZING (MIN. # CHAMBERS)

| MODEL    | WQF  | # CHAMBERS |
|----------|------|------------|
| SC-160LP | 0.48 | 8.79       |
| SC-310   | 0.48 | 4.39       |
| SC-740   | 0.48 | 3.22       |
| DC-780   | 0.48 | 3.22       |
| MC-3500  | 0.48 | 2.01       |
| MC-4500  | 0.48 | 2.84       |



**STORMWATER TREATMENT CALCULATIONS [POND-03B]****Compute Water Quality Volume**

$$WQV = \frac{(I' \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **1.897** acresIA = **0.465** acres**Determine Percent Impervious Cover (I)**I = **25%****Calculate Volumetric Runoff Coefficient (R)**R = **0.27****Calculate Water Quality Volume**WQV = **0.043** acre-feet**Calculate Minimum Sediment Forebay Volume**Vsed = WQV x 0.10 = **186** cf**Sediment Forebay Proposed**Vsed = **cf****Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

Q<sub>(in)</sub> = **0.27** watershed inches**Determine NCRS Curve Number (CN)**Q<sub>(in)</sub> = **0.27** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **89****Determine Initial Abstraction (I<sub>a</sub>)**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#)I<sub>a</sub> = **0.247** inches**Determine Unit Peak Discharge (q<sub>u</sub>)**Time of Concentration (T<sub>c</sub>), referenced from Pipe Flow Calculation WorksheetT<sub>c</sub> = **0.28** hoursI<sub>a</sub>/P = **0.247**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#)q<sub>u</sub> = **460** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)

q<sub>u</sub> = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>)Q<sub>(in)</sub> = runoff depth (watershed inches)WQF = **0.369** cfs**Compute Required Filter Bed Area**

$$A = \frac{WQV \times d}{k \times t \times (h + d)}$$

A = Filter Bed Surface Area (sf)

WQV = Water Quality Volume (cf)

d = Filter Media Depth (ft)

k = Filter Media Permeability (ft/day)

t = Time (day)

h = Depth to Outlet (ft)

1863 cf

1 ft

3.5 ft/day

1 day

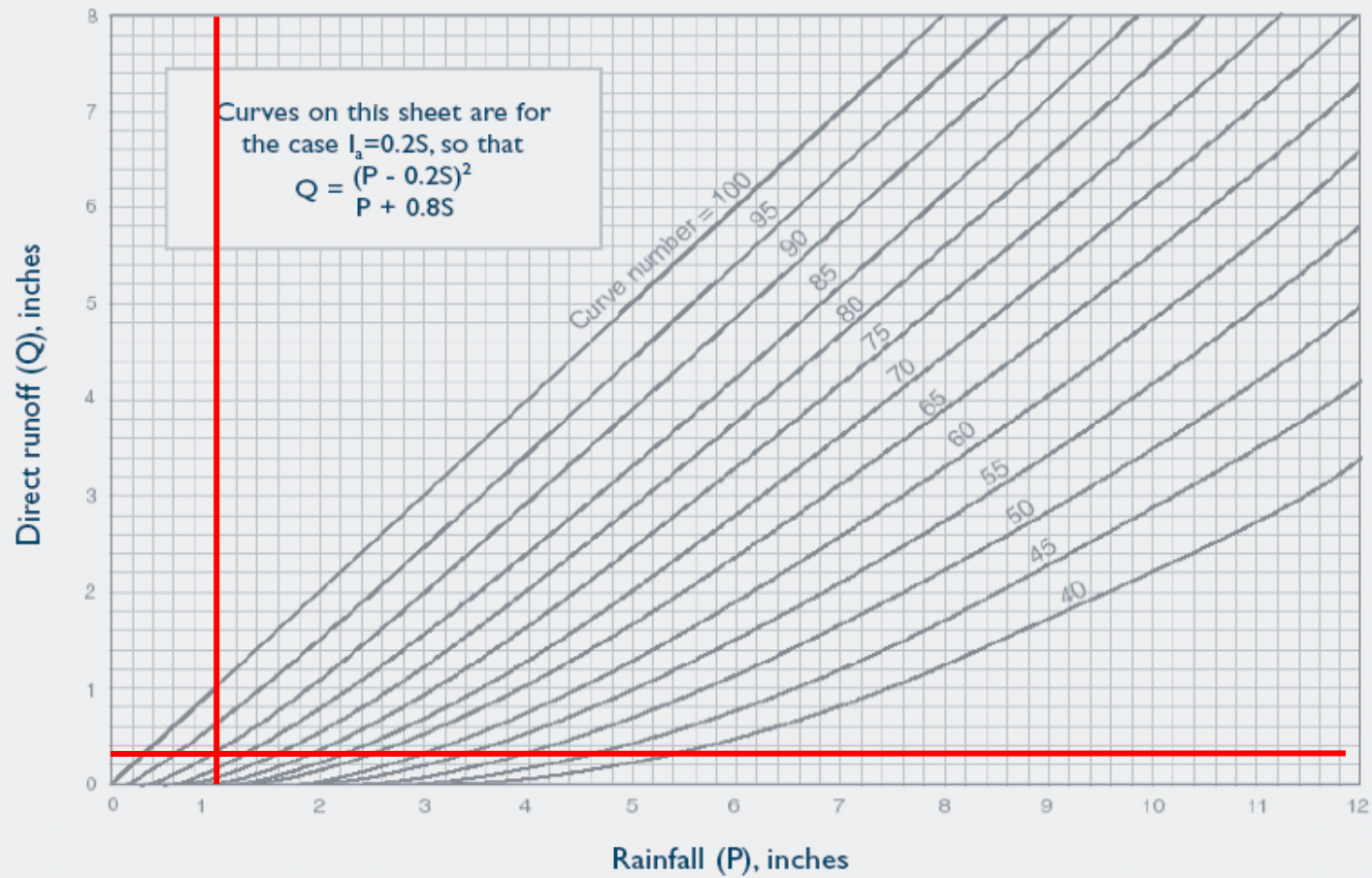
0.75 feet

A = **304** square feet required

1400

square feet provided in Detention Pond 03B

**Figure 2-1 Solution of Runoff Equation**

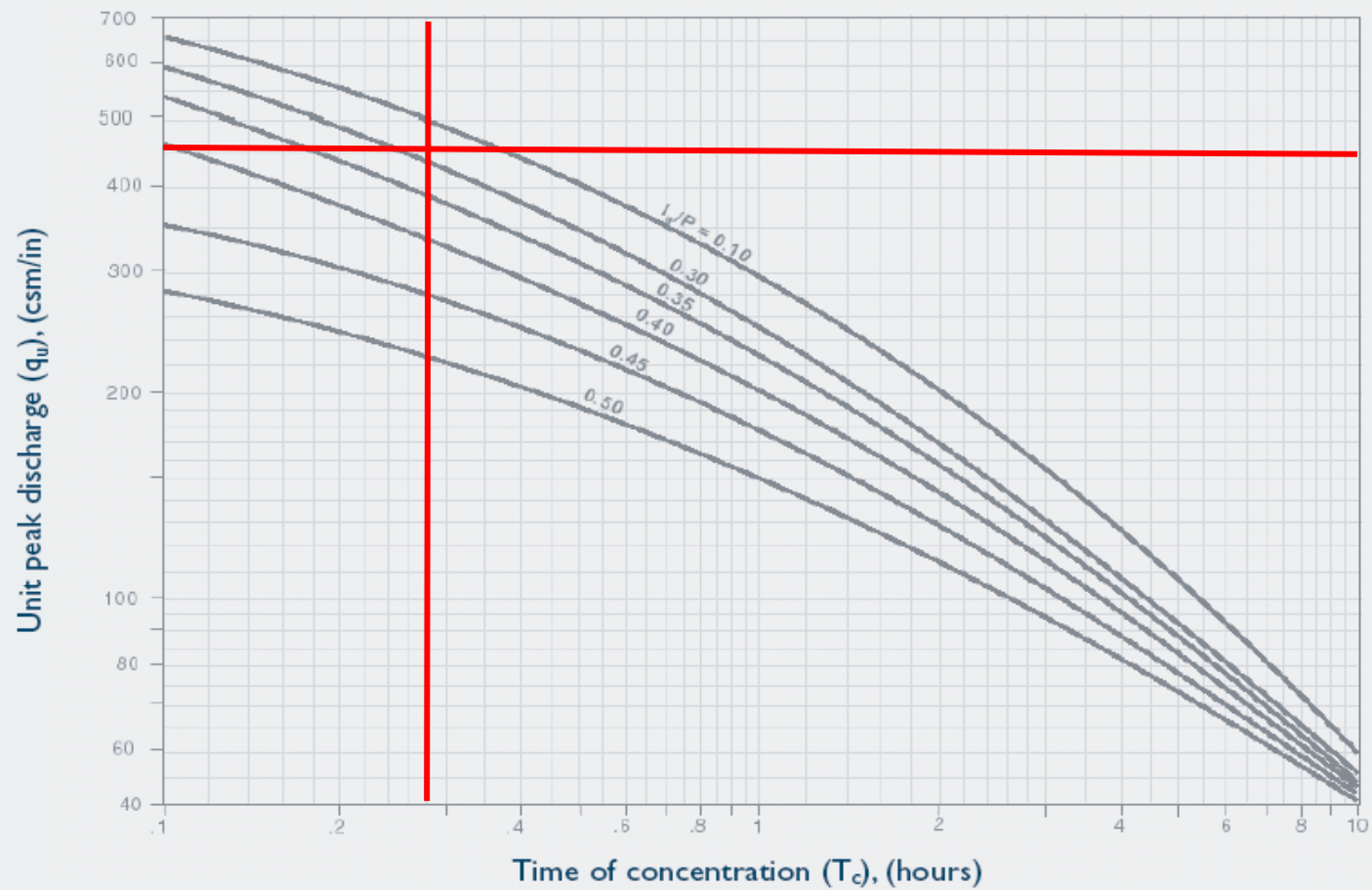


**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |



## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)

**STORMWATER TREATMENT CALCULATIONS [INF-03B]****Compute Water Quality Volume**

$$WQV = \frac{(I \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)

R = Volumetric Runoff Coefficient,  $0.050 + 0.009(I)$ 

I = Percent Impervious Cover, Impervious Area / Total Area

DA = Drainage Area (Acres)

IA = Impervious Area (Acres)

DA = **0.750** acresIA = **0.601** acres**Determine Percent Impervious Cover (I)**I = **80%****Calculate Volumetric Runoff Coefficient (R)**R = **0.77****Calculate Water Quality Volume**WQV = **0.048** acre-feet**Calculate Minimum Sediment Forebay Volume**Vsed = WQV x 0.10 = **210** cf**Sediment Forebay Proposed**Vsed = **cf****Compute Runoff Depth**

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)

WQV = Water Quality Volume (acre-feet)

DA = Drainage Area (acres)

 $Q_{(in)}$  = **0.77** watershed inches**Determine NCRS Curve Number (CN)** $Q_{(in)}$  = **0.77** watershed inchesP = **1** in[From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual](#)CN = **96****Determine Initial Abstraction ( $I_a$ )**[From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual](#) $I_a$  = **0.083** inches**Determine Unit Peak Discharge ( $q_u$ )**Time of Concentration ( $T_c$ ), referenced from Pipe Flow Calculation Worksheet $T_c$  = **0.14** hours $I_a/P$  = **0.083**[From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual](#) $q_u$  = **600** csm/in**Compute Water Quality Flow**

$$WQF = q_u \times DA \times Q_{(in)}$$

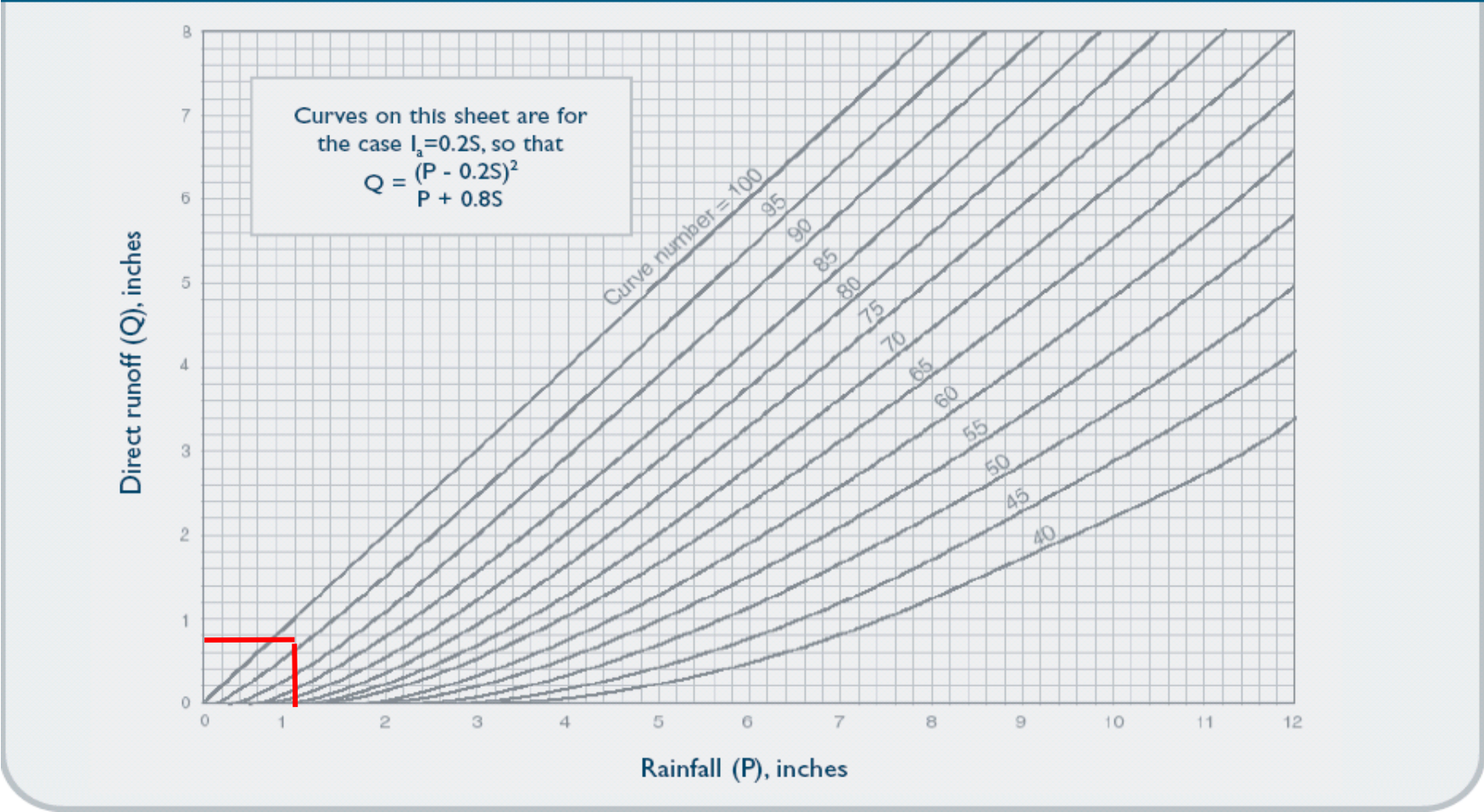
WQF = Water Quality Flow (cfs)

 $q_u$  = unit peak discharge (cfs/mi<sup>2</sup>/inch)DA = drainage area (mi<sup>2</sup>) $Q_{(in)}$  = runoff depth (watershed inches)WQF = **0.542** cfs**Compute Required Isolator Row Length**

| Model    | WQF Each | Chambers |
|----------|----------|----------|
| SC-160LP | 0.06     | 9.86     |
| SC-310   | 0.11     | 4.93     |
| SC-740   | 0.15     | 3.62     |
| DC-780   | 0.15     | 3.62     |
| MC-3500  | 0.24     | 2.26     |
| MC-4500  | 0.17     | 3.19     |

8 Proposed 221%

## Figure 2-1 Solution of Runoff Equation

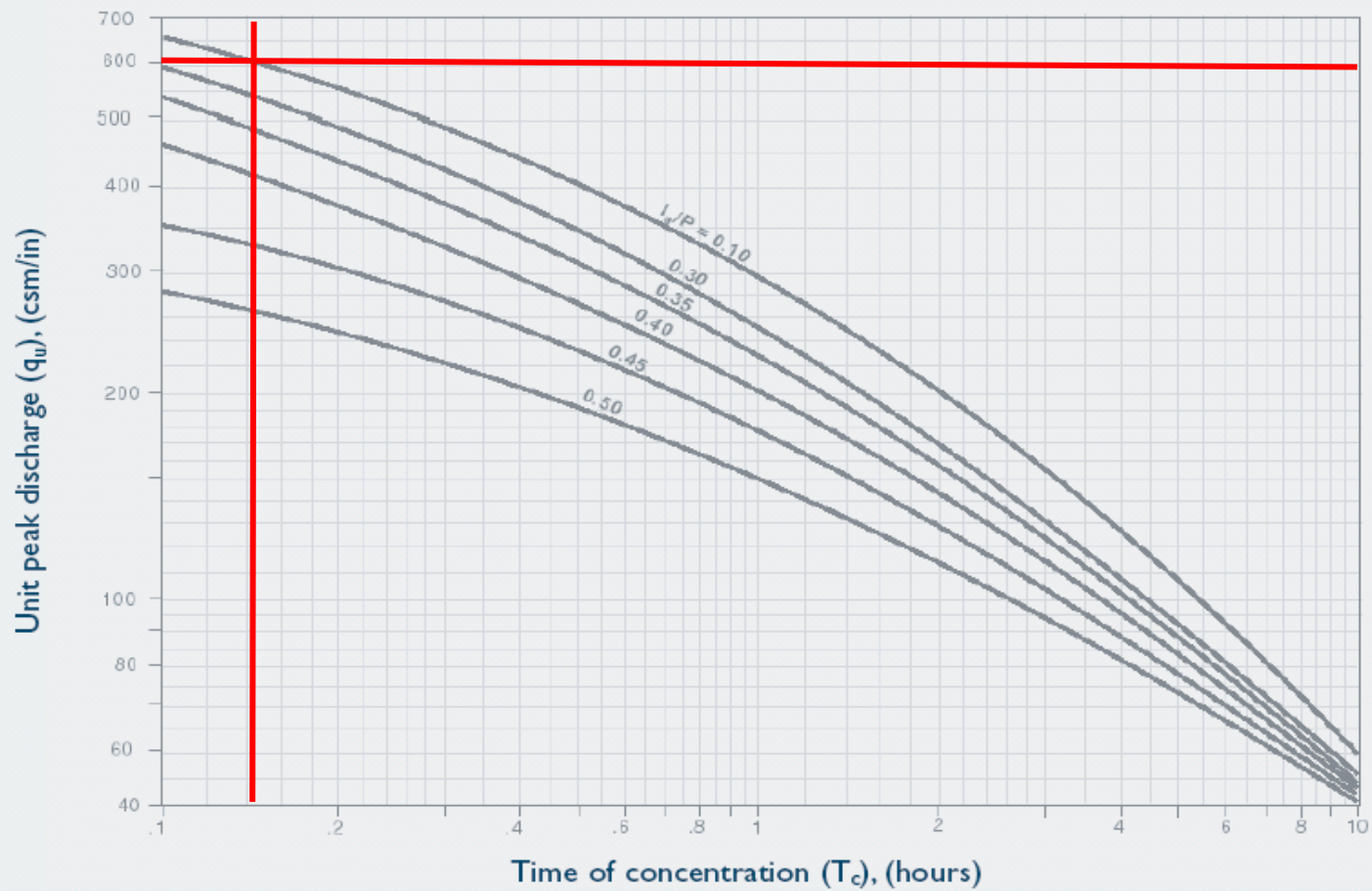


**Table 4-1  $I_a$  values for runoff curve numbers**

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 40 .....     | 3.000      | 55 .....     | 1.636      | 70 .....     | 0.857      | 85 .....     | 0.353      |
| 41 .....     | 2.878      | 56 .....     | 1.571      | 71 .....     | 0.817      | 86 .....     | 0.326      |
| 42 .....     | 2.762      | 57 .....     | 1.509      | 72 .....     | 0.778      | 87 .....     | 0.299      |
| 43 .....     | 2.651      | 58 .....     | 1.448      | 73 .....     | 0.740      | 88 .....     | 0.273      |
| 44 .....     | 2.545      | 59 .....     | 1.390      | 74 .....     | 0.703      | 89 .....     | 0.247      |
| 45 .....     | 2.444      | 60 .....     | 1.333      | 75 .....     | 0.667      | 90 .....     | 0.222      |
| 46 .....     | 2.348      | 61 .....     | 1.279      | 76 .....     | 0.632      | 91 .....     | 0.198      |
| 47 .....     | 2.255      | 62 .....     | 1.226      | 77 .....     | 0.597      | 92 .....     | 0.174      |
| 48 .....     | 2.167      | 63 .....     | 1.175      | 78 .....     | 0.564      | 93 .....     | 0.151      |
| 49 .....     | 2.082      | 64 .....     | 1.125      | 79 .....     | 0.532      | 94 .....     | 0.128      |
| 50 .....     | 2.000      | 65 .....     | 1.077      | 80 .....     | 0.500      | 95 .....     | 0.105      |
| 51 .....     | 1.922      | 66 .....     | 1.030      | 81 .....     | 0.469      | 96 .....     | 0.083      |
| 52 .....     | 1.846      | 67 .....     | 0.985      | 82 .....     | 0.439      | 97 .....     | 0.062      |
| 53 .....     | 1.774      | 68 .....     | 0.941      | 83 .....     | 0.410      | 98 .....     | 0.041      |
| 54 .....     | 1.704      | 69 .....     | 0.899      | 84 .....     | 0.381      |              |            |



## Exhibit 4-1 I I Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



[Return to Outlet Treatment Summary](#)



**STORMTECH ISOLATOR ROW SIZING CHART**

|                                     | SC-160LP | SC-310 | SC-740 | DC-780 | MC-3500 | MC-4500 |
|-------------------------------------|----------|--------|--------|--------|---------|---------|
| Chamber Area (Sq.Ft.)               | 11.4     | 20     | 27.8   | 27.8   | 43.2    | 30.1    |
| Treated Flow Rate per chamber (CFS) | 0.055    | 0.11   | 0.15   | 0.15   | 0.24    | 0.17    |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |
|                                     |          |        |        |        |         |         |

**NOTE:** Testing of the Isolator Row verified by NJCAT. It has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250. MASTEP verification of up to 83% TSS of the OK-110.

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

**ISOLATOR ROW SIZING (MIN. # CHAMBERS)**

| MODEL    | WQF  | # CHAMBERS |
|----------|------|------------|
| SC-160LP | 0.54 | 9.86       |
| SC-310   | 0.54 | 4.93       |
| SC-740   | 0.54 | 3.62       |
| DC-780   | 0.54 | 3.62       |
| MC-3500  | 0.54 | 2.26       |
| MC-4500  | 0.54 | 3.19       |





**GROUNDWATER RECHARGE CALCULATIONS****Groundwater Recharge Volume**

$$GRV = \frac{(D)(A)(I)}{12}$$

GRV = Groundwater Volume (acre-ft)  
 D = recharge depth (inches) per LID Table 2.1  
 A = Site Area (acres)  
 I = Site Imperviousness

**Determine Site Imperviousness (I)**

|                     |        |       |                                    |
|---------------------|--------|-------|------------------------------------|
| A =                 | 26.635 | acres |                                    |
| I <sub>PRE</sub> =  | 0.058  | acres | I = $\frac{I_{POST} - I_{PRE}}{A}$ |
| I <sub>POST</sub> = | 5.619  | acres |                                    |

**Calculate Site Imperviousness (I)**

|     |       |                     |
|-----|-------|---------------------|
| I = | 0.209 | GRV design required |
|-----|-------|---------------------|

**Compute Groundwater Recharge Volume**

|     |        |           |       |        |       |       |
|-----|--------|-----------|-------|--------|-------|-------|
|     |        |           | HSG A | HSG B  | HSG C | HSG D |
| D = | 0.16   | Composite |       | 17.441 |       | 9.194 |
| A = | 26.635 | acres     |       |        |       |       |
| I = | 0.209  |           |       |        |       |       |

**Calculate GRV**

|       |       |         |                     |
|-------|-------|---------|---------------------|
| GRV = | 0.076 | acre-ft | GRV design required |
|-------|-------|---------|---------------------|

**Summarize Groundwater Recharge Volume Provided**

| Structure | GRV Provided |    |       |         | Notes                                                        |
|-----------|--------------|----|-------|---------|--------------------------------------------------------------|
| POND-01A  | 2200.00      | CF | 0.051 | acre-ft | Retention volume below 4" diameter low level outlet at 30.17 |
| INF-01B   | 300.00       | CF | 0.007 | acre-ft | Retention volume below 4" diameter low level outlet at 28.85 |
| POND-02A  | 4300.00      | CF | 0.099 | acre-ft | Retention volume below 4" diameter low level outlet at 28.50 |
| POND-03A  | 1000.00      | CF | 0.023 | acre-ft | Retention volume below 4" diameter low level outlet at 21.25 |
| INF-03A   | 850.00       | CF | 0.020 | acre-ft | Retention volume below 4" diameter low level outlet at 23.50 |
| POND-03B  | 2300.00      | CF | 0.053 | acre-ft | Retention volume below 4" diameter low level outlet at 18.25 |
| INF-03B   | 915.00       | CF | 0.021 | acre-ft | Retention volume below 4" diameter low level outlet at 23.00 |
|           |              |    | 0.272 | acre-ft | <b>358% required GRV within retention areas</b>              |





WATERFORD WOODS APARTMENTS PHASE 2  
384 & 394 WILLETTS AVENUE EXT.  
WATERFORD, CONNECTICUT

## **APPENDIX D SUPPLEMENTAL DATA**

NRCS SOIL DATA  
NOAA RAINFALL DATA





United States  
Department of  
Agriculture

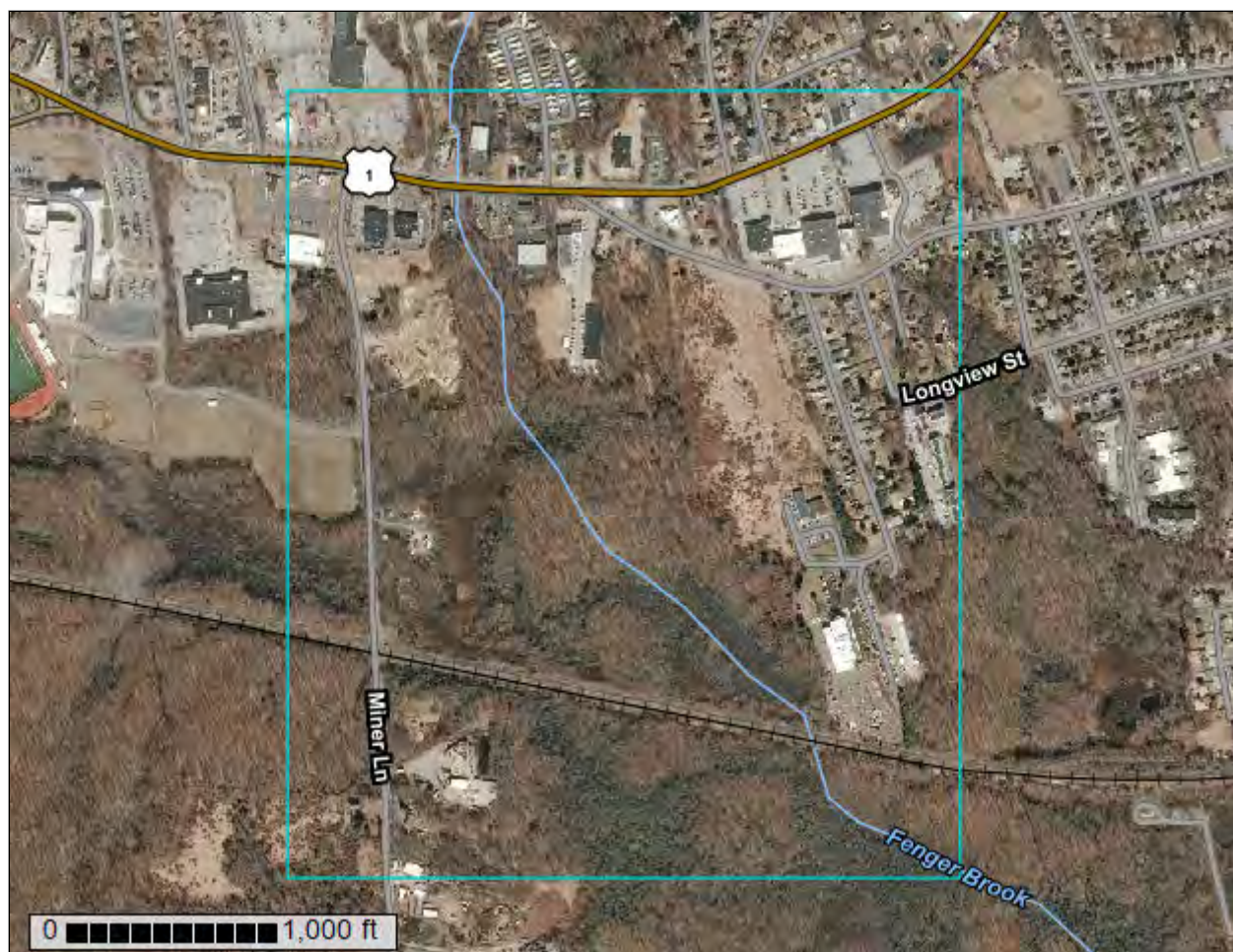
**NRCS**

Natural  
Resources  
Conservation  
Service

A product of the National  
Cooperative Soil Survey,  
a joint effort of the United  
States Department of  
Agriculture and other  
Federal agencies, State  
agencies including the  
Agricultural Experiment  
Stations, and local  
participants

# Custom Soil Resource Report for State of Connecticut

384 & 394 Willetts Avenue Ext.,  
Waterford



August 27, 2020



# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# How Soil Surveys Are Made

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Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

## Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.



# Soil Map

---

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report

## Soil Map (384 & 394 Willetts Avenue Extension, Waterford)



## Custom Soil Resource Report

### 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 1:12,000.

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: State of Connecticut

Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Mar 20, 2019—Mar 27, 2019

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 (384 & 394 Willetts Avenue Extension, Waterford)

| Map Unit Symbol                    | Map Unit Name                                                                   | Acres in AOI | Percent of AOI |
|------------------------------------|---------------------------------------------------------------------------------|--------------|----------------|
| 3                                  | Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony | 16.2         | 5.9%           |
| 13                                 | Walpole sandy loam, 0 to 3 percent slopes                                       | 11.2         | 4.1%           |
| 15                                 | Scarboro muck, 0 to 3 percent slopes                                            | 13.1         | 4.8%           |
| 17                                 | Timakwa and Natchaug soils, 0 to 2 percent slopes                               | 35.3         | 12.8%          |
| 23A                                | Sudbury sandy loam, 0 to 5 percent slopes                                       | 26.2         | 9.5%           |
| 50A                                | Sutton fine sandy loam, 0 to 3 percent slopes                                   | 0.7          | 0.2%           |
| 50B                                | Sutton fine sandy loam, 3 to 8 percent slopes                                   | 0.2          | 0.1%           |
| 51B                                | Sutton fine sandy loam, 0 to 8 percent slopes, very stony                       | 0.8          | 0.3%           |
| 52C                                | Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony                 | 1.6          | 0.6%           |
| 60B                                | Canton and Charlton fine sandy loams, 3 to 8 percent slopes                     | 11.3         | 4.1%           |
| 61B                                | Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony         | 9.4          | 3.4%           |
| 61C                                | Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony        | 4.2          | 1.5%           |
| 66B                                | Narragansett silt loam, 2 to 8 percent slopes                                   | 12.5         | 4.5%           |
| 67B                                | Narragansett silt loam, 3 to 8 percent slopes, very stony                       | 10.4         | 3.8%           |
| 73C                                | Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky                  | 50.7         | 18.4%          |
| 306                                | Udorthents-Urban land complex                                                   | 46.5         | 16.9%          |
| 307                                | Urban land                                                                      | 25.3         | 9.2%           |
| <b>Totals for Area of Interest</b> |                                                                                 | <b>275.7</b> | <b>100.0%</b>  |

# **Soil Information for All Uses**

---

## **Soil Properties and Qualities**

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

## **Soil Physical Properties**

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

### **Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts Avenue Extension, Waterford)**

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

## Custom Soil Resource Report

Low: 0.01 to 0.1

Moderately low: 0.1 to 1.0

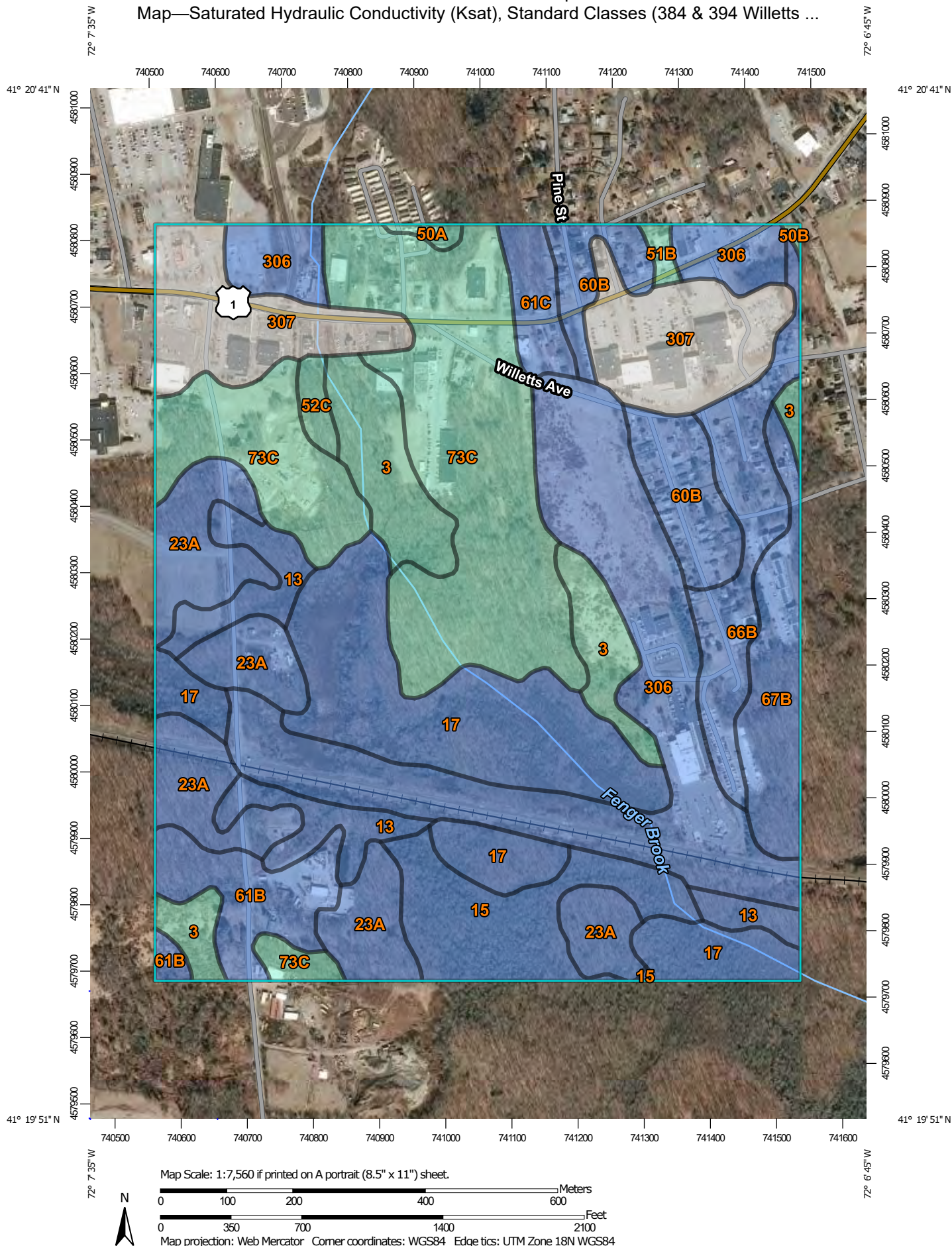
Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705



Custom Soil Resource Report  
Map—Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts ...



MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

|                                                                                     |                            |
|-------------------------------------------------------------------------------------|----------------------------|
|  | Very Low (0.0 - 0.01)      |
|  | Low (0.01 - 0.1)           |
|  | Moderately Low (0.1 - 1)   |
|  | Moderately High (1 - 10)   |
|  | High (10 - 100)            |
|  | Very High (100 - 705)      |
|  | Not rated or not available |

**Water Features**

 Streams and Canals

**Transportation**

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

**Background**

 Aerial Photography

☐ Not rated or not available

**Soil Rating Lines**

|                                                                                       |                            |
|---------------------------------------------------------------------------------------|----------------------------|
|    | Very Low (0.0 - 0.01)      |
|    | Low (0.01 - 0.1)           |
|    | Moderately Low (0.1 - 1)   |
|    | Moderately High (1 - 10)   |
|    | High (10 - 100)            |
|    | Very High (100 - 705)      |
|  | Not rated or not available |

**Soil Rating Points**

|                                                                                       |                          |
|---------------------------------------------------------------------------------------|--------------------------|
|  | Very Low (0.0 - 0.01)    |
|  | Low (0.01 - 0.1)         |
|  | Moderately Low (0.1 - 1) |
|  | Moderately High (1 - 10) |
|  | High (10 - 100)          |
|  | Very High (100 - 705)    |

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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)

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Soil Survey Area: State of Connecticut  
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Mar 20, 2019—Mar 27, 2019

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.

**Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts Avenue Extension, Waterford)**

| Map unit symbol | Map unit name                                                                   | Rating (micrometers per second) | Acres in AOI | Percent of AOI |
|-----------------|---------------------------------------------------------------------------------|---------------------------------|--------------|----------------|
| 3               | Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony | 3.2151                          | 16.2         | 5.9%           |
| 13              | Walpole sandy loam, 0 to 3 percent slopes                                       | 59.6262                         | 11.2         | 4.1%           |
| 15              | Scarboro muck, 0 to 3 percent slopes                                            | 91.1682                         | 13.1         | 4.8%           |
| 17              | Timakwa and Natchaug soils, 0 to 2 percent slopes                               | 33.5514                         | 35.3         | 12.8%          |
| 23A             | Sudbury sandy loam, 0 to 5 percent slopes                                       | 89.2523                         | 26.2         | 9.5%           |
| 50A             | Sutton fine sandy loam, 0 to 3 percent slopes                                   | 10.0000                         | 0.7          | 0.2%           |
| 50B             | Sutton fine sandy loam, 3 to 8 percent slopes                                   | 10.0000                         | 0.2          | 0.1%           |
| 51B             | Sutton fine sandy loam, 0 to 8 percent slopes, very stony                       | 10.0000                         | 0.8          | 0.3%           |
| 52C             | Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony                 | 10.0000                         | 1.6          | 0.6%           |
| 60B             | Canton and Charlton fine sandy loams, 3 to 8 percent slopes                     | 41.4019                         | 11.3         | 4.1%           |
| 61B             | Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony         | 47.0094                         | 9.4          | 3.4%           |
| 61C             | Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony        | 47.0094                         | 4.2          | 1.5%           |
| 66B             | Narragansett silt loam, 2 to 8 percent slopes                                   | 41.8879                         | 12.5         | 4.5%           |
| 67B             | Narragansett silt loam, 3 to 8 percent slopes, very stony                       | 41.8879                         | 10.4         | 3.8%           |
| 73C             | Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky                  | 10.0000                         | 50.7         | 18.4%          |
| 306             | Udorthents-Urban land complex                                                   | 21.0748                         | 46.5         | 16.9%          |
| 307             | Urban land                                                                      |                                 | 25.3         | 9.2%           |

| Map unit symbol             | Map unit name | Rating (micrometers per second) | Acres in AOI | Percent of AOI |
|-----------------------------|---------------|---------------------------------|--------------|----------------|
| Totals for Area of Interest |               |                                 | 275.7        | 100.0%         |

### **Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts Avenue Extension, Waterford)**

*Units of Measure:* micrometers per second

*Aggregation Method:* Dominant Component

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Fastest

*Interpret Nulls as Zero:* No

*Layer Options (Horizon Aggregation Method):* Depth Range (Weighted Average)

*Top Depth:* 6

*Bottom Depth:* 48

*Units of Measure:* Inches

## **Soil Qualities and Features**

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

### **Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)**

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

## Custom Soil Resource Report

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

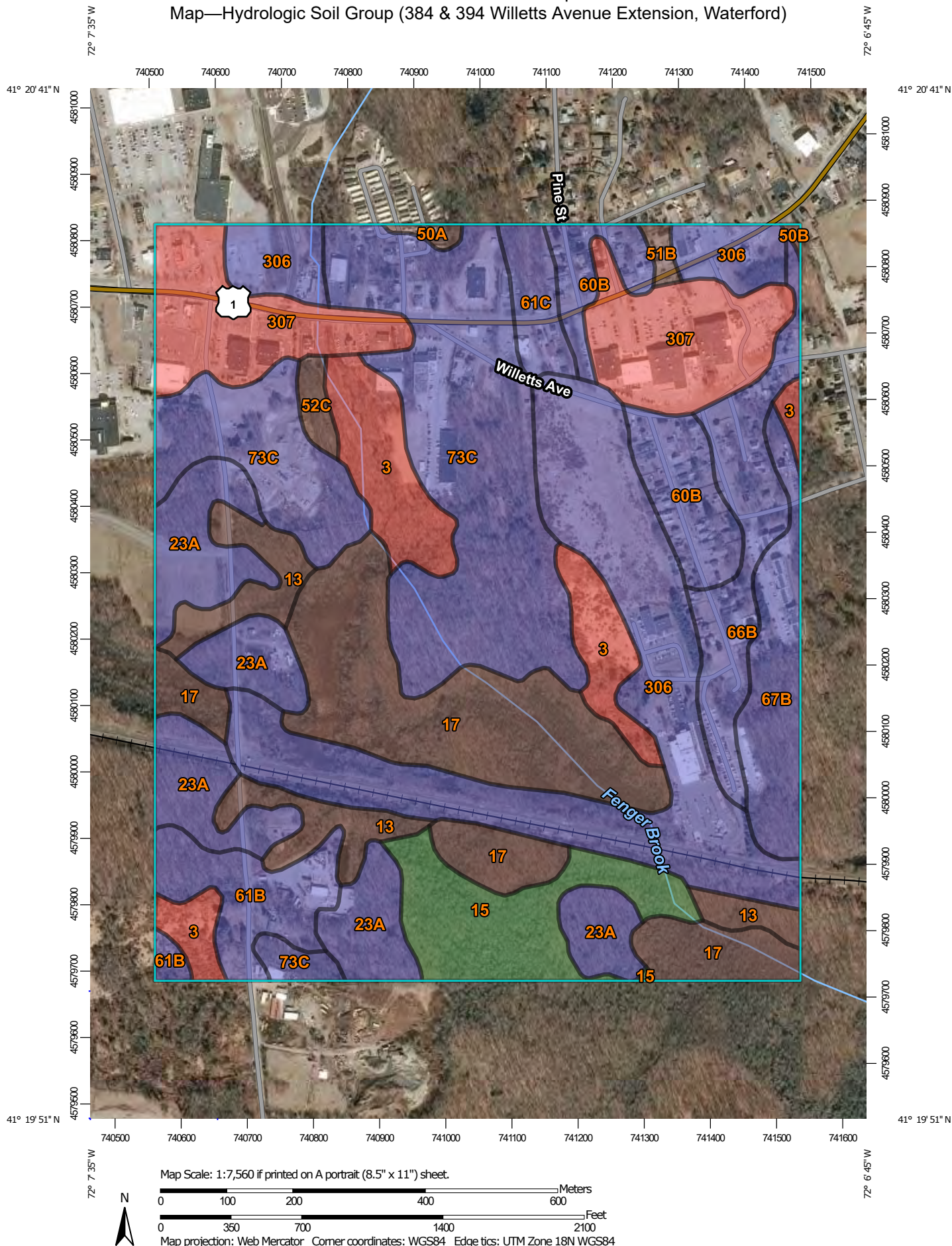
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Custom Soil Resource Report  
Map—Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)





MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

**Soil Rating Lines**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Points**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
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**Table—Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)**

| Map unit symbol                    | Map unit name                                                                   | Rating | Acres in AOI | Percent of AOI |
|------------------------------------|---------------------------------------------------------------------------------|--------|--------------|----------------|
| 3                                  | Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony | D      | 16.2         | 5.9%           |
| 13                                 | Walpole sandy loam, 0 to 3 percent slopes                                       | B/D    | 11.2         | 4.1%           |
| 15                                 | Scarboro muck, 0 to 3 percent slopes                                            | A/D    | 13.1         | 4.8%           |
| 17                                 | Timakwa and Natchaug soils, 0 to 2 percent slopes                               | B/D    | 35.3         | 12.8%          |
| 23A                                | Sudbury sandy loam, 0 to 5 percent slopes                                       | B      | 26.2         | 9.5%           |
| 50A                                | Sutton fine sandy loam, 0 to 3 percent slopes                                   | B/D    | 0.7          | 0.2%           |
| 50B                                | Sutton fine sandy loam, 3 to 8 percent slopes                                   | B/D    | 0.2          | 0.1%           |
| 51B                                | Sutton fine sandy loam, 0 to 8 percent slopes, very stony                       | B/D    | 0.8          | 0.3%           |
| 52C                                | Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony                 | B/D    | 1.6          | 0.6%           |
| 60B                                | Canton and Charlton fine sandy loams, 3 to 8 percent slopes                     | B      | 11.3         | 4.1%           |
| 61B                                | Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony         | B      | 9.4          | 3.4%           |
| 61C                                | Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony        | B      | 4.2          | 1.5%           |
| 66B                                | Narragansett silt loam, 2 to 8 percent slopes                                   | B      | 12.5         | 4.5%           |
| 67B                                | Narragansett silt loam, 3 to 8 percent slopes, very stony                       | B      | 10.4         | 3.8%           |
| 73C                                | Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky                  | B      | 50.7         | 18.4%          |
| 306                                | Udorthents-Urban land complex                                                   | B      | 46.5         | 16.9%          |
| 307                                | Urban land                                                                      | D      | 25.3         | 9.2%           |
| <b>Totals for Area of Interest</b> |                                                                                 |        | <b>275.7</b> | <b>100.0%</b>  |

**Rating Options—Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)**

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

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NOAA Atlas 14, Volume 10, Version 3  
Location name: Waterford, Connecticut, USA\*  
Latitude: 41.3376°, Longitude: -72.1197°  
Elevation: 27.7 ft\*\*  
\* source: ESRI Maps  
\*\* source: USGS



## POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

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### PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup> |                                     |                        |                        |                        |                        |                       |                       |                      |                      |                      |
|----------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|
| Duration                                                                                                 | Average recurrence interval (years) |                        |                        |                        |                        |                       |                       |                      |                      |                      |
|                                                                                                          | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                    | 100                   | 200                  | 500                  | 1000                 |
| 5-min                                                                                                    | 0.335<br>(0.258-0.430)              | 0.401<br>(0.308-0.515) | 0.509<br>(0.389-0.654) | 0.599<br>(0.457-0.773) | 0.722<br>(0.534-0.963) | 0.814<br>(0.591-1.10) | 0.911<br>(0.645-1.27) | 1.02<br>(0.686-1.44) | 1.19<br>(0.769-1.72) | 1.33<br>(0.838-1.94) |
| 10-min                                                                                                   | 0.475<br>(0.365-0.609)              | 0.568<br>(0.436-0.729) | 0.721<br>(0.552-0.926) | 0.847<br>(0.645-1.09)  | 1.02<br>(0.756-1.36)   | 1.15<br>(0.837-1.56)  | 1.29<br>(0.914-1.80)  | 1.45<br>(0.973-2.04) | 1.68<br>(1.09-2.43)  | 1.88<br>(1.19-2.75)  |
| 15-min                                                                                                   | 0.559<br>(0.429-0.716)              | 0.669<br>(0.513-0.858) | 0.849<br>(0.650-1.09)  | 0.998<br>(0.760-1.29)  | 1.20<br>(0.890-1.61)   | 1.36<br>(0.985-1.84)  | 1.52<br>(1.08-2.12)   | 1.71<br>(1.15-2.40)  | 1.98<br>(1.28-2.86)  | 2.21<br>(1.40-3.24)  |
| 30-min                                                                                                   | 0.793<br>(0.609-1.02)               | 0.948<br>(0.727-1.22)  | 1.20<br>(0.919-1.54)   | 1.41<br>(1.07-1.82)    | 1.70<br>(1.26-2.27)    | 1.91<br>(1.39-2.59)   | 2.14<br>(1.52-2.99)   | 2.40<br>(1.61-3.39)  | 2.79<br>(1.81-4.03)  | 3.11<br>(1.97-4.56)  |
| 60-min                                                                                                   | 1.03<br>(0.790-1.32)                | 1.23<br>(0.941-1.57)   | 1.55<br>(1.19-1.99)    | 1.82<br>(1.39-2.35)    | 2.19<br>(1.62-2.93)    | 2.47<br>(1.79-3.35)   | 2.77<br>(1.96-3.86)   | 3.10<br>(2.08-4.37)  | 3.60<br>(2.33-5.20)  | 4.01<br>(2.54-5.88)  |
| 2-hr                                                                                                     | 1.35<br>(1.05-1.71)                 | 1.61<br>(1.25-2.04)    | 2.04<br>(1.58-2.59)    | 2.39<br>(1.84-3.06)    | 2.88<br>(2.15-3.81)    | 3.25<br>(2.38-4.37)   | 3.64<br>(2.60-5.03)   | 4.09<br>(2.76-5.71)  | 4.75<br>(3.09-6.79)  | 5.30<br>(3.37-7.69)  |
| 3-hr                                                                                                     | 1.56<br>(1.22-1.97)                 | 1.87<br>(1.46-2.35)    | 2.36<br>(1.84-2.99)    | 2.78<br>(2.15-3.52)    | 3.35<br>(2.51-4.39)    | 3.77<br>(2.78-5.03)   | 4.22<br>(3.03-5.80)   | 4.74<br>(3.22-6.58)  | 5.51<br>(3.60-7.83)  | 6.14<br>(3.92-8.87)  |
| 6-hr                                                                                                     | 1.98<br>(1.57-2.47)                 | 2.37<br>(1.87-2.95)    | 2.99<br>(2.36-3.74)    | 3.51<br>(2.75-4.41)    | 4.22<br>(3.20-5.49)    | 4.76<br>(3.54-6.28)   | 5.32<br>(3.85-7.24)   | 5.98<br>(4.08-8.21)  | 6.93<br>(4.55-9.76)  | 7.73<br>(4.96-11.0)  |
| 12-hr                                                                                                    | 2.45<br>(1.96-3.03)                 | 2.92<br>(2.33-3.60)    | 3.68<br>(2.93-4.56)    | 4.32<br>(3.42-5.36)    | 5.19<br>(3.98-6.67)    | 5.84<br>(4.39-7.63)   | 6.53<br>(4.77-8.79)   | 7.33<br>(5.04-9.97)  | 8.50<br>(5.62-11.9)  | 9.47<br>(6.11-13.4)  |
| 24-hr                                                                                                    | 2.87<br>(2.32-3.50)                 | 3.43<br>(2.77-4.19)    | 4.35<br>(3.51-5.32)    | 5.11<br>(4.10-6.28)    | 6.17<br>(4.78-7.85)    | 6.95<br>(5.28-9.00)   | 7.79<br>(5.74-10.4)   | 8.77<br>(6.08-11.8)  | 10.2<br>(6.80-14.1)  | 11.5<br>(7.44-16.1)  |
| 2-day                                                                                                    | 3.18<br>(2.61-3.84)                 | 3.85<br>(3.15-4.65)    | 4.94<br>(4.03-5.97)    | 5.84<br>(4.73-7.10)    | 7.08<br>(5.56-8.94)    | 8.00<br>(6.15-10.3)   | 9.00<br>(6.72-12.0)   | 10.2<br>(7.11-13.6)  | 12.0<br>(8.04-16.4)  | 13.6<br>(8.86-18.8)  |
| 3-day                                                                                                    | 3.44<br>(2.84-4.12)                 | 4.15<br>(3.42-4.98)    | 5.32<br>(4.37-6.39)    | 6.28<br>(5.13-7.59)    | 7.62<br>(6.01-9.55)    | 8.60<br>(6.65-11.0)   | 9.67<br>(7.26-12.8)   | 11.0<br>(7.67-14.5)  | 12.9<br>(8.67-17.6)  | 14.6<br>(9.55-20.1)  |
| 4-day                                                                                                    | 3.68<br>(3.05-4.39)                 | 4.42<br>(3.66-5.28)    | 5.64<br>(4.65-6.75)    | 6.64<br>(5.45-7.98)    | 8.03<br>(6.36-10.0)    | 9.06<br>(7.02-11.5)   | 10.2<br>(7.65-13.3)   | 11.5<br>(8.08-15.2)  | 13.5<br>(9.10-18.3)  | 15.2<br>(10.00-20.9) |
| 7-day                                                                                                    | 4.37<br>(3.66-5.16)                 | 5.17<br>(4.32-6.11)    | 6.47<br>(5.39-7.67)    | 7.55<br>(6.25-8.99)    | 9.04<br>(7.22-11.2)    | 10.1<br>(7.92-12.7)   | 11.3<br>(8.57-14.7)   | 12.7<br>(9.00-16.6)  | 14.8<br>(10.0-19.9)  | 16.6<br>(10.9-22.5)  |
| 10-day                                                                                                   | 5.06<br>(4.26-5.94)                 | 5.89<br>(4.95-6.92)    | 7.24<br>(6.07-8.54)    | 8.37<br>(6.97-9.90)    | 9.91<br>(7.96-12.1)    | 11.1<br>(8.68-13.8)   | 12.3<br>(9.31-15.8)   | 13.7<br>(9.74-17.8)  | 15.8<br>(10.7-21.0)  | 17.5<br>(11.5-23.7)  |
| 20-day                                                                                                   | 7.17<br>(6.12-8.33)                 | 8.06<br>(6.87-9.37)    | 9.52<br>(8.08-11.1)    | 10.7<br>(9.04-12.5)    | 12.4<br>(10.0-14.9)    | 13.7<br>(10.8-16.7)   | 15.0<br>(11.3-18.7)   | 16.3<br>(11.7-20.9)  | 18.2<br>(12.4-23.9)  | 19.6<br>(13.0-26.3)  |
| 30-day                                                                                                   | 8.94<br>(7.69-10.3)                 | 9.88<br>(8.48-11.4)    | 11.4<br>(9.76-13.2)    | 12.7<br>(10.8-14.7)    | 14.4<br>(11.7-17.2)    | 15.8<br>(12.5-19.1)   | 17.1<br>(13.0-21.2)   | 18.4<br>(13.3-23.5)  | 20.1<br>(13.9-26.3)  | 21.4<br>(14.2-28.4)  |
| 45-day                                                                                                   | 11.1<br>(9.65-12.8)                 | 12.1<br>(10.5-13.9)    | 13.8<br>(11.9-15.8)    | 15.1<br>(12.9-17.5)    | 17.0<br>(13.9-20.1)    | 18.5<br>(14.7-22.1)   | 19.9<br>(15.1-24.3)   | 21.1<br>(15.4-26.7)  | 22.7<br>(15.7-29.5)  | 23.7<br>(15.9-31.4)  |
| 60-day                                                                                                   | 13.0<br>(11.3-14.8)                 | 14.0<br>(12.2-16.0)    | 15.8<br>(13.6-18.0)    | 17.2<br>(14.8-19.8)    | 19.2<br>(15.8-22.5)    | 20.8<br>(16.6-24.7)   | 22.2<br>(16.9-27.0)   | 23.5<br>(17.1-29.6)  | 24.9<br>(17.3-32.3)  | 25.8<br>(17.4-34.1)  |

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

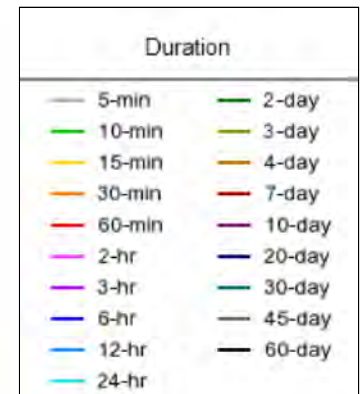
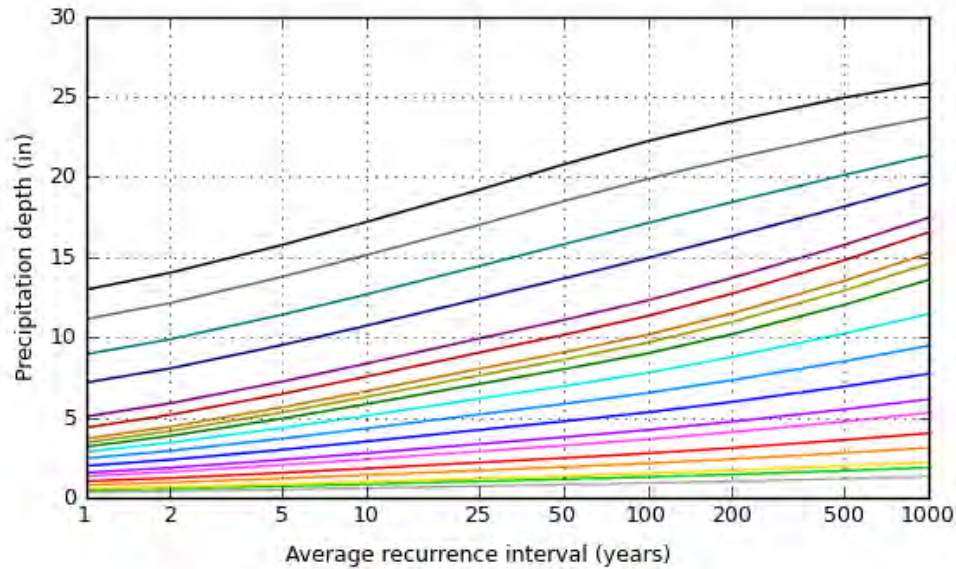
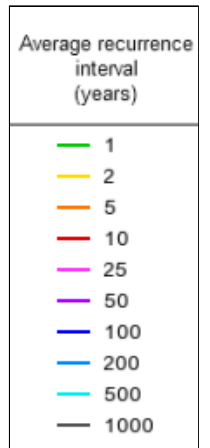
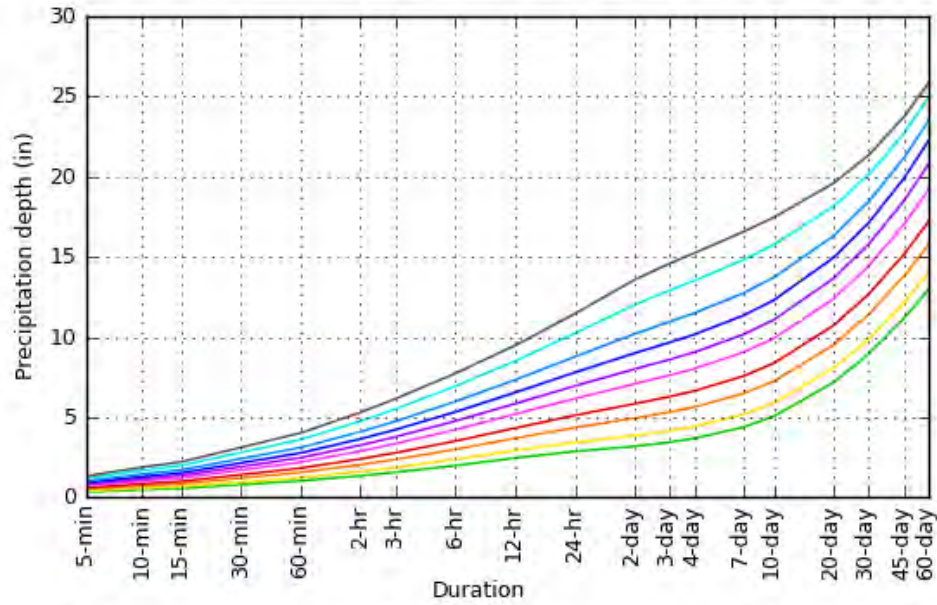
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### PF graphical



## PDS-based depth-duration-frequency (DDF) curves

Latitude: 41.3376°, Longitude: -72.1197°



## Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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NOAA Atlas 14, Volume 10, Version 3  
Location name: Waterford, Connecticut, USA\*  
Latitude: 41.3376°, Longitude: -72.1197°  
Elevation: 27.7 ft\*\*  
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## POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

### PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) <sup>1</sup> |                                     |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Duration                                                                                                      | Average recurrence interval (years) |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|                                                                                                               | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                     | 100                    | 200                    | 500                    | 1000                   |
| 5-min                                                                                                         | 4.02<br>(3.10-5.16)                 | 4.81<br>(3.70-6.18)    | 6.11<br>(4.67-7.85)    | 7.19<br>(5.48-9.28)    | 8.66<br>(6.41-11.6)    | 9.77<br>(7.09-13.2)    | 10.9<br>(7.74-15.3)    | 12.3<br>(8.23-20.6)    | 14.3<br>(9.23-20.6)    | 15.9<br>(10.1-23.3)    |
| 10-min                                                                                                        | 2.85<br>(2.19-3.65)                 | 3.41<br>(2.62-4.37)    | 4.33<br>(3.31-5.56)    | 5.08<br>(3.87-6.56)    | 6.13<br>(4.54-8.18)    | 6.92<br>(5.02-9.38)    | 7.75<br>(5.48-10.8)    | 8.70<br>(5.84-12.3)    | 10.1<br>(6.53-14.6)    | 11.3<br>(7.13-16.5)    |
| 15-min                                                                                                        | 2.24<br>(1.72-2.86)                 | 2.68<br>(2.05-3.43)    | 3.40<br>(2.60-4.37)    | 3.99<br>(3.04-5.15)    | 4.81<br>(3.56-6.42)    | 5.42<br>(3.94-7.36)    | 6.08<br>(4.30-8.48)    | 6.82<br>(4.58-9.62)    | 7.92<br>(5.12-11.4)    | 8.83<br>(5.59-12.9)    |
| 30-min                                                                                                        | 1.59<br>(1.22-2.03)                 | 1.90<br>(1.45-2.43)    | 2.40<br>(1.84-3.09)    | 2.82<br>(2.15-3.64)    | 3.40<br>(2.51-4.53)    | 3.83<br>(2.78-5.19)    | 4.28<br>(3.03-5.98)    | 4.81<br>(3.23-6.78)    | 5.58<br>(3.61-8.06)    | 6.22<br>(3.94-9.12)    |
| 60-min                                                                                                        | 1.03<br>(0.790-1.32)                | 1.23<br>(0.941-1.57)   | 1.55<br>(1.19-1.99)    | 1.82<br>(1.39-2.35)    | 2.19<br>(1.62-2.93)    | 2.47<br>(1.79-3.35)    | 2.77<br>(1.96-3.86)    | 3.10<br>(2.08-4.37)    | 3.60<br>(2.33-5.20)    | 4.01<br>(2.54-5.88)    |
| 2-hr                                                                                                          | 0.674<br>(0.523-0.854)              | 0.804<br>(0.624-1.02)  | 1.02<br>(0.788-1.30)   | 1.20<br>(0.921-1.53)   | 1.44<br>(1.08-1.91)    | 1.63<br>(1.19-2.18)    | 1.82<br>(1.30-2.52)    | 2.04<br>(1.38-2.85)    | 2.37<br>(1.55-3.40)    | 2.65<br>(1.69-3.85)    |
| 3-hr                                                                                                          | 0.520<br>(0.407-0.656)              | 0.621<br>(0.486-0.784) | 0.787<br>(0.613-0.995) | 0.925<br>(0.716-1.17)  | 1.11<br>(0.837-1.46)   | 1.25<br>(0.925-1.68)   | 1.41<br>(1.01-1.93)    | 1.58<br>(1.07-2.19)    | 1.83<br>(1.20-2.61)    | 2.05<br>(1.31-2.95)    |
| 6-hr                                                                                                          | 0.331<br>(0.262-0.413)              | 0.395<br>(0.312-0.493) | 0.499<br>(0.393-0.625) | 0.586<br>(0.459-0.736) | 0.705<br>(0.535-0.916) | 0.794<br>(0.591-1.05)  | 0.889<br>(0.643-1.21)  | 0.998<br>(0.682-1.37)  | 1.16<br>(0.761-1.63)   | 1.29<br>(0.828-1.85)   |
| 12-hr                                                                                                         | 0.204<br>(0.163-0.251)              | 0.242<br>(0.194-0.299) | 0.306<br>(0.244-0.378) | 0.358<br>(0.284-0.445) | 0.431<br>(0.330-0.554) | 0.485<br>(0.364-0.633) | 0.542<br>(0.396-0.730) | 0.609<br>(0.419-0.827) | 0.706<br>(0.467-0.984) | 0.786<br>(0.507-1.11)  |
| 24-hr                                                                                                         | 0.119<br>(0.097-0.146)              | 0.143<br>(0.116-0.174) | 0.181<br>(0.146-0.222) | 0.213<br>(0.171-0.262) | 0.257<br>(0.199-0.327) | 0.290<br>(0.220-0.375) | 0.325<br>(0.239-0.433) | 0.365<br>(0.253-0.492) | 0.426<br>(0.284-0.589) | 0.477<br>(0.310-0.669) |
| 2-day                                                                                                         | 0.066<br>(0.054-0.080)              | 0.080<br>(0.066-0.097) | 0.103<br>(0.084-0.124) | 0.122<br>(0.099-0.148) | 0.148<br>(0.116-0.186) | 0.167<br>(0.128-0.214) | 0.187<br>(0.140-0.249) | 0.212<br>(0.148-0.283) | 0.250<br>(0.168-0.342) | 0.283<br>(0.185-0.392) |
| 3-day                                                                                                         | 0.048<br>(0.039-0.057)              | 0.058<br>(0.048-0.069) | 0.074<br>(0.061-0.089) | 0.087<br>(0.071-0.105) | 0.106<br>(0.083-0.133) | 0.119<br>(0.092-0.152) | 0.134<br>(0.101-0.177) | 0.152<br>(0.107-0.201) | 0.179<br>(0.120-0.244) | 0.203<br>(0.133-0.279) |
| 4-day                                                                                                         | 0.038<br>(0.032-0.046)              | 0.046<br>(0.038-0.055) | 0.059<br>(0.048-0.070) | 0.069<br>(0.057-0.083) | 0.084<br>(0.066-0.104) | 0.094<br>(0.073-0.120) | 0.106<br>(0.080-0.139) | 0.120<br>(0.084-0.158) | 0.141<br>(0.095-0.191) | 0.159<br>(0.104-0.218) |
| 7-day                                                                                                         | 0.026<br>(0.022-0.031)              | 0.031<br>(0.026-0.036) | 0.039<br>(0.032-0.046) | 0.045<br>(0.037-0.054) | 0.054<br>(0.043-0.066) | 0.060<br>(0.047-0.076) | 0.067<br>(0.051-0.087) | 0.076<br>(0.054-0.099) | 0.088<br>(0.060-0.118) | 0.099<br>(0.065-0.134) |
| 10-day                                                                                                        | 0.021<br>(0.018-0.025)              | 0.025<br>(0.021-0.029) | 0.030<br>(0.025-0.036) | 0.035<br>(0.029-0.041) | 0.041<br>(0.033-0.051) | 0.046<br>(0.036-0.057) | 0.051<br>(0.039-0.066) | 0.057<br>(0.041-0.074) | 0.066<br>(0.045-0.088) | 0.073<br>(0.048-0.099) |
| 20-day                                                                                                        | 0.015<br>(0.013-0.017)              | 0.017<br>(0.014-0.020) | 0.020<br>(0.017-0.023) | 0.022<br>(0.019-0.026) | 0.026<br>(0.021-0.031) | 0.028<br>(0.022-0.035) | 0.031<br>(0.024-0.039) | 0.034<br>(0.024-0.044) | 0.038<br>(0.026-0.050) | 0.041<br>(0.027-0.055) |
| 30-day                                                                                                        | 0.012<br>(0.011-0.014)              | 0.014<br>(0.012-0.016) | 0.016<br>(0.014-0.018) | 0.018<br>(0.015-0.020) | 0.020<br>(0.016-0.024) | 0.022<br>(0.017-0.027) | 0.024<br>(0.018-0.029) | 0.026<br>(0.018-0.033) | 0.028<br>(0.019-0.037) | 0.030<br>(0.020-0.039) |
| 45-day                                                                                                        | 0.010<br>(0.009-0.012)              | 0.011<br>(0.010-0.013) | 0.013<br>(0.011-0.015) | 0.014<br>(0.012-0.016) | 0.016<br>(0.013-0.019) | 0.017<br>(0.014-0.020) | 0.018<br>(0.014-0.022) | 0.020<br>(0.014-0.025) | 0.021<br>(0.015-0.027) | 0.022<br>(0.015-0.029) |
| 60-day                                                                                                        | 0.009<br>(0.008-0.010)              | 0.010<br>(0.008-0.011) | 0.011<br>(0.009-0.013) | 0.012<br>(0.010-0.014) | 0.013<br>(0.011-0.016) | 0.014<br>(0.012-0.017) | 0.015<br>(0.012-0.019) | 0.016<br>(0.012-0.021) | 0.017<br>(0.012-0.022) | 0.018<br>(0.012-0.024) |

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

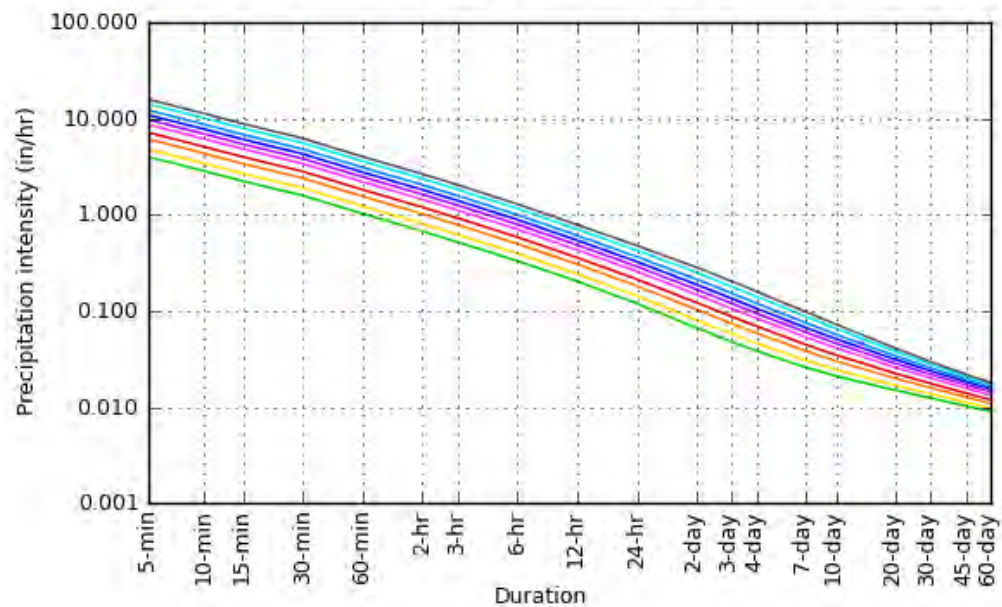
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### PF graphical

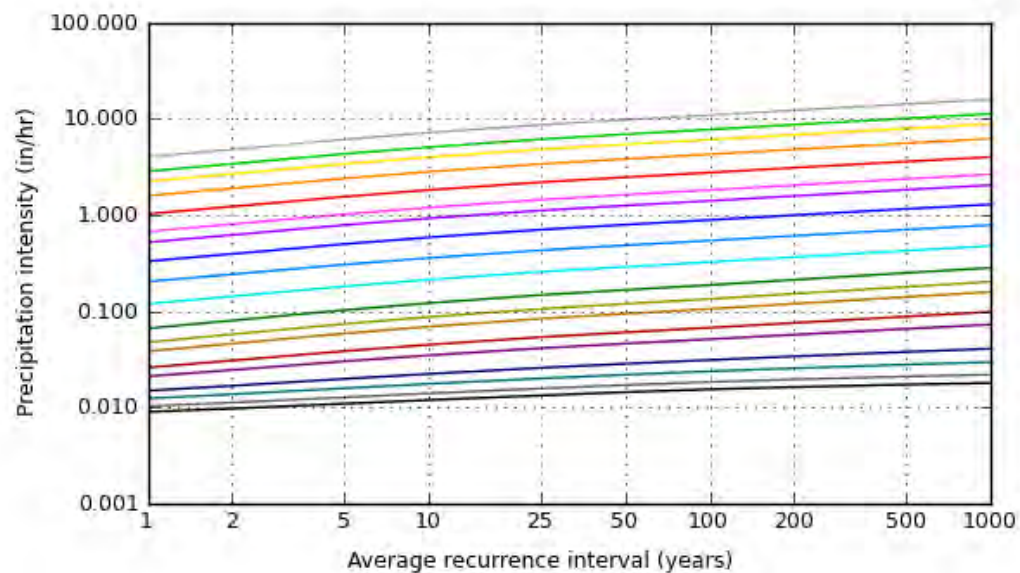


## PDS-based intensity-duration-frequency (IDF) curves

Latitude: 41.3376°, Longitude: -72.1197°



| Average recurrence interval (years) |
|-------------------------------------|
| 1                                   |
| 2                                   |
| 5                                   |
| 10                                  |
| 25                                  |
| 50                                  |
| 100                                 |
| 200                                 |
| 500                                 |
| 1000                                |



| Duration |        |
|----------|--------|
| 5-min    | 2-day  |
| 10-min   | 3-day  |
| 15-min   | 4-day  |
| 30-min   | 7-day  |
| 60-min   | 10-day |
| 2-hr     | 20-day |
| 3-hr     | 30-day |
| 6-hr     | 45-day |
| 12-hr    | 60-day |
| 24-hr    |        |

## Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial





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