YANTIC RIVER
CONSULTANTS, LLC

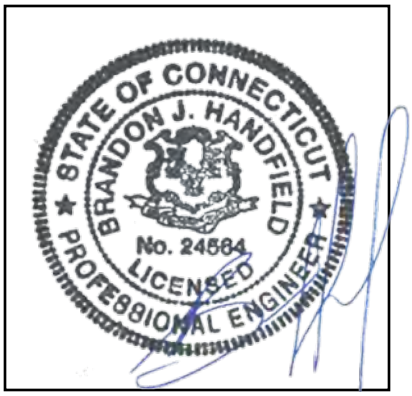
STORMWATER MANAGEMENT REPORT

WATERFORD WOODS APARTMENTS
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: SEPTEMBER 21, 2021



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PROJECT DESCRIPTION

Waterford Woods, LLC is proposing to construct 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). The multi-family development received site plan approval PL-21-1 on March 9, 2021, per Section 16 & 18 of the Zoning Regulations. An application has been submitted to the Town for a site plan modification related to a new Clubhouse and associated amenities.

The multi-family development will consist of the construction of three (3) apartment buildings with a total of 98 units with a mix of 58 one-bedroom and 40 two-bedroom dwelling units. Main access to the development will be provided from the north via Willetts Avenue Extension. Additional site work will include:

- Clearing and grubbing.
- Demolition and removal of the existing outbuilding on 384 Willetts Avenue Extension.
- Excavation and disposal of construction and demolition debris stockpiled throughout the Site.
- Construction of three (3) multi-family apartment buildings.
- Construction of Clubhouse building with exterior pool and patio.
- Construction of a new curb cut to the north on Willetts Avenue Extension.
- 28’ main access drive with 24’ wide internal access drives including a looped connection to improve vehicular circulation and emergency access throughout the development.
- Paved parking situated near the apartment buildings and site amenities with a total of 167 spaces including 6 handicapped accessible.
- Concrete pedestrian sidewalks connecting the apartment buildings with interior amenities and the existing public sidewalk along the south shoulder of Willetts Avenue Extension.
- Outdoor recreation areas including a mix of active recreation, passive recreation, and community spaces.
- Drainage improvements including a stormwater collection network, grass-lined treatment swales, subsurface infiltration systems, and detention ponds.
- Connection to water, sewer, electric, gas and telecom services in Willetts Avenue Extension.
- Landscaping including a mixture of street trees, shrubs, foundation plantings and planting beds.
- Building and street lighting.
- Erosion and sedimentation control measures.

EXISTING SITE DESCRIPTION

Construction related to Site Plan Application PL-21-1 has commenced. Prior to commencement, 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 where the current Clubhouse is proposed.

TOPOGRAPHY – The existing topography generally consists 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 range from 4% to 7% with steeper slopes around the perimeter of the delineated inland wetland areas.

SOILS – The USDA NRCS Web Soil Survey indicates 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

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 2020 v.3.0.0.20 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.
  - 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.

- **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.
  - SITE-PR-01 is 6.648 acres and consists of the north/northwest portion of the developed site.
  - SITE-PR-02 is 3.955 acres and consists of the eastern portion of the developed site.
  - SITE-PR-03 is 6.838 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.
- **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 EVENT	AREA 01			AREA 02			AREA 03			TOTAL SITE		
	SITE-EX-01	SITE-PR-01	EX vs. PR	SITE-EX-02	SITE-PR-02	EX vs. PR	SITE-EX-03	SITE-PR-03	EX vs. PR	SITE-EX	SITE-PR	EX vs. PR
2-yr	1.15	3.84	2.69	0.30	3.20	2.90	0.81	2.75	1.94	2.26	9.61	7.35
5-yr	3.09	6.66	3.57	0.86	5.20	4.34	2.34	5.67	3.34	6.29	17.08	10.79
10-yr	5.20	9.24	4.04	1.49	6.99	5.50	4.03	8.48	4.45	10.71	23.98	13.27
25-yr	8.63	13.08	4.45	2.52	9.60	7.08	6.83	12.83	6.00	17.98	34.35	16.37
50-yr	11.45	16.05	4.60	3.37	11.59	8.22	9.14	16.25	7.11	23.95	42.39	18.44
100-yr	14.69	19.32	4.63	4.36	13.77	9.41	11.82	20.09	8.27	30.85	51.31	20.46

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

As shown in the table 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.
    - 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.
    - 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.
    - 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.
- 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.
    - 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.

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 EVENT	AREA 01			AREA 02			AREA 03			TOTAL SITE		
	SITE-EX-01	SITE-PR-01A	EX vs. PR	SITE-EX-02	SITE-PR-02A	EX vs. PR	SITE-EX-03	SITE-PR-03A	EX vs. PR	SITE-EX	SITE-PR-DET-A	EX vs. PR
2-yr	1.15	1.00	-0.15	0.30	0.37	0.07	0.81	0.28	-0.53	2.26	1.32	-0.94
5-yr	3.09	2.33	-0.76	0.86	0.73	-0.13	2.34	0.83	-1.51	6.29	3.28	-3.01
10-yr	5.20	3.69	-1.51	1.49	1.73	0.24	4.03	2.73	-1.30	10.71	6.74	-3.97
25-yr	8.63	5.38	-3.25	2.52	3.42	0.90	6.83	5.39	-1.44	17.98	13.56	-4.42
50-yr	11.45	6.88	-4.57	3.37	4.40	1.03	9.14	7.81	-1.33	23.95	18.56	-5.39
100-yr	14.69	8.78	-5.91	4.36	5.35	0.99	11.82	10.59	-1.23	30.85	24.28	-6.57

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 the results show minor increases within with the individual subareas, these increases are eliminated for entire Site due to offsetting 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 is the minimum allowed per zoning requirements. Impervious area totals 15% of the total site, which is lower than 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
01A	4.285	1.138	0.103	0.735	N/A	Sediment Forebay	0.16	N/A	N/A	158% WQV
01A	4.285	1.138	0.103	0.735	769	Filter Bed	N/A	N/A	1500	195% WQF
01B	0.917	0.572	0.047	0.526	N/A	SC-740 Isolator Row	N/A	1.2	N/A	228% WQV
02A	2.930	1.486	0.124	0.974	N/A	Sediment Forebay	0.055	N/A	N/A	45% WQV
02A	2.930	1.486	0.124	0.974	770	Filter Bed	N/A	N/A	2100	272% WQF
03A	2.715	0.287	0.033	0.209	N/A	Sediment Forebay	0.041	N/A	N/A	124% WQV
03A	2.715	0.287	0.033	0.209	234	Filter Bed	N/A	N/A	1000	427% WQF
03B	4.123	0.467	0.052	0.343	N/A	Sediment Forebay	0.01	N/A	N/A	20% WQV [1]
03B	4.123	0.467	0.052	0.343	371	Filter Bed	N/A	N/A	1400	377% WQF

TABLE 3: PROPOSED TREATMENT SUMMARY

1. No Sediment Load from Clubhouse Roof or Patio. Runoff flows through vegetated filter swale.

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) = 0.053 acre-feet
GRV (provided) = 0.232 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 over 4 times the recommended groundwater recharge volume, thereby exceeding the GRV requirement.

CONCLUSION

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

PIPE FLOW

Pipe flow was calculated using the Rational Method based on local drainage areas, runoff coefficients (C), time of concentration (Tc) and rainfall intensity (I). Stormwater Studio version 3.0.0.24 was used to perform proposed pipe flow calculations for the 10 and 25-year design storms based on the following parameters.

- **RUNOFF COEFFICIENT:** Composite runoff coefficient (C) values were calculated for local drainage areas based on existing and proposed surface materials.
- **RAINFALL INTENSITY:** Precipitation frequency and depth estimates (rainfall data) were obtained from Northeast Regional Climate Center (NRCC) at Lat. 41.713 Long. -72.726, which corresponds with the geographic location of the Site.
- **TIME OF CONCENTRATION:** Time of concentration (Tc) was estimated for each collection structure based on the SCS method. For smaller areas with short flow paths over impervious surfaces a minimum time of concentration (Tc) of 5 minutes was used.

PROPOSED NETWORK

The proposed development will include a network of overland flow, roof leaders, yard drains, catch basins, sediment forebays, filter beds, subsurface infiltration, and detention systems designed to accommodate a 25-year storm event with pipes flowing below full capacity.

No adverse impacts on the downstream drainage patterns are anticipated.

APPENDIX A
DRAINAGE AREA MAPS

Existing Conditions DA-01A
Proposed Conditions DA-02A
Proposed Detention DA 03A
Proposed Pipe DA-04A (Not Included)

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)

WILLETTS AVENUE EXTENSION

NRCS SOIL BOUNDARY

UPSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

306

3

73C

DRAINAGE AREA 'SITE-EX-02'
TOTAL AREA = 2.495 AC
WOODS (GOOD) = 2.495

ELEV.= 71±

SHEET FLOW - 200'
MEADOW/WOODS @ 5.5%

ELEV.= 60±

DRAINAGE AREA 'SITE-EX-01'
TOTAL AREA = 8.182 AC
IMPERVIOUS = 0.058
OPEN SPACE (GOOD) = 0.818
MEADOW/BRUSH (GOOD) = 0.434
WOODS (GOOD) = 6.872

SHALLOW CONC.- 650'
WOODS @ 4.8%

ELEV.= 44±

SHEET FLOW - 200'
MEADOW/WOODS @ 5.0%

ELEV.= 34±

SHALLOW CONC.- 210'
WOODS @ 5.7%

WETLANDS
AREA = 5.585 AC

DISCHARGE POINT AT INLAND WETLANDS
ELEV. = 22±

17

DISCHARGE POINT AT INLAND WETLANDS
ELEV. = 29±

DRAINAGE AREA 'SITE-EX-03'
TOTAL AREA = 6.764 AC
WOODS (GOOD) = 6.764

WETLANDS
AREA = 3.609 AC

DOWNSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

SCALE: 1" = 160'
160 0 160

PROJECT NO:	DATE:	SHEET NO:
00096 - 001	11/18/20	DA-01A

CONTACT INFORMATION
YANTIC RIVER CONSULTANTS, LLC
191 NORWICH AVENUE
LEBANON, CONN 06249
Phone: (860) 367-7264
Email: yanticriver@gmail.com
Web: www.yanticriverconsultants.com

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)

WILLETTS AVENUE EXTENSION

NRCS SOIL BOUNDARY

UPSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

306

3

DRAINAGE AREA 'SITE-PR-02'
TOTAL AREA = 3.955 AC
IMPERVIOUS = 1.486
OPEN SPACE (GOOD) = 1.136
MEADOW / BRUSH = 0.446
WOODS (GOOD) = 0.887

73C

ELEV.= 71±

SHEET FLOW - 200'
GRASS @ 4.5%

SHALLOW CONC.- 200'
GRASS @ 4.5%

SHALLOW CONC.
930' @ 3.3%

ELEV.= 62±

ELEV.= 53±

ELEV.= 68±

SHEET FLOW
200' @ 4.5%

ELEV.= 59±

60 50 40 30 41

DISCHARGE POINT AT INLAND WETLANDS
ELEV. = 22±

WETLANDS
AREA = 5.585 AC

DRAINAGE AREA 'SITE-PR-03B'
TOTAL AREA = 4.123 AC
IMPERVIOUS = 0.467
OPEN SPACE (GOOD) = 1.935
MEADOW / BRUSH = 0.322
WOODS (GOOD) = 1.399

17

ELEV.= 48±

SHALLOW CONC.- 900'
GRASS @ 3.3%

73C

DISCHARGE POINT AT INLAND WETLANDS
ELEV. = 29±

ELEV.= 21±

SHALLOW CONC.
250' @ 4%

DRAINAGE AREA 'SITE-PR-01'
TOTAL AREA = 6.648 AC
IMPERVIOUS = 1.710
OPEN SPACE (GOOD) = 3.124
MEADOW / BRUSH = 0.544
WOODS (GOOD) = 1.270

WETLANDS
AREA = 3.609 AC

ELEV.= 27.5±

SHEET FLOW
100' @ 1%

ELEV.= 29±

ELEV.= 28±

SHEET FLOW
150' @ 5%

SHALLOW CONC.
200' @ 1.5%

ELEV.= 17±

3

17

DRAINAGE AREA 'SITE-PR-03A'
TOTAL AREA = 2.715 AC
IMPERVIOUS = 0.287
OPEN SPACE (GOOD) = 0.929
MEADOW / BRUSH = 0.203
WOODS (GOOD) = 1.296

DOWNSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

73C

SCALE: 1" = 160'
160 0 160

PROJECT NO:	DATE:	SHEET NO:
00096 - 001	09/21/21	DA-02A

CONTACT INFORMATION
YANTIC RIVER CONSULTANTS, LLC
191 NORWICH AVENUE
LEBANON, CONN 06249

Phone: (860) 367-7264
Email: yanticriver@gmail.com
Web: www.yanticriverconsultants.com

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)

WILLETTS AVENUE EXTENSION

NRCS SOIL BOUNDARY

DRAINAGE AREA 'INF-01B'
TOTAL AREA = 0.917 AC
IMPERVIOUS = 0.572
OPEN SPACE (GOOD) = 0.345
WOODS (GOOD) = 0.000

DRAINAGE AREA 'POND-02A'
TOTAL AREA = 2.930 AC
IMPERVIOUS = 1.486
OPEN SPACE (GOOD) = 1.076
MEADOW/BRUSH = 0.368
WOODS (GOOD) = 0.000

DRAINAGE AREA 'PR-02A'
TOTAL AREA = 1.025 AC
IMPERVIOUS = 0.000
OPEN SPACE (GOOD) = 0.060
MEADOW/BRUSH = 0.078
WOODS (GOOD) = 0.887

306

3

73C

FB-01A
2,100 SF

WETLANDS
AREA = 5.585 AC

DRAINAGE AREA 'SITE-PR-03B'
TOTAL AREA = 4.123 AC
IMPERVIOUS = 0.467
OPEN SPACE (GOOD) = 1.935
MEADOW / BRUSH = 0.322
WOODS (GOOD) = 1.399

17

FB-01A
1,500 SF

FB-03A
1,000 SF

DRAINAGE AREA 'POND-01A'
TOTAL AREA = 4.285 AC
IMPERVIOUS = 1.138
OPEN SPACE (GOOD) = 2.430
MEADOW/BRUSH = 0.403
WOODS (GOOD) = 0.314

73C

DRAINAGE AREA 'PR-01A'
TOTAL AREA = 1.446 AC
IMPERVIOUS = 0.000
OPEN SPACE (GOOD) = 0.349
MEADOW/BRUSH = 0.141
WOODS (GOOD) = 0.956

3

WETLANDS
AREA = 3.609 AC

FB-03B
1,400 SF

DRAINAGE AREA 'SITE-PR-03A'
TOTAL AREA = 2.715 AC
IMPERVIOUS = 0.287
OPEN SPACE (GOOD) = 0.929
MEADOW / BRUSH = 0.203
WOODS (GOOD) = 1.296

DOWNSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

17

73C

SCALE: 1" = 160'

160 0 160

PROJECT NO:	DATE:	SHEET NO:
00096 - 001	09/21/21	DA-03A

CONTACT INFORMATION

YANTIC RIVER CONSULTANTS, LLC
191 NORWICH AVENUE
LEBANON, CONN 06249

Phone: (860) 367-7264
Email: yanticriver@gmail.com
Web: www.yanticriverconsultants.com

WATERFORD WOODS

PREPARED FOR SIG CON ASSOCIATES, LLC

DRAINAGE MAP - PROPOSED DETENTION

384 & 394 WILLETTS AVE. EXT. WATERFORD, CT

APPENDIX B
HYDROLOGIC COMPUTATIONS

HYDROLOGY STUDIO REPORT

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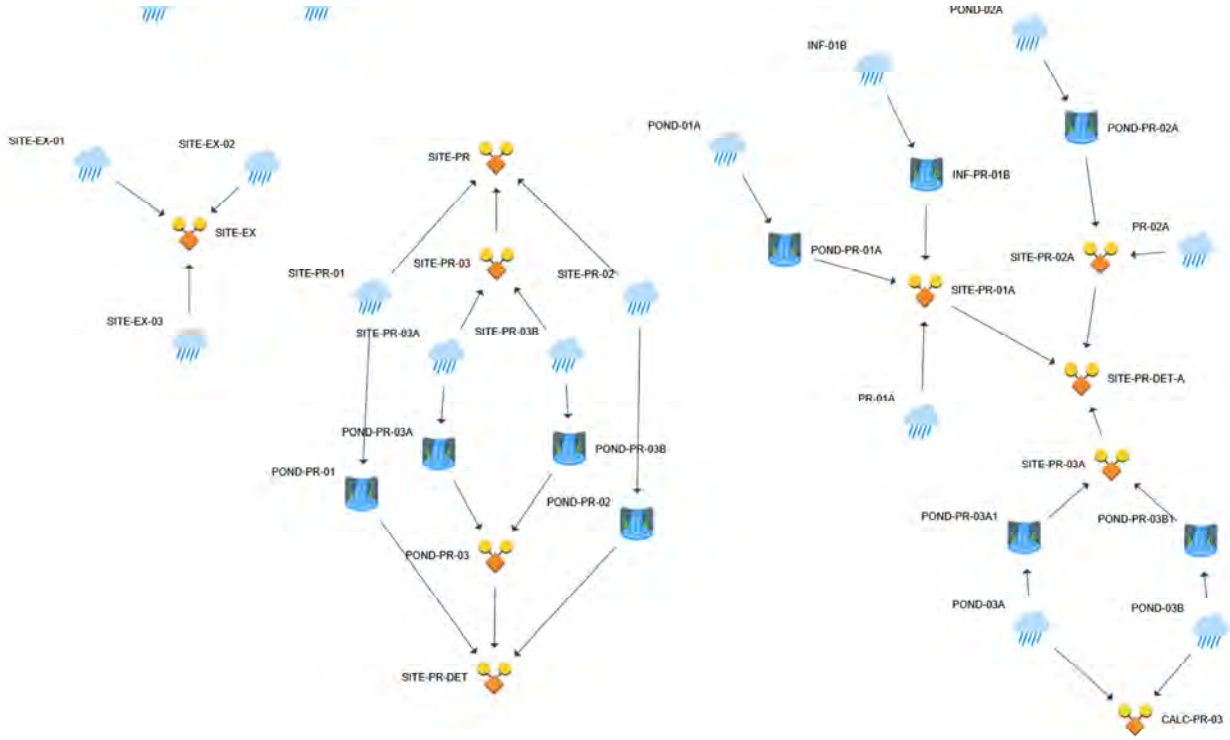
Basin Model

Hydrology Studio v 3.0.0.20

Project Name: Waterford Woods

09-21-2021



Hydrograph by Return Period

Project Name: Waterford Woods

09-21-2021

Hydrology Studio v 3.0.0.20

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		3.839		6.658	9.239	13.08	16.05	19.32
8	NRCS Runoff	SITE-PR-02		3.197		5.202	6.987	9.602	11.59	13.77
9	NRCS Runoff	SITE-PR-03B		1.784		3.638	5.414	8.148	10.30	12.72
10	NRCS Runoff	SITE-PR-03A		0.990		2.069	3.121	4.754	6.042	7.500
11	Junction	SITE-PR-03		2.749		5.667	8.480	12.83	16.25	20.09
12	Junction	SITE-PR		9.611		17.08	23.98	34.35	42.39	51.31
13	Pond Route	POND-PR-01		0.440		1.941	3.333	4.762	9.363	11.07
14	Pond Route	POND-PR-02		0.309		0.601	1.665	3.252	4.049	4.752
15	Pond Route	POND-PR-03A		0.146		0.376	1.172	2.049	3.317	4.587
16	Pond Route	POND-PR-03B		0.143		0.455	1.554	3.344	4.490	6.009
17	Junction	POND-PR-03		0.282		0.829	2.726	5.386	7.807	10.59
18	Junction	SITE-PR-DET		1.024		3.236	7.477	13.09	20.44	25.98
19	NRCS Runoff	PR-01A		0.271		0.716	1.197	1.976	2.609	3.333
20	NRCS Runoff	POND-01A		2.649		4.515	6.210	8.727	10.66	12.78
21	NRCS Runoff	INF-01B		1.901		2.702	3.376	4.325	5.024	5.775
22	NRCS Runoff	PR-02A		0.160		0.449	0.772	1.305	1.742	2.242
23	NRCS Runoff	POND-02A		3.352		5.023	6.461	8.511	10.04	11.69
24	NRCS Runoff	POND-03A		0.990		2.069	3.121	4.754	6.042	7.500
25	NRCS Runoff	POND-03B		1.784		3.638	5.414	8.148	10.30	12.72
26	Pond Route	INF-PR-01B		0.729		1.646	2.396	3.112	4.106	4.939
27	Pond Route	POND-PR-01A		0.325		0.603	1.740	3.237	4.060	4.800
28	Junction	SITE-PR-01A		0.999		2.334	3.689	5.379	6.878	8.783
29	Pond Route	POND-PR-02A		0.325		0.569	1.517	2.943	3.695	4.290
30	Pond Route	POND-PR-03A1		0.146		0.376	1.172	2.049	3.317	4.587
31	Pond Route	POND-PR-03B1		0.143		0.455	1.554	3.344	4.490	6.009
32	Junction	SITE-PR-02A		0.370		0.732	1.725	3.421	4.395	5.352
33	Junction	SITE-PR-03A		0.282		0.829	2.726	5.386	7.807	10.59
34	Junction	SITE-PR-DET-A		1.316		3.277	6.737	13.56	18.56	24.28
35	Junction	CALC-PR-03		2.749		5.667	8.480	12.83	16.25	20.09

Hydrograph 2-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.20

09-21-2021

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	3.839	12.42	22,180	----		
8	NRCS Runoff	SITE-PR-02	3.197	12.32	16,284	----		
9	NRCS Runoff	SITE-PR-03B	1.784	12.25	9,476	----		
10	NRCS Runoff	SITE-PR-03A	0.990	12.33	5,756	----		
11	Junction	SITE-PR-03	2.749	12.28	15,233	9, 10		
12	Junction	SITE-PR	9.611	12.33	53,697	7, 8, 11		
13	Pond Route	POND-PR-01	0.440	15.08	16,604	7	31.43	10,499
14	Pond Route	POND-PR-02	0.309	14.82	9,517	8	29.21	8,345
15	Pond Route	POND-PR-03A	0.146	13.70	2,250	10	21.57	1,958
16	Pond Route	POND-PR-03B	0.143	14.62	2,506	9	18.54	3,878
17	Junction	POND-PR-03	0.282	14.07	4,756	15, 16		
18	Junction	SITE-PR-DET	1.024	14.32	30,878	13, 14, 17		
19	NRCS Runoff	PR-01A	0.271	12.38	1,976	----		
20	NRCS Runoff	POND-01A	2.649	12.40	15,096	----		
21	NRCS Runoff	INF-01B	1.901	12.10	6,111	----		
22	NRCS Runoff	PR-02A	0.160	12.42	1,256	----		
23	NRCS Runoff	POND-02A	3.352	12.30	16,364	----		
24	NRCS Runoff	POND-03A	0.990	12.33	5,756	----		
25	NRCS Runoff	POND-03B	1.784	12.25	9,476	----		
26	Pond Route	INF-PR-01B	0.729	12.35	3,860	21	30.17	1,813
27	Pond Route	POND-PR-01A	0.325	14.53	9,965	20	30.94	7,025
28	Junction	SITE-PR-01A	0.999	12.37	15,801	19, 26, 27		
29	Pond Route	POND-PR-02A	0.325	14.23	9,552	23	29.27	8,725
30	Pond Route	POND-PR-03A1	0.146	13.70	2,250	24	21.57	1,958
31	Pond Route	POND-PR-03B1	0.143	14.62	2,506	25	18.54	3,878
32	Junction	SITE-PR-02A	0.370	13.75	10,808	22, 29		
33	Junction	SITE-PR-03A	0.282	14.07	4,756	30, 31		
34	Junction	SITE-PR-DET-A	1.316	13.12	31,365	28, 32, 33		
35	Junction	CALC-PR-03	2.749	12.28	15,233	24, 25		

Hydrograph 5-yr Summary

Project Name: Waterford Woods

09-21-2021

Hydrology Studio v 3.0.0.20

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	6.658	12.38	36,401	----		
8	NRCS Runoff	SITE-PR-02	5.202	12.30	25,635	----		
9	NRCS Runoff	SITE-PR-03B	3.638	12.22	16,874	----		
10	NRCS Runoff	SITE-PR-03A	2.069	12.27	10,415	----		
11	Junction	SITE-PR-03	5.667	12.23	27,289	9, 10		
12	Junction	SITE-PR	17.08	12.32	89,325	7, 8, 11		
13	Pond Route	POND-PR-01	1.941	12.98	30,386	7	32.02	14,746
14	Pond Route	POND-PR-02	0.601	14.00	18,336	8	29.95	13,176
15	Pond Route	POND-PR-03A	0.376	13.08	6,532	10	22.22	3,644
16	Pond Route	POND-PR-03B	0.455	13.42	9,096	9	19.59	6,556
17	Junction	POND-PR-03	0.829	13.12	15,628	15, 16		
18	Junction	SITE-PR-DET	3.236	13.03	64,350	13, 14, 17		
19	NRCS Runoff	PR-01A	0.716	12.28	3,964	----		
20	NRCS Runoff	POND-01A	4.515	12.37	24,504	----		
21	NRCS Runoff	INF-01B	2.702	12.10	8,728	----		
22	NRCS Runoff	PR-02A	0.449	12.30	2,592	----		
23	NRCS Runoff	POND-02A	5.023	12.28	24,286	----		
24	NRCS Runoff	POND-03A	2.069	12.27	10,415	----		
25	NRCS Runoff	POND-03B	3.638	12.22	16,874	----		
26	Pond Route	INF-PR-01B	1.646	12.20	6,216	21	30.55	2,215
27	Pond Route	POND-PR-01A	0.603	14.03	18,809	20	31.63	11,899
28	Junction	SITE-PR-01A	2.334	12.23	28,988	19, 26, 27		
29	Pond Route	POND-PR-02A	0.569	13.75	16,992	23	29.94	13,060
30	Pond Route	POND-PR-03A1	0.376	13.08	6,532	24	22.22	3,644
31	Pond Route	POND-PR-03B1	0.455	13.42	9,096	25	19.59	6,556
32	Junction	SITE-PR-02A	0.732	12.40	19,584	22, 29		
33	Junction	SITE-PR-03A	0.829	13.12	15,628	30, 31		
34	Junction	SITE-PR-DET-A	3.277	12.37	64,201	28, 32, 33		
35	Junction	CALC-PR-03	5.667	12.23	27,289	24, 25		

Hydrograph 10-yr Summary

Project Name: Waterford Woods

09-21-2021

Hydrology Studio v 3.0.0.20

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	9.239	12.37	49,425	----		
8	NRCS Runoff	SITE-PR-02	6.987	12.30	34,026	----		
9	NRCS Runoff	SITE-PR-03B	5.414	12.22	23,910	----		
10	NRCS Runoff	SITE-PR-03A	3.121	12.25	14,877	----		
11	Junction	SITE-PR-03	8.480	12.23	38,786	9, 10		
12	Junction	SITE-PR	23.98	12.30	122,237	7, 8, 11		
13	Pond Route	POND-PR-01	3.333	12.87	43,151	7	32.53	18,920
14	Pond Route	POND-PR-02	1.665	12.92	26,481	8	30.28	15,676
15	Pond Route	POND-PR-03A	1.172	12.67	10,780	10	22.58	4,776
16	Pond Route	POND-PR-03B	1.554	12.67	15,636	9	19.92	8,554
17	Junction	POND-PR-03	2.726	12.67	26,416	15, 16		
18	Junction	SITE-PR-DET	7.477	12.78	96,048	13, 14, 17		
19	NRCS Runoff	PR-01A	1.197	12.25	5,950	----		
20	NRCS Runoff	POND-01A	6.210	12.37	33,075	----		
21	NRCS Runoff	INF-01B	3.376	12.08	10,967	----		
22	NRCS Runoff	PR-02A	0.772	12.27	3,943	----		
23	NRCS Runoff	POND-02A	6.461	12.28	31,190	----		
24	NRCS Runoff	POND-03A	3.121	12.25	14,877	----		
25	NRCS Runoff	POND-03B	5.414	12.22	23,910	----		
26	Pond Route	INF-PR-01B	2.396	12.18	8,314	21	30.83	2,484
27	Pond Route	POND-PR-01A	1.740	12.97	27,135	20	31.97	14,369
28	Junction	SITE-PR-01A	3.689	12.20	41,399	19, 26, 27		
29	Pond Route	POND-PR-02A	1.517	12.88	23,664	23	30.24	15,386
30	Pond Route	POND-PR-03A1	1.172	12.67	10,780	24	22.58	4,776
31	Pond Route	POND-PR-03B1	1.554	12.67	15,636	25	19.92	8,554
32	Junction	SITE-PR-02A	1.725	12.83	27,607	22, 29		
33	Junction	SITE-PR-03A	2.726	12.67	26,416	30, 31		
34	Junction	SITE-PR-DET-A	6.737	12.77	95,422	28, 32, 33		
35	Junction	CALC-PR-03	8.480	12.23	38,786	24, 25		

Hydrograph 25-yr Summary

Project Name: Waterford Woods

09-21-2021

Hydrology Studio v 3.0.0.20

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	13.08	12.35	68,975	----		
8	NRCS Runoff	SITE-PR-02	9.602	12.28	46,433	----		
9	NRCS Runoff	SITE-PR-03B	8.148	12.20	34,767	----		
10	NRCS Runoff	SITE-PR-03A	4.754	12.25	21,797	----		
11	Junction	SITE-PR-03	12.83	12.22	56,564	9, 10		
12	Junction	SITE-PR	34.35	12.28	171,972	7, 8, 11		
13	Pond Route	POND-PR-01	4.762	12.85	62,373	7	33.37	26,255
14	Pond Route	POND-PR-02	3.252	12.75	38,596	8	30.80	19,854
15	Pond Route	POND-PR-03A	2.049	12.62	17,444	10	23.14	6,635
16	Pond Route	POND-PR-03B	3.344	12.55	25,942	9	20.36	11,202
17	Junction	POND-PR-03	5.386	12.57	43,386	15, 16		
18	Junction	SITE-PR-DET	13.09	12.70	144,356	13, 14, 17		
19	NRCS Runoff	PR-01A	1.976	12.23	9,126	----		
20	NRCS Runoff	POND-01A	8.727	12.35	45,889	----		
21	NRCS Runoff	INF-01B	4.325	12.08	14,165	----		
22	NRCS Runoff	PR-02A	1.305	12.23	6,119	----		
23	NRCS Runoff	POND-02A	8.511	12.28	41,182	----		
24	NRCS Runoff	POND-03A	4.754	12.25	21,797	----		
25	NRCS Runoff	POND-03B	8.148	12.20	34,767	----		
26	Pond Route	INF-PR-01B	3.112	12.17	11,352	21	31.27	2,861
27	Pond Route	POND-PR-01A	3.237	12.83	39,657	20	32.49	18,542
28	Junction	SITE-PR-01A	5.379	12.20	60,135	19, 26, 27		
29	Pond Route	POND-PR-02A	2.943	12.73	33,385	23	30.67	18,799
30	Pond Route	POND-PR-03A1	2.049	12.62	17,444	24	23.14	6,635
31	Pond Route	POND-PR-03B1	3.344	12.55	25,942	25	20.36	11,202
32	Junction	SITE-PR-02A	3.421	12.62	39,504	22, 29		
33	Junction	SITE-PR-03A	5.386	12.57	43,386	30, 31		
34	Junction	SITE-PR-DET-A	13.56	12.55	143,026	28, 32, 33		
35	Junction	CALC-PR-03	12.83	12.22	56,564	24, 25		

Hydrograph 50-yr Summary

Project Name: Waterford Woods

09-21-2021

Hydrology Studio v 3.0.0.20

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	16.05	12.35	84,136	----		
8	NRCS Runoff	SITE-PR-02	11.59	12.28	55,950	----		
9	NRCS Runoff	SITE-PR-03B	10.30	12.20	43,361	----		
10	NRCS Runoff	SITE-PR-03A	6.042	12.23	27,294	----		
11	Junction	SITE-PR-03	16.25	12.22	70,655	9, 10		
12	Junction	SITE-PR	42.39	12.28	210,741	7, 8, 11		
13	Pond Route	POND-PR-01	9.363	12.70	77,339	7	33.75	29,752
14	Pond Route	POND-PR-02	4.049	12.73	47,913	8	31.21	23,494
15	Pond Route	POND-PR-03A	3.317	12.53	22,758	10	23.48	7,959
16	Pond Route	POND-PR-03B	4.490	12.53	34,116	9	20.71	13,717
17	Junction	POND-PR-03	7.807	12.53	56,875	15, 16		
18	Junction	SITE-PR-DET	20.44	12.67	182,127	13, 14, 17		
19	NRCS Runoff	PR-01A	2.609	12.23	11,704	----		
20	NRCS Runoff	POND-01A	10.66	12.35	55,799	----		
21	NRCS Runoff	INF-01B	5.024	12.08	16,557	----		
22	NRCS Runoff	PR-02A	1.742	12.23	7,895	----		
23	NRCS Runoff	POND-02A	10.04	12.28	48,727	----		
24	NRCS Runoff	POND-03A	6.042	12.23	27,294	----		
25	NRCS Runoff	POND-03B	10.30	12.20	43,361	----		
26	Pond Route	INF-PR-01B	4.106	12.15	13,642	21	31.58	3,065
27	Pond Route	POND-PR-01A	4.060	12.82	49,371	20	32.93	22,186
28	Junction	SITE-PR-01A	6.878	12.17	74,718	19, 26, 27		
29	Pond Route	POND-PR-02A	3.695	12.70	40,746	23	31.02	21,611
30	Pond Route	POND-PR-03A1	3.317	12.53	22,758	24	23.48	7,959
31	Pond Route	POND-PR-03B1	4.490	12.53	34,116	25	20.71	13,717
32	Junction	SITE-PR-02A	4.395	12.55	48,641	22, 29		
33	Junction	SITE-PR-03A	7.807	12.53	56,875	30, 31		
34	Junction	SITE-PR-DET-A	18.56	12.50	180,234	28, 32, 33		
35	Junction	CALC-PR-03	16.25	12.22	70,655	24, 25		

Hydrograph 100-yr Summary

Project Name: Waterford Woods

09-21-2021

Hydrology Studio v 3.0.0.20

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	19.32	12.35	101,027	----		
8	NRCS Runoff	SITE-PR-02	13.77	12.28	66,474	----		
9	NRCS Runoff	SITE-PR-03B	12.72	12.20	53,064	----		
10	NRCS Runoff	SITE-PR-03A	7.500	12.23	33,517	----		
11	Junction	SITE-PR-03	20.09	12.22	86,582	9, 10		
12	Junction	SITE-PR	51.31	12.28	254,081	7, 8, 11		
13	Pond Route	POND-PR-01	11.07	12.70	94,057	7	34.14	33,553
14	Pond Route	POND-PR-02	4.752	12.73	58,235	8	31.65	27,804
15	Pond Route	POND-PR-03A	4.587	12.48	28,796	10	23.77	9,132
16	Pond Route	POND-PR-03B	6.009	12.50	43,391	9	21.03	16,203
17	Junction	POND-PR-03	10.59	12.48	72,187	15, 16		
18	Junction	SITE-PR-DET	25.98	12.58	224,479	13, 14, 17		
19	NRCS Runoff	PR-01A	3.333	12.22	14,665	----		
20	NRCS Runoff	POND-01A	12.78	12.35	66,817	----		
21	NRCS Runoff	INF-01B	5.775	12.08	19,159	----		
22	NRCS Runoff	PR-02A	2.242	12.23	9,942	----		
23	NRCS Runoff	POND-02A	11.69	12.28	56,985	----		
24	NRCS Runoff	POND-03A	7.500	12.23	33,517	----		
25	NRCS Runoff	POND-03B	12.72	12.20	53,064	----		
26	Pond Route	INF-PR-01B	4.939	12.15	16,148	21	31.82	3,209
27	Pond Route	POND-PR-01A	4.800	12.82	60,192	20	33.40	26,496
28	Junction	SITE-PR-01A	8.783	12.33	91,006	19, 26, 27		
29	Pond Route	POND-PR-02A	4.290	12.70	48,819	23	31.35	24,885
30	Pond Route	POND-PR-03A1	4.587	12.48	28,796	24	23.77	9,132
31	Pond Route	POND-PR-03B1	6.009	12.50	43,391	25	21.03	16,203
32	Junction	SITE-PR-02A	5.352	12.42	58,761	22, 29		
33	Junction	SITE-PR-03A	10.59	12.48	72,187	30, 31		
34	Junction	SITE-PR-DET-A	24.28	12.40	221,953	28, 32, 33		
35	Junction	CALC-PR-03	20.09	12.22	86,582	24, 25		

IDF Report

IDF filename: NOAA Willetts Avenue.idf

Hydrology Studio v 3.0.0.20

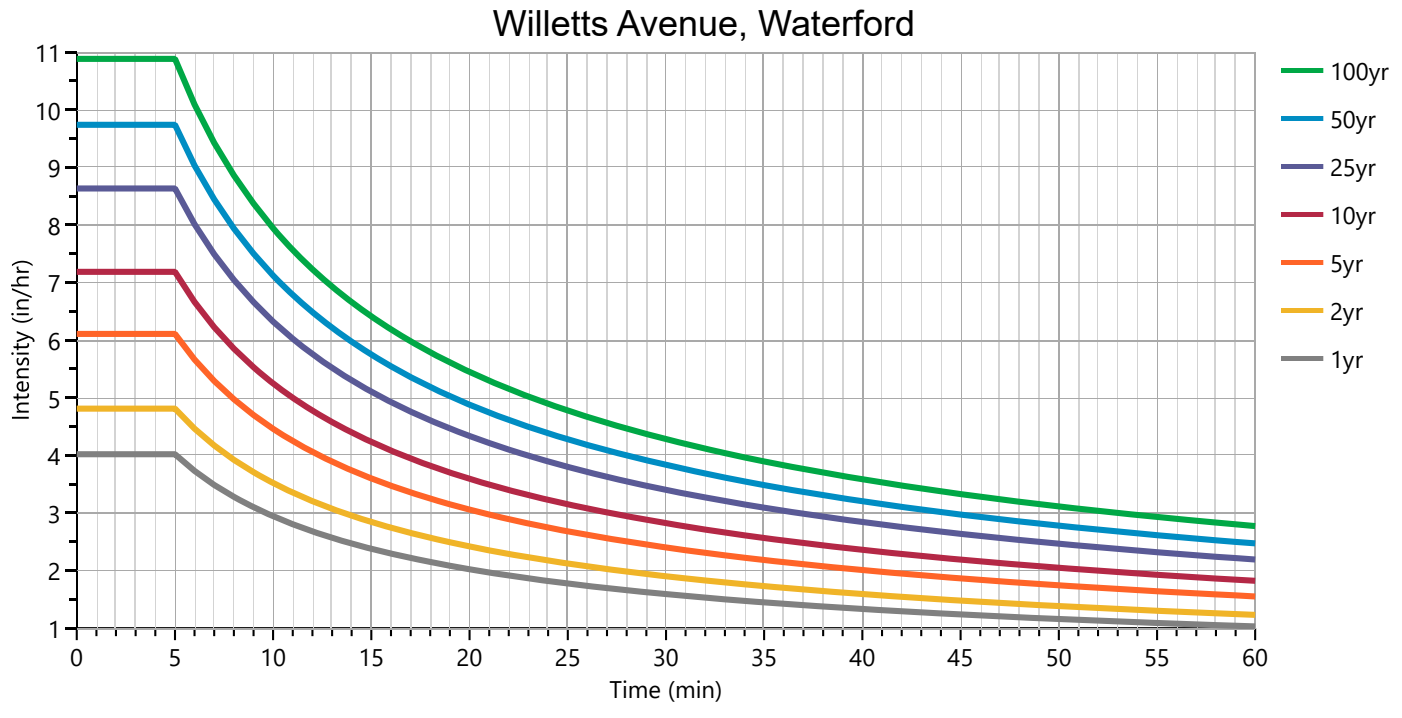
09-21-2021

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	17.3767	20.8408	0.0000	26.6717	31.4579	38.9130	43.2178	46.6733	
D	3.6000	3.6000	0.0000	3.6000	3.6000	3.8000	3.7000	3.5000	
E	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	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	4.02	4.81	0	6.11	7.18	8.63	9.74	10.88	
10	2.94	3.52	0	4.46	5.25	6.32	7.12	7.94	
15	2.38	2.84	0	3.60	4.23	5.10	5.75	6.41	
20	2.02	2.42	0	3.06	3.59	4.33	4.88	5.45	
25	1.77	2.12	0	2.68	3.15	3.80	4.28	4.78	
30	1.59	1.90	0	2.40	2.82	3.40	3.83	4.28	
35	1.45	1.73	0	2.18	2.56	3.09	3.48	3.89	
40	1.33	1.59	0	2.01	2.36	2.84	3.20	3.58	
45	1.24	1.48	0	1.86	2.19	2.64	2.97	3.33	
50	1.16	1.38	0	1.74	2.05	2.46	2.78	3.11	
55	1.09	1.30	0	1.64	1.93	2.32	2.61	2.93	
60	1.03	1.23	0	1.55	1.82	2.19	2.47	2.77	

Cf = Correction Factor applied to Rational Method runoff coefficient.



Precipitation Report

Precipitation filename: NOAA Willetts Avenue.pcp

Hydrology Studio v 3.0.0.20 (Rainfall totals in Inches)

09-21-2021

	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

09-21-2021

	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

09-21-2021

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔		✔	✔	✔	✔	✔
NRCS Storms	**> NRCS Dimensionless Storms**								
NRCS MSE1, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCS MSE2, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCS MSE3, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCS MSE4, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCS MSE5, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCS MSE6, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NOAA-A, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NOAA-B, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NOAA-C, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NOAA-D, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCC-A, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCC-B, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCC-C, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
NRCC-D, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
CA-1, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
CA-2, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
CA-3, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
CA-4, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
CA-5, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79
CA-6, 24-hr		2.87	3.43	0	4.35	5.11	6.17	6.95	7.79

APPENDIX C
STORMWATER TREATMENT CALCULATIONS

Proposed Area 01A
Proposed Area 01B
Proposed Area 02A
Proposed Area 03A
Proposed Area 03B
Groundwater Recharge Calculations

STORMWATER TREATMENT CALCULATIONS [POND-01A]

Compute Water Quality Volume

$$WQV = \frac{(1'' \times R \times A)}{12}$$

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) DA = 4.285 acres
IA = Impervious Area (Acres) IA = 1.138 acres

Determine Percent Impervious Cover (I)

I = 27%

Calculate Volumetric Runoff Coefficient (R)

R = 0.29

Calculate Water Quality Volume			Calculate Minimum Sediment Forebay Volume				Sediment Forebay Proposed			
WQV =	0.103	acre-feet	Vsed =	WQV x 0.10	450	cf	Vsed =	7100	cf	158%

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)

$Q_{(in)}$ = 0.29 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.29 watershed inches P = 1 in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = 90

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = 0.222 inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = 0.50 hours

I_a/P = 0.222

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = 380 csm/in

Compute Water Quality Flow

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

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.735 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) 4496 cf
d = Filter Media Depth (ft) 1 ft
k = Filter Media Permeability (ft/day) 3.5 ft/day
t = Time (day) 1 day
h = Depth to Outlet (ft) 0.67 feet

A = 769 square feet required 1500 square feet provided in Detention Pond 01A

Figure 2-1 Solution of Runoff Equation

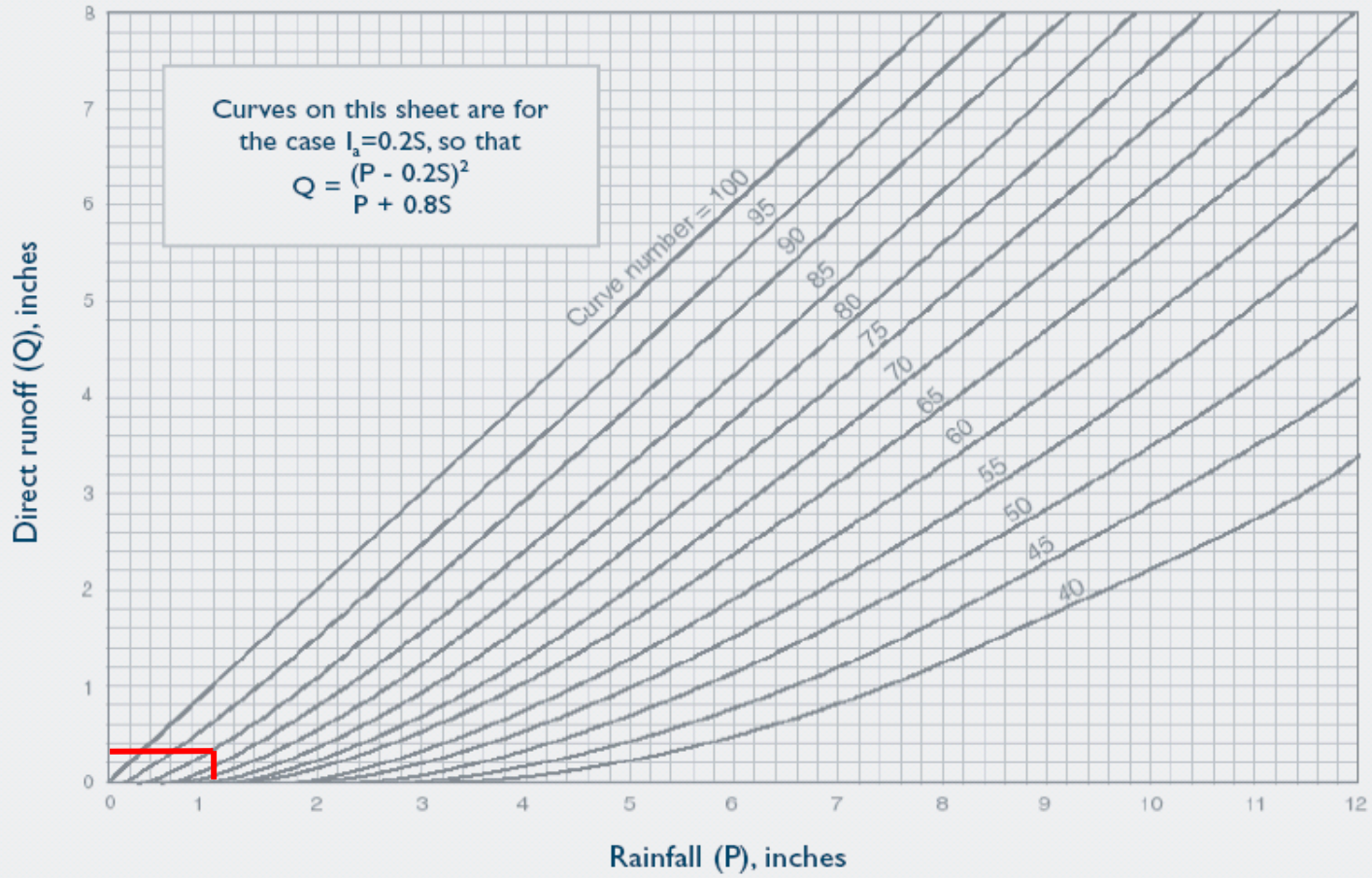
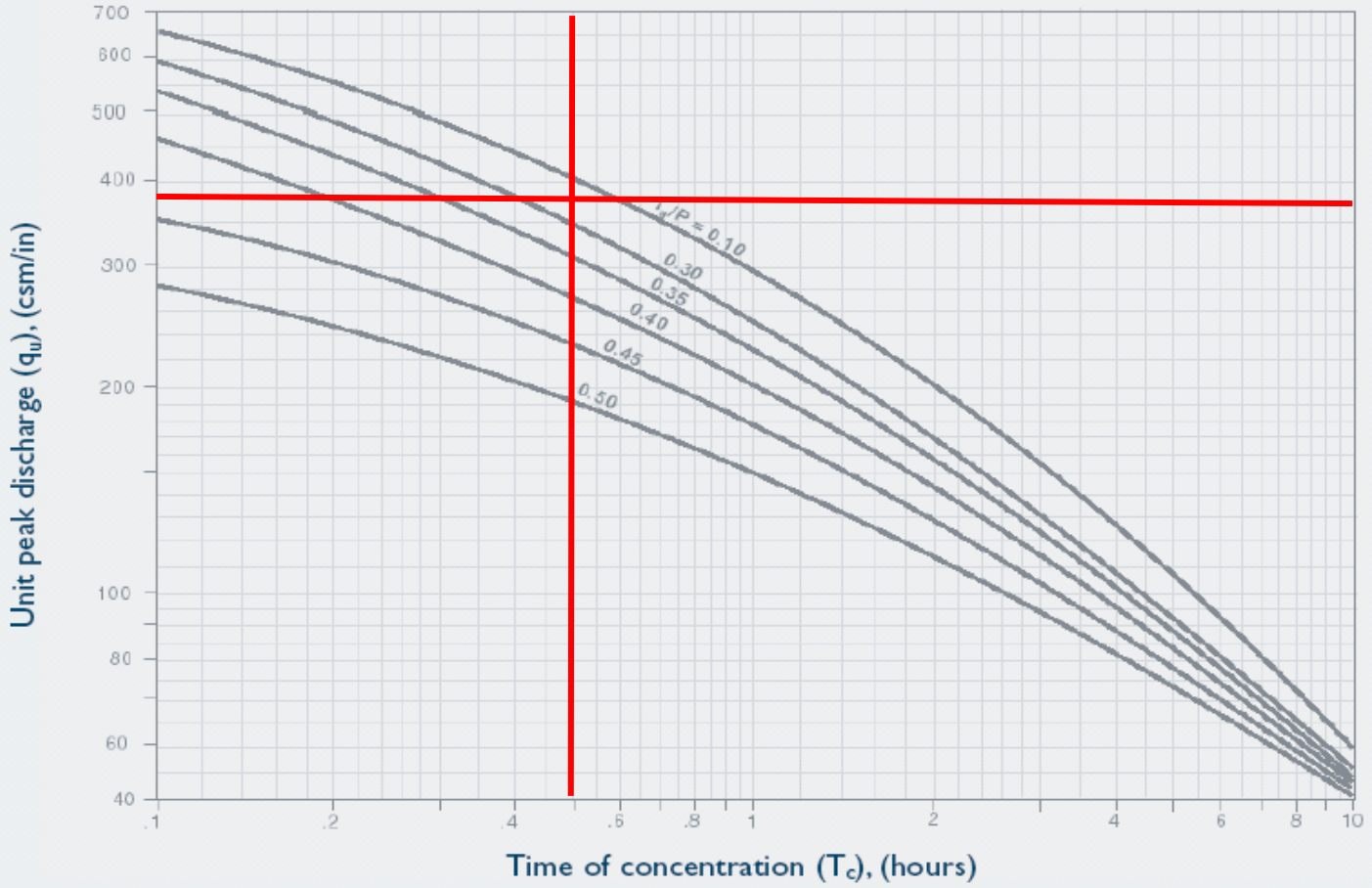


Table 4-1 I_a values for runoff curve numbers

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 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



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STORMWATER TREATMENT CALCULATIONS [INF-01B]

Compute Water Quality Volume

$$WQV = \frac{(1" \times R \times A)}{12}$$

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) DA = **0.917** acres
IA = Impervious Area (Acres) IA = **0.572** acres

Determine Percent Impervious Cover (I)

I = 62%

Calculate Volumetric Runoff Coefficient (R)

R = 0.61

Calculate Water Quality Volume			Calculate Minimum Sediment Forebay Volume				Sediment Forebay Proposed			
WQV =	0.047	acre-feet	Vsed =	WQV x 0.10	204	cf	Vsed =	200	cf	10%

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)

$Q_{(in)}$ = 0.61 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.61 watershed inches P = **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)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.526 cfs

Compute Required Isolator Row Length

Model	WQF Each	Chambers
SC-160LP	0.06	9.56
SC-310	0.11	4.78
SC-740	0.15	3.50
DC-780	0.15	3.50
MC-3500	0.24	2.19
MC-4500	0.17	3.09

8 Proposed 228%

Figure 2-1 Solution of Runoff Equation

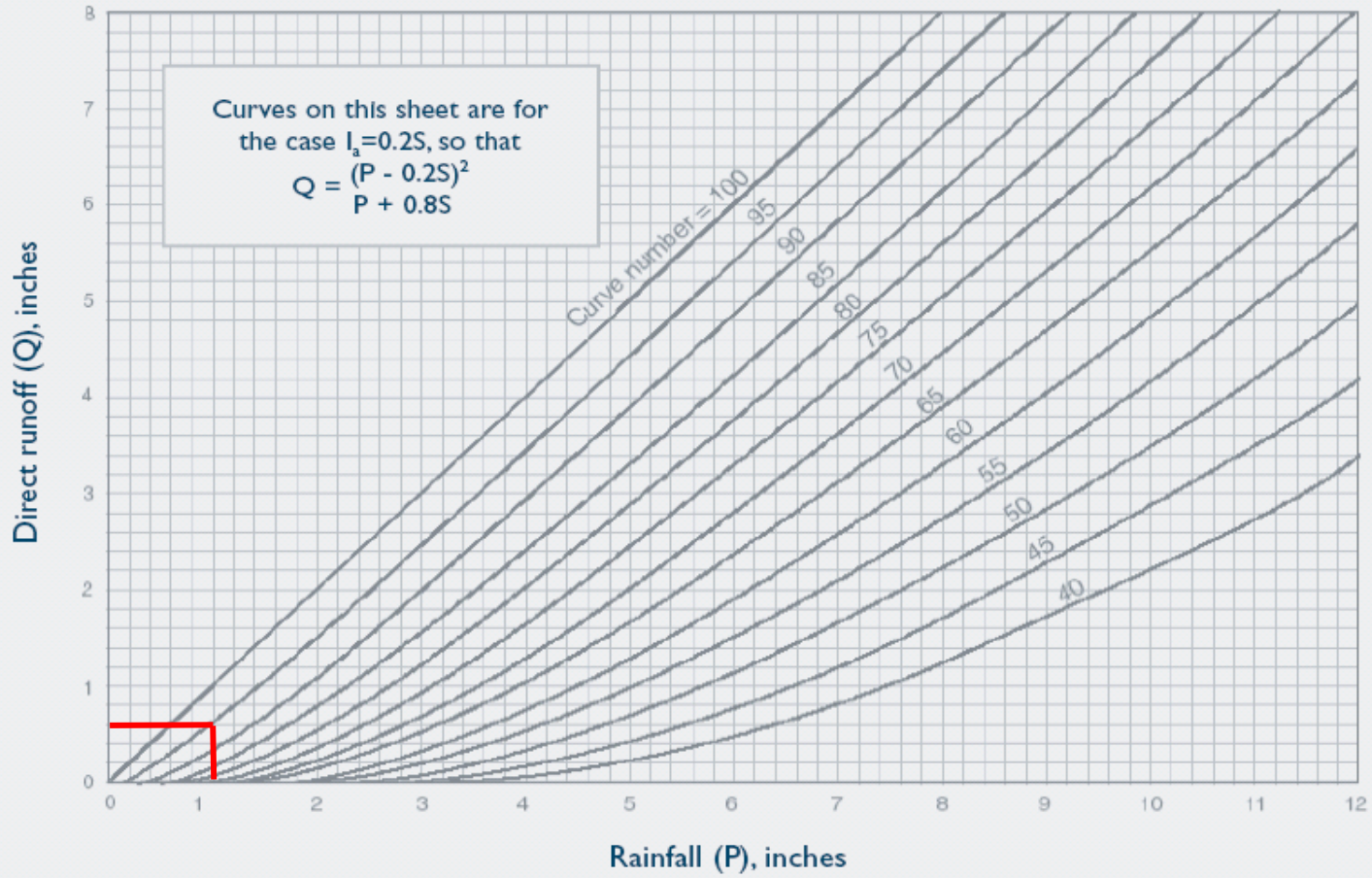
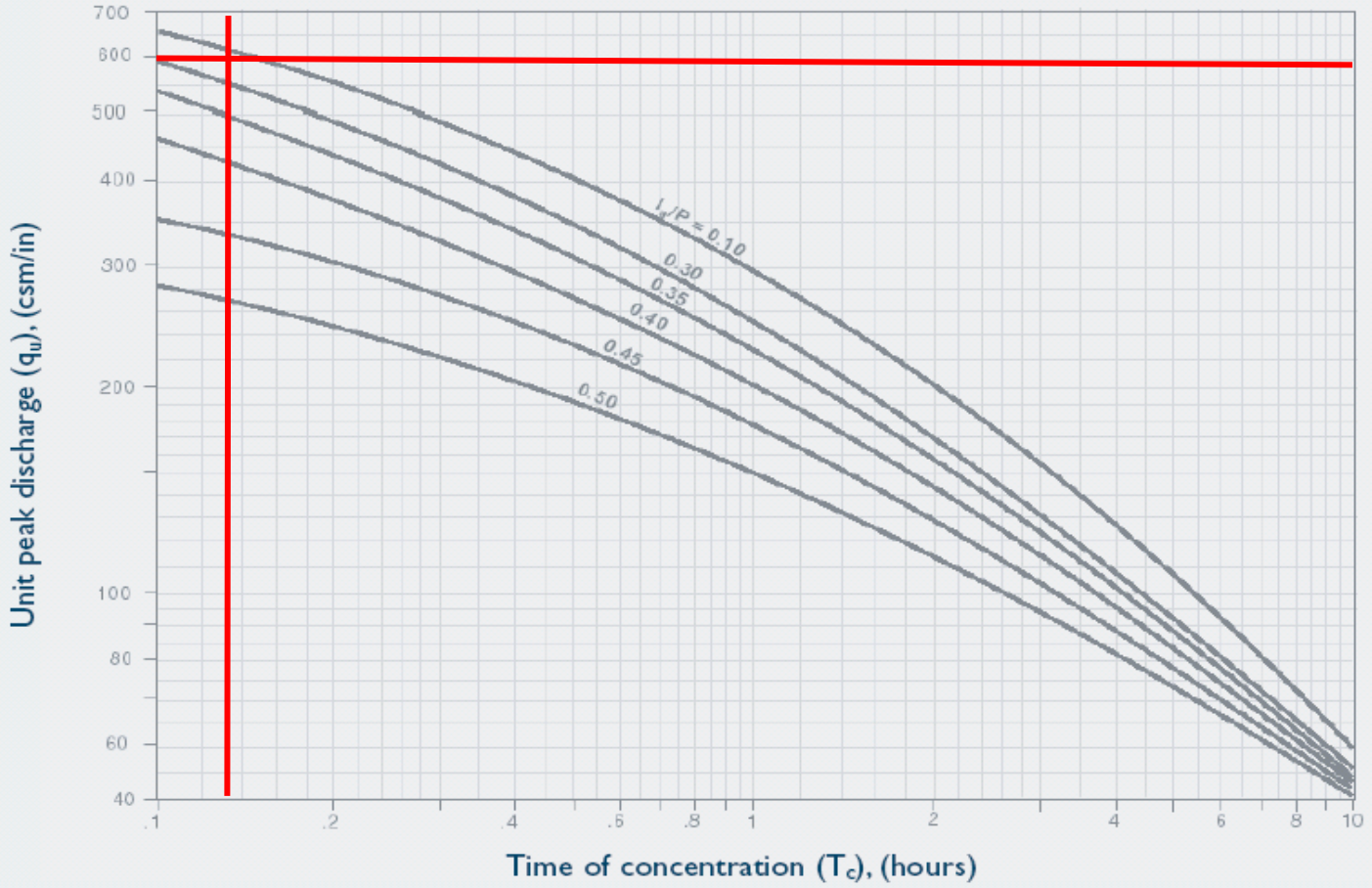


Table 4-1 I_a values for runoff curve numbers

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 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



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StormTech®
Detention • Retention • Water Quality
Division of ADS

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	0.53	9.56
SC-310	0.53	4.78
SC-740	0.53	3.50
DC-780	0.53	3.50
MC-3500	0.53	2.19
MC-4500	0.53	3.09

STORMWATER TREATMENT CALCULATIONS [POND-02A]

Compute Water Quality Volume

$$WQV = \frac{(1'' \times R \times A)}{12}$$

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) — DA = 2.930 acres
IA = Impervious Area (Acres) — IA = 1.486 acres

Determine Percent Impervious Cover (I)

I = 51%

Calculate Volumetric Runoff Coefficient (R)

R = 0.51

Calculate Water Quality Volume			Calculate Minimum Sediment Forebay Volume				Sediment Forebay Proposed			
WQV =	0.124	acre-feet	Vsed =	WQV x 0.10	539	cf	Vsed =	2400	cf	45%

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)

$Q_{(in)}$ = 0.51 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.51 watershed inches — P = 1 in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = 93

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = 0.151 inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = 0.42 hours

I_a/P = 0.151

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = 420 csm/in

Compute Water Quality Flow

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

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.974 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) — 5387 cf
d = Filter Media Depth (ft) — 1 ft
k = Filter Media Permeability (ft/day) — 3.5 ft/day
t = Time (day) — 1 day
h = Depth to Outlet (ft) — 1 feet

A = 770 square feet required — 2100 square feet provided in Detention Pond 02A

Figure 2-1 Solution of Runoff Equation

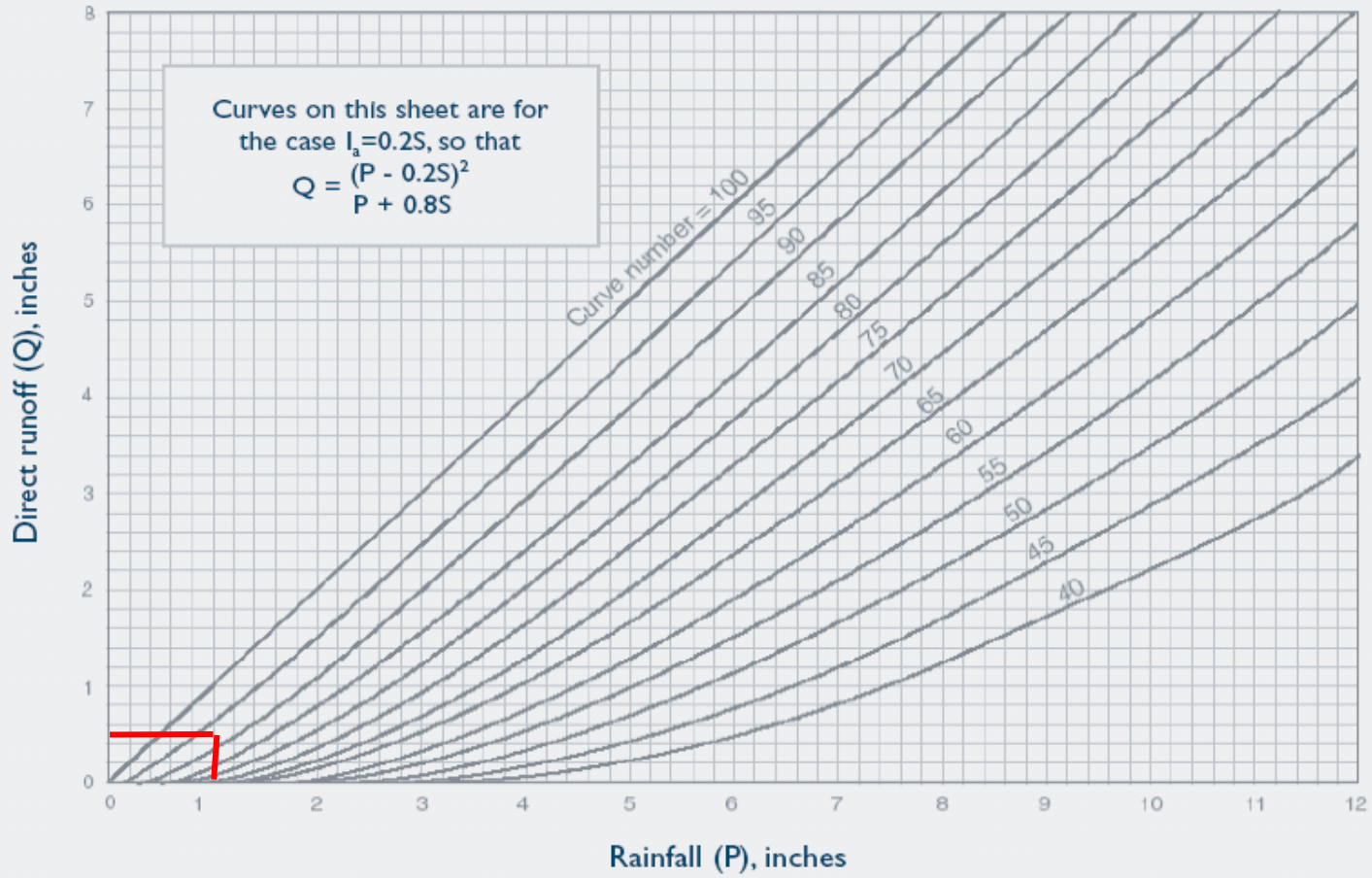
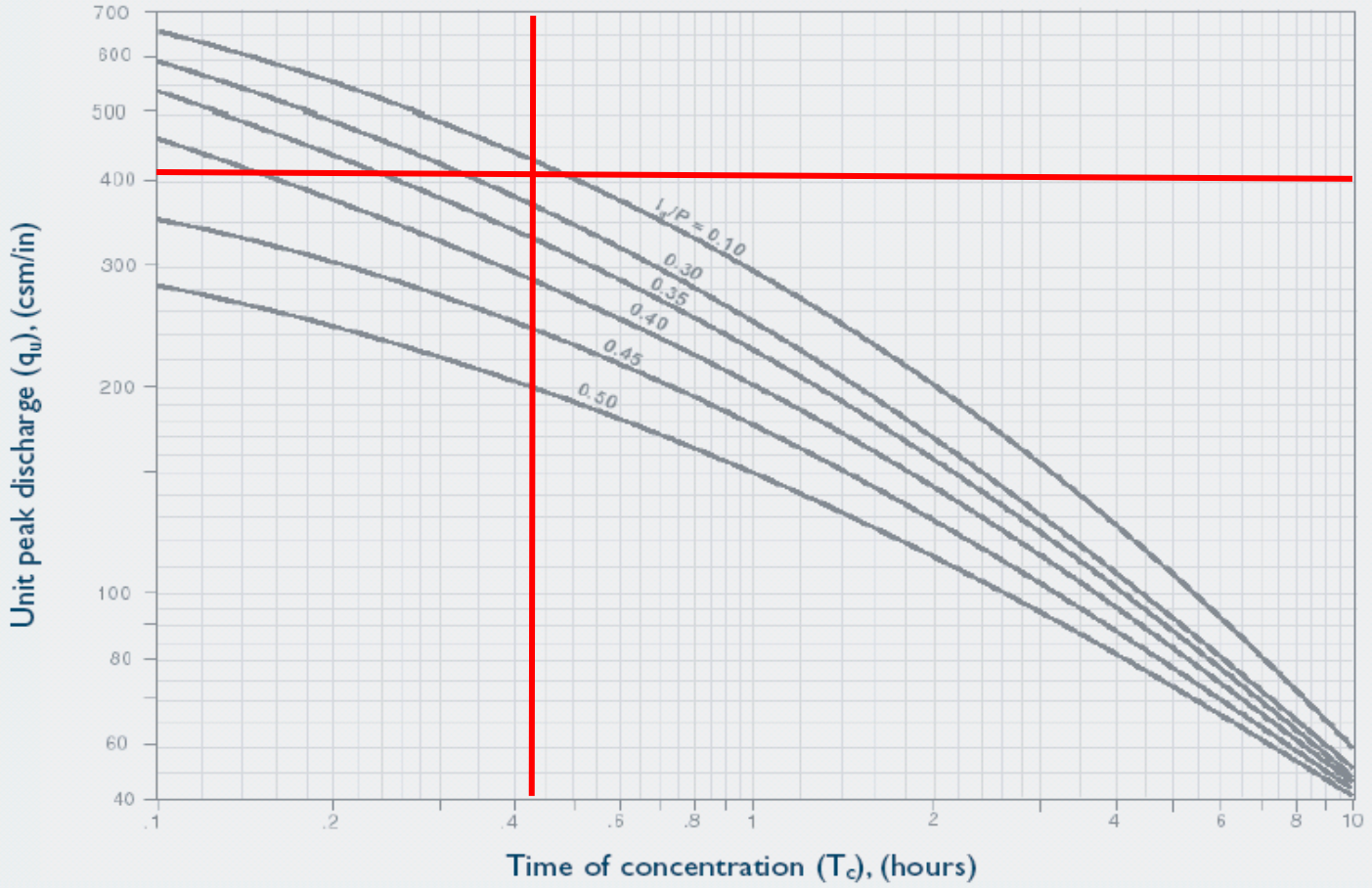


Table 4-1 I_a values for runoff curve numbers

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 4-111 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

$$WQV = \frac{(1'' \times R \times A)}{12}$$

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) — DA = **2.715** acres
IA = Impervious Area (Acres) — IA = **0.287** acres

Determine Percent Impervious Cover (I)

I = 11%

Calculate Volumetric Runoff Coefficient (R)

R = 0.15

Calculate Water Quality Volume			Calculate Minimum Sediment Forebay Volume				Sediment Forebay Proposed			
WQV =	0.033	acre-feet	Vsed =	WQV x 0.10	143	cf	Vsed =	2400	cf	168%

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)

$Q_{(in)}$ = 0.15 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.15 watershed inches — P = **1** in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = **84**

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = **0.381** inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = **0.33** hours

I_a/P = 0.381

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = **340** csm/in

Compute Water Quality Flow

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

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.209 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) — 1430 cf
d = Filter Media Depth (ft) — 1 ft
k = Filter Media Permeability (ft/day) — 3.5 ft/day
t = Time (day) — 1 day
h = Depth to Outlet (ft) — 0.75 feet

A = 234 square feet required — 1000 square feet provided in Detention Pond 03A

Figure 2-1 Solution of Runoff Equation

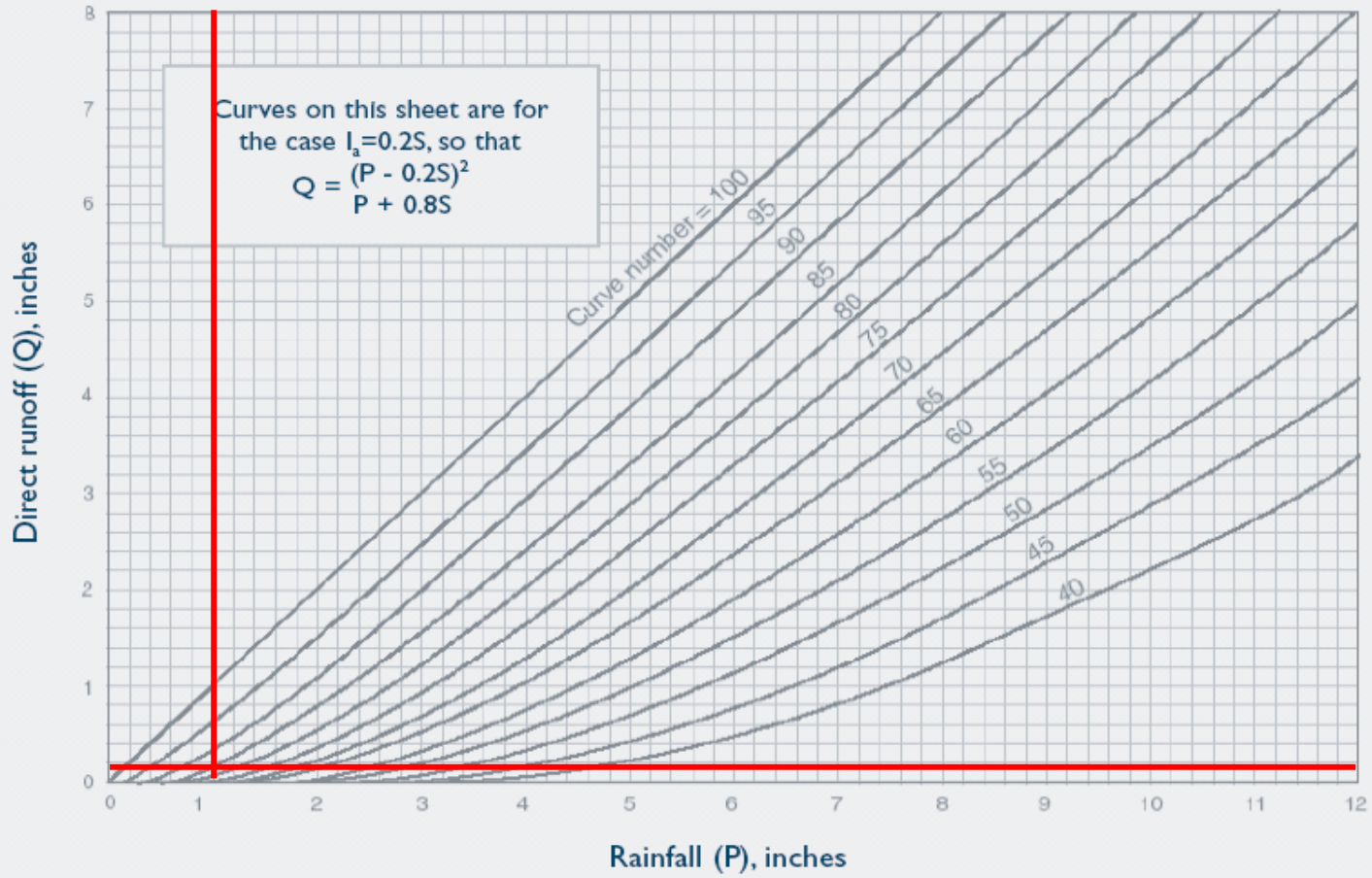
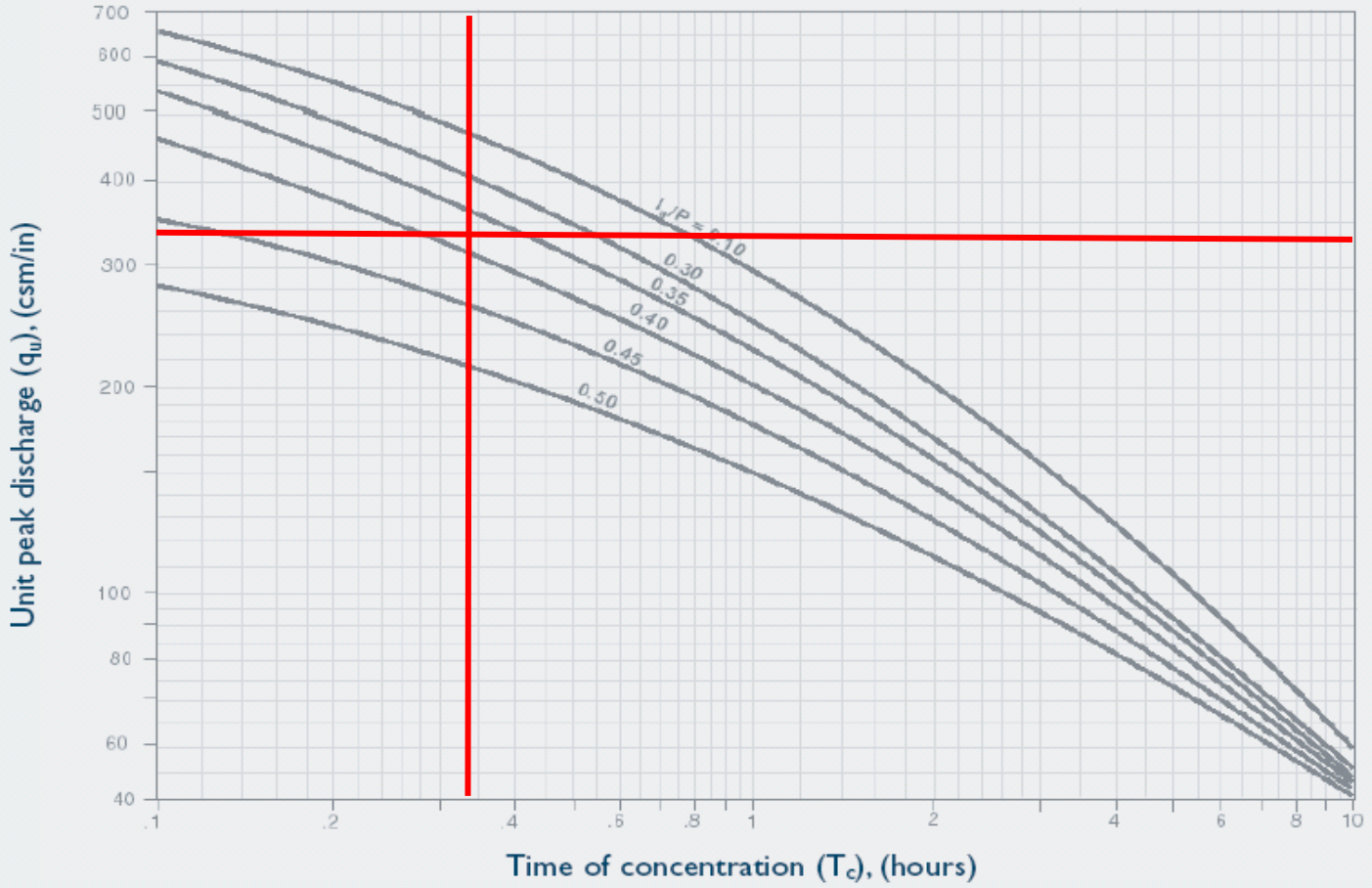


Table 4-1 I_a values for runoff curve numbers

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 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



Return to Outlet Treatment Summary

STORMWATER TREATMENT CALCULATIONS [POND-03B]

Compute Water Quality Volume

$$WQV = \frac{(1'' \times R \times A)}{12}$$

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) — DA = **4.123** acres
IA = Impervious Area (Acres) — IA = **0.467** acres

Determine Percent Impervious Cover (I)

I = 11%

Calculate Volumetric Runoff Coefficient (R)

R = 0.15

Calculate Water Quality Volume			Calculate Minimum Sediment Forebay Volume				Sediment Forebay Proposed	
WQV =	0.052	acre-feet	Vsed =	WQV x 0.10	227	cf	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)

$Q_{(in)}$ = 0.15 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.15 watershed inches — P = **1** in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = **84**

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = **0.381** inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = **0.28** hours

I_a/P = 0.381

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = **350** csm/in

Compute Water Quality Flow

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

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.343 cfs

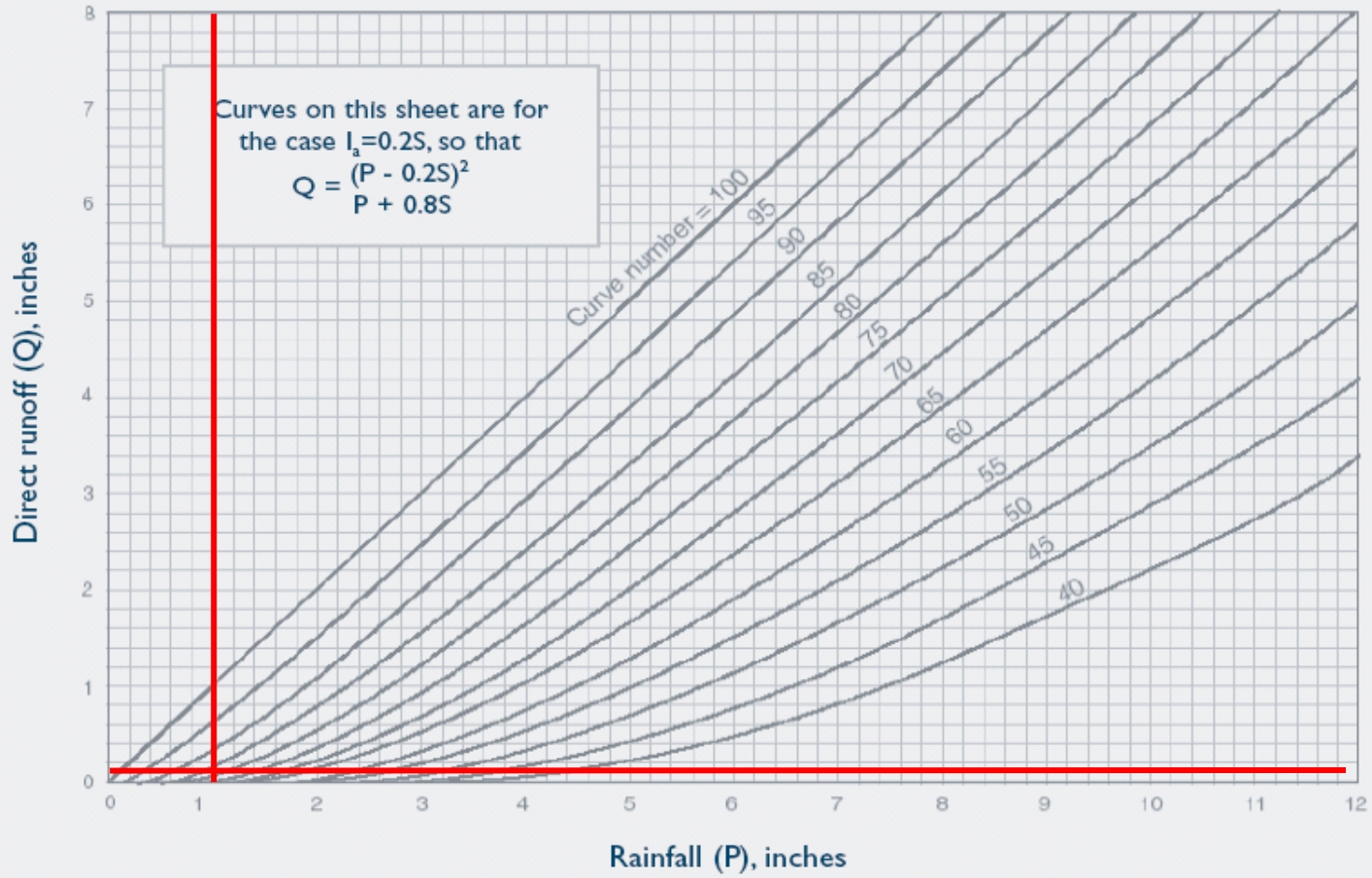
Compute Required Filter Bed Area

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

A = Filter Bed Surface Area (sf)
WQV = Water Quality Volume (cf) — 2274 cf
d = Filter Media Depth (ft) — 1 ft
k = Filter Media Permeability (ft/day) — 3.5 ft/day
t = Time (day) — 1 day
h = Depth to Outlet (ft) — 0.75 feet

A = 371 square feet required — 1400 square feet provided in Detention Pond 03B

Figure 2-1 Solution of Runoff Equation



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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
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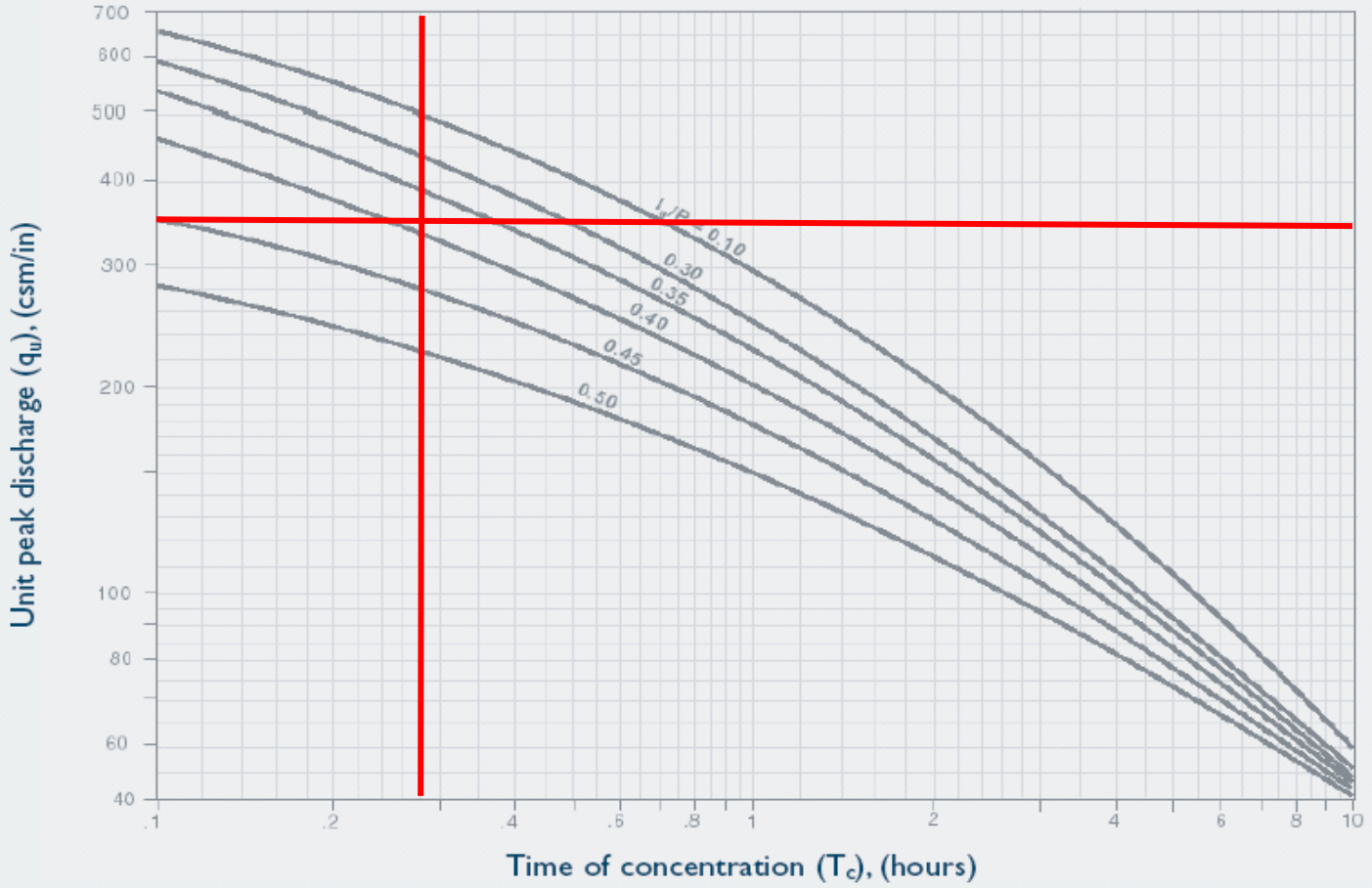
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

Exhibit 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



Return to Outlet Treatment Summary

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_{PRE} =	0.058	acres
I_{POST} =	3.950	acres

$$I = \frac{I_{POST} - I_{PRE}}{A}$$

Calculate Site Imperviousness (I)

I =	0.146	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 =	0.146					

Calculate GRV

GRV =	0.053	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
POND-03B	2300.00	CF	0.053	acre-ft	Retention volume below 4" diameter low level outlet at 18.25
			0.232	acre-ft	**437% required GRV within retention areas**

APPENDIX D
PIPE FLOW CALCULATIONS & PROFILES

NOT INCLUDED

APPENDIX E
SUPPLEMENTAL DATA

NRCS SOIL DATA
NOAA RAINFALL DATA

United States Department of Agriculture

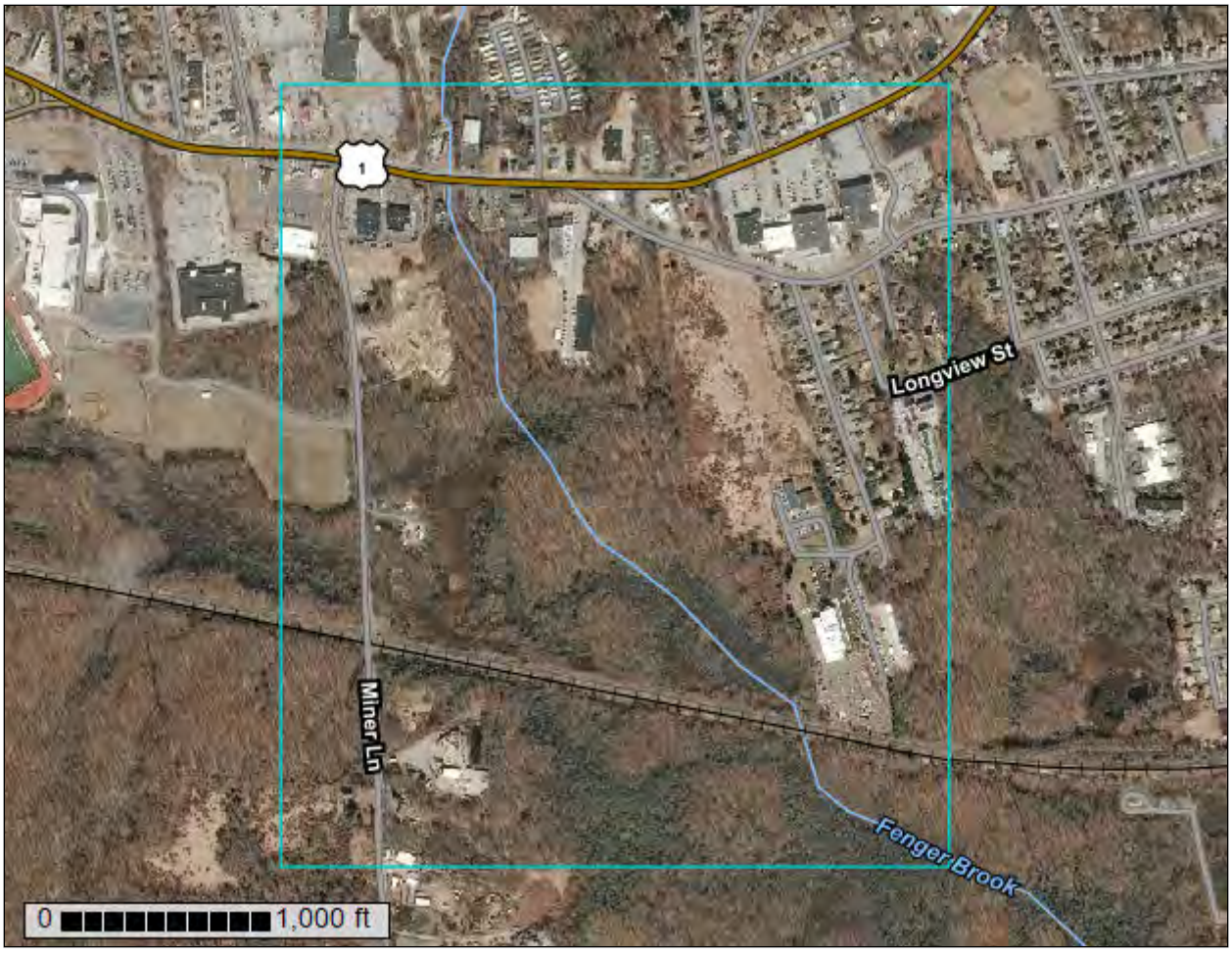
NRCS

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

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).

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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Contents

How Soil Surveys Are Made

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

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.

Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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%
Totals for Area of Interest		**275.7**	**100.0%**

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

Low: 0.01 to 0.1

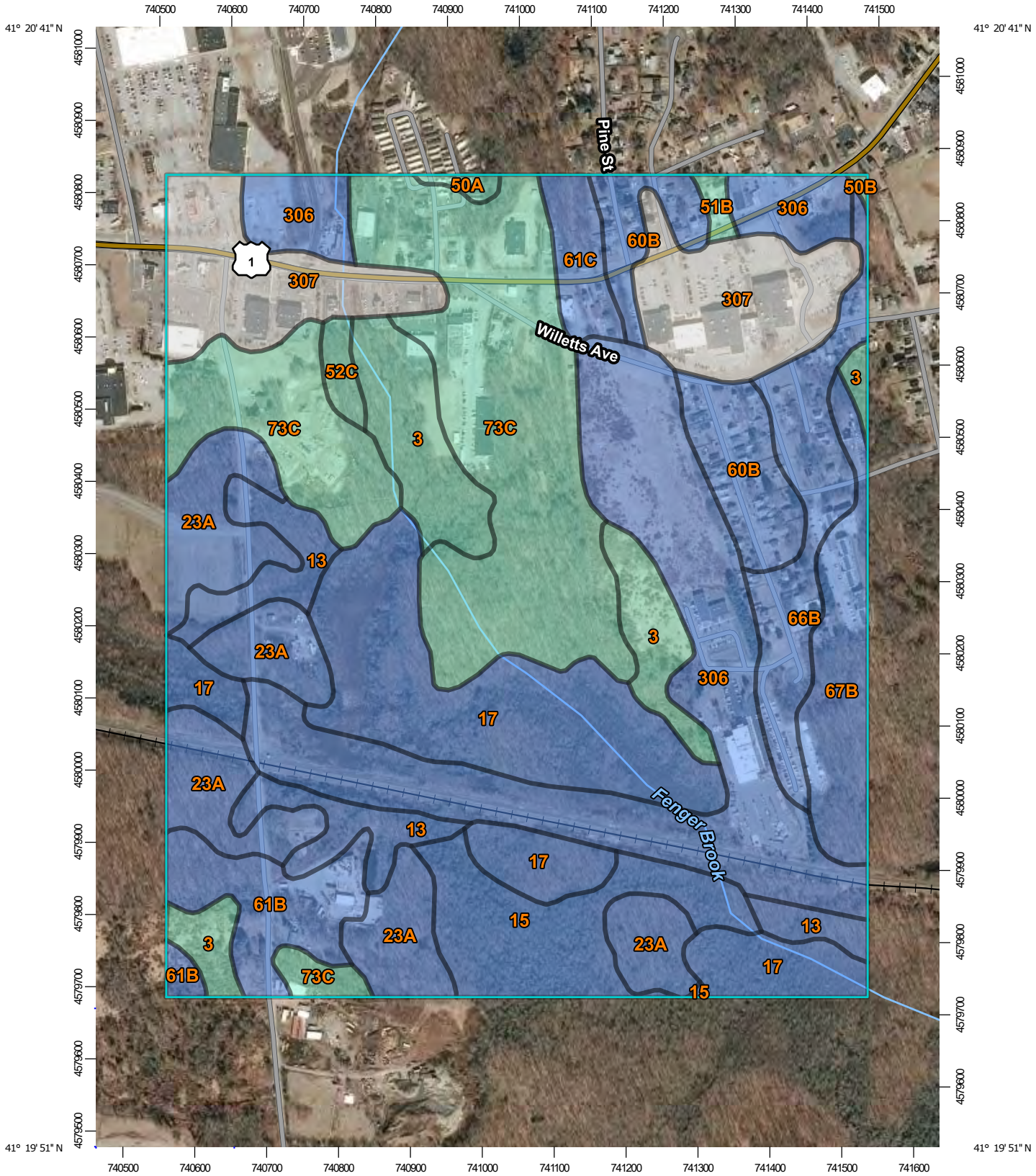
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

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



Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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

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)
- Not rated or not available

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.

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.

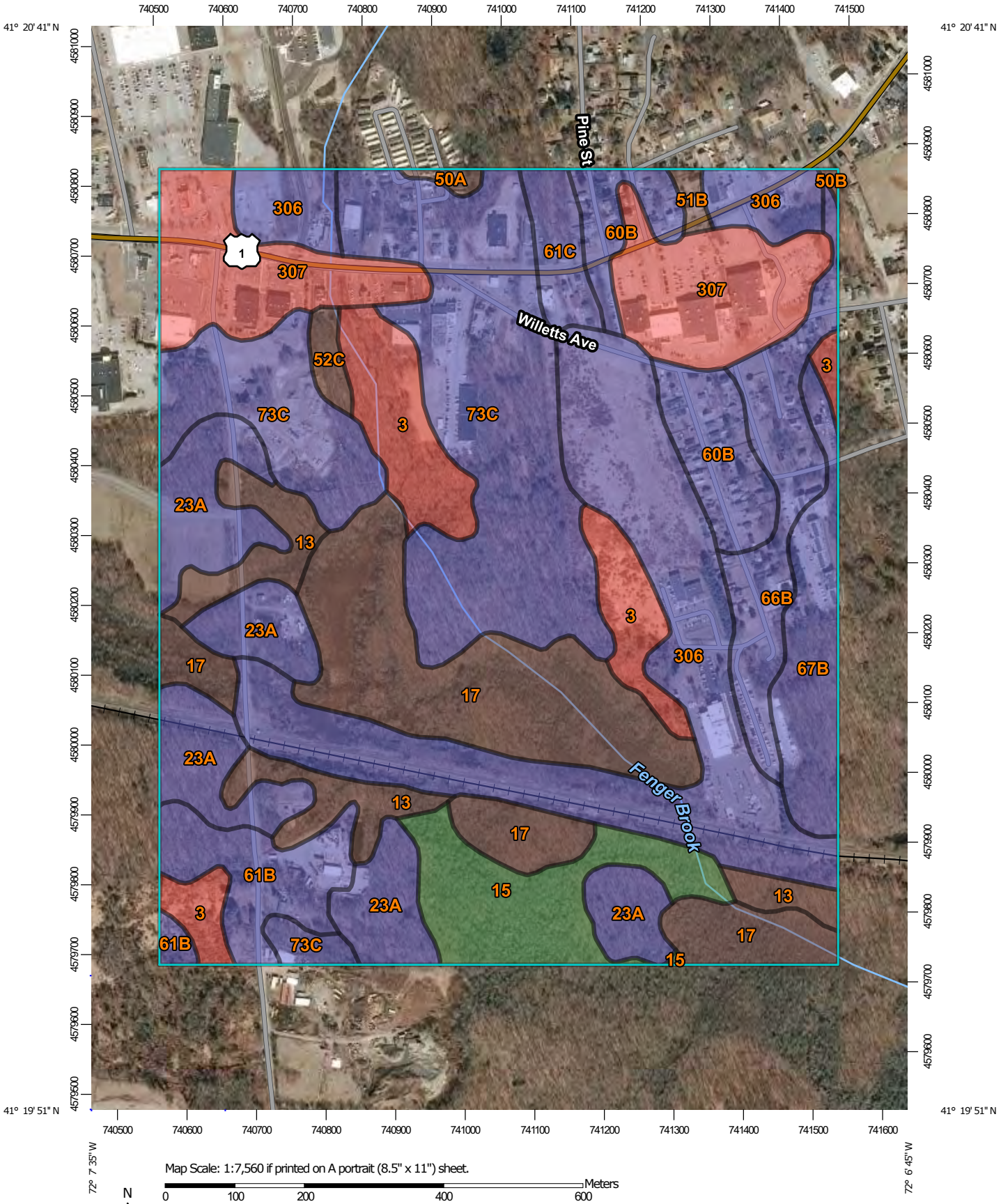
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

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



Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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

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

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.

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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

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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%
Totals for Area of Interest			**275.7**	**100.0%**

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

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

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

[1] 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.

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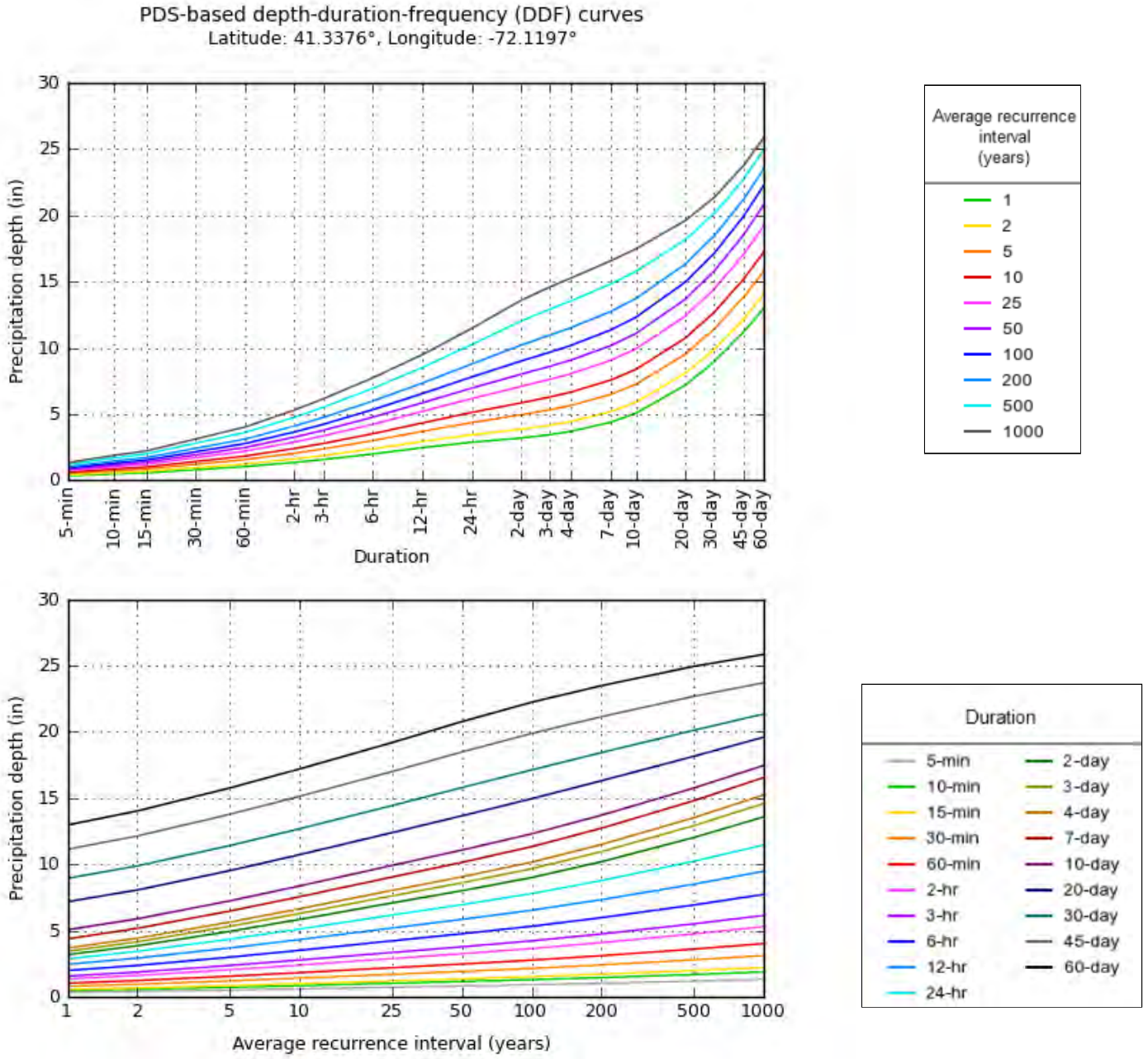
PF graphical



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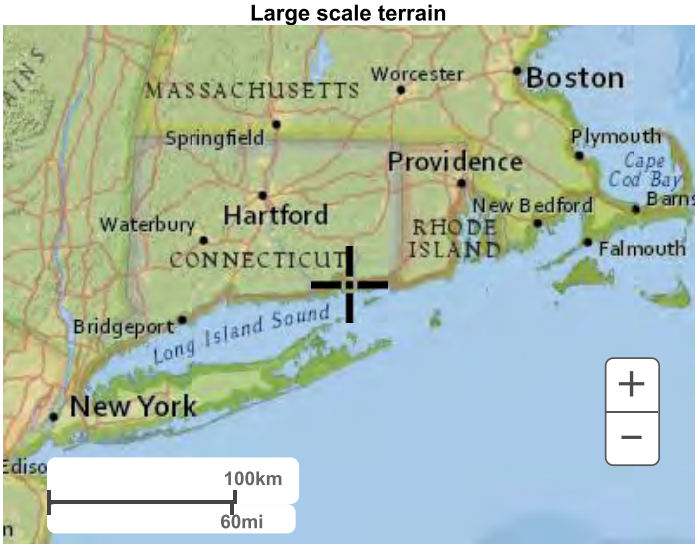
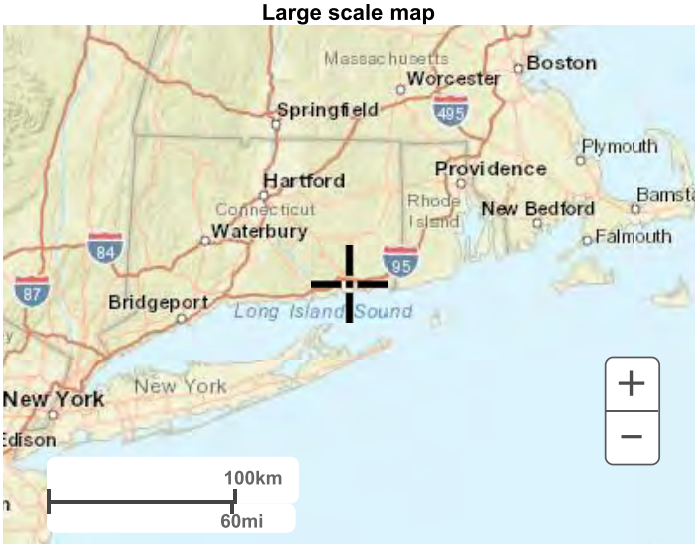
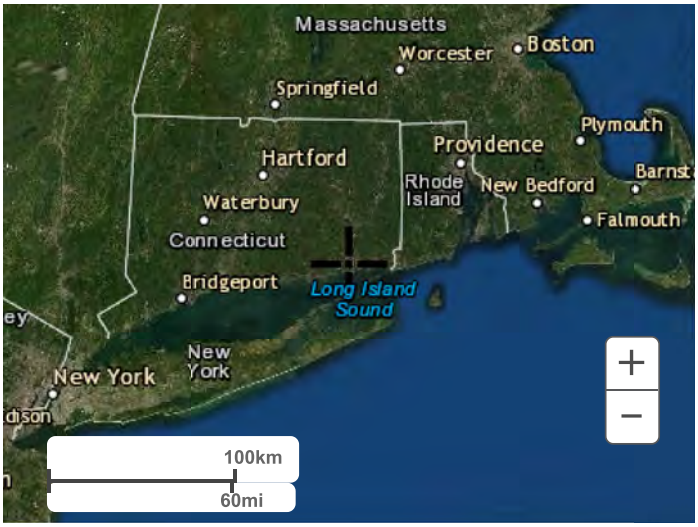


Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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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

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.02** (3.10-5.16)	**4.81** (3.70-6.18)	**6.11** (4.67-7.85)	**7.19** (5.48-9.28)	**8.66** (6.41-11.6)	**9.77** (7.09-13.2)	**10.9** (7.74-15.3)	**12.3** (8.23-17.3)	**14.3** (9.23-20.6)	**15.9** (10.1-23.3)
10-min	**2.85** (2.19-3.65)	**3.41** (2.62-4.37)	**4.33** (3.31-5.56)	**5.08** (3.87-6.56)	**6.13** (4.54-8.18)	**6.92** (5.02-9.38)	**7.75** (5.48-10.8)	**8.70** (5.84-12.3)	**10.1** (6.53-14.6)	**11.3** (7.13-16.5)
15-min	**2.24** (1.72-2.86)	**2.68** (2.05-3.43)	**3.40** (2.60-4.37)	**3.99** (3.04-5.15)	**4.81** (3.56-6.42)	**5.42** (3.94-7.36)	**6.08** (4.30-8.48)	**6.82** (4.58-9.62)	**7.92** (5.12-11.4)	**8.83** (5.59-12.9)
30-min	**1.59** (1.22-2.03)	**1.90** (1.45-2.43)	**2.40** (1.84-3.09)	**2.82** (2.15-3.64)	**3.40** (2.51-4.53)	**3.83** (2.78-5.19)	**4.28** (3.03-5.98)	**4.81** (3.23-6.78)	**5.58** (3.61-8.06)	**6.22** (3.94-9.12)
60-min	**1.03** (0.790-1.32)	**1.23** (0.941-1.57)	**1.55** (1.19-1.99)	**1.82** (1.39-2.35)	**2.19** (1.62-2.93)	**2.47** (1.79-3.35)	**2.77** (1.96-3.86)	**3.10** (2.08-4.37)	**3.60** (2.33-5.20)	**4.01** (2.54-5.88)
2-hr	**0.674** (0.523-0.854)	**0.804** (0.624-1.02)	**1.02** (0.788-1.30)	**1.20** (0.921-1.53)	**1.44** (1.08-1.91)	**1.63** (1.19-2.18)	**1.82** (1.30-2.52)	**2.04** (1.38-2.85)	**2.37** (1.55-3.40)	**2.65** (1.69-3.85)
3-hr	**0.520** (0.407-0.656)	**0.621** (0.486-0.784)	**0.787** (0.613-0.995)	**0.925** (0.716-1.17)	**1.11** (0.837-1.46)	**1.25** (0.925-1.68)	**1.41** (1.01-1.93)	**1.58** (1.07-2.19)	**1.83** (1.20-2.61)	**2.05** (1.31-2.95)
6-hr	**0.331** (0.262-0.413)	**0.395** (0.312-0.493)	**0.499** (0.393-0.625)	**0.586** (0.459-0.736)	**0.705** (0.535-0.916)	**0.794** (0.591-1.05)	**0.889** (0.643-1.21)	**0.998** (0.682-1.37)	**1.16** (0.761-1.63)	**1.29** (0.828-1.85)
12-hr	**0.204** (0.163-0.251)	**0.242** (0.194-0.299)	**0.306** (0.244-0.378)	**0.358** (0.284-0.445)	**0.431** (0.330-0.554)	**0.485** (0.364-0.633)	**0.542** (0.396-0.730)	**0.609** (0.419-0.827)	**0.706** (0.467-0.984)	**0.786** (0.507-1.11)
24-hr	**0.119** (0.097-0.146)	**0.143** (0.116-0.174)	**0.181** (0.146-0.222)	**0.213** (0.171-0.262)	**0.257** (0.199-0.327)	**0.290** (0.220-0.375)	**0.325** (0.239-0.433)	**0.365** (0.253-0.492)	**0.426** (0.284-0.589)	**0.477** (0.310-0.669)
2-day	**0.066** (0.054-0.080)	**0.080** (0.066-0.097)	**0.103** (0.084-0.124)	**0.122** (0.099-0.148)	**0.148** (0.116-0.186)	**0.167** (0.128-0.214)	**0.187** (0.140-0.249)	**0.212** (0.148-0.283)	**0.250** (0.168-0.342)	**0.283** (0.185-0.392)
3-day	**0.048** (0.039-0.057)	**0.058** (0.048-0.069)	**0.074** (0.061-0.089)	**0.087** (0.071-0.105)	**0.106** (0.083-0.133)	**0.119** (0.092-0.152)	**0.134** (0.101-0.177)	**0.152** (0.107-0.201)	**0.179** (0.120-0.244)	**0.203** (0.133-0.279)
4-day	**0.038** (0.032-0.046)	**0.046** (0.038-0.055)	**0.059** (0.048-0.070)	**0.069** (0.057-0.083)	**0.084** (0.066-0.104)	**0.094** (0.073-0.120)	**0.106** (0.080-0.139)	**0.120** (0.084-0.158)	**0.141** (0.095-0.191)	**0.159** (0.104-0.218)
7-day	**0.026** (0.022-0.031)	**0.031** (0.026-0.036)	**0.039** (0.032-0.046)	**0.045** (0.037-0.054)	**0.054** (0.043-0.066)	**0.060** (0.047-0.076)	**0.067** (0.051-0.087)	**0.076** (0.054-0.099)	**0.088** (0.060-0.118)	**0.099** (0.065-0.134)
10-day	**0.021** (0.018-0.025)	**0.025** (0.021-0.029)	**0.030** (0.025-0.036)	**0.035** (0.029-0.041)	**0.041** (0.033-0.051)	**0.046** (0.036-0.057)	**0.051** (0.039-0.066)	**0.057** (0.041-0.074)	**0.066** (0.045-0.088)	**0.073** (0.048-0.099)
20-day	**0.015** (0.013-0.017)	**0.017** (0.014-0.020)	**0.020** (0.017-0.023)	**0.022** (0.019-0.026)	**0.026** (0.021-0.031)	**0.028** (0.022-0.035)	**0.031** (0.024-0.039)	**0.034** (0.024-0.044)	**0.038** (0.026-0.050)	**0.041** (0.027-0.055)
30-day	**0.012** (0.011-0.014)	**0.014** (0.012-0.016)	**0.016** (0.014-0.018)	**0.018** (0.015-0.020)	**0.020** (0.016-0.024)	**0.022** (0.017-0.027)	**0.024** (0.018-0.029)	**0.026** (0.018-0.033)	**0.028** (0.019-0.037)	**0.030** (0.020-0.039)
45-day	**0.010** (0.009-0.012)	**0.011** (0.010-0.013)	**0.013** (0.011-0.015)	**0.014** (0.012-0.016)	**0.016** (0.013-0.019)	**0.017** (0.014-0.020)	**0.018** (0.014-0.022)	**0.020** (0.014-0.025)	**0.021** (0.015-0.027)	**0.022** (0.015-0.029)
60-day	**0.009** (0.008-0.010)	**0.010** (0.008-0.011)	**0.011** (0.009-0.013)	**0.012** (0.010-0.014)	**0.013** (0.011-0.016)	**0.014** (0.012-0.017)	**0.015** (0.012-0.019)	**0.016** (0.012-0.021)	**0.017** (0.012-0.022)	**0.018** (0.012-0.024)

[1] 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.

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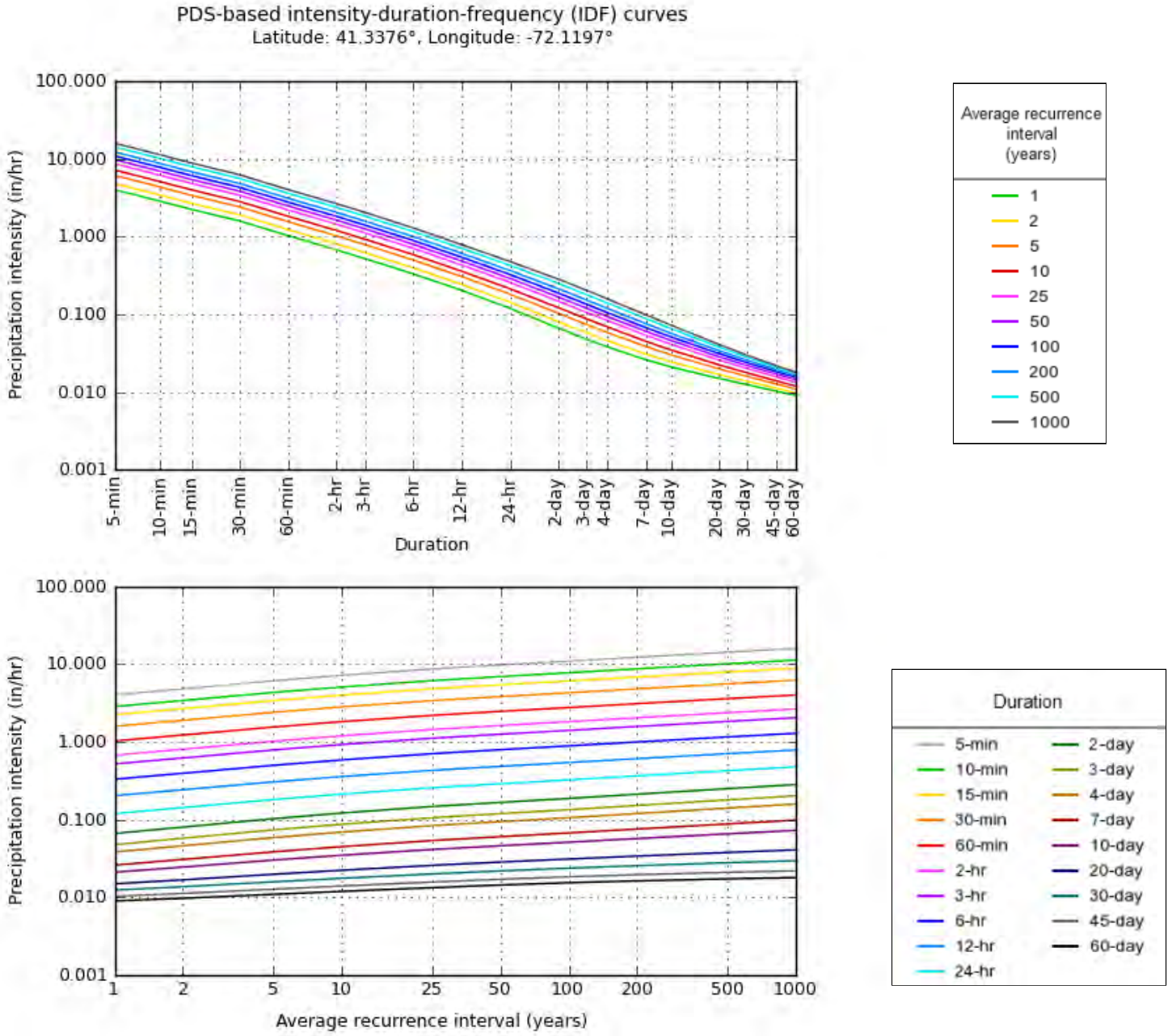
PF graphical



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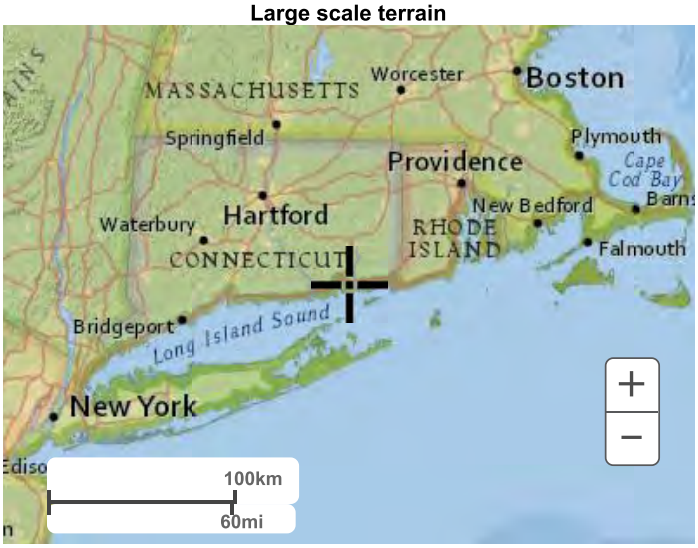

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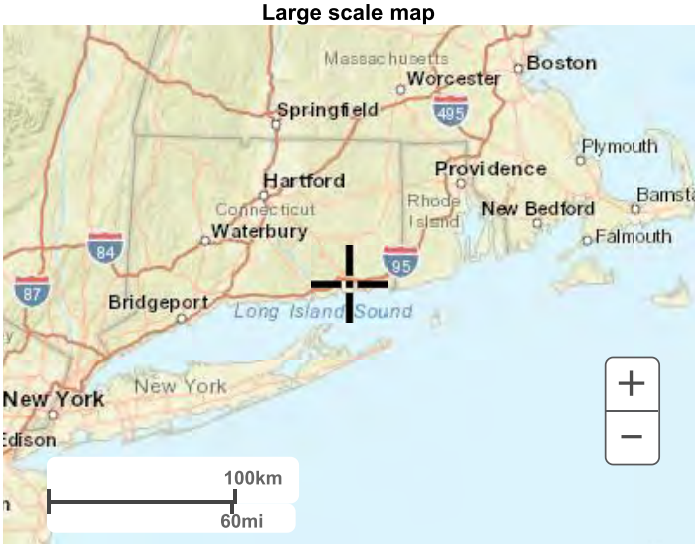

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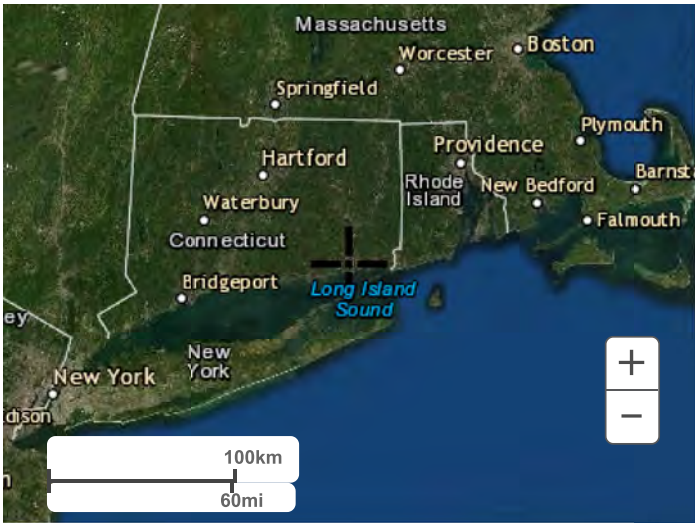

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