cole

HARRY E. COLE & SON

engineering · surveying · planning

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TOWN OF LISBON

STORMWATER MANAGEMENT REPORT

98 River Road
Lisbon, Connecticut

Prepared For
AutoZone, Inc.
HEC Project #2135

August 10, 2021

By

Harry E. Cole & Son
876 South Main Street
Plantsville, CT 06479
(860) 628-4484

STATE OF CONNECTICUT
BARTON N. BOVEE
REGISTERED PROFESSIONAL ENGINEER

Barton N. Bovee, P.E. #13653
NOT VALID UNLESS EMBOSSED
SEAL IS AFFIXED HERETO.

Table of Contents

I. INTRODUCTION

1.1 Objective

The intent of this report is to summarize the engineering drainage analysis and technical findings for 98 River Road. The development team desires to present to the Town of Lisbon all of the pertinent site factors which have influenced the plan; thereby making a joint effort to solidify a design proposal that ensures a balance of quality, technical adequacy, and conservation. This document will demonstrate that the proposed Stormwater Management plan will comply with the Town of Lisbon drainage criteria, and that there will be no significant impact on downstream properties.

To achieve these objectives Harry E. Cole & Son (HEC) conducted an evaluation of regulatory criteria, existing site conditions, and the proposed development plan. Specific to this mission were the assessment of Stormwater Management opportunities, constraints, and the various competing site factors, which are important to the design and layout of the project. Elements that were most critical in developing a stormwater plan, included the following:

A.) An inventory and inspection of the site soils and surficial geology, wetland/watercourses, surface drainage and runoff patterns, general forms of vegetation, wildlife, and habitat values, topography-shapes, slopes and orientation, physical constraints, surroundings.
B.) Site background and history.
C.) Zoning and land use regulations.
D.) Infrastructure capacity and demands.
E.) Off-site impacts, engineering and construction practices.
F.) Previous Drainage Calculations.

II. EXISTING CONDITIONS

2.1 Site Location

The 5.2± acre subject site is located at 98 River Road in Lisbon, Connecticut.

2.2 Site Description

The current 5.2± acre project is comprised of one parcel currently zoned residential BV-IV. Originally the parcel contained a structure and driveway both of which have been removed or abandoned and only a foundation remains. Town Water and Sewage mains are located in River Road at the west side of the property. Drainage for the property is one basin. Basin E1 is comprised of 1.34 acres and slopes at grades of 1-20% to the east towards the Quinebaug River. Soils on the site have a predominate hydrologic rating of A and B. These soil composed of Merrimac and Udorthents have high to moderate infiltration rates respectively.

III. POST-DEVELOPMENT CONDITIONS

3.1 Proposed Facilities

The proposed plan will build an AutoZone (car parts retail store) with access off of River Road. Water and sewer services will be extended into the property from the existing mains in River Road. One detention basin is proposed to collect flows onsite and provide time to allow runoff to infiltrate. Excess flows will release through the spillway during the 100-year storm and are directed towards the Quinebaug river. Additionally, the detention basin will provide adequate water quality volume.

3.2 Detention

Detention for the site will be provided in the form of an infiltration retention basin. Slopes for this basin are 4:1 on the sides. This basin will receive runoff from the building's roof, driveway, parking lot, and immediate surrounding areas. Flows from the detention basin are stored in the basin and will infiltrate over time into the Type A soils. The 100-year storm event will produce a discharge through the basins spillway and these regulated flows will flow to wetlands and floodplain areas on site adjacent to the river. A summary of the site flows is located in Appendix B. The summary table depicts an overall decease in runoff.

3.3 Water Quality

The detention basin will provide adequate water quality volume and a sediment basin is located at the outfall of the collection system piping from the parking lot. Catch basins will all have sumps to store and collect sediment and the last catch basin in the system will have a hood to stop oils or grease from the parking from entering the basin. Sizing for the water quality volume in the basin can be found in Appendix D.

IV. FINDINGS & CONCLUSION

Overall, a reduction in peak flows will be achieved with the designed drainage system, and the conveyance systems will adequately convey runoff for all design storms. In summary, we believe the proposed stormwater management plan has satisfied the Town of Lisbon's drainage criteria and significant impacts to downstream properties should not occur.

V. TECHNICAL CRITERIA & METHODOLOGY

5.1 Technical Criteria

Design Element	Design Frequency
-Detention Basin Sizing	2, 5, 10, 25, & 100 Year
-Water Quality Basin	2004 CT Stormwater Manual

5.2 Methodology	Design Storm
-Detention Volume	24-Hour Type III from NOAA Atlas Precipitation Frequency Data Serve
-Peak infrastructure flow	Rational Method with NOAA Atlas Precipitation Frequency Data Serve IDF tables.

Time of Concentration: Interpreted from topography with the aid of computer software. Based on calculations from the State of Connecticut, Department of Transportation equations for Sheet-Flow (6.C.2), Shallow Concentrated Flow (6.C.4) and Open Channel Flow (6.C.6).

Areas: Estimates from computer software (Land Desktop) and results of surveying.

REFERENCES

1) Subdivision Regulations, Town of Lisbon, Connecticut

2) Zoning Regulations, Town of Lisbon, Connecticut

3) 2004 Connecticut Stormwater Quality Manual, Connecticut Department of Environmental Protection, 79 Elm Street, Hartford, Connecticut

4) 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, Connecticut Council on Soil and Water Conservation, 79 Elm Street, Hartford, Connecticut.

5) 2000 Drainage Manual, Connecticut Department of Transportation,

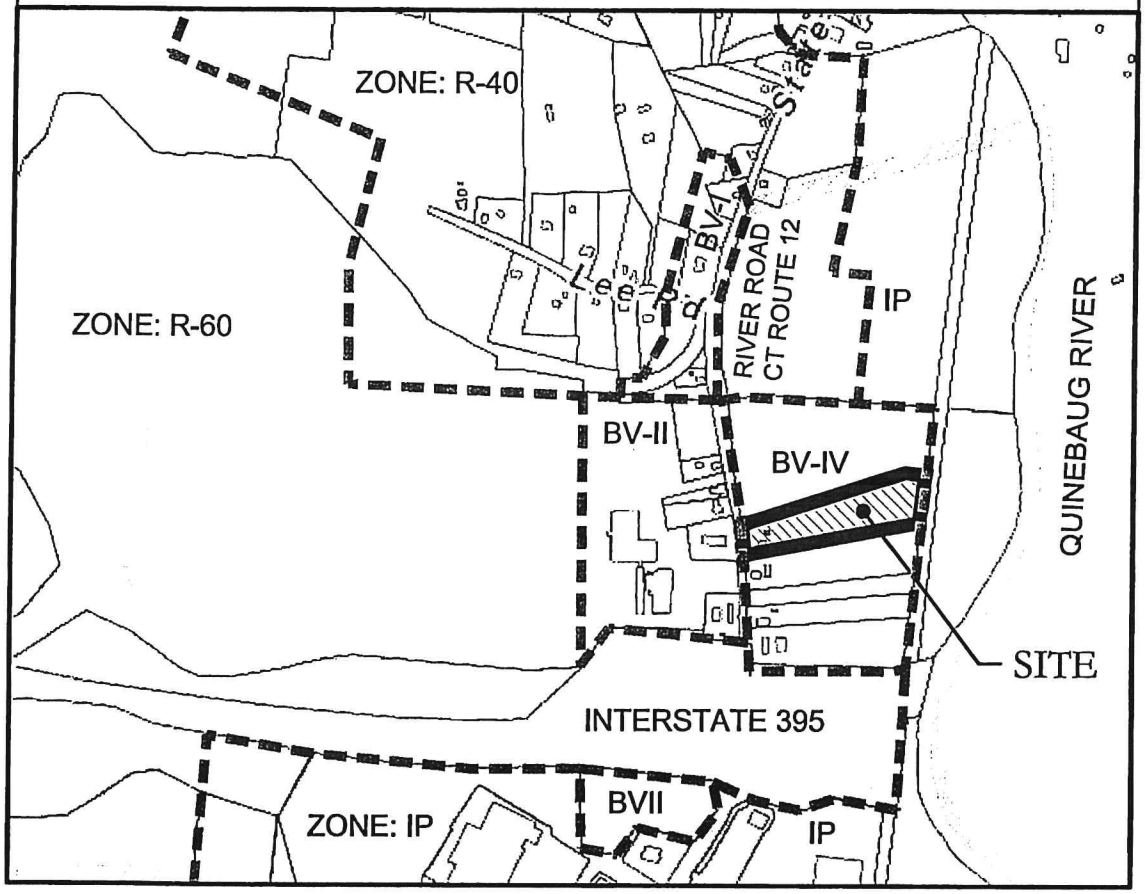
APPENDICES TABLE OF CONTENTS

APPENDIX 'A'

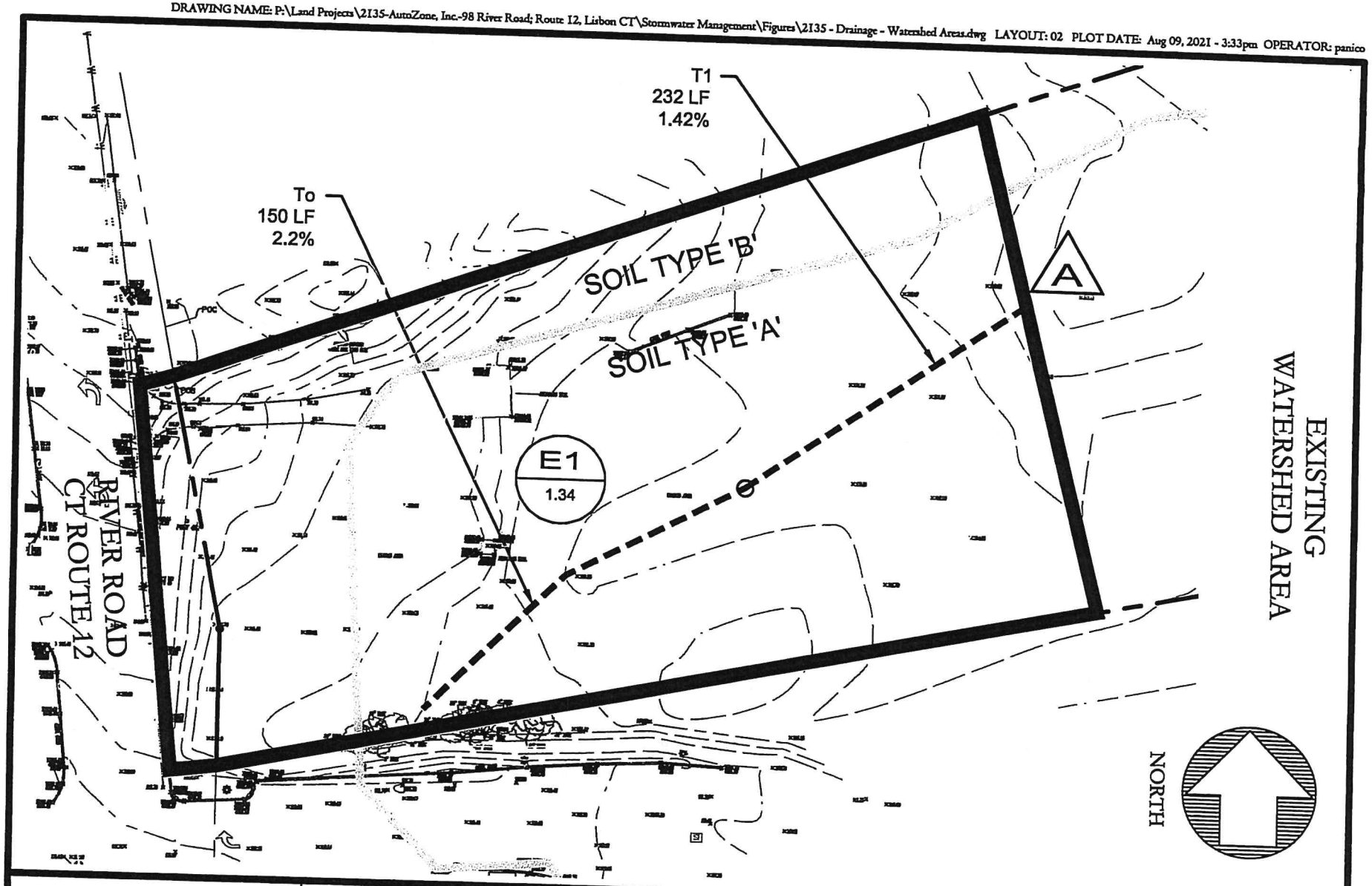
FIGURES

VICINITY MAP

(SCALE: 1" = 1000')



DRAWING NAME: P:\Land Projects\2135-AutoZone, Inc.-98 River Road; Route 12, Lisbon CT\Stormwater Management\Figures\2135 - Drainage - Watershed Areas.dwg LAYOUT: 02 PLOT DATE: Aug 09, 2021 - 3:33pm OPERATOR: panico



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T (860) 628-4484
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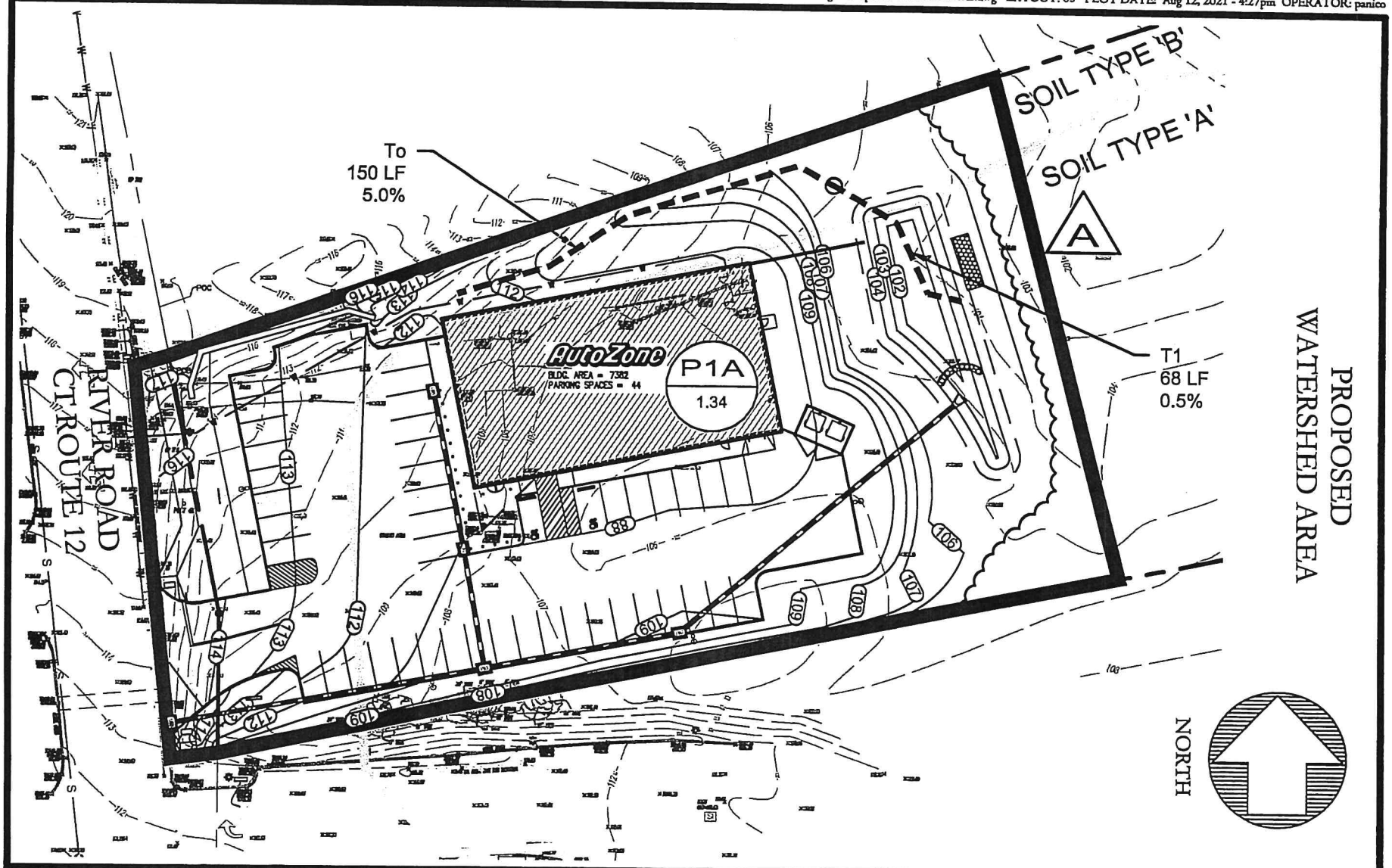
98 River Road
PRE DEVELOPMENT
WATERSHED AREA MAP
Lisbon, Connecticut

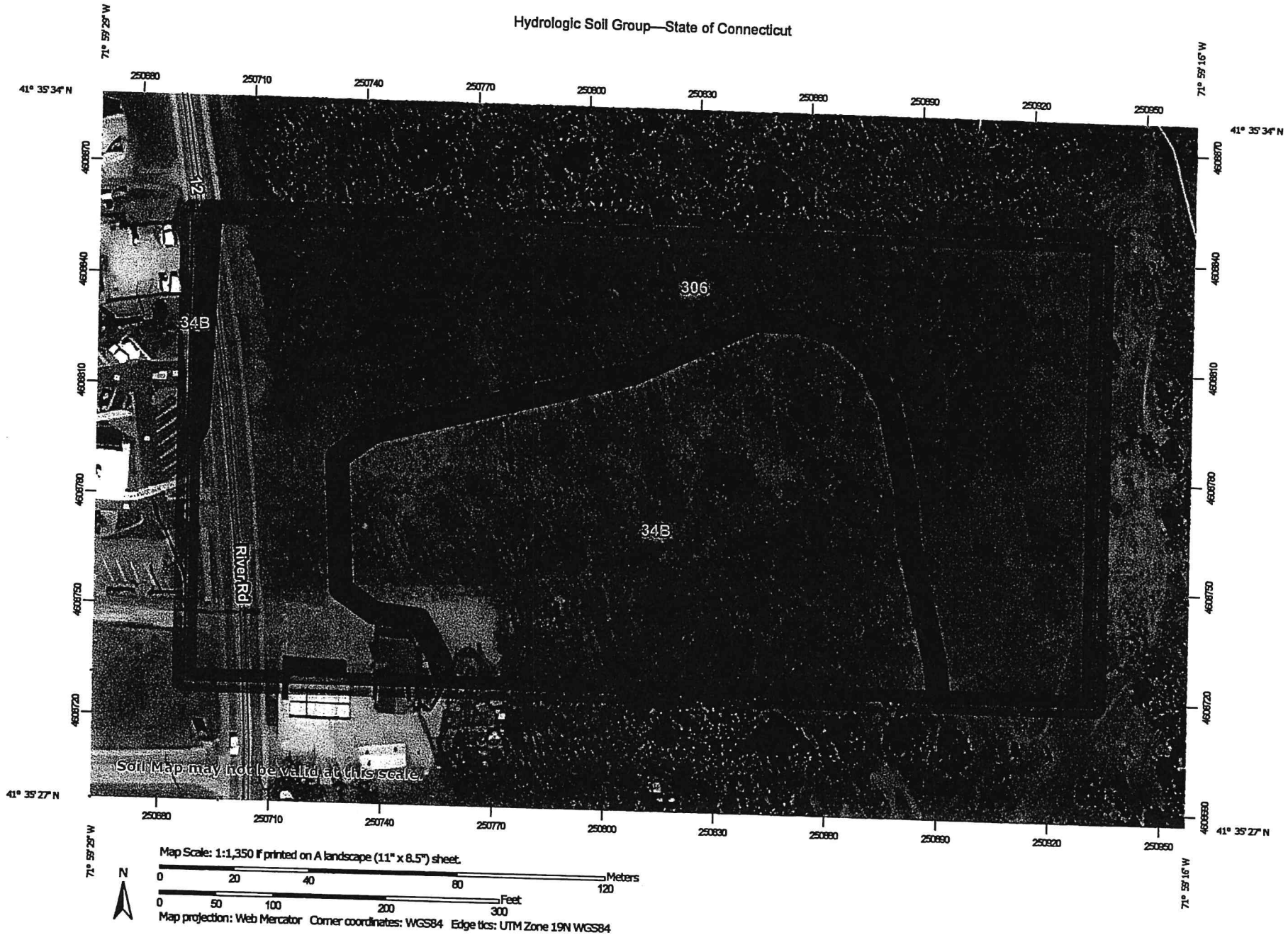
Scale: 1" = 50'
Date: August 9, 2021
Project #: 2135

02

DRAWING NAME: P:\Land Projects\2135-AutoZone, Inc.-98 River Road; Route 12, Lisbon CT\Stormwater Management\Figures\2135 - Drainage - Proposed Watershed Areas.dwg LAYOUT: 03 PLOT DATE: Aug 12, 2021 - 4:27pm OPERATOR: panico



cole engineering. surveying. planning.	P. O. BOX 44 876 SOUTH MAIN STREET PLANTSVILLE, CT 06479 T (860) 628-4484 F (860) 620-0196	98 River Road POST DEVELOPMENT WATERSHED AREA MAP Lisbon, Connecticut	Scale: 1" = 50' Date: August 9, 2021 Project #: 2135	03



Map Scale: 1:1,350 if printed on A landscape (11" x 8.5") sheet.

N

0 20 40 80 120 Meters

0 50 100 200 300 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N 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.

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

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

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

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

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

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

Soil Survey Area: 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
34B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	3.2	41.6%
306	Udorthents-Urban land complex	B	4.5	58.4%
Totals for Area of Interest			7.7	100.0%

Description

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.

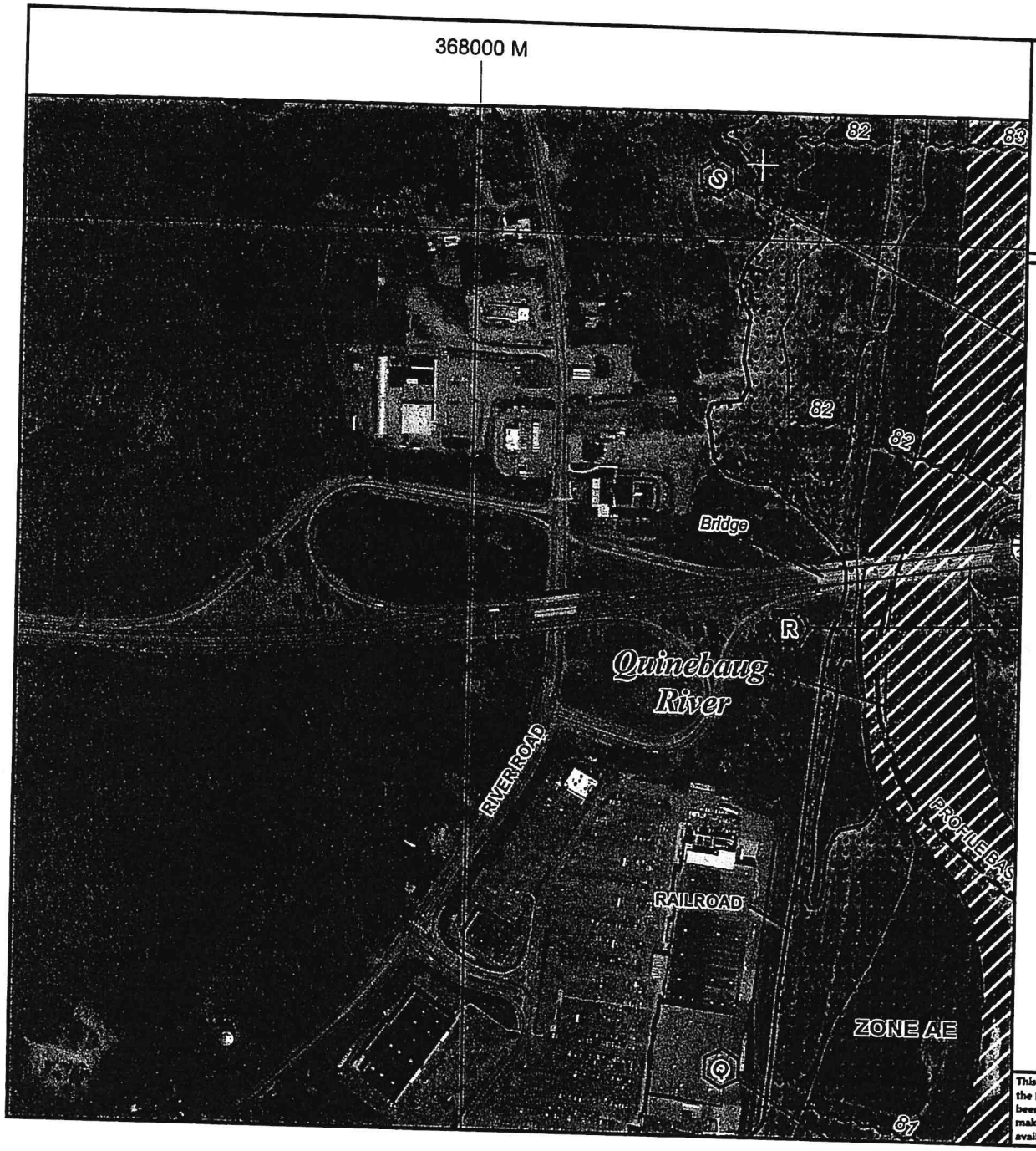
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



MAP SCALE 1" = 500'

250 0 500 1000 FEE

150 0 150 300 M

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0228G

FIRM

FLOOD INSURANCE RATE MAP

NEW LONDON COUNTY, CONNECTICUT

ALL JURISDICTIONS

PANEL 228 OF 554

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GRISWOLD, TOWN OF	090173	0228	G
LISBON, TOWN OF	090172	0228	G
PRESTON, TOWN OF	090139	0228	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
09011C0228G

EFFECTIVE DATE
JULY 18, 2011

Federal Emergency Management Agency

Natural Diversity Data Base Areas

LISBON, CT

June 2021

State and Federal Listed Species

Critical Habitat

Town Boundary

NOTE: This map shows general locations of State and Federal Listed Species and Critical Habitats. Information on listed species is collected and compiled by the Natural Diversity Data Base (NDDB) from a variety of data sources . Exact locations of species have been buffered to produce the generalized locations.

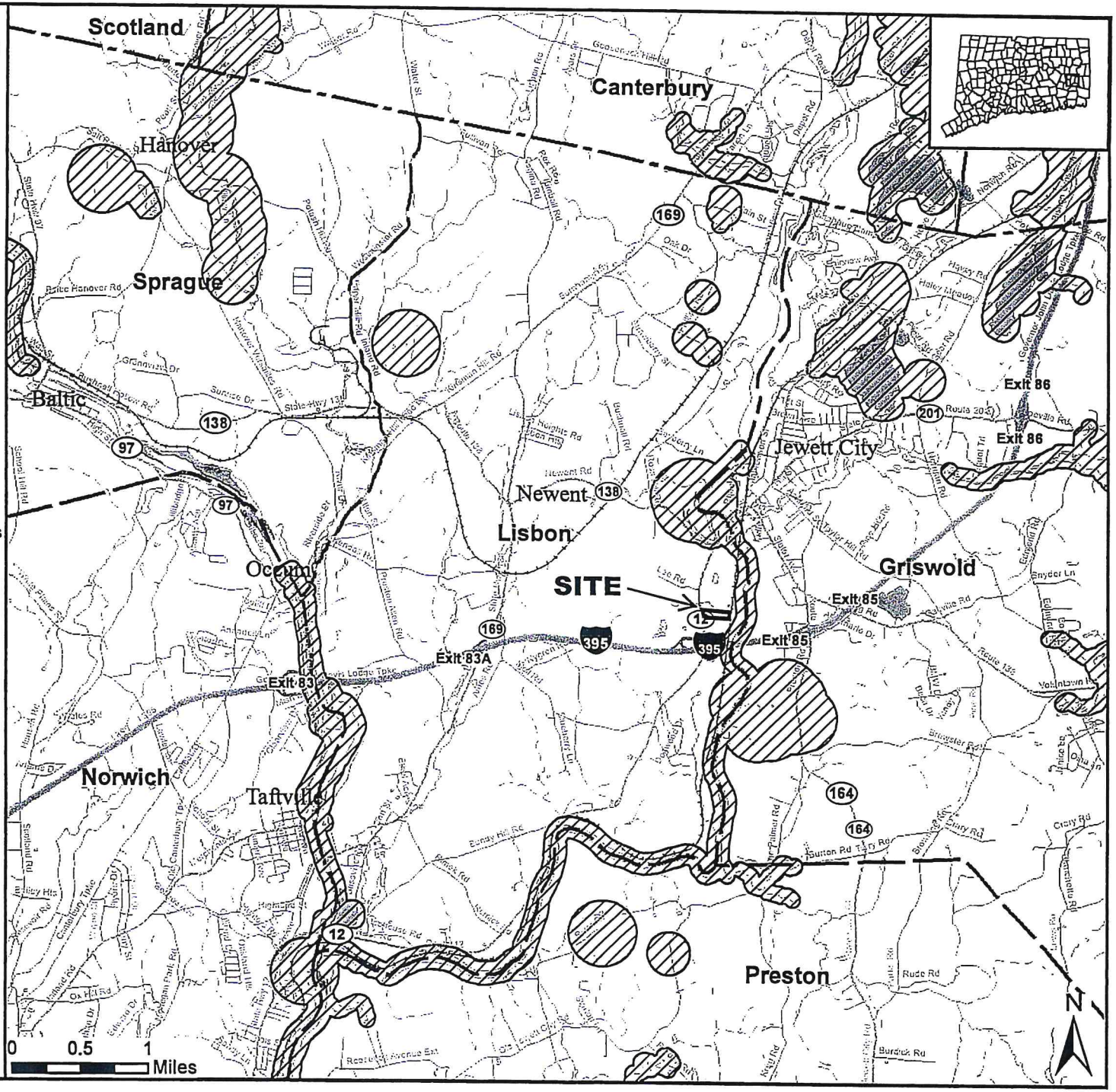
This map is intended for use as a preliminary screening tool for conducting a Natural Diversity Data Base Review Request. To use the map, locate the project boundaries and any additional affected areas If the project is within a hatched area there may be a potential conflict with a listed species. For more information, complete a Request for Natural Diversity Data Base State Listed Species Review form (DEP-APP-007), and submit it to the NDDB along with the required maps and information. More detailed instructions are provided with the request form on our website.

www.ct.gov/deep/nddbrequest

Use the CTECO Interactive Map Viewers at http://cteco.uconn.edu to more precisely search for and locate a site and to view aerial imagery with NDDB Areas.

QUESTIONS: Department of Energy and Environmental Protection (DEEP)
79 Elm St, Hartford, CT 06106
email: deep.nddbrequest@ct.gov
Phone: (860) 424-3011

Connecticut Department of Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division



APPENDIX 'B'

PRE AND POST DEVELOPMENT ANALYSIS

Pre and Post Development Summary Table

Design Point	Design Storm	Existing Peak Flow (cfs)	Proposed Peak Flow (cfs)	Change in Peak Flow (cfs)
DP A (East Side of Property)	2	0.44	0.00	-0.44
	5	0.57	0.00	-0.57
	10	0.67	0.00	-0.67
	25	0.81	0.00	-0.81
	100	1.02	0.73	-0.29

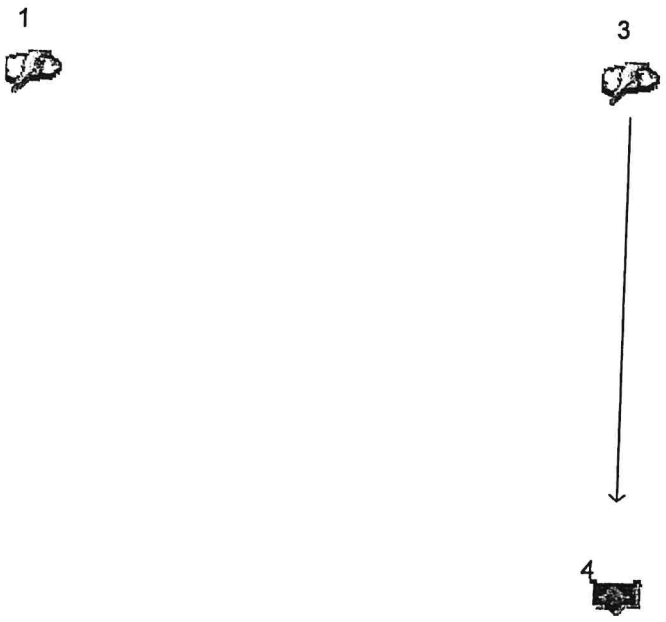
See note Below

Notes:

1. Proposed Peak flows at Design Point A are a summation of the detention pond release and drainage basin P1

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	Rational	E1
3	Rational	P1A
4	Reservoir	Basin

Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	----	----	0.444	----	0.567	0.668	0.806	----	1.020	E1
3	Rational	----	----	1.609	----	2.058	2.424	2.921	----	3.699	P1A
4	Reservoir	3	----	0.000	----	0.000	0.000	0.000	----	0.728	Basin

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.444	1	30	799	—	—	—	E1
3	Rational	1.609	1	22	2,124	—	—	—	P1A
4	Reservoir	0.000	1	n/a	0	3	103.73	2,124	Basin

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.567	1	30	1,020	-----	-----	-----	E1
3	Rational	2.058	1	22	2,716	-----	-----	-----	P1A
4	Reservoir	0.000	1	n/a	0	3	104.02	2,716	Basin

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time Interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.668	1	30	1,203	—	—	—	E1
3	Rational	2.424	1	22	3,200	—	—	—	P1A
4	Reservoir	0.000	1	n/a	0	3	104.22	3,200	Basin

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.806	1	30	1,450	----	----	----	E1
3	Rational	2.921	1	22	3,856	----	----	----	P1A
4	Reservoir	0.000	1	n/a	0	3	104.48	3,856	Basin

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time Interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	1.020	1	30	1,836	----	----	----	E1
3	Rational	3.699	1	22	4,882	----	----	----	P1A
4	Reservoir	0.728	1	40	393	3	104.76	4,659	Basin

Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Thursday, 08 / 12 / 2021

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	———
2	21.2564	3.6000	0.6962	———
3	0.0000	0.0000	0.0000	———
5	28.4971	3.9000	0.7082	———
10	33.3887	3.9000	0.7065	———
25	39.0706	3.7000	0.6992	———
50	44.4114	3.7000	0.7004	———
100	49.8773	3.8000	0.7009	———

File name: 2135 - NOAA intensity.pcp.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.75	3.45	2.78	2.35	2.06	1.84	1.67	1.53	1.42	1.33	1.25	1.18
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.06	4.42	3.55	3.01	2.63	2.35	2.13	1.96	1.81	1.69	1.59	1.50
10	7.13	5.20	4.19	3.55	3.10	2.77	2.51	2.31	2.14	2.00	1.87	1.77
25	8.61	6.27	5.04	4.27	3.74	3.34	3.03	2.79	2.58	2.41	2.27	2.14
50	9.76	7.10	5.71	4.84	4.23	3.78	3.43	3.15	2.92	2.73	2.56	2.42
100	10.86	7.93	6.38	5.41	4.73	4.23	3.84	3.53	3.27	3.05	2.87	2.71

Tc = time in minutes. Values may exceed 60.

5-AutoZone, Inc.-98 River Road; Route 12, Lisbon CT\Stormwater Management\Detention\2135 - NOAA frequency.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.39	0.00	4.29	5.04	6.08	6.85	7.67
SCS 6-Hr	0.00	2.27	0.00	2.87	3.36	4.05	4.56	5.11
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NOAA Atlas 14, Volume 10, Version 3
Location name: Jewett City, Connecticut, USA*
Latitude: 41.5918°, Longitude: -71.9906°
Elevation: 110.86 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	0.331 (0.256-0.422)	0.397 (0.308-0.508)	0.505 (0.391-0.647)	0.596 (0.458-0.767)	0.720 (0.536-0.957)	0.814 (0.593-1.10)	0.912 (0.646-1.27)	1.02 (0.687-1.44)	1.18 (0.762-1.70)	1.30 (0.825-1.91)
10-min	0.468 (0.363-0.598)	0.563 (0.436-0.719)	0.717 (0.553-0.919)	0.845 (0.649-1.09)	1.02 (0.759-1.36)	1.15 (0.841-1.56)	1.29 (0.916-1.79)	1.45 (0.974-2.04)	1.67 (1.08-2.41)	1.85 (1.17-2.71)
15-min	0.551 (0.427-0.704)	0.662 (0.513-0.846)	0.843 (0.651-1.08)	0.994 (0.763-1.28)	1.20 (0.893-1.60)	1.36 (0.990-1.83)	1.52 (1.08-2.11)	1.70 (1.15-2.39)	1.96 (1.27-2.83)	2.17 (1.38-3.19)
30-min	0.766 (0.594-0.978)	0.921 (0.713-1.18)	1.17 (0.907-1.50)	1.38 (1.06-1.78)	1.67 (1.24-2.22)	1.89 (1.38-2.55)	2.12 (1.50-2.94)	2.37 (1.59-3.33)	2.73 (1.77-3.94)	3.03 (1.92-4.43)
60-min	0.981 (0.761-1.25)	1.18 (0.914-1.51)	1.50 (1.16-1.92)	1.77 (1.36-2.28)	2.14 (1.59-2.85)	2.42 (1.76-3.27)	2.71 (1.92-3.76)	3.04 (2.04-4.27)	3.50 (2.27-5.05)	3.88 (2.46-5.69)
2-hr	1.28 (0.995-1.62)	1.53 (1.19-1.94)	1.95 (1.51-2.48)	2.29 (1.77-2.93)	2.77 (2.07-3.66)	3.12 (2.29-4.20)	3.50 (2.50-4.85)	3.93 (2.66-5.50)	4.57 (2.97-6.55)	5.10 (3.24-7.42)
3-hr	1.48 (1.16-1.87)	1.77 (1.39-2.24)	2.25 (1.75-2.85)	2.65 (2.05-3.37)	3.20 (2.40-4.21)	3.60 (2.65-4.83)	4.04 (2.90-5.58)	4.54 (3.07-6.33)	5.29 (3.44-7.55)	5.91 (3.76-8.57)
6-hr	1.90 (1.49-2.38)	2.27 (1.78-2.85)	2.87 (2.25-3.61)	3.36 (2.62-4.25)	4.05 (3.06-5.30)	4.56 (3.38-6.07)	5.11 (3.68-7.01)	5.74 (3.90-7.94)	6.68 (4.36-9.48)	7.46 (4.76-10.8)
12-hr	2.39 (1.89-2.98)	2.84 (2.25-3.55)	3.59 (2.83-4.49)	4.20 (3.29-5.28)	5.05 (3.83-6.56)	5.68 (4.23-7.51)	6.36 (4.60-8.65)	7.13 (4.87-9.80)	8.27 (5.42-11.7)	9.22 (5.90-13.2)
24-hr	2.84 (2.26-3.52)	3.39 (2.70-4.21)	4.29 (3.40-5.34)	5.04 (3.97-6.30)	6.08 (4.64-7.85)	6.85 (5.12-8.99)	7.67 (5.57-10.4)	8.62 (5.90-11.8)	10.0 (6.59-14.0)	11.2 (7.18-15.9)
2-day	3.19 (2.56-3.93)	3.85 (3.08-4.74)	4.92 (3.92-6.08)	5.81 (4.60-7.21)	7.04 (5.40-9.04)	7.95 (5.98-10.4)	8.92 (6.53-12.0)	10.1 (6.93-13.7)	11.8 (7.80-16.4)	13.3 (8.56-18.7)
3-day	3.46 (2.78-4.25)	4.17 (3.35-5.12)	5.33 (4.27-6.56)	6.30 (5.01-7.78)	7.62 (5.87-9.77)	8.61 (6.50-11.2)	9.67 (7.11-13.0)	10.9 (7.53-14.8)	12.8 (8.50-17.8)	14.5 (9.34-20.3)
4-day	3.71 (2.99-4.54)	4.46 (3.59-5.46)	5.69 (4.56-6.98)	6.70 (5.34-8.26)	8.10 (6.26-10.4)	9.14 (6.92-11.9)	10.3 (7.56-13.8)	11.6 (8.00-15.6)	13.6 (9.03-18.8)	15.3 (9.93-21.5)
7-day	4.40 (3.57-5.36)	5.24 (4.23-6.37)	6.60 (5.31-8.05)	7.72 (6.19-9.46)	9.28 (7.19-11.8)	10.4 (7.92-13.5)	11.7 (8.62-15.6)	13.1 (9.10-17.6)	15.4 (10.2-21.1)	17.2 (11.2-24.0)
10-day	5.10 (4.14-6.18)	5.97 (4.85-7.25)	7.41 (5.99-9.01)	8.60 (6.90-10.5)	10.2 (7.95-12.9)	11.5 (8.71-14.7)	12.8 (9.41-16.9)	14.3 (9.91-19.0)	16.5 (11.0-22.6)	18.4 (12.0-25.6)
20-day	7.26 (5.93-8.74)	8.19 (6.68-9.87)	9.72 (7.90-11.7)	11.0 (8.87-13.3)	12.7 (9.90-15.8)	14.0 (10.7-17.8)	15.4 (11.3-20.0)	16.8 (11.8-22.3)	18.8 (12.6-25.5)	20.4 (13.3-28.1)
30-day	9.08 (7.44-10.9)	10.0 (8.22-12.0)	11.6 (9.46-14.0)	12.9 (10.5-15.6)	14.7 (11.5-18.2)	16.1 (12.2-20.2)	17.5 (12.8-22.3)	18.8 (13.2-24.7)	20.5 (13.8-27.7)	21.8 (14.2-29.9)
45-day	11.3 (9.32-13.5)	12.3 (10.1-14.7)	14.0 (11.4-16.7)	15.3 (12.5-18.4)	17.2 (13.4-21.1)	18.7 (14.2-23.2)	20.1 (14.7-25.4)	21.3 (15.0-27.9)	22.8 (15.4-30.7)	23.8 (15.6-32.6)
60-day	13.2 (10.9-15.7)	14.2 (11.7-17.0)	15.9 (13.1-19.0)	17.4 (14.2-20.8)	19.3 (15.1-23.6)	20.9 (15.9-25.9)	22.3 (16.3-28.1)	23.5 (16.6-30.7)	25.0 (16.9-33.5)	25.8 (16.9-35.2)

[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.

Please refer to NOAA Atlas 14 document for more information.

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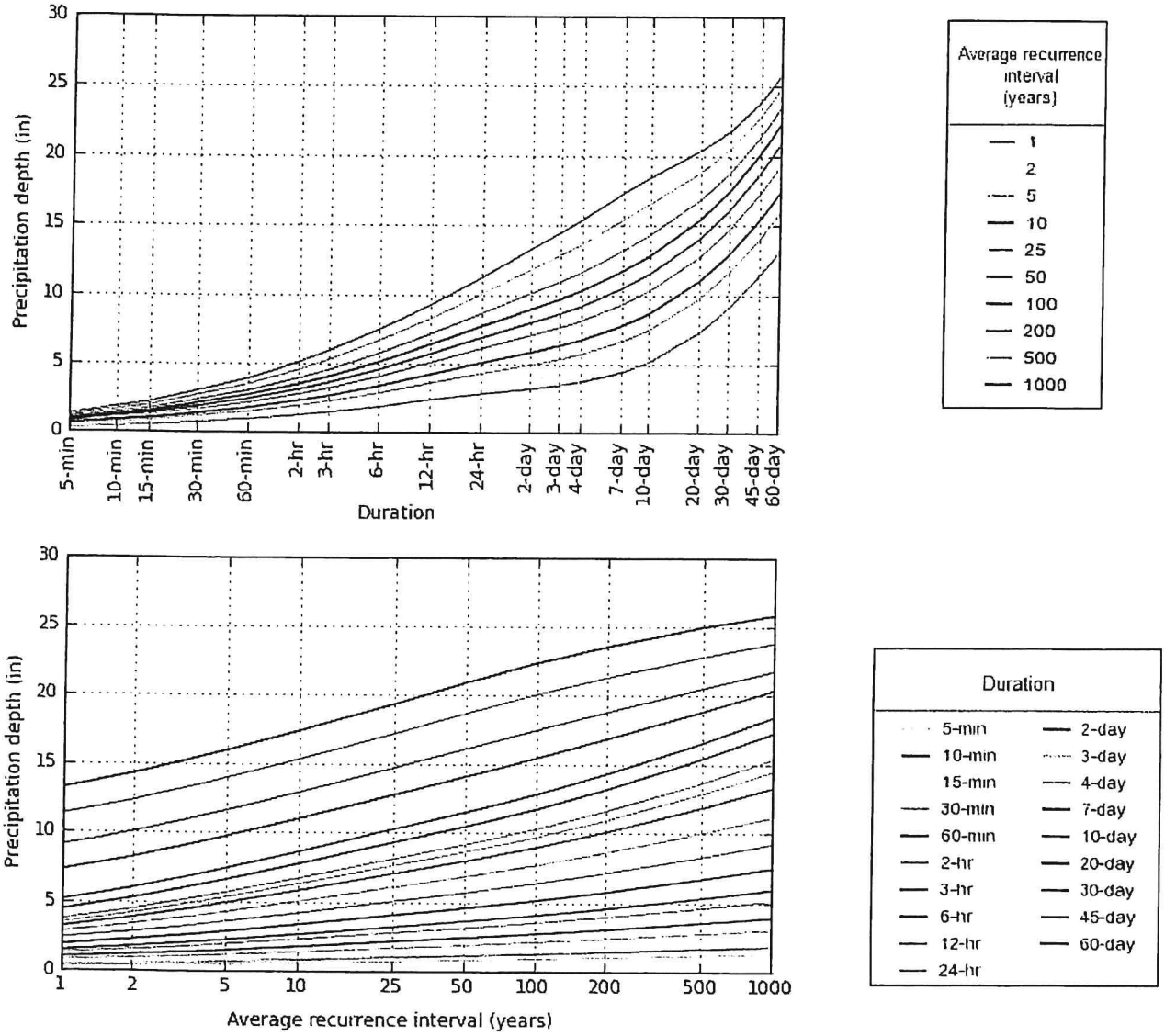
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 41.5918°, Longitude: -71.9906°



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Mon Aug 9 15:14:33 2021

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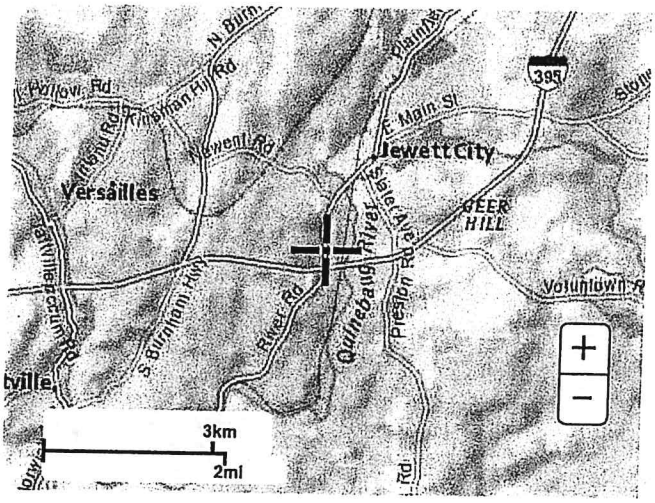
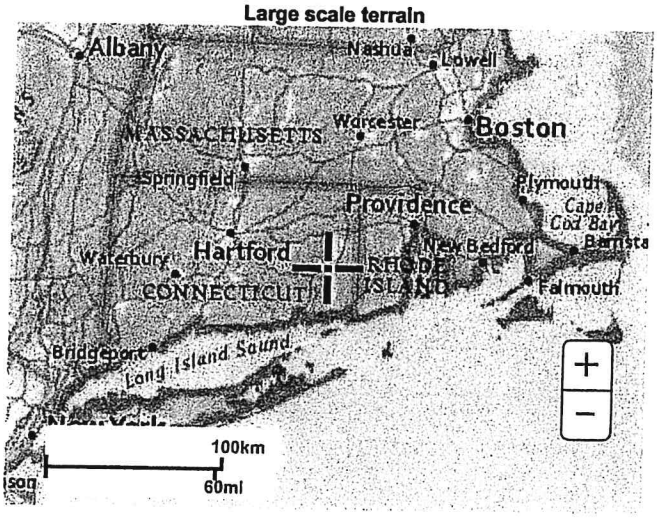
Maps & aerials

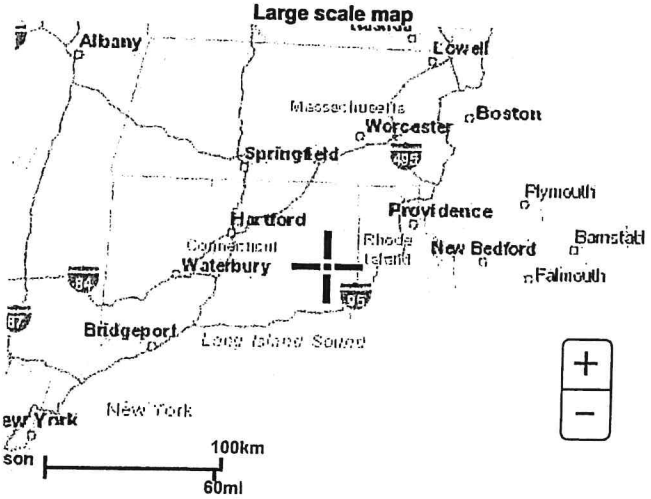
Small scale terrain



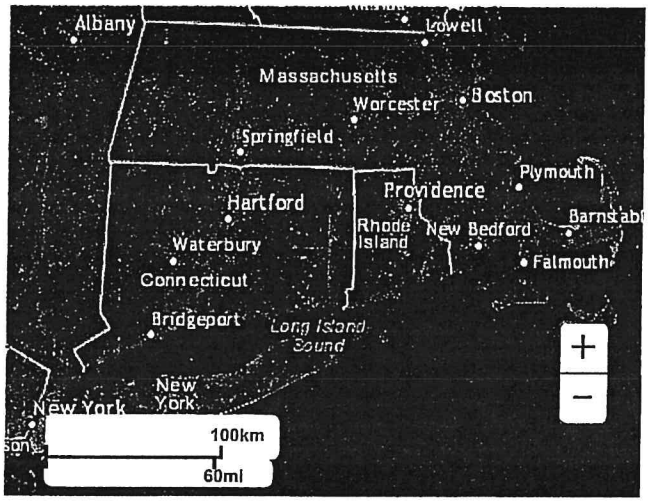
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

RATIONAL METHOD COMPOSITE RUNOFF COEFFICIENTS

Character of Surface	Runoff Coefficient	Source
Asphalt, Concrete, Roofs & Water Surface	0.95	CONN DOT Table 6-5
Industrial Impervious Area	0.75	CONN DOT Table 6-4
Residential Single Family Area	0.50	CONN DOT Table 6-4
Parks & Cemeteries	0.25	CONN DOT Table 6-4
Unimproved Areas	0.30	CONN DOT Table 6-4
		CONN DOT Table 6-4

Character of Surface	Runoff Coefficient	Source
Forest (Hydrologic Type A Soil)	0.14	McCuen, 1989 Table 7-2
Forest (Hydrologic Type B Soil)	0.18	McCuen, 1989 Table 7-3
Lawns Sandy Soil (Steep 7%+)	0.18	McCuen, 1989 Table 7-3
Lawns Sandy Soil (2% to 7%)	0.16	McCuen, 1989 Table 7-3
		McCuen, 1989 Table 7-3

Project: AutoZone
Lisbon, CT

Calcs By: BTP
Date: 8/6/21
Revised :

Basin ID	Basin Area (acres)	Asphalt, Concrete, Roofs & Water Surface (acres)	Industrial Impervious Area (acres)	Residential Single Family Area (acres)	Parks & Cemeteries (acres)	Unimproved Areas (acres)	0 (acres)	Forest (Hydrologic Type A Soil) (acres)	Forest (Hydrologic Type B Soil) (acres)	Lawns Sandy Soil (Steep 7%+) (acres)	Lawns Sandy Soil (2% to 7%) (acres)	Composite Runoff Coefficient
E1	1.34	0.04						0.86	0.43		0.00	0.18
P1A	1.34	0.64						0.06	0.02	0.06	0.56	0.54

Note:

TIME OF CONCENTRATION COMPUTATIONS

Overland Flow: (Maximum 150 FT)

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$ (TR-55 Equation 3-3)

T_t=Travel Time (Hr)
n=Manning's Roughness (TR-55 Table 3-1)
L=Flow Length (ft)
P_2= 2 Year, 24-hour Rainfall (in)
s=slope (ft/ft)

Project: AutoZone
Lisbon, CT

Calculations By: BTP
Date: 8/6/2021

Shallow Concentrated Flow:

Unpaved: $V=16.1345(s)^{0.5}$
Paved: $V=20.3284(s)^{0.5}$
$T_t = L / 60V$
(Conn DOT Equations 6.C.4 & C.C.5)

T_t=Travel Time (min)
V=Velocity (ft/s)
s=slope (ft/ft)

Common Manning n Values for overland flow

Woods	0.400	Light Underbrush
Pavement	0.011	
Lawns	0.410	Bermuda Grass
Dense Grass	0.240	Lovegrass, Bluegrass, Buffalo,Grama & Native

Open Channel\Swale Flow:

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n}$$ (TR-55 Equation 3-4)

T_t=Travel Time (min)
n=Manning's Roughness
L=Flow Length (ft)
V=Velocity (ft/s)
s=slope (ft/ft)
r= hydraulic radius (a/pw)
a=cross-section area (ft^2)
p_w=wetted perimeter (ft)

$T_t = L / 60V$

Minimum allowable T_c = 5.00 min.

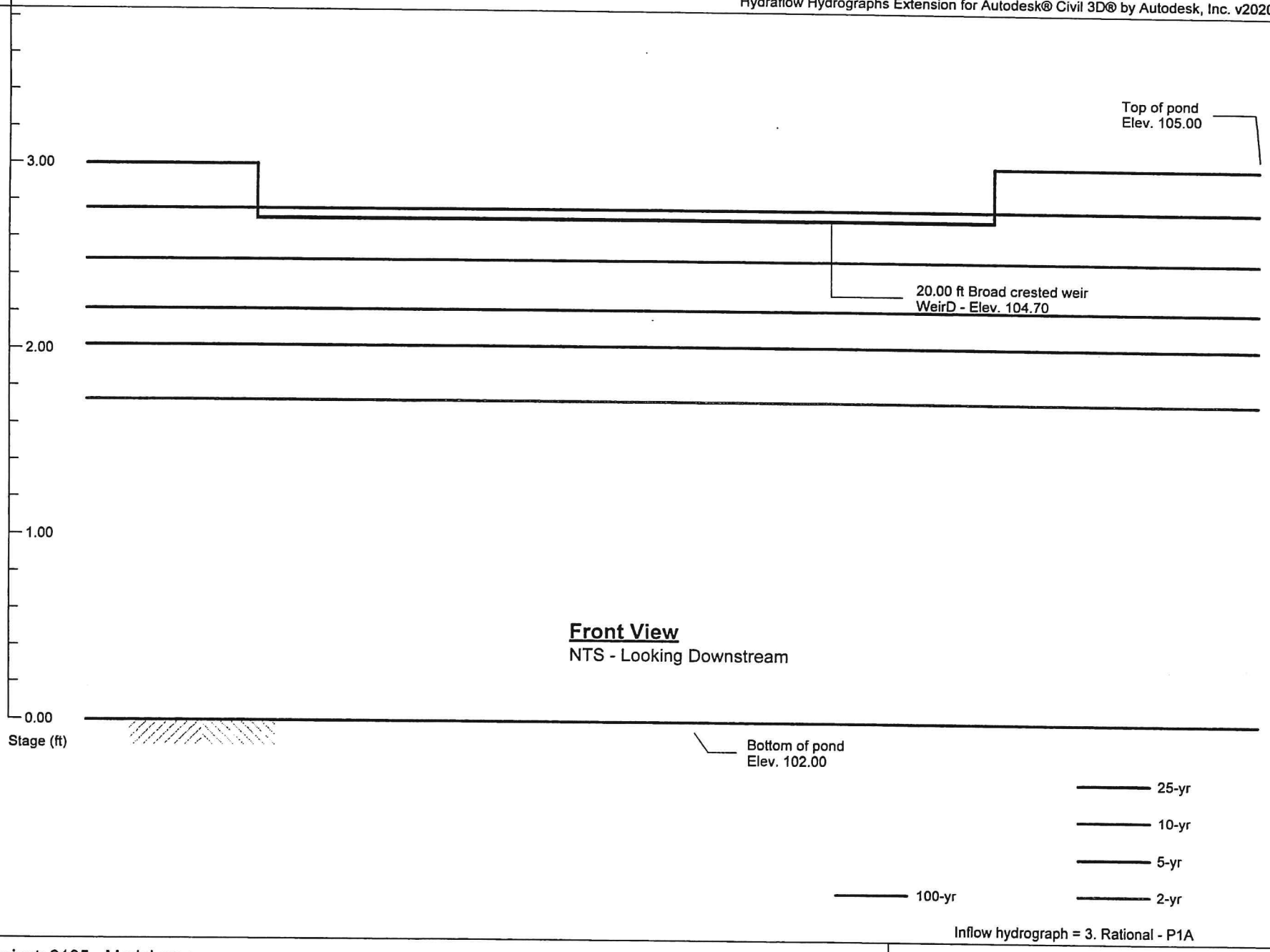
		Overland Sheet Flow				Shallow Flow					Swale Flow							Pipe Flow					Total
Design Point	Basin(s)	n	L (ft)	S (%)	T_o (min)	Paved (Y or N)	L (ft)	S (%)	V (ft/s)	T_1 (min)	n	Area (s.f.)	Wet. Perim. (ft)	S (%)	V(full flow) (ft/s)	L (ft)	Ts (min)	Dia. (in)	L (ft)	S (%)	V(full flow) (ft/s)	Tp (min)	T (min)
A	E1	0.400	150	2.20	28.59	Y	232	1.42	2.42	1.59									0.00				
				Subtotal	28.59				Subtotal	1.59						Subtotal						Subtotal		30.19
A	P1A	0.410	150	5.00	21.00	N	68	0.50	1.14	0.99													
				Subtotal	21.00				Subtotal	0.99						Subtotal						Subtotal		21.99

APPENDIX 'C'

DETENTION DESIGN

Pond No. 2 - Retention Basin

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



Project: 2135 - Model.gpw

Thursday, 08 / 12 / 2021

Pond Report

Pond No. 2 - Retention Basin

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 102.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	102.00	588	0	0
0.50	102.50	900	369	369
1.00	103.00	1,295	546	915
1.50	103.50	1,745	757	1,672
2.00	104.00	2,220	989	2,661
2.50	104.50	2,720	1,233	3,894
3.00	105.00	3,246	1,489	5,383

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

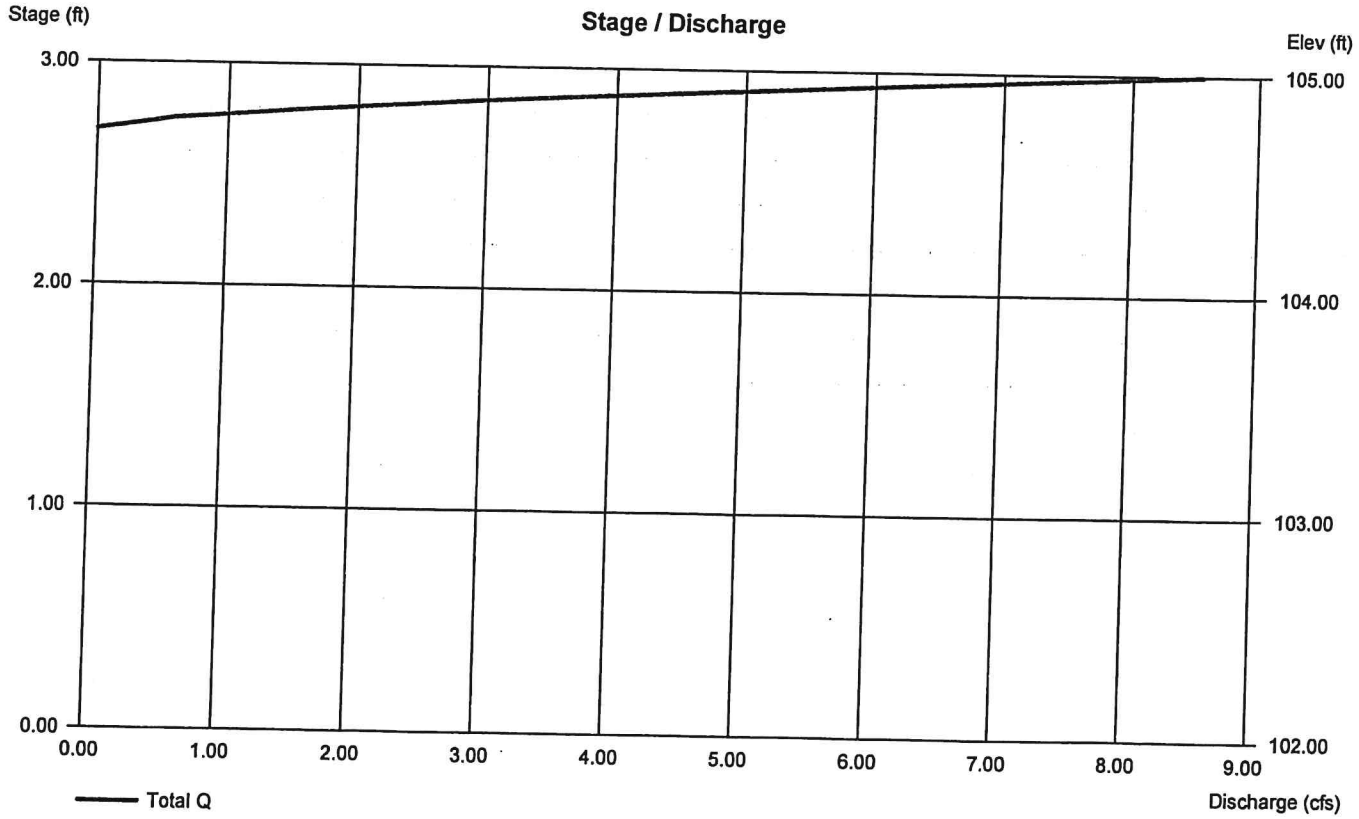
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	20.00
Crest El. (ft)	= 0.00	0.00	0.00	104.70
Weir Coeff.	= 3.33	3.33	3.33	2.60
Weir Type	= ---	---	---	Broad
Multi-Stage	= No	No	No	No

Exfil.(In/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



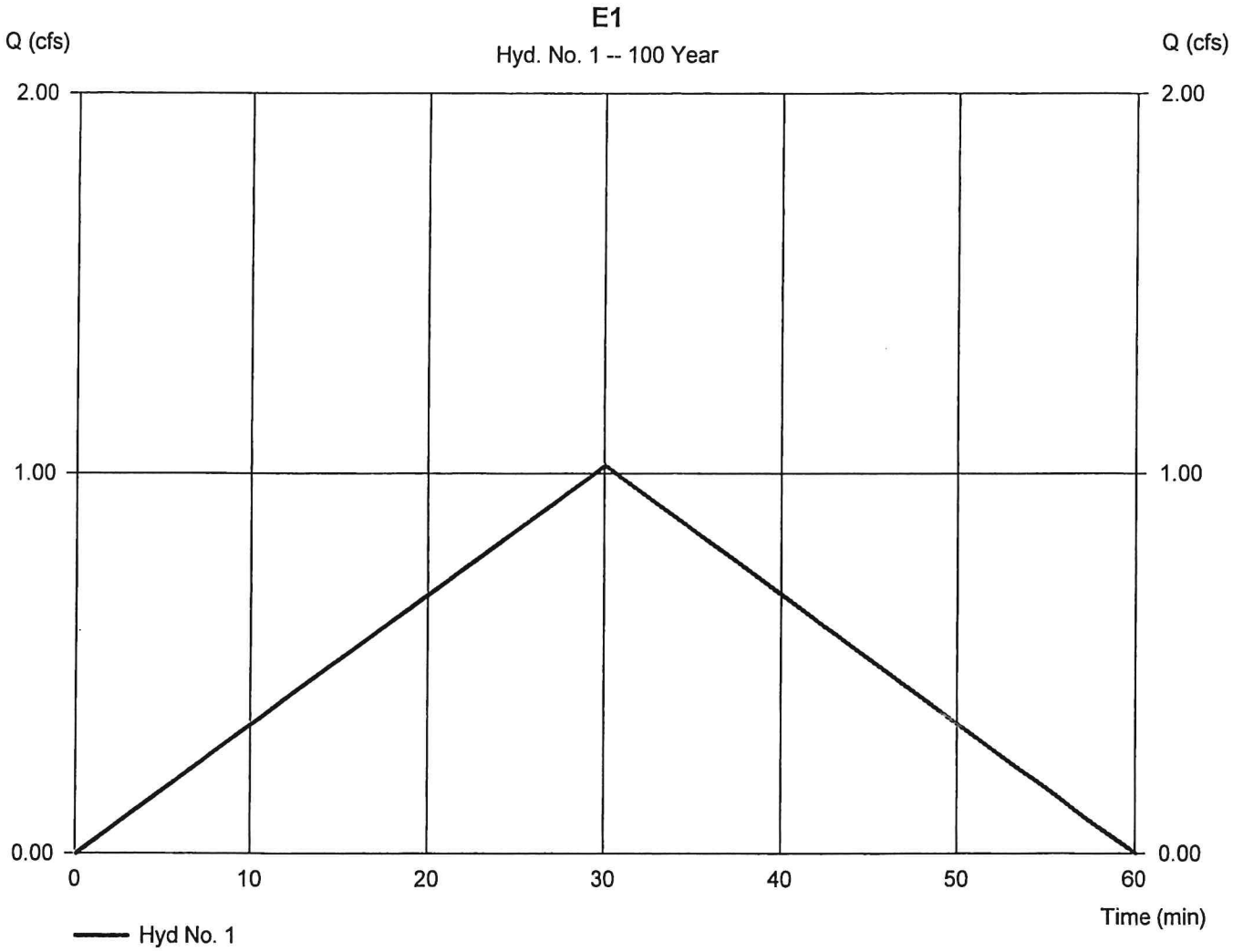
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Thursday, 08 / 12 / 2021

Hyd. No. 1

E1

Hydrograph type	= Rational	Peak discharge	= 1.020 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,836 cuft
Drainage area	= 1.340 ac	Runoff coeff.	= 0.18
Intensity	= 4.230 in/hr	Tc by User	= 30.00 min
IDF Curve	= 2135 - NOAA intensity.pcp.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

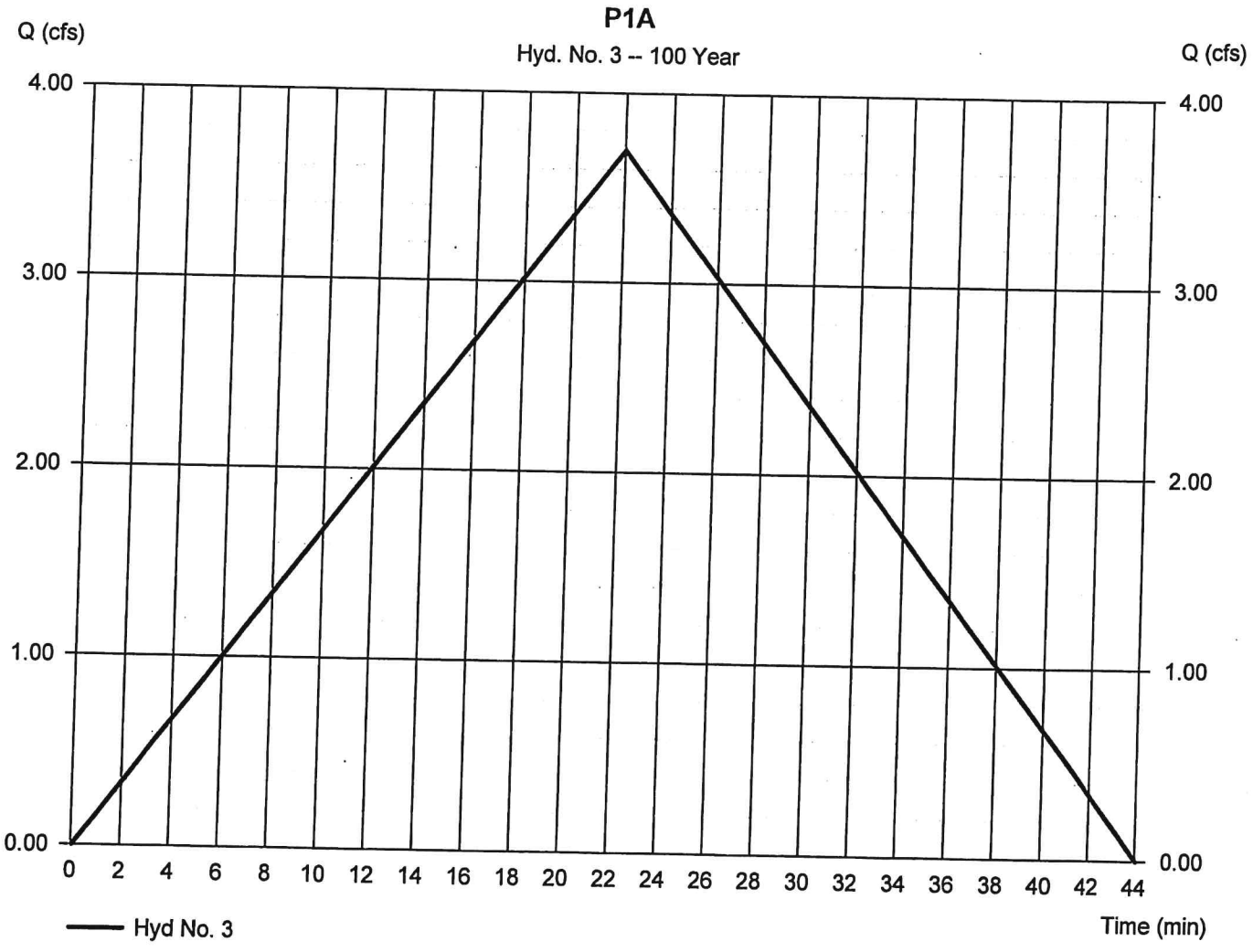
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

Thursday, 08 / 12 / 2021

Hyd. No. 3

P1A

Hydrograph type	= Rational	Peak discharge	= 3.699 cfs
Storm frequency	= 100 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 4,882 cuft
Drainage area	= 1.340 ac	Runoff coeff.	= 0.54
Intensity	= 5.112 in/hr	Tc by User	= 22.00 min
IDF Curve	= 2135 - NOAA intensity.pcp.IDFAsc/Rec limb fact		= 1/1



Hydrograph Report

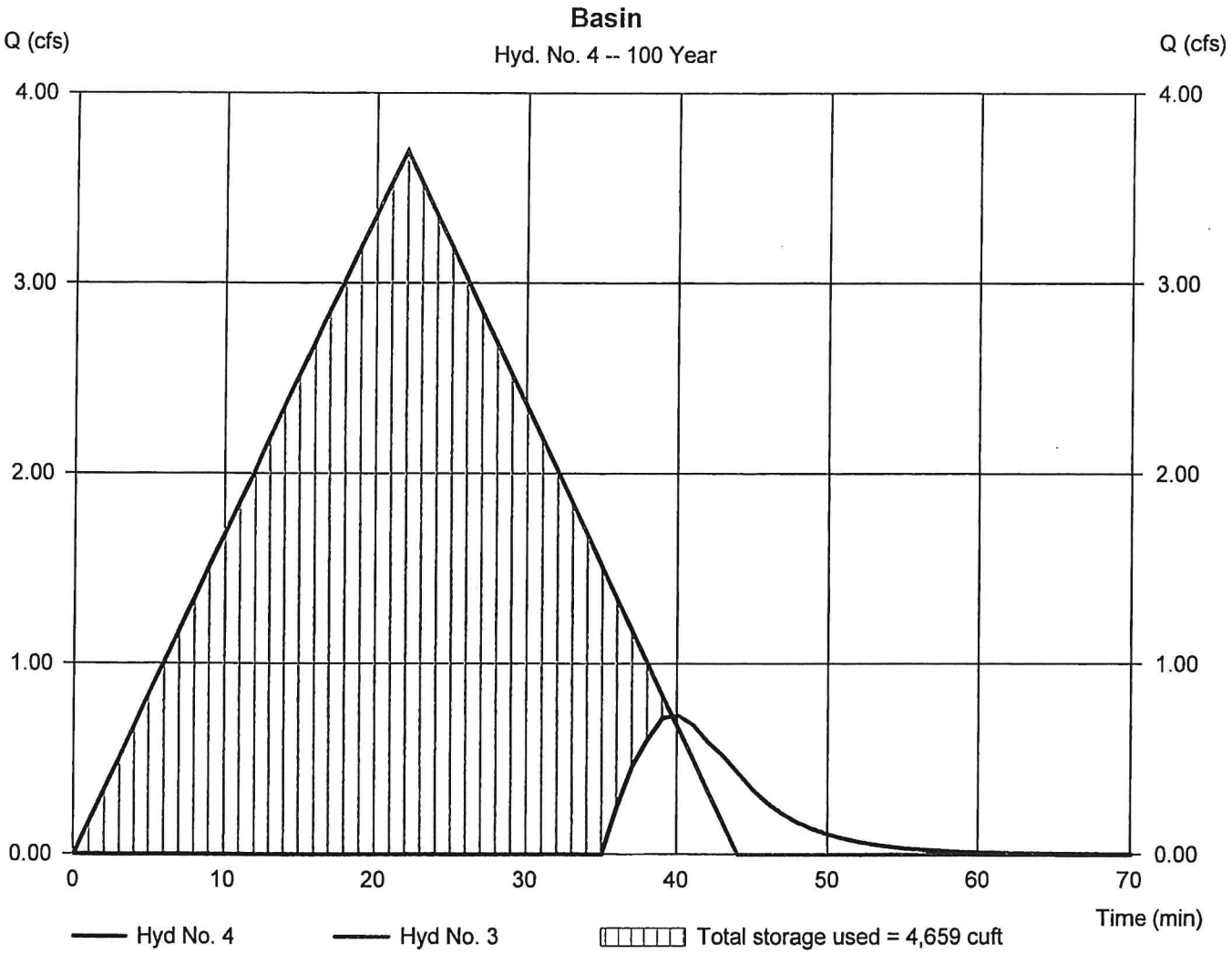
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Thursday, 08 / 12 / 2021

Hyd. No. 4

Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.728 cfs
Storm frequency	= 100 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 393 cuft
Inflow hyd. No.	= 3 - P1A	Max. Elevation	= 104.76 ft
Reservoir name	= Retention Basin	Max. Storage	= 4,659 cuft

Storage Indication method used.



Stage Storage
Project: AutoZone - Lisbon, CT
Basin Description: Detention Basin

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
102.00	588.03	N/A	N/A	0	N/A	0
102.50	900.09	0.50	372	372	369	369
103.00	1,294.58	0.50	549	921	546	915
103.50	1,744.64	0.50	760	1681	757	1672
104.00	2,219.82	0.50	991	2672	989	2661
104.50	2,720.15	0.50	1235	3907	1233	3894
105.00	3,245.60	0.50	1491	5398	1490	5383

APPENDIX "D'

WATER QUALITY

Water Quality Volume (WQV)

Project: AutoZone
98 River Road
Lisbon, CT

Project #: 2135
Date: 8/10/2021
By: BTP

Equation:

WQV = (1")(R)(A)/12 *Section 7.4.1 of 2004 Connecticut Stormwater Quality Manual*

WQV= Water Quality Volume (ac-ft)
R = Volumemetric Runoff Coefficient = 0.05+0.009 (I)
I = Percent Impervious Cover
A = Site Area in Acres

					Required		Forebay Area		Main Area		Total	
					Calculated		Provided	Provided	Provided	Provided	Provided	Provided
Basin #	Site Area "A" (acres)	Impervious Area (acres)	Impervious Cover "I" (%)	Runoff Coefficient "R"	WQV (ac-ft)	WQV (cu-ft)	WQV (cu-ft)	WQV (%)	WQV (cu-ft)	WQV (%)	WQV (cu-ft)	WQV (%)
P1A	1.34	0.64	47.8	0.480	0.054	2,334.09	353	15%	2279	98%	2632	113%

Note: WQV provided in detention basin.

Stage Storage Volume
Project: 2135 - AutoZone
Basin Description: Retention Basin

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
Forebay Area						
102.00	2.73	N/A	N/A	0	N/A	0
102.50	44.00	0.50	12	12	10	10
103.00	151.62	0.50	49	61	46	56
103.50	298.53	0.50	113	173	110	166
104.00	453.83	0.50	188	361	187	353
Main Basin Area						
102.00	580.38	N/A	N/A	0	N/A	0
102.50	844.05	0.50	356	356	354	354
103.00	1,127.74	0.50	493	849	491	845
103.50	1,431.54	0.50	640	1489	638	1484
104.00	1,756.15	0.50	797	2286	796	2279

APPENDIX "E'

STORMWATER MANAGEMENT MAINTENANCE SCHEDULE

STORMWATER MANAGEMENT MAINTENANCE SCHEDULE
LISBON, CONNECTICUT

The following are the required maintenance and monitoring procedures:

Riprap and Discharge Aprons - Shall be cleared of all sediment deposits and invasive plant species and are to be inspected for rip-rap damage and deterioration. These procedures to be conducted yearly between May I and before September 15.

Emergency Spillway - Shall be cleared of all sediment deposits and invasive plant species and are to be inspected for riprap damage and deterioration. These procedures to be conducted yearly between May 1 and September 15. Repairs shall be executed immediately.

Catch Basins - All basin rim areas and sumps shall be cleaned of all sediment, trash and debris. These procedures to be conducted yearly anytime after May I and before September 15.

Swales - all swales be cleared of all sediment deposits, invasive plant species and debris. Any erosion shall be repaired. These procedures to be conducted annually. Swales shall be inspected two times a year and after significant rainfall events. Additional maintenance, beyond schedule maintenance, may be required based upon inspections.

Retention Basin - Basin shall be cleared of all sediment deposits, invasive plant species and debris. These procedures to be conducted yearly between May 1 and September 15. Basin shall be inspected two times a year and after significant rainfall events. Additional maintenance, beyond scheduled maintenance, may be required based upon inspections.

Slopes - Slope erosion control blankets and vegetation shall be inspected twice a year and after significant rainfall events. Additional maintenance, beyond schedule maintenance, may be required based upon inspections. Any rills or channeling shall be repaired immediately

Parking Lot\Drive Sweeping - Use mechanical sweeping on paved areas where dust and fine materials accumulate. These procedures to be conducted yearly anytime after May I and before September 15.
All sediment deposits, trash and debris shall be removed to a location off-site and disposed of in an environmentally acceptable manner.

All sediment deposits, trash and debris shall be removed to a location off-site and disposed of in an environmentally acceptable manner.