

November 25, 2019

Denise M. Gaffey
Director and City Planner
562 Main Street, 2nd Floor
Melrose, MA 02176

RE: Drainage Summary Letter
99 Washington Street
Melrose, MA

Dear Ms. Gaffey,

On behalf of our Client, Oak Grove Mill, LLC, Allen & Major Associates (A&M) is pleased to provide this letter in support of the Site Plan application for the multi-family project at 99 Washington Street. This letter will summarize the changes to the stormwater management system which are proposed as part of the redevelopment efforts.

Existing Conditions

The Site is located on the eastern side of Washington Street between the intersections with Pleasant Street, to the north, and Brazil Street to the South. It is comprised of a single property, identified by the City Assessor's office as Parcel B2 0 16-18. The Site is predominantly covered by paved parking and roof top with a small portion of the easterly side of the Site covered by gravel.

Elevations onsite range from approximately El 48 at the northwesterly property corner, to approximately El 42 at a low point catch basin near the southeasterly side of the Site. Stormwater sheet flows over the paved parking lot to onsite catch basins which discharge to existing stormwater management infrastructure on the neighboring parcels. Stormwater from the roof discharges to the ground surface and sheet flows to catch basins on Site. A review of the NRCS soil report for Middlesex County indicates that the soil onsite is considered Urban Land. A copy of the Existing Watershed Plan is included herewith.

Proposed Conditions

The project, which proposes the addition to and renovation of the existing buildings, to accommodate a multi-family development, will revise the parking alignment and make improvements to the utilities and stormwater management systems. A total of 172 parking spaces are proposed onsite. The proposed work will result in approximately 29,500 square feet of impervious material being replaced with landscaped islands, pervious pavement, and permeable pavers. A copy of the Proposed Watershed Plan is included herewith.

Runoff flows were estimated for both pre and post development conditions using HydroCAD 10.00 software, at two specific "Study Points" (SP-1 and SP-2). Study Point 1 is a drain manhole towards the southeasterly corner of the Site, but on the 37 Washington Street property. Stormwater from the portion of the Site west and south of the existing building is directed to this manhole through various roof leaders, underdrains, and catch basins. Study Point 2 is the stormwater management system on the abutting property to the east. In the proposed condition, stormwater from the portion of the Site which is east of the existing building will be directed to the Study Point 2 in a manner consistent with the existing conditions. Both stormwater management systems on the 37 Washington and Stone Place properties were designed and constructed to manage stormwater from the Site.

The table below shows that the project causes a reduction in the peak rate of runoff and volume of stormwater leaving the site at SP-1 and SP-2, a benefit to the stormwater management systems on the neighboring properties. Copies of the HydroCAD worksheets are included herewith.

STUDY POINT #1 (on-site flow west to 37 Washington)								
	2-Year		10-Year		25-Year		100-Year	
	Rate (cfs)	Volume (cf)	Rate (cfs)	Volume (cf)	Rate (cfs)	Volume (cf)	Rate (cfs)	Volume (cf)
Existing Flow	5.97	19,170	9.25	30,504	11.81	39,433	17.01	57,739
Proposed Flow	3.66	16,891	5.77	28,426	7.49	37,604	10.75	56,529
Change	-2.31	-2,279	-3.48	-2,078	-4.32	-1,829	-6.26	-1,210

STUDY POINT #2 (on-site flow east to abutter)								
	2-Year		10-Year		25-Year		100-Year	
	Rate (cfs)	Volume (cf)	Rate (cfs)	Volume (cf)	Rate (cfs)	Volume (cf)	Rate (cfs)	Volume (cf)
Existing Flow	4.16	13,621	6.39	21,407	8.13	27,530	11.68	40,070
Proposed Flow	3.81	12,329	5.92	19,588	7.56	25,307	10.89	37,036
Change	-0.35	-1,292	-0.47	-1,819	-0.57	-2,223	-0.79	-3,034

Summary

As shown in the table above, the proposed development will have a positive impact on the stormwater management systems by reducing the rate and volume of stormwater runoff from the Site.

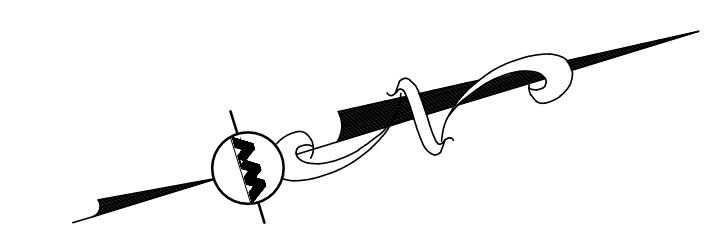
Very truly yours,

ALLEN & MAJOR ASSOCIATES, INC.

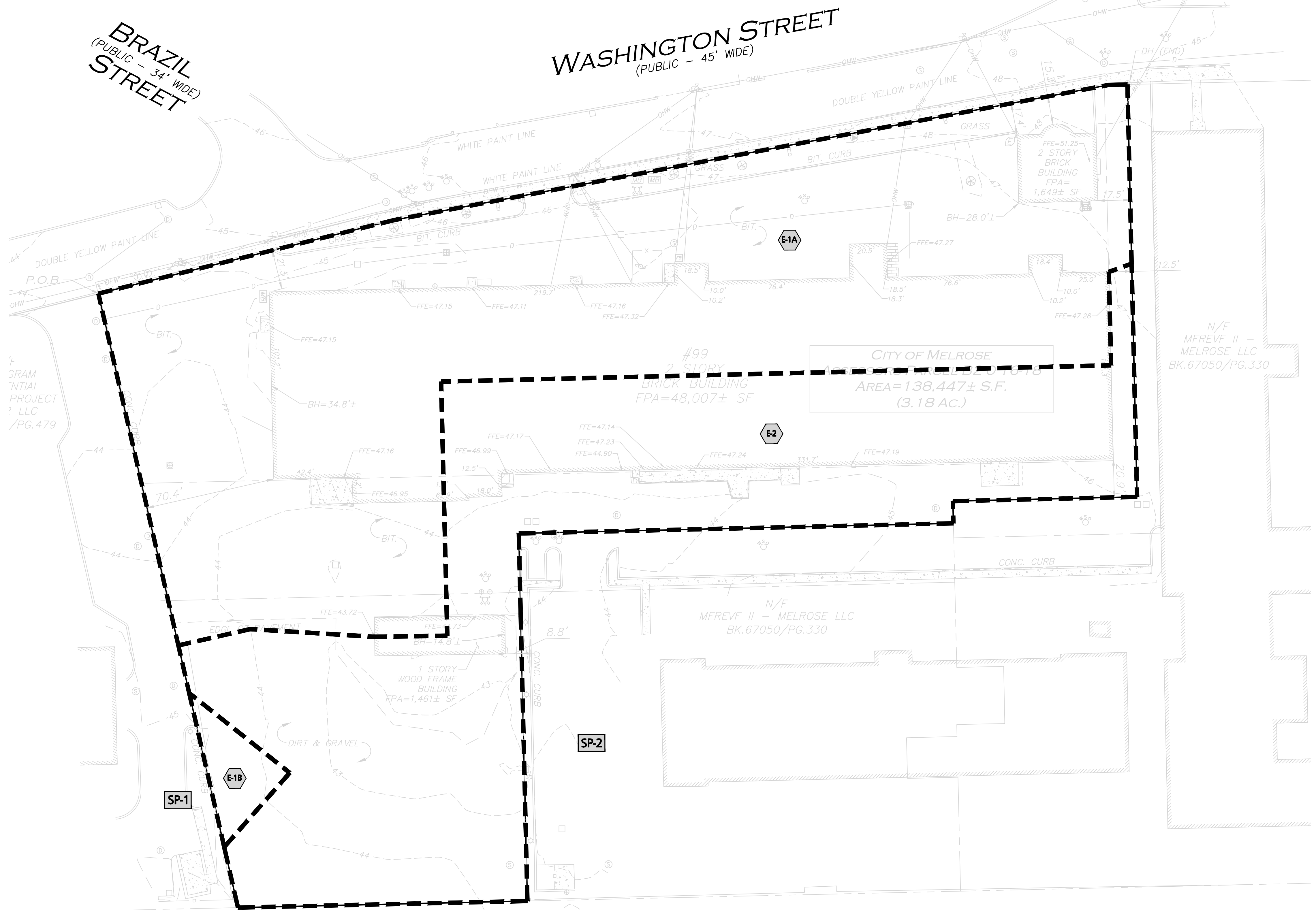
Brian D. Jones, PE
Senior Project Manager

Attachments:

1. Existing Watershed Plan
2. Proposed Watershed Plan
3. Predevelopment HydroCAD Calculations
4. Post development HydroCAD Calculations
5. Extreme Precipitation Tables
6. NRCS Soil Report
7. Operation and Maintenance Plan

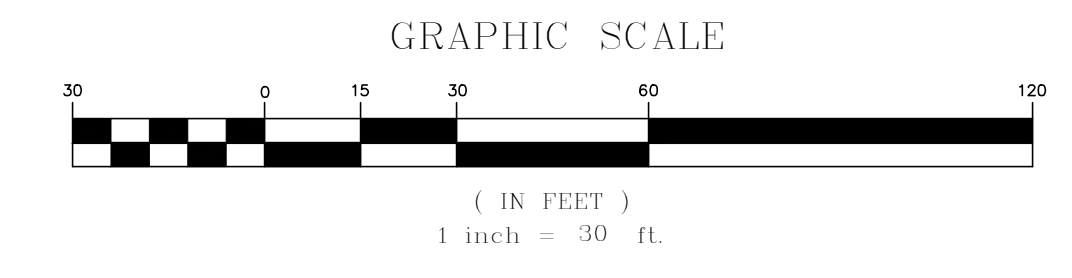


LEGEND	
SUBCATCHMENT BOUNDARY	
SUBCATCHMENT LABEL	



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REV	DATE	DESCRIPTION

APPLICANT/OWNER:
 OAK GROVE MILL, LLC
 ONE MARINA PARK DRIVE
 SUITE 1500
 BOSTON, MA 02210

PROJECT:
 99 WASHINGTON STREET
 MELROSE, MA

PROJECT NO.	2674-01A	DATE:	10-03-19
SCALE:	1" = 30'	DWG. NAME:	C2674-01A
DESIGNED BY:	SM	CHECKED BY:	BDJ

ALLEN & MAJOR ASSOCIATES, INC.
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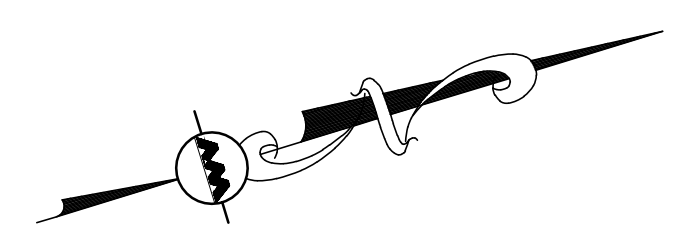
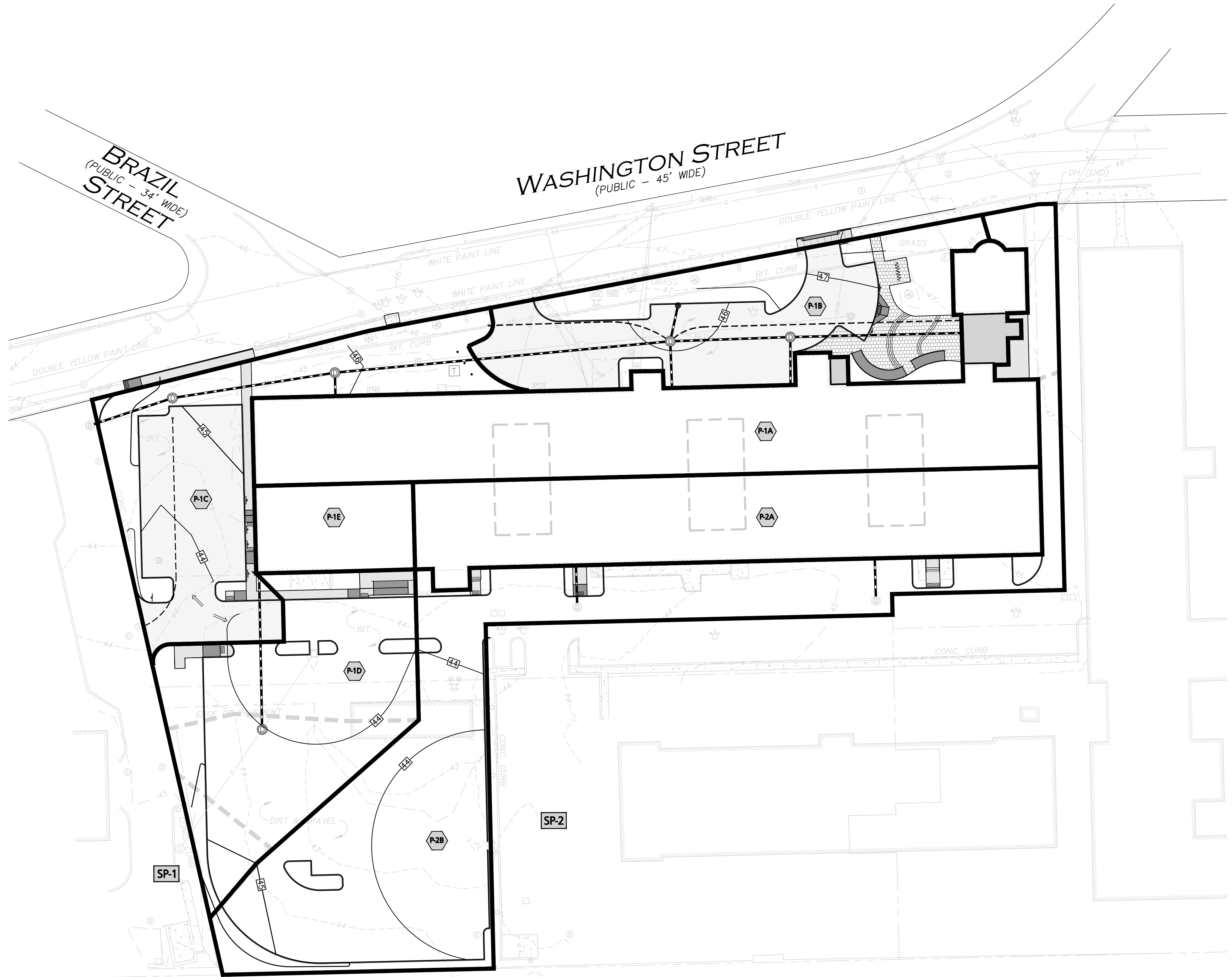
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DRAWING TITLE:	SHEET No.
EXISTING WATERSHED PLAN	EWS-1

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LEGEND	
EXISTING SUBCATCHMENT	---
SUBCATCHMENT LABEL	
SUBCATCHMENT BOUNDARY	—

REV	DATE	DESCRIPTION

APPLICANT/OWNER:
OAK GROVE MILL, LLC
 ONE MARINA PARK DRIVE
 SUITE 1500
 BOSTON, MA 02210

PROJECT:
99 WASHINGTON STREET
 MELROSE, MA

PROJECT NO. 2674-01A DATE: 11-21-19

SCALE: 1" = 30' DWG. NAME: C2674-01A

DESIGNED BY: SM CHECKED BY: BDJ

PREPARED BY:

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 environmental consulting • landscape architecture
 www.allenmajor.com
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 FAX: (781) 935-2896

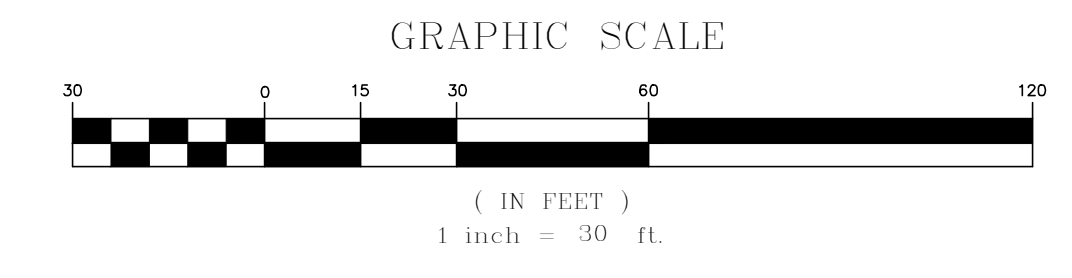
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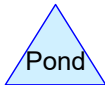
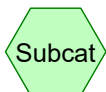
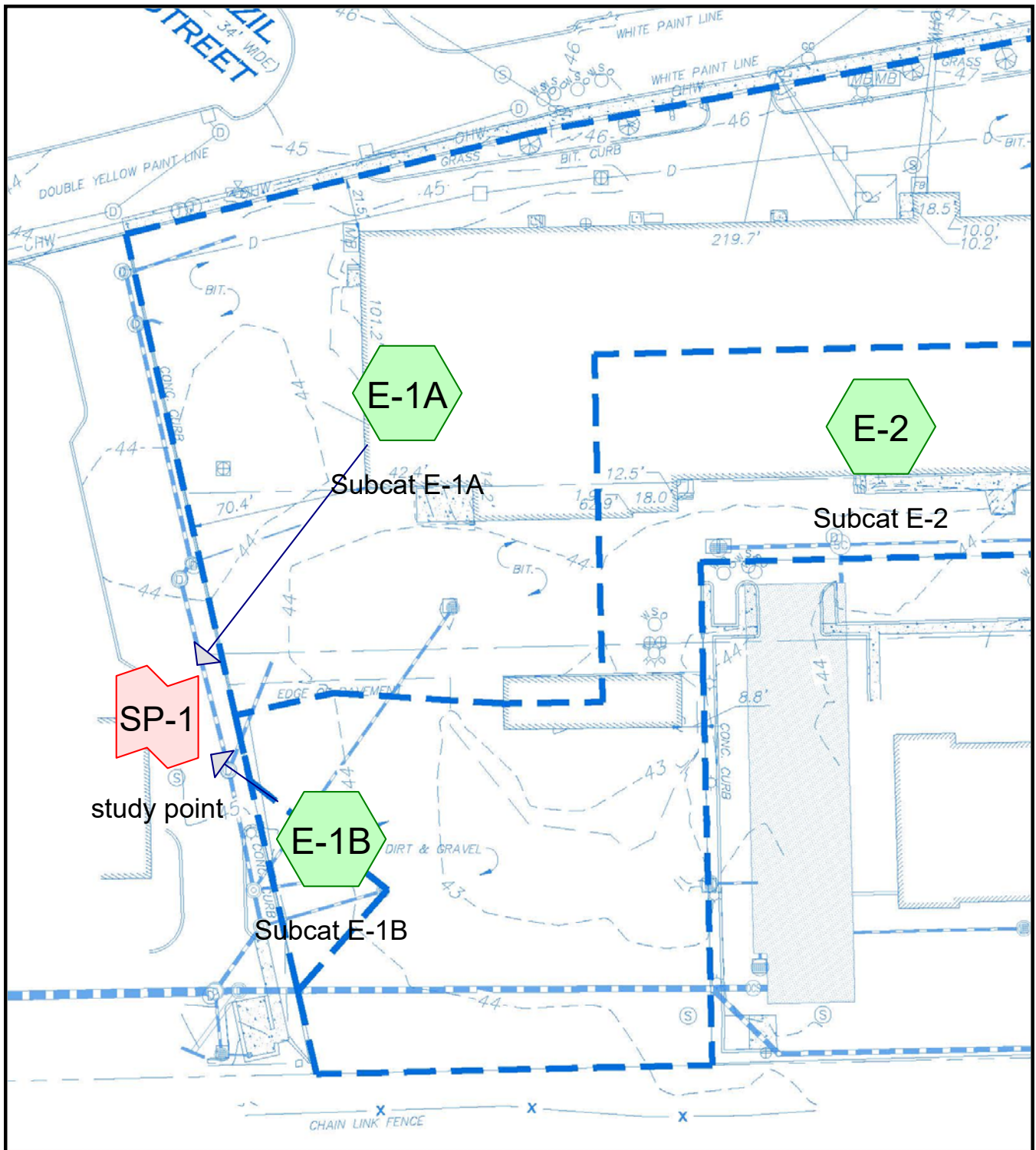
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DRAWING TITLE: **PROPOSED WATERSHED PLAN** SHEET No. **PWS-1**

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Routing Diagram for 2674-01A Existing-Conditions
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2674-01A_Existing-Conditions

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Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,378	74	>75% Grass cover, Good, HSG C (E-1A, E-2)
21,771	96	Gravel surface, HSG C (E-1A, E-1B, E-2)
61,830	98	Paved parking, HSG C (E-1A, E-2)
49,468	98	Roofs, HSG C (E-1A, E-2)
138,447	97	TOTAL AREA

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Page 3

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	5,378	0	0	5,378	>75% Grass cover, Good	
0	0	21,771	0	0	21,771	Gravel surface	
0	0	61,830	0	0	61,830	Paved parking	
0	0	49,468	0	0	49,468	Roofs	
0	0	138,447	0	0	138,447	TOTAL AREA	

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 4

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1A: Subcat E-1A

Runoff Area=80,339 sf 92.47% Impervious Runoff Depth=2.80"
Tc=5.0 min CN=96 Runoff=5.83 cfs 18,735 cf

Subcatchment E-1B: Subcat E-1B

Runoff Area=1,864 sf 0.00% Impervious Runoff Depth=2.80"
Tc=5.0 min CN=96 Runoff=0.14 cfs 435 cf

Subcatchment E-2: Subcat E-2

Runoff Area=56,244 sf 65.80% Impervious Runoff Depth=2.91"
Tc=5.0 min CN=97 Runoff=4.16 cfs 13,621 cf

Link SP-1: study point

Inflow=5.97 cfs 19,170 cf
Primary=5.97 cfs 19,170 cf

Total Runoff Area = 138,447 sf Runoff Volume = 32,791 cf Average Runoff Depth = 2.84"
19.61% Pervious = 27,149 sf 80.39% Impervious = 111,298 sf

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Type III 24-hr 2-Year Rainfall=3.25"

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Summary for Subcatchment E-1A: Subcat E-1A

Runoff = 5.83 cfs @ 12.07 hrs, Volume= 18,735 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
44,658	98	Paved parking, HSG C
29,629	98	Roofs, HSG C
678	96	Gravel surface, HSG C
5,374	74	>75% Grass cover, Good, HSG C
80,339	96	Weighted Average
6,052		7.53% Pervious Area
74,287		92.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-1B: Subcat E-1B

Runoff = 0.14 cfs @ 12.07 hrs, Volume= 435 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
1,864	96	Gravel surface, HSG C
1,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-2: Subcat E-2

Runoff = 4.16 cfs @ 12.07 hrs, Volume= 13,621 cf, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
19,839	98	Roofs, HSG C
19,229	96	Gravel surface, HSG C
4	74	>75% Grass cover, Good, HSG C
17,171	98	Paved parking, HSG C
56,244	97	Weighted Average
19,233		34.20% Pervious Area
37,011		65.80% Impervious Area

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Type III 24-hr 2-Year Rainfall=3.25"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Link SP-1: study point

Inflow Area = 82,203 sf, 90.37% Impervious, Inflow Depth = 2.80" for 2-Year event
Inflow = 5.97 cfs @ 12.07 hrs, Volume= 19,170 cf
Primary = 5.97 cfs @ 12.07 hrs, Volume= 19,170 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 10-Year Rainfall=4.92"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1A: Subcat E-1A Runoff Area=80,339 sf 92.47% Impervious Runoff Depth=4.45"
Tc=5.0 min CN=96 Runoff=9.04 cfs 29,813 cf

Subcatchment E-1B: Subcat E-1B Runoff Area=1,864 sf 0.00% Impervious Runoff Depth=4.45"
Tc=5.0 min CN=96 Runoff=0.21 cfs 692 cf

Subcatchment E-2: Subcat E-2 Runoff Area=56,244 sf 65.80% Impervious Runoff Depth=4.57"
Tc=5.0 min CN=97 Runoff=6.39 cfs 21,407 cf

Link SP-1: study point Inflow=9.25 cfs 30,504 cf
Primary=9.25 cfs 30,504 cf

Total Runoff Area = 138,447 sf Runoff Volume = 51,912 cf Average Runoff Depth = 4.50"
19.61% Pervious = 27,149 sf 80.39% Impervious = 111,298 sf

2674-01A_Existing-Conditions

Type III 24-hr 10-Year Rainfall=4.92"

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Page 8

Summary for Subcatchment E-1A: Subcat E-1A

Runoff = 9.04 cfs @ 12.07 hrs, Volume= 29,813 cf, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
44,658	98	Paved parking, HSG C
29,629	98	Roofs, HSG C
678	96	Gravel surface, HSG C
5,374	74	>75% Grass cover, Good, HSG C
80,339	96	Weighted Average
6,052		7.53% Pervious Area
74,287		92.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-1B: Subcat E-1B

Runoff = 0.21 cfs @ 12.07 hrs, Volume= 692 cf, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
1,864	96	Gravel surface, HSG C
1,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-2: Subcat E-2

Runoff = 6.39 cfs @ 12.07 hrs, Volume= 21,407 cf, Depth= 4.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
19,839	98	Roofs, HSG C
19,229	96	Gravel surface, HSG C
4	74	>75% Grass cover, Good, HSG C
17,171	98	Paved parking, HSG C
56,244	97	Weighted Average
19,233		34.20% Pervious Area
37,011		65.80% Impervious Area

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Type III 24-hr 10-Year Rainfall=4.92"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Link SP-1: study point

Inflow Area = 82,203 sf, 90.37% Impervious, Inflow Depth = 4.45" for 10-Year event
Inflow = 9.25 cfs @ 12.07 hrs, Volume= 30,504 cf
Primary = 9.25 cfs @ 12.07 hrs, Volume= 30,504 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 25-Year Rainfall=6.23"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1A: Subcat E-1A

Runoff Area=80,339 sf 92.47% Impervious Runoff Depth=5.76"
Tc=5.0 min CN=96 Runoff=11.54 cfs 38,539 cf

Subcatchment E-1B: Subcat E-1B

Runoff Area=1,864 sf 0.00% Impervious Runoff Depth=5.76"
Tc=5.0 min CN=96 Runoff=0.27 cfs 894 cf

Subcatchment E-2: Subcat E-2

Runoff Area=56,244 sf 65.80% Impervious Runoff Depth=5.87"
Tc=5.0 min CN=97 Runoff=8.13 cfs 27,530 cf

Link SP-1: study point

Inflow=11.81 cfs 39,433 cf
Primary=11.81 cfs 39,433 cf

Total Runoff Area = 138,447 sf Runoff Volume = 66,963 cf Average Runoff Depth = 5.80"
19.61% Pervious = 27,149 sf 80.39% Impervious = 111,298 sf

2674-01A_Existing-Conditions

Type III 24-hr 25-Year Rainfall=6.23"

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Summary for Subcatchment E-1A: Subcat E-1A

Runoff = 11.54 cfs @ 12.07 hrs, Volume= 38,539 cf, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
44,658	98	Paved parking, HSG C
29,629	98	Roofs, HSG C
678	96	Gravel surface, HSG C
5,374	74	>75% Grass cover, Good, HSG C
80,339	96	Weighted Average
6,052		7.53% Pervious Area
74,287		92.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-1B: Subcat E-1B

Runoff = 0.27 cfs @ 12.07 hrs, Volume= 894 cf, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
1,864	96	Gravel surface, HSG C
1,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-2: Subcat E-2

Runoff = 8.13 cfs @ 12.07 hrs, Volume= 27,530 cf, Depth= 5.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
19,839	98	Roofs, HSG C
19,229	96	Gravel surface, HSG C
4	74	>75% Grass cover, Good, HSG C
17,171	98	Paved parking, HSG C
56,244	97	Weighted Average
19,233		34.20% Pervious Area
37,011		65.80% Impervious Area

2674-01A_Existing-Conditions*Type III 24-hr 25-Year Rainfall=6.23"*

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Page 12

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Link SP-1: study point

Inflow Area = 82,203 sf, 90.37% Impervious, Inflow Depth = 5.76" for 25-Year event
Inflow = 11.81 cfs @ 12.07 hrs, Volume= 39,433 cf
Primary = 11.81 cfs @ 12.07 hrs, Volume= 39,433 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

2674-01A_Existing-Conditions

Type III 24-hr 100-Year Rainfall=8.91"

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Page 13

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1A: Subcat E-1A

Runoff Area=80,339 sf 92.47% Impervious Runoff Depth=8.43"
Tc=5.0 min CN=96 Runoff=16.62 cfs 56,430 cf

Subcatchment E-1B: Subcat E-1B

Runoff Area=1,864 sf 0.00% Impervious Runoff Depth=8.43"
Tc=5.0 min CN=96 Runoff=0.39 cfs 1,309 cf

Subcatchment E-2: Subcat E-2

Runoff Area=56,244 sf 65.80% Impervious Runoff Depth=8.55"
Tc=5.0 min CN=97 Runoff=11.68 cfs 40,070 cf

Link SP-1: study point

Inflow=17.01 cfs 57,739 cf
Primary=17.01 cfs 57,739 cf

Total Runoff Area = 138,447 sf Runoff Volume = 97,810 cf Average Runoff Depth = 8.48"
19.61% Pervious = 27,149 sf 80.39% Impervious = 111,298 sf

2674-01A_Existing-Conditions

Type III 24-hr 100-Year Rainfall=8.91"

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Page 14

Summary for Subcatchment E-1A: Subcat E-1A

Runoff = 16.62 cfs @ 12.07 hrs, Volume= 56,430 cf, Depth= 8.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
44,658	98	Paved parking, HSG C
29,629	98	Roofs, HSG C
678	96	Gravel surface, HSG C
5,374	74	>75% Grass cover, Good, HSG C
80,339	96	Weighted Average
6,052		7.53% Pervious Area
74,287		92.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-1B: Subcat E-1B

Runoff = 0.39 cfs @ 12.07 hrs, Volume= 1,309 cf, Depth= 8.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
1,864	96	Gravel surface, HSG C
1,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment E-2: Subcat E-2

Runoff = 11.68 cfs @ 12.07 hrs, Volume= 40,070 cf, Depth= 8.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
19,839	98	Roofs, HSG C
19,229	96	Gravel surface, HSG C
4	74	>75% Grass cover, Good, HSG C
17,171	98	Paved parking, HSG C
56,244	97	Weighted Average
19,233		34.20% Pervious Area
37,011		65.80% Impervious Area

2674-01A_Existing-Conditions

Type III 24-hr 100-Year Rainfall=8.91"

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Page 15

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Link SP-1: study point

Inflow Area = 82,203 sf, 90.37% Impervious, Inflow Depth = 8.43" for 100-Year event

Inflow = 17.01 cfs @ 12.07 hrs, Volume= 57,739 cf

Primary = 17.01 cfs @ 12.07 hrs, Volume= 57,739 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
22,352	74	>75% Grass cover, Good, HSG C (P-1B, P-1C, P-1D, P-2B)
66,293	98	Paved parking, HSG C (P-1B, P-1C, P-1D, P-2B)
49,802	98	Roofs, HSG C (P-1A, P-1E, P-2A)
138,447	94	TOTAL AREA

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Page 3

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	22,352	0	0	22,352	>75% Grass cover, Good	
0	0	66,293	0	0	66,293	Paved parking	
0	0	49,802	0	0	49,802	Roofs	
0	0	138,447	0	0	138,447	TOTAL AREA	

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Page 4

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	dmh-05	40.94	40.69	50.0	0.0050	0.013	12.0	0.0	0.0
2	dmh-06	38.74	37.54	84.0	0.0143	0.013	12.0	0.0	0.0
3	ds-1	44.04	43.50	107.0	0.0050	0.020	6.0	0.0	0.0
4	ds-1	44.35	43.50	170.0	0.0050	0.020	6.0	0.0	0.0
5	ds-1	42.59	41.62	195.0	0.0050	0.013	12.0	0.0	0.0
6	ds-2	40.90	40.27	127.0	0.0050	0.020	4.0	0.0	0.0

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 5

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A	Runoff Area=26,516 sf 100.00% Impervious Runoff Depth=3.02" Tc=5.0 min CN=98 Runoff=1.99 cfs 6,667 cf
Subcatchment P-1B: Subcat P-1B	Runoff Area=18,898 sf 64.71% Impervious Runoff Depth=2.21" Tc=5.0 min CN=90 Runoff=1.15 cfs 3,488 cf
Subcatchment P-1C: Subcat P-1C	Runoff Area=17,618 sf 53.08% Impervious Runoff Depth=1.96" Tc=5.0 min CN=87 Runoff=0.96 cfs 2,876 cf
Subcatchment P-1D: Subcat P-1D	Runoff Area=18,076 sf 81.48% Impervious Runoff Depth=2.59" Tc=5.0 min CN=94 Runoff=1.25 cfs 3,905 cf
Subcatchment P-1E: Subcat P-1E	Runoff Area=4,655 sf 100.00% Impervious Runoff Depth=3.02" Tc=5.0 min CN=98 Runoff=0.35 cfs 1,170 cf
Subcatchment P-2A: Subcat P-2A	Runoff Area=18,631 sf 100.00% Impervious Runoff Depth=3.02" Tc=5.0 min CN=98 Runoff=1.40 cfs 4,685 cf
Subcatchment P-2B: Subcat P-2B	Runoff Area=34,053 sf 88.05% Impervious Runoff Depth=2.69" Tc=5.0 min CN=95 Runoff=2.42 cfs 7,644 cf
Pond dmh-05: dmh	Peak Elev=41.88' Inflow=1.99 cfs 9,037 cf 12.0" Round Culvert n=0.013 L=50.0' S=0.0050 '/' Outflow=1.99 cfs 9,037 cf
Pond dmh-06: dmh	Peak Elev=39.42' Inflow=1.60 cfs 5,075 cf 12.0" Round Culvert n=0.013 L=84.0' S=0.0143 '/' Outflow=1.60 cfs 5,075 cf
Pond ds-1: Pervious Pavement	Peak Elev=44.30' Storage=2,098 cf Inflow=1.15 cfs 3,488 cf Outflow=0.09 cfs 2,369 cf
Pond ds-2: Pervious Pavement	Peak Elev=41.41' Storage=1,454 cf Inflow=0.96 cfs 2,876 cf 4.0" Round Culvert n=0.020 L=127.0' S=0.0050 '/' Outflow=0.10 cfs 2,779 cf
Link SP-1: study point	Inflow=3.66 cfs 16,891 cf Primary=3.66 cfs 16,891 cf
Link SP-2: study point	Inflow=3.81 cfs 12,329 cf Primary=3.81 cfs 12,329 cf

Total Runoff Area = 138,447 sf Runoff Volume = 30,436 cf Average Runoff Depth = 2.64"
16.14% Pervious = 22,352 sf 83.86% Impervious = 116,095 sf

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 6

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 1.99 cfs @ 12.07 hrs, Volume= 6,667 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
26,516	98	Roofs, HSG C
26,516		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 1.15 cfs @ 12.07 hrs, Volume= 3,488 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
12,230	98	Paved parking, HSG C
6,669	74	>75% Grass cover, Good, HSG C
18,898	90	Weighted Average
6,669		35.29% Pervious Area
12,230		64.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1C: Subcat P-1C

Runoff = 0.96 cfs @ 12.07 hrs, Volume= 2,876 cf, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
8,266	74	>75% Grass cover, Good, HSG C
9,353	98	Paved parking, HSG C
17,618	87	Weighted Average
8,266		46.92% Pervious Area
9,353		53.08% Impervious Area

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 7

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1D: Subcat P-1D

Runoff = 1.25 cfs @ 12.07 hrs, Volume= 3,905 cf, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
14,728	98	Paved parking, HSG C
3,348	74	>75% Grass cover, Good, HSG C
18,076	94	Weighted Average
3,348		18.52% Pervious Area
14,728		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1E: Subcat P-1E

Runoff = 0.35 cfs @ 12.07 hrs, Volume= 1,170 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
4,655	98	Roofs, HSG C
4,655		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 1.40 cfs @ 12.07 hrs, Volume= 4,685 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
18,631	98	Roofs, HSG C
18,631		100.00% Impervious Area

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 8

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 2.42 cfs @ 12.07 hrs, Volume= 7,644 cf, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
4,070	74	>75% Grass cover, Good, HSG C
29,983	98	Paved parking, HSG C
34,053	95	Weighted Average
4,070		11.95% Pervious Area
29,983		88.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond dmh-05: dmh

Inflow Area = 45,415 sf, 85.32% Impervious, Inflow Depth > 2.39" for 2-Year event
 Inflow = 1.99 cfs @ 12.07 hrs, Volume= 9,037 cf
 Outflow = 1.99 cfs @ 12.07 hrs, Volume= 9,037 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.99 cfs @ 12.07 hrs, Volume= 9,037 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 41.88' @ 12.07 hrs
 Flood Elev= 44.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	40.94'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 40.94' / 40.69' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.99 cfs @ 12.07 hrs HW=41.88' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 1.99 cfs @ 3.37 fps)

Summary for Pond dmh-06: dmh

Inflow Area = 22,731 sf, 85.27% Impervious, Inflow Depth = 2.68" for 2-Year event
 Inflow = 1.60 cfs @ 12.07 hrs, Volume= 5,075 cf
 Outflow = 1.60 cfs @ 12.07 hrs, Volume= 5,075 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.60 cfs @ 12.07 hrs, Volume= 5,075 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 9

Peak Elev= 39.42' @ 12.07 hrs

Flood Elev= 44.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.74'	12.0" Round Culvert L= 84.0' Ke= 0.500 Inlet / Outlet Invert= 38.74' / 37.54' S= 0.0143 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.60 cfs @ 12.07 hrs HW=39.42' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 1.60 cfs @ 2.81 fps)

Summary for Pond ds-1: Pervious Pavement

Inflow Area = 18,898 sf, 64.71% Impervious, Inflow Depth = 2.21" for 2-Year event
 Inflow = 1.15 cfs @ 12.07 hrs, Volume= 3,488 cf
 Outflow = 0.09 cfs @ 13.29 hrs, Volume= 2,369 cf, Atten= 93%, Lag= 73.3 min
 Primary = 0.09 cfs @ 13.29 hrs, Volume= 2,369 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 44.30' @ 13.29 hrs Surf.Area= 12,211 sf Storage= 2,098 cf

Flood Elev= 45.37' Surf.Area= 12,211 sf Storage= 6,407 cf

Plug-Flow detention time= 459.9 min calculated for 2,369 cf (68% of inflow)

Center-of-Mass det. time= 363.8 min (1,169.2 - 805.4)

Volume	Invert	Avail.Storage	Storage Description
#1	43.78'	6,407 cf	stone voids (Irregular) Listed below (Recalc) 19,415 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.78	12,211	802.0	0	0	12,211
45.37	12,211	802.0	19,415	19,415	13,486

Device	Routing	Invert	Outlet Devices
#1	Device 3	44.04'	6.0" Round underdrain L= 107.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.04' / 43.50' S= 0.0050 '/ Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#2	Device 3	44.35'	6.0" Round underdrain L= 170.0' Ke= 0.500 Inlet / Outlet Invert= 44.35' / 43.50' S= 0.0050 '/ Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#3	Primary	42.59'	12.0" Round Culvert L= 195.0' Ke= 0.500 Inlet / Outlet Invert= 42.59' / 41.62' S= 0.0050 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.09 cfs @ 13.29 hrs HW=44.30' TW=41.21' (Dynamic Tailwater)

↑**3=Culvert** (Passes 0.09 cfs of 2.96 cfs potential flow)

↑**1=underdrain** (Barrel Controls 0.09 cfs @ 1.21 fps)

↑**2=underdrain** (Controls 0.00 cfs)

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Type III 24-hr 2-Year Rainfall=3.25"

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Page 10

Summary for Pond ds-2: Pervious Pavement

Inflow Area = 17,618 sf, 53.08% Impervious, Inflow Depth = 1.96" for 2-Year event
 Inflow = 0.96 cfs @ 12.07 hrs, Volume= 2,876 cf
 Outflow = 0.10 cfs @ 15.00 hrs, Volume= 2,779 cf, Atten= 90%, Lag= 175.3 min
 Primary = 0.10 cfs @ 15.00 hrs, Volume= 2,779 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 41.41' @ 12.91 hrs Surf.Area= 8,246 sf Storage= 1,454 cf
 Flood Elev= 43.22' Surf.Area= 8,246 sf Storage= 6,368 cf

Plug-Flow detention time= 278.5 min calculated for 2,779 cf (97% of inflow)
 Center-of-Mass det. time= 259.5 min (1,076.8 - 817.3)

Volume	Invert	Avail.Storage	Storage Description
#1	40.88'	6,368 cf	stone voids (Irregular) Listed below (Recalc) 19,296 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.88	8,246	532.0	0	0	8,246
43.22	8,246	532.0	19,296	19,296	9,491

Device	Routing	Invert	Outlet Devices
#1	Primary	40.90'	4.0" Round underdrain L= 127.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 40.90' / 40.27' S= 0.0050 ' S= 0.0050 ' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.09 sf

Primary OutFlow Max=0.10 cfs @ 15.00 hrs HW=41.32' TW=0.00' (Dynamic Tailwater)
 ↑1=underdrain (Barrel Controls 0.10 cfs @ 1.16 fps)

Summary for Link SP-1: study point

Inflow Area = 85,764 sf, 78.68% Impervious, Inflow Depth > 2.36" for 2-Year event
 Inflow = 3.66 cfs @ 12.07 hrs, Volume= 16,891 cf
 Primary = 3.66 cfs @ 12.07 hrs, Volume= 16,891 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP-2: study point

Inflow Area = 52,683 sf, 92.28% Impervious, Inflow Depth = 2.81" for 2-Year event
 Inflow = 3.81 cfs @ 12.07 hrs, Volume= 12,329 cf
 Primary = 3.81 cfs @ 12.07 hrs, Volume= 12,329 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 10-Year Rainfall=4.92"

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Page 11

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A	Runoff Area=26,516 sf 100.00% Impervious Runoff Depth=4.68" Tc=5.0 min CN=98 Runoff=3.03 cfs 10,349 cf
Subcatchment P-1B: Subcat P-1B	Runoff Area=18,898 sf 64.71% Impervious Runoff Depth=3.80" Tc=5.0 min CN=90 Runoff=1.93 cfs 5,983 cf
Subcatchment P-1C: Subcat P-1C	Runoff Area=17,618 sf 53.08% Impervious Runoff Depth=3.49" Tc=5.0 min CN=87 Runoff=1.69 cfs 5,127 cf
Subcatchment P-1D: Subcat P-1D	Runoff Area=18,076 sf 81.48% Impervious Runoff Depth=4.23" Tc=5.0 min CN=94 Runoff=1.98 cfs 6,370 cf
Subcatchment P-1E: Subcat P-1E	Runoff Area=4,655 sf 100.00% Impervious Runoff Depth=4.68" Tc=5.0 min CN=98 Runoff=0.53 cfs 1,817 cf
Subcatchment P-2A: Subcat P-2A	Runoff Area=18,631 sf 100.00% Impervious Runoff Depth=4.68" Tc=5.0 min CN=98 Runoff=2.13 cfs 7,271 cf
Subcatchment P-2B: Subcat P-2B	Runoff Area=34,053 sf 88.05% Impervious Runoff Depth=4.34" Tc=5.0 min CN=95 Runoff=3.79 cfs 12,316 cf
Pond dmh-05: dmh	Peak Elev=42.46' Inflow=3.15 cfs 15,211 cf 12.0" Round Culvert n=0.013 L=50.0' S=0.0050 '/' Outflow=3.15 cfs 15,211 cf
Pond dmh-06: dmh	Peak Elev=39.68' Inflow=2.52 cfs 8,187 cf 12.0" Round Culvert n=0.013 L=84.0' S=0.0143 '/' Outflow=2.52 cfs 8,187 cf
Pond ds-1: Pervious Pavement	Peak Elev=44.58' Storage=3,237 cf Inflow=1.93 cfs 5,983 cf Outflow=0.34 cfs 4,863 cf
Pond ds-2: Pervious Pavement	Peak Elev=41.91' Storage=2,789 cf Inflow=1.69 cfs 5,127 cf 4.0" Round Culvert n=0.020 L=127.0' S=0.0050 '/' Outflow=0.12 cfs 5,028 cf
Link SP-1: study point	Inflow=5.77 cfs 28,426 cf Primary=5.77 cfs 28,426 cf
Link SP-2: study point	Inflow=5.92 cfs 19,588 cf Primary=5.92 cfs 19,588 cf

Total Runoff Area = 138,447 sf Runoff Volume = 49,233 cf Average Runoff Depth = 4.27"
16.14% Pervious = 22,352 sf 83.86% Impervious = 116,095 sf

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Type III 24-hr 10-Year Rainfall=4.92"

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Page 12

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 3.03 cfs @ 12.07 hrs, Volume= 10,349 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
26,516	98	Roofs, HSG C
26,516		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 1.93 cfs @ 12.07 hrs, Volume= 5,983 cf, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
12,230	98	Paved parking, HSG C
6,669	74	>75% Grass cover, Good, HSG C
18,898	90	Weighted Average
6,669		35.29% Pervious Area
12,230		64.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1C: Subcat P-1C

Runoff = 1.69 cfs @ 12.07 hrs, Volume= 5,127 cf, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
8,266	74	>75% Grass cover, Good, HSG C
9,353	98	Paved parking, HSG C
17,618	87	Weighted Average
8,266		46.92% Pervious Area
9,353		53.08% Impervious Area

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Type III 24-hr 10-Year Rainfall=4.92"

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Page 13

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1D: Subcat P-1D

Runoff = 1.98 cfs @ 12.07 hrs, Volume= 6,370 cf, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
14,728	98	Paved parking, HSG C
3,348	74	>75% Grass cover, Good, HSG C
18,076	94	Weighted Average
3,348		18.52% Pervious Area
14,728		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1E: Subcat P-1E

Runoff = 0.53 cfs @ 12.07 hrs, Volume= 1,817 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
4,655	98	Roofs, HSG C
4,655		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 2.13 cfs @ 12.07 hrs, Volume= 7,271 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
18,631	98	Roofs, HSG C
18,631		100.00% Impervious Area

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Type III 24-hr 10-Year Rainfall=4.92"

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Page 14

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 3.79 cfs @ 12.07 hrs, Volume= 12,316 cf, Depth= 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
4,070	74	>75% Grass cover, Good, HSG C
29,983	98	Paved parking, HSG C
34,053	95	Weighted Average
4,070		11.95% Pervious Area
29,983		88.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond dmh-05: dmh

Inflow Area = 45,415 sf, 85.32% Impervious, Inflow Depth > 4.02" for 10-Year event
 Inflow = 3.15 cfs @ 12.07 hrs, Volume= 15,211 cf
 Outflow = 3.15 cfs @ 12.07 hrs, Volume= 15,211 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.15 cfs @ 12.07 hrs, Volume= 15,211 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 42.46' @ 12.07 hrs
 Flood Elev= 44.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	40.94'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 40.94' / 40.69' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.15 cfs @ 12.07 hrs HW=42.45' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 3.15 cfs @ 4.01 fps)

Summary for Pond dmh-06: dmh

Inflow Area = 22,731 sf, 85.27% Impervious, Inflow Depth = 4.32" for 10-Year event
 Inflow = 2.52 cfs @ 12.07 hrs, Volume= 8,187 cf
 Outflow = 2.52 cfs @ 12.07 hrs, Volume= 8,187 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.52 cfs @ 12.07 hrs, Volume= 8,187 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

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Type III 24-hr 10-Year Rainfall=4.92"

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Page 15

Peak Elev= 39.68' @ 12.07 hrs
Flood Elev= 44.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.74'	12.0" Round Culvert L= 84.0' Ke= 0.500 Inlet / Outlet Invert= 38.74' / 37.54' S= 0.0143 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.52 cfs @ 12.07 hrs HW=39.68' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 2.52 cfs @ 3.29 fps)

Summary for Pond ds-1: Pervious Pavement

Inflow Area = 18,898 sf, 64.71% Impervious, Inflow Depth = 3.80" for 10-Year event
 Inflow = 1.93 cfs @ 12.07 hrs, Volume= 5,983 cf
 Outflow = 0.34 cfs @ 12.52 hrs, Volume= 4,863 cf, Atten= 82%, Lag= 26.8 min
 Primary = 0.34 cfs @ 12.52 hrs, Volume= 4,863 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 44.58' @ 12.52 hrs Surf.Area= 12,211 sf Storage= 3,237 cf
 Flood Elev= 45.37' Surf.Area= 12,211 sf Storage= 6,407 cf

Plug-Flow detention time= 317.5 min calculated for 4,862 cf (81% of inflow)
 Center-of-Mass det. time= 245.2 min (1,035.6 - 790.3)

Volume	Invert	Avail.Storage	Storage Description
#1	43.78'	6,407 cf	stone voids (Irregular) Listed below (Recalc) 19,415 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.78	12,211	802.0	0	0	12,211
45.37	12,211	802.0	19,415	19,415	13,486

Device	Routing	Invert	Outlet Devices
#1	Device 3	44.04'	6.0" Round underdrain L= 107.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.04' / 43.50' S= 0.0050 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#2	Device 3	44.35'	6.0" Round underdrain L= 170.0' Ke= 0.500 Inlet / Outlet Invert= 44.35' / 43.50' S= 0.0050 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#3	Primary	42.59'	12.0" Round Culvert L= 195.0' Ke= 0.500 Inlet / Outlet Invert= 42.59' / 41.62' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.34 cfs @ 12.52 hrs HW=44.58' TW=41.50' (Dynamic Tailwater)
 ↳ **3=Culvert** (Passes 0.34 cfs of 3.20 cfs potential flow)
 ↳ **1=underdrain** (Barrel Controls 0.27 cfs @ 1.60 fps)
 ↳ **2=underdrain** (Barrel Controls 0.07 cfs @ 1.12 fps)

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Type III 24-hr 10-Year Rainfall=4.92"

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Page 16

Summary for Pond ds-2: Pervious Pavement

Inflow Area = 17,618 sf, 53.08% Impervious, Inflow Depth = 3.49" for 10-Year event
Inflow = 1.69 cfs @ 12.07 hrs, Volume= 5,127 cf
Outflow = 0.12 cfs @ 13.31 hrs, Volume= 5,028 cf, Atten= 93%, Lag= 74.5 min
Primary = 0.12 cfs @ 13.31 hrs, Volume= 5,028 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 41.91' @ 13.31 hrs Surf.Area= 8,246 sf Storage= 2,789 cf
Flood Elev= 43.22' Surf.Area= 8,246 sf Storage= 6,368 cf

Plug-Flow detention time= 316.2 min calculated for 5,028 cf (98% of inflow)
Center-of-Mass det. time= 304.4 min (1,105.3 - 800.9)

Volume	Invert	Avail.Storage	Storage Description
#1	40.88'	6,368 cf	stone voids (Irregular) Listed below (Recalc) 19,296 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.88	8,246	532.0	0	0	8,246
43.22	8,246	532.0	19,296	19,296	9,491

Device	Routing	Invert	Outlet Devices
#1	Primary	40.90'	4.0" Round underdrain L= 127.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 40.90' / 40.27' S= 0.0050 ' S= 0.0050 ' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.09 sf

Primary OutFlow Max=0.12 cfs @ 13.31 hrs HW=41.91' TW=0.00' (Dynamic Tailwater)
↑**1=underdrain** (Barrel Controls 0.12 cfs @ 1.41 fps)

Summary for Link SP-1: study point

Inflow Area = 85,764 sf, 78.68% Impervious, Inflow Depth = 3.98" for 10-Year event
Inflow = 5.77 cfs @ 12.07 hrs, Volume= 28,426 cf
Primary = 5.77 cfs @ 12.07 hrs, Volume= 28,426 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP-2: study point

Inflow Area = 52,683 sf, 92.28% Impervious, Inflow Depth = 4.46" for 10-Year event
Inflow = 5.92 cfs @ 12.07 hrs, Volume= 19,588 cf
Primary = 5.92 cfs @ 12.07 hrs, Volume= 19,588 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 25-Year Rainfall=6.23"

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Page 17

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A	Runoff Area=26,516 sf 100.00% Impervious Runoff Depth=5.99" Tc=5.0 min CN=98 Runoff=3.85 cfs 13,240 cf
Subcatchment P-1B: Subcat P-1B	Runoff Area=18,898 sf 64.71% Impervious Runoff Depth=5.07" Tc=5.0 min CN=90 Runoff=2.54 cfs 7,985 cf
Subcatchment P-1C: Subcat P-1C	Runoff Area=17,618 sf 53.08% Impervious Runoff Depth=4.74" Tc=5.0 min CN=87 Runoff=2.26 cfs 6,956 cf
Subcatchment P-1D: Subcat P-1D	Runoff Area=18,076 sf 81.48% Impervious Runoff Depth=5.52" Tc=5.0 min CN=94 Runoff=2.55 cfs 8,322 cf
Subcatchment P-1E: Subcat P-1E	Runoff Area=4,655 sf 100.00% Impervious Runoff Depth=5.99" Tc=5.0 min CN=98 Runoff=0.68 cfs 2,324 cf
Subcatchment P-2A: Subcat P-2A	Runoff Area=18,631 sf 100.00% Impervious Runoff Depth=5.99" Tc=5.0 min CN=98 Runoff=2.71 cfs 9,302 cf
Subcatchment P-2B: Subcat P-2B	Runoff Area=34,053 sf 88.05% Impervious Runoff Depth=5.64" Tc=5.0 min CN=95 Runoff=4.85 cfs 16,005 cf
Pond dmh-05: dmh	Peak Elev=43.02' Inflow=4.15 cfs 20,103 cf 12.0" Round Culvert n=0.013 L=50.0' S=0.0050 '/' Outflow=4.15 cfs 20,103 cf
Pond dmh-06: dmh	Peak Elev=39.97' Inflow=3.23 cfs 10,646 cf 12.0" Round Culvert n=0.013 L=84.0' S=0.0143 '/' Outflow=3.23 cfs 10,646 cf
Pond ds-1: Pervious Pavement	Peak Elev=44.81' Storage=4,145 cf Inflow=2.54 cfs 7,985 cf Outflow=0.52 cfs 6,863 cf
Pond ds-2: Pervious Pavement	Peak Elev=42.31' Storage=3,897 cf Inflow=2.26 cfs 6,956 cf 4.0" Round Culvert n=0.020 L=127.0' S=0.0050 '/' Outflow=0.14 cfs 6,855 cf
Link SP-1: study point	Inflow=7.49 cfs 37,604 cf Primary=7.49 cfs 37,604 cf
Link SP-2: study point	Inflow=7.56 cfs 25,307 cf Primary=7.56 cfs 25,307 cf

Total Runoff Area = 138,447 sf Runoff Volume = 64,133 cf Average Runoff Depth = 5.56"
16.14% Pervious = 22,352 sf 83.86% Impervious = 116,095 sf

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Type III 24-hr 25-Year Rainfall=6.23"

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Page 18

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 3.85 cfs @ 12.07 hrs, Volume= 13,240 cf, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
26,516	98	Roofs, HSG C
26,516		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 2.54 cfs @ 12.07 hrs, Volume= 7,985 cf, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
12,230	98	Paved parking, HSG C
6,669	74	>75% Grass cover, Good, HSG C
18,898	90	Weighted Average
6,669		35.29% Pervious Area
12,230		64.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1C: Subcat P-1C

Runoff = 2.26 cfs @ 12.07 hrs, Volume= 6,956 cf, Depth= 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
8,266	74	>75% Grass cover, Good, HSG C
9,353	98	Paved parking, HSG C
17,618	87	Weighted Average
8,266		46.92% Pervious Area
9,353		53.08% Impervious Area

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Type III 24-hr 25-Year Rainfall=6.23"

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Page 19

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1D: Subcat P-1D

Runoff = 2.55 cfs @ 12.07 hrs, Volume= 8,322 cf, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
14,728	98	Paved parking, HSG C
3,348	74	>75% Grass cover, Good, HSG C
18,076	94	Weighted Average
3,348		18.52% Pervious Area
14,728		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1E: Subcat P-1E

Runoff = 0.68 cfs @ 12.07 hrs, Volume= 2,324 cf, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
4,655	98	Roofs, HSG C
4,655		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 2.71 cfs @ 12.07 hrs, Volume= 9,302 cf, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
18,631	98	Roofs, HSG C
18,631		100.00% Impervious Area

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Type III 24-hr 25-Year Rainfall=6.23"

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Page 20

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 4.85 cfs @ 12.07 hrs, Volume= 16,005 cf, Depth= 5.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.23"

Area (sf)	CN	Description
4,070	74	>75% Grass cover, Good, HSG C
29,983	98	Paved parking, HSG C
34,053	95	Weighted Average
4,070		11.95% Pervious Area
29,983		88.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond dmh-05: dmh

Inflow Area = 45,415 sf, 85.32% Impervious, Inflow Depth = 5.31" for 25-Year event
 Inflow = 4.15 cfs @ 12.07 hrs, Volume= 20,103 cf
 Outflow = 4.15 cfs @ 12.07 hrs, Volume= 20,103 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.15 cfs @ 12.07 hrs, Volume= 20,103 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 43.02' @ 12.07 hrs
 Flood Elev= 44.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	40.94'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 40.94' / 40.69' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.15 cfs @ 12.07 hrs HW=43.02' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 4.15 cfs @ 5.28 fps)

Summary for Pond dmh-06: dmh

Inflow Area = 22,731 sf, 85.27% Impervious, Inflow Depth = 5.62" for 25-Year event
 Inflow = 3.23 cfs @ 12.07 hrs, Volume= 10,646 cf
 Outflow = 3.23 cfs @ 12.07 hrs, Volume= 10,646 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.23 cfs @ 12.07 hrs, Volume= 10,646 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

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Type III 24-hr 25-Year Rainfall=6.23"

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Page 21

Peak Elev= 39.97' @ 12.07 hrs
Flood Elev= 44.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.74'	12.0" Round Culvert L= 84.0' Ke= 0.500 Inlet / Outlet Invert= 38.74' / 37.54' S= 0.0143 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.23 cfs @ 12.07 hrs HW=39.97' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 3.23 cfs @ 4.11 fps)

Summary for Pond ds-1: Pervious Pavement

Inflow Area = 18,898 sf, 64.71% Impervious, Inflow Depth = 5.07" for 25-Year event
 Inflow = 2.54 cfs @ 12.07 hrs, Volume= 7,985 cf
 Outflow = 0.52 cfs @ 12.48 hrs, Volume= 6,863 cf, Atten= 79%, Lag= 24.8 min
 Primary = 0.52 cfs @ 12.48 hrs, Volume= 6,863 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 44.81' @ 12.48 hrs Surf.Area= 12,211 sf Storage= 4,145 cf
 Flood Elev= 45.37' Surf.Area= 12,211 sf Storage= 6,407 cf

Plug-Flow detention time= 270.1 min calculated for 6,863 cf (86% of inflow)
 Center-of-Mass det. time= 208.9 min (991.5 - 782.6)

Volume	Invert	Avail.Storage	Storage Description
#1	43.78'	6,407 cf	stone voids (Irregular) Listed below (Recalc) 19,415 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.78	12,211	802.0	0	0	12,211
45.37	12,211	802.0	19,415	19,415	13,486

Device	Routing	Invert	Outlet Devices
#1	Device 3	44.04'	6.0" Round underdrain L= 107.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.04' / 43.50' S= 0.0050 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#2	Device 3	44.35'	6.0" Round underdrain L= 170.0' Ke= 0.500 Inlet / Outlet Invert= 44.35' / 43.50' S= 0.0050 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#3	Primary	42.59'	12.0" Round Culvert L= 195.0' Ke= 0.500 Inlet / Outlet Invert= 42.59' / 41.62' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.52 cfs @ 12.48 hrs HW=44.81' TW=41.65' (Dynamic Tailwater)
 ↳ **3=Culvert** (Passes 0.52 cfs of 3.38 cfs potential flow)
 ↳ **1=underdrain** (Barrel Controls 0.31 cfs @ 1.56 fps)
 ↳ **2=underdrain** (Barrel Controls 0.22 cfs @ 1.51 fps)

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Type III 24-hr 25-Year Rainfall=6.23"

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Page 22

Summary for Ponds-2: Pervious Pavement

Inflow Area = 17,618 sf, 53.08% Impervious, Inflow Depth = 4.74" for 25-Year event
Inflow = 2.26 cfs @ 12.07 hrs, Volume= 6,956 cf
Outflow = 0.14 cfs @ 13.66 hrs, Volume= 6,855 cf, Atten= 94%, Lag= 95.6 min
Primary = 0.14 cfs @ 13.66 hrs, Volume= 6,855 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 42.31' @ 13.66 hrs Surf.Area= 8,246 sf Storage= 3,897 cf
Flood Elev= 43.22' Surf.Area= 8,246 sf Storage= 6,368 cf

Plug-Flow detention time= 361.5 min calculated for 6,855 cf (99% of inflow)
Center-of-Mass det. time= 352.5 min (1,144.9 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	40.88'	6,368 cf	stone voids (Irregular) Listed below (Recalc) 19,296 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.88	8,246	532.0	0	0	8,246
43.22	8,246	532.0	19,296	19,296	9,491

Device	Routing	Invert	Outlet Devices
#1	Primary	40.90'	4.0" Round underdrain L= 127.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 40.90' / 40.27' S= 0.0050 ' S= 0.0050 ' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.09 sf

Primary OutFlow Max=0.14 cfs @ 13.66 hrs HW=42.31' TW=0.00' (Dynamic Tailwater)
↑**1=underdrain** (Barrel Controls 0.14 cfs @ 1.61 fps)

Summary for Link SP-1: study point

Inflow Area = 85,764 sf, 78.68% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 7.49 cfs @ 12.07 hrs, Volume= 37,604 cf
Primary = 7.49 cfs @ 12.07 hrs, Volume= 37,604 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP-2: study point

Inflow Area = 52,683 sf, 92.28% Impervious, Inflow Depth = 5.76" for 25-Year event
Inflow = 7.56 cfs @ 12.07 hrs, Volume= 25,307 cf
Primary = 7.56 cfs @ 12.07 hrs, Volume= 25,307 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 100-Year Rainfall=8.91"

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Page 23

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A	Runoff Area=26,516 sf 100.00% Impervious Runoff Depth=8.67" Tc=5.0 min CN=98 Runoff=5.52 cfs 19,157 cf
Subcatchment P-1B: Subcat P-1B	Runoff Area=18,898 sf 64.71% Impervious Runoff Depth=7.70" Tc=5.0 min CN=90 Runoff=3.77 cfs 12,131 cf
Subcatchment P-1C: Subcat P-1C	Runoff Area=17,618 sf 53.08% Impervious Runoff Depth=7.34" Tc=5.0 min CN=87 Runoff=3.41 cfs 10,773 cf
Subcatchment P-1D: Subcat P-1D	Runoff Area=18,076 sf 81.48% Impervious Runoff Depth=8.19" Tc=5.0 min CN=94 Runoff=3.71 cfs 12,333 cf
Subcatchment P-1E: Subcat P-1E	Runoff Area=4,655 sf 100.00% Impervious Runoff Depth=8.67" Tc=5.0 min CN=98 Runoff=0.97 cfs 3,363 cf
Subcatchment P-2A: Subcat P-2A	Runoff Area=18,631 sf 100.00% Impervious Runoff Depth=8.67" Tc=5.0 min CN=98 Runoff=3.88 cfs 13,460 cf
Subcatchment P-2B: Subcat P-2B	Runoff Area=34,053 sf 88.05% Impervious Runoff Depth=8.31" Tc=5.0 min CN=95 Runoff=7.02 cfs 23,576 cf
Pond dmh-05: dmh	Peak Elev=44.41' Inflow=5.94 cfs 30,166 cf 12.0" Round Culvert n=0.013 L=50.0' S=0.0050 '/' Outflow=5.94 cfs 30,166 cf
Pond dmh-06: dmh	Peak Elev=40.82' Inflow=4.67 cfs 15,696 cf 12.0" Round Culvert n=0.013 L=84.0' S=0.0143 '/' Outflow=4.67 cfs 15,696 cf
Pond ds-1: Pervious Pavement	Peak Elev=45.29' Storage=6,073 cf Inflow=3.77 cfs 12,131 cf Outflow=0.69 cfs 11,008 cf
Pond ds-2: Pervious Pavement	Peak Elev=43.19' Storage=6,282 cf Inflow=3.41 cfs 10,773 cf 4.0" Round Culvert n=0.020 L=127.0' S=0.0050 '/' Outflow=0.17 cfs 10,668 cf
Link SP-1: study point	Inflow=10.75 cfs 56,529 cf Primary=10.75 cfs 56,529 cf
Link SP-2: study point	Inflow=10.89 cfs 37,036 cf Primary=10.89 cfs 37,036 cf

Total Runoff Area = 138,447 sf Runoff Volume = 94,793 cf Average Runoff Depth = 8.22"
16.14% Pervious = 22,352 sf 83.86% Impervious = 116,095 sf

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Type III 24-hr 100-Year Rainfall=8.91"

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Page 24

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 5.52 cfs @ 12.07 hrs, Volume= 19,157 cf, Depth= 8.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
26,516	98	Roofs, HSG C
26,516		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 3.77 cfs @ 12.07 hrs, Volume= 12,131 cf, Depth= 7.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
12,230	98	Paved parking, HSG C
6,669	74	>75% Grass cover, Good, HSG C
18,898	90	Weighted Average
6,669		35.29% Pervious Area
12,230		64.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1C: Subcat P-1C

Runoff = 3.41 cfs @ 12.07 hrs, Volume= 10,773 cf, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
8,266	74	>75% Grass cover, Good, HSG C
9,353	98	Paved parking, HSG C
17,618	87	Weighted Average
8,266		46.92% Pervious Area
9,353		53.08% Impervious Area

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Type III 24-hr 100-Year Rainfall=8.91"

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Page 25

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1D: Subcat P-1D

Runoff = 3.71 cfs @ 12.07 hrs, Volume= 12,333 cf, Depth= 8.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
14,728	98	Paved parking, HSG C
3,348	74	>75% Grass cover, Good, HSG C
18,076	94	Weighted Average
3,348		18.52% Pervious Area
14,728		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-1E: Subcat P-1E

Runoff = 0.97 cfs @ 12.07 hrs, Volume= 3,363 cf, Depth= 8.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
4,655	98	Roofs, HSG C
4,655		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 3.88 cfs @ 12.07 hrs, Volume= 13,460 cf, Depth= 8.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
18,631	98	Roofs, HSG C
18,631		100.00% Impervious Area

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Type III 24-hr 100-Year Rainfall=8.91"

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Page 26

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 7.02 cfs @ 12.07 hrs, Volume= 23,576 cf, Depth= 8.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.91"

Area (sf)	CN	Description
4,070	74	>75% Grass cover, Good, HSG C
29,983	98	Paved parking, HSG C
34,053	95	Weighted Average
4,070		11.95% Pervious Area
29,983		88.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond dmh-05: dmh

Inflow Area = 45,415 sf, 85.32% Impervious, Inflow Depth = 7.97" for 100-Year event
 Inflow = 5.94 cfs @ 12.07 hrs, Volume= 30,166 cf
 Outflow = 5.94 cfs @ 12.07 hrs, Volume= 30,166 cf, Atten= 0%, Lag= 0.0 min
 Primary = 5.94 cfs @ 12.07 hrs, Volume= 30,166 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 44.41' @ 12.07 hrs
 Flood Elev= 44.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	40.94'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 40.94' / 40.69' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=5.93 cfs @ 12.07 hrs HW=44.41' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 5.93 cfs @ 7.55 fps)

Summary for Pond dmh-06: dmh

Inflow Area = 22,731 sf, 85.27% Impervious, Inflow Depth = 8.29" for 100-Year event
 Inflow = 4.67 cfs @ 12.07 hrs, Volume= 15,696 cf
 Outflow = 4.67 cfs @ 12.07 hrs, Volume= 15,696 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.67 cfs @ 12.07 hrs, Volume= 15,696 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

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Type III 24-hr 100-Year Rainfall=8.91"

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Page 27

Peak Elev= 40.82' @ 12.07 hrs

Flood Elev= 44.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.74'	12.0" Round Culvert L= 84.0' Ke= 0.500 Inlet / Outlet Invert= 38.74' / 37.54' S= 0.0143 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.67 cfs @ 12.07 hrs HW=40.82' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 4.67 cfs @ 5.95 fps)

Summary for Pond ds-1: Pervious Pavement

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area = 18,898 sf, 64.71% Impervious, Inflow Depth = 7.70" for 100-Year event
 Inflow = 3.77 cfs @ 12.07 hrs, Volume= 12,131 cf
 Outflow = 0.69 cfs @ 12.50 hrs, Volume= 11,008 cf, Atten= 82%, Lag= 26.0 min
 Primary = 0.69 cfs @ 12.50 hrs, Volume= 11,008 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 45.29' @ 12.50 hrs Surf.Area= 12,211 sf Storage= 6,073 cf
 Flood Elev= 45.37' Surf.Area= 12,211 sf Storage= 6,407 cf

Plug-Flow detention time= 226.5 min calculated for 11,007 cf (91% of inflow)
 Center-of-Mass det. time= 180.6 min (952.5 - 771.9)

Volume	Invert	Avail.Storage	Storage Description
#1	43.78'	6,407 cf	stone voids (Irregular) Listed below (Recalc) 19,415 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.78	12,211	802.0	0	0	12,211
45.37	12,211	802.0	19,415	19,415	13,486

Device	Routing	Invert	Outlet Devices
#1	Device 3	44.04'	6.0" Round underdrain L= 107.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.04' / 43.50' S= 0.0050 '/ Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#2	Device 3	44.35'	6.0" Round underdrain L= 170.0' Ke= 0.500 Inlet / Outlet Invert= 44.35' / 43.50' S= 0.0050 '/ Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf
#3	Primary	42.59'	12.0" Round Culvert L= 195.0' Ke= 0.500 Inlet / Outlet Invert= 42.59' / 41.62' S= 0.0050 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.69 cfs @ 12.50 hrs HW=45.29' TW=41.78' (Dynamic Tailwater)

↑**3=Culvert** (Passes 0.69 cfs of 3.73 cfs potential flow)
 ↑**1=underdrain** (Barrel Controls 0.39 cfs @ 1.96 fps)
 ↑**2=underdrain** (Barrel Controls 0.31 cfs @ 1.58 fps)

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Type III 24-hr 100-Year Rainfall=8.91"

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Page 28

Summary for Pond ds-2: Pervious Pavement

Inflow Area = 17,618 sf, 53.08% Impervious, Inflow Depth = 7.34" for 100-Year event
 Inflow = 3.41 cfs @ 12.07 hrs, Volume= 10,773 cf
 Outflow = 0.17 cfs @ 14.08 hrs, Volume= 10,668 cf, Atten= 95%, Lag= 120.4 min
 Primary = 0.17 cfs @ 14.08 hrs, Volume= 10,668 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 43.19' @ 14.08 hrs Surf.Area= 8,246 sf Storage= 6,282 cf
 Flood Elev= 43.22' Surf.Area= 8,246 sf Storage= 6,368 cf

Plug-Flow detention time= 447.7 min calculated for 10,666 cf (99% of inflow)
 Center-of-Mass det. time= 441.8 min (1,222.4 - 780.6)

Volume	Invert	Avail.Storage	Storage Description
#1	40.88'	6,368 cf	stone voids (Irregular) Listed below (Recalc) 19,296 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.88	8,246	532.0	0	0	8,246
43.22	8,246	532.0	19,296	19,296	9,491

Device	Routing	Invert	Outlet Devices
#1	Primary	40.90'	4.0" Round underdrain L= 127.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 40.90' / 40.27' S= 0.0050 ' S= 0.0050 ' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.09 sf

Primary OutFlow Max=0.17 cfs @ 14.08 hrs HW=43.19' TW=0.00' (Dynamic Tailwater)
 ↳ **1=underdrain** (Barrel Controls 0.17 cfs @ 1.98 fps)

Summary for Link SP-1: study point

Inflow Area = 85,764 sf, 78.68% Impervious, Inflow Depth = 7.91" for 100-Year event
 Inflow = 10.75 cfs @ 12.07 hrs, Volume= 56,529 cf
 Primary = 10.75 cfs @ 12.07 hrs, Volume= 56,529 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP-2: study point

Inflow Area = 52,683 sf, 92.28% Impervious, Inflow Depth = 8.44" for 100-Year event
 Inflow = 10.89 cfs @ 12.07 hrs, Volume= 37,036 cf
 Primary = 10.89 cfs @ 12.07 hrs, Volume= 37,036 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.072 degrees West
Latitude	42.443 degrees North
Elevation	0 feet
Date/Time	Tue, 24 Sep 2019 10:07:12 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.69	0.86	1.09	1yr	0.75	1.03	1.27	1.63	2.09	2.71	2.98	1yr	2.40	2.87	3.29	4.00	4.67	1yr
2yr	0.35	0.53	0.67	0.88	1.10	1.39	2yr	0.95	1.27	1.62	2.04	2.57	3.25	3.61	2yr	2.88	3.47	3.97	4.72	5.37	2yr
5yr	0.41	0.64	0.80	1.08	1.38	1.76	5yr	1.19	1.60	2.04	2.59	3.26	4.12	4.58	5yr	3.64	4.40	5.02	5.99	6.72	5yr
10yr	0.46	0.73	0.92	1.25	1.62	2.09	10yr	1.40	1.90	2.45	3.10	3.91	4.92	5.48	10yr	4.35	5.27	6.00	7.16	7.96	10yr
25yr	0.55	0.87	1.11	1.53	2.02	2.63	25yr	1.75	2.40	3.09	3.93	4.96	6.23	6.97	25yr	5.51	6.70	7.59	9.09	9.97	25yr
50yr	0.61	0.99	1.27	1.78	2.40	3.15	50yr	2.07	2.85	3.71	4.73	5.96	7.45	8.36	50yr	6.59	8.04	9.08	10.89	11.83	50yr
100yr	0.71	1.15	1.48	2.09	2.84	3.75	100yr	2.45	3.40	4.43	5.65	7.13	8.91	10.04	100yr	7.89	9.65	10.86	13.05	14.04	100yr
200yr	0.80	1.31	1.70	2.44	3.36	4.48	200yr	2.90	4.05	5.30	6.78	8.55	10.67	12.06	200yr	9.44	11.59	13.00	15.64	16.67	200yr
500yr	0.97	1.59	2.07	3.01	4.22	5.66	500yr	3.64	5.11	6.72	8.61	10.86	13.54	15.37	500yr	11.98	14.78	16.50	19.89	20.94	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.25	0.38	0.47	0.63	0.78	0.86	1yr	0.67	0.85	1.16	1.42	1.76	2.41	2.44	1yr	2.13	2.34	2.94	3.52	3.85	1yr
2yr	0.33	0.51	0.63	0.85	1.05	1.25	2yr	0.91	1.23	1.44	1.91	2.47	3.15	3.48	2yr	2.79	3.35	3.83	4.56	5.20	2yr
5yr	0.39	0.60	0.74	1.02	1.29	1.51	5yr	1.12	1.47	1.72	2.23	2.86	3.79	4.15	5yr	3.35	3.99	4.60	5.49	6.21	5yr
10yr	0.43	0.66	0.82	1.15	1.48	1.73	10yr	1.28	1.69	1.97	2.51	3.21	4.34	4.84	10yr	3.84	4.66	5.29	6.29	7.07	10yr
25yr	0.50	0.75	0.94	1.34	1.76	2.06	25yr	1.52	2.02	2.34	2.93	3.73	5.18	5.86	25yr	4.59	5.63	6.35	7.49	8.40	25yr
50yr	0.55	0.84	1.04	1.50	2.02	2.37	50yr	1.74	2.32	2.66	3.30	4.19	5.89	6.76	50yr	5.22	6.50	7.27	8.55	9.55	50yr
100yr	0.62	0.93	1.17	1.69	2.31	2.70	100yr	2.00	2.64	3.03	3.73	4.70	6.75	7.83	100yr	5.97	7.53	8.35	9.71	10.85	100yr
200yr	0.69	1.04	1.32	1.91	2.67	3.10	200yr	2.30	3.03	3.45	4.20	5.28	7.68	9.09	200yr	6.80	8.74	9.59	11.00	12.32	200yr
500yr	0.81	1.21	1.55	2.25	3.20	3.71	500yr	2.77	3.62	4.09	4.93	6.16	9.13	11.08	500yr	8.08	10.66	11.51	12.95	14.54	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.47	0.57	0.77	0.95	1.11	1yr	0.82	1.09	1.30	1.74	2.23	2.88	3.21	1yr	2.55	3.08	3.55	4.36	5.06	1yr
2yr	0.36	0.55	0.68	0.92	1.14	1.35	2yr	0.98	1.32	1.56	2.05	2.66	3.40	3.77	2yr	3.01	3.63	4.12	4.93	5.56	2yr
5yr	0.45	0.69	0.86	1.17	1.49	1.77	5yr	1.29	1.73	2.05	2.65	3.38	4.49	5.04	5yr	3.97	4.85	5.48	6.49	7.26	5yr
10yr	0.55	0.84	1.04	1.45	1.88	2.17	10yr	1.62	2.12	2.52	3.21	4.06	5.57	6.27	10yr	4.93	6.03	6.78	8.02	8.90	10yr
25yr	0.71	1.08	1.34	1.92	2.52	2.85	25yr	2.18	2.79	3.34	4.16	5.17	7.40	8.41	25yr	6.55	8.08	9.02	10.67	11.68	25yr
50yr	0.86	1.31	1.63	2.34	3.15	3.52	50yr	2.72	3.44	4.12	5.05	6.23	9.20	10.48	50yr	8.15	10.08	11.20	13.25	14.36	50yr
100yr	1.05	1.59	2.00	2.88	3.95	4.34	100yr	3.41	4.24	5.11	6.15	7.49	11.44	13.08	100yr	10.12	12.58	13.91	16.50	17.68	100yr
200yr	1.28	1.93	2.45	3.55	4.95	5.35	200yr	4.27	5.23	6.33	7.47	8.99	14.22	16.32	200yr	12.58	15.69	17.28	20.55	21.80	200yr
500yr	1.68	2.50	3.22	4.67	6.64	7.05	500yr	5.73	6.89	8.43	9.67	11.48	18.98	21.86	500yr	16.80	21.02	23.02	27.51	28.80	500yr





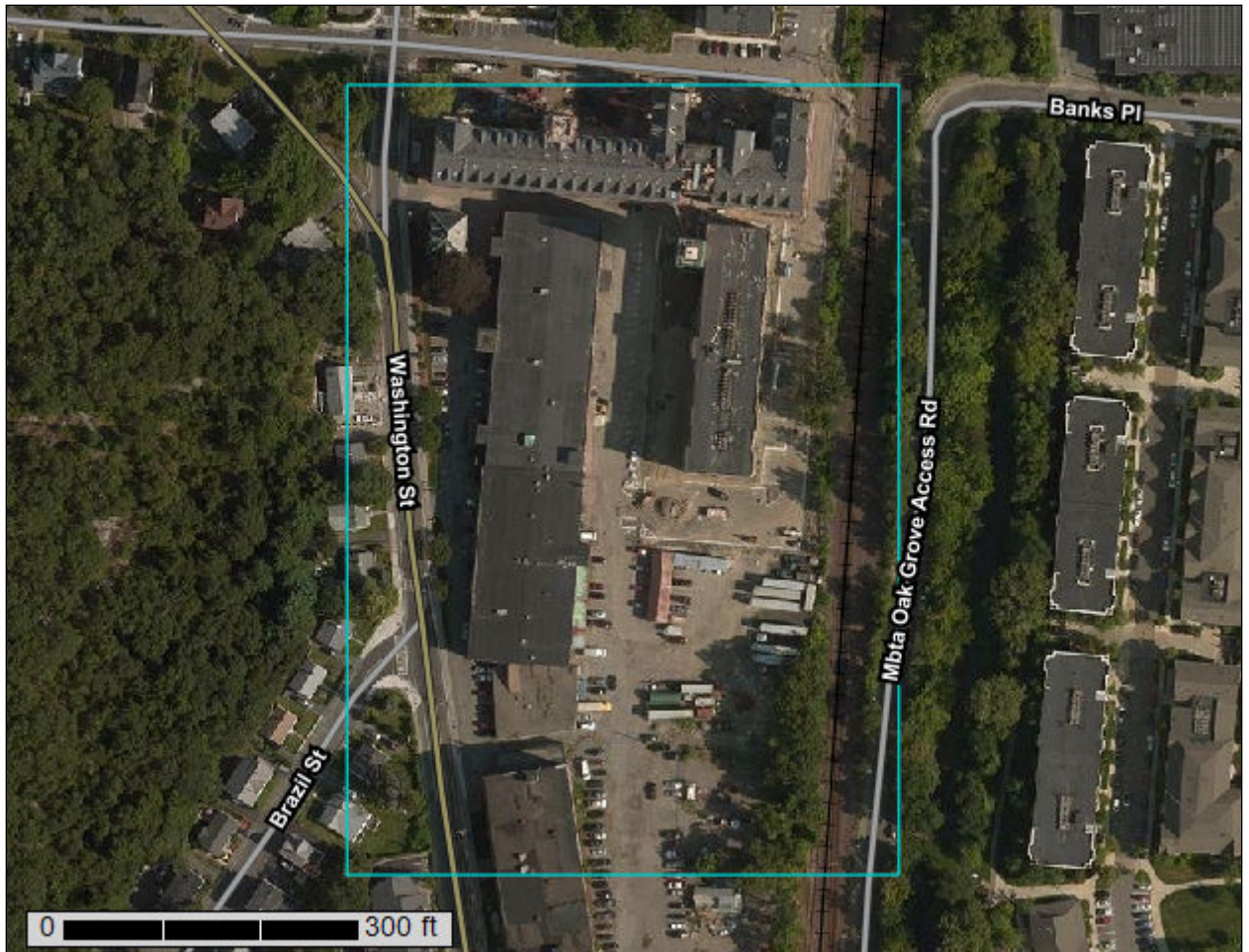
United States
Department of
Agriculture

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 Middlesex County, Massachusetts



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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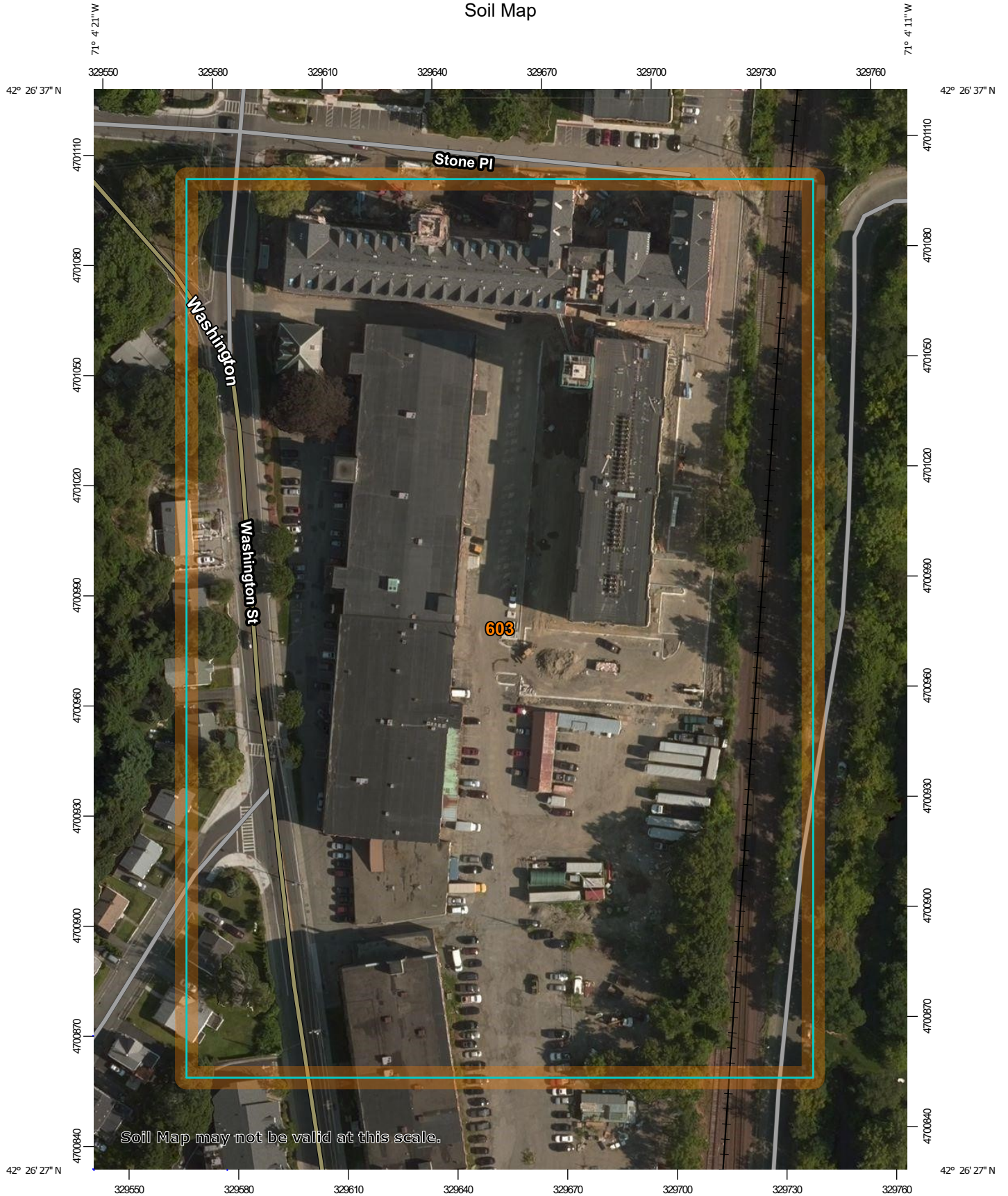
Contents

Preface	2
Soil Map	5
Soil Map.....	6
Legend.....	7
Map Unit Legend.....	8
Map Unit Descriptions.....	8
Middlesex County, Massachusetts.....	10
603—Urban land, wet substratum.....	10

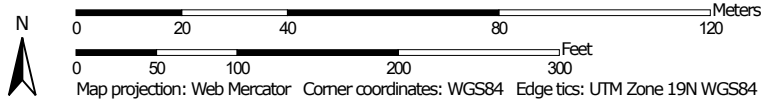
Soil Map

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

Custom Soil Resource Report Soil Map




Map Scale: 1:1,430 if printed on A portrait (8.5" x 11") sheet.




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 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 1:25,000.

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: Middlesex County, Massachusetts
 Survey Area Data: Version 18, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
603	Urban land, wet substratum	10.4	100.0%
Totals for Area of Interest		10.4	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Custom Soil Resource Report

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

603—Urban land, wet substratum

Map Unit Setting

National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy

Percent of map unit: 10 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

PERVIOUS PAVEMENT - DESCRIPTION

From the bottom up, the pervious pavement structure consists of:

- An un-compacted level subgrade.
- A stone recharge bed consisting of clean, ¾” crushed stone. This course is considered the “reservoir course” and is a structural layer that also temporarily stores stormwater as it infiltrates in the soil below.
- A filter blanket comprised of pea-stone. The filter blanket prevents the filter course from migrating into the reservoir course.
- A filter course comprised of sand and gravel. The purpose of the filter course is to provide water quality treatment prior to recharge.
- A choker course comprised of ¾” crushed stone. The purpose of the choker course is to stabilize the surface for the paving equipment.
- Pervious pavement – an open-graded asphalt surface with interconnected voids that allow stormwater to flow through the pavement into the reservoir course.

PERVIOUS PAVEMENT - MAINTENANCE

Pervious pavement shall not be seal-coated. In addition, sand must not be used for the control of snow and ice. All pervious pavements should be inspected several times in the first few months after construction and at least quarterly thereafter. Pavement inspections should include, but not be limited to, checking for cracks, surface unraveling (individual aggregate particles dislodging from the surface), unevenness, heaving, and settlement (particularly at boundaries. Inspections should be conducted during and after large storms (2” of rainfall in a 24-hour period) to check for surface ponding that might indicate possible clogging. To prevent clogging of pervious pavements, the areas shall be vacuum swept at least twice per year. Snow plowing shall be conducted using a plastic, rubber, or composite plow blade. Steel-edged plow blades increase the likelihood of surface unraveling.