



May 12, 2021

Mr. Peter Matchak
Town Planner/Director
Town of Ashland
101 Main Street
Ashland, MA 01721

RE: A&M Project # 2604-01
Comprehensive Permit Site Plan Review
Arbella at Ashland, Memorial Drive
Response to Peer Review Comments

Dear Chairman Trefethen, Mr. Matchak and Members of the Zoning Board of Appeals:

On behalf of our Client, US Senior Manager, LLC, Allen & Major Associates Inc. (A&M) would like to provide responses, summarized below as related to a peer review memo prepared by Michael J. Carter, PE of GCG Associates, Inc., dated April 26, 2021.

The responses to the comments are shown below in **bold** preceded by the original comment shown in *italics*. For brevity, only the comments that remain open are noted below with numbering in accordance with the April 26, 2021 letter. Revisions based on these comments are contained within the drawings noted as Revision 2 dated May 11, 2021.

Project Narrative Section 8.0 – Requested Waivers

The Applicant has requested the following preliminary waivers:

Comment 1: Subject to ZBA approval.

Response 1: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 2: Subjects to ZBA approval. There are some concerns with the inspection requirements under the Stormwater Management Permit. This Comprehensive Permit approval is a prerequisite for issuing of a building permit. All site works, utilities and building constructions will be subject to Inspection Service Department (building constructions), Department of Public Works (water, sewer, and underground utilities), and Conservation Commission (administers Stormwater Management Regulations) inspections. This project is required to meet the Ashland Stormwater Management regulations with or without the SMP. Therefore, Conservation Department inspections are still required. The Town also has the right to require third-party inspection, testing, and certification to meet the Comprehensive Permit and Building Permit conditions as they see fit.

Response 2: No further response required. The applicant seeks to discuss waivers with the Zoning Board of Appeals when appropriate to the hearing process. By condition of permit, the applicant can work with the Town on appropriate inspection and oversight of construction to ensure all construction meets applicable standards.

Comment 3: A WPA Form 2 - Determination of Applicability has been issued by the Ashland Conservation Commission on 11/17/2020 and determined that this project meets the Negative 1 determination, "The area described in the Request is not an area subject to protection under the Act or the Buffer Zone." And no further action under the Wetlands Protection Act is required by the applicant.

Response 3: No further response required.

Comment 4: This project proposed 159 parking spaces for the 156 apartment units, 48 tandem parking spaces for the 24 townhouse units, and 40 parking spaces for the club house (consists of approximately 480+/- square feet office uses). Subjects to ZBA approval. GCG recommends keeping the 14 future/additional parking spaces with Grass Pavers surface treatment, which is pervious grass surface (mow-able) with structure support. Applicant should install parking signs in front of the parking areas to indicate as surplus parking stalls.

Response 4: Noted. The applicant requests the opportunity to provide signage at the time the additional spaces are utilized.

Comment 5: Subject to ZBA approval.

Response 5: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 6: Subject to ZBA approval.

Response 6: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 7: Landscape islands have been revised per comments, layout subject to ZBA approval.

Response 7: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 8: No action required.

Response 8: No further response required.

Comment 9: The Conservation administers the stormwater management regulations and erosion control (SWPPP) during and after the construction.

Response 9: Noted. A SWPPP shall be prepared for the project. It would be the intent of the applicant to require inspections be performed by the site contractor and/or engineer to confirm compliance with the SWPPP and provide reports to the Conservation Department. The applicant can coordinate further with the Conservation Department.

Comment 10: Subject to ZBA approval.

Response 10: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 11: Waiver requested and subject to ZBA approval.

Response 11: No further response required. The applicant will coordinate approval and discussion of the waiver with the Zoning Board of Appeals as part of the hearing process.

Comment 12: Subject to ZBA approval.

Response 12: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 13: Subject to ZBA approval.

Response 13: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 14: Subject to ZBA approval.

Response 14: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 15: Subject to ZBA approval.

Response 15: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 16: Subject to ZBA approval.

Response 16: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 17: Subject to ZBA approval.

Response 17: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 18: No action required.

Response 18: No further response required.

Comment 19: Subject to ZBA approval, see additional drainage comments below.

Response 19: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 20: Subject to ZBA approval. A negative determination has been issued.

Response 20: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 21: Waivers from section 8.4.1.1 and 8.4.1.2 have been requested. GCG recommends the applicant provide a pedestrian access along the proposed driveway and matching the road grade, as recommended by the PROWAG (Public Right of Way Accessibility Guidelines). Applicant could alter the paved shoulder width to accommodate a walkway and/or bike path to provide the non-ADA compliance access.

Response 21: As part of comments received from the Town's traffic review consultant, the roadway cross section has been altered slightly. The lane striping has been modified to reflect an 11 foot (11') travel lane with a 5 foot (5') shoulder (versus the previous 12 and 4 dimensions). This shift allows for more appropriate use for bicycles and pedestrians. However, the applicant is not promoting the use of the site driveway for pedestrians and will provide transportation accommodations for residents as needed. The lack of a sidewalk has been a point of discussion with the Zoning Board of Appeals and will be discussed in greater detail at the time of discussion on project waivers.

A&M and the applicant note the provisions of PROWAG as suggested by GCG but remain consistent in the approach to not provide a sidewalk along the site driveway.

Comment 22: Waiver from section 8.4.6.5 requested, subject to ZBA approval.

Response 22: No further response required. The applicant will coordinate approval and discussion of the waiver with the Zoning Board of Appeals as part of the hearing process.

General Comments

Plan Sheet – Cover

Land Usage Table:

Comment 1: Subject to ZBA's waivers approval and conditions with Planning Board ANR process.

Response 1: No further response required. The applicant will coordinate approval and discussion of the waiver with the Zoning Board of Appeals as part of the hearing process.

Comment 3: Subject to ZBA approval.

Response 3: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Comment 4: Subject to ZBA approval. See additional parking layout comments below.

Response 4: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Plan Sheets C-001 – C-002, Abbreviations & Notes

Comment 2: Waivers from 8.4.1.1 and 8.4.1.2 have been requested. GCG concurs that an ADA compliance sidewalk/walkway may not be feasible for the existing physical topography constraints. GCG recommends a "pedestrian circulation path" be installed along the steep driveway/street as recommended by the Public Right-of-Way Accessibility Guidelines, (PROWAG). The residents are expected will utilize the 4 feet wide paved shoulders as walkway or bicycle path as available. Applicant could add grass paver strip (for structural vehicle support) to provide separation to pedestrian path and promote drainage treatments by reducing flow velocity and sediment/filtration.

Response 2: Please refer to Response 21 above.

Comment 3: Subject to ZBA approval.

Response 3: No further response required. The applicant will coordinate approval and discussion of the waiver with the Zoning Board of Appeals as part of the hearing process.

Comment 4: GCG recommends to callout the major storm as precipitation of greater than 0.5 inch over 24 hours, as recommended by the 2017 SWPPP template.

Response 4: The note has been revised to reflect that inspections would be conducted either weekly or if precipitation greater than 0.5 inches (0.5") occurs over 24 hours.

Plan Sheets C-102 – C-104, Layout & Materials Plan

Comment 1: GCG recommends adding grass paver strip for temporary snow storage and utilize sidewalk snow thrower to clear snow outside the drainage swale and catch basin areas.

Response 1: Please refer to Response 21 regarding site driveway coordination. The applicant is aware of the operation and maintenance obligations in approval of the driveway as provided.

Comment 2: Incorporate the paved shoulder areas for pedestrian circulation path layout.

Response 2: The roadway shoulder has been increased to 5 feet (5') and can accommodate pedestrian travel.

Comment 3: GCG concurs with the MDM Transportation Consultants, Inc.'s traffic study. However, the plan did not address the existing light poles at the driveway entrance. GCG recommends tightening the curb opening and maintain the two existing light poles at the entrance. See additional Photometric Plan comments below.

Response 3: The curb radii have been reduced to a 30 foot (30') radii to preserve the existing site lighting installed along Memorial Drive.

Comment 5: Waivers requested. The residents will use the 4-foot (4') wide shoulders as pedestrian walkway as physically available regardless the layout. GCG recommends modifying the paved shoulders to pedestrian circulation path as recommended by PROWAG.

Response 5: No further response required. The applicant will coordinate approval and discussion of the waiver with the Zoning Board of Appeals as part of the hearing process.

Comment 6: Waiver from section 344-4 has been requested. The new lot will be created for the purpose of transferring approximately 20 acres of land to the Town of Ashland. Granting a waiver from section 344-4 should not affect the physical layout of this project, a drainage easement has been proposed along Memorial Drive to accommodate the drainage mitigation. Subject to ZBA approval.

Response 6: Through clarification with the Planning Department, the Rule of 22 is not applicable to lots of this size. The waiver has been removed from the requested list of exceptions.

Comment 7: Waiver from the conditions of the Subdivision of Land Regulations has been requested. This is a private driveway and meeting the AASHTO standards for street design for 15 MPH speed limit. Incorporate sidewalk and bike path with the paved shoulders are recommended.

Response 7: No further response required.

Comment 8: GCG recommends installing additional (R2-1) signs along the steep driveway and within the site to emphasis the 15 MPH speed limit. Subject to ZBA approval.

Response 8: The additional signs have been added along the site driveway as suggested.

Comment 10: Waiver requested, granting of this waiver should have no adverse impact to the engineering aspect of the layout. Subject to ZBA approval.

Response 10: No further response required.

Comment 11: Subject to ZBA approval.

Response 11: No further response required. The applicant will coordinate approval and discussion of the waiver with the Zoning Board of Appeals as part of the hearing process.

Comment 16: The proposed tandem parking layout for the Townhouse units are commonly acceptable for this type of (single-family use) dwelling unit. The proposed 35 standard parking stalls (14 spaces with grass pavers surface) and 5 accessible stalls for the clubhouse facility appears to be more than adequate, considering the facility is intended to service the development's residents and their guests. The proposed 159 spaces for the 156 apartment dwelling units are at a ratio of approximately 1 space per each unit. The applicant has stated that, "It is the applicant's opinion this suffices for parking demand." Since age restricted housing development is relatively new and has not meet its peak demand, parking demand could be fluctuated by tenant's age. Therefore, ZBA approval is required. If deems necessary, there appears to be some areas suitable for future parking expansion available at the southwest side of building 1 and across from building 5. Additional parking layout with grass pavers surface finish should have minimum impact to the drainage system.

Response 16: No further response required. The applicant will coordinate approval with the Zoning Board of Appeals as part of the hearing process.

Plan Sheet C-105 – C-107, Grading & Drainage Plan

Comment 1: GCG recommends incorporate pedestrian path with the paved shoulders layout per PROWAG recommendations.

Response 1: Please refer to Response 21 above.

Comment 5: The proposed Stormtrap (UIC Class V well) system does not meet the 10' setback to water supply line.

Response 5: A&M has revised both the subsurface infiltration system and the position of the water line to conform with the UIC registration setbacks.

Comment 6: Clarify Stormtrap label Bottom Chamber invert elevation shown on C-106. The Stormtrap Design Criteria uses system invert at the top of stone bed, which is 3" above the bottom of chamber, see Stormtrap Design Criteria detail #1 shown on sheet C-505. GCG recommends using the exact manufacturer's terminology (system Invert) in the plan label.

Response 6: The nomenclature has been revised on the sheet to reflect "System Invert".

Plan Sheet C-501 – C-505, Details

Comment 5: Provide trash rack in front of the infiltration basin outlet orifice.

Response 5: A trash rack at the orifice has been added as suggested.

Comment 8: Specify CDS units and Stormceptor structure number per Grading and Drainage Plan labels. As shown the drainage plan labels called for (WQS) without specifying model.

Response 8: The water quality, unit specific labels have been added to the Grading and Drainage Plan and details as suggested.

Plan Sheet L-101 – L-103, Landscape Plan

Comment 4: Relocate landscape tree on top of the Stormtrap concrete chamber (near PCB 11).

Response 4: The trees affected by the subsurface infiltration field have been relocated. Some shrubbery remains over the field, but in the opinion of A&M the depth of cover over will allow for the growth of a shrub without impact to either the roots or the drainage system.

Provide project timetable/schedule per Section 9.4.4.12

Applicant will provide updated schedule.

Provide lighting detail and photometric plan per 9.4.4.8

Comment 1. Proposed light poles along the driveway are 18-foot height with fixture mounting height at 20'-6". In comparison, 8.6.10.(7) – requires lighting fixture mounted no higher than 15 feet. And the existing light poles along the Memorial Drive sidewalk are 12-foot height.

Response 1: The applicant has added lighting height as a waiver to the requested list of exceptions for the project to provide lighting as shown on the site development plans in a safe and efficient manner in the heights shown.

Comment 2. The Photometric plan sheet C-114 shows 2.7 foot-candles overspill at the Memorial Drive curb opening right-of-way line, which should blend in with the two existing pole lights at intersection. Applicant should address the two existing pole lights within the curb opening. These two poles would require extensive works to be relocated. GCG recommends reconfiguring the curb opening to avoid pole lights relocation. If necessary, provide new photometric analysis with pole lights relocation to assure sufficient illumination along Memorial Drive sidewalk.

Response 2: The curb radii at the Memorial Drive intersection have been revised as suggested. The lighting of the bike path was not reflected in the site photometric plan. It is presumed the lighting along this corridor is adequate and will be maintained in its current form.

Comment 3. Verify double pole light and single pole light symbols shown on Legend.

Response 3: The light pole symbols have been coordinated as suggested.

Traffic Report as deemed necessary per 9.4.8

Comment 1: GCG concurs with the MDM Transportation Consultants report for this development. GCG recommends revisiting the intersection configuration to avoid pole lights relocation.

Response 1: No further response required.

Stormwater Report

Massachusetts Stormwater Management Standards Analysis:

Comment 1: The proposed treatment chain entering the Stormtrap infiltration system consists of deep sump hooded catch basin and/or proprietary separator (water quality structure, WQS) for pre-treatments and subsurface structures (Stormtrap concrete chambers) for infiltration. The outflow discharges through another WQS and onto the infiltration basin. MassDEPMSH rated 80% TSS removal credit for the subsurface structure with pre-treatment. And stated that there is insufficient data to support Nutrients (Nitrogen, Phosphorus) removal efficiencies for deep sump hooded catch basin, proprietary separator, and subsurface structures. Since this discharge received addition infiltration basin system treatment. This treatment chain should qualify for 96% TSS removal credit. And the downstream infiltration basin treatment does qualify for 60% to 70% TP, and 50% to 60% TN. The second treatment chain consists of deep sump hooded catch basin and proprietary separator and discharges onto the infiltration basin. The third treatment consists of deep sump hooded catch basin and WQS only. GCG would consider these three treatment chains average meets with the MS4's TSS, TP and TN removal requirements.

Response 1: No further response required.

Comment 2: The revised Table 3.2.B shows a 37.2% discharge volume increase during the 100-year storm event. According to the HydroCAD report Pond 4P: Stormtrap model, the calculations were based on 40 Stormtrap chambers in 2 rows layout, which did not match the proposed 88 chambers shown on the Stormtrap Chambers detail #3 shown on plan sheet C-505. GCG recommends the applicant to utilize the Chamber Wizard option within the HydroCAD program to analysis the Stormtrap chambers application as recommended by manufacturer. The 88 chambers system should increase the storage volume significantly, which affect the discharge rate and volume.

Response 2: A&M has coordinated the Stormtrap system design with the manufacturer inclusive of appropriate modeling within HydroCAD. The manufacturer's layout is attached hereto for reference as well as updated HydroCAD watershed reports. The net result is a lessening of the discharge volume during the 100-year storm events. Below are the updated tables from the original drainage report and the updated drawdown calculation based on the reconfiguration of the subsurface field.

Table 3.2.A – Design Point 1 Existing vs Proposed peak rate of runoff at the Southeast Corner

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.68	0.33	-0.35 (51.4%)
10-year	3.14	2.52	-0.62 (19.7%)
25-year	6.42	5.19	-1.23 (19.1%)
100-year	11.85	9.42	-2.43 (20.5%)

Table 3.2.B – Design Point 1 Existing vs Proposed runoff volume at the Southeast Corner

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.123	0.115	-0.008 (6.5%)
10-year	0.444	0.408	-0.036 (8.1%)
25-year	0.774	0.700	-0.074 (9.5%)
100-year	1.286	1.714	0.428 (33.3%)

Table 3.2.C – Design Point 2 Existing vs Proposed peak rate of runoff at the Northerly Property

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	6.26	1.21	-5.05 (80.7%)
10-year	14.63	3.24	-11.38 (77.8%)
25-year	21.30	5.00	-16.3 (76.5%)
100-year	30.29	7.37	-22.92 (75.7%)

Table 3.2.D – Design Point 2 Existing vs Proposed runoff volume at the Northerly Property

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.61	0.120	-0.49 (80.3%)
10-year	1.305	0.273	-1.032 (79.1%)
25-year	1.869	0.400	-1.469 (78.6%)
100-year	2.641	0.576	-2.065 (78.2%)

Table 3.2.E – Design Point 3 Existing vs Proposed peak rate of runoff at the Westerly Wetlands

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	5.97	5.67	-0.30 (5.0%)
10-year	13.05	12.07	-0.98 (7.5%)
25-year	18.62	17.07	-1.55 (8.3%)
100-year	26.06	23.71	-2.35 (9.0%)

Table 3.2.F – Design Point 3 Existing vs Proposed runoff volume at the Westerly Wetlands

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.585	0.561	-0.024 (4.1%)
10-year	1.207	1.121	-0.086 (7.1%)
25-year	1.704	1.564	-0.14 (8.2%)
100-year	2.379	2.159	-0.22 (9.2%)

Standard 3

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The USDA Soil Survey of Middlesex County was used to determine soil types on site.

The required recharge rates for each soil classification are as follows:

Table 5.1 – Recharge Volume per Hydrologic Soil Group (HSG)

	HSG A	HSG B	HSG C	HSG D
Required Recharge	0.60 inches	0.35 inches	0.25 inches	0.10 inches

Table 5.2 – Proposed Impervious Surface

Site	Total Area	HSG A	HSG B	HSG C	HSG D
Building Roof	99,970 sf	-	-	99,970 sf	-
Pavement/sidewalk	183,388 sf	28,314 sf	-	155,074 sf	-
Total Impervious Area	283,358 sf	28,314 sf	-	255,044 sf	-

The project is considered a new development project under proposed conditions, the project will have 283,358 sf of impervious surface area. Per the Massachusetts Stormwater Handbook, the project is required to recharge the increase in impervious surface. All runoff that flows from impervious areas will be collected by the proposed closed drainage system and directed into an underground infiltration system. The required recharge volume is given by the following equation

$$R_v = F \times IA \text{ (Equation 1 Stormwater Handbook Volume 3)}$$

- where R_v = Required Recharge Volume, ft^3
- F = Target Depth factor
- IA = Impervious drainage area
- R_v = $F \times IA$
 $= (0.6 \text{ inches})(1\text{foot}/12 \text{ inches})(28,314 \text{ sf}) + (0.25 \text{ inches})(1\text{foot}/12 \text{ inches})(255,044 \text{ sf})$
 $= 6,729 \text{ cubic feet}$

The volume within the infiltration basin and the subsurface infiltration system, below the lowest orifice in the outlet control structure is approximately 68,355 cubic feet which exceeds the required volume of 6,729 cubic feet.

MA MS4 General Permit requires the project to retain and infiltrate the volume of one (1) inch over the post-developed impervious surface, therefore the required $V = (1'')(1'/12'')(255,044 \text{ sf}) = 21,254 \text{ cf}$.

The volume within the subsurface infiltration system, below the lowest orifice in the outlet control structure is approximately 68,355 cubic feet which exceeds the required volume of 21,254 cubic feet.

The basin drawdown time is defined as:

- $Time_{drawdown} = R_v / (K)(\text{bottom area})$
- where R_v = Required Recharge Volume, ft^3
- K = Saturated Hydraulic Conductivity (Rawls Table)
- Bottom area = Bottom area of recharge structure

Table 5.3 – Drawdown Calculation

System	R_v	K	Bottom Area	$Time_{drawdown}$
Infiltration Basin	49,080 cf	8.27 in/hr	10,661 sf	6.7 hrs
Stormtrap	19,516 cf	0.27 in/hr	12,219 sf	70.9 hrs

Comment 3: Submit revised pre-development HydroCAD report.

Response 3: A&M has revised the curve number calculations for the pre-development condition to reflect the proper coverage of wooded cover, grass cover, and open space. The pre-development HydroCAD report is attached hereto.

Comment 6: P-1 infiltration basin surface should be modeled with water surface (CN 98).

Response 6: The infiltration basin has been modeled as CN 98 as suggested in the updated HydroCAD reports.

Comment 8: Reference each WQS model on the drainage plan sheet or QWS detail drawings. Under the current MSH rating, the proposed treatment trains meet the MS4 requirements.

Response 8: The WQS models have been cross referenced between the grading and drainage drawings and the details as suggested.

Comment 11: Update Stormtrap chambers and drawdown time calculations.

Response 11: Noted. Please see Comment 2 above.

Comment 12: Non WQS catch basin should be inspected and grate and sump cleaned 4 times per year as required by MSH. Subsurface structure inlets cleaning should include building gutter system, where applicable.

Response 12: Noted. This requirement shall be factored into the Operation and Maintenance report for the site.

Comment 13: Statement (re UIC registration), no response required.

Response 13: Noted. A&M shall register the subsurface recharge field with the MassDEP UIC program upon approval of the system design and prior to general use.

General comment (unnumbered): GCG is aware that the Ashland DPW is requesting an update of the TP40 precipitation data with NOAA Atlas 14. The NOAA Atlas 14 is a more intense and conservative set of rainfall data, which better matching with the current rainfall patterns. GCG agrees that the use of this data would be appropriate.

Response: A&M does not disagree with GCG's position regarding the industry transition from TP-40 to NOAA Atlas 14 for stormwater evaluation. The data supplied is in accordance with the MassDEP Stormwater standards until new precipitation values are integrated into the requirements.

A&M believes these responses will provide sufficient information for the final review of this application.

If you require any additional information, please feel free to contact me.

Very truly yours,

ALLEN & MAJOR ASSOCIATES, INC.



Philip Cordeiro, P.E.

Branch Manager

pcordeiro@allenmajor.com

cc: J. Smetana, US Senior Manager
R. Buckley, Esq., Riemer & Braunstein
T. MA – GCG Associates
File

Enclosures: Site Development Drawings – Revision 2 dated May 11, 2021
Pre-Development HydroCAD
Post-Development HydroCAD
Stormtrap shop drawings
Arbella at Ashland Waiver List dated May 12, 2021



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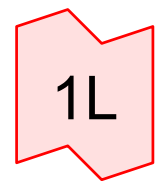
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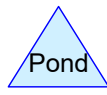
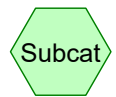
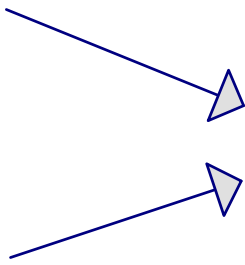
Wly Wetland



Area 1W



SE Corner



Routing Diagram for 2604-01 - Existing Conditions
Prepared by {enter your company name here}, Printed 5/12/2021
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2604-01 - Existing Conditions

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Yr	Type III 24-hr		Default	24.00	1	3.20	2
2	10 Yr	Type III 24-hr		Default	24.00	1	4.55	2
3	25 Yr	Type III 24-hr		Default	24.00	1	5.50	2
4	100 Yr	Type III 24-hr		Default	24.00	1	6.70	2

2604-01 - Existing Conditions

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.520	39	>75% Grass cover, Good, HSG A (1W, 2W, 3W)
1.866	74	>75% Grass cover, Good, HSG C (3W, 4W)
6.221	30	Woods, Good, HSG A (1W, 2W, 3W)
21.993	70	Woods, Good, HSG C (1W, 2W, 3W, 4W)
0.435	77	Woods, Good, HSG D (4W)
31.035	62	TOTAL AREA

2604-01 - Existing Conditions

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
6.741	HSG A	1W, 2W, 3W
0.000	HSG B	
23.859	HSG C	1W, 2W, 3W, 4W
0.435	HSG D	4W
0.000	Other	
31.035		TOTAL AREA

2604-01 - Existing Conditions

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.520	0.000	1.866	0.000	0.000	2.386	>75% Grass cover, Good	1W, 2W, 3W, 4W
6.221	0.000	21.993	0.435	0.000	28.649	Woods, Good	1W, 2W, 3W, 4W
6.741	0.000	23.859	0.435	0.000	31.035	TOTAL AREA	

2604-01 - Existing Conditions

Type III 24-hr 2 Yr Rainfall=3.20"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1W: Area 1W

Runoff Area=6.318 ac 0.00% Impervious Runoff Depth>0.01"
Flow Length=1,579' Tc=12.8 min CN=43 Runoff=0.02 cfs 0.006 af

Subcatchment 2W: Area 2W

Runoff Area=5.335 ac 0.00% Impervious Runoff Depth>0.26"
Flow Length=1,077' Tc=19.7 min CN=57 Runoff=0.68 cfs 0.116 af

Subcatchment 3W: Nly PL

Runoff Area=10.509 ac 0.00% Impervious Runoff Depth>0.70"
Flow Length=850' Tc=14.8 min CN=69 Runoff=6.28 cfs 0.612 af

Subcatchment 4W: Wly Wetland

Runoff Area=8.873 ac 0.00% Impervious Runoff Depth>0.79"
Flow Length=1,383' Tc=16.6 min CN=71 Runoff=5.97 cfs 0.585 af

Link 1L: SE Corner

Inflow=0.68 cfs 0.123 af
Primary=0.68 cfs 0.123 af

Total Runoff Area = 31.035 ac Runoff Volume = 1.319 af Average Runoff Depth = 0.51"
100.00% Pervious = 31.035 ac 0.00% Impervious = 0.000 ac

2604-01 - Existing Conditions

Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment 1W: Area 1W

Runoff = 0.02 cfs @ 17.28 hrs, Volume= 0.006 af, Depth> 0.01"

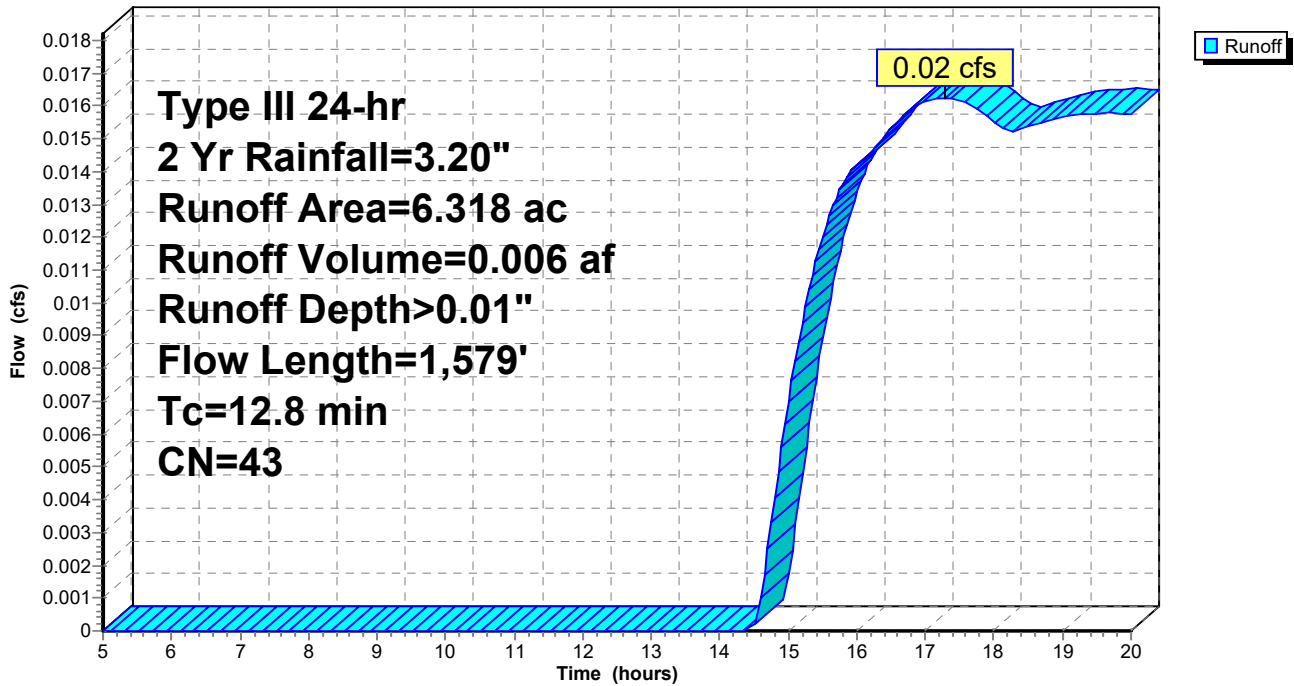
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
4.141	30	Woods, Good, HSG A
0.241	39	>75% Grass cover, Good, HSG A
1.936	70	Woods, Good, HSG C
6.318	43	Weighted Average
6.318		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
5.3	1,529	0.0900	4.83		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
12.8	1,579	Total			

Subcatchment 1W: Area 1W

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment 2W: Area 2W

Runoff = 0.68 cfs @ 12.50 hrs, Volume= 0.116 af, Depth> 0.26"

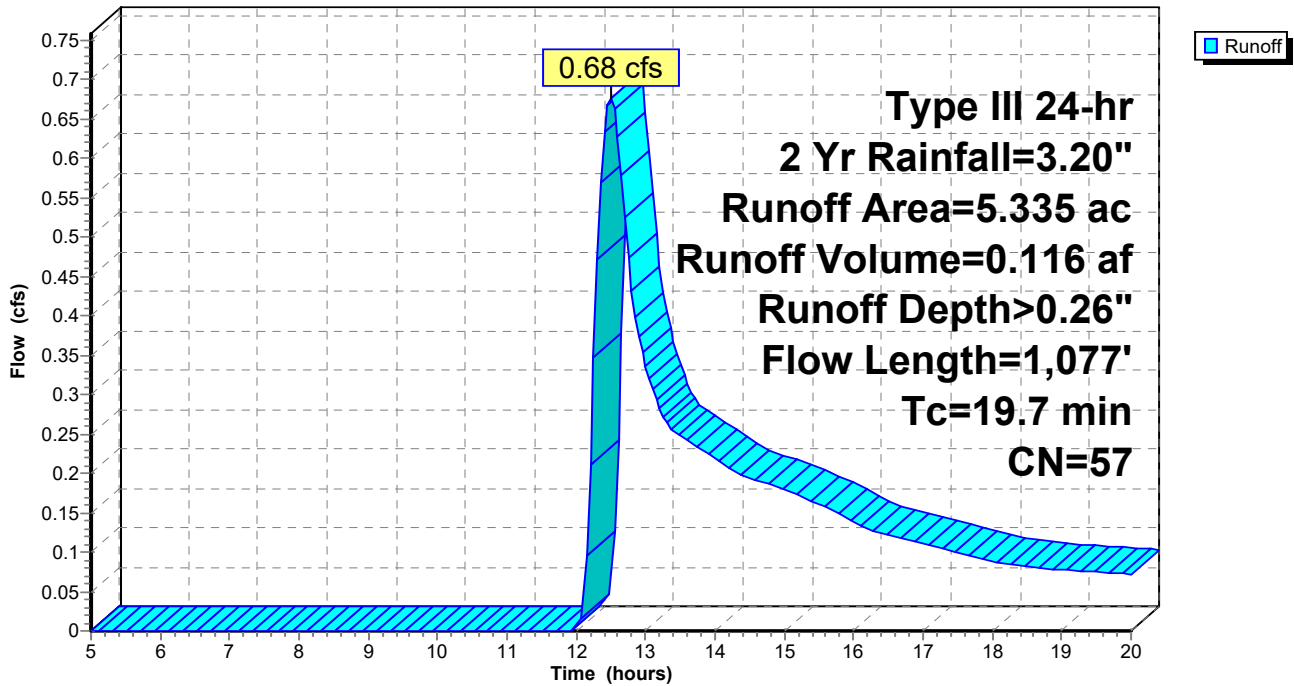
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
1.641	30	Woods, Good, HSG A
0.173	39	>75% Grass cover, Good, HSG A
3.521	70	Woods, Good, HSG C
5.335	57	Weighted Average
5.335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	1,027	0.1000	5.09		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.7	1,077	Total			

Subcatchment 2W: Area 2W

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment 3W: Nly PL

Runoff = 6.28 cfs @ 12.24 hrs, Volume= 0.612 af, Depth> 0.70"

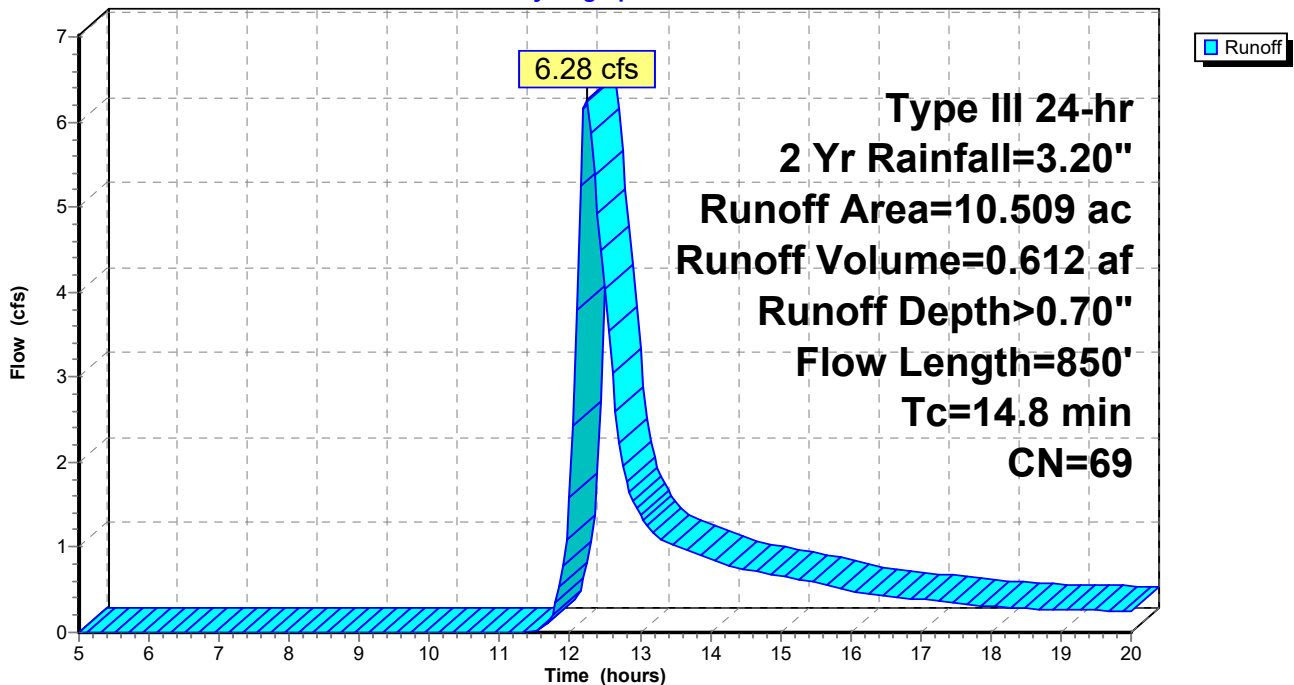
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
0.439	30	Woods, Good, HSG A
0.106	39	>75% Grass cover, Good, HSG A
8.526	70	Woods, Good, HSG C
1.438	74	>75% Grass cover, Good, HSG C
10.509	69	Weighted Average
10.509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
2.5	800	0.1100	5.34		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
14.8	850	Total			

Subcatchment 3W: Nly PL

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment 4W: Wly Wetland

Runoff = 5.97 cfs @ 12.26 hrs, Volume= 0.585 af, Depth> 0.79"

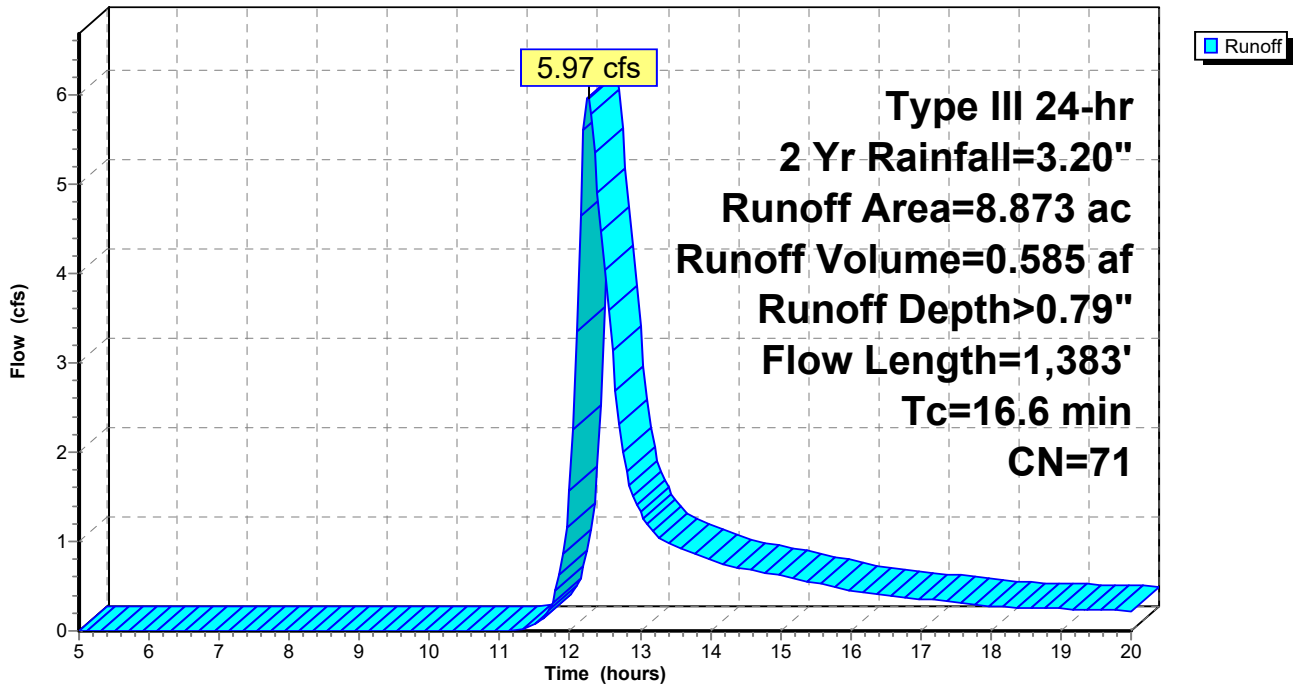
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
8.010	70	Woods, Good, HSG C
0.428	74	>75% Grass cover, Good, HSG C
0.435	77	Woods, Good, HSG D
8.873	71	Weighted Average
8.873		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.1	1,333	0.0520	3.67		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
16.6	1,383	Total			

Subcatchment 4W: Wly Wetland

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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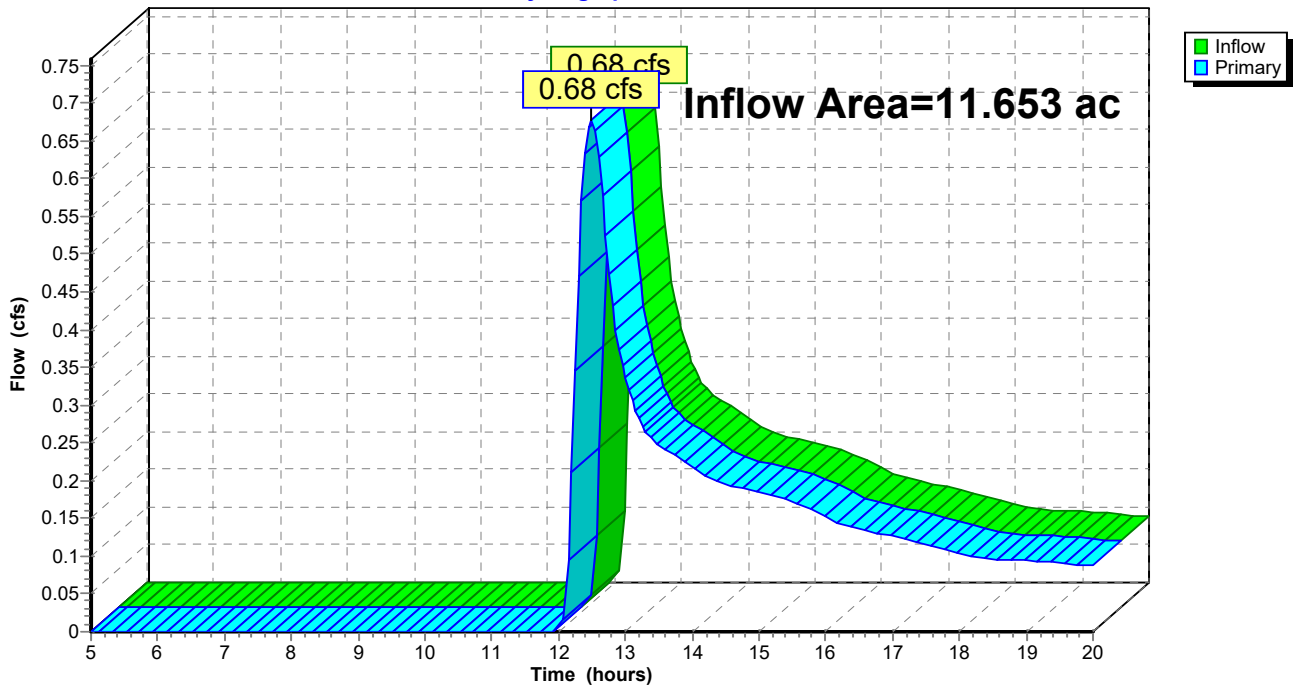
Summary for Link 1L: SE Corner

Inflow Area = 11.653 ac, 0.00% Impervious, Inflow Depth > 0.13" for 2 Yr event
Inflow = 0.68 cfs @ 12.50 hrs, Volume= 0.123 af
Primary = 0.68 cfs @ 12.50 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 10 Yr Rainfall=4.55"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1W: Area 1W

Runoff Area=6.318 ac 0.00% Impervious Runoff Depth>0.19"
Flow Length=1,579' Tc=12.8 min CN=43 Runoff=0.38 cfs 0.101 af

Subcatchment 2W: Area 2W

Runoff Area=5.335 ac 0.00% Impervious Runoff Depth>0.77"
Flow Length=1,077' Tc=19.7 min CN=57 Runoff=2.91 cfs 0.343 af

Subcatchment 3W: Nly PL

Runoff Area=10.509 ac 0.00% Impervious Runoff Depth>1.49"
Flow Length=850' Tc=14.8 min CN=69 Runoff=14.67 cfs 1.309 af

Subcatchment 4W: Wly Wetland

Runoff Area=8.873 ac 0.00% Impervious Runoff Depth>1.63"
Flow Length=1,383' Tc=16.6 min CN=71 Runoff=13.05 cfs 1.207 af

Link 1L: SE Corner

Inflow=3.14 cfs 0.444 af
Primary=3.14 cfs 0.444 af

Total Runoff Area = 31.035 ac Runoff Volume = 2.959 af Average Runoff Depth = 1.14"
100.00% Pervious = 31.035 ac 0.00% Impervious = 0.000 ac

2604-01 - Existing Conditions

Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment 1W: Area 1W

Runoff = 0.38 cfs @ 12.52 hrs, Volume= 0.101 af, Depth> 0.19"

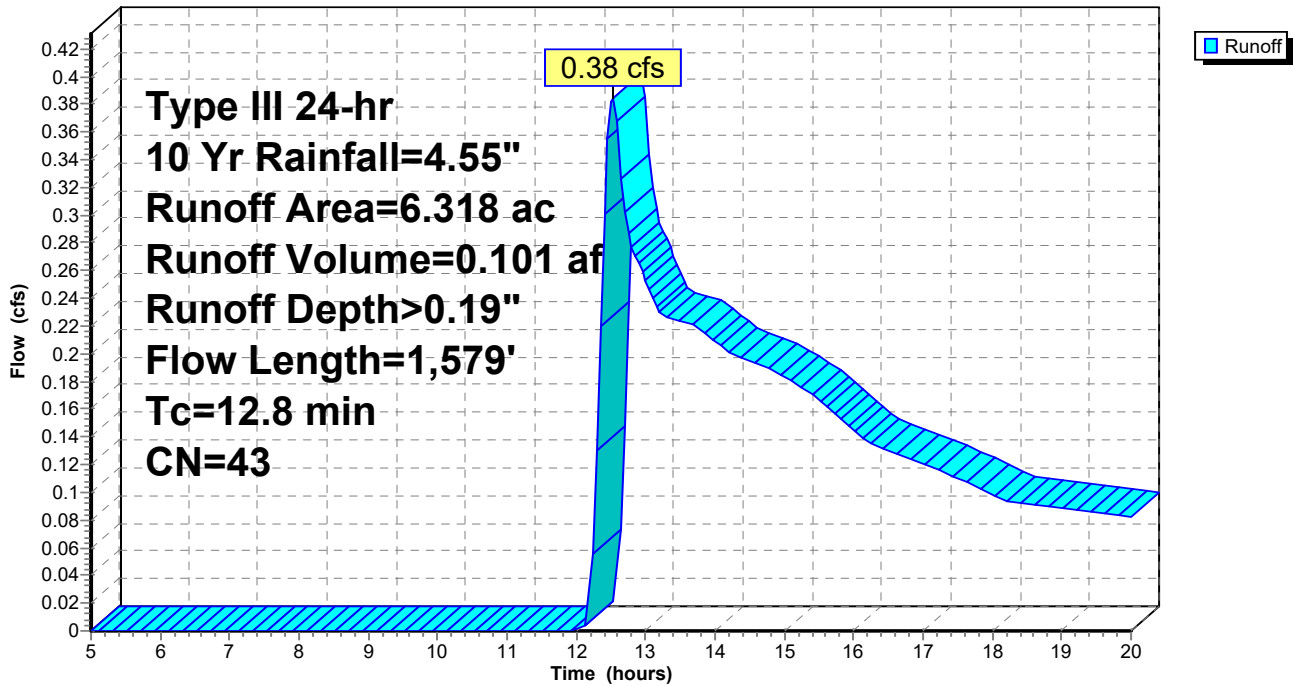
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
4.141	30	Woods, Good, HSG A
0.241	39	>75% Grass cover, Good, HSG A
1.936	70	Woods, Good, HSG C
6.318	43	Weighted Average
6.318		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
5.3	1,529	0.0900	4.83		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
12.8	1,579	Total			

Subcatchment 1W: Area 1W

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment 2W: Area 2W

Runoff = 2.91 cfs @ 12.34 hrs, Volume= 0.343 af, Depth> 0.77"

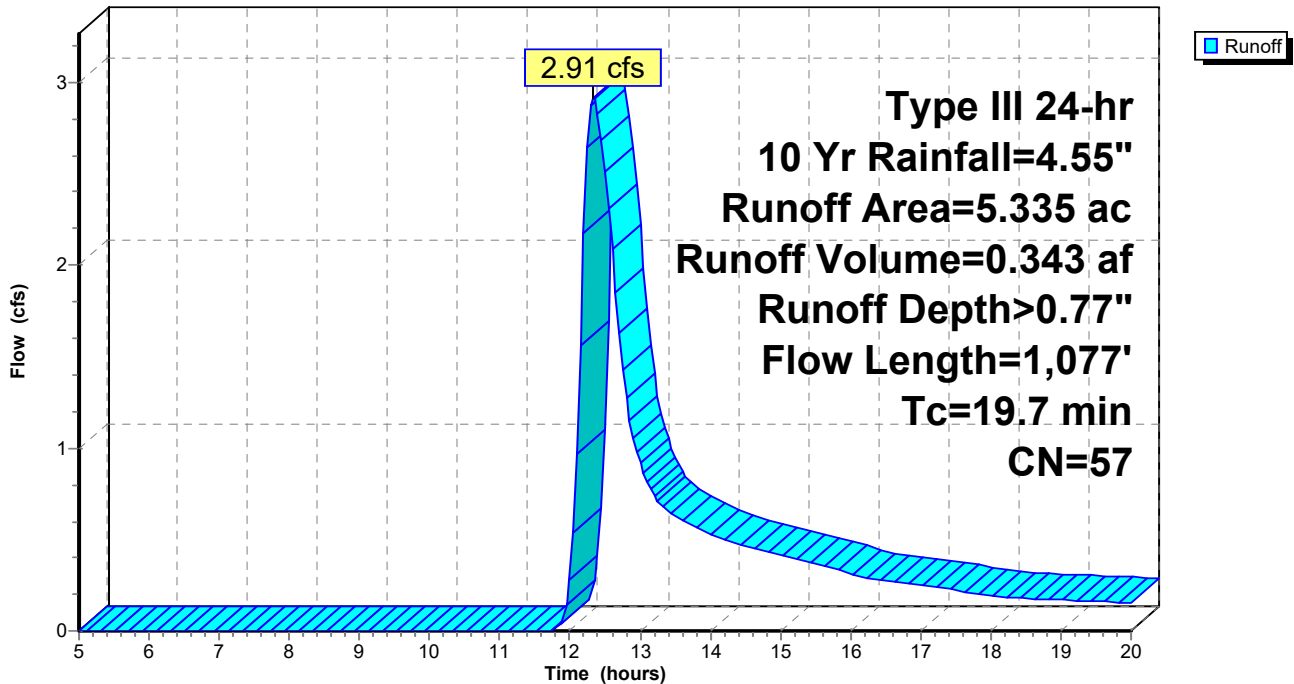
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
1.641	30	Woods, Good, HSG A
0.173	39	>75% Grass cover, Good, HSG A
3.521	70	Woods, Good, HSG C
5.335	57	Weighted Average
5.335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	1,027	0.1000	5.09		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.7	1,077	Total			

Subcatchment 2W: Area 2W

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment 3W: Nly PL

Runoff = 14.67 cfs @ 12.22 hrs, Volume= 1.309 af, Depth> 1.49"

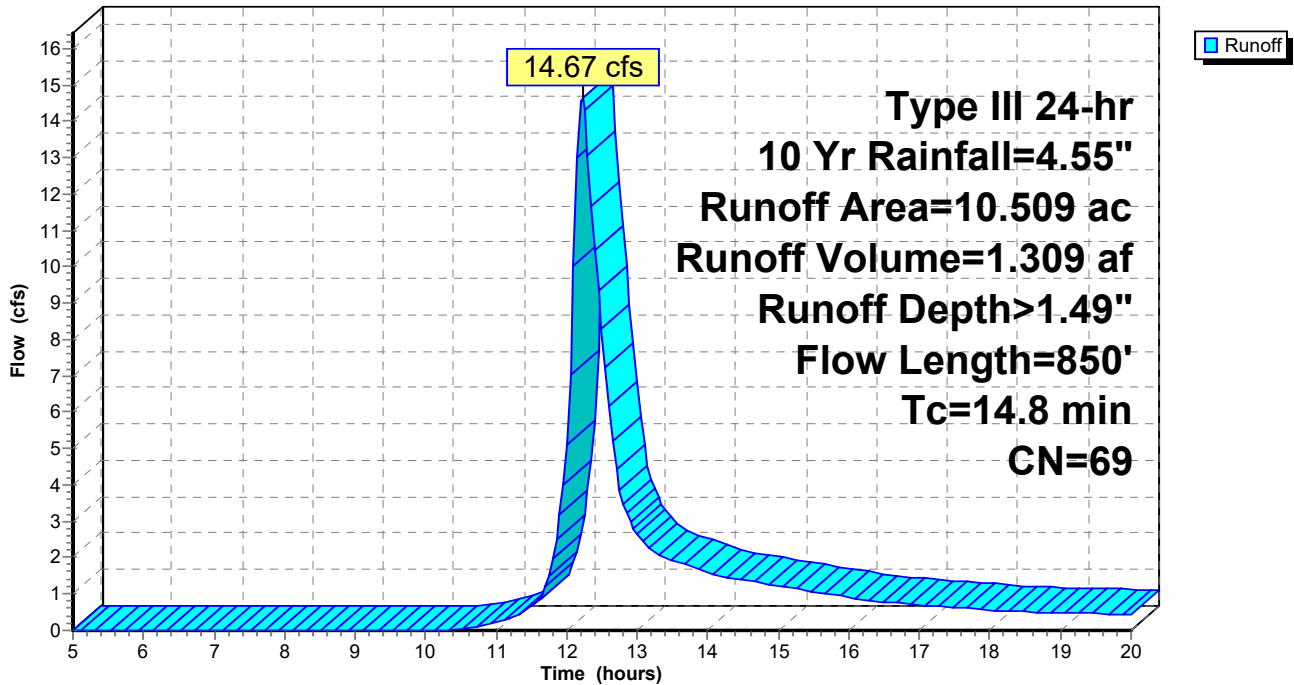
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
0.439	30	Woods, Good, HSG A
0.106	39	>75% Grass cover, Good, HSG A
8.526	70	Woods, Good, HSG C
1.438	74	>75% Grass cover, Good, HSG C
10.509	69	Weighted Average
10.509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
2.5	800	0.1100	5.34		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
14.8	850	Total			

Subcatchment 3W: Nly PL

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment 4W: Wly Wetland

Runoff = 13.05 cfs @ 12.24 hrs, Volume= 1.207 af, Depth> 1.63"

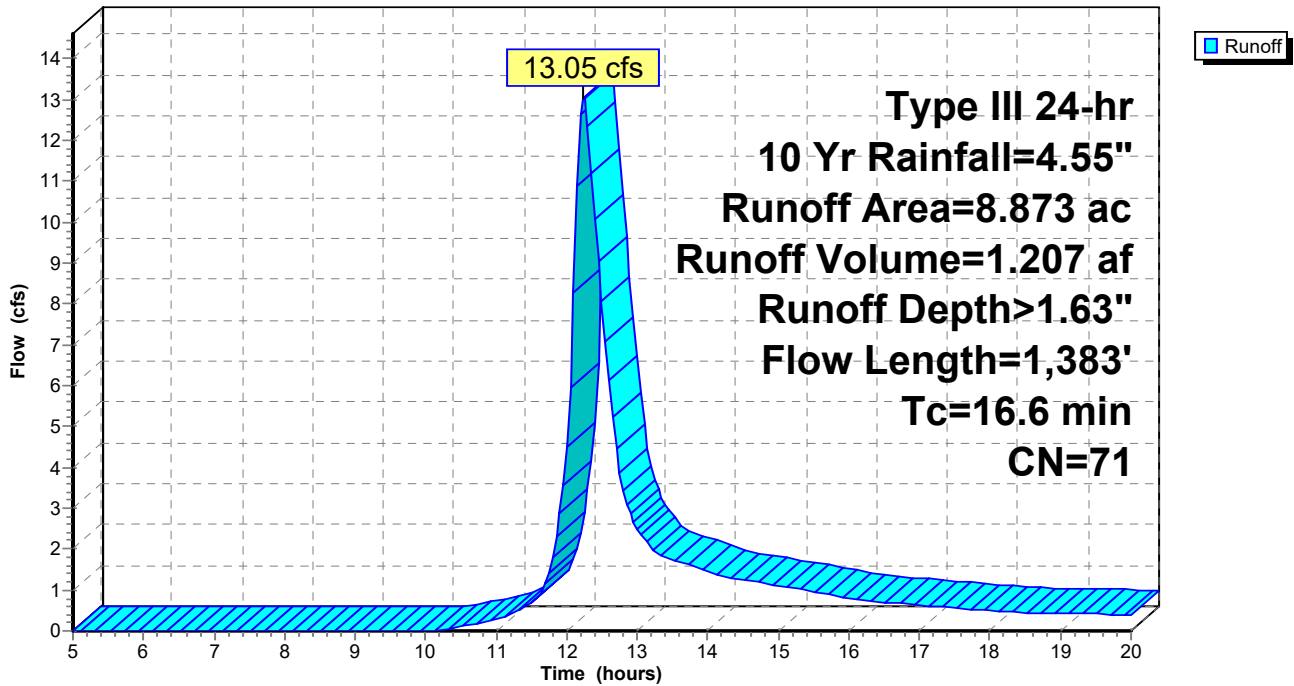
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
8.010	70	Woods, Good, HSG C
0.428	74	>75% Grass cover, Good, HSG C
0.435	77	Woods, Good, HSG D
8.873	71	Weighted Average
8.873		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.1	1,333	0.0520	3.67		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
16.6	1,383	Total			

Subcatchment 4W: Wly Wetland

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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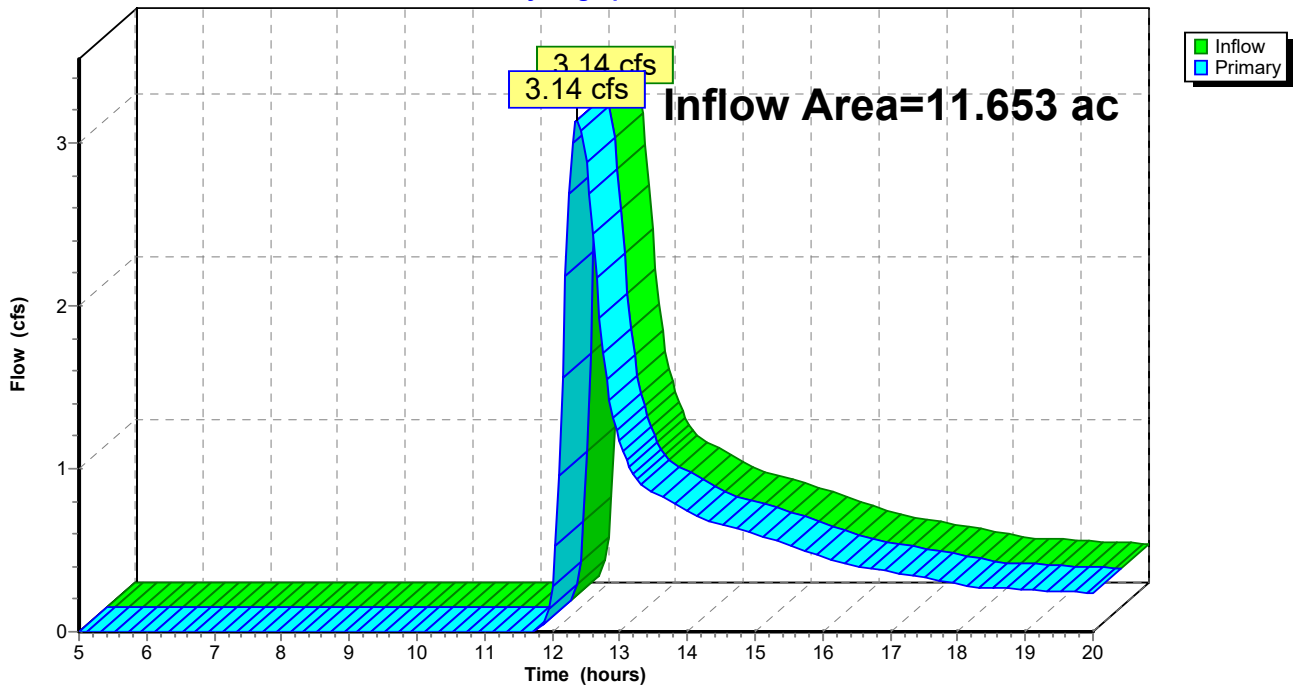
Summary for Link 1L: SE Corner

Inflow Area = 11.653 ac, 0.00% Impervious, Inflow Depth > 0.46" for 10 Yr event
Inflow = 3.14 cfs @ 12.37 hrs, Volume= 0.444 af
Primary = 3.14 cfs @ 12.37 hrs, Volume= 0.444 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 25 Yr Rainfall=5.50"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1W: Area 1W

Runoff Area=6.318 ac 0.00% Impervious Runoff Depth>0.43"
Flow Length=1,579' Tc=12.8 min CN=43 Runoff=1.37 cfs 0.224 af

Subcatchment 2W: Area 2W

Runoff Area=5.335 ac 0.00% Impervious Runoff Depth>1.24"
Flow Length=1,077' Tc=19.7 min CN=57 Runoff=5.14 cfs 0.550 af

Subcatchment 3W: Nly PL

Runoff Area=10.509 ac 0.00% Impervious Runoff Depth>2.14"
Flow Length=850' Tc=14.8 min CN=69 Runoff=21.35 cfs 1.874 af

Subcatchment 4W: Wly Wetland

Runoff Area=8.873 ac 0.00% Impervious Runoff Depth>2.30"
Flow Length=1,383' Tc=16.6 min CN=71 Runoff=18.62 cfs 1.704 af

Link 1L: SE Corner

Inflow=6.42 cfs 0.774 af
Primary=6.42 cfs 0.774 af

Total Runoff Area = 31.035 ac Runoff Volume = 4.352 af Average Runoff Depth = 1.68"
100.00% Pervious = 31.035 ac 0.00% Impervious = 0.000 ac

2604-01 - Existing Conditions

Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment 1W: Area 1W

Runoff = 1.37 cfs @ 12.40 hrs, Volume= 0.224 af, Depth> 0.43"

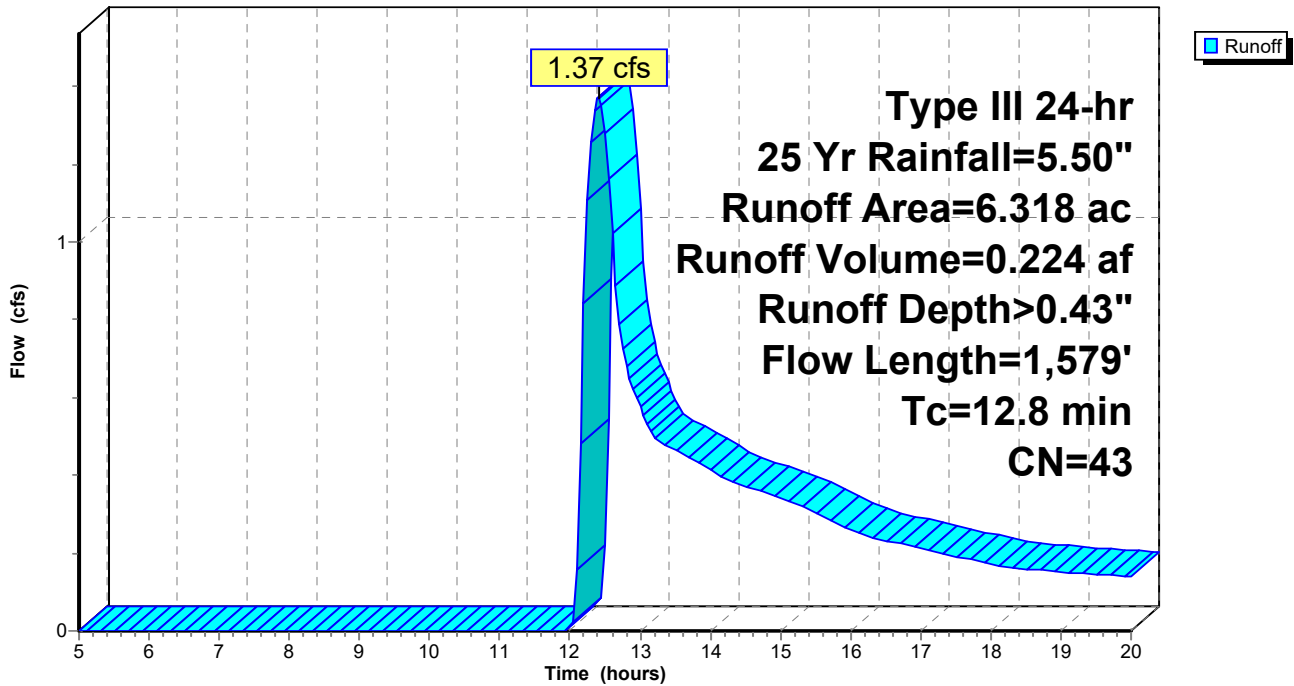
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
4.141	30	Woods, Good, HSG A
0.241	39	>75% Grass cover, Good, HSG A
1.936	70	Woods, Good, HSG C
6.318	43	Weighted Average
6.318		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
5.3	1,529	0.0900	4.83		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
12.8	1,579	Total			

Subcatchment 1W: Area 1W

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment 2W: Area 2W

Runoff = 5.14 cfs @ 12.31 hrs, Volume= 0.550 af, Depth> 1.24"

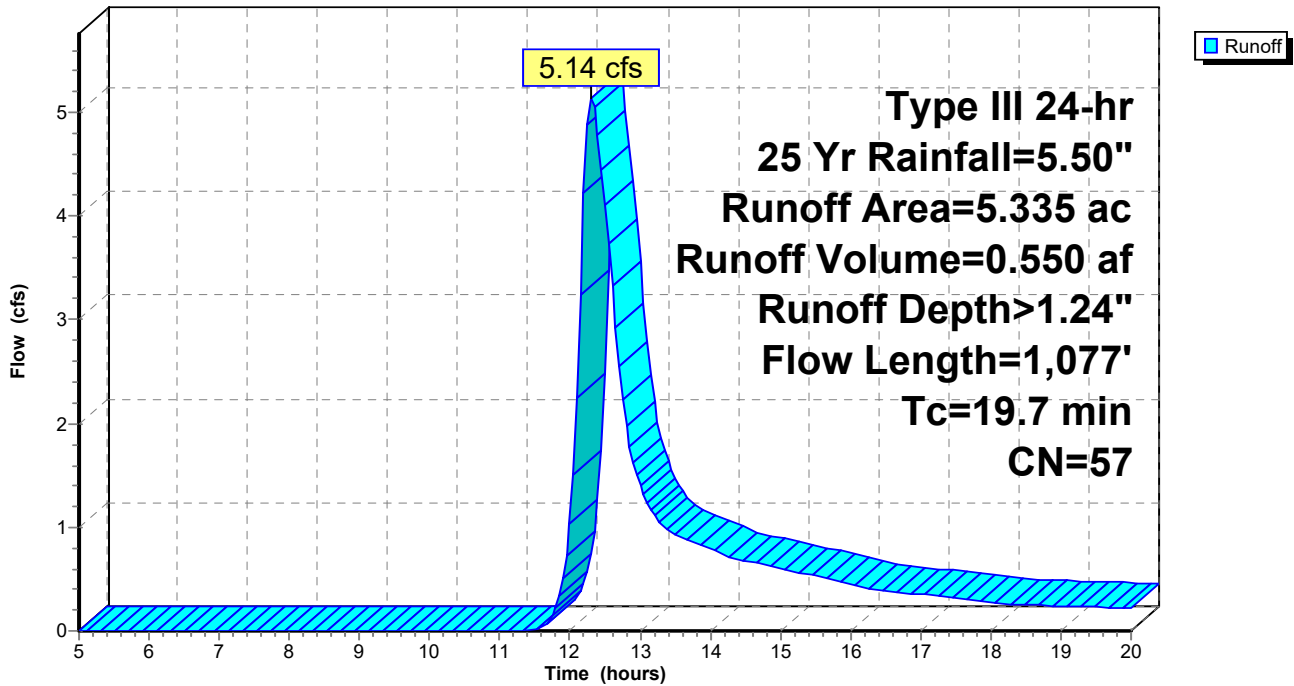
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
1.641	30	Woods, Good, HSG A
0.173	39	>75% Grass cover, Good, HSG A
3.521	70	Woods, Good, HSG C
5.335	57	Weighted Average
5.335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	1,027	0.1000	5.09		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.7	1,077	Total			

Subcatchment 2W: Area 2W

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment 3W: Nly PL

Runoff = 21.35 cfs @ 12.21 hrs, Volume= 1.874 af, Depth> 2.14"

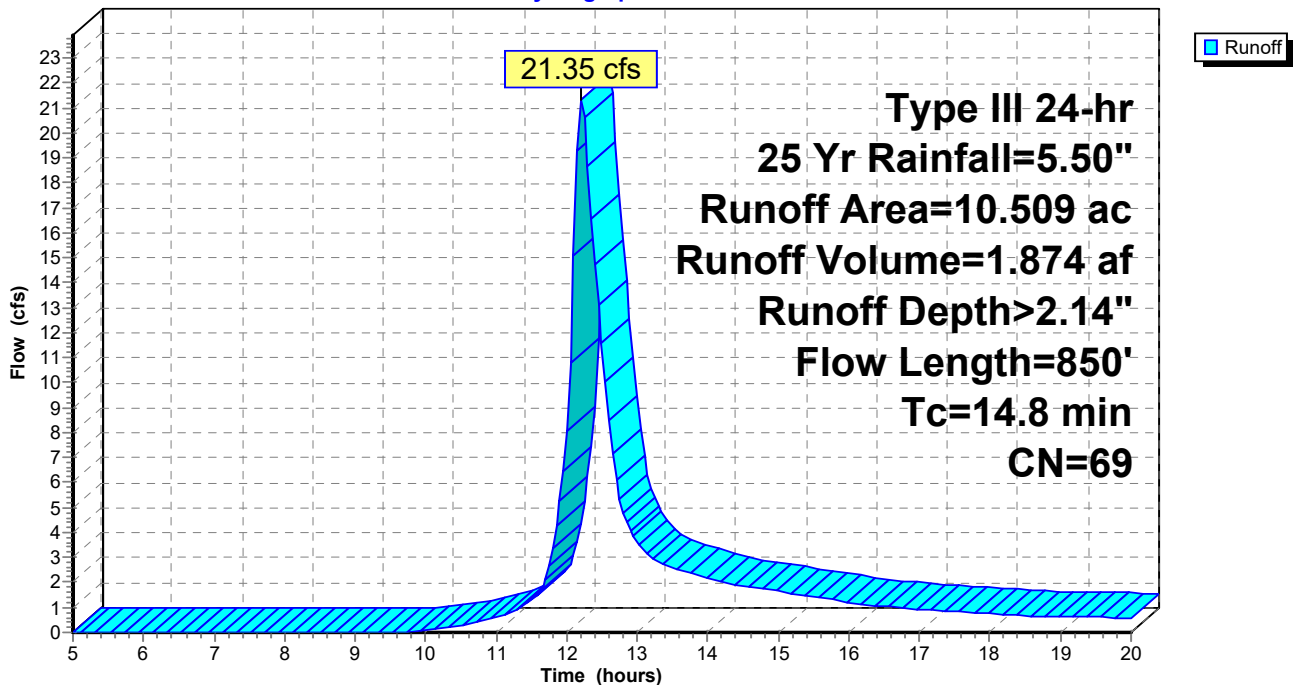
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
0.439	30	Woods, Good, HSG A
0.106	39	>75% Grass cover, Good, HSG A
8.526	70	Woods, Good, HSG C
1.438	74	>75% Grass cover, Good, HSG C
10.509	69	Weighted Average
10.509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
2.5	800	0.1100	5.34		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
14.8	850	Total			

Subcatchment 3W: Nly PL

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment 4W: Wly Wetland

Runoff = 18.62 cfs @ 12.24 hrs, Volume= 1.704 af, Depth> 2.30"

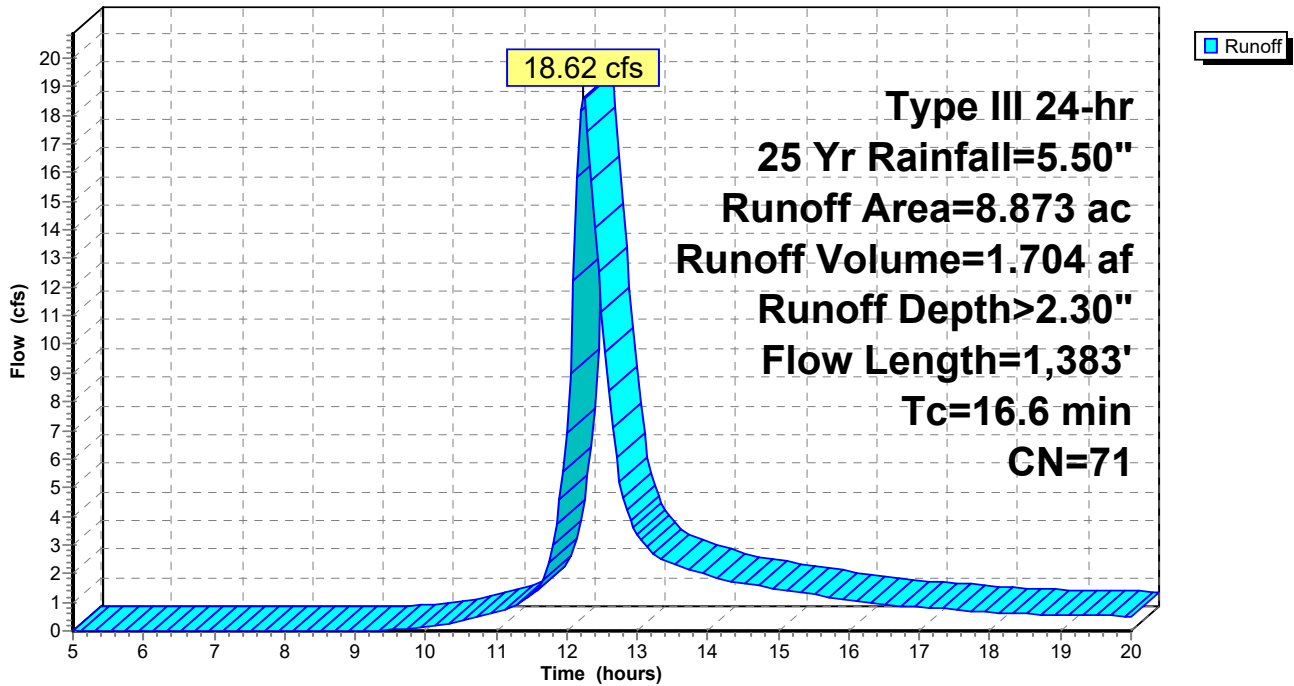
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
8.010	70	Woods, Good, HSG C
0.428	74	>75% Grass cover, Good, HSG C
0.435	77	Woods, Good, HSG D
8.873	71	Weighted Average
8.873		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.1	1,333	0.0520	3.67		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
16.6	1,383	Total			

Subcatchment 4W: Wly Wetland

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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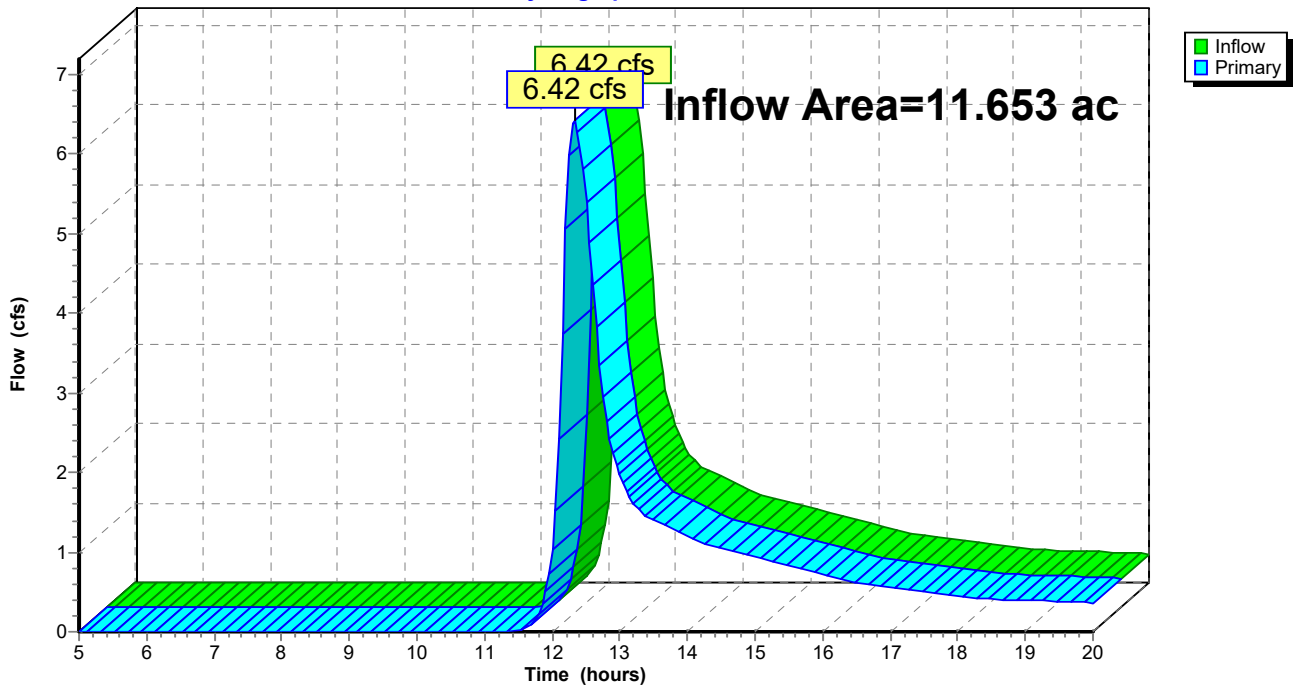
Summary for Link 1L: SE Corner

Inflow Area = 11.653 ac, 0.00% Impervious, Inflow Depth > 0.80" for 25 Yr event
Inflow = 6.42 cfs @ 12.33 hrs, Volume= 0.774 af
Primary = 6.42 cfs @ 12.33 hrs, Volume= 0.774 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 100 Yr Rainfall=6.70"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1W: Area 1W

Runoff Area=6.318 ac 0.00% Impervious Runoff Depth>0.83"
Flow Length=1,579' Tc=12.8 min CN=43 Runoff=3.55 cfs 0.434 af

Subcatchment 2W: Area 2W

Runoff Area=5.335 ac 0.00% Impervious Runoff Depth>1.92"
Flow Length=1,077' Tc=19.7 min CN=57 Runoff=8.38 cfs 0.852 af

Subcatchment 3W: Nly PL

Runoff Area=10.509 ac 0.00% Impervious Runoff Depth>3.02"
Flow Length=850' Tc=14.8 min CN=69 Runoff=30.36 cfs 2.648 af

Subcatchment 4W: Wly Wetland

Runoff Area=8.873 ac 0.00% Impervious Runoff Depth>3.22"
Flow Length=1,383' Tc=16.6 min CN=71 Runoff=26.06 cfs 2.379 af

Link 1L: SE Corner

Inflow=11.85 cfs 1.286 af
Primary=11.85 cfs 1.286 af

Total Runoff Area = 31.035 ac Runoff Volume = 6.313 af Average Runoff Depth = 2.44"
100.00% Pervious = 31.035 ac 0.00% Impervious = 0.000 ac

2604-01 - Existing Conditions

Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment 1W: Area 1W

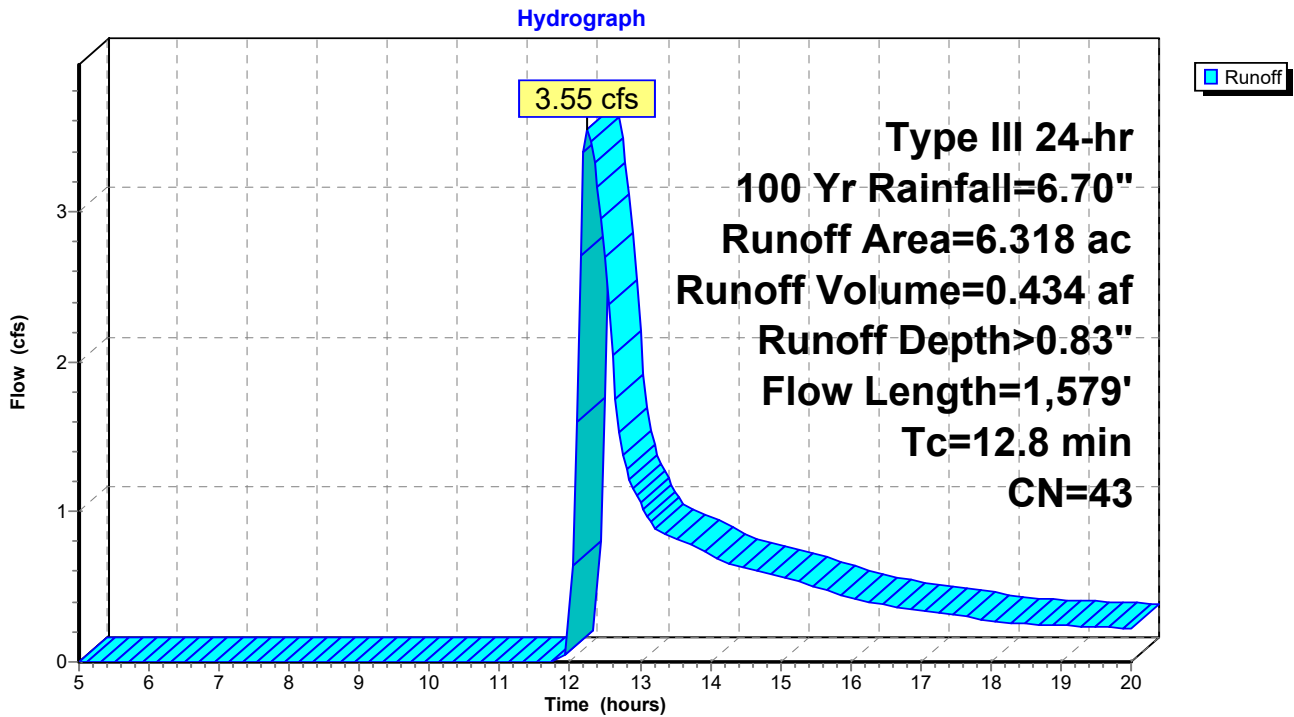
Runoff = 3.55 cfs @ 12.26 hrs, Volume= 0.434 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
4.141	30	Woods, Good, HSG A
0.241	39	>75% Grass cover, Good, HSG A
1.936	70	Woods, Good, HSG C
6.318	43	Weighted Average
6.318		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
5.3	1,529	0.0900	4.83		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
12.8	1,579	Total			

Subcatchment 1W: Area 1W



2604-01 - Existing Conditions

Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment 2W: Area 2W

Runoff = 8.38 cfs @ 12.30 hrs, Volume= 0.852 af, Depth> 1.92"

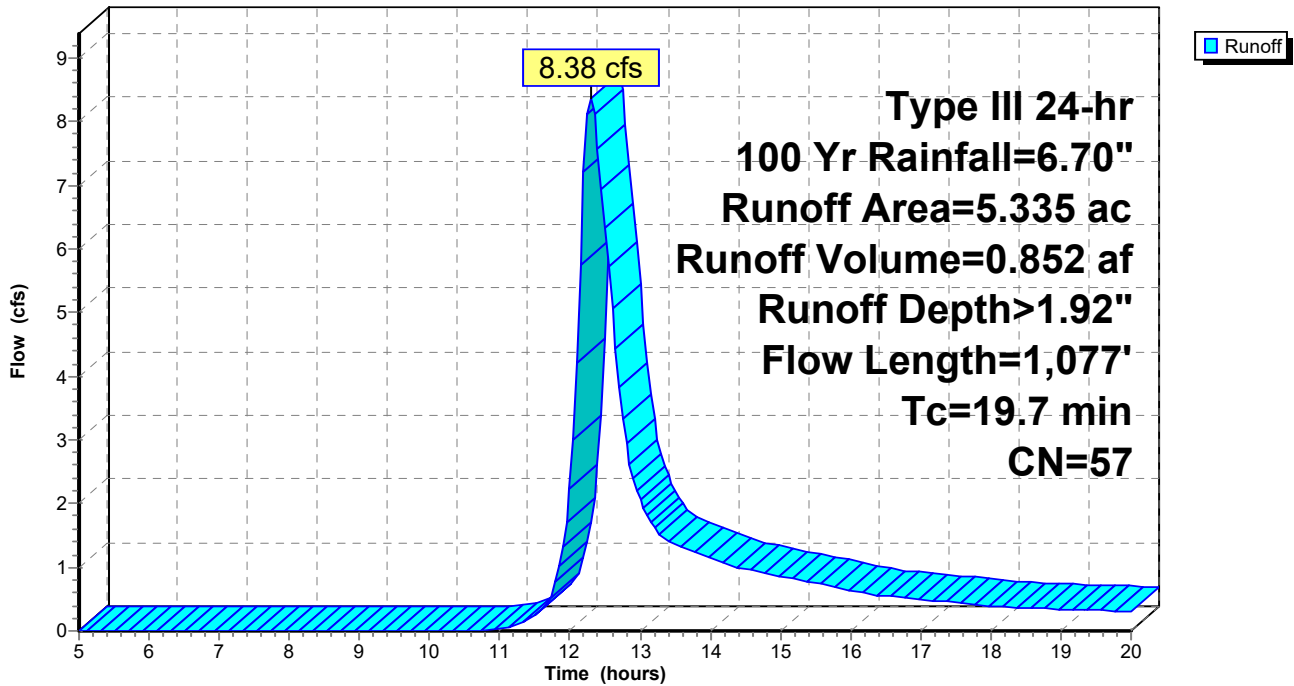
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
1.641	30	Woods, Good, HSG A
0.173	39	>75% Grass cover, Good, HSG A
3.521	70	Woods, Good, HSG C
5.335	57	Weighted Average
5.335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	1,027	0.1000	5.09		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.7	1,077	Total			

Subcatchment 2W: Area 2W

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment 3W: Nly PL

Runoff = 30.36 cfs @ 12.21 hrs, Volume= 2.648 af, Depth> 3.02"

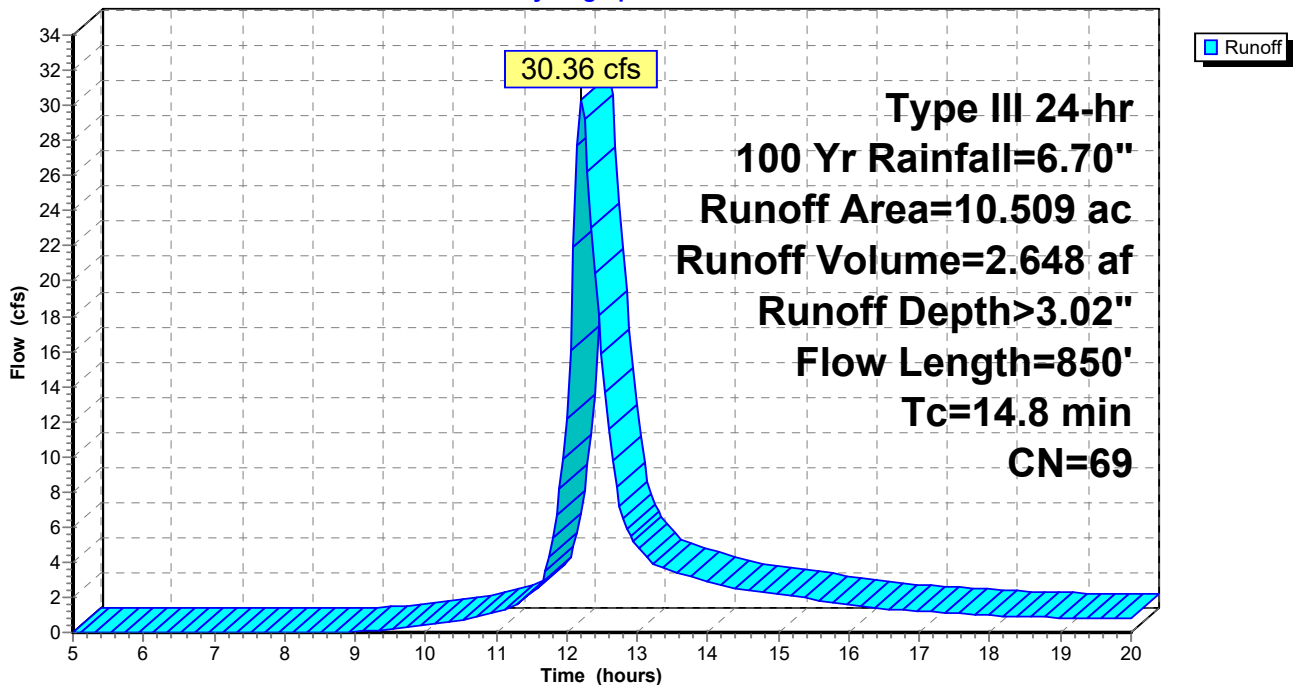
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
0.439	30	Woods, Good, HSG A
0.106	39	>75% Grass cover, Good, HSG A
8.526	70	Woods, Good, HSG C
1.438	74	>75% Grass cover, Good, HSG C
10.509	69	Weighted Average
10.509		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
2.5	800	0.1100	5.34		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
14.8	850	Total			

Subcatchment 3W: Nly PL

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment 4W: Wly Wetland

Runoff = 26.06 cfs @ 12.23 hrs, Volume= 2.379 af, Depth> 3.22"

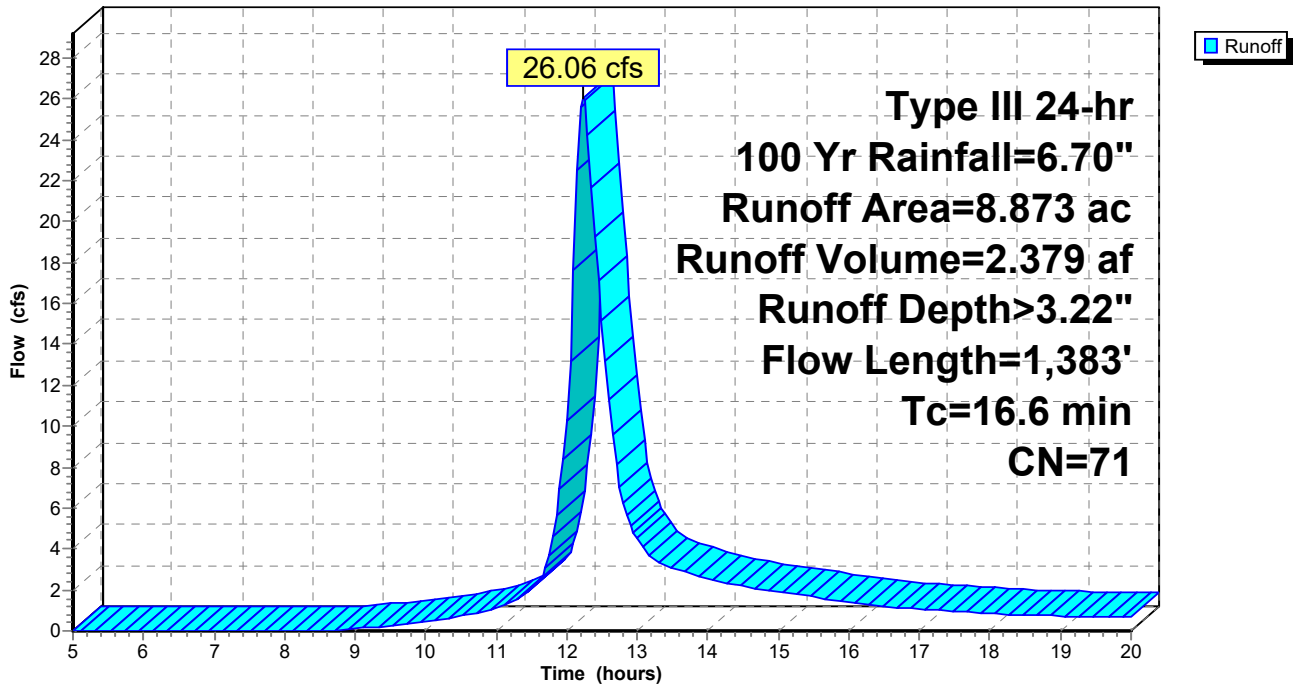
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
8.010	70	Woods, Good, HSG C
0.428	74	>75% Grass cover, Good, HSG C
0.435	77	Woods, Good, HSG D
8.873	71	Weighted Average
8.873		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.1	1,333	0.0520	3.67		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
16.6	1,383	Total			

Subcatchment 4W: Wly Wetland

Hydrograph



2604-01 - Existing Conditions

Type III 24-hr 100 Yr Rainfall=6.70"

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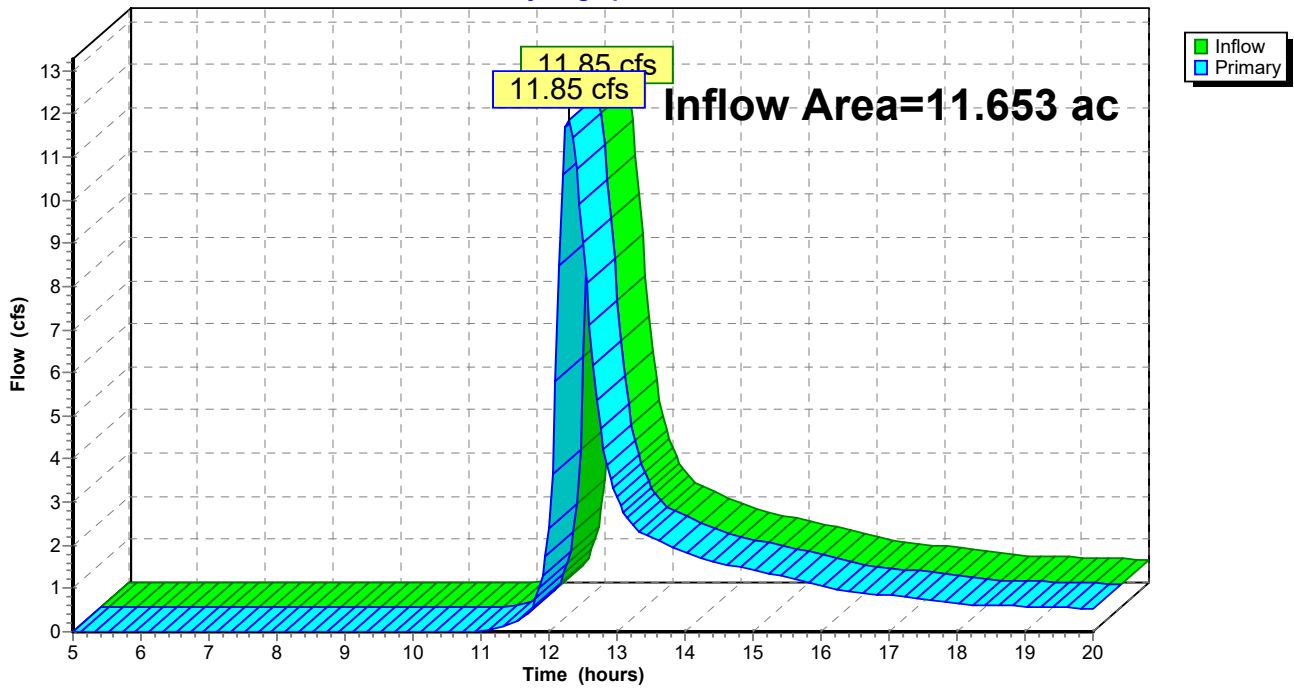
Summary for Link 1L: SE Corner

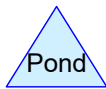
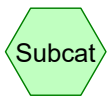
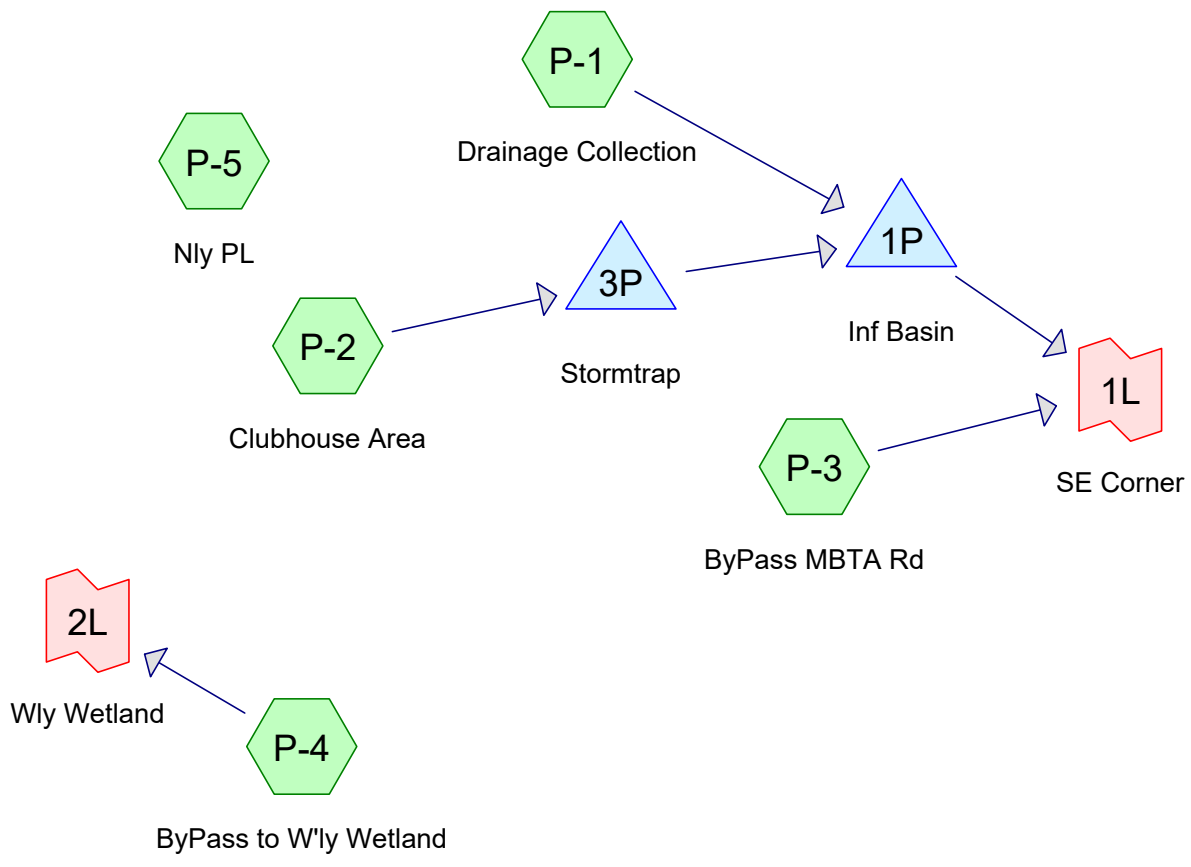
Inflow Area = 11.653 ac, 0.00% Impervious, Inflow Depth > 1.32" for 100 Yr event
Inflow = 11.85 cfs @ 12.29 hrs, Volume= 1.286 af
Primary = 11.85 cfs @ 12.29 hrs, Volume= 1.286 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph





Routing Diagram for 2604-01 - Proposed Conditions Revisions
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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Yr	Type III 24-hr		Default	24.00	1	3.20	2
2	10 Yr	Type III 24-hr		Default	24.00	1	4.55	2
3	25 Yr	Type III 24-hr		Default	24.00	1	5.50	2
4	100 Yr	Type III 24-hr		Default	24.00	1	6.70	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.630	39	>75% Grass cover, Good, HSG A (P-1, P-3, P-5)
7.748	74	>75% Grass cover, Good, HSG C (P-1, P-2, P-3, P-4, P-5)
0.339	98	Paved parking, HSG A (P-1)
3.792	98	Paved parking, HSG C (P-1, P-2, P-4, P-5)
0.311	98	Paved roads w/curbs & sewers, HSG A (P-3)
2.082	98	Roofs, HSG C (P-1, P-2)
0.023	98	Unconnected pavement, HSG C (P-4)
0.210	98	Unconnected roofs, HSG C (P-4)
0.400	98	Water Surface, 0% imp, HSG A (P-1)
3.490	30	Woods, Good, HSG A (P-1, P-3, P-5)
9.580	70	Woods, Good, HSG C (P-1, P-3, P-4, P-5)
0.430	77	Woods, Good, HSG D (P-4)
31.035	70	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
7.170	HSG A	P-1, P-3, P-5
0.000	HSG B	
23.435	HSG C	P-1, P-2, P-3, P-4, P-5
0.430	HSG D	P-4
0.000	Other	
31.035		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
2.630	0.000	7.748	0.000	0.000	10.378	>75% Grass cover, Good	P-1, P-2, P-3, P-4, P-5
0.339	0.000	3.792	0.000	0.000	4.131	Paved parking	P-1, P-2, P-4, P-5
0.311	0.000	0.000	0.000	0.000	0.311	Paved roads w/curbs & sewers	P-3
0.000	0.000	2.082	0.000	0.000	2.082	Roofs	P-1, P-2
0.000	0.000	0.023	0.000	0.000	0.023	Unconnected pavement	P-4
0.000	0.000	0.210	0.000	0.000	0.210	Unconnected roofs	P-4
0.400	0.000	0.000	0.000	0.000	0.400	Water Surface, 0% imp	P-1
3.490	0.000	9.580	0.430	0.000	13.500	Woods, Good	P-1, P-3, P-4, P-5
7.170	0.000	23.435	0.430	0.000	31.035	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	1P	280.91	277.45	119.0	0.0291	0.012	0.0	24.0	0.0
2	3P	350.00	348.52	74.0	0.0200	0.012	0.0	24.0	0.0

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Type III 24-hr 2 Yr Rainfall=3.20"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Drainage Collection Runoff Area=8.041 ac 30.37% Impervious Runoff Depth>1.15"
Flow Length=345' Tc=14.0 min CN=76 Runoff=8.06 cfs 0.769 af

Subcatchment P-2: Clubhouse Area Runoff Area=5.263 ac 70.70% Impervious Runoff Depth>2.25"
Flow Length=305' Tc=12.5 min CN=91 Runoff=11.06 cfs 0.989 af

Subcatchment P-3: ByPass MBTA Rd Runoff Area=8.056 ac 3.86% Impervious Runoff Depth>0.17"
Flow Length=1,801' Tc=19.5 min CN=52 Runoff=0.33 cfs 0.115 af

Subcatchment P-4: ByPass to W'ly Wetland Runoff Area=7.265 ac 3.48% Impervious Runoff Depth>0.93"
Flow Length=258' Tc=13.6 min CN=72 Runoff=5.67 cfs 0.561 af

Subcatchment P-5: Nly PL Runoff Area=2.410 ac 1.24% Impervious Runoff Depth>0.60"
Flow Length=77' Tc=8.0 min CN=65 Runoff=1.21 cfs 0.120 af

Pond 1P: Inf Basin Peak Elev=284.18' Storage=7,987 cf Inflow=8.06 cfs 0.969 af
Discarded=2.43 cfs 0.967 af Primary=0.00 cfs 0.000 af Outflow=2.43 cfs 0.967 af

Pond 3P: Stormtrap Peak Elev=356.08' Storage=30,940 cf Inflow=11.06 cfs 0.989 af
Discarded=0.09 cfs 0.115 af Primary=0.45 cfs 0.200 af Outflow=0.54 cfs 0.315 af

Link 1L: SE Corner Inflow=0.33 cfs 0.115 af
Primary=0.33 cfs 0.115 af

Link 2L: Wly Wetland Inflow=5.67 cfs 0.561 af
Primary=5.67 cfs 0.561 af

Total Runoff Area = 31.035 ac Runoff Volume = 2.554 af Average Runoff Depth = 0.99"
78.23% Pervious = 24.278 ac 21.77% Impervious = 6.757 ac

2604-01 - Proposed Conditions Revisions

Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment P-1: Drainage Collection

Runoff = 8.06 cfs @ 12.21 hrs, Volume= 0.769 af, Depth> 1.15"

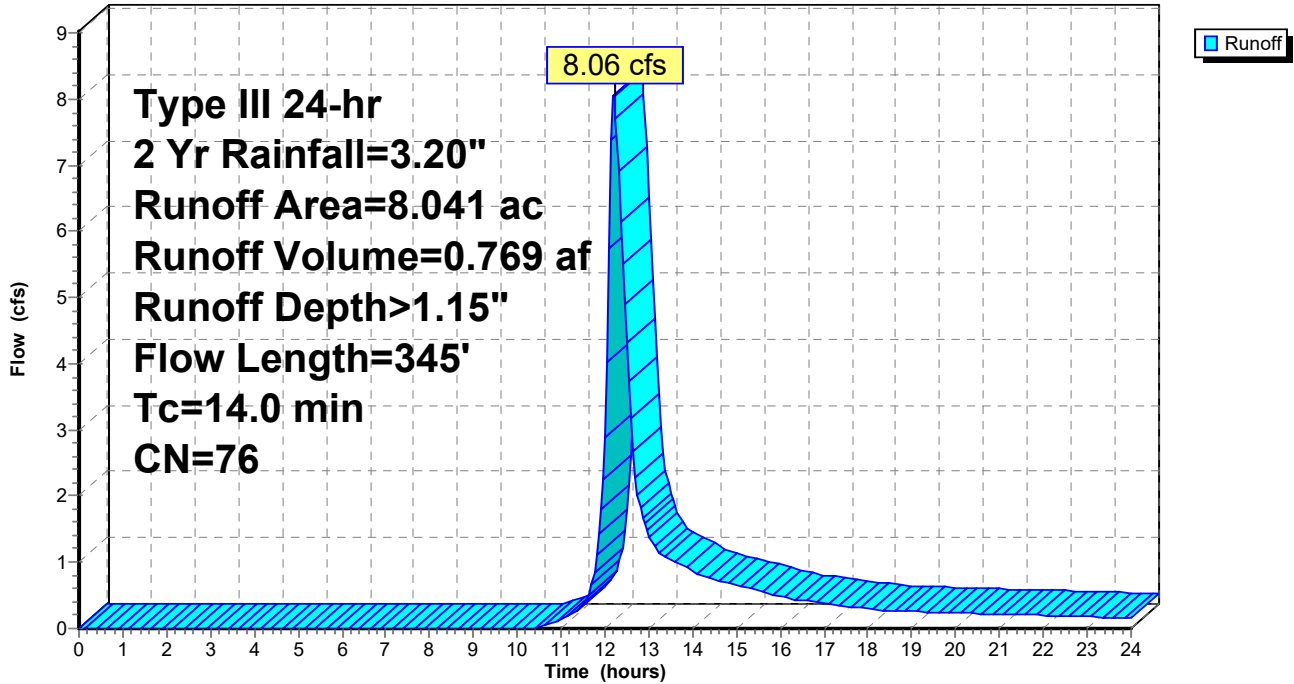
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
0.080	30	Woods, Good, HSG A
1.391	39	>75% Grass cover, Good, HSG A
0.339	98	Paved parking, HSG A
0.294	70	Woods, Good, HSG C
3.434	74	>75% Grass cover, Good, HSG C
1.412	98	Paved parking, HSG C
0.691	98	Roofs, HSG C
0.400	98	Water Surface, 0% imp, HSG A
8.041	76	Weighted Average
5.599		69.63% Pervious Area
2.442		30.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	145	0.0470	3.49		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.1	62	0.3300	9.25		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.9	88	0.0100	1.61		Shallow Concentrated Flow, D-E Unpaved Kv= 16.1 fps
14.0	345	Total			

Subcatchment P-1: Drainage Collection

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment P-2: Clubhouse Area

Runoff = 11.06 cfs @ 12.17 hrs, Volume= 0.989 af, Depth> 2.25"

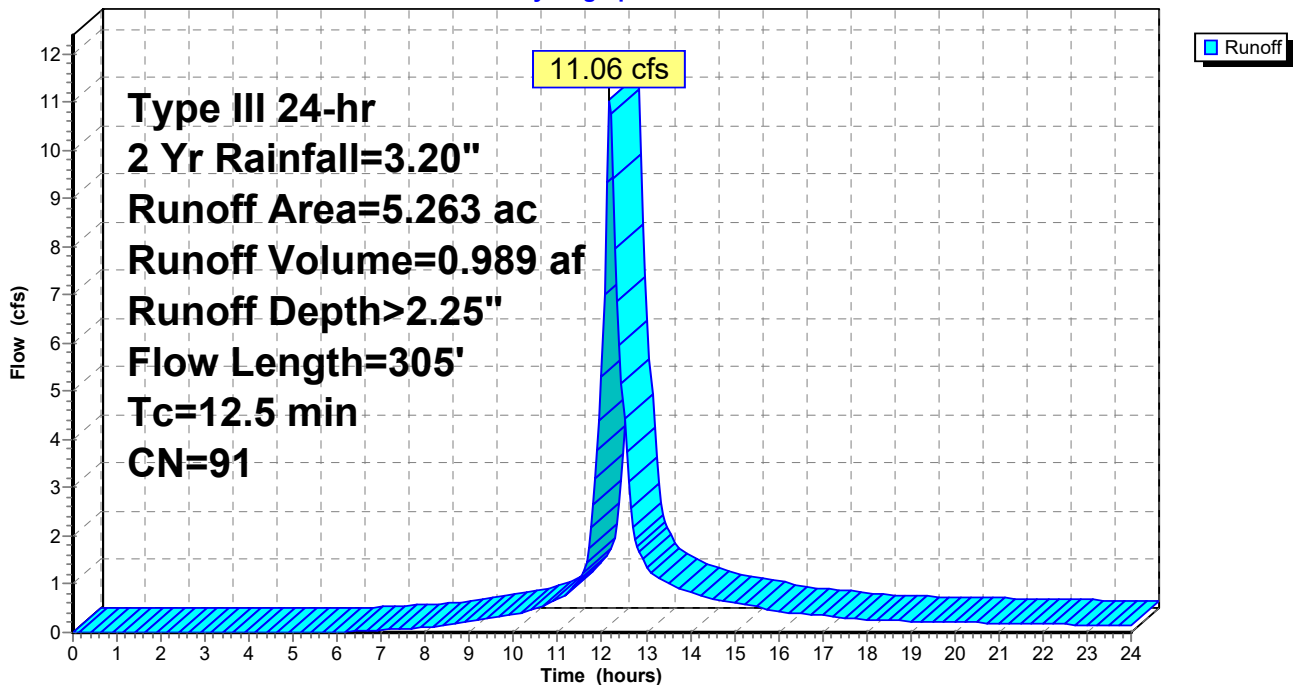
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
1.542	74	>75% Grass cover, Good, HSG C
2.330	98	Paved parking, HSG C
1.391	98	Roofs, HSG C
5.263	91	Weighted Average
1.542		29.30% Pervious Area
3.721		70.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.20"
0.7	89	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
1.0	166	0.0200	2.87		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
12.5	305	Total			

Subcatchment P-2: Clubhouse Area

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment P-3: ByPass MBTA Rd

Runoff = 0.33 cfs @ 12.62 hrs, Volume= 0.115 af, Depth> 0.17"

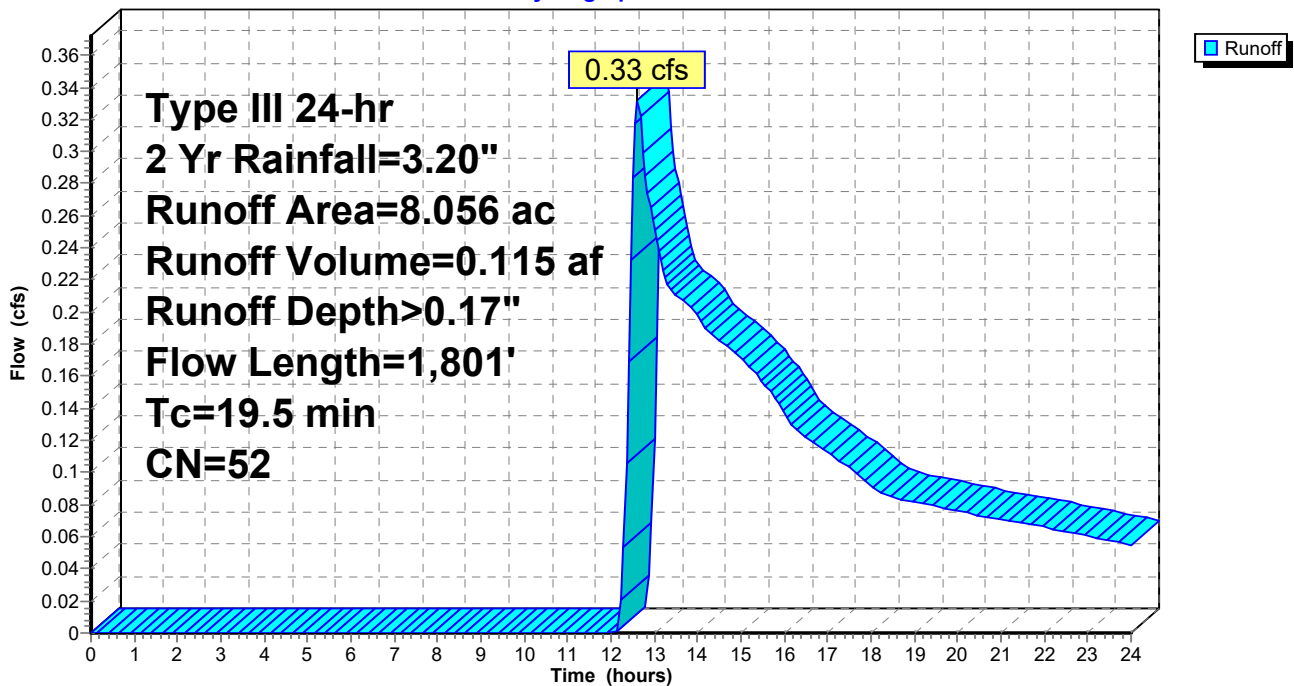
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
3.340	30	Woods, Good, HSG A
0.600	39	>75% Grass cover, Good, HSG A
3.306	70	Woods, Good, HSG C
0.380	74	>75% Grass cover, Good, HSG C
0.311	98	Paved roads w/curbs & sewers, HSG A
0.119	39	>75% Grass cover, Good, HSG A
8.056	52	Weighted Average
7.745		96.14% Pervious Area
0.311		3.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0180	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.6	1,751	0.0760	4.44		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.5	1,801	Total			

Subcatchment P-3: ByPass MBTA Rd

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment P-4: ByPass to W'ly Wetland

Runoff = 5.67 cfs @ 12.21 hrs, Volume= 0.561 af, Depth> 0.93"

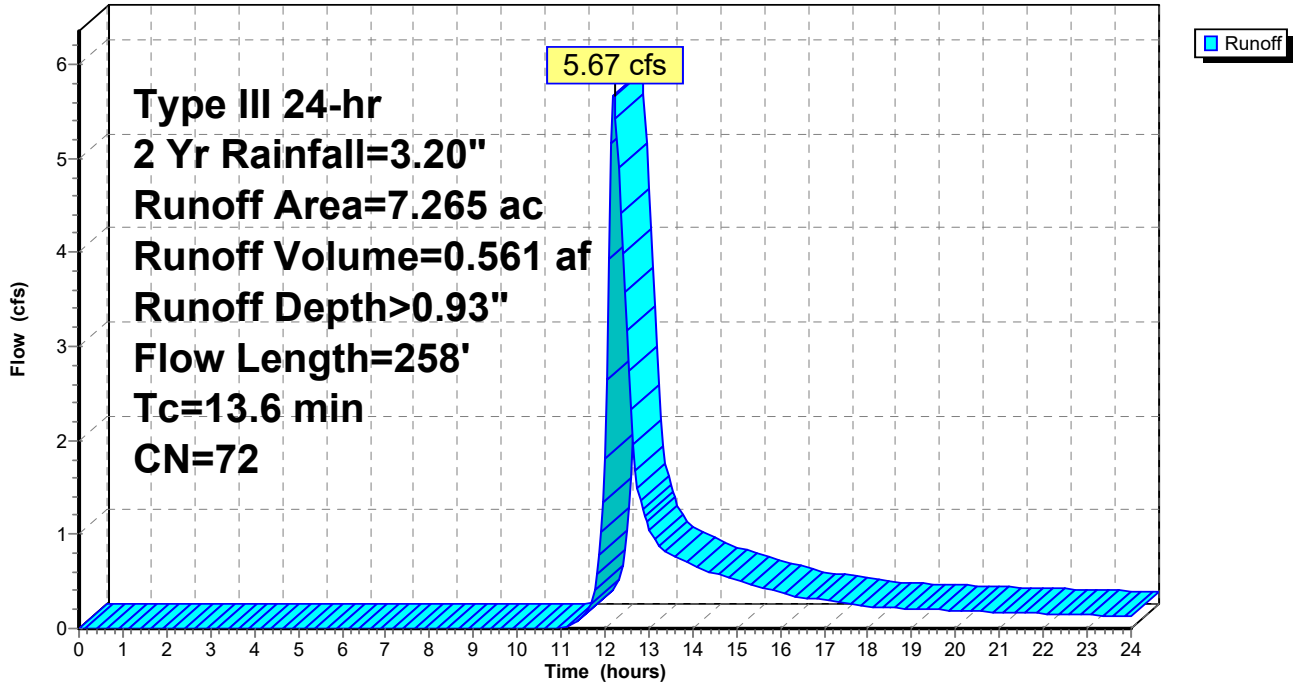
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
5.540	70	Woods, Good, HSG C
0.830	74	>75% Grass cover, Good, HSG C
0.020	98	Paved parking, HSG C
0.430	77	Woods, Good, HSG D
0.212	74	>75% Grass cover, Good, HSG C
0.210	98	Unconnected roofs, HSG C
0.023	98	Unconnected pavement, HSG C
7.265	72	Weighted Average
7.012		96.52% Pervious Area
0.253		3.48% Impervious Area
0.233		92.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	208	0.0270	2.65		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
13.6	258	Total			

Subcatchment P-4: ByPass to W'ly Wetland

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Subcatchment P-5: Nly PL

Runoff = 1.21 cfs @ 12.15 hrs, Volume= 0.120 af, Depth> 0.60"

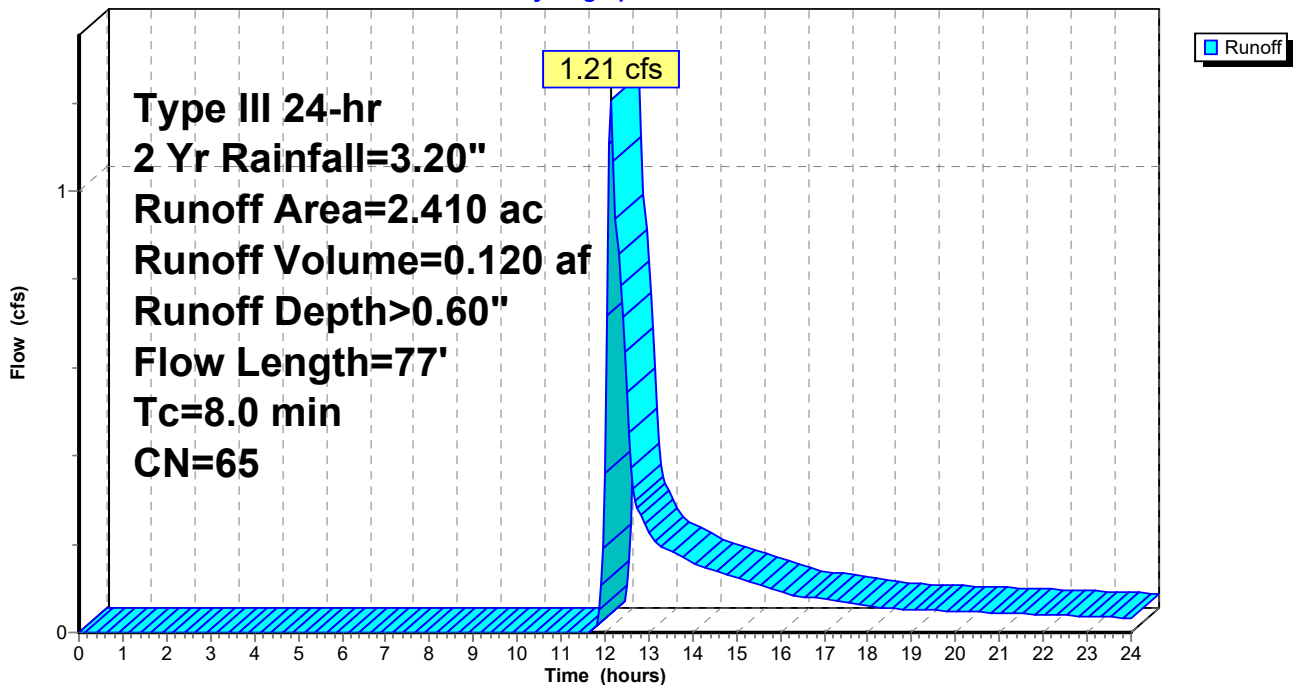
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.20"

Area (ac)	CN	Description
0.070	30	Woods, Good, HSG A
0.520	39	>75% Grass cover, Good, HSG A
0.440	70	Woods, Good, HSG C
1.350	74	>75% Grass cover, Good, HSG C
0.030	98	Paved parking, HSG C
2.410	65	Weighted Average
2.380		98.76% Pervious Area
0.030		1.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	27	0.0700	4.26		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
8.0	77	Total			

Subcatchment P-5: Nly PL

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Pond 1P: Inf Basin

Inflow Area = 13.304 ac, 46.32% Impervious, Inflow Depth > 0.87" for 2 Yr event
 Inflow = 8.06 cfs @ 12.21 hrs, Volume= 0.969 af
 Outflow = 2.43 cfs @ 12.68 hrs, Volume= 0.967 af, Atten= 70%, Lag= 28.6 min
 Discarded = 2.43 cfs @ 12.68 hrs, Volume= 0.967 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 284.18' @ 12.68 hrs Surf.Area= 12,669 sf Storage= 7,987 cf

Plug-Flow detention time= 19.9 min calculated for 0.965 af (100% of inflow)
 Center-of-Mass det. time= 18.8 min (920.1 - 901.3)

Volume	Invert	Avail.Storage	Storage Description
#1	283.50'	112,982 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.50	10,661	0	0
284.00	12,357	5,755	5,755
285.00	14,108	13,233	18,987
286.00	15,917	15,013	34,000
287.00	17,782	16,850	50,849
288.00	19,703	18,743	69,592
289.00	21,681	20,692	90,284
290.00	23,716	22,699	112,982

Device	Routing	Invert	Outlet Devices
#1	Discarded	283.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	280.91'	24.0" Round Culvert L= 119.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 280.91' / 277.45' S= 0.0291 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	286.90'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	287.25'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	288.50'	16.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.43 cfs @ 12.68 hrs HW=284.18' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 2.43 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=283.50' (Free Discharge)

↳ **2=Culvert** (Passes 0.00 cfs of 19.07 cfs potential flow)

↳ **3=Orifice/Grate** (Controls 0.00 cfs)

↳ **4=Orifice/Grate** (Controls 0.00 cfs)

↳ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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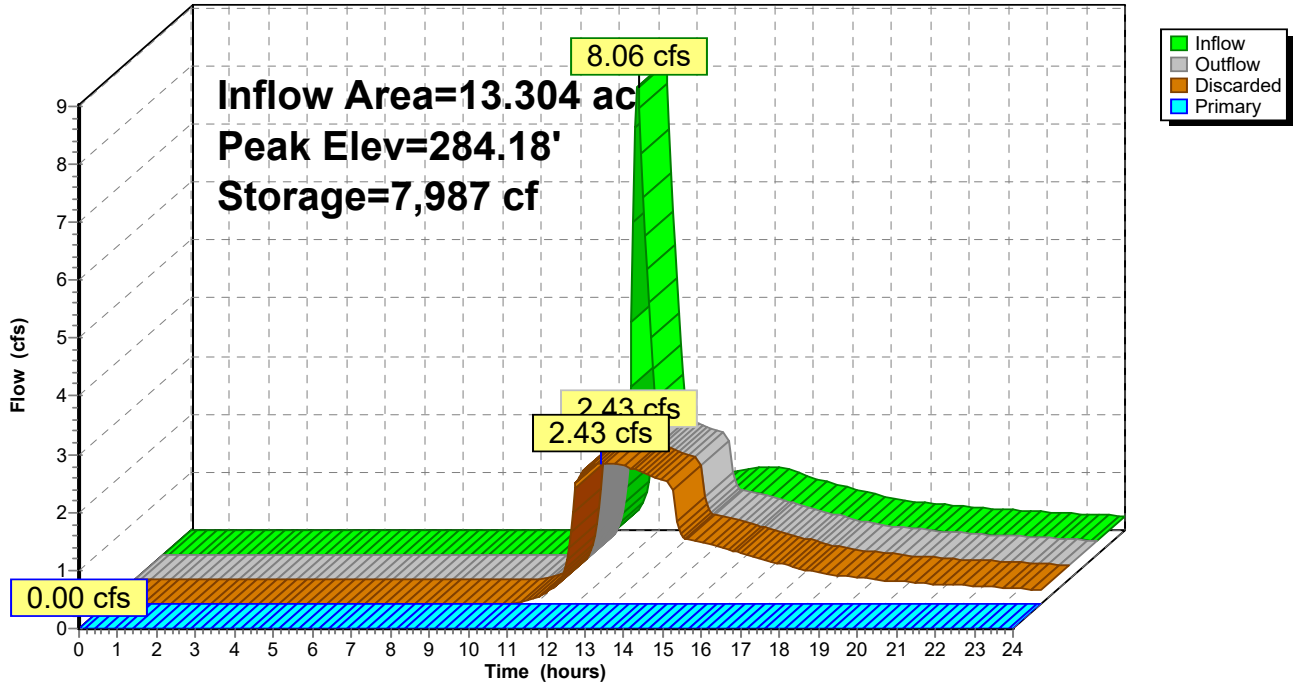
Type III 24-hr 2 Yr Rainfall=3.20"

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Pond 1P: Inf Basin

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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Summary for Pond 3P: Stormtrap

Custom Storage to Match Stormtrap Design

Stormtrap Area=10,714 sf

Stone Area=12,219 sf

Inflow Area = 5.263 ac, 70.70% Impervious, Inflow Depth > 2.25" for 2 Yr event
 Inflow = 11.06 cfs @ 12.17 hrs, Volume= 0.989 af
 Outflow = 0.54 cfs @ 15.46 hrs, Volume= 0.315 af, Atten= 95%, Lag= 197.4 min
 Discarded = 0.09 cfs @ 11.65 hrs, Volume= 0.115 af
 Primary = 0.45 cfs @ 15.46 hrs, Volume= 0.200 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 356.08' @ 15.46 hrs Surf.Area= 13,724 sf Storage= 30,940 cf

Plug-Flow detention time= 343.8 min calculated for 0.314 af (32% of inflow)
 Center-of-Mass det. time= 210.6 min (1,017.8 - 807.3)

Volume	Invert	Avail.Storage	Storage Description
#1	352.50'	4,888 cf	Custom Stage Data (Prismatic) Listed below
#2	353.50'	39,464 cf	Custom Stage Data Listed below -Impervious
#3	353.50'	2,504 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		46,856 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
352.50	12,219	0.0	0	0
353.50	12,219	40.0	4,888	4,888

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	0	0
357.66	39,464	39,464

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	1,505	0.0	0	0
357.66	1,505	40.0	2,504	2,504

Device	Routing	Invert	Outlet Devices
#1	Discarded	352.50'	0.270 in/hr Exfiltration over Surface area
#2	Primary	350.00'	24.0" Round Culvert L= 74.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 350.00' / 348.52' S= 0.0200 1' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	354.95'	1.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	355.85'	4.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	356.50'	7.5' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

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Type III 24-hr 2 Yr Rainfall=3.20"

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Discarded OutFlow Max=0.09 cfs @ 11.65 hrs HW=353.50' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.45 cfs @ 15.46 hrs HW=356.08' (Free Discharge)

↳ **2=Culvert** (Passes 0.45 cfs of 34.10 cfs potential flow)

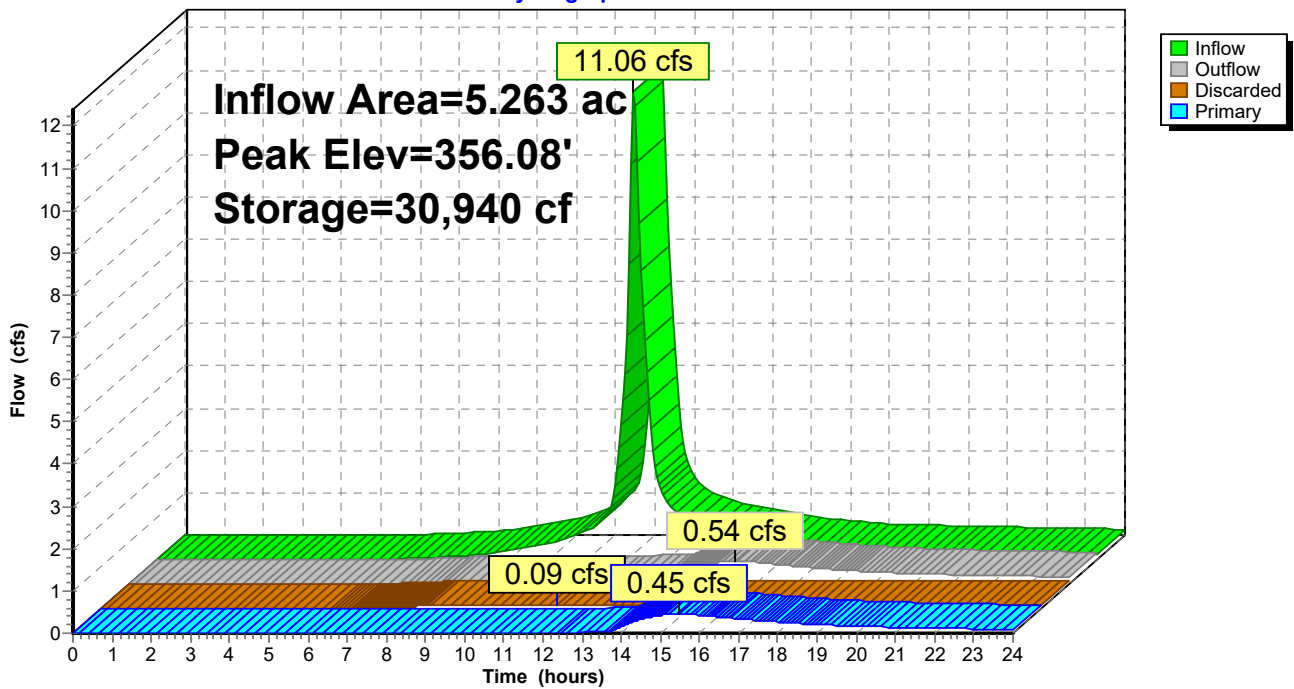
↳ **3=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.03 fps)

↳ **4=Orifice/Grate** (Orifice Controls 0.43 cfs @ 1.64 fps)

↳ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Stormtrap

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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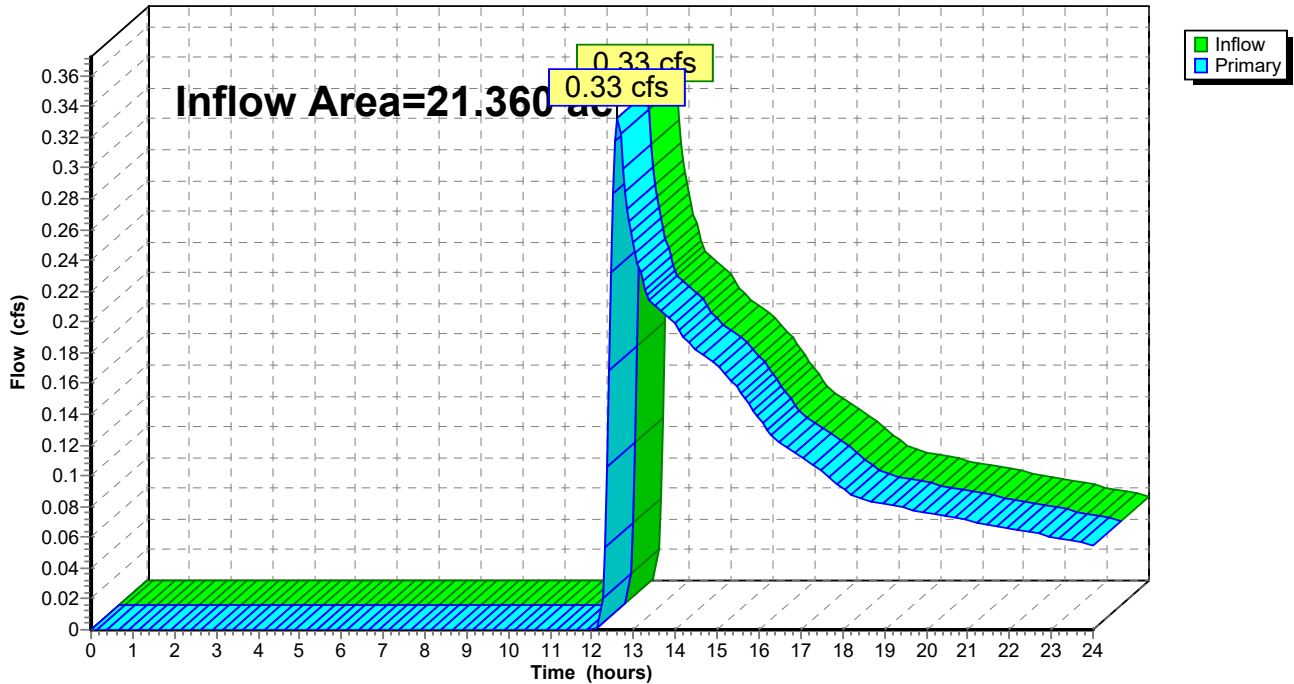
Summary for Link 1L: SE Corner

Inflow Area = 21.360 ac, 30.31% Impervious, Inflow Depth > 0.06" for 2 Yr event
Inflow = 0.33 cfs @ 12.62 hrs, Volume= 0.115 af
Primary = 0.33 cfs @ 12.62 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



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Type III 24-hr 2 Yr Rainfall=3.20"

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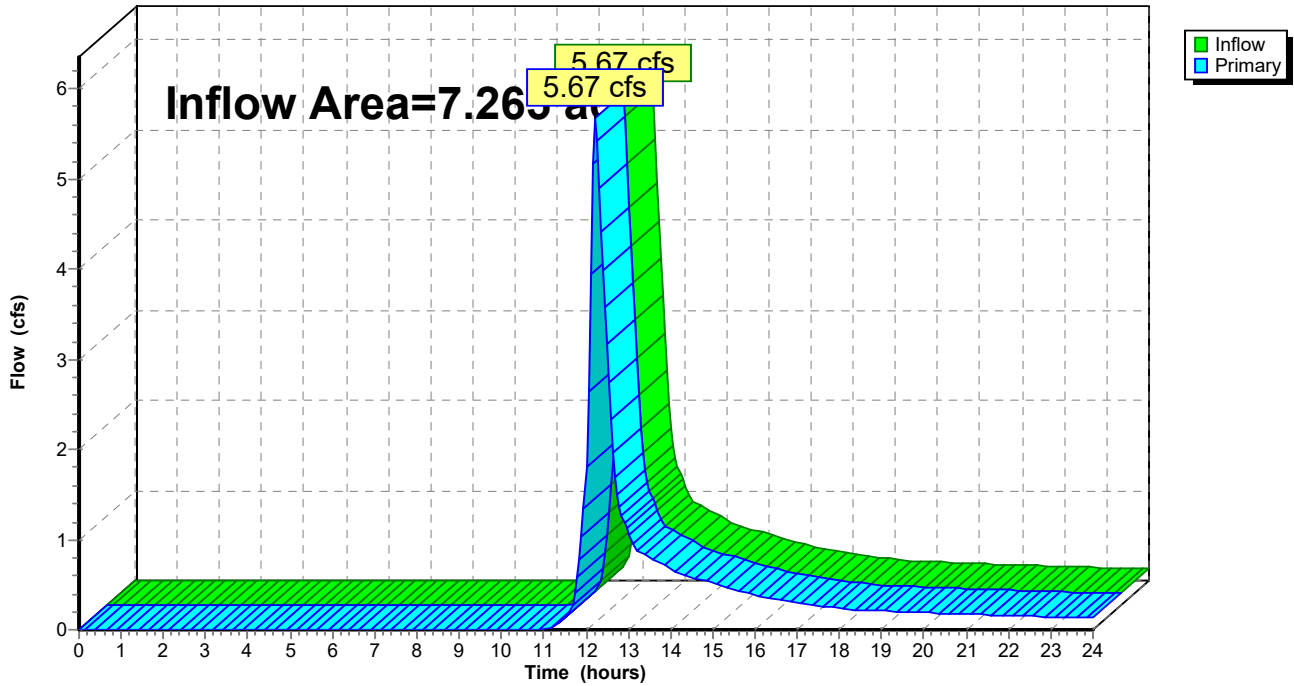
Summary for Link 2L: Wly Wetland

Inflow Area = 7.265 ac, 3.48% Impervious, Inflow Depth > 0.93" for 2 Yr event
Inflow = 5.67 cfs @ 12.21 hrs, Volume= 0.561 af
Primary = 5.67 cfs @ 12.21 hrs, Volume= 0.561 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Wly Wetland

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Drainage Collection Runoff Area=8.041 ac 30.37% Impervious Runoff Depth>2.16"
Flow Length=345' Tc=14.0 min CN=76 Runoff=15.69 cfs 1.450 af

Subcatchment P-2: Clubhouse Area Runoff Area=5.263 ac 70.70% Impervious Runoff Depth>3.54"
Flow Length=305' Tc=12.5 min CN=91 Runoff=17.04 cfs 1.553 af

Subcatchment P-3: ByPass MBTA Rd Runoff Area=8.056 ac 3.86% Impervious Runoff Depth>0.61"
Flow Length=1,801' Tc=19.5 min CN=52 Runoff=2.52 cfs 0.408 af

Subcatchment P-4: ByPass to W'ly Wetland Runoff Area=7.265 ac 3.48% Impervious Runoff Depth>1.85"
Flow Length=258' Tc=13.6 min CN=72 Runoff=12.07 cfs 1.121 af

Subcatchment P-5: Nly PL Runoff Area=2.410 ac 1.24% Impervious Runoff Depth>1.36"
Flow Length=77' Tc=8.0 min CN=65 Runoff=3.25 cfs 0.273 af

Pond 1P: Inf Basin Peak Elev=285.77' Storage=30,375 cf Inflow=15.71 cfs 2.194 af
Discarded=2.97 cfs 2.191 af Primary=0.00 cfs 0.000 af Outflow=2.97 cfs 2.191 af

Pond 3P: Stormtrap Peak Elev=356.73' Storage=37,510 cf Inflow=17.04 cfs 1.553 af
Discarded=0.09 cfs 0.125 af Primary=3.85 cfs 0.744 af Outflow=3.93 cfs 0.870 af

Link 1L: SE Corner Inflow=2.52 cfs 0.408 af
Primary=2.52 cfs 0.408 af

Link 2L: Wly Wetland Inflow=12.07 cfs 1.121 af
Primary=12.07 cfs 1.121 af

Total Runoff Area = 31.035 ac Runoff Volume = 4.805 af Average Runoff Depth = 1.86"
78.23% Pervious = 24.278 ac 21.77% Impervious = 6.757 ac

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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment P-1: Drainage Collection

Runoff = 15.69 cfs @ 12.20 hrs, Volume= 1.450 af, Depth> 2.16"

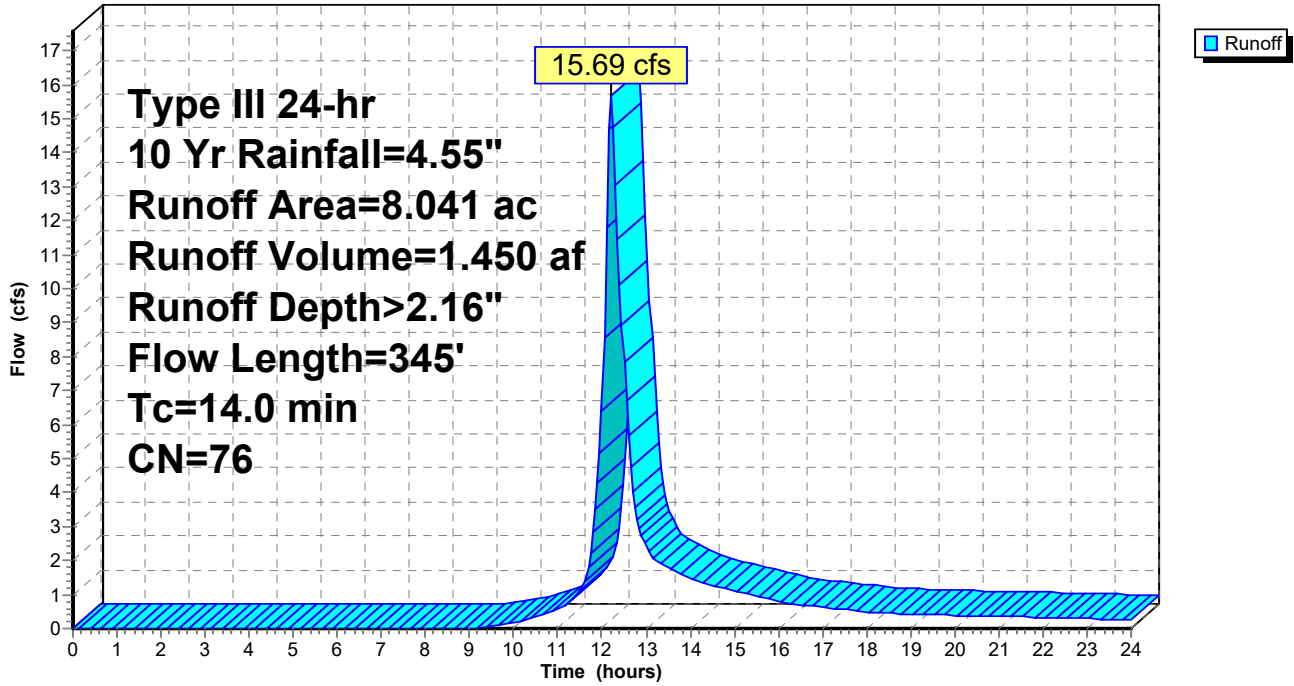
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
0.080	30	Woods, Good, HSG A
1.391	39	>75% Grass cover, Good, HSG A
0.339	98	Paved parking, HSG A
0.294	70	Woods, Good, HSG C
3.434	74	>75% Grass cover, Good, HSG C
1.412	98	Paved parking, HSG C
0.691	98	Roofs, HSG C
0.400	98	Water Surface, 0% imp, HSG A
8.041	76	Weighted Average
5.599		69.63% Pervious Area
2.442		30.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	145	0.0470	3.49		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.1	62	0.3300	9.25		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.9	88	0.0100	1.61		Shallow Concentrated Flow, D-E Unpaved Kv= 16.1 fps
14.0	345	Total			

Subcatchment P-1: Drainage Collection

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment P-2: Clubhouse Area

Runoff = 17.04 cfs @ 12.17 hrs, Volume= 1.553 af, Depth> 3.54"

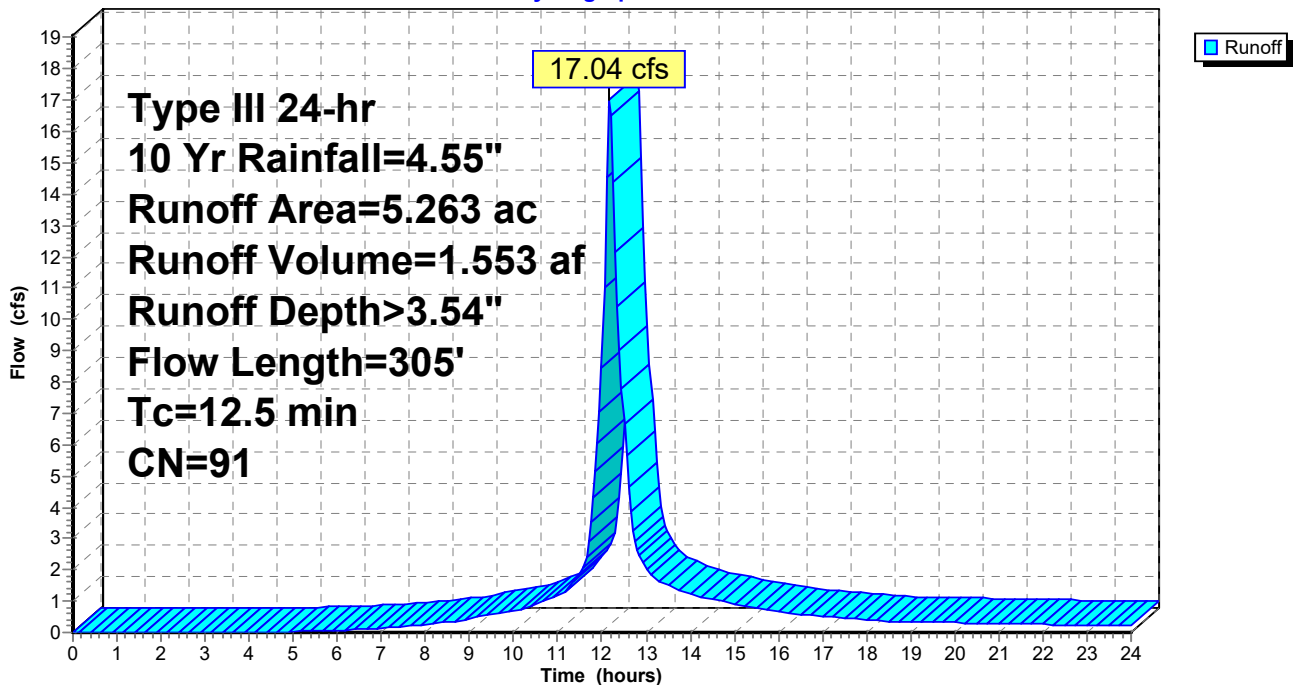
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
1.542	74	>75% Grass cover, Good, HSG C
2.330	98	Paved parking, HSG C
1.391	98	Roofs, HSG C
5.263	91	Weighted Average
1.542		29.30% Pervious Area
3.721		70.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.20"
0.7	89	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
1.0	166	0.0200	2.87		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
12.5	305	Total			

Subcatchment P-2: Clubhouse Area

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment P-3: ByPass MBTA Rd

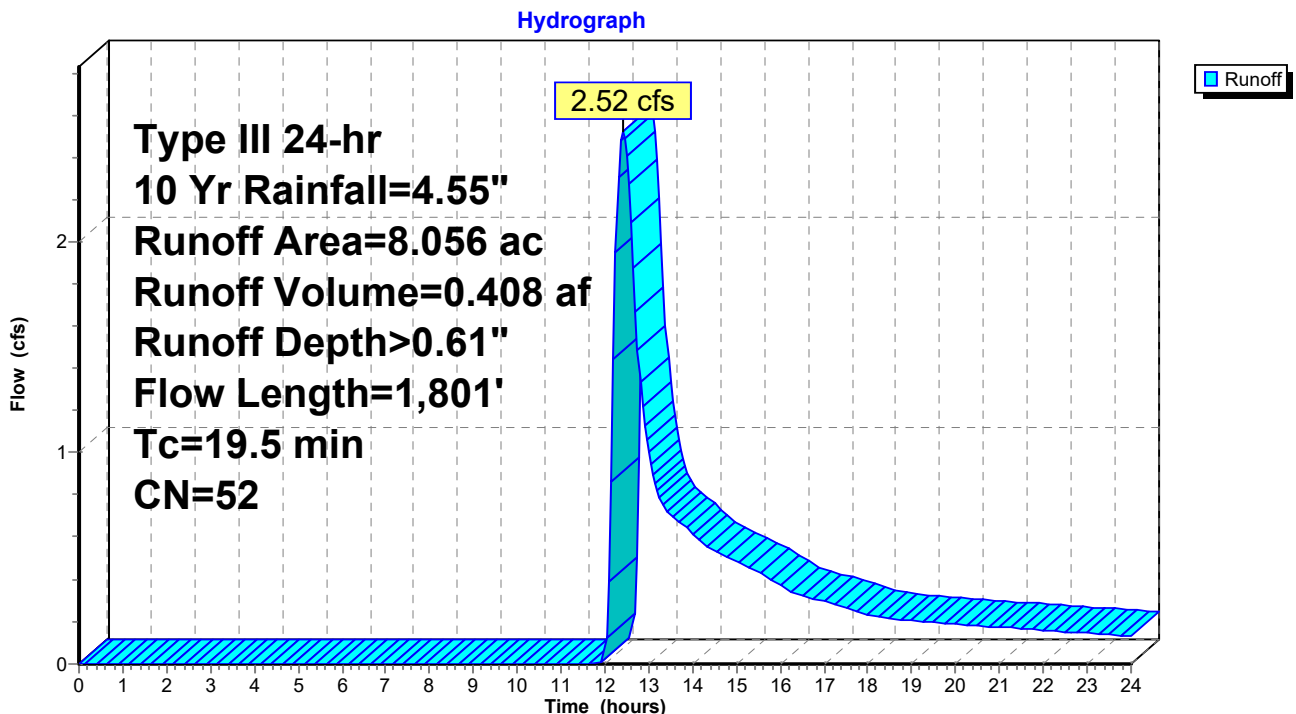
Runoff = 2.52 cfs @ 12.40 hrs, Volume= 0.408 af, Depth> 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
3.340	30	Woods, Good, HSG A
0.600	39	>75% Grass cover, Good, HSG A
3.306	70	Woods, Good, HSG C
0.380	74	>75% Grass cover, Good, HSG C
0.311	98	Paved roads w/curbs & sewers, HSG A
0.119	39	>75% Grass cover, Good, HSG A
8.056	52	Weighted Average
7.745		96.14% Pervious Area
0.311		3.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0180	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.6	1,751	0.0760	4.44		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.5	1,801	Total			

Subcatchment P-3: ByPass MBTA Rd



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment P-4: ByPass to W'ly Wetland

Runoff = 12.07 cfs @ 12.20 hrs, Volume= 1.121 af, Depth> 1.85"

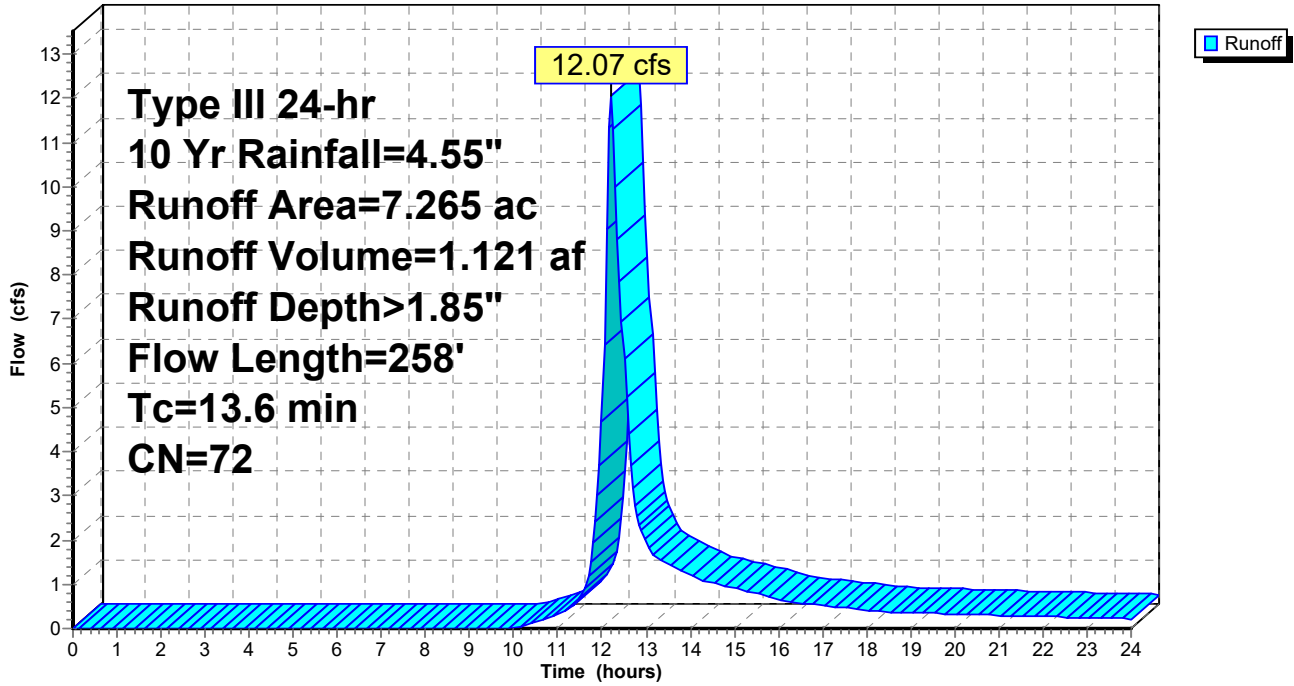
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
5.540	70	Woods, Good, HSG C
0.830	74	>75% Grass cover, Good, HSG C
0.020	98	Paved parking, HSG C
0.430	77	Woods, Good, HSG D
0.212	74	>75% Grass cover, Good, HSG C
0.210	98	Unconnected roofs, HSG C
0.023	98	Unconnected pavement, HSG C
7.265	72	Weighted Average
7.012		96.52% Pervious Area
0.253		3.48% Impervious Area
0.233		92.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	208	0.0270	2.65		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
13.6	258	Total			

Subcatchment P-4: ByPass to W'ly Wetland

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Subcatchment P-5: Nly PL

Runoff = 3.25 cfs @ 12.13 hrs, Volume= 0.273 af, Depth> 1.36"

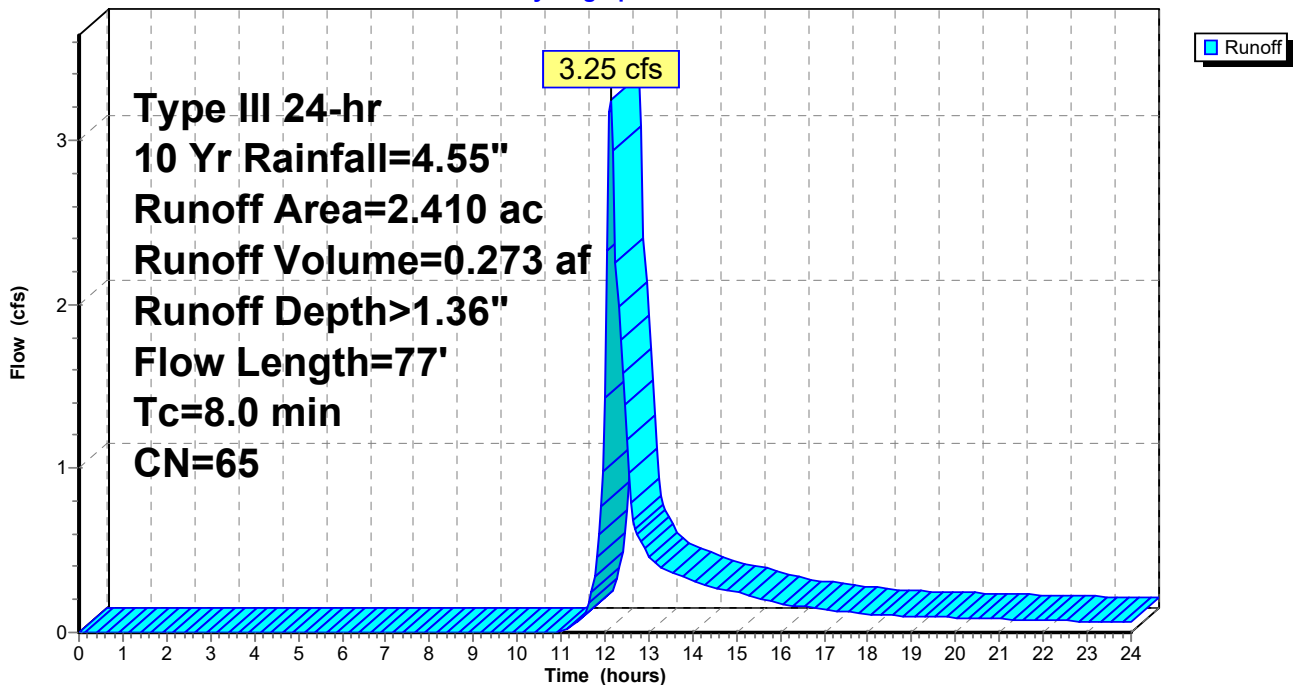
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (ac)	CN	Description
0.070	30	Woods, Good, HSG A
0.520	39	>75% Grass cover, Good, HSG A
0.440	70	Woods, Good, HSG C
1.350	74	>75% Grass cover, Good, HSG C
0.030	98	Paved parking, HSG C
2.410	65	Weighted Average
2.380		98.76% Pervious Area
0.030		1.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	27	0.0700	4.26		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
8.0	77	Total			

Subcatchment P-5: Nly PL

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Pond 1P: Inf Basin

Inflow Area = 13.304 ac, 46.32% Impervious, Inflow Depth > 1.98" for 10 Yr event
 Inflow = 15.71 cfs @ 12.20 hrs, Volume= 2.194 af
 Outflow = 2.97 cfs @ 13.89 hrs, Volume= 2.191 af, Atten= 81%, Lag= 101.1 min
 Discarded = 2.97 cfs @ 13.89 hrs, Volume= 2.191 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 285.77' @ 13.89 hrs Surf.Area= 15,500 sf Storage= 30,375 cf

Plug-Flow detention time= 105.2 min calculated for 2.191 af (100% of inflow)
 Center-of-Mass det. time= 104.4 min (975.7 - 871.3)

Volume	Invert	Avail.Storage	Storage Description
#1	283.50'	112,982 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.50	10,661	0	0
284.00	12,357	5,755	5,755
285.00	14,108	13,233	18,987
286.00	15,917	15,013	34,000
287.00	17,782	16,850	50,849
288.00	19,703	18,743	69,592
289.00	21,681	20,692	90,284
290.00	23,716	22,699	112,982

Device	Routing	Invert	Outlet Devices
#1	Discarded	283.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	280.91'	24.0" Round Culvert L= 119.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 280.91' / 277.45' S= 0.0291 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	286.90'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	287.25'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	288.50'	16.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.97 cfs @ 13.89 hrs HW=285.77' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 2.97 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=283.50' (Free Discharge)

↳ **2=Culvert** (Passes 0.00 cfs of 19.07 cfs potential flow)

↳ **3=Orifice/Grate** (Controls 0.00 cfs)

↳ **4=Orifice/Grate** (Controls 0.00 cfs)

↳ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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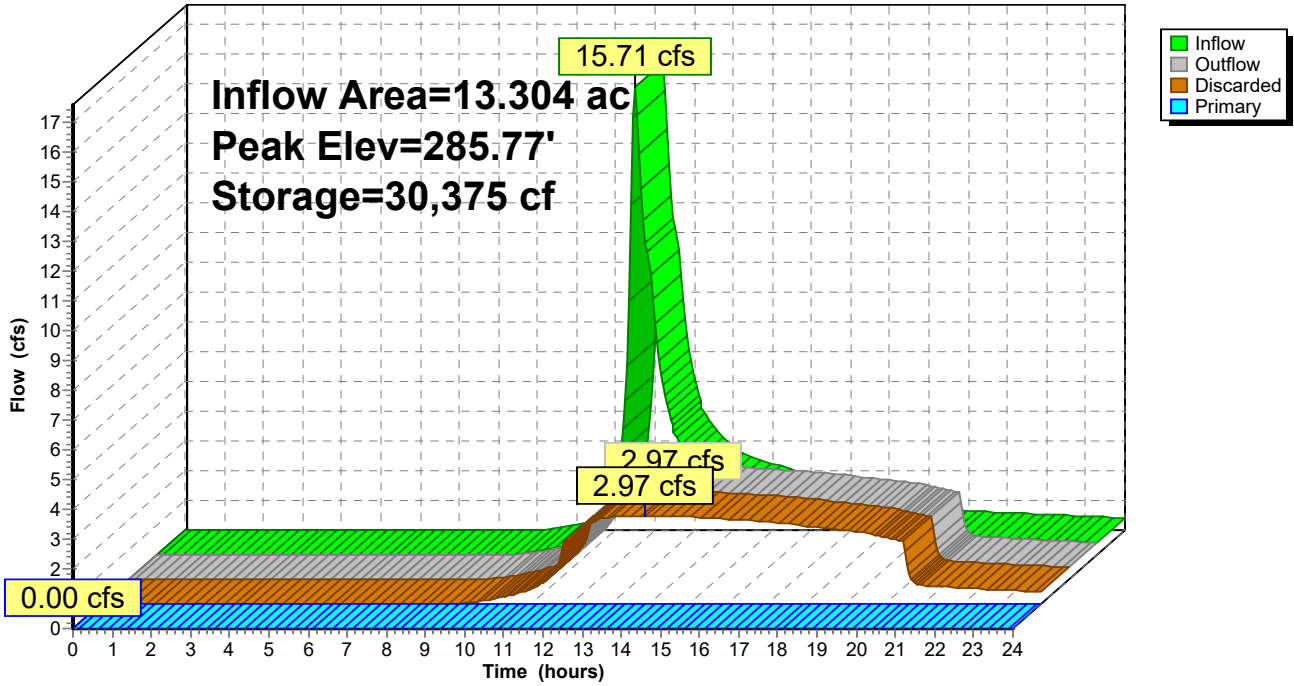
Type III 24-hr 10 Yr Rainfall=4.55"

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Pond 1P: Inf Basin

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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Summary for Pond 3P: Stormtrap

Custom Storage to Match Stormtrap Design

Stormtrap Area=10,714 sf

Stone Area=12,219 sf

Inflow Area = 5.263 ac, 70.70% Impervious, Inflow Depth > 3.54" for 10 Yr event
 Inflow = 17.04 cfs @ 12.17 hrs, Volume= 1.553 af
 Outflow = 3.93 cfs @ 12.65 hrs, Volume= 0.870 af, Atten= 77%, Lag= 29.0 min
 Discarded = 0.09 cfs @ 10.60 hrs, Volume= 0.125 af
 Primary = 3.85 cfs @ 12.65 hrs, Volume= 0.744 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 356.73' @ 12.65 hrs Surf.Area= 13,724 sf Storage= 37,510 cf

Plug-Flow detention time= 235.7 min calculated for 0.870 af (56% of inflow)
 Center-of-Mass det. time= 129.4 min (924.3 - 794.8)

Volume	Invert	Avail.Storage	Storage Description
#1	352.50'	4,888 cf	Custom Stage Data (Prismatic) Listed below
#2	353.50'	39,464 cf	Custom Stage Data Listed below -Impervious
#3	353.50'	2,504 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		46,856 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
352.50	12,219	0.0	0	0
353.50	12,219	40.0	4,888	4,888

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	0	0
357.66	39,464	39,464

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	1,505	0.0	0	0
357.66	1,505	40.0	2,504	2,504

Device	Routing	Invert	Outlet Devices
#1	Discarded	352.50'	0.270 in/hr Exfiltration over Surface area
#2	Primary	350.00'	24.0" Round Culvert L= 74.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 350.00' / 348.52' S= 0.0200 1' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	354.95'	1.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	355.85'	4.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	356.50'	7.5' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

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Type III 24-hr 10 Yr Rainfall=4.55"

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Discarded OutFlow Max=0.09 cfs @ 10.60 hrs HW=353.51' (Free Discharge)

1=Exfiltration (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=3.84 cfs @ 12.65 hrs HW=356.73' (Free Discharge)

2=Culvert (Passes 3.84 cfs of 36.22 cfs potential flow)

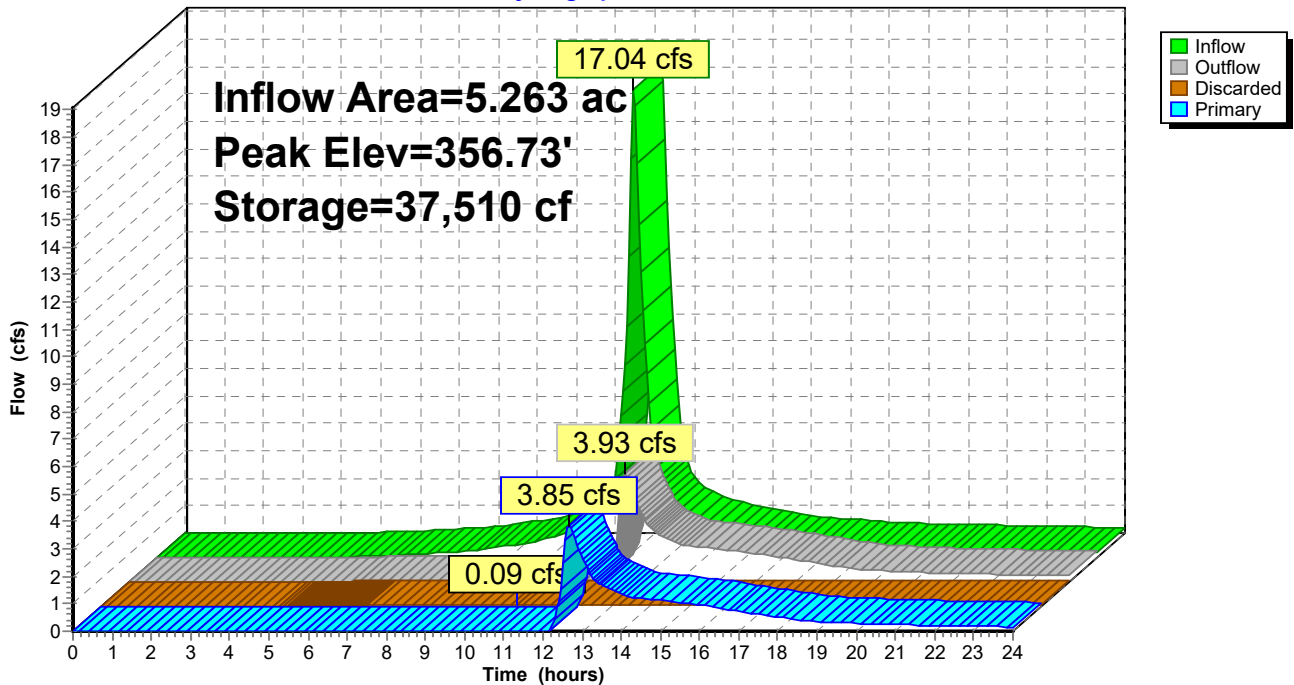
3=Orifice/Grate (Orifice Controls 0.03 cfs @ 6.35 fps)

4=Orifice/Grate (Orifice Controls 1.42 cfs @ 4.08 fps)

5=Broad-Crested Rectangular Weir (Weir Controls 2.39 cfs @ 1.36 fps)

Pond 3P: Stormtrap

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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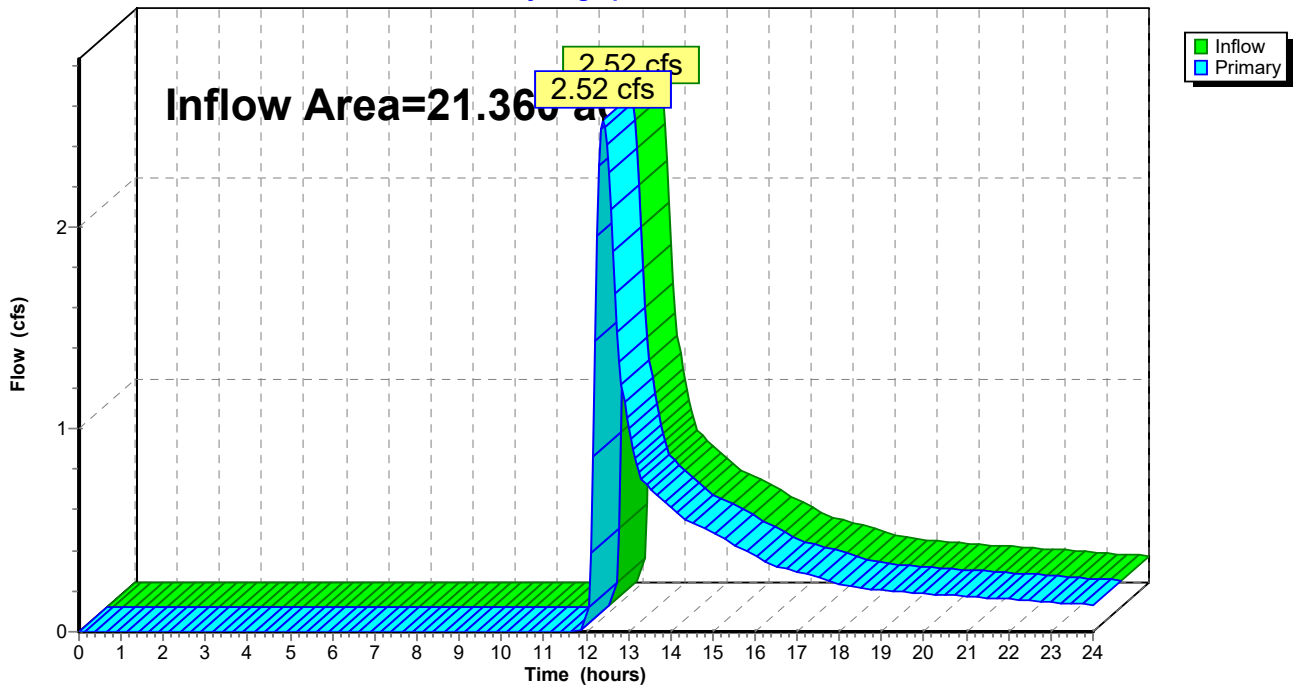
Summary for Link 1L: SE Corner

Inflow Area = 21.360 ac, 30.31% Impervious, Inflow Depth > 0.23" for 10 Yr event
Inflow = 2.52 cfs @ 12.40 hrs, Volume= 0.408 af
Primary = 2.52 cfs @ 12.40 hrs, Volume= 0.408 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



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Type III 24-hr 10 Yr Rainfall=4.55"

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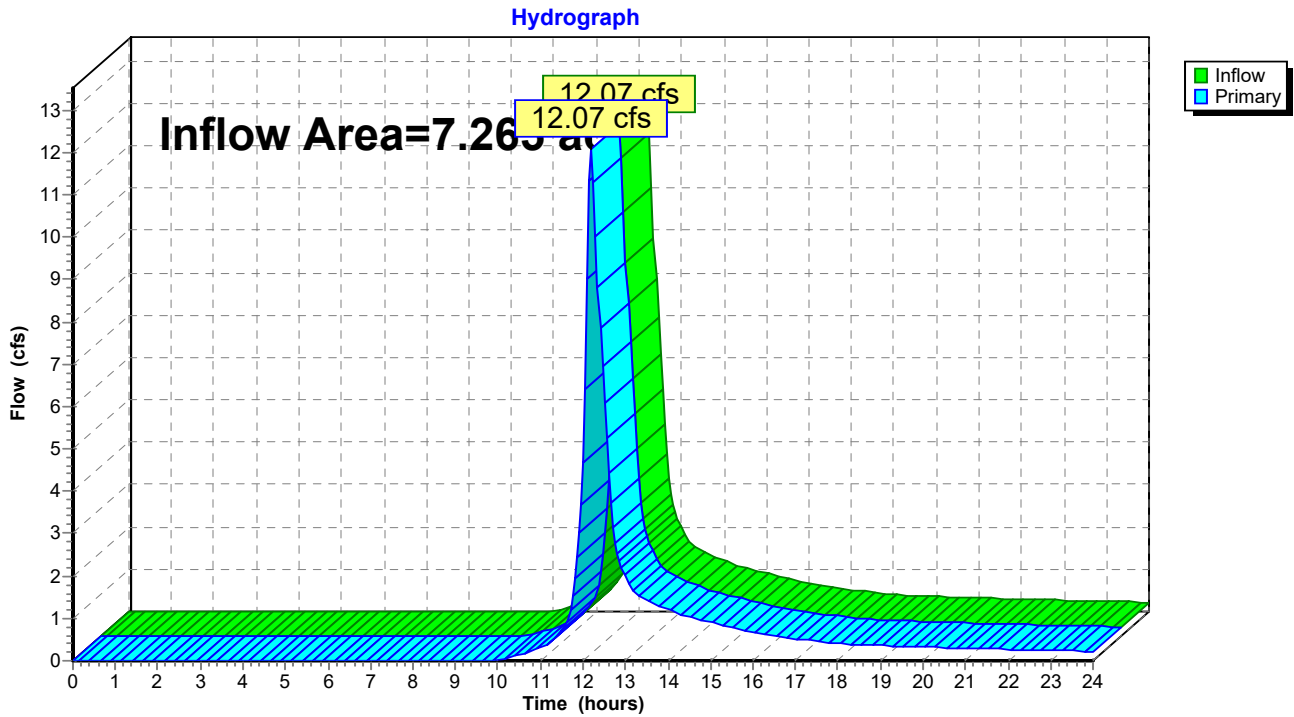
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Summary for Link 2L: Wly Wetland

Inflow Area = 7.265 ac, 3.48% Impervious, Inflow Depth > 1.85" for 10 Yr event
Inflow = 12.07 cfs @ 12.20 hrs, Volume= 1.121 af
Primary = 12.07 cfs @ 12.20 hrs, Volume= 1.121 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Wly Wetland



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Type III 24-hr 25 Yr Rainfall=5.50"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Drainage Collection Runoff Area=8.041 ac 30.37% Impervious Runoff Depth>2.95"
Flow Length=345' Tc=14.0 min CN=76 Runoff=21.48 cfs 1.974 af

Subcatchment P-2: Clubhouse Area Runoff Area=5.263 ac 70.70% Impervious Runoff Depth>4.46"
Flow Length=305' Tc=12.5 min CN=91 Runoff=21.22 cfs 1.956 af

Subcatchment P-3: ByPass MBTA Rd Runoff Area=8.056 ac 3.86% Impervious Runoff Depth>1.03"
Flow Length=1,801' Tc=19.5 min CN=52 Runoff=5.19 cfs 0.691 af

Subcatchment P-4: ByPass to W'ly Wetland Runoff Area=7.265 ac 3.48% Impervious Runoff Depth>2.58"
Flow Length=258' Tc=13.6 min CN=72 Runoff=17.07 cfs 1.564 af

Subcatchment P-5: Nly PL Runoff Area=2.410 ac 1.24% Impervious Runoff Depth>1.99"
Flow Length=77' Tc=8.0 min CN=65 Runoff=5.00 cfs 0.400 af

Pond 1P: Inf Basin Peak Elev=287.20' Storage=54,436 cf Inflow=24.80 cfs 3.111 af
Discarded=3.48 cfs 3.098 af Primary=0.05 cfs 0.008 af Outflow=3.53 cfs 3.107 af

Pond 3P: Stormtrap Peak Elev=357.03' Storage=40,494 cf Inflow=21.22 cfs 1.956 af
Discarded=0.09 cfs 0.131 af Primary=10.47 cfs 1.137 af Outflow=10.56 cfs 1.268 af

Link 1L: SE Corner Inflow=5.19 cfs 0.700 af
Primary=5.19 cfs 0.700 af

Link 2L: Wly Wetland Inflow=17.07 cfs 1.564 af
Primary=17.07 cfs 1.564 af

Total Runoff Area = 31.035 ac Runoff Volume = 6.585 af Average Runoff Depth = 2.55"
78.23% Pervious = 24.278 ac 21.77% Impervious = 6.757 ac

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Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment P-1: Drainage Collection

Runoff = 21.48 cfs @ 12.20 hrs, Volume= 1.974 af, Depth> 2.95"

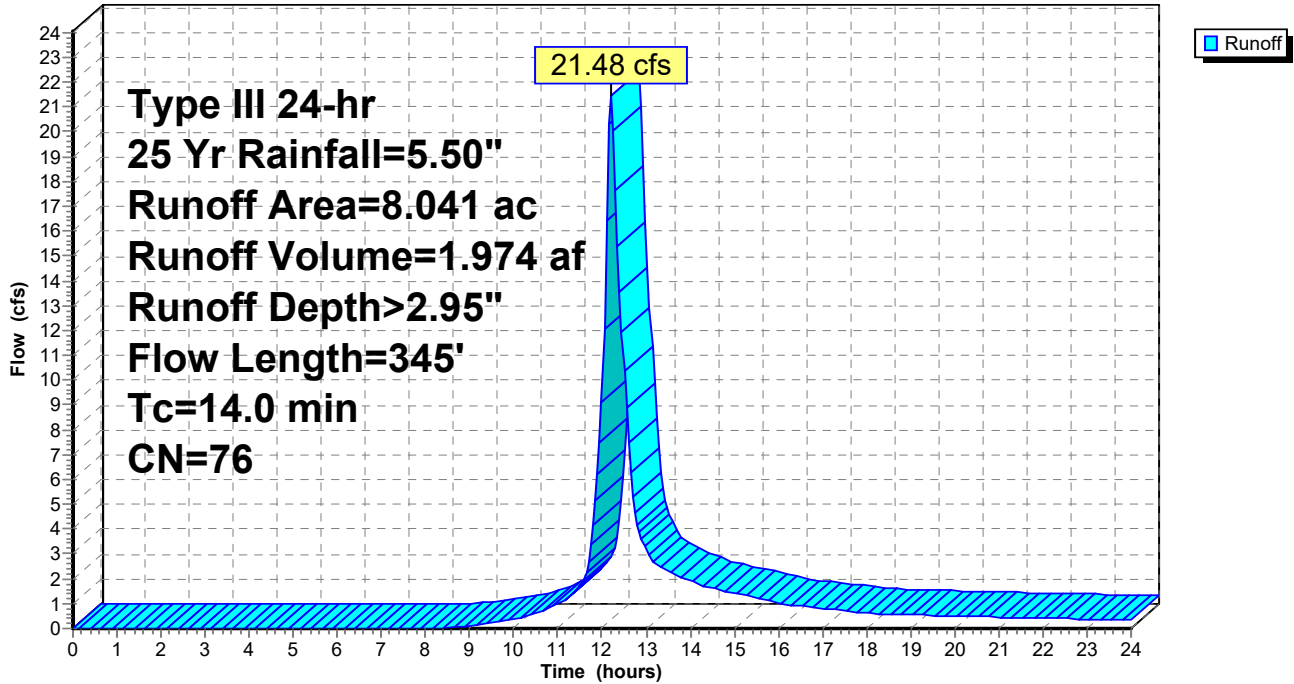
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
0.080	30	Woods, Good, HSG A
1.391	39	>75% Grass cover, Good, HSG A
0.339	98	Paved parking, HSG A
0.294	70	Woods, Good, HSG C
3.434	74	>75% Grass cover, Good, HSG C
1.412	98	Paved parking, HSG C
0.691	98	Roofs, HSG C
0.400	98	Water Surface, 0% imp, HSG A
8.041	76	Weighted Average
5.599		69.63% Pervious Area
2.442		30.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	145	0.0470	3.49		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.1	62	0.3300	9.25		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.9	88	0.0100	1.61		Shallow Concentrated Flow, D-E Unpaved Kv= 16.1 fps
14.0	345	Total			

Subcatchment P-1: Drainage Collection

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment P-2: Clubhouse Area

Runoff = 21.22 cfs @ 12.17 hrs, Volume= 1.956 af, Depth> 4.46"

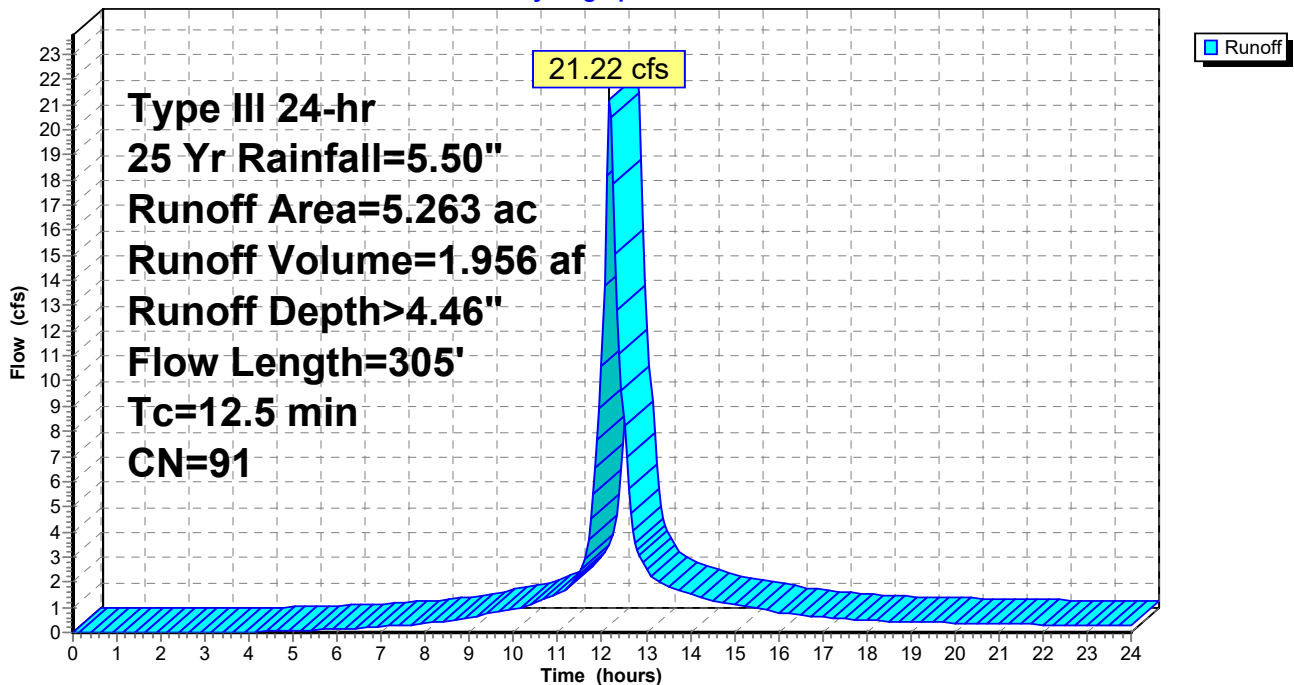
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
1.542	74	>75% Grass cover, Good, HSG C
2.330	98	Paved parking, HSG C
1.391	98	Roofs, HSG C
5.263	91	Weighted Average
1.542		29.30% Pervious Area
3.721		70.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.20"
0.7	89	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
1.0	166	0.0200	2.87		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
12.5	305	Total			

Subcatchment P-2: Clubhouse Area

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment P-3: ByPass MBTA Rd

Runoff = 5.19 cfs @ 12.34 hrs, Volume= 0.691 af, Depth> 1.03"

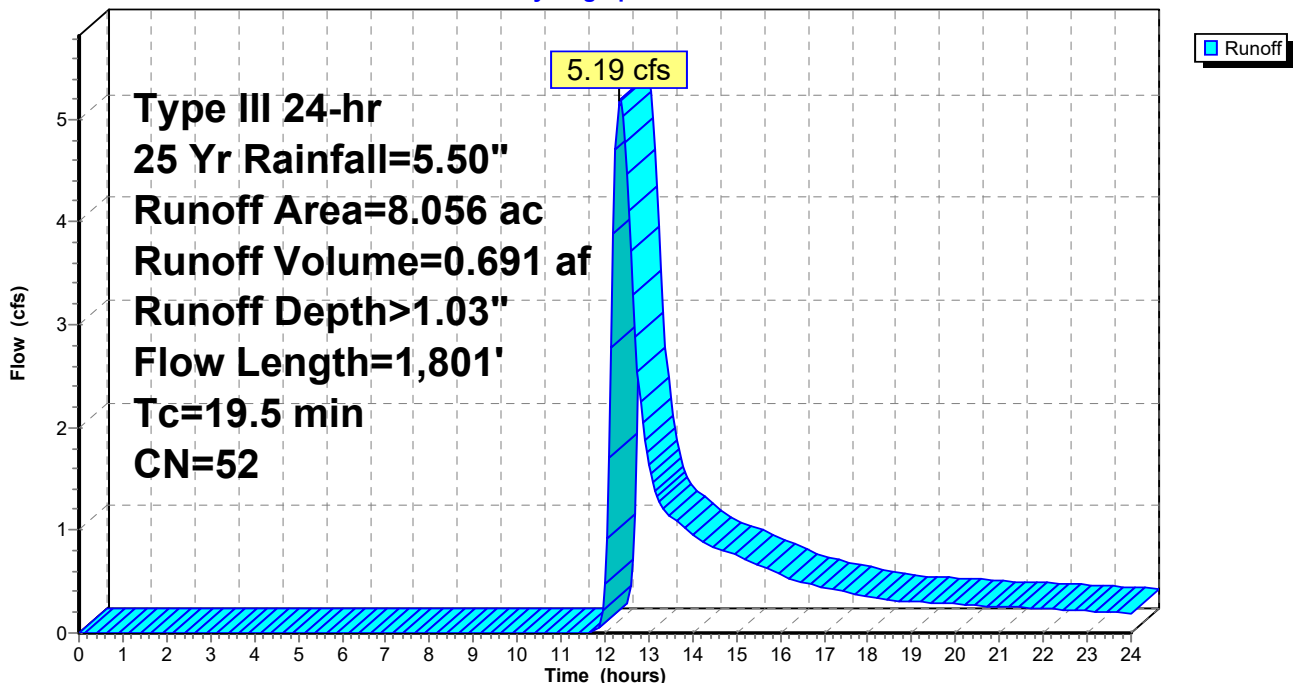
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
3.340	30	Woods, Good, HSG A
0.600	39	>75% Grass cover, Good, HSG A
3.306	70	Woods, Good, HSG C
0.380	74	>75% Grass cover, Good, HSG C
0.311	98	Paved roads w/curbs & sewers, HSG A
0.119	39	>75% Grass cover, Good, HSG A
8.056	52	Weighted Average
7.745		96.14% Pervious Area
0.311		3.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0180	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.6	1,751	0.0760	4.44		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.5	1,801	Total			

Subcatchment P-3: ByPass MBTA Rd

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment P-4: ByPass to W'ly Wetland

Runoff = 17.07 cfs @ 12.20 hrs, Volume= 1.564 af, Depth> 2.58"

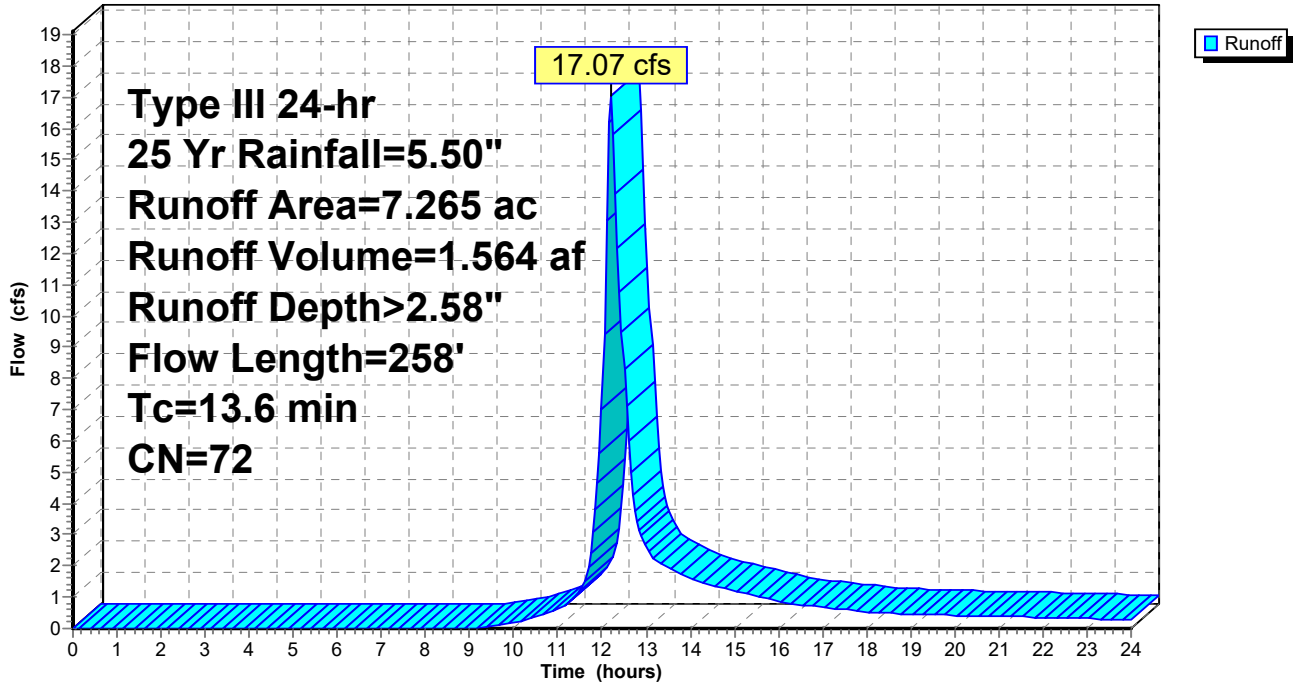
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
5.540	70	Woods, Good, HSG C
0.830	74	>75% Grass cover, Good, HSG C
0.020	98	Paved parking, HSG C
0.430	77	Woods, Good, HSG D
0.212	74	>75% Grass cover, Good, HSG C
0.210	98	Unconnected roofs, HSG C
0.023	98	Unconnected pavement, HSG C
7.265	72	Weighted Average
7.012		96.52% Pervious Area
0.253		3.48% Impervious Area
0.233		92.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	208	0.0270	2.65		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
13.6	258	Total			

Subcatchment P-4: ByPass to W'ly Wetland

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Subcatchment P-5: Nly PL

Runoff = 5.00 cfs @ 12.12 hrs, Volume= 0.400 af, Depth> 1.99"

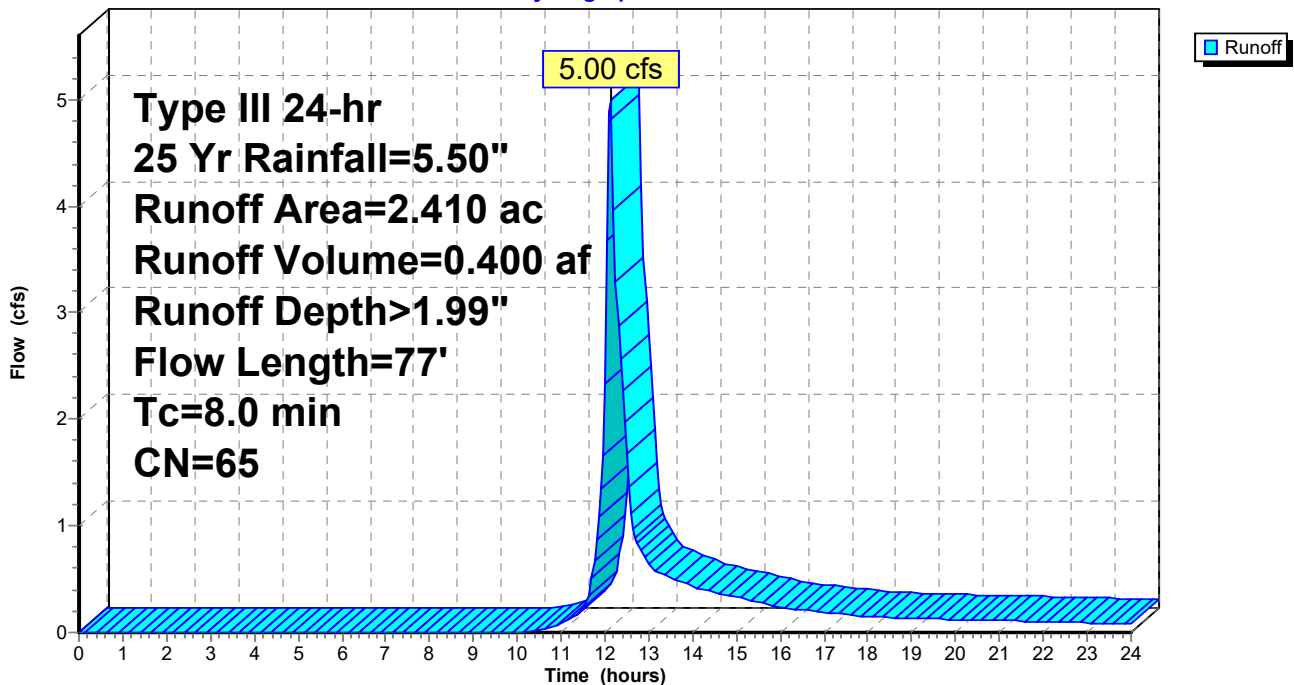
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.50"

Area (ac)	CN	Description
0.070	30	Woods, Good, HSG A
0.520	39	>75% Grass cover, Good, HSG A
0.440	70	Woods, Good, HSG C
1.350	74	>75% Grass cover, Good, HSG C
0.030	98	Paved parking, HSG C
2.410	65	Weighted Average
2.380		98.76% Pervious Area
0.030		1.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	27	0.0700	4.26		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
8.0	77	Total			

Subcatchment P-5: Nly PL

Hydrograph



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Summary for Pond 1P: Inf Basin

Inflow Area = 13.304 ac, 46.32% Impervious, Inflow Depth > 2.81" for 25 Yr event
 Inflow = 24.80 cfs @ 12.34 hrs, Volume= 3.111 af
 Outflow = 3.53 cfs @ 14.02 hrs, Volume= 3.107 af, Atten= 86%, Lag= 100.7 min
 Discarded = 3.48 cfs @ 14.02 hrs, Volume= 3.098 af
 Primary = 0.05 cfs @ 14.02 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 287.20' @ 14.02 hrs Surf.Area= 18,165 sf Storage= 54,436 cf

Plug-Flow detention time= 169.5 min calculated for 3.107 af (100% of inflow)
 Center-of-Mass det. time= 168.7 min (1,023.9 - 855.3)

Volume	Invert	Avail.Storage	Storage Description
#1	283.50'	112,982 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.50	10,661	0	0
284.00	12,357	5,755	5,755
285.00	14,108	13,233	18,987
286.00	15,917	15,013	34,000
287.00	17,782	16,850	50,849
288.00	19,703	18,743	69,592
289.00	21,681	20,692	90,284
290.00	23,716	22,699	112,982

Device	Routing	Invert	Outlet Devices
#1	Discarded	283.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	280.91'	24.0" Round Culvert L= 119.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 280.91' / 277.45' S= 0.0291 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	286.90'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	287.25'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	288.50'	16.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=3.48 cfs @ 14.02 hrs HW=287.20' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 3.48 cfs)

Primary OutFlow Max=0.05 cfs @ 14.02 hrs HW=287.20' (Free Discharge)

↳ **2=Culvert** (Passes 0.05 cfs of 34.79 cfs potential flow)

↳ **3=Orifice/Grate** (Orifice Controls 0.05 cfs @ 2.24 fps)

↳ **4=Orifice/Grate** (Controls 0.00 cfs)

↳ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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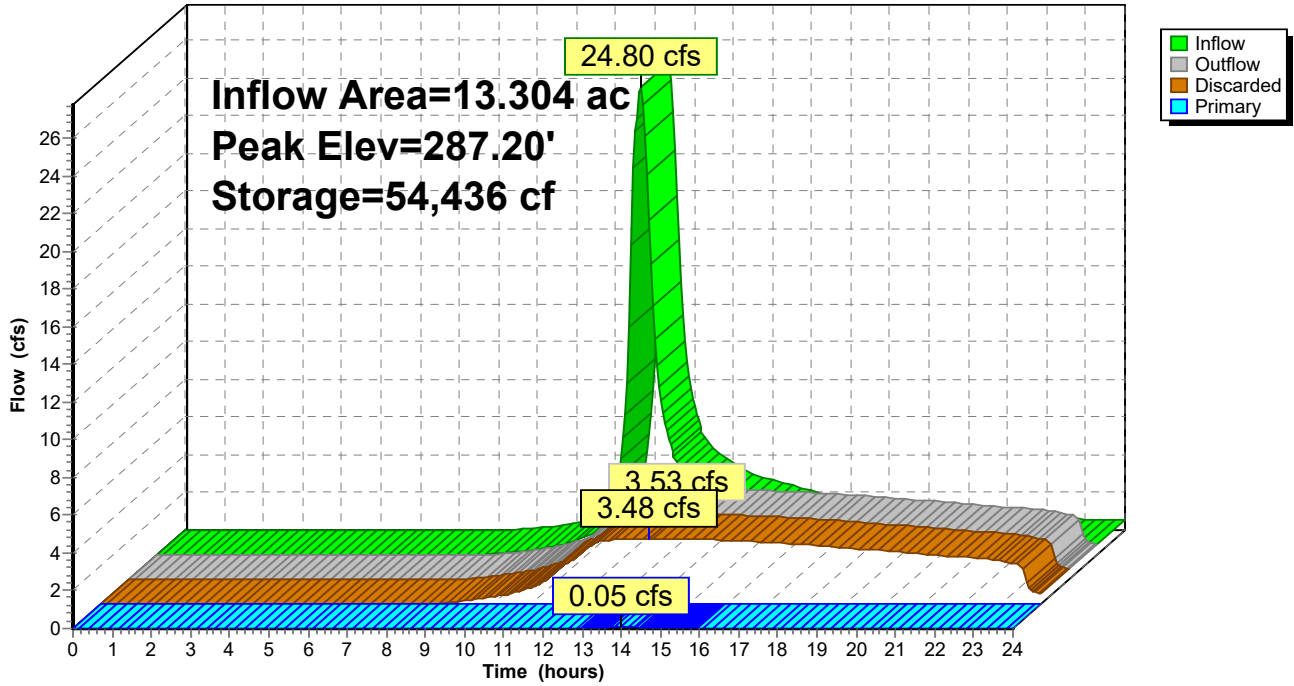
Type III 24-hr 25 Yr Rainfall=5.50"

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Pond 1P: Inf Basin

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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Summary for Pond 3P: Stormtrap

Custom Storage to Match Stormtrap Design

Stormtrap Area=10,714 sf

Stone Area=12,219 sf

Inflow Area = 5.263 ac, 70.70% Impervious, Inflow Depth > 4.46" for 25 Yr event
 Inflow = 21.22 cfs @ 12.17 hrs, Volume= 1.956 af
 Outflow = 10.56 cfs @ 12.42 hrs, Volume= 1.268 af, Atten= 50%, Lag= 15.3 min
 Discarded = 0.09 cfs @ 9.85 hrs, Volume= 0.131 af
 Primary = 10.47 cfs @ 12.42 hrs, Volume= 1.137 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 357.03' @ 12.42 hrs Surf.Area= 13,724 sf Storage= 40,494 cf

Plug-Flow detention time= 200.2 min calculated for 1.268 af (65% of inflow)
 Center-of-Mass det. time= 103.0 min (891.7 - 788.6)

Volume	Invert	Avail.Storage	Storage Description
#1	352.50'	4,888 cf	Custom Stage Data (Prismatic) Listed below
#2	353.50'	39,464 cf	Custom Stage Data Listed below -Impervious
#3	353.50'	2,504 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		46,856 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
352.50	12,219	0.0	0	0
353.50	12,219	40.0	4,888	4,888

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	0	0
357.66	39,464	39,464

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	1,505	0.0	0	0
357.66	1,505	40.0	2,504	2,504

Device	Routing	Invert	Outlet Devices
#1	Discarded	352.50'	0.270 in/hr Exfiltration over Surface area
#2	Primary	350.00'	24.0" Round Culvert L= 74.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 350.00' / 348.52' S= 0.0200 1' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	354.95'	1.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	355.85'	4.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	356.50'	7.5' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

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Type III 24-hr 25 Yr Rainfall=5.50"

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Discarded OutFlow Max=0.09 cfs @ 9.85 hrs HW=353.50' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=10.34 cfs @ 12.42 hrs HW=357.02' (Free Discharge)

↳ **2=Culvert** (Passes 10.34 cfs of 37.13 cfs potential flow)

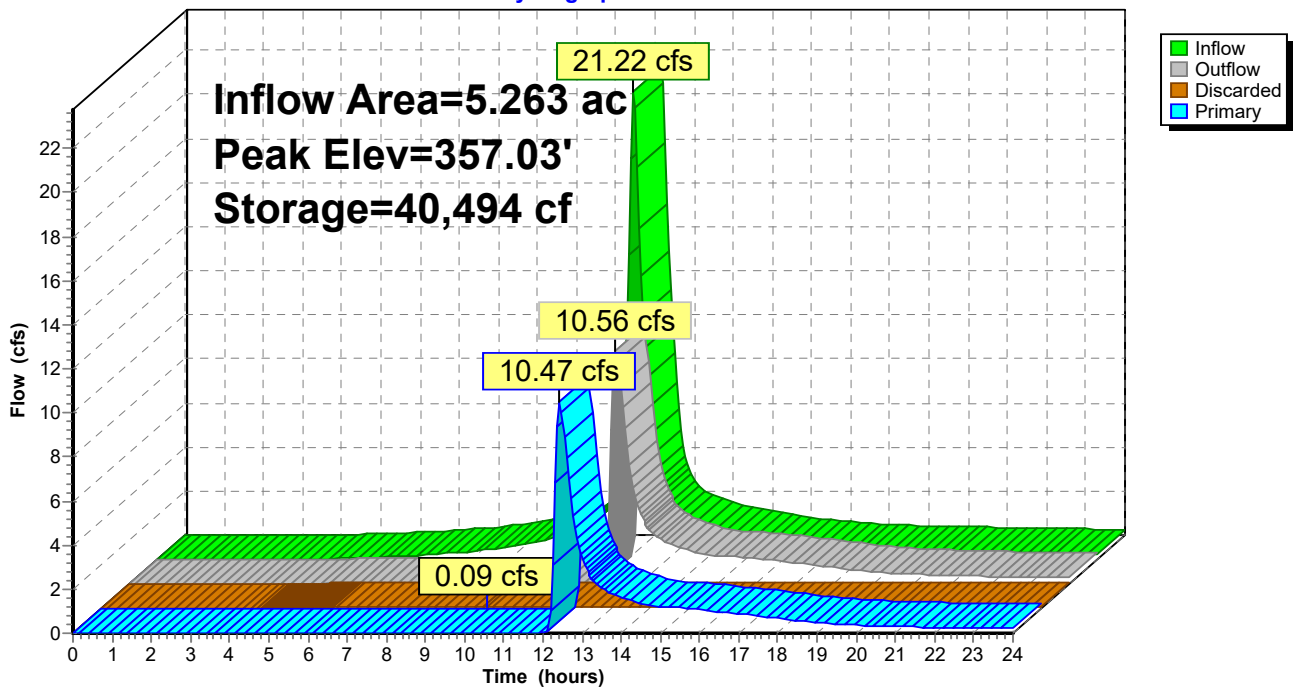
↳ **3=Orifice/Grate** (Orifice Controls 0.04 cfs @ 6.87 fps)

↳ **4=Orifice/Grate** (Orifice Controls 1.69 cfs @ 4.83 fps)

↳ **5=Broad-Crested Rectangular Weir** (Weir Controls 8.61 cfs @ 2.19 fps)

Pond 3P: Stormtrap

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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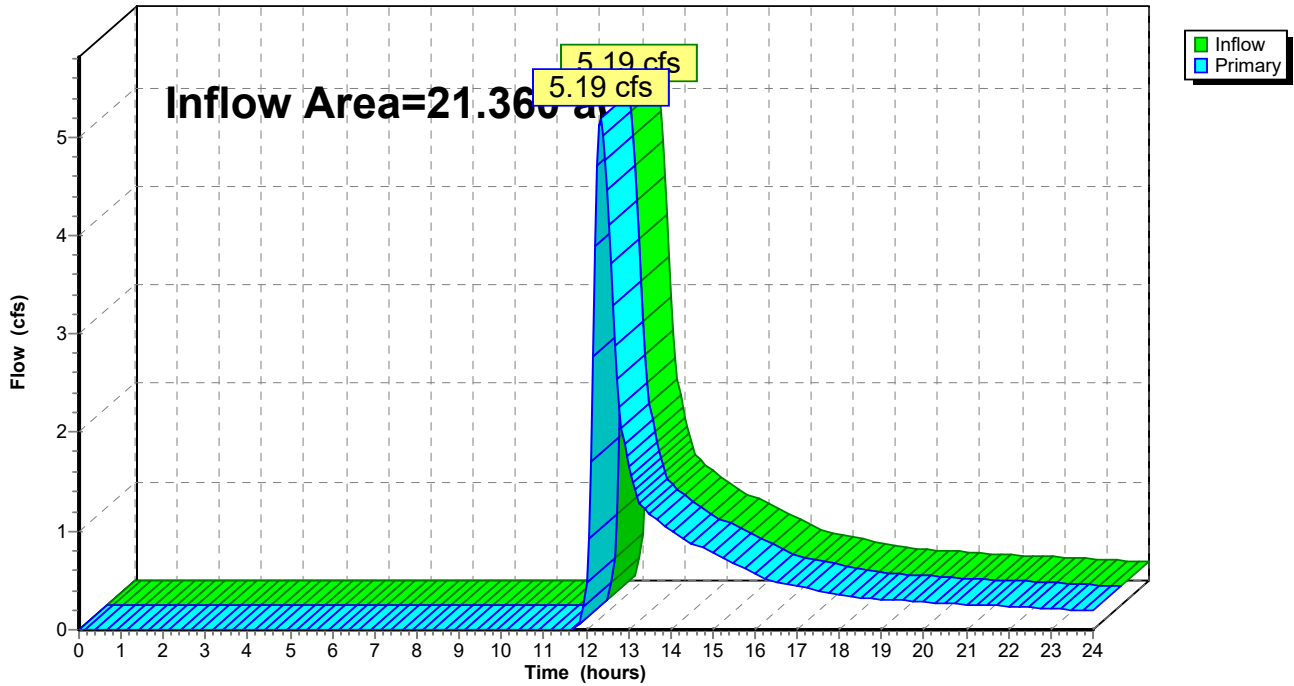
Summary for Link 1L: SE Corner

Inflow Area = 21.360 ac, 30.31% Impervious, Inflow Depth > 0.39" for 25 Yr event
Inflow = 5.19 cfs @ 12.34 hrs, Volume= 0.700 af
Primary = 5.19 cfs @ 12.34 hrs, Volume= 0.700 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



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Type III 24-hr 25 Yr Rainfall=5.50"

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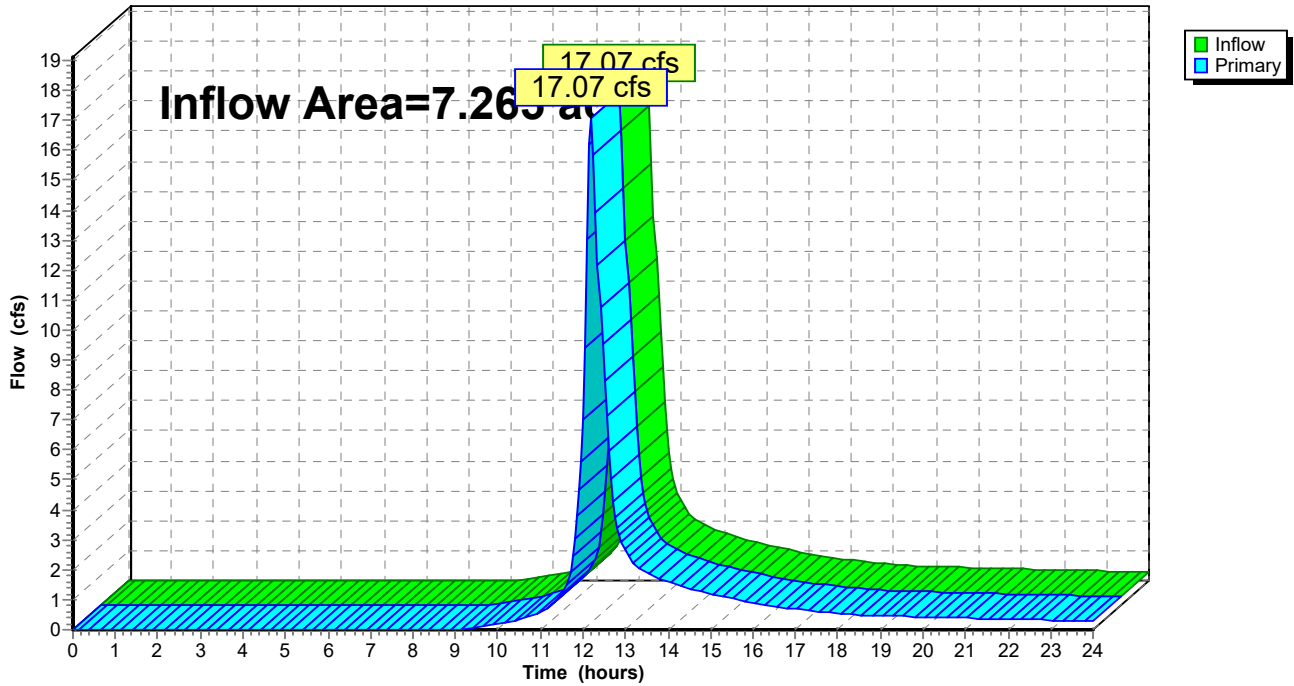
Summary for Link 2L: Wly Wetland

Inflow Area = 7.265 ac, 3.48% Impervious, Inflow Depth > 2.58" for 25 Yr event
Inflow = 17.07 cfs @ 12.20 hrs, Volume= 1.564 af
Primary = 17.07 cfs @ 12.20 hrs, Volume= 1.564 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Wly Wetland

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Drainage Collection Runoff Area=8.041 ac 30.37% Impervious Runoff Depth>3.98"
Flow Length=345' Tc=14.0 min CN=76 Runoff=29.03 cfs 2.668 af

Subcatchment P-2: Clubhouse Area Runoff Area=5.263 ac 70.70% Impervious Runoff Depth>5.63"
Flow Length=305' Tc=12.5 min CN=91 Runoff=26.46 cfs 2.471 af

Subcatchment P-3: ByPass MBTA Rd Runoff Area=8.056 ac 3.86% Impervious Runoff Depth>1.66"
Flow Length=1,801' Tc=19.5 min CN=52 Runoff=9.42 cfs 1.117 af

Subcatchment P-4: ByPass to W'ly Wetland Runoff Area=7.265 ac 3.48% Impervious Runoff Depth>3.57"
Flow Length=258' Tc=13.6 min CN=72 Runoff=23.71 cfs 2.159 af

Subcatchment P-5: Nly PL Runoff Area=2.410 ac 1.24% Impervious Runoff Depth>2.87"
Flow Length=77' Tc=8.0 min CN=65 Runoff=7.37 cfs 0.576 af

Pond 1P: Inf Basin Peak Elev=288.37' Storage=77,012 cf Inflow=46.01 cfs 4.309 af
Discarded=3.91 cfs 3.532 af Primary=2.77 cfs 0.597 af Outflow=6.68 cfs 4.129 af

Pond 3P: Stormtrap Peak Elev=357.30' Storage=43,249 cf Inflow=26.46 cfs 2.471 af
Discarded=0.09 cfs 0.136 af Primary=19.74 cfs 1.641 af Outflow=19.82 cfs 1.777 af

Link 1L: SE Corner Inflow=9.42 cfs 1.714 af
Primary=9.42 cfs 1.714 af

Link 2L: Wly Wetland Inflow=23.71 cfs 2.159 af
Primary=23.71 cfs 2.159 af

Total Runoff Area = 31.035 ac Runoff Volume = 8.991 af Average Runoff Depth = 3.48"
78.23% Pervious = 24.278 ac 21.77% Impervious = 6.757 ac

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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment P-1: Drainage Collection

Runoff = 29.03 cfs @ 12.20 hrs, Volume= 2.668 af, Depth> 3.98"

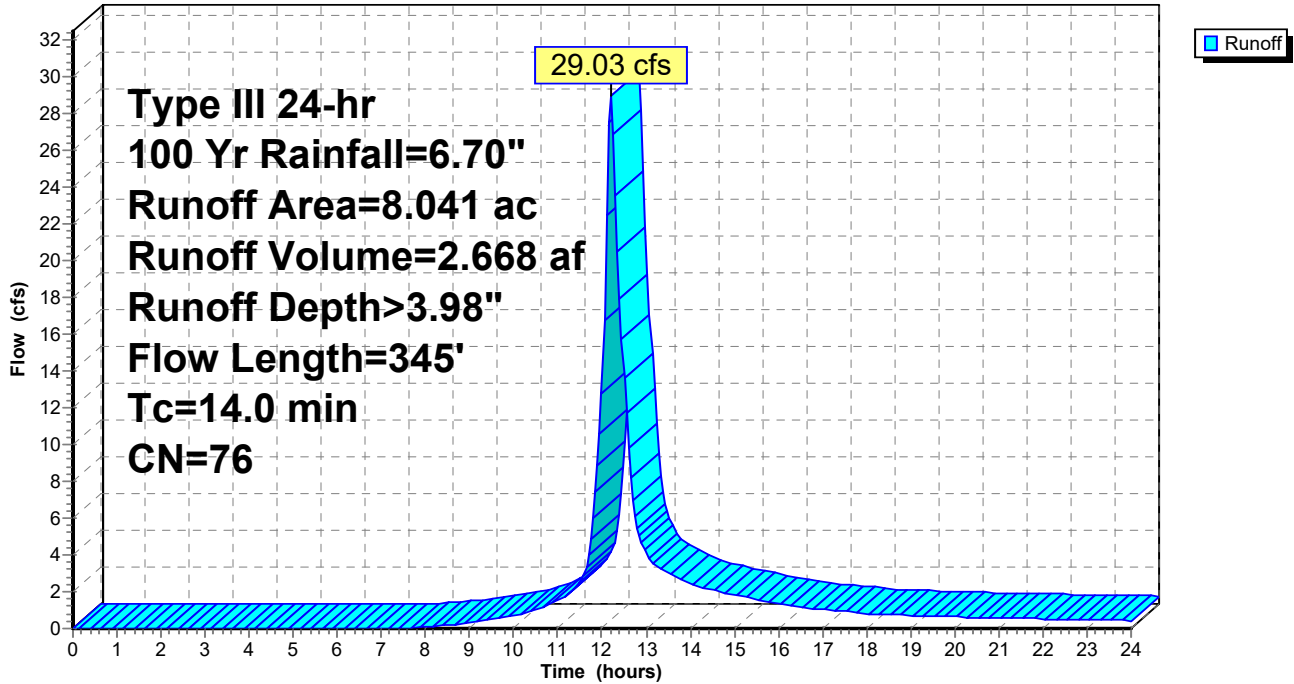
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
0.080	30	Woods, Good, HSG A
1.391	39	>75% Grass cover, Good, HSG A
0.339	98	Paved parking, HSG A
0.294	70	Woods, Good, HSG C
3.434	74	>75% Grass cover, Good, HSG C
1.412	98	Paved parking, HSG C
0.691	98	Roofs, HSG C
0.400	98	Water Surface, 0% imp, HSG A
8.041	76	Weighted Average
5.599		69.63% Pervious Area
2.442		30.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	145	0.0470	3.49		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.1	62	0.3300	9.25		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.9	88	0.0100	1.61		Shallow Concentrated Flow, D-E Unpaved Kv= 16.1 fps
14.0	345	Total			

Subcatchment P-1: Drainage Collection

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment P-2: Clubhouse Area

Runoff = 26.46 cfs @ 12.17 hrs, Volume= 2.471 af, Depth> 5.63"

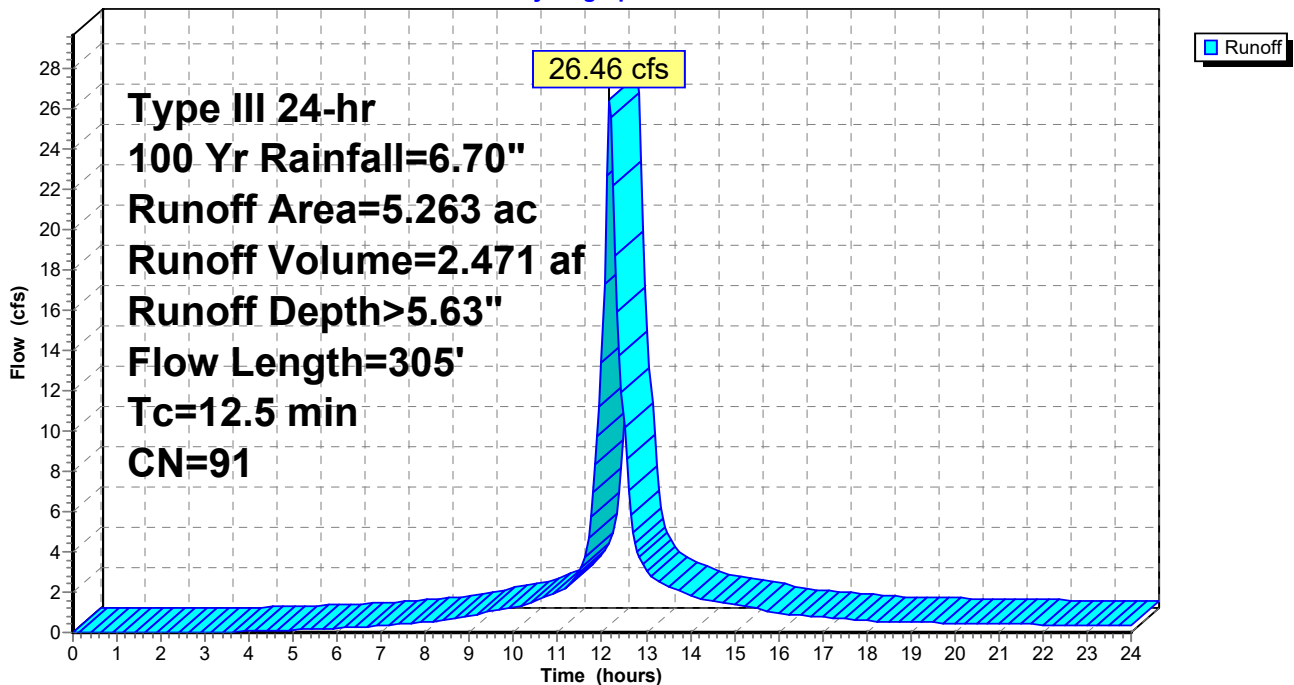
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
1.542	74	>75% Grass cover, Good, HSG C
2.330	98	Paved parking, HSG C
1.391	98	Roofs, HSG C
5.263	91	Weighted Average
1.542		29.30% Pervious Area
3.721		70.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.20"
0.7	89	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
1.0	166	0.0200	2.87		Shallow Concentrated Flow, C-D Paved Kv= 20.3 fps
12.5	305	Total			

Subcatchment P-2: Clubhouse Area

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment P-3: ByPass MBTA Rd

Runoff = 9.42 cfs @ 12.31 hrs, Volume= 1.117 af, Depth> 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

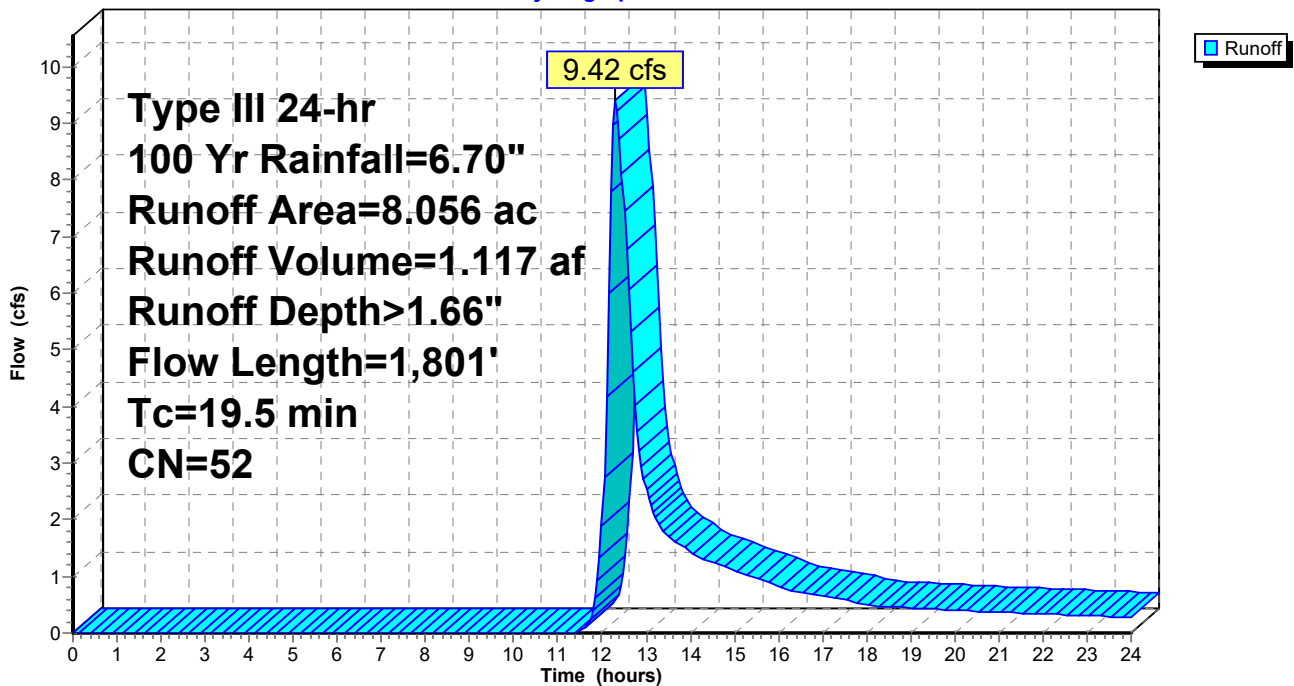
Area (ac)	CN	Description
3.340	30	Woods, Good, HSG A
0.600	39	>75% Grass cover, Good, HSG A
3.306	70	Woods, Good, HSG C
0.380	74	>75% Grass cover, Good, HSG C
0.311	98	Paved roads w/curbs & sewers, HSG A
0.119	39	>75% Grass cover, Good, HSG A

8.056	52	Weighted Average
7.745		96.14% Pervious Area
0.311		3.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0180	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
6.6	1,751	0.0760	4.44		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.5	1,801	Total			

Subcatchment P-3: ByPass MBTA Rd

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment P-4: ByPass to W'ly Wetland

Runoff = 23.71 cfs @ 12.19 hrs, Volume= 2.159 af, Depth> 3.57"

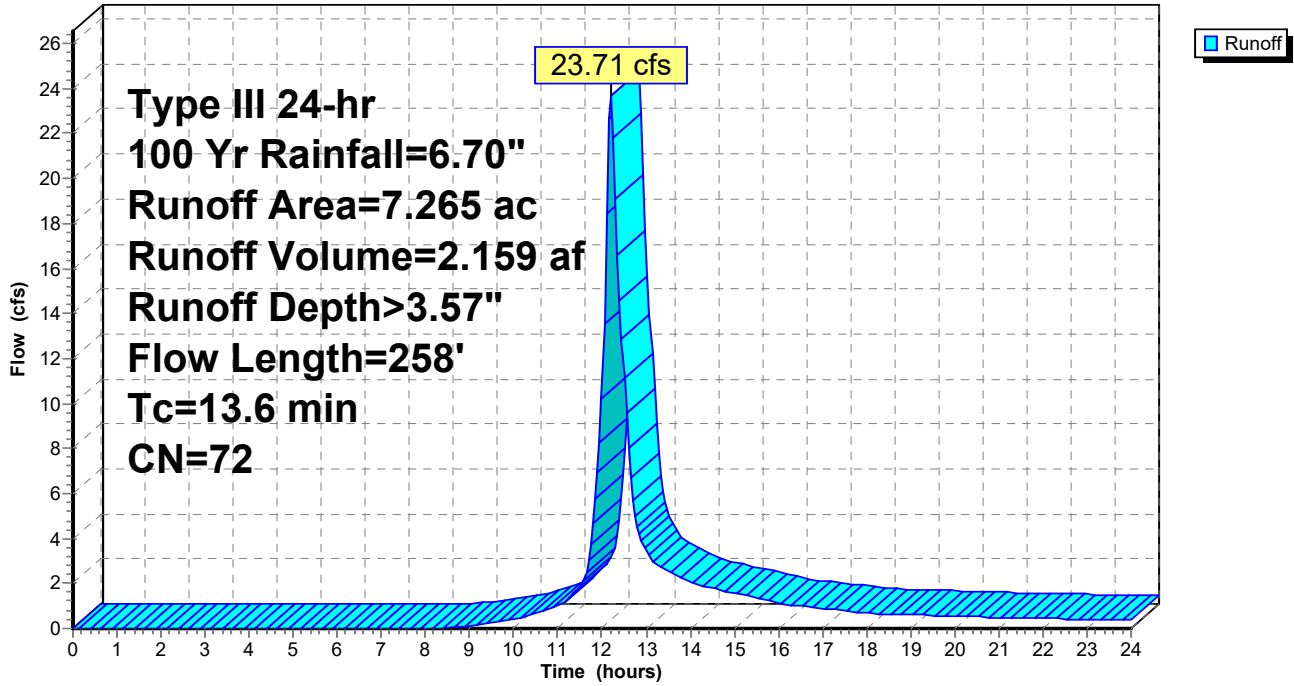
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
5.540	70	Woods, Good, HSG C
0.830	74	>75% Grass cover, Good, HSG C
0.020	98	Paved parking, HSG C
0.430	77	Woods, Good, HSG D
0.212	74	>75% Grass cover, Good, HSG C
0.210	98	Unconnected roofs, HSG C
0.023	98	Unconnected pavement, HSG C
7.265	72	Weighted Average
7.012		96.52% Pervious Area
0.253		3.48% Impervious Area
0.233		92.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	208	0.0270	2.65		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
13.6	258	Total			

Subcatchment P-4: ByPass to W'ly Wetland

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Subcatchment P-5: Nly PL

Runoff = 7.37 cfs @ 12.12 hrs, Volume= 0.576 af, Depth> 2.87"

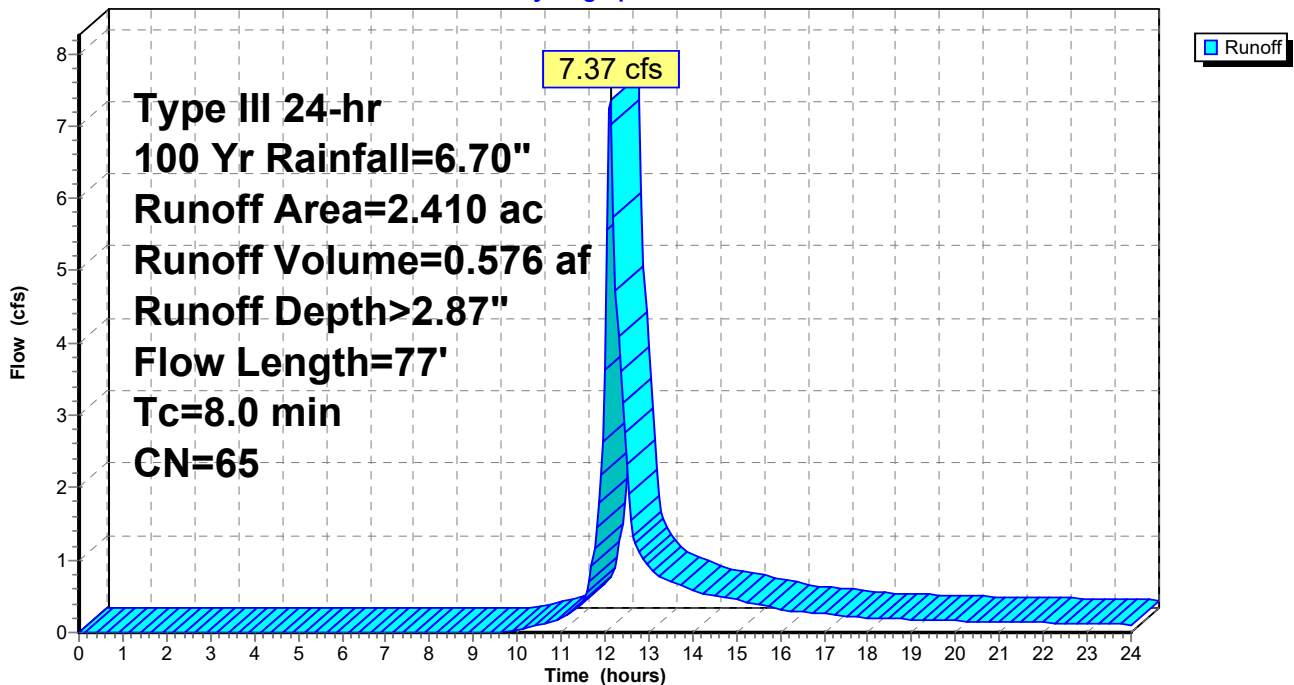
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.70"

Area (ac)	CN	Description
0.070	30	Woods, Good, HSG A
0.520	39	>75% Grass cover, Good, HSG A
0.440	70	Woods, Good, HSG C
1.350	74	>75% Grass cover, Good, HSG C
0.030	98	Paved parking, HSG C
2.410	65	Weighted Average
2.380		98.76% Pervious Area
0.030		1.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	27	0.0700	4.26		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
8.0	77	Total			

Subcatchment P-5: Nly PL

Hydrograph



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Type III 24-hr 100 Yr Rainfall=6.70"

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Summary for Pond 1P: Inf Basin

Inflow Area = 13.304 ac, 46.32% Impervious, Inflow Depth > 3.89" for 100 Yr event
 Inflow = 46.01 cfs @ 12.25 hrs, Volume= 4.309 af
 Outflow = 6.68 cfs @ 13.18 hrs, Volume= 4.129 af, Atten= 85%, Lag= 55.9 min
 Discarded = 3.91 cfs @ 13.18 hrs, Volume= 3.532 af
 Primary = 2.77 cfs @ 13.18 hrs, Volume= 0.597 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 288.37' @ 13.18 hrs Surf.Area= 20,434 sf Storage= 77,012 cf

Plug-Flow detention time= 176.1 min calculated for 4.129 af (96% of inflow)
 Center-of-Mass det. time= 153.8 min (995.9 - 842.1)

Volume	Invert	Avail.Storage	Storage Description
#1	283.50'	112,982 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.50	10,661	0	0
284.00	12,357	5,755	5,755
285.00	14,108	13,233	18,987
286.00	15,917	15,013	34,000
287.00	17,782	16,850	50,849
288.00	19,703	18,743	69,592
289.00	21,681	20,692	90,284
290.00	23,716	22,699	112,982

Device	Routing	Invert	Outlet Devices
#1	Discarded	283.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	280.91'	24.0" Round Culvert L= 119.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 280.91' / 277.45' S= 0.0291 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	286.90'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	287.25'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	288.50'	16.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=3.91 cfs @ 13.18 hrs HW=288.37' (Free Discharge)

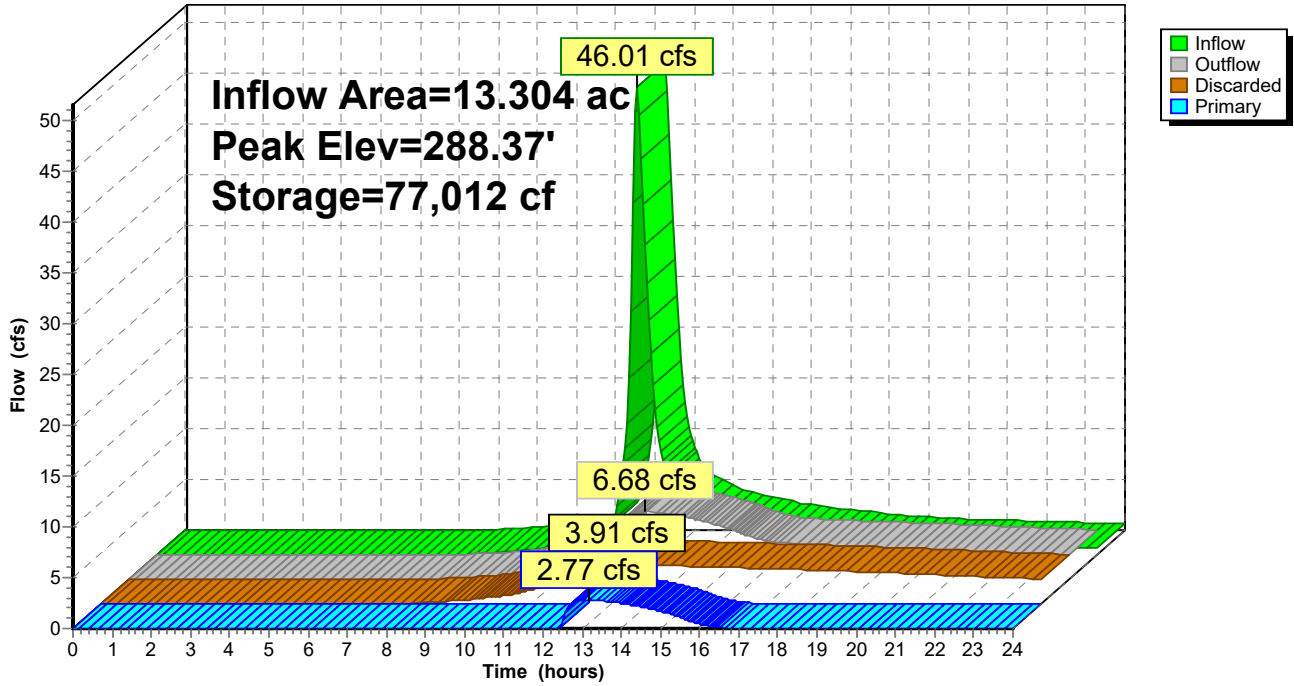
↳ **1=Exfiltration** (Exfiltration Controls 3.91 cfs)

Primary OutFlow Max=2.77 cfs @ 13.18 hrs HW=288.37' (Free Discharge)

↳ **2=Culvert** (Passes 2.77 cfs of 38.45 cfs potential flow)
 ↳ **3=Orifice/Grate** (Orifice Controls 0.12 cfs @ 5.67 fps)
 ↳ **4=Orifice/Grate** (Orifice Controls 2.64 cfs @ 4.49 fps)
 ↳ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Inf Basin

Hydrograph



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Summary for Pond 3P: Stormtrap

Custom Storage to Match Stormtrap Design

Stormtrap Area=10,714 sf

Stone Area=12,219 sf

Inflow Area = 5.263 ac, 70.70% Impervious, Inflow Depth > 5.63" for 100 Yr event
 Inflow = 26.46 cfs @ 12.17 hrs, Volume= 2.471 af
 Outflow = 19.82 cfs @ 12.29 hrs, Volume= 1.777 af, Atten= 25%, Lag= 7.5 min
 Discarded = 0.09 cfs @ 9.10 hrs, Volume= 0.136 af
 Primary = 19.74 cfs @ 12.29 hrs, Volume= 1.641 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 357.30' @ 12.29 hrs Surf.Area= 13,724 sf Storage= 43,249 cf

Plug-Flow detention time= 173.9 min calculated for 1.773 af (72% of inflow)
 Center-of-Mass det. time= 86.5 min (869.1 - 782.6)

Volume	Invert	Avail.Storage	Storage Description
#1	352.50'	4,888 cf	Custom Stage Data (Prismatic) Listed below
#2	353.50'	39,464 cf	Custom Stage Data Listed below -Impervious
#3	353.50'	2,504 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		46,856 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
352.50	12,219	0.0	0	0
353.50	12,219	40.0	4,888	4,888

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	0	0
357.66	39,464	39,464

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
353.50	1,505	0.0	0	0
357.66	1,505	40.0	2,504	2,504

Device	Routing	Invert	Outlet Devices
#1	Discarded	352.50'	0.270 in/hr Exfiltration over Surface area
#2	Primary	350.00'	24.0" Round Culvert L= 74.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 350.00' / 348.52' S= 0.0200 1' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	354.95'	1.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 2	355.85'	4.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads
#5	Device 2	356.50'	7.5' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

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Type III 24-hr 100 Yr Rainfall=6.70"

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Discarded OutFlow Max=0.09 cfs @ 9.10 hrs HW=353.50' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=19.61 cfs @ 12.29 hrs HW=357.30' (Free Discharge)

↳ **2=Culvert** (Passes 19.61 cfs of 37.96 cfs potential flow)

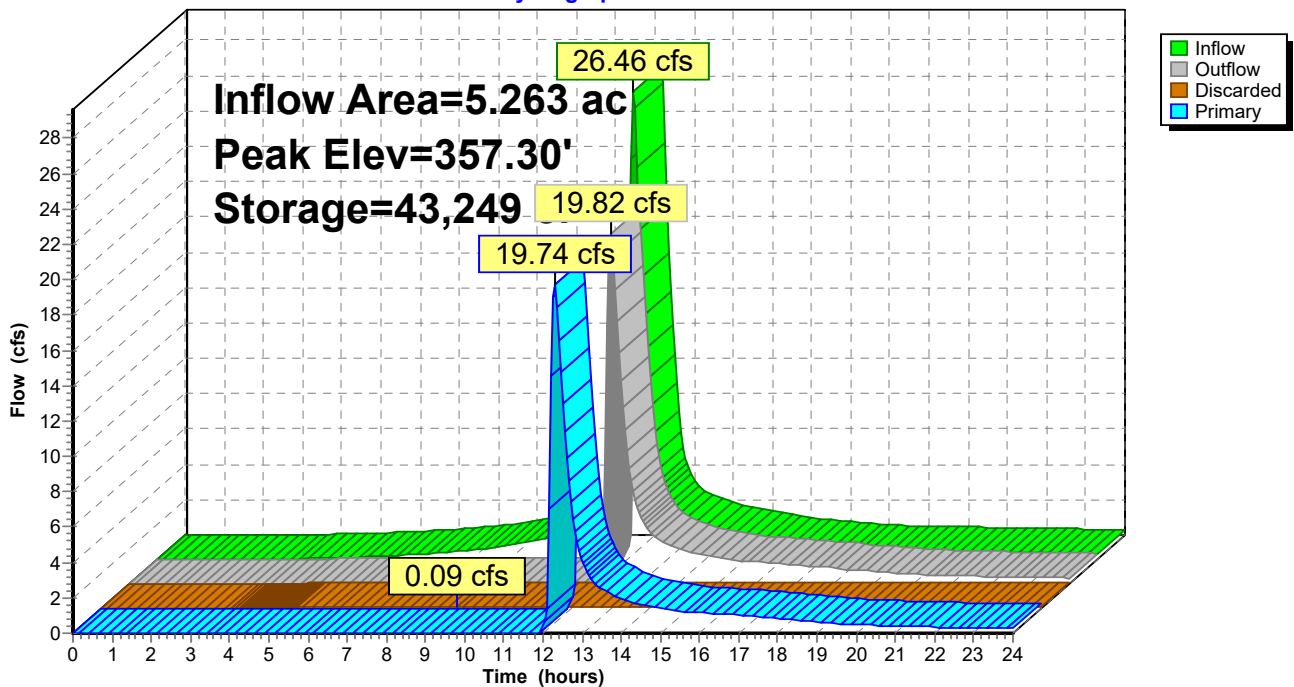
↳ **3=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.31 fps)

↳ **4=Orifice/Grate** (Orifice Controls 1.90 cfs @ 5.45 fps)

↳ **5=Broad-Crested Rectangular Weir** (Weir Controls 17.67 cfs @ 2.95 fps)

Pond 3P: Stormtrap

Hydrograph



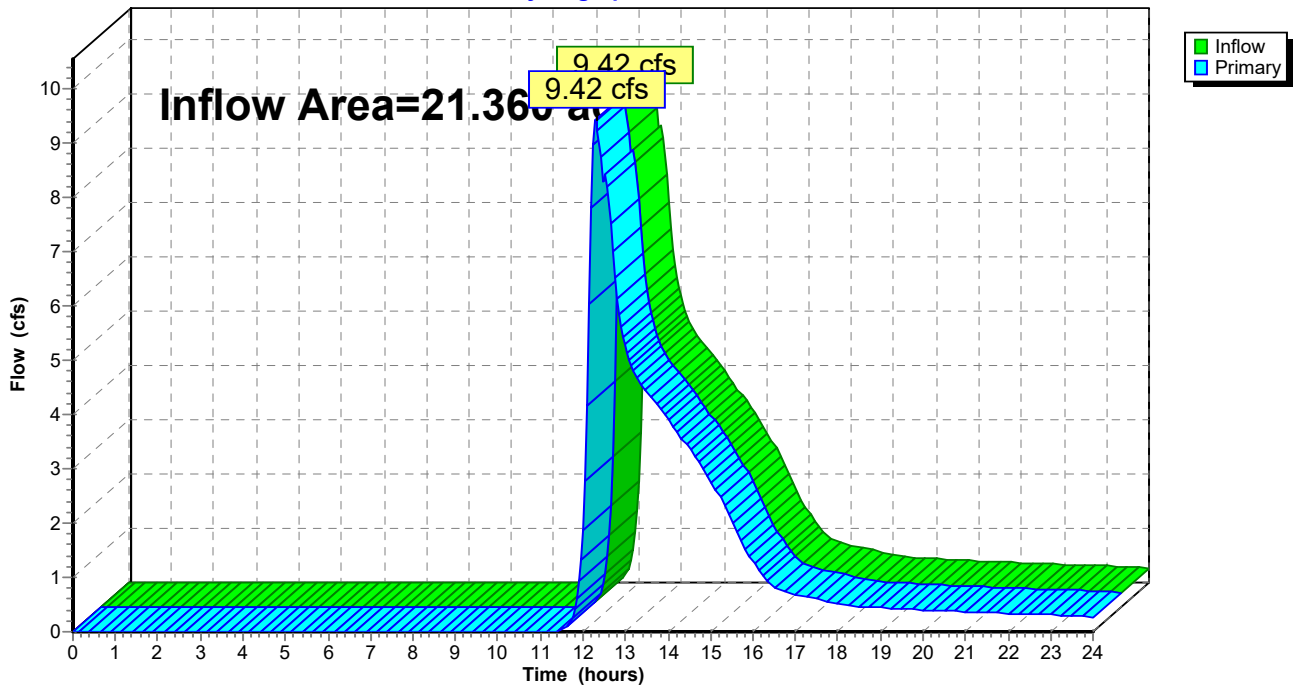
Summary for Link 1L: SE Corner

Inflow Area = 21.360 ac, 30.31% Impervious, Inflow Depth > 0.96" for 100 Yr event
Inflow = 9.42 cfs @ 12.31 hrs, Volume= 1.714 af
Primary = 9.42 cfs @ 12.31 hrs, Volume= 1.714 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: SE Corner

Hydrograph



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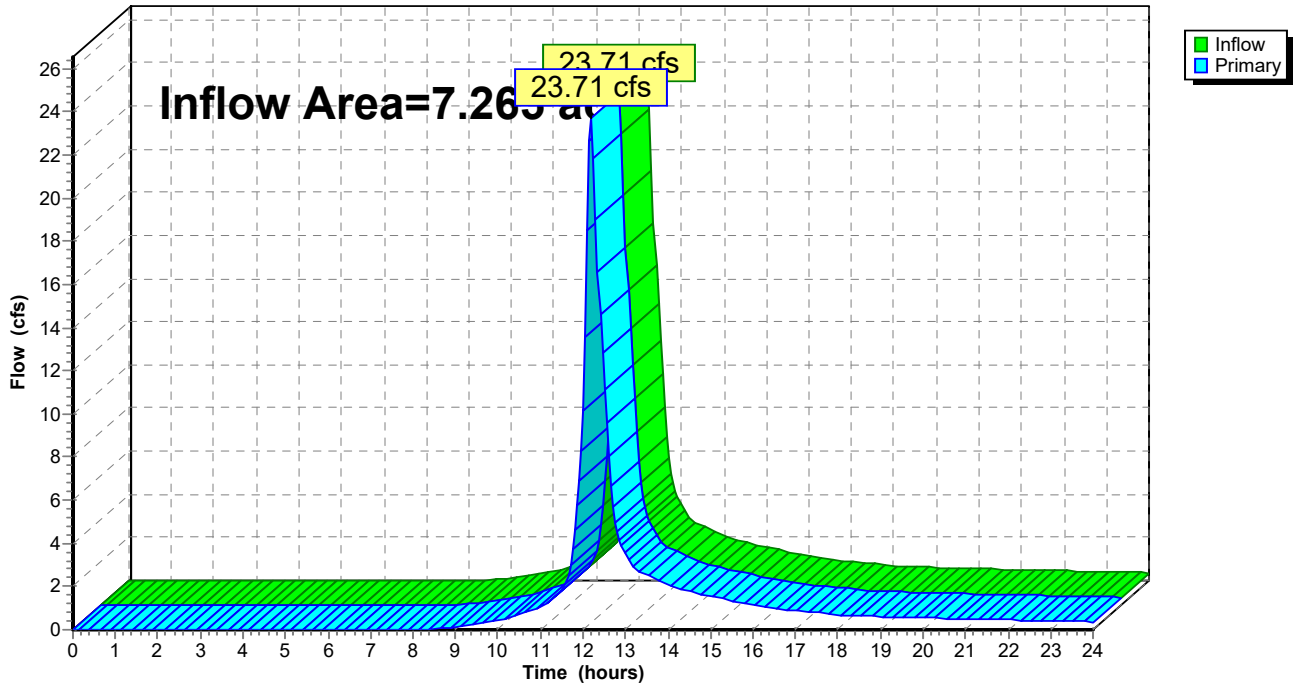
Summary for Link 2L: Wly Wetland

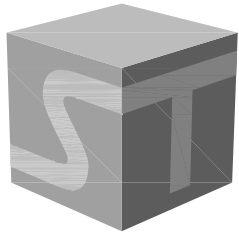
Inflow Area = 7.265 ac, 3.48% Impervious, Inflow Depth > 3.57" for 100 Yr event
Inflow = 23.71 cfs @ 12.19 hrs, Volume= 2.159 af
Primary = 23.71 cfs @ 12.19 hrs, Volume= 2.159 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Wly Wetland

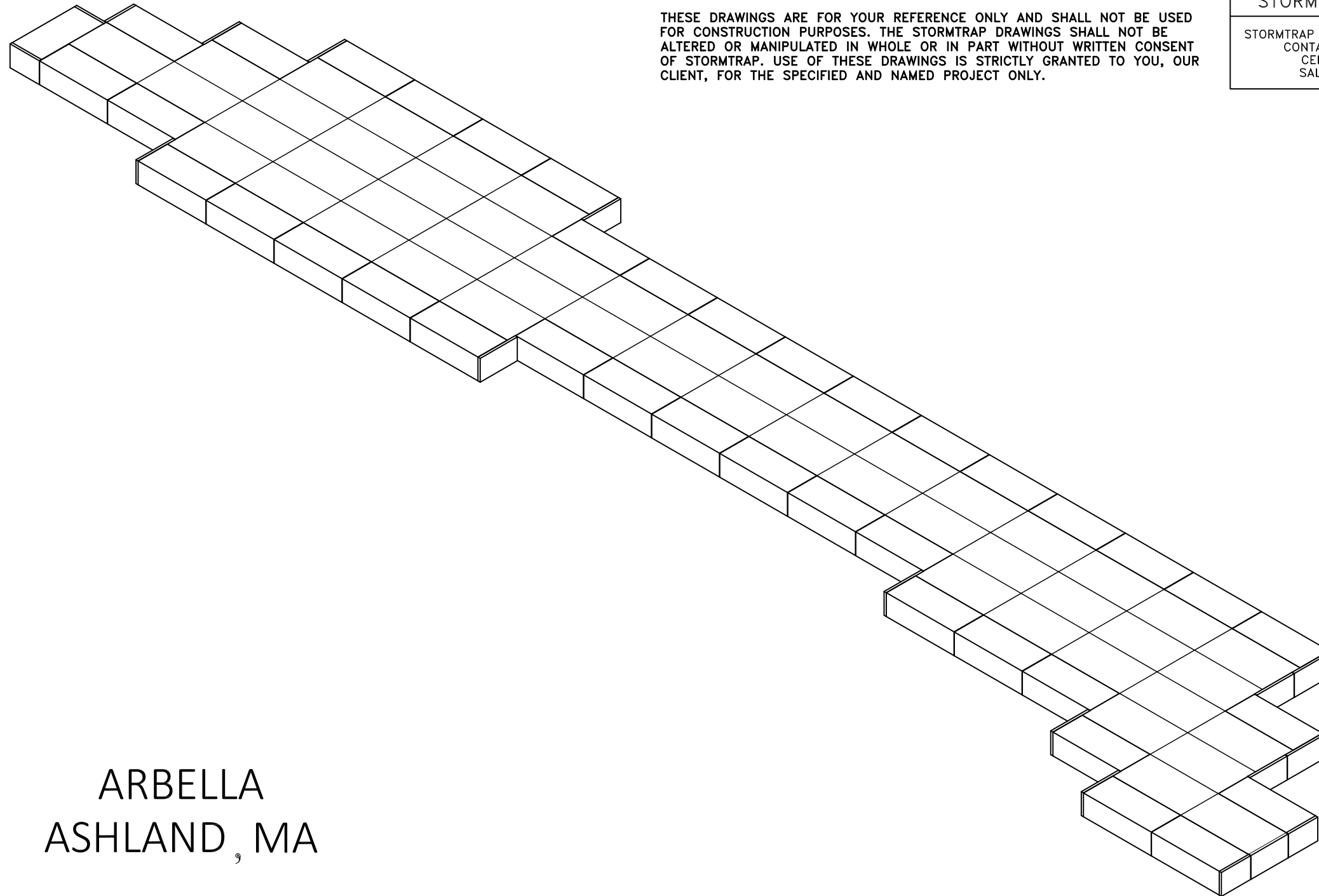
Hydrograph





StormTrap®

MODULAR CONCRETE
STORMWATER MANAGEMENT



ARBELLA
ASHLAND, MA

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SHEET INDEX	
PAGE	DESCRIPTION
0.0	COVER SHEET
1.0	SINGLETRAP DESIGN CRITERIA
2.0	SINGLETRAP SYSTEM LAYOUT
3.0	SINGLETRAP INSTALLATION SPECIFICATIONS
3.1	SINGLETRAP INSTALLATION SPECIFICATIONS
4.0	SINGLETRAP BACKFILL SPECIFICATIONS
5.0	RECOMMENDED PIPE/ACCESS OPENING SPECIFICATIONS
6.0	SPLASH PAD & GEOWEB DETAILS
7.0	SINGLETRAP MODULE TYPES

STORMTRAP CONTACT INFORMATION

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 CONTACT NAME: PATRICK GORDON
 CELL PHONE: 603-391-1206
 SALES EMAIL: PGORDON@STORMTRAP.COM

StormTrap®

PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT]

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ENGINEER INFORMATION:

ALLEN & MAJOR
10 MAIN STREET

LAKEVILLE, MA
508-923-1010

PROJECT INFORMATION:

ARBELLA

ASHLAND, MA

CURRENT ISSUE DATE:

5/12/2021

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SCALE:

NTS

SHEET TITLE:

COVER SHEET

SHEET NUMBER:

0.0

STRUCTURAL DESIGN LOADING CRITERIA

LIVE LOADING: **AASHTO HS-20 HIGHWAY LOADING**
 GROUND WATER TABLE: BELOW INVERT OF SYSTEM
 SOIL BEARING PRESSURE: 4000PSF
 SOIL DENSITY: 120 PCF
 EQUIVALENT UNSATURATED LATERAL ACTIVE EARTH PRESSURE: 35 PSF / FT.
 EQUIVALENT SATURATED LATERAL ACTIVE EARTH PRESSURE: 80 PSF/FT. (IF WATER TABLE PRESENT)
 APPLICABLE CODES: ASTM C857
 ACI-318
 BACKFILL TYPE: SEE SHEET 4.0 FOR BACKFILL OPTIONS

STORMTRAP SYSTEM INFORMATION

WATER STORAGE PROV: 39,380.79 CUBIC FEET
 WATER STORAGE PROV IN 12" BASE STONE AND 24" PERIMETER STONE: 7,398.26 CUBIC FEET
 TOTAL WATER STORAGE PROV: 46,779.05 CUBIC FEET
 UNIT HEADROOM: 4'-2" SINGLETRAP
 UNIT QUANTITY: 90 TOTAL PIECES

SITE SPECIFIC DESIGN CRITERIA

1. STORMTRAP UNITS SHALL BE MANUFACTURED AND INSTALLED ACCORDING TO SHOP DRAWINGS APPROVED BY THE INSTALLING CONTRACTOR AND ENGINEER OF RECORD. THE SHOP DRAWINGS SHALL INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET/ OUTLET PIPE TYPES, SIZES, INVERT ELEVATIONS AND SIZE OF OPENINGS.
2. COVER RANGE: MIN. 3.83' MAX. 7.83' CONSULT STORMTRAP FOR ADDITIONAL COVER OPTIONS.
3. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE REQUIRED TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO STORMTRAP INSTALLATION.
4. FOR STRUCTURAL CALCULATIONS THE GROUND WATER TABLE IS ASSUMED TO BE BELOW INVERT OF SYSTEM IF WATER TABLE IS DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.



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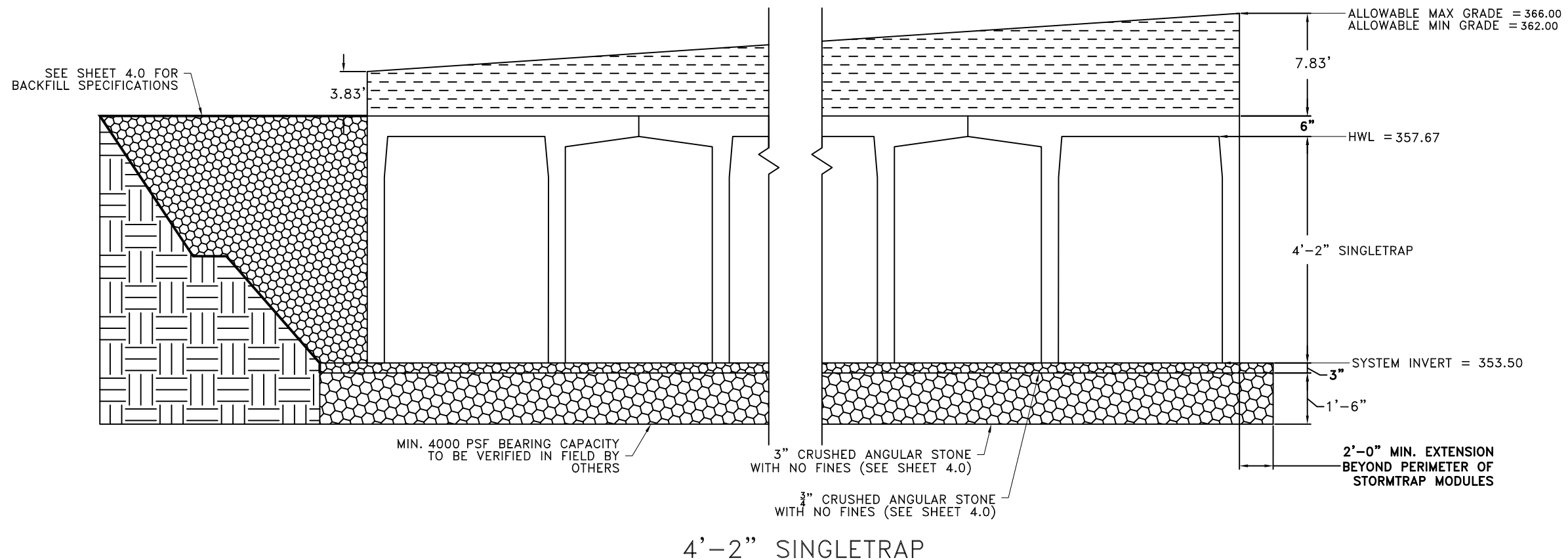
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SHEET TITLE:

SINGLETRAP
 DESIGN
 CRITERIA

SHEET NUMBER:

1.0



BILL OF MATERIALS

QTY.	UNIT TYPE	DESCRIPTION	WEIGHT
0	I	4'-2" SINGLETRAP	-
51	II	4'-2" SINGLETRAP	16835
0	III	4'-2" SINGLETRAP	-
38	IV	4'-2" SINGLETRAP	15283
0	VII	4'-2" SINGLETRAP	-
1	SPIV	4'-2" SINGLETRAP	VARIES
13	T2 PANEL	6" THICK PANEL	2948
5	T4 PANEL	6" THICK PANEL	2319
0	T7 PANEL	6" THICK PANEL	-
19	JOINTWRAP	150' PER ROLL	
0	JOINTTAPE	14.5' PER ROLL	

LOADING DISCLAIMER:

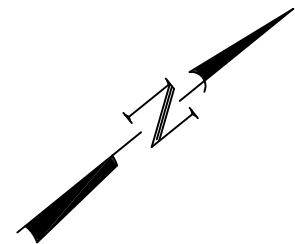
STORMTRAP IS NOT DESIGNED TO ACCEPT ANY ADDITIONAL LOADINGS FROM NEARBY STRUCTURES NEXT TO OR OVER THE TOP OF STORMTRAP. IF ADDITIONAL LOADING CONSIDERATIONS ARE REQUIRED FOR STRUCTURAL DESIGN OF STORMTRAP, PLEASE CONTACT STORMTRAP IMMEDIATELY.

DESIGN CRITERIA

ALLOWABLE MAX GRADE = 366.00
 ALLOWABLE MIN GRADE = 362.00
 INSIDE HEIGHT ELEVATION = 357.67
 SYSTEM INVERT = 353.50

NOTES:

- DIMENSIONING OF STORMTRAP SYSTEM SHOWN BELOW ALLOW FOR A 3/4" GAP BETWEEN EACH MODULE.
- ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
- SEE SHEET 3.0 FOR INSTALLATION SPECIFICATIONS.
- SP - INDICATES A MODULE WITH MODIFICATIONS.
- P - INDICATES A MODULE WITH A PANEL ATTACHMENT.
- CONTRACTORS RESPONSIBILITY TO ENSURE CONSISTENCY/ACCURACY TO FINAL ENGINEER OF RECORD PLAN SET.
- IF A WATERTIGHT SOLUTION IS REQUIRED FOR THIS OUTLET CONTROL STRUCTURE, IT WILL BE THE RESPONSIBILITY OF THE PRECASTER TO PROVIDE AND INSTALL A WATERTIGHT APPLICATION TO ALL INTERIOR COLD JOINTS WITHIN THE STRUCTURE PRIOR TO DELIVERY TO JOB SITE. FOR ALL EXTERIOR COLD JOINTS, INCLUDING JOINT BETWEEN TOP AND BASE MODULES, BETWEEN TOP AND BASE OF ADJOINING SYMONS WALLS, AND JOINTS BETWEEN MODULE AND ADJACENT END PANELS, IT WILL BE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO PROVIDE AND INSTALL THE WATERTIGHT APPLICATION PER THE EOR'S SPECIFICATION. CONTACT STORMTRAP FOR A LIST OF APPROVED APPLICATORS.



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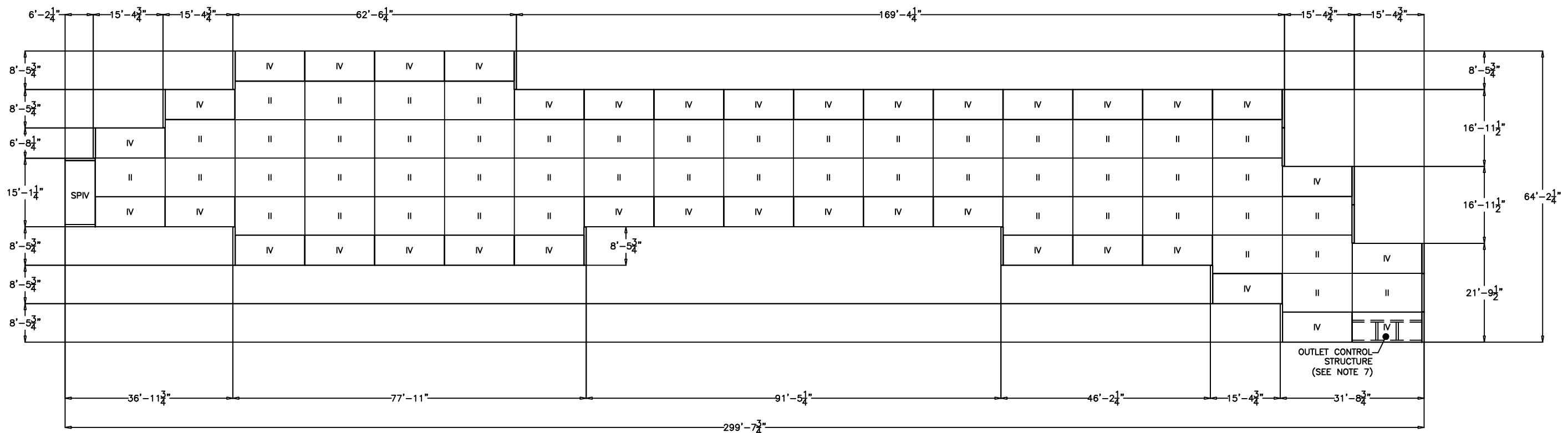
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SINGLETRAP
 LAYOUT DETAILS

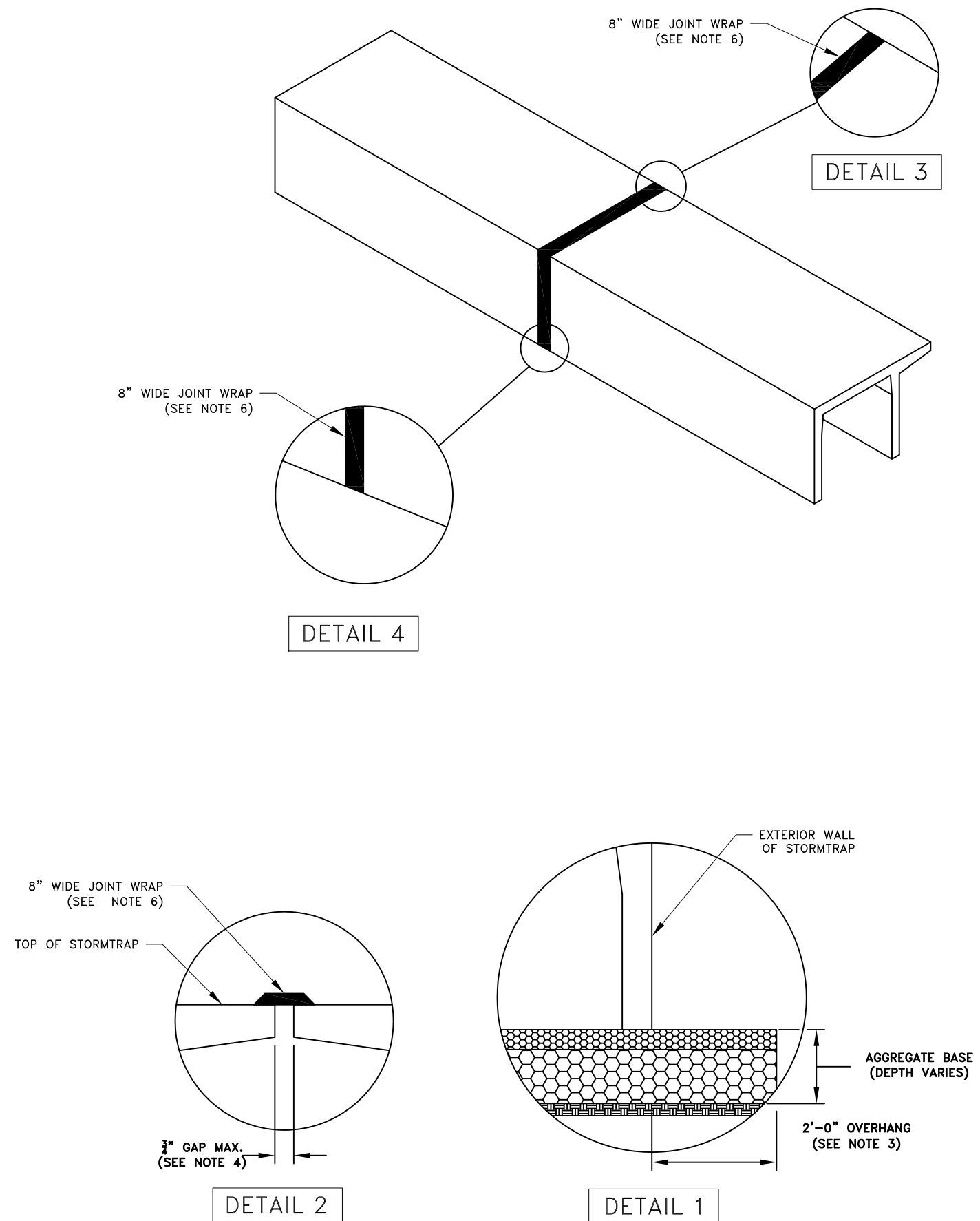
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STORMTRAP INSTALLATION SPECIFICATIONS

1. STORMTRAP SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C891 STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRE-CAST CONCRETE UTILITY STRUCTURES. THE FOLLOWING ADDITIONS AND/OR EXCEPTIONS SHALL APPLY:
2. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO ENSURE THAT PROPER/ADEQUATE EQUIPMENT IS USED TO SET/INSTALL THE MODULES.
3. THE AGGREGATE FOUNDATION HAS BEEN DESIGNED BASED ON THE FOLLOWING ASSUMPTIONS. THESE ASSUMPTIONS WILL NEED TO BE VERIFIED BY A GEOTECHNICAL ENGINEER WHICH WILL NEED TO BE EMPLOYED BY THE OWNER.
 - 3.1. A QUALIFIED GEOTECHNICAL ENGINEER WILL BE EMPLOYED, BY OWNER, TO PROVIDE ASSISTANCE IN EVALUATING THE EXISTING SOIL CONDITIONS BELOW THE PROPOSED ENGINEERED STONE FOUNDATION. IF A STONE FOUNDATION DESIGN IS TO BE USED, THE BEARING PRESSURE OF THE SOILS BELOW THE STONE WILL NEED TO MEET OR EXCEED ALLOWABLE CAPACITY. IF THIS IS NOT POSSIBLE, THE STONE FOUNDATION MAY NOT BE AN OPTION FOR THIS LOCATION.
 - 3.2. A QUALIFIED GEOTECHNICAL ENGINEER WILL BE EMPLOYED, BY OWNER, TO EVALUATE A SOURCE OF STONE AGGREGATES THAT WILL BE PLACED ON PROPERLY COMPACTED SOILS (SEE SHEET 1.0 FOR SOIL BEARING CAPACITY REQUIREMENTS). THE AGGREGATE BASE COURSE FOR WHICH THE STORMTRAP SYSTEM WILL BEAR DIRECTLY ON SHALL CONSIST OF A 3" THICK BED OF 3/4" DIAMETER ANGULAR STONE, WELL COMPACTED AND SEATED, WITH NO FINES. AND A 1'-6" THICK BED OF 3" DIAMETER STONE AGGREGATE (SEE SHEET 4.0 FOR FURTHER DESCRIPTION/EXPLANATION). PLEASE NOTE THAT THESE ARE ONLY MINIMUM RECOMMENDATIONS AND A QUALIFIED GEOTECHNICAL ENGINEER SHALL BE USED TO DETERMINE THE EXACT REQUIREMENTS FOR THE LOCATIONS THAT THE STORMTRAP SYSTEM IS TO BE LOCATED.
 - 3.3. THE CONTRACTOR SHALL REMOVE ANY AND ALL EXPANDABLE OR COLLAPSIBLE SOILS AT THE DIRECTION OF A QUALIFIED GEOTECHNICAL ENGINEER.
 - 3.4. THE AGGREGATE FOUNDATION SHALL BE INSTALLED SUCH THAT THE AGGREGATE EXTENDS A MINIMUM OF 2'-0" PAST THE OUTSIDE OF THE SYSTEM (SEE DETAIL 1).
 - 3.5. THE 3/4" AGGREGATE SHALL BE COMPACTED USING A VIBRATING ROLLER WITH ITS' FULL DYNAMIC FORCE APPLIED TO ACHIEVE A FLAT SURFACE.
 - 3.6. DISK, DRY AND COMPACT THE TOP 8" OF THE SUBGRADE SOILS TO 95% OF THE STANDARD DRY DENSITY AND 110% OPTIMUM MOISTURE CONTENT.
 - 3.7. AGGREGATE SHALL BE GRADED WITHIN +/- 1/4" OF THE GRADE SHOWN ON THE PLANS.
 - 3.8. MINIMUM SOIL BEARING CAPACITY LISTED ON SHEET 1.0 SHALL BE VERIFIED IN FIELD BY OTHERS.
4. THE STORMTRAP MODULES SHALL BE PLACED SUCH THAT THE MAXIMUM SPACE BETWEEN ADJACENT MODULES DOES NOT EXCEED 3/4" (SEE DETAIL 2). IF THE SPACE EXCEEDS 3/4", THE MODULES SHALL BE RESET WITH APPROPRIATE ADJUSTMENT MADE TO LINE AND GRADE TO BRING THE SPACE INTO SPECIFICATION.
5. STORMTRAP MODULES ARE NOT WATERTIGHT. IF A WATERTIGHT SOLUTION IS REQUIRED, CONTACT STORMTRAP FOR RECOMMENDATIONS. THE WATERTIGHT APPLICATION IS TO BE PROVIDED AND IMPLEMENTED BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT THE SELECTED WATERTIGHT SOLUTION PERFORMS AS SPECIFIED BY THE MANUFACTURER.
6. ALL EXTERIOR JOINTS BETWEEN ADJACENT STORMTRAP MODULES SHALL BE SEALED WITH 8" WIDE PRE-FORMED, COLD-APPLIED, SELF-ADHERING ELASTOMERIC RESIN, BONDED TO A WOVEN, HIGHLY PUNCTURE RESISTANT POLYMER WRAP, CONFORMING TO ASTM C891 AND SHALL BE INTEGRATED WITH PRIMER SEALANT AS APPROVED BY STORMTRAP (SEE DETAILS 3 & 4). THE JOINT WRAP DOES NOT PROVIDE A WATERTIGHT SEAL. THE SOLE PURPOSE OF THE JOINT WRAP IS TO PROVIDE A SILT AND SOIL TIGHT SYSTEM. THE ADHESIVE EXTERIOR JOINT WRAP SHALL BE INSTALLED ACCORDING TO THE FOLLOWING INSTALLATION INSTRUCTIONS:
 - 6.1. USE A BRUSH OR WET CLOTH TO THOROUGHLY CLEAN THE OUTSIDE SURFACE AT THE POINT WHERE THE JOINT WRAP IS TO BE APPLIED.
 - 6.2. A RELEASE PAPER PROTECTS THE ADHESIVE SIDE OF THE JOINT WRAP. PLACE THE ADHESIVE TAPE (ADHESIVE SIDE DOWN) AROUND THE STRUCTURE, REMOVING THE RELEASE PAPER AS YOU GO. PRESS THE JOINT WRAP FIRMLY AGAINST THE STORMTRAP MODULE SURFACE WHEN APPLYING.
7. IF THE CONTRACTOR NEEDS TO CANCEL ANY SHIPMENTS, THEY MUST DO SO 48 HOURS PRIOR TO THEIR SCHEDULED ARRIVAL AT THE JOB SITE. IF CANCELED AFTER THAT TIME, PLEASE CONTACT THE PROJECT MANAGER.
8. IF THE STORMTRAP MODULE(S) IS DAMAGED IN ANY WAY PRIOR, DURING, OR AFTER INSTALL, STORMTRAP, MUST BE CONTACTED IMMEDIATELY TO ASSESS THE DAMAGE AND TO DETERMINE WHETHER OR NOT THE MODULE(S) WILL NEED TO BE REPLACED. IF ANY MODULE ARRIVES AT THE JOBSITE DAMAGED DO NOT UNLOAD IT; CONTACT STORMTRAP, IMMEDIATELY. ANY DAMAGE NOT REPORTED BEFORE THE TRUCK IS UNLOADED WILL BE THE CONTRACTOR'S RESPONSIBILITY.
9. STORMTRAP MODULES CANNOT BE ALTERED IN ANY WAY AFTER MANUFACTURING WITHOUT WRITTEN CONSENT FROM STORMTRAP.



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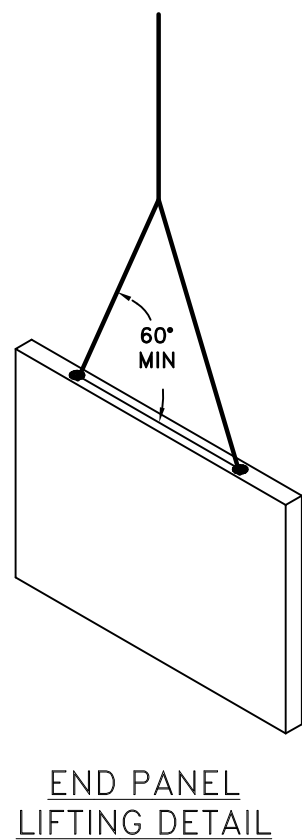
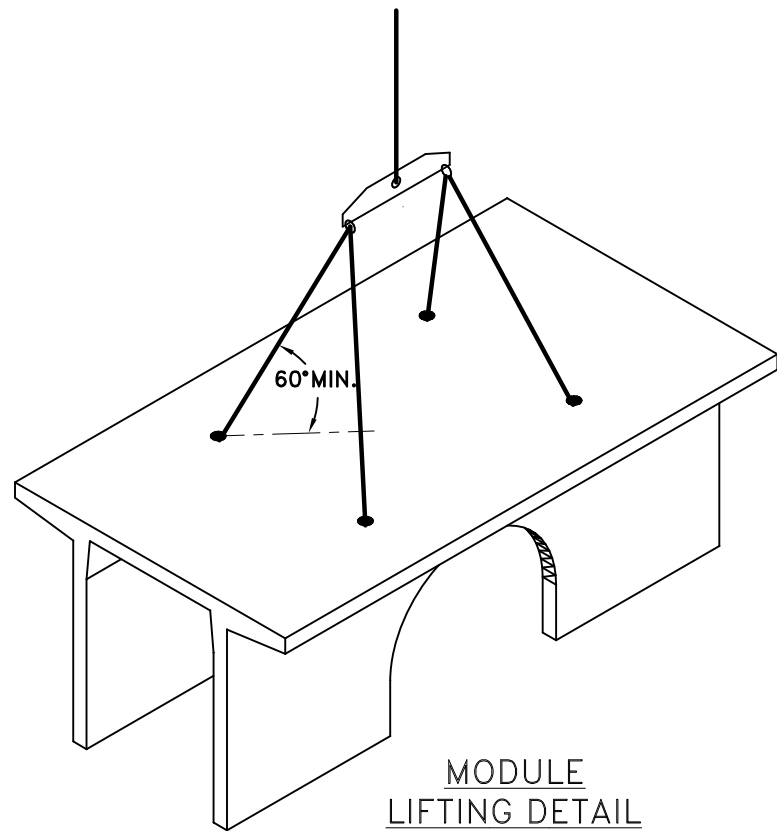
SINGLETRAP
INSTALLATION
SPECIFICATIONS

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3.0

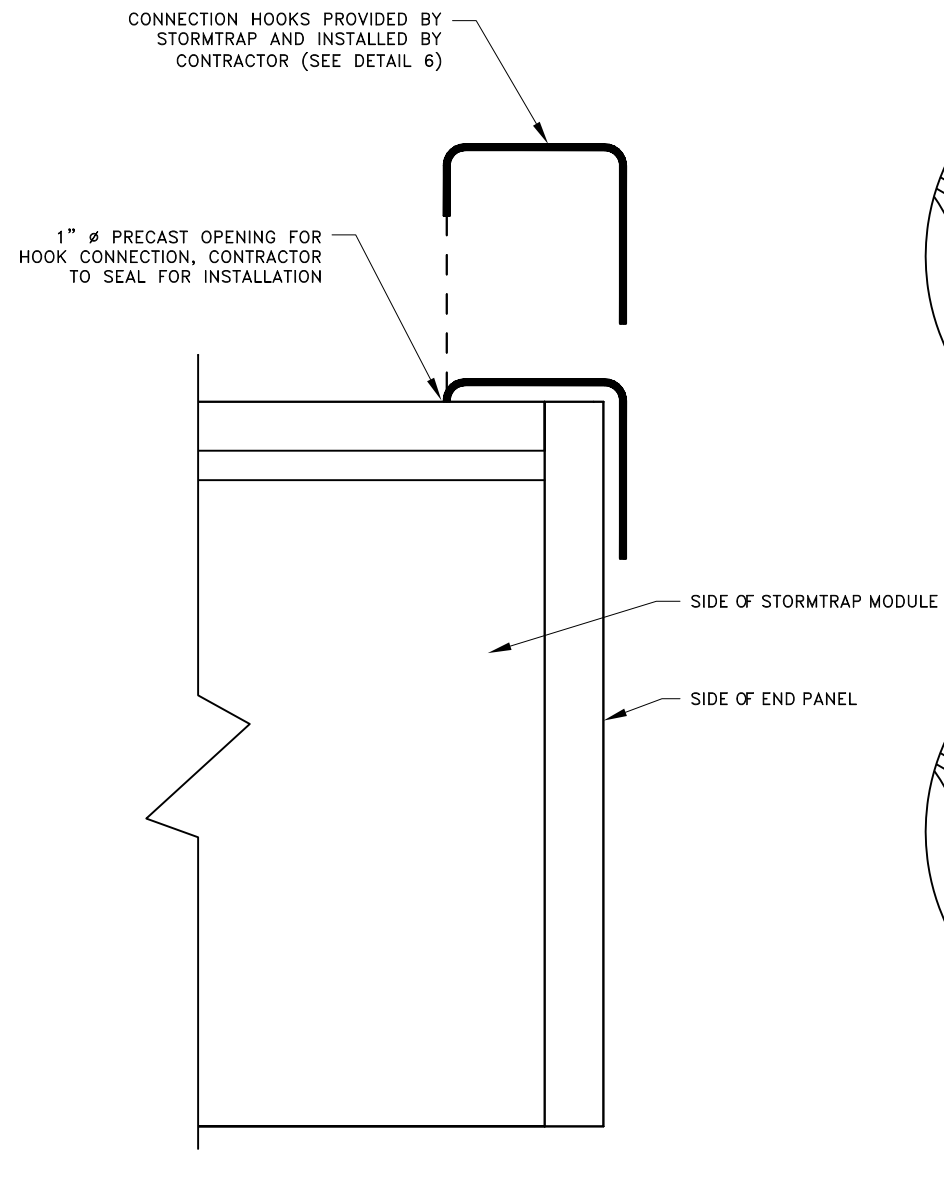
STORMTRAP MODULE LIFTING INSTALLATION NOTES

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL (4) CHAINS/CABLES ARE SECURED PROPERLY TO THE LIFTING ANCHORS AND IN EQUAL TENSION WHEN LIFTING THE STORMTRAP MODULE (SEE RECOMMENDATIONS 2 & 3).
2. MINIMUM 7'-0" CHAIN/CABLE LENGTH TO BE USED TO LIFT STORMTRAP MODULES (SUPPLIED BY CONTRACTOR).
3. CONTRACTOR TO ENSURE MINIMUM LIFTING ANGLE IS 60° FROM TOP SURFACE OF STORMTRAP MODULE. SEE DETAIL.



END PANEL ERECTION/INSTALLATION NOTES

1. END PANELS WILL BE SUPPLIED TO CLOSE OFF OPEN ENDS OF ROWS.
2. PANELS SHALL BE INSTALLED IN A TILT UP FASHION DIRECTLY ADJACENT TO OPEN END OF MODULE (REFER TO SHEET 2.0 FOR END PANEL LOCATIONS).
3. CONNECTION HOOKS WILL BE SUPPLIED WITH END PANELS TO SECURELY CONNECT PANEL TO ADJACENT STORMTRAP MODULE (SEE PANEL CONNECTION ELEVATION VIEW).
4. ONCE CONNECTION HOOK IS ATTACHED, LIFTING CLUTCHES MAY BE REMOVED.
5. JOINT WRAP SHALL BE PLACED AROUND PERIMETER JOINT PANEL (SEE SHEET 3.0).



PANEL CONNECTION ELEVATION VIEW

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3.1

ZONE CHART		
ZONES	ZONE DESCRIPTIONS	REMARKS
ZONE 1 A	FOUNDATION AGGREGATE	#5 (3/4") STONE AGGREGATE (SEE NOTE 4 FOR DESCRIPTION)
ZONE 1 B	FOUNDATION AGGREGATE	3" STONE AGGREGATE (SEE NOTE 5 FOR DESCRIPTION)
ZONE 2	BACKFILL	UNIFIED SOILS CLASSIFICATION (GW, GP, SW, SP) OR SEE BELOW FOR APPROVED BACKFILL OPTIONS
ZONE 3	FINAL COVER OVERTOP	MATERIALS NOT TO EXCEED 120 PCF

FILL DEPTH	TRACK WIDTH	MAX VEHICLE WEIGHT (KIPS)	MAX GROUND PRESSURE
12"	12"	51.8	1690 psf
	18"	56.1	1219 psf
	24"	68.1	1111 psf
	30"	76.7	1000 psf
	36"	85.0	924 psf

NOTE:
TRACK LENGTH NOT TO EXCEED 15'-4".
ONLY TWO TRACKS PER VEHICLE.

STORMTRAP ZONE INSTALLATION SPECIFICATIONS/PROCEDURES

1. THE FILL PLACED AROUND THE STORMTRAP MODULES MUST DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 2'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL EITHER BE COMPACTED AND/OR VIBRATED TO ENSURE THAT BACKFILL AGGREGATE/STONE MATERIAL IS WELL SEATED AND PROPERLY INTER LOCKED. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGING ACTION. CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MUST BE FREE-DRAINING MATERIAL. SEE ZONE 2 BACKFILL CHART ON THIS PAGE FOR APPROVED BACKFILL OPTIONS. IF NATIVE EARTH IS SUSCEPTIBLE TO MIGRATION, CONFIRM WITH GEOTECHNICAL ENGINEER AND PROVIDE PROTECTION AS REQUIRED (PROVIDED BY OTHERS).
2. DURING PLACEMENT OF MATERIAL OVERTOP THE SYSTEM, AT NO TIME SHALL MACHINERY BE USED OVERTOP THAT EXCEEDS THE DESIGN LIMITATIONS OF THE SYSTEM. WHEN PLACEMENT OF MATERIAL OVERTOP, MATERIAL SHALL BE PLACED SUCH THAT THE DIRECTION OF PLACEMENT IS PARALLEL WITH THE OVERALL LONGITUDINAL DIRECTION OF THE SYSTEM WHENEVER POSSIBLE.
3. THE FILL PLACED OVERTOP THE SYSTEM SHALL BE PLACED AT A MINIMUM OF 6" LIFTS. AT NO TIME SHALL MACHINERY OR VEHICLES GREATER THAN THE DESIGN HS-20 LOADING CRITERIA TRAVEL OVERTOP THE SYSTEM WITHOUT THE MINIMUM DESIGN COVERAGE. IF TRAVEL IS NECESSARY OVERTOP THE SYSTEM PRIOR TO ACHIEVING THE MINIMUM DESIGN COVER, IT MAY BE NECESSARY TO REDUCE THE ULTIMATE LOAD/BURDEN OF THE OPERATING MACHINERY SO AS TO NOT EXCEED THE DESIGN CAPACITY OF THE SYSTEM. IN SOME CASES, IN ORDER TO ACHIEVE REQUIRED COMPACTION, HAND COMPACTION MAY BE NECESSARY IN ORDER NOT TO EXCEED THE ALLOTTED DESIGN LOADING. SEE CHART FOR TRACKED VEHICLE WIDTH AND ALLOWABLE MAXIMUM PRESSURE PER TRACK.
4. FREE DRAINING AGGREGATE - 80% AGGREGATE RETAINED ON 1/2" SIEVE MAJORITY OF AGGREGATE SIZE BETWEEN 1/2" AND 1" ONLY 5% OF MATERIAL PASSING #8 SIEVE.
5. FREE DRAINING, NO FINES, 3" AGGREGATE - MAJORITY OF STONE SIZE IN BETWEEN 1 1/2" AND 3" - VERY SIMILAR TO AASHTO (#1, #2, #3, & #24) STONE AGGREGATE GRADATION.

APPROVED ZONE 2 BACKFILL OPTIONS	
OPTION	REMARKS
3/4" STONE AGGREGATE	THE STONE AGGREGATE SHALL CONSIST OF CLEAN AND FREE DRAINING ANGULAR MATERIAL. THE SIZE OF THIS MATERIAL SHALL HAVE 100% PASSING THE 1" SIEVE WITH 0% TO 5% PASSING THE #8 SIEVE. THIS MATERIAL SHALL BE SEPARATED FROM NATIVE MATERIAL USING GEOFABRIC AROUND THE PERIMETER OF THE BACKFILL (ASTM SIZE #57) AS DETERMINED BY THE GEOTECHNICAL ENGINEER.
SAND	IMPORTED PURE SAND IS PERMITTED TO BE USED AS BACKFILL IF IT IS CLEAN AND FREE DRAINING. THE SAND USED FOR BACKFILLING SHALL HAVE LESS THAN 40% PASSING #40 SIEVE AND LESS THAN 5% PASSING #200 SIEVE. THIS MATERIAL SHALL BE SEPARATED FROM NATIVE MATERIAL USING GEOFABRIC AROUND THE PERIMETER OF THE SAND BACKFILL.
CRUSHED CONCRETE AGGREGATE	CLEAN, FREE DRAINING CRUSHED CONCRETE AGGREGATE MATERIAL CAN BE USED AS BACKFILL FOR STORMTRAP'S MODULES. THE SIZE OF THIS MATERIAL SHALL HAVE 100% PASSING THE 1" SIEVE WITH 0% TO 5% PASSING THE #8 SIEVE. THIS MATERIAL SHALL BE SEPARATED FROM NATIVE MATERIAL USING GEOFABRIC AROUND THE PERIMETER OF THE BACKFILL.
ROAD PACK	STONE AGGREGATE 100% PASSING THE 1-1/2" SIEVE WITH LESS THAN 12% PASSING THE #200 SIEVE (ASTM SIZE #467). GEOFABRIC AS PER GEOTECHNICAL ENGINEER RECOMMENDATION.

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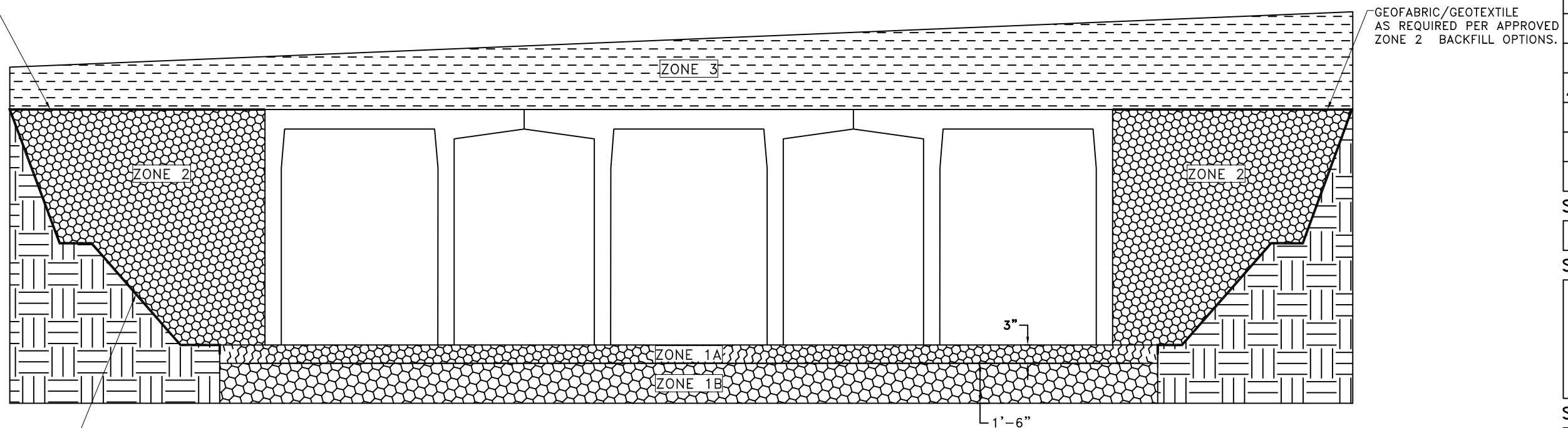
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GEOFABRIC/GEOTEXTILE AS REQUIRED PER APPROVED ZONE 2 BACKFILL OPTIONS.



GEOFABRIC/GEOTEXTILE AS REQUIRED PER APPROVED ZONE 2 BACKFILL OPTIONS.

STEPPED OR SERRATED AND APPLICABLE OSHA REQUIREMENTS (SEE INSTALLATION SPECIFICATIONS)

BACKFILL DETAIL

RECOMMENDED ACCESS OPENING SPECIFICATION

1. A TYPICAL ACCESS OPENING FOR THE STORMTRAP SYSTEM ARE 2'-0" IN DIAMETER. ACCESS OPENINGS LARGER THAN 3'-0" IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 1'-0" OF CLEARANCE FROM THE END OF THE STORMTRAP MODULE UNLESS NOTED OTHERWISE. ALL ACCESS OPENINGS TO BE LOCATED ON INSIDE LEG UNLESS OTHERWISE SPECIFIED.
2. PLASTIC COATED STEEL STEPS PRODUCED BY M.A. INDUSTRIES PART #PS3-PFC OR APPROVED EQUAL (SEE STEP DETAIL) ARE PROVIDED INSIDE ANY MODULE WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE MODULE IS TO BE PLACED A DISTANCE OF 1'-0" FROM THE INSIDE EDGE OF THE STORMTRAP MODULES. ALL ENSUING STEPS SHALL BE PLACED AT A DISTANCE BETWEEN 10" MIN AND 14" MAX BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE MODULE.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO AVOID INTERFERENCE WITH ACCESS OPENINGS OR THE CENTER OF GRAVITY OF THE MODULE AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER TO MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST TWO ACCESS OPENINGS PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 2' TO USE PRECAST BARREL OR CONE SECTIONS. (PROVIDED BY OTHERS)

RECOMMENDED PIPE OPENING SPECIFICATION

1. MINIMUM EDGE DISTANCE FOR AN OPENING ON THE OUTSIDE WALL SHALL BE NO LESS THAN 1'-0".
2. MAXIMUM OPENING SIZE TO BE DETERMINED BY THE MODULE HEIGHT. PREFERRED OPENING SIZE IS ϕ 36" OR LESS. ANY OPENING NEEDED THAT DOES NOT FIT THIS CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF STORMTRAP FOR REVIEW.
3. CONNECTING PIPES SHALL BE INSTALLED WITH A 1'-0" CONCRETE COLLAR, AND AN AGGREGATE CRADLE FOR AT LEAST ONE PIPE LENGTH (SEE PIPE CONNECTION DETAIL). A STRUCTURAL GRADE CONCRETE OR HIGH STRENGTH, NON-SHRINK GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI SHALL BE USED.
4. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH HIGH STRENGTH NON-SHRINK GROUT.

RECOMMENDED PIPE INSTALLATION INSTRUCTIONS

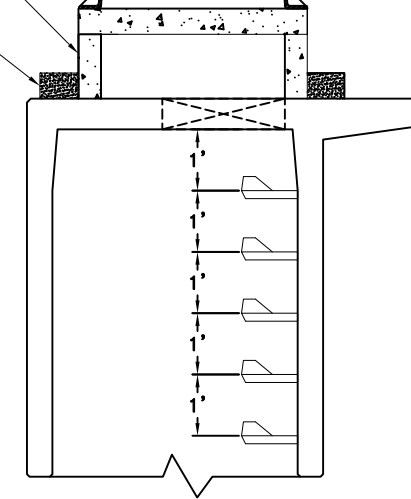
1. CLEAN AND LIGHTLY LUBRICATE ALL OF THE PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.

NOTE: ALL ANCILLARY PRODUCTS/SPECIFICATIONS RECOMMENDED AND SHOWN ON THIS SHEET ARE RECOMMENDATIONS ONLY AND SUBJECT TO CHANGE PER THE INSTALLING CONTRACTOR AND/OR PER LOCAL MUNICIPAL CODE/REQUIREMENTS.

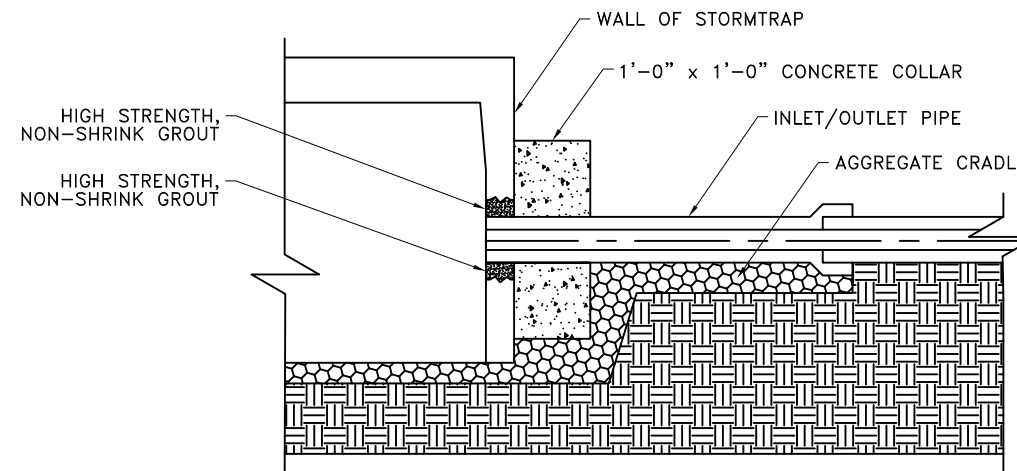
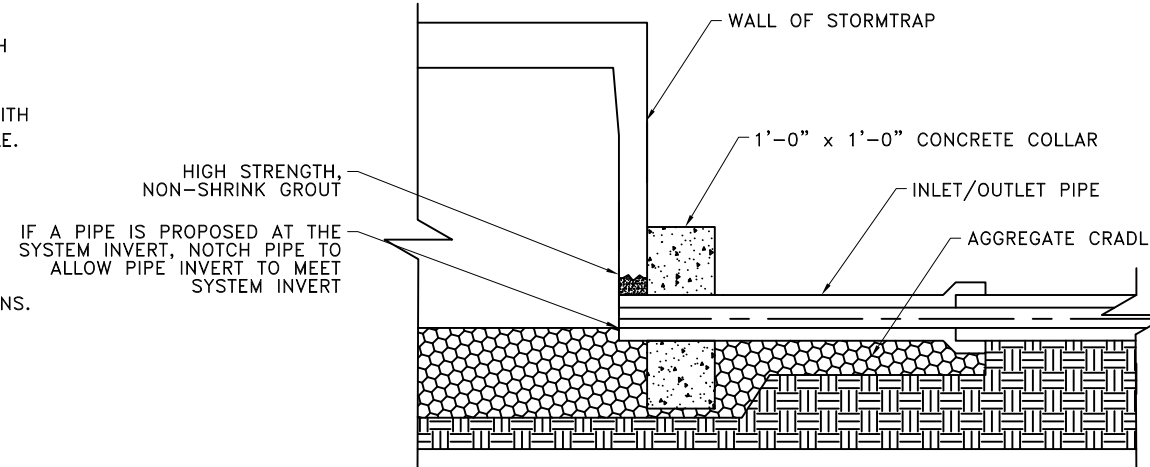
PRECAST CONCRETE ADJUSTING RINGS, BARREL OR CONE SECTIONS AS NEEDED SEE RECOMMENDED ACCESS OPENING SPECIFICATION NOTE 6. (SUPPLIED BY OTHERS)

FRAME & COVER AS SPECIFIED BY ENGINEER (SUPPLIED BY OTHERS)

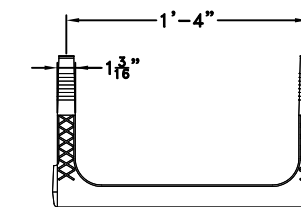
NON-SHRINK GROUT



RISER / STAIR DETAIL

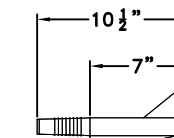
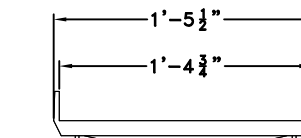


PIPE CONNECTION DETAIL



MEETS:
OPSS 1351.08.02
BNQ
ASTM C-478.95a
ASTM D4-101.95b

AASHTO M-199
ASTM 4A-15



STEP DETAIL

StormTrap

PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT]

1287 WINDHAM PARKWAY
ROMEVILLE, IL 60446
P:815-941-4549 / F:331-318-5347

ENGINEER INFORMATION:

ALLEN & MAJOR
10 MAIN STREET

LAKEVILLE, MA
508-923-1010

PROJECT INFORMATION:

ARBELLA

ASHLAND, MA

CURRENT ISSUE DATE:

5/12/2021

ISSUED FOR:

PRELIMINARY

REV.	DATE:	ISSUED FOR:	DWN BY:
4	5/12/2021	PRELIMINARY	BG
3	5/4/2021	PRELIMINARY	BG
2	3/19/2021	PRELIMINARY	BG
1	3/17/2021	PRELIMINARY	BG

SCALE:

NTS

SHEET TITLE:

RECOMMENDED
PIPE / ACCESS
OPENING
SPECIFICATIONS

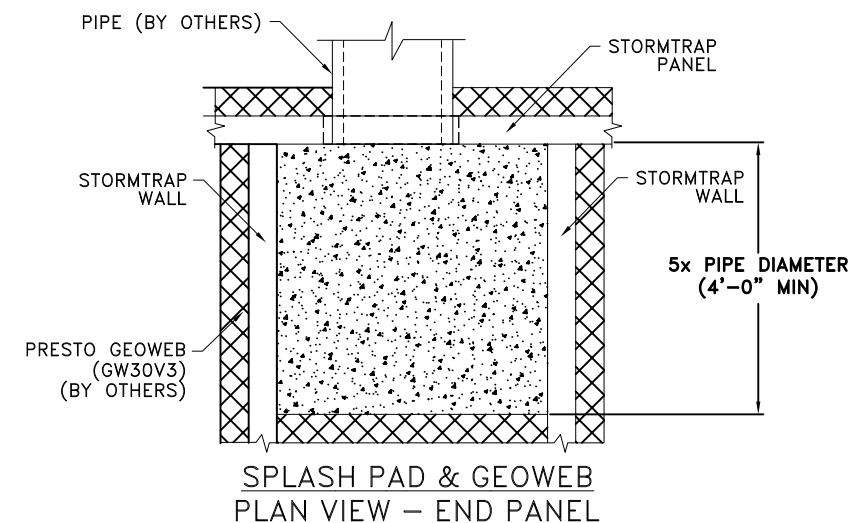
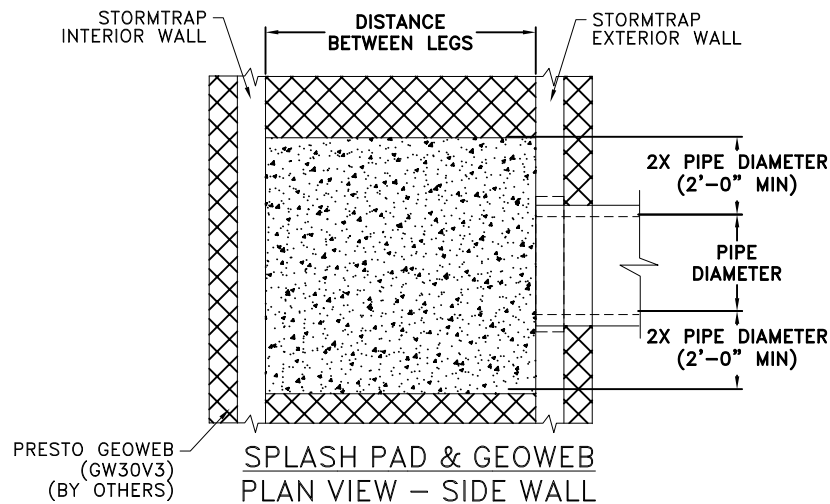
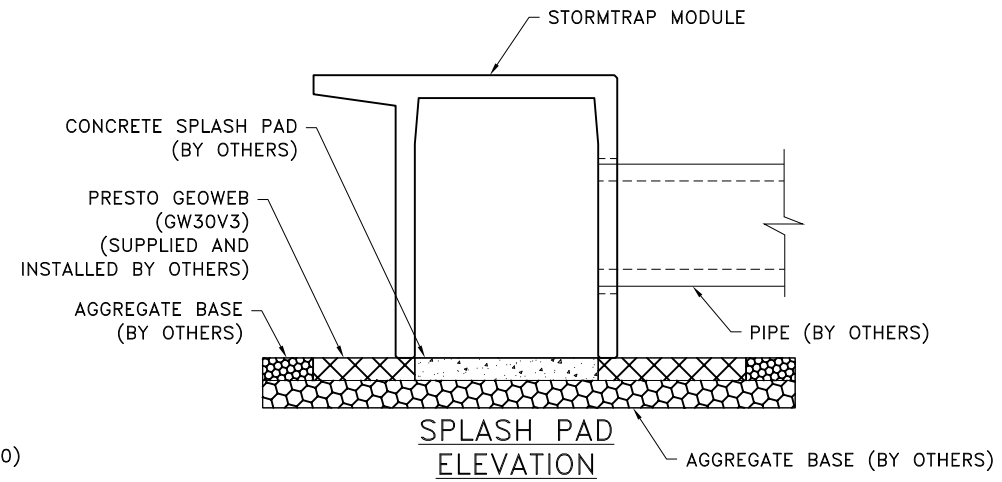
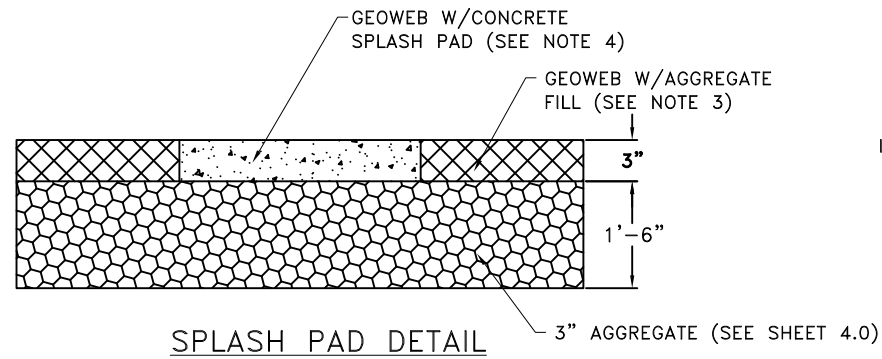
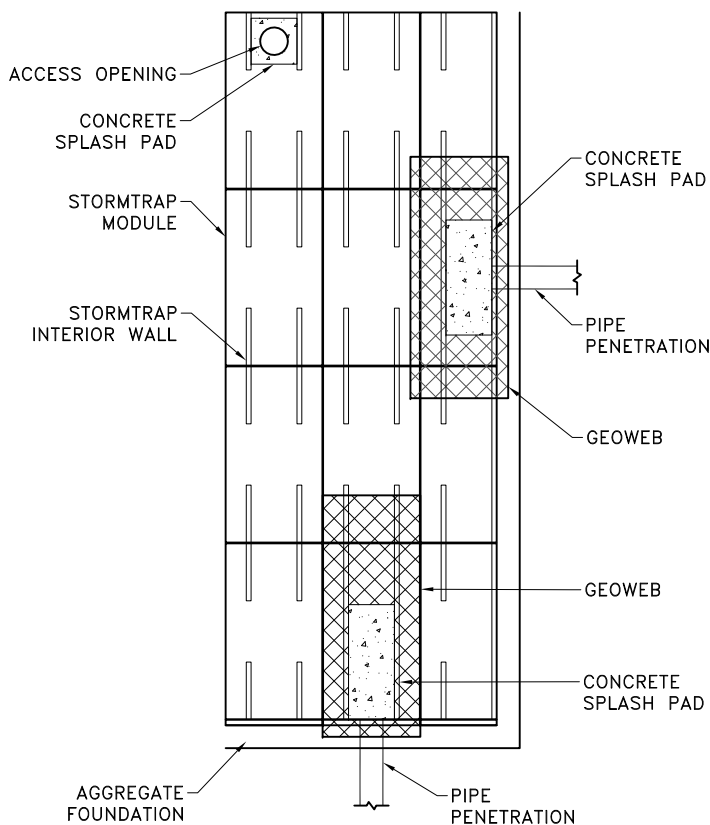
SHEET NUMBER:

5.0

NOTES:

1. THE APPROVED GEOWEB SHALL BE PRESTO GEOWEB (GW30V3). THE GEOWEB NOMINAL DIMENSIONS SHALL BE 9-FT x 25-FT.
2. THE CONCRETE SPLASH PAD AND GEOWEB SHALL BE INSTALLED PRIOR TO INSTALLATION OF THE STORMTRAP MODULES.
3. THE GEOWEB INFILL MATERIAL SHALL BE #5 AGGREGATE.
4. THE CONCRETE SPLASH PAD SHALL BE INSTALLED WITHIN THE GEOWEB AND IS REQUIRED AT ALL PIPE ENTRY LOCATIONS.
5. THE GEOWEB EDGE SHALL BE INSTALLED 1-FT BEYOND THE OUTER PERIMETER OF THE STORMTRAP SYSTEM.
6. THE GEOWEB LONGITUDINAL DIMENSION (25-FT) SHALL BE INSTALLED PARALLEL TO THE STORMTRAP LEGS.
7. THE CONCRETE SPLASH PAD AND GEOWEB SHALL BE CENTERED AT THE PIPE PENETRATION.
8. REFER TO SPLASH PAD LAYOUT FOR CONCRETE SPLASH PAD DIMENSIONS.
9. IF ANY PRODUCT OTHER THAN PRESTO GEOWEB IS TO BE INSTALLED, THE PRODUCT MANUFACTURER IS REQUIRED TO SUBMIT A LETTER STATING THAT THE PRODUCT IS EQUAL OR BETTER THAN PRESTO GEOWEB, BOTH IN PERFORMANCE AND IN STRUCTURAL CAPACITY.
10. ALL GEOWEB AND SPLASH PADS TO BE SUPPLIED AND INSTALLED BY CONTRACTOR.
11. A CONCRETE SPLASH PAD IS REQUIRED AT ANY ACCESS OPENING THAT HAS AN OPEN GRATE FOR DRAINAGE. THE CONCRETE SPLASH PAD SHALL EXTEND BETWEEN THE UNIT LEG WALLS AND 3'-0" FROM THE CENTERLINE OF THE OPENING ON BOTH SIDES UNLESS SPECIFIED OTHERWISE ON THE SPLASH PAD LAYOUT. GEOWEB IS NOT REQUIRED UNDER ACCESS OPENINGS.

SPLASH PAD CONFIGURATION



StormTrap

PATENTS LISTED AT: [\[HTTP://STORMTRAP.COM/PATENT\]](http://stormtrap.com/patent)

1287 WINDHAM PARKWAY
ROMEVILLE, IL 60446
P:815-941-4549 / F:331-318-5347

ENGINEER INFORMATION:

ALLEN & MAJOR
10 MAIN STREET

LAKEVILLE, MA
508-923-1010

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2	3/19/2021	PRELIMINARY	BG
1	3/17/2021	PRELIMINARY	BG

SCALE:

NTS

SHEET TITLE:

SPLASH PAD &
GEOWEB DETAILS

SHEET NUMBER:

6.0

ENGINEER INFORMATION:

ALLEN & MAJOR
10 MAIN STREET

LAKEVILLE, MA
508-923-1010

PROJECT INFORMATION:

ARBELLA

ASHLAND, MA

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1	3/17/2021	PRELIMINARY	BG

SCALE:

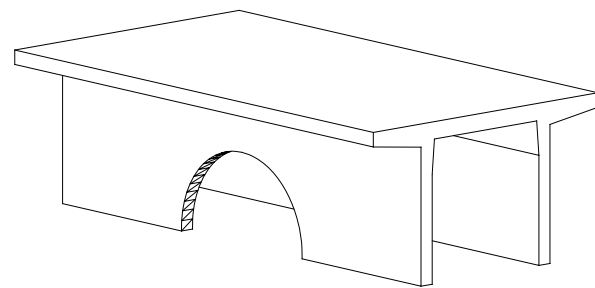
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SHEET TITLE:

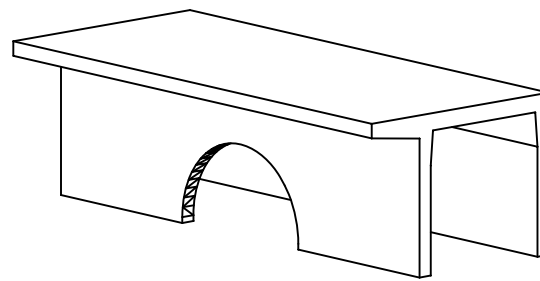
SINGLETRAP
MODULE TYPES

SHEET NUMBER:

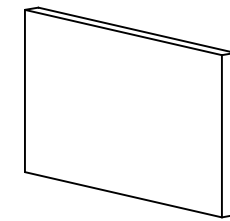
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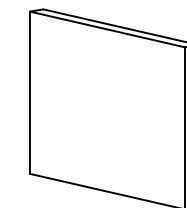
TYPE II



TYPE IV



TYPE II
END PANEL



TYPE IV
END PANEL

NOTES:

1. OPENING LOCATIONS AND SHAPES MAY VARY.
2. SP - INDICATES A MODULE WITH MODIFICATIONS.
3. P - INDICATES A MODULE WITH A PANEL ATTACHMENT.
4. POCKET WINDOW OPENINGS ARE OPTIONAL.



ARBELLA - ASHLAND, MA
STAGE STORAGE BREAKDOWN
4'-2" SingleTrap
TOTAL VOLUME: 39464.19 (C.F.)

0.00
Allen & Major
10 Main Street
Lakeville, MA

Storage Height	Type I QTY	Type II QTY	Type III QTY	Type IV QTY	Type V QTY	Type VII QTY	SPIV 1 QTY	SPIV 2 QTY	SPIV 3 QTY	SPIV 4 QTY	SPIV 5 QTY	SPIV 6 QTY	SPIV 7 QTY	SPIV 8 QTY	SPIV 9 QTY	SPIV 10 QTY	Total Units	Elevations
	0	51	0	38	0	0	1	0	0	0	0	0	0	0	0	0	90	
0.00																		353.50
0.25	0.00	1,497.84	0.00	847.60	0.00	0.00	20.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,365.96	353.75
0.50	0.00	2,995.68	0.00	1,695.20	0.00	0.00	41.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,731.92	354.00
0.75	0.00	4,493.52	0.00	2,542.81	0.00	0.00	61.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7,097.88	354.25
1.00	0.00	5,991.36	0.00	3,390.41	0.00	0.00	82.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9,463.84	354.50
1.25	0.00	7,489.19	0.00	4,238.01	0.00	0.00	102.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11,829.79	354.75
1.50	0.00	8,987.03	0.00	5,085.61	0.00	0.00	123.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14,195.75	355.00
1.75	0.00	10,484.87	0.00	5,933.22	0.00	0.00	143.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16,561.71	355.25
2.00	0.00	11,982.71	0.00	6,780.82	0.00	0.00	164.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18,927.67	355.50
2.25	0.00	13,480.55	0.00	7,628.42	0.00	0.00	184.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21,293.63	355.75
2.50	0.00	14,978.39	0.00	8,476.02	0.00	0.00	205.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23,659.59	356.00
2.75	0.00	16,476.23	0.00	9,323.63	0.00	0.00	225.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26,025.55	356.25
3.00	0.00	17,974.07	0.00	10,171.23	0.00	0.00	246.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28,391.51	356.50
3.25	0.00	19,471.90	0.00	11,018.83	0.00	0.00	266.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30,757.47	356.75
3.50	0.00	20,969.74	0.00	11,866.43	0.00	0.00	287.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33,123.42	357.00
3.75	0.00	22,467.58	0.00	12,714.04	0.00	0.00	307.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35,489.38	357.25
4.00	0.00	23,965.42	0.00	13,561.64	0.00	0.00	328.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37,855.34	357.50
4.25	0.00	25,463.26	0.00	14,409.24	0.00	0.00	348.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	357.75
4.50	0.00	26,961.10	0.00	15,256.84	0.00	0.00	369.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	358.00
4.75	0.00	28,458.94	0.00	16,104.45	0.00	0.00	389.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	358.25
5.00	0.00	29,956.78	0.00	16,952.05	0.00	0.00	410.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	358.50
5.25	0.00	31,454.61	0.00	17,799.65	0.00	0.00	430.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	358.75
5.50	0.00	32,952.45	0.00	18,647.25	0.00	0.00	451.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	359.00
5.68	0.00	34,017.58	0.00	19,249.99	0.00	0.00	465.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	359.18
5.75	0.00	34,450.29	0.00	19,494.86	0.00	0.00	471.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	359.25
6.00	0.00	35,948.13	0.00	20,342.46	0.00	0.00	492.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	359.50
6.25	0.00	37,445.97	0.00	21,190.06	0.00	0.00	512.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
6.50	0.00	38,943.81	0.00	22,037.66	0.00	0.00	533.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
6.75	0.00	40,441.65	0.00	22,885.27	0.00	0.00	553.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
7.00	0.00	41,939.49	0.00	23,732.87	0.00	0.00	574.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
7.25	0.00	43,437.32	0.00	24,580.47	0.00	0.00	595.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
7.50	0.00	44,935.16	0.00	25,428.07	0.00	0.00	615.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
7.75	0.00	46,433.00	0.00	26,275.67	0.00	0.00	636.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
8.00	0.00	47,930.84	0.00	27,123.28	0.00	0.00	656.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
8.25	0.00	49,428.68	0.00	27,970.88	0.00	0.00	677.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
8.50	0.00	50,926.52	0.00	28,818.48	0.00	0.00	697.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
8.75	0.00	52,424.36	0.00	29,666.08	0.00	0.00	718.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
9.00	0.00	53,922.20	0.00	30,513.69	0.00	0.00	738.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
9.25	0.00	55,420.04	0.00	31,361.29	0.00	0.00	759.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
9.50	0.00	56,917.87	0.00	32,208.89	0.00	0.00	779.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
9.75	0.00	58,415.71	0.00	33,056.49	0.00	0.00	800.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
10.00	0.00	59,913.55	0.00	33,904.10	0.00	0.00	820.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
10.25	0.00	61,411.39	0.00	34,751.70	0.00	0.00	841.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
10.50	0.00	62,909.23	0.00	35,599.30	0.00	0.00	861.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
10.75	0.00	64,407.07	0.00	36,446.90	0.00	0.00	882.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
11.00	0.00	65,904.91	0.00	37,294.51	0.00	0.00	902.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
11.25	0.00	67,402.75	0.00	38,142.11	0.00	0.00	923.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	
11.33	0.00	67,902.03	0.00	38,424.64	0.00	0.00	930.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	

**Arbella at Ashland
Senior development
MBTA Roadway in Ashland, Massachusetts
May 12, 2021**

**WAIVER REQUEST LIST TO ACCOMPANY THE LOCAL INITIATIVE PROGRAM
APPLICATION FOR COMPREHENSIVE PERMIT PROJECTS**

The Applicant’s requested exceptions are based on the Plans entitled “Issued for Comprehensive Permit – Arbella at Ashland, Ashland, MA” prepared by Allen & Major Associates, Inc., dated September 4, 2020 revised through March 24, 2021 (revision 1) (“Site Development Plans”). Subsequent amendments to the Site Development Plans or the applicable Ordinances, By-Laws and/or Regulations may require different or additional waivers, thus the Applicant respectfully reserves all of its rights to supplement or amend the list.

The list herein has been revised to include additional waivers necessary for the project based on the peer review letter issued by the Town’s consultant, GCG Associates, Inc. dated January 14, 2021.

By design intent, the applicant shall seek to conform to the local zoning code and has sought relief only where necessary to support the project and would not result in condition that compromised standard engineering practice, public safety, or other adverse condition if granted.

Waivers are based on the Town of Ashland Town Bylaw and subsections as noted below.

- I. The Property is located in the Rail Transit District (RTD) Areas A, E, and F as depicted on the Site Development Plans. The Project requires the following waivers:

	CHAPTER	SECTION REQUIREMENT	PROPOSED
§242 – Soil Removal			
1.	Section 242-3 A.	Except as otherwise provided in § 242-4 and 242-5 herein, no earth shall be removed from any lot in the Town of Ashland unless a permit shall have first been obtained by the owner from the Board.	It is the applicant’s opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Planning Board review, otherwise, a waiver is requested.
§247 – Stormwater Management and Illicit Discharges and Connections			
2.	Section 247 Stormwater Management and Illicit Discharges and Connections	Regulation of activities that result in the disturbance of land and the creation of stormwater runoff is necessary for the protection of the Town of Ashland to safeguard the health, safety, and welfare of the general public and protect the natural resources of the Town. The purpose of this bylaw is to comply with the Environmental Protection Agency's National Pollutant Discharge Elimination System Phase II program by preventing or diminishing stormwater impacts by controlling runoff	It is the applicant’s opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Conservation Commission review, otherwise, a waiver is requested from Section 247, in its entirety, from the bylaw. The project shall be designed in accordance with the Massachusetts Stormwater Standards.

	CHAPTER	SECTION REQUIREMENT	PROPOSED
		<p>and preventing soil erosion and sedimentation resulting from site construction, development and other circumstances, and eliminating non-stormwater discharges into the Town's municipal storm sewer system.</p> <p>§ 247-1-8Administration. A. The Conservation Commission shall be the permit granting authority for the issuance of a stormwater management permit and shall administer, implement and enforce this bylaw. Any powers granted to or duties imposed upon the Commission may be delegated in writing by the Commission to its employees or agents or other municipal employees as appropriate. Such permit applications shall be submitted, considered, and issued only in accordance with the provisions of this bylaw and the regulations adopted pursuant to this bylaw.</p>	
§280 – Wetlands Protection			
3.	Section 280	<p>The purpose of this bylaw is to protect the wetlands, water resources, flood prone areas, and adjoining upland areas in the Town of Ashland by controlling activities deemed by the Conservation Commission likely to have a significant or cumulative effect on resource area values, including but not limited to the following: public or private water supply, groundwater supply, flood control, erosion and sedimentation control, storm damage prevention, water quality, prevention and control of pollution, wildlife habitat, rare species habitat including rare plant and animal species, agriculture, and aquaculture, deemed important to the community.</p>	<p>It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Conservation Commission review, otherwise, a waiver is requested from Section 280, in its entirety, from the bylaw.</p> <p>If applicable, the project will be designed in accordance with the performance standards of the Massachusetts Wetlands Protection Act.</p>
§282 – Zoning			
4.	Section 5.1.2 Schedule of Parking Area Requirements	Dwellings – 2 spaces per dwelling unit	Relief from the quantity of spaces required is requested. The senior project proposed has a historical adequacy of 1 space per apartment unit.

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5.	Section 5.2 Loading Requirements	"Adequate off-street loading spaces or loading areas shall be provided and maintained . . . "	Relief from strict adherence to this section is sought. No marked loading spaces shall be provided. Moving trucks, and similar, shall be coordinated with the management office for move-in processes that do not encumber the project or circulation.
6.	Section 5.2.8 Special Permit	Any loading requirement set forth herein may be reduced upon the issuance of a special permit by the Planning Board if the Board finds that the reduction is not inconsistent with public health and safety, or that reduction promotes a public benefit.	It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Planning Board review, otherwise, a waiver is requested.
7.	Section 5.3 Signs <i>(Added May 12, 2021)</i>	(Signage requirements section 5.3.1 through 5.3.20)	The applicant requests a waiver from this section in its entirety. The Bylaw does not provide specific guidance for signs within the Rail Transit District apart from the directive under 5.3.2. that requires "all signs must comply with the regulations of this Section". The applicant seeks approval from the Zoning Board of Appeals within the Comprehensive Permit for a finding that the identification signage (i.e. non-traffic and wayfinding) are appropriate in scale, location, setback, illumination, and size for this development and as shown on the Site Development Plans with pertinent supplemental details provided
8.	Section 5.4.4 Interior Landscaping in Parking Areas	Parking areas containing eight or more spaces shall contain or be bordered by at least one tree per eight spaces. . . .	A waiver from this requirement is requested to allow for the necessary installation of protective guardrails to site slopes that are required to accommodate site topography. Adequate plantings shall be provided to achieve the design intent of the bylaw but with site specific accommodations.
9.	Section 5.4.4 3, Landscaped Islands and buffers	Landscaped islands and buffer shall have a minimum area of one hundred fifty square feet and minimum width of eight feet and	The Site Development Plans propose islands and areas of the specified width, but is of the opinion that the viability of

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		shall contain at least one tree per one hundred square feet.	multiple trees within a confined area may affect their long term viability. A waiver is requested from this provision of the bylaw.
10.	5.7.3 1. Environmental Standards, Erosion Control	No grading shall take place on slopes in excess of a horizontal of three and a vertical of one slope except under special permit from the Planning Board . . .	It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Planning Board review, otherwise, a waiver is requested.
11.	5.8 Site Alteration Special Permit	<p>Intent and Purpose. The intent of this section is to promote and protect the public health, safety, and welfare through the preservation and protection of the environment and by recognizing the vital importance of free and vegetation growth in the ecological system. It is further the purpose of this section to:</p> <ol style="list-style-type: none"> 1. Preserve and protect the natural scenic beauty and related natural resources in the Town of Ashland; 2. Limit land clearing and alteration of natural topography prior to site plan, preliminary plan, and/or definitive plan approval; 3. 3. To protect, preserve, and promote the aesthetic appeal, character, and value of the surrounding neighborhoods; and, 4. 4. To regulate prior to development plan approval, the removal of natural vegetation, especially major trees, and excavation and alteration of land, in order to minimize any danger of erosion, sedimentation, flooding, water pollution, unnecessary detracton from natural visual setting, obstruction of significant views, and other adverse impacts of development. 	It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Planning Board review, otherwise, a waiver is requested from this Section.
12.	Section 8.4.1.1 Purpose (Added April 12, 2021)	Purpose. The Rail Transit District (the "District" or sometimes hereinafter referred to as a "RTD") use in Ashland, associated with the MBTA Rail Station and abutting open land, is established to provide a coordinated, high aesthetic standard for the development of high	The applicant seeks a waiver from this section to allow for the construction of the site as shown on the Site Development Plans.

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		<p>technology, research and development, incubator establishments, offices, all of a non-nuisance-type and have provision for retail and multi-unit housing and age restricted housing components (rental and owner occupied). In addition, the purpose of this District is to promote a neo-traditional transit- oriented private and public development initiative which departs from the standard low-density, auto-oriented suburban residential growth of the past. The distinctive principle for this development's initiative is envisioned to provide:</p> <ol style="list-style-type: none"> 1. features and site layouts that are conducive to walking, biking and transit riding; 	<p>The topographic nature of the site renders full pedestrian connectivity financially infeasible and constructible in providing a sidewalk the length of the site driveway. The applicant utilizes onsite management to ensure the residents can be connected to Memorial Drive, West Union Street, and the downtown corridor while continuing to meet this intent.</p>
13.	<p>Section 8.4.1.2 Purpose <i>(Added April 12, 2021)</i></p>	<ol style="list-style-type: none"> 2. Pedestrian friendliness, alternative suburban living/working environments; 	<p>The applicant seeks a waiver from this section to allow for the construction of the site as shown on the Site Development Plans.</p> <p>The topographic nature of the site renders full pedestrian connectivity financially infeasible and constructible in providing a sidewalk the length of the site driveway. The applicant utilizes onsite management to ensure the residents can be connected to Memorial Drive, West Union Street, and the downtown corridor while continuing to meet this intent.</p>
	<p>Section 8.4.4. Permitted Uses</p>	<p>Permitted Residential component uses in Area "A" per use plan, (d) Dwelling Multi-family, For Rent: N (No)</p>	<p>The applicant seeks a waiver from this restriction to allow rentable, senior multi-family units located within Area A of the RTD.</p>
	<p>Section 8.4.4. Permitted Uses <i>(Added April 12, 2021)</i></p>	<p>Permitted Residential component uses in Area "A" per use plan.</p>	<p>The applicant seeks a waiver from this section to allow for the construction of the clubhouse and outdoor recreational facilities as part of the residential component table of uses.</p>
	<p>Section 8.4.6 Dimensional Requirements 4. Building Area</p>	<p>Building Area. Age Restricted, Attached; Age Restricted. Detached and Age Restricted Multifamily, Dwelling and Dwelling Multifamily, For Rent Unit Requirements in a Rail Transit District (RTD). Determined based upon the total</p>	<p>The applicant seeks a waiver from strict adherence to this calculation. The subject property contains 37.99 acres, sufficient to meet the density requirements for 180 proposed units as designated on</p>

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		cumulative land area of the applicable Areas (A, C, D or E) as specified in the formula set forth herein, at a density of: (i) 10 units per acre for Age Restricted, Attached; Age Restricted, Detached; and Age Restricted, Multifamily; and (ii) twenty (20) units per acre for Dwelling Multifamily, For Rent (permitted in Area E only). Written computation of the foregoing density shall be provided at the time of the filing of a Site Plan Application with the Planning Board.	the Site Development Plans. By Development Agreement, 20-24 acres of land (final area to be agreed upon by the Town of Ashland) is to be deeded to the Town of Ashland. The transfer of land to the Town of Ashland will result in a net project area of between 13.99 to 17.99 acres resulting in higher density that noted under Section 8.4.6. for the resulting land.
	Section 8.4.6 Dimensional Requirements 5. Building Separation <i>(Added April 12, 2021)</i>	Building Separation. There shall be a minimum of twenty (20) foot separation between abutting buildings (side to side) in a Rail Transit District (RTD).	The applicant requests this waiver to allow for the construction of Buildings 4 and 5 as shown on the Site Development Drawings.
	Section 8.4.6 Dimensional Requirements 11. Building/Structure Height <i>(Revised April 12, 2021)</i>	Building/Structure Height. Except as otherwise specifically provided herein, the maximum height of any Dwelling Multifamily, For Rent structure) in a Rail Transit District (RTD) shall be three (3) stories above grade (four stories at the rear of the building if the slope of the land permits) and the maximum height of any Age Restricted, Attached, Age Restricted, Detached, and Age Restricted, Multifamily building and any accessory structure related to such age restricted dwelling building shall not exceed two (2) stories above grade (three stories at the rear of the building if the slope of the land permits). The maximum height of any commercial building permitted in a Rail Transit District (RTD) shall be thirty (30) feet. The maximum height may be increased to fifty (50) feet within the Rail Transit District (RTD) upon the grant of a Special Permit and in accordance with the State Building Code.	The applicant seeks a waiver to construct 2-4/5 story apartment buildings with heights as shown on the Site Development Drawings. The increase in height allows for no loss in program elements (180 units) but minimizes the development footprint to increase perimeter buffers and setbacks to adjacent uses.
	Section 8.4.8 Parking and Loading Requirements	Parking and Loading Requirements. Except in a TVC which shall be governed by Section 8.4.14.12.a, below, parking and loading requirements shall be in conformance with Sections 5.1 and 5.2.	The applicant requests a waiver to minimize parking in keeping with the limitations identified per Sections 5.1 and 5.2 above.

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	Section 8.4.13 Requirements of a Site Development Plan	Requirements of a Site Development Plan. The submission of a parcel Site Development Plan (refer to § 10.0, Definitions) shall meet all criteria set forth in this Section as well as Section 9.4.	It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Planning Board review, otherwise, a waiver is requested from this Section.
	Section 8.6.10, 7 Lighting <i>(Added May 12, 2021)</i>	To avoid lighting impacts, outdoor lighting fixtures excluding municipal school outdoor recreational facilities (which are also subject to review by the Planning Board) shall be mounted no higher than fifteen (15) feet except for taller fixtures as requested and approved in writing by the Planning Board which shall be directed inward to the extent feasible, or otherwise oriented and shielded to avoid glare on adjoining premises and planting or other screening used to block headlight glare from drives and parking lots onto adjacent properties and roadway.	The applicant requests the waiver from this section to provide lighting in excess of 15 feet up to a mounting height of 20'6" along the site driveway to provide adequate safe lighting in an efficient manner. All lights shall be shielded and directed downward and where feasible are buffered by existing or proposed vegetative screening.
	Section 9.4 Site Plan Review	Site Plan Review	A waiver is requested in keeping with the RTD cross reference contained under Section 8.4.13. It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Planning Board review, otherwise, a waiver is requested from this Section.
	Section 9.6 Design Plan Review	Purpose. The purpose of the Design Review is to coordinate the aesthetic development of designated areas in Town through land, site, architectural, and sign review. This shall occur through an open process that involves the community and as guided by relevant documents, the Design Guidelines, as well as commonly accepted design standards. Applicability and Authority. The DRC shall review applications for Site Plan Review submitted under Section 9.4 of the Ashland Zoning Bylaw, provided the	It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Design Plan Review, otherwise, a waiver is requested from this Section.

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		<p>property exists in the following areas of town:</p> <ol style="list-style-type: none"> 1. Downtown and Pleasant Street: The geographic center of Ashland, including the Ashland Downtown District zoning districts. 2. Route 135 Corridor: Properties with frontage on Route 135 and in the Highway Commerce, Industrial, Neighborhood Commerce, or Wildwood Mixed Use Zoning districts. 3. Route 126 Corridor: Properties with frontage on Route 126 and in the Highway Commerce, Village Commerce, or Multifamily zoning districts. 4. Properties with projects requiring design review per section 9.4.7 of Chapter 282 (Zoning) of the Town of Ashland Code. 	
	<p>Section 9.7 Rate of Development Bylaw, Section 9.7.3 Building Permit Limitation. <i>(Deleted April 12, 2021)</i></p>	<p>Building Permit Limitation: Each such Project to which this Bylaw applies may receive only 25% of its the proposed building permits for the proposed buildings or lots approved in said Project in a given year. For example, for an eight-lot subdivision, only two building permits for single or two family buildings may be issued per year; and for a condominium or apartment complex containing eight buildings to be used for residential units, only two buildings per year may receive building permits. Each fraction of a unit or building shall be rounded down with a minimum of one.</p>	<p>The applicant has removed this waiver request as no longer being pertinent to the application.</p>
§343 – Stormwater Management			
	<p>Section 343 Stormwater Management</p>	<p>The purposes of these Stormwater Management Regulations are to:</p> <p>Protect, maintain and enhance the public health, safety, environment, and general welfare by establishing minimum requirements and procedures to control the adverse effects of increased post-development stormwater runoff, decreased groundwater recharge, and nonpoint</p>	<p>It is the applicant's opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Conservation Commission review, otherwise, a waiver is requested.</p>

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		<p>source pollution associated with new development and redevelopment, as more specifically addressed in the Stormwater Management Bylaw of the Town of Ashland . . .</p> <p>The Rules and Regulations (Regulations) contained herein have been adopted by the Town of Ashland Conservation Commission (Commission) in accordance with the Town of Ashland Stormwater Management Bylaw.</p>	<p>The project shall be designed in accordance with the Massachusetts Stormwater Standards.</p>
§344 – Planning Board Rule and Regulations Subdivision of Land			
	<p>Section 344, Article IV, Design Standards, 12 Streets <i>(Added April 12, 2021)</i></p>	<p>Design standards Sections A - I</p>	<p>The applicant requests a waiver from this section of the Subdivision of Land Article in its entirety to construct the site driveway as shown on the Site Development Drawings.</p> <p>The proposed site driveway does not constitute a “roadway” offered under the Subdivision of Land guidance. The driveway shall remain private in perpetuity. No request for Town services for this roadway shall be sought now or in the future.</p>
	<p>Section 344 Planning Board Rules & Regulations, Article 4, Terms Defined <i>(Added April 12, 2021)</i> <i>(Removed April 21, 2021)</i></p>	<p>RULE OF 22 FOR A LOT—The square of the lot perimeter divided by the gross area of the lot does not exceed twenty-two (22).</p>	<p>The lotting configuration shown on the Site Development Drawings is required by condition of the Development Agreement. The existing irregularly shape lot will not result in subdivided lots that meet the “Rule of 22” and allow for the Arbella program and/or the minimum 20 acres of municipal land.</p>
§348 – Wetlands Protection			
	<p>Section 348</p>	<p>The purpose of these regulations is to protect the wetlands, water resources, flood prone areas, and adjoining upland areas in the Town of Ashland by controlling activities deemed by the Commission likely to have a significant or cumulative effect on resource area values,</p>	<p>It is the applicant’s opinion that a Comprehensive Permit issued duly by the Zoning Board of Appeals will meet this criteria and therefore not require Conservation Commission review, otherwise, a</p>

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		including but not limited to the following: public or private water supply, groundwater supply, flood control, erosion and sedimentation control, storm damage prevention, water quality, prevention and control of pollution, wildlife habitat, rare species habitat including rare plant and animal species, agriculture, and aquaculture, deemed important to the community. The failure of these regulations to address all aspects of the bylaw, or a legal declaration of their invalidity in part or in whole, shall not act to suspend or invalidate the effect of the bylaw.	waiver is requested from Section 348, in its entirety, from the bylaw. If applicable, the project will be designed in accordance with the performance standards of the Massachusetts Wetlands Protection Act.

Notwithstanding anything to the contrary contained herein, the Applicant hereby requests relief from any other local rule, regulation, or ordinance or to the extent necessary to construct and operate the Project in accordance with the Project Plans submitted with this Application or that would prohibit the development of the Project or make such Project uneconomic. The Applicant reserves the right to supplement this waiver request based on modifications of the Site Development Plans and/or the Architectural Plan or clarification of any other applicable local rule, regulation or ordinance.