

**EcoTec, Inc.**  
**ENVIRONMENTAL CONSULTING SERVICES**  
**102 Grove Street**  
**Worcester, MA 01605-2629**  
**508-752-9666 – Fax: 508-752-9494**

BY EMAIL AND BY HAND

June 28, 2023

Melrose Conservation Commission  
Melrose City Hall  
562 Main Street  
Melrose, MA 02176

RE: -Notice of Intent under the Massachusetts Wetlands Protection Act and City of Melrose Wetlands Protection Ordinance  
-Proposed Construction of a Pool, an Associated Patio, an Infiltration System, and Associated Site Features Associated with an Existing Single-Family House in Buffer Zone; at 31 Cranmore Lane, Melrose, Massachusetts  
-Applicant and Property Owner: Quang-De Nguyen

To the Commission:

Enclosed please find two (2) copies of the Notice of Intent filed under the Massachusetts Wetlands Protection Act and the City of Melrose Wetlands Protection Ordinance for the above-referenced property. Also enclosed please find two checks made payable to the City of Melrose: (1) \$67.50 for the City share of the Act fee, and (2) \$50.00 for the Request for Permit fee under the Ordinance.

**Please have the legal notice billed to EcoTec, Inc. (508-752-9666 ext. 228).**

**Submitted Materials:**

This submittal consists of the following:

1. This Cover Letter, which includes:
  - a. Wetland Resource Evaluation with:
    - 1) BVW Field Forms for Flag A2;
    - 2) Flood Insurance Rate Map, Map No. 25017C0431E, Dated June 4, 2010 with site indicated;
    - 3) USGS Map, Boston North Quadrangle, 1985 with site indicated;
    - 4) Massachusetts NHESP Atlas (15<sup>th</sup> Edition), August 1, 2021 with site indicated; and
    - 5) Resume; and
  - b. Project Description and Analysis;
2. The Notice of Intent Form (WPA Form 3) with NOI Wetland Fee Transmittal Form, with copy of checks;
3. Certified Abutters List, Abutters Map, Abutter Notification, and Affidavit of Service;

4. Existing Conditions Plan: “31 Cranmore Lane, Melrose, Massachusetts, Existing Conditions Site Plan” Sheet 1 of 1, Scale 1” = 20’, prepared by Peter Nolan and Associates LLC, dated June 26, 2023, signed and stamped by Peter J. Nolan, PLS.
5. Civil Plan Set: 31 Cranmore Lane, Melrose, Massachusetts, prepared by Spruhan Engineering, P.C. and Peter Nolan and Associates LLC, dated June 27, 2023, signed and stamped by Edmund T. Spruhan, P.E.;
  - a. Sheet 1 of 2, Civil Plan, Scale: 1” = 20’
  - b. Sheet 2 of 2, Details, Scale: NTS;
6. “Stormwater Report, 31 Cranmore Lane, Melrose, Massachusetts”, prepared by Spruhan Engineering, P.C. dated June 27, 2023, signed and stamped by Edmund T. Spruhan, P.E.

One copy of this filing and a payment of \$67.50 have been submitted to the Northeast Regional Office of the Department of Environmental Protection by certified mail, return receipt requested, and the DEP lockbox by regular mail, respectively. Documentation of all payments is included in the filing.

In compliance with the Act and Ordinance, all abutters within 100 feet of the site have been notified of this filing via Certificate of Mailing. The abutter notification materials are included as part of the filing. Proof of mailing will be provided by email well in advance of the public hearing.

#### **Wetland Resource Evaluation:**

On June 6, 2023, EcoTec, Inc. inspected the above-referenced property for the presence of wetland resources as defined by: (1) the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, § 40; the “Act”) and its implementing regulations (310 CMR 10.00 *et seq.*; the “Regulations”); (2) the City of Melrose Wetlands Protection Ordinance; and (3) the U.S. Clean Water Act (i.e., Section 404 and 401 wetlands). Kate O’Donnell, WPIT conducted the inspection.

The subject site consists of an approximately 0.3±acre parcel located to the east of Cranmore Lane in Melrose. The subject site is previously developed with an existing single-family home, paved driveway, as well as a wooden deck, lawn, raised garden beds, ornamental landscaped areas, woodchipped areas, and mulched areas which are located within the rear yard that is surrounded by a panel fence. The site also contains a small portion of undeveloped forested land in the eastern portion of the property. Black cherry (*Prunus serotina*) and Norway Maple (*Acer platanoides*) trees and/or saplings; Virginia creeper (*Parthenocissus quinquefolia*) climbing woody vines; bramble (*Rubus sp.*) and multiflora rose (*Rosa multiflora*) shrubs; and garlic mustard (*Alliaria petiolate*) ground cover were observed within the undeveloped forested area. The wetland resources observed on/near the site are described below.

#### ***Methodology***

The subject site was inspected, and areas suspected to qualify as wetland resources were identified. The boundary of Bordering Vegetated Wetlands was delineated in the field in accordance with the definition set forth in the regulations at 310 CMR 10.55(2)(c). Section 10.55(2)(c) states that “The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.” The methodology used to delineate Bordering Vegetated Wetlands is further described in: (1) the BVW

Policy “BVW: *Bordering Vegetated Wetlands Delineation Criteria and Methodology*,” issued March 1, 1995; and (2) “*Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act: A Handbook*,” produced by the Massachusetts Department of Environmental Protection, dated March 1995. The plant taxonomy used in this report is based on the *National List of Plant Species that Occur in Wetlands: Massachusetts* (Fish and Wildlife Service, U.S. Department of the Interior, 1988). Federal wetlands were presumed to have boundaries conterminous with the delineated Bordering Vegetated Wetlands. One set of DEP Bordering Vegetated Wetland Delineation Field Data Forms completed for observation plots located in the wetlands and uplands near flag A2 is attached. The table below provides the Flag Numbers, Flag Type, and Wetland Types and Locations for the delineated wetland resources.

Flag Numbers	Flag Type	Wetland Types and Locations
Start A1 to A6 Stop	Blue Flags	Boundary of Bordering Vegetated Wetlands located in the eastern portion of the site that is associated with an unmapped intermittent stream located off-site to the east.

***Findings***

Land Under Water Bodies and Waterways, Bank, and Bordering Vegetated Wetlands: Wetland A (i.e. A-series flags), which is located in the eastern portion of the site, consists of wooded/shrub swamp that is associated with an intermittent stream. Plant species observed include red maple (*Acer rubrum*) trees and/or saplings; arrow-wood (*Viburnum dentatum*), glossy buckthorn (*Rhamnus frangula*), and American elderberry (*Sambucus canadensis*) shrubs; and sensitive fern (*Onoclea sensibilis*), skunk-cabbage (*Symplocarpus foetidus*), swamp Jack-in-the-pulpit (*Arisaema triphyllum*), and spotted touch-me-not (*Impatiens capensis*) ground cover. Evidence of wetland hydrology, including hydric soils, leaf staining, and saturated soils, was observed within the delineated wetland. This vegetated wetland borders an intermittent stream; accordingly, the vegetated wetland would be regulated as Bordering Vegetated Wetlands and the intermittent stream would be regulated as Bank under the Act and Ordinance. A 100-foot Buffer Zone extends horizontally outward from the edge of Bordering Vegetated Wetlands under the Act and Ordinance.

Bordering Land Subject to Flooding: Bordering Land Subject to Flooding is an area that floods due to a rise in floodwaters from a bordering waterway or water body. Where flood studies have been completed, the boundary of Bordering Land Subject to Flooding is based upon flood profile data prepared by the National Flood Insurance Program. Section 10.57(2)(a)3. states that “The boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm.” Based upon a review of the Flood Insurance Rate Map, Middlesex County, Massachusetts, Map Number 25017C0431E, Effective Date 6/4/2010 (attached), there is a mapped Zone A (i.e., 100-year floodplain with an unspecified flood elevation) located off-site to the east. The site itself is mapped as Other Areas: Zone X, which is defined as areas located outside of the 0.2% annual chance flood (i.e., outside of 500-year floodplain). The project engineer should evaluate the most recent National Flood Insurance Program flood profile data to determine if Bordering Land Subject to Flooding occurs on the site. Bordering Land Subject to Flooding would occur in areas where the 100-year flood elevation is located outside of or upgradient of the delineated Bordering Vegetated Wetlands boundary. Bordering Land Subject to Flooding does not have a Buffer Zone under the Act.

Riverfront Area: The Massachusetts Rivers Protection Act amended the Act to establish an additional wetland resource area: Riverfront Area. Based upon a review of the current USGS Map (i.e., Boston North Quadrangle, dated 1985, attached) and observations made during the site inspection, there are no mapped or unmapped streams located within 200 feet of the site. Accordingly, Riverfront Area would not occur on the site. Riverfront Area does not have a Buffer Zone under the Act.

Estimated Habitat and Certified Vernal Pools: The Regulations require that no project may be permitted that will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures set forth at 310 CMR 10.59. Based upon a review of the *Massachusetts Natural Heritage Atlas*, 15<sup>th</sup> edition, Priority Habitats and Estimated Habitats from the NHESP Interactive Viewer, valid from August 1, 2021, and viewed on June 9, 2023, and Certified Vernal Pools from MassGIS, there are no Estimated Habitats [for use with the Act and Regulations (310 CMR 10.00 *et seq.*)], Priority Habitats [for use with Massachusetts Endangered Species Act (M.G.L. Ch. 131A; “MESA”) and MESA Regulations (321 CMR 10.00 *et seq.*)], or Certified Vernal Pools on or in the immediate vicinity of the site. A copy of this map is attached.

The reader should be aware that the regulatory authority for determining wetland jurisdiction rests with local, state, and federal authorities.

### **Proposed Project and Analysis:**

The proposed project consists of the removal of several garden/flower beds from the work area, located within the lawn to the east of the existing house, and the and installation of new site features including a pool, and an associated concrete retaining wall, sundeck with steps, paver terrace, and a stormwater infiltration system within this rear yard of the property. The proposed work is located within the 100-foot Buffer Zone to a Bordering Vegetated Wetland. The closest proposed structure to the delineated wetland is greater than 35 feet. All proposed work is located entirely within existing lawn, landscaped areas, and within existing structures. All pool discharges (e.g., backwashing, drawdowns, etc.) will be made through the infiltration system; under no circumstances will pool discharges of any type be made to or toward the vegetated wetland located to the east of the property.

An erosion control barrier consisting of 12”-diameter compost sock secured by wooden stakes at 10’ intervals will be installed exactly on the line shown on Sheet 1. This erosion control barrier serves as the Limit of Work (LOW). The compost sock will remain in place and be maintained as necessary for the duration of the project. Stockpiling would occur in the driveway outside jurisdiction and excess soil will be trucked from the site. Concrete washout, if necessary, would also be addressed outside jurisdiction. Approval of the issuing authority will be received prior to the removal of the erosion control barrier.

Under the existing condition, stormwater runoff is not controlled or treated. Under proposed conditions, stormwater runoff from the proposed patio is controlled, treated, and infiltrated with the proposed infiltration system comprising three (3) Storm Tech units. A Stormwater Report with associated drainage calculations by Spruhan Engineering is included as part the NOI.

### **Compliance with the Section 231-6 of the Melrose Wetland Protection Ordinance:**

Section 231-6 of the Melrose Wetland Protection Ordinance lists several standards which a project must comply with in order to be granted a permit. These standards are as follows:

- A. (1) (a) *No disturbance zone. A no disturbance zone shall be provided and maintained in the area of land situated between a wetland and a parallel line located 15 feet away, measured outward horizontally from the edge of the wetland. The no disturbance zone shall be naturally vegetated and free from oil, hazardous materials, and chemicals (including, without limitation, fertilizers, herbicides and pesticides).*

The proposed project does not propose any disturbance within the 15' No Disturbance Zone. The work proposed is greater than 35 feet from the wetland. The proposed erosion control barrier is located outside the 15' Buffer Zone which will serve as a demarcation of the limit of work and will serve to protect the adjacent resources.

- (b) *No construction zone. A no construction zone shall be provided and maintained in the area of land situated between a wetland and a parallel line located 20 feet away, measured outward horizontally from the edge of the wetland. Lawns and landscaping are permitted but structures and appurtenances thereto are prohibited in the no construction zone.*

The proposed project does not include construction within the 20' No Construction Zone. The work proposed is greater than 35 feet from the wetland. The existing condition of the property includes lawn and landscaping approximately 15 feet from the wetland. This area will remain lawn as part of the proposed project.

- (2) *Wetland-dependent structures. A zero-foot setback for wetland dependent structures (drain outfalls, weirs, etc.) will be permitted where the Commission, in its sole discretion, deems reasonable. (3) Upland access. A zero-foot setback for site improvements necessary for upland access will be permitted where the Commission, in its sole discretion, deems reasonable alternative access to be unavailable. (4) Wetland setbacks for preexisting structures. Projects associated with preexisting structures or projects not presently in compliance with this chapter may not increase the degree of nonconformance of those structures or projects. No new alteration shall be commenced and no new structure shall be located within the no construction zone or no disturbance zone, as set forth in this chapter.*

The proposed work does not involve any of the activities or structures listed in this standard. The work proposed is greater than 35 feet from the wetland.

- “B. Floodplain requirements. There shall be no net loss of flood storage volume at any elevation. There shall be no increase in the rate of runoff as a result of any project. The Commission may impose specific planting and/or maintenance requirements in order to achieve floodplain requirements. The Commission may also require the applicant to conduct drainage calculation studies and to take other mitigation measures as appropriate.”*

Based upon a review of the Flood Insurance Rate Map, Middlesex County, Massachusetts, Map Number 25017C0431E, Effective Date 6/4/2010 (attached), the site is mapped as Other Areas: Zone X, which is defined as areas located outside of the 0.2% annual chance flood (i.e., outside of 500-year floodplain). Accordingly, there is no floodplain on the site and no loss of flood storage volume would result from the proposed work.

- “C. Wildlife habitat. No project may result in the loss of critical habitat or cause negative impacts on critical habitat of rare, threatened, or endangered species, or species of special concern. Any applicant proposing an alteration near a critical habitat area shall be required to include a description of wildlife habitat characteristics observed on the property.”*

The proposed work will occur within the existing structures, and lawn and landscaped areas associated with the property. These areas are not important to the protection of wildlife habitat. Additionally, based upon a review of the Massachusetts Natural Heritage Atlas, 15th edition, Priority

Habitats and Estimated Habitats from the NHESP Interactive Viewer, valid from August 1, 2021, and viewed on June 9, 2023, and Certified Vernal Pools from MassGIS, there are no Estimated Habitats [for use with the Act and Regulations (310 CMR 10.00 et seq.)], Priority Habitats [for use with Massachusetts Endangered Species Act (M.G.L. Ch. 131A; “MESA”) and MESA Regulations (321 CMR 10.00 et seq.)], or Certified Vernal Pools on or in the immediate vicinity of the site.

*“D. Stormwater management. (1) Any applicant proposing an increase of impervious area greater than 500 square feet within a buffer zone or land subject to flooding must demonstrate that there will be no net increase in runoff peak discharge rate and no net loss of recharge to groundwater. (2) This requirement may be met in one of two ways: (a) DEP Stormwater Policy method. An applicant may submit engineering calculations using methods approved in the Massachusetts DEP Stormwater Management Policy and guidance documents in effect at the time of the application, showing pre- and post-development recharge and peak discharge rates for a one-, two-, and ten-year storm. Drainage calculations submitted in compliance with the DEP Stormwater Policy may be used to satisfy this requirement but must include calculations for a one-year storm in addition to those required under the DEP policy.”*

The proposed project will result in an increase of impervious area greater than 500 square feet within the Buffer Zone. Accordingly, engineering calculations showing the pre- and post-development recharge and peak discharge rates for a one-, two-, and ten-year storm were submitted to satisfy this standard. As indicated in the drainage calculations, the post-development peak discharge rates are reduced compared to pre-development conditions due to the proposed infiltration system. The drainage calculations are included in the Stormwater Report prepared by Spruhan Engineering, included as part of the NOI.

#### Narrative Standard for Work in the Buffer Zone:

Section 10.53(1) of the Regulations provides a narrative standard for work in the Buffer Zone and states “...If the issuing authority determines that a resource area is significant to an interest identified in M.G.L. c. 131, § 40 for which no presumption is stated in the Preamble to the applicable section, the issuing authority shall impose such conditions as are necessary to contribute to the protection of such interests. For work in the buffer zone subject to review under 310 CMR 10.02(2)(b)3., the issuing authority shall impose conditions to protect the interests of the Act identified for the adjacent resource area. The potential for adverse impacts to resource areas from work in the buffer zone may increase with the extent of the work and the proximity to the resource area. The issuing authority may consider the characteristics of the buffer zone, such as the presence of steep slopes, that may increase the potential for adverse impacts on resource areas. Conditions may include limitations on the scope and location of work in the buffer zone as necessary to avoid alteration of resource areas. The issuing authority may require erosion and sedimentation controls during construction, a clear limit of work, and the preservation of natural vegetation adjacent to the resource area and/or other measures commensurate with the scope and location of the work within the buffer zone to protect the interests of the Act. Where a buffer zone has already been developed, the issuing authority may consider the extent of existing development in its review of subsequent proposed work and, where prior development is extensive, may consider measures such as the restoration of natural vegetation adjacent to a resource area to protect the interest of the Act. The purpose of preconstruction review of work in the buffer zone is to ensure that adjacent resource areas are not adversely affected during or after completion of the work.” As indicated in the Preface to the 2005 Revisions to the Regulations, “This standard is intended to provide better guidance to applicants, conservation commissions and DEP by identifying the measures that will ensure that adjacent wetland resource areas are not adversely affected during or after completion of the work.”

Prior to the start of earth moving activities, an erosion control barrier consisting of staked compost sock, which will also serve as the Limit of Work, will be located around the work area as shown on the Site Plan. This erosion control barrier will be maintained until the work area is stabilized. Approval of the issuing authority will be received prior to the removal of the erosion control barrier.

Conclusions:

In conclusion, it is EcoTec's opinion that the proposed project meets the applicable narrative standard under the Regulations and meets the standards under the Melrose Wetland Ordinance for work within the 100' Buffer Zone. Work is proposed within the 100' Buffer Zone greater than 35 feet from the Bordering Vegetated Wetlands boundary. The proposed work in the 100' Buffer Zone will occur within existing structures, lawn, and landscaping. Infiltration of stormwater is proposed. Erosion controls and other means to protect the areas outside the limit of work are proposed. As such, it is EcoTec's opinion that the proposed project complies with the applicable provisions of the Act and Regulations and Ordinance and will serve to protect the applicable statutory interests.

We look forward to meeting with the Commission regarding this filing on July 20, 2023, at 7:30 pm. If you have any questions or require additional information, please feel free to contact me at any time.

Cordially,  
ECOTEC, INC.



Kate O'Donnell, WPIT  
Environmental Scientist

C: Department of Environmental Protection – Northeast regional Office (via Certified Mail, Return Receipt Requested)  
Applicant: Quang-De Nguyen (Via email)  
Edmund Spruhan, P.E. (Via email)

**BORDERING VEGETATED WETLAND DETERMINATION FORM**

Project/Site: 31 Cranmore Lane City/Town: Melrose Sampling Date: 6/6/2023

Applicant/Owner: \_\_\_\_\_ Sampling Point or Zone: A2

Investigator(s): Kate O'Donnell, EcoTec, Inc. Latitude / Longitude: \_\_\_\_\_

Soil Map Unit Name: Swansea NWI or DEP Classification: \_\_\_\_\_

Are climatic/hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks)

Are Vegetation , Soil , or Hydrology  significantly disturbed? (If yes, explain in Remarks)

Are Vegetation , Soil , or Hydrology  naturally problematic? (If yes, explain in Remarks)

**SUMMARY OF FINDINGS – Attach site map and photograph log showing sampling locations, transects, etc.**

Wetland vegetation criterion met?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Hydric Soils criterion met?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>			
Wetlands hydrology present?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>			
Remarks, Photo Details, Flagging, etc.:					

**HYDROLOGY**

<b>Field Observations:</b>		
Surface Water Present?	Yes <input type="checkbox"/>	No <input type="checkbox"/> Depth (inches) _____
Water Table Present?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/> Depth (inches) <u>6</u>
Saturation Present (including capillary fringe)?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/> Depth (inches) <u>0</u>
<b>Wetland Hydrology Indicators</b>		
<b>Reliable Indicators of Wetlands Hydrology</b>	<b>Indicators that can be Reliable with Proper Interpretation</b>	<b>Indicators of the Influence of Water</b>
<input checked="" type="checkbox"/> Water-stained leaves <input type="checkbox"/> Evidence of aquatic fauna <input type="checkbox"/> Iron deposits <input type="checkbox"/> Algal mats or crusts <input type="checkbox"/> Oxidized rhizospheres/pore linings <input type="checkbox"/> Thin muck surfaces <input type="checkbox"/> Plants with air-filled tissue (aerenchyma) <input type="checkbox"/> Plants with polymorphic leaves <input type="checkbox"/> Plants with floating leaves <input type="checkbox"/> Hydrogen sulfide odor	<input type="checkbox"/> Hydrological records <input checked="" type="checkbox"/> Free water in a soil test hole <input checked="" type="checkbox"/> Saturated soil <input type="checkbox"/> Water marks <input type="checkbox"/> Moss trim lines  <input type="checkbox"/> Presence of reduced iron <input type="checkbox"/> Woody plants with adventitious roots <input type="checkbox"/> Trees with shallow root systems <input type="checkbox"/> Woody plants with enlarged lenticels	<input type="checkbox"/> Direct observation of inundation <input type="checkbox"/> Drainage patterns <input type="checkbox"/> Drift lines <input type="checkbox"/> Scoured areas <input type="checkbox"/> Sediment deposits  <input type="checkbox"/> Surface soil cracks <input type="checkbox"/> Sparsely vegetated concave surface <input type="checkbox"/> Microtopographic relief <input type="checkbox"/> Geographic position (depression, toe of slope, fringing lowland)
Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):		

This form is only for BVW delineations. Other wetland resource areas may be present and should be delineated according to the applicable regulatory provisions.



**VEGETATION** – Use both common and scientific names of plants.

<u>Tree Stratum</u>		Plot size <u>30' Radius</u>		Indicator Status	Absolute/ Relative % (yes/no) Cover	Dominant? (yes/no)	Wetland Indicator? (yes/no)
Common name*	Scientific name						
1. red maple	<i>Acer rubrum</i>	FAC	50/100	Yes	Yes		
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
				50 = Total Absolute Cover			
<u>Shrub/Sapling Stratum</u>		Plot size <u>15' Radius</u>		Indicator Status	Absolute/ Relative % (yes/no) Cover	Dominant? (yes/no)	Wetland Indicator? (yes/no)
Common name*	Scientific name						
1. glossy buckthorn	<i>Rhamnus frangula</i>	FAC	20/40	Yes	Yes		
2. black cherry	<i>Prunus serotina</i>	FACU	10/20	Yes	No		
3. northern arrow-wood	<i>Viburnum dentatum</i>	FAC	10/20	Yes	Yes		
4. american elderberry	<i>Sambucus canadensis</i>	FACW	10/20	Yes	Yes		
5.							
6.							
7.							
8.							
9.							
				50 = Total Absolute Cover			
<u>Herb Stratum</u>		Plot size <u>5' Radius</u>		Indicator Status	Absolute/ Relative % (yes/no) Cover	Dominant? (yes/no)	Wetland Indicator? (yes/no)
Common name*	Scientific name						
1. sensitive fern	<i>Onoclea sensibilis</i>	FACW	30/75	Yes	Yes		
2. jack-in-the-pulpit	<i>Arisaema triphyllum</i>	FACW	10/25	Yes	Yes		
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
				40 = Total Absolute Cover			

\* 1988 Plant List

**VEGETATION** – continued.

<u>Woody Vine Stratum</u>		Plot size <u>30' Radius</u>		Indicator Status	Absolute/ Dominant? Relative % (yes/no) Cover	Wetland Indicator? (yes/no)
Common name*		Scientific name				
1.						
2.						
3.						
4.						
						_____ = Total Absolute Cover

\* 1988 Plant List

<b>Rapid Test:</b> Do all dominant species have an indicator status of OBL or FACW?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<b>Dominance Test:</b>	Number of dominant species	Number of dominant species that are wetland indicator plants	Do wetland indicator plants make up ≥ 50% of dominant plant species?	
	7	6	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<b>Prevalence Index:</b>		Total % Cover (all strata)	Multiply by:	Result
	OBL species	0	X 1	= 0.0
	FACW species	50	X 2	= 100.0
	FAC species	80	X 3	= 240.0
	FACU species	10	X 4	= 40.0
	UPL species	0	X 5	= 0.0
	Column Totals	(A) 140.0		(B) 380.0
Prevalence Index		B/A = 2.7	Is the Prevalence Index ≤ 3.0?	
			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<b>Wetland vegetation criterion met?</b>			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>

**Definitions of Vegetation Strata**

- Tree - Woody plants 3 in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height
- Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 ft. (1 m) tall
- Herb - All herbaceous (non-woody plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall
- Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges	
Range	Midpoint
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

**SOIL**

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)								
Horizon/ Depth	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Location <sup>2</sup>		
A: 0-24"	10YR 2/1	100						

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains      <sup>2</sup>Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)	Indicators for Problematic Hydric Soils
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> 2 cm Muck (A10)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> 5 cm Mucky Peat or Peat (S3)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Dark Surface (S7)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Polyvalue Below Surface (S8)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Thin Dark Surface (S9)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Iron-Manganese Masses (F12)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Mesic Spodic (A17)
<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Red Parent Material (F21)
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Other (Include Explanation in Remarks)
<input type="checkbox"/> Stripped Matrix (S6)	
<input type="checkbox"/> Dark Surface (S7)	

**Restrictive Layer (if observed)** Type: \_\_\_\_\_ Depth (inches): \_\_\_\_\_

Remarks:

Hydric Soils criterion met?      Yes       No

**BORDERING VEGETATED WETLAND DETERMINATION FORM**

Project/Site: 31 Cranmore Lane City/Town: Melrose Sampling Date: 6/6/2023

Applicant/Owner: \_\_\_\_\_ Sampling Point or Zone: A2

Investigator(s): Kate O'Donnell, EcoTec, Inc. Latitude / Longitude: \_\_\_\_\_

Soil Map Unit Name: Swansea NWI or DEP Classification: \_\_\_\_\_

Are climatic/hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks)

Are Vegetation , Soil , or Hydrology  significantly disturbed? (If yes, explain in Remarks)

Are Vegetation , Soil , or Hydrology  naturally problematic? (If yes, explain in Remarks)

**SUMMARY OF FINDINGS – Attach site map and photograph log showing sampling locations, transects, etc.**

Wetland vegetation criterion met?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Hydric Soils criterion met?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>			
Wetlands hydrology present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>			
Remarks, Photo Details, Flagging, etc.:					

**HYDROLOGY**

<b>Field Observations:</b>			
Surface Water Present?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth (inches) _____
Water Table Present?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth (inches) _____
Saturation Present (including capillary fringe)?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth (inches) _____
<b>Wetland Hydrology Indicators</b>			
<b>Reliable Indicators of Wetlands Hydrology</b>	<b>Indicators that can be Reliable with Proper Interpretation</b>	<b>Indicators of the Influence of Water</b>	
<input type="checkbox"/> Water-stained leaves <input type="checkbox"/> Evidence of aquatic fauna <input type="checkbox"/> Iron deposits <input type="checkbox"/> Algal mats or crusts <input type="checkbox"/> Oxidized rhizospheres/pore linings <input type="checkbox"/> Thin muck surfaces <input type="checkbox"/> Plants with air-filled tissue (aerenchyma) <input type="checkbox"/> Plants with polymorphic leaves <input type="checkbox"/> Plants with floating leaves <input type="checkbox"/> Hydrogen sulfide odor	<input type="checkbox"/> Hydrological records <input type="checkbox"/> Free water in a soil test hole <input type="checkbox"/> Saturated soil <input type="checkbox"/> Water marks <input type="checkbox"/> Moss trim lines  <input type="checkbox"/> Presence of reduced iron <input type="checkbox"/> Woody plants with adventitious roots <input type="checkbox"/> Trees with shallow root systems <input type="checkbox"/> Woody plants with enlarged lenticels	<input type="checkbox"/> Direct observation of inundation <input type="checkbox"/> Drainage patterns <input type="checkbox"/> Drift lines <input type="checkbox"/> Scoured areas <input type="checkbox"/> Sediment deposits  <input type="checkbox"/> Surface soil cracks <input type="checkbox"/> Sparsely vegetated concave surface <input type="checkbox"/> Microtopographic relief <input type="checkbox"/> Geographic position (depression, toe of slope, fringing lowland)	
Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):			

This form is only for BVW delineations. Other wetland resource areas may be present and should be delineated according to the applicable regulatory provisions.

**VEGETATION** – Use both common and scientific names of plants.

<u>Tree Stratum</u>		Plot size <u>30' Radius</u>		Indicator Status	Absolute/ Relative % (yes/no) Cover	Dominant? (yes/no)	Wetland Indicator? (yes/no)
Common name*	Scientific name						
1. norway maple	<i>Acer platanoides</i>	NL	50/63	Yes	No		
2. red maple	<i>Acer rubrum</i>	FAC	30/37	Yes	Yes		
3.							
4.							
5.							
6.							
7.							
8.							
9.							
				_____ 80 _____ = Total Absolute Cover			
<u>Shrub/Sapling Stratum</u>		Plot size <u>15' Radius</u>		Indicator Status	Absolute/ Relative % (yes/no) Cover	Dominant? (yes/no)	Wetland Indicator? (yes/no)
Common name*	Scientific name						
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
				_____ = Total Absolute Cover			
<u>Herb Stratum</u>		Plot size <u>5' Radius</u>		Indicator Status	Absolute/ Relative % (yes/no) Cover	Dominant? (yes/no)	Wetland Indicator? (yes/no)
Common name*	Scientific name						
1. garlic mustard	<i>Alliaria petiolata</i>	FACU	30/100	Yes	No		
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
				_____ 30 _____ = Total Absolute Cover			

\* 1988 Plant List

**VEGETATION** – continued.

<u>Woody Vine Stratum</u>		Plot size <u>30' Radius</u>		Indicator Status	Absolute/ Dominant? Relative % (yes/no) Cover	Wetland Indicator? (yes/no)
Common name*		Scientific name				
1.	virginia creeper	<i>Parthenocissus quinquefolia</i>		FACU	30/100	Yes No
2.						
3.						
4.						
						<u>30</u> = Total Absolute Cover

\* 1988 Plant List

<b>Rapid Test:</b> Do all dominant species have an indicator status of OBL or FACW?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<b>Dominance Test:</b>	Number of dominant species	Number of dominant species that are wetland indicator plants	Do wetland indicator plants make up ≥ 50% of dominant plant species?	
	4	1	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<b>Prevalence Index:</b>		Total % Cover (all strata)	Multiply by:	Result
	OBL species	0	X 1	= 0.0
	FACW species	0	X 2	= 0.0
	FAC species	30	X 3	= 90.0
	FACU species	30	X 4	= 120.0
	UPL species	0	X 5	= 0.0
	Column Totals	(A) 60.0		(B) 210.0
Prevalence Index		B/A = 3.5	Is the Prevalence Index ≤ 3.0?	
			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<b>Wetland vegetation criterion met?</b>			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

**Definitions of Vegetation Strata**

- Tree - Woody plants 3 in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height
- Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 ft. (1 m) tall
- Herb - All herbaceous (non-woody plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall
- Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges	
Range	Midpoint
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

**SOIL**

**Profile Description:** (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Horizon/ Depth	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Location <sup>2</sup>		
A: 0-16"+	10YR 3/2	100						

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains    <sup>2</sup>Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)	Indicators for Problematic Hydric Soils
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Polyvalue Below Surface (S8)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> 2 cm Muck (A10)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Matrix (F3)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Dark Surface (F7)
<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Depleted Dark Surface (F8)
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Iron-Manganese Masses (F12)
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Mesic Spodic (A17)
<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Red Parent Material (F21)
<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)
	<input type="checkbox"/> Other (Include Explanation in Remarks)

**Restrictive Layer (if observed)**    Type: \_\_\_\_\_    Depth (inches): \_\_\_\_\_

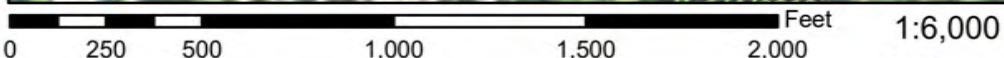
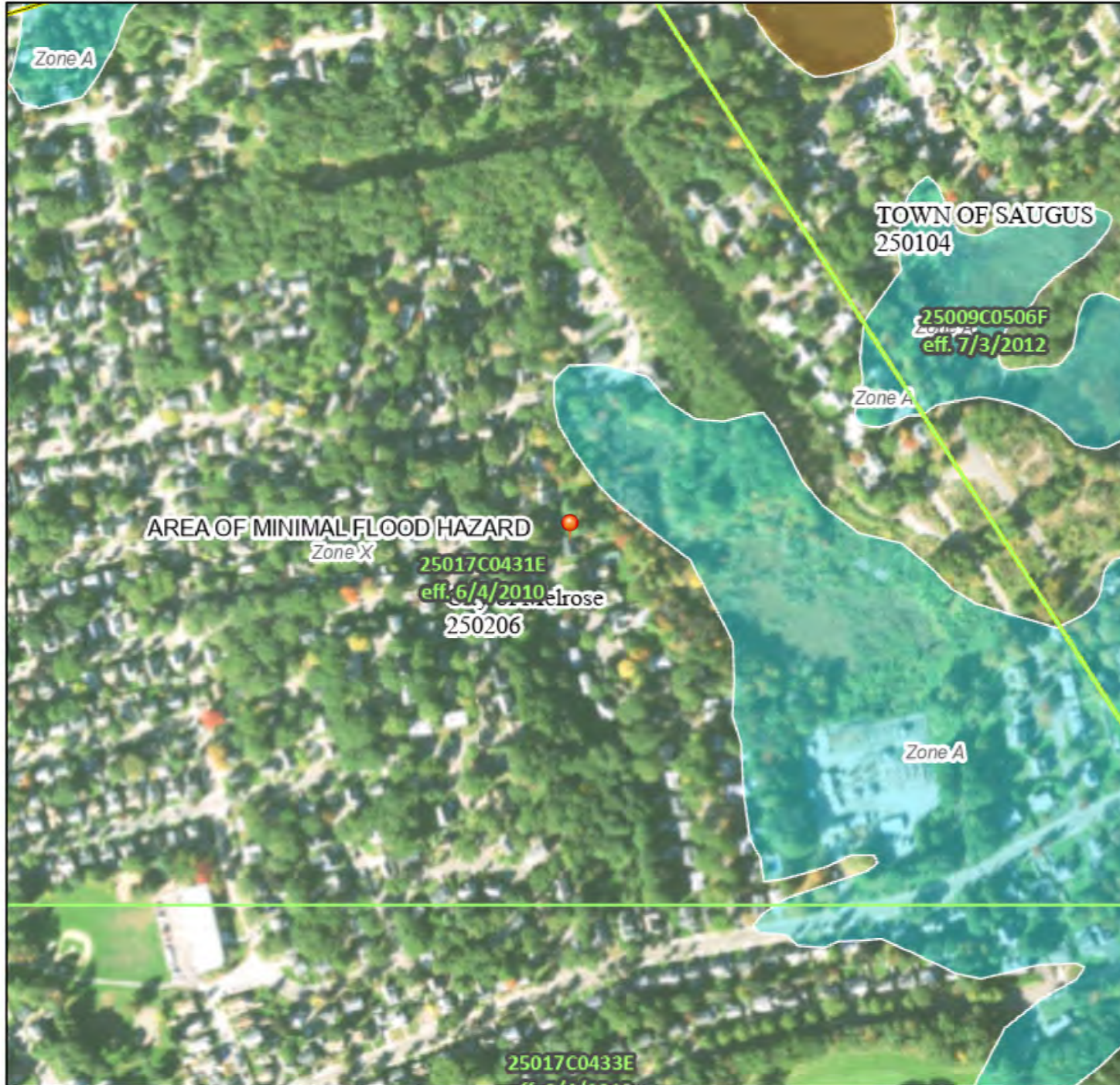
Remarks:

Hydric Soils criterion met?    Yes     No

# National Flood Hazard Layer FIRMMette



71°3'30"W 42°28'30"N



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- |                                    |   |
|------------------------------------|---|
| <b>SPECIAL FLOOD HAZARD AREAS</b>  | Without Base Flood Elevation (BFE)<br>Zone A, V, A99  |
|                                    | With BFE or Depth Zone AE, AO, AH, VE, AR   |
|                                    | Regulatory Floodway   |
| <b>OTHER AREAS OF FLOOD HAZARD</b> | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X |
|                                    | Future Conditions 1% Annual Chance Flood Hazard Zone X  |
|                                    | Area with Reduced Flood Risk due to Levee. See Notes. Zone X  |
|                                    | Area with Flood Risk due to Levee Zone D  |
| <b>OTHER AREAS</b>                 | NO SCREEN Area of Minimal Flood Hazard Zone X   |
|                                    | Effective LOMRs   |
|                                    | Area of Undetermined Flood Hazard Zone D  |
| <b>GENERAL STRUCTURES</b>          | Channel, Culvert, or Storm Sewer  |
|                                    | Levee, Dike, or Floodwall   |
| <b>OTHER FEATURES</b>              | Cross Sections with 1% Annual Chance Water Surface Elevation  |
|                                    | Coastal Transect  |
|                                    | Base Flood Elevation Line (BFE)   |
|                                    | Limit of Study  |
|                                    | Jurisdiction Boundary   |
|                                    | Coastal Transect Baseline   |
|                                    | Profile Baseline  |
|                                    | Hydrographic Feature  |
| <b>MAP PANELS</b>                  | Digital Data Available  |
|                                    | No Digital Data Available   |
|                                    | Unmapped  |
- The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

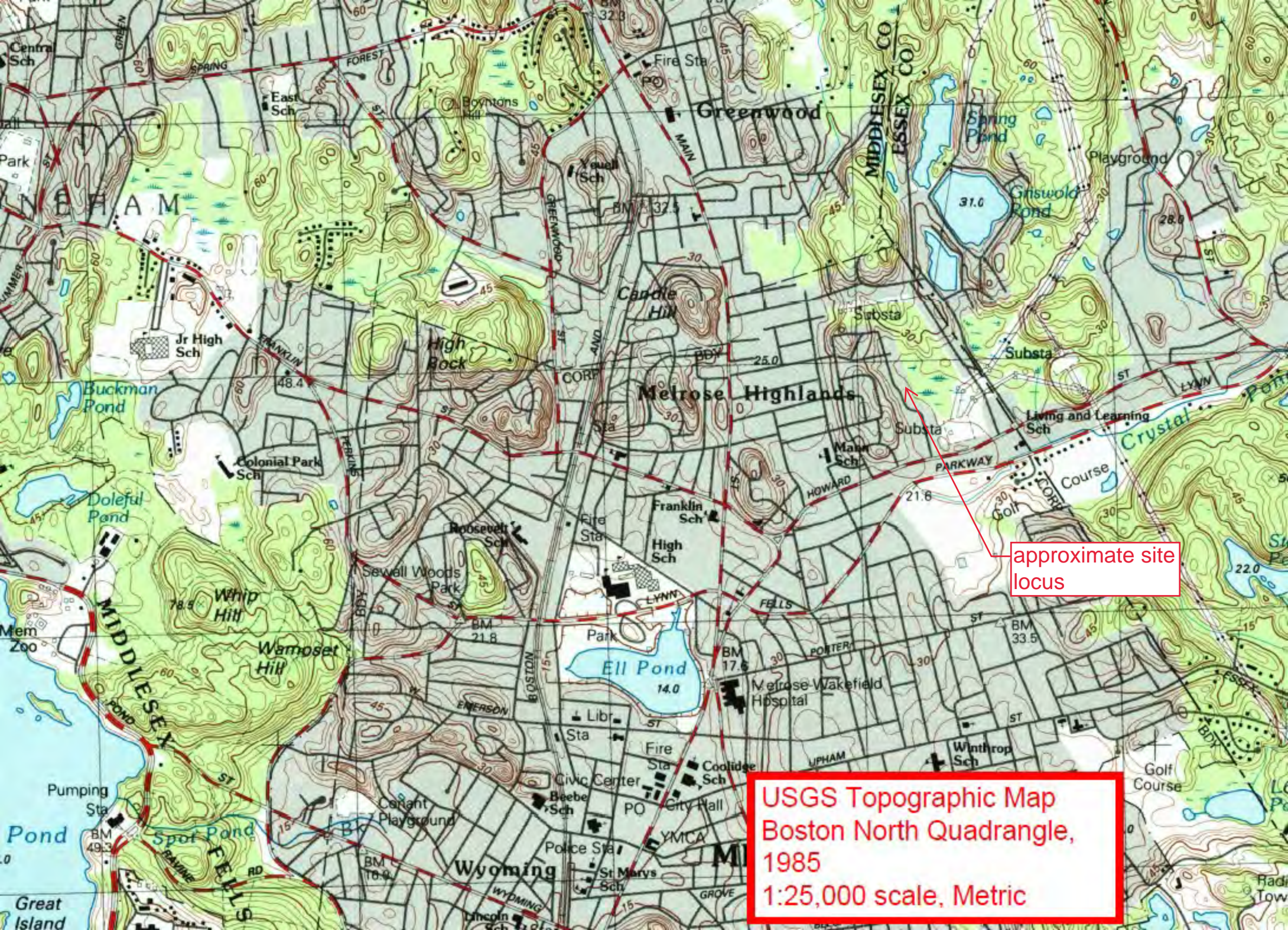


This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **6/1/2023 at 1:00 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

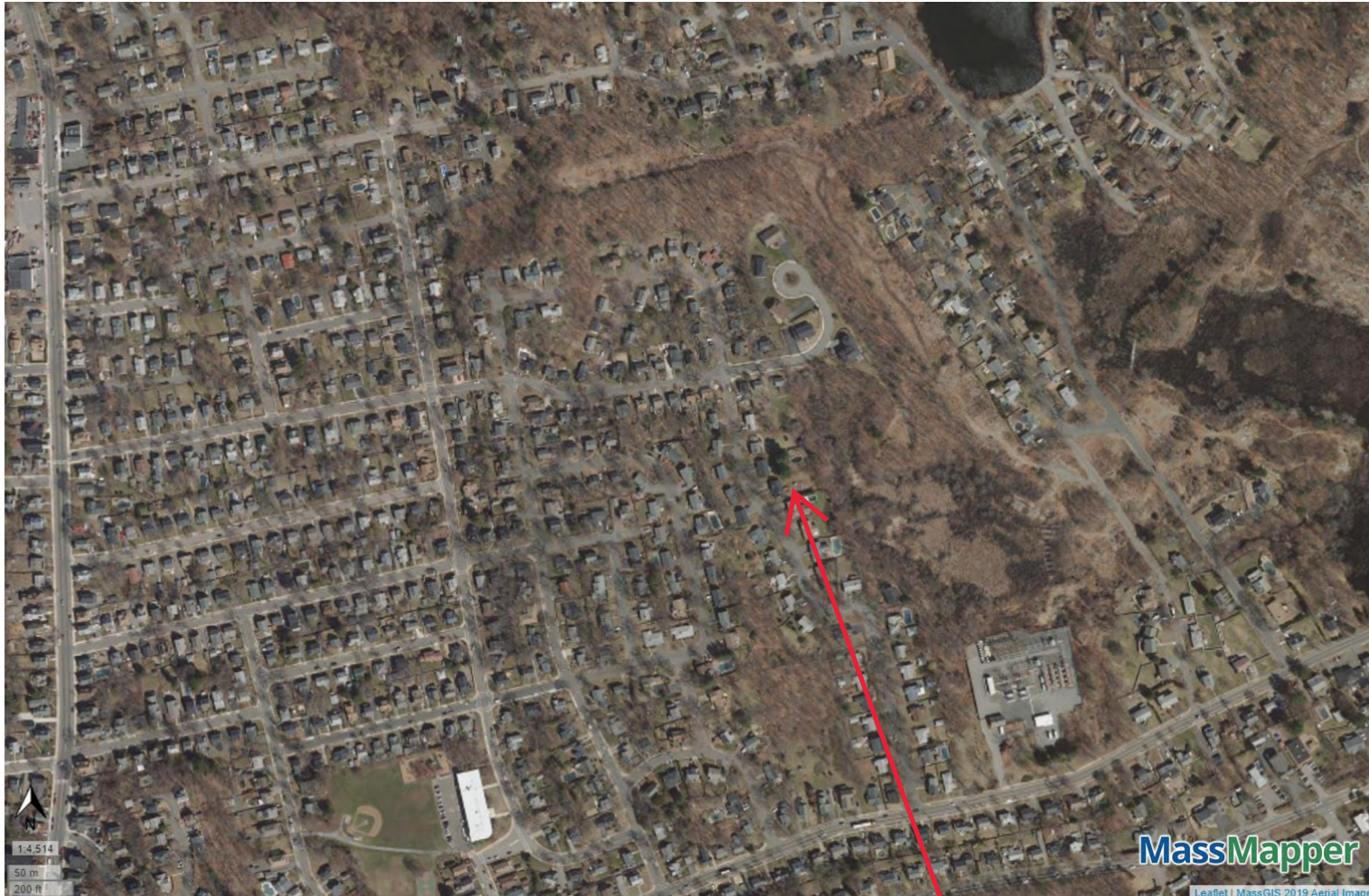




approximate site locus

USGS Topographic Map  
Boston North Quadrangle,  
1985  
1:25,000 scale, Metric

# 31 Cranmore Ln., Melrose, NHESP



NHESP Priority Habitats of Rare Species



NHESP Estimated Habitats of Rare Wildlife



NHESP Certified Vernal Pools



Natural Heritage  
Atlas Online Data  
Viewer, 15th  
edition, valid  
August 1, 2023  
31 Cranmore Ln.,  
Melrose

approximate site  
locus

# EcoTec, Inc.

## ENVIRONMENTAL CONSULTING SERVICES

102 Grove Street  
Worcester, MA 01605-2629  
508-752-9666 – Fax: 508-752-9494

### **Kate O'Donnell, WPIT Environmental Scientist**

Kate O'Donnell is an Environmental Scientist at EcoTec, Inc. Since joining EcoTec in June of 2021, her project experience includes wetland resource evaluation and delineation, as well as environmental permitting at the local, state, and federal level. She received certification as a Wetland Professional In Training (WPIT) from the International Society of Wetland Scientists (SWS) in September of 2021. Additionally, Ms. O'Donnell has experience in turbidity and erosion control monitoring, salinity sampling, wildlife habitat evaluation, stream evaluation, vernal pool evaluation and certification, preconstruction sweeps for rare species including the eastern box turtle, Stormwater Pollution Prevention Plan (SWPPP) preparation, Turtle Protection Plan preparation, Massachusetts Endangered Species Act (MESA) Project Review Checklists, and Massachusetts Environmental Policy Act (MEPA) documentation. Prior to starting at EcoTec, Ms. O'Donnell was a student at the College of the Holy Cross, where she received degrees in Biology and Environmental Studies. Her educational background includes with extensive coursework in ecology and environmental science, as well as courses in geoscience, biology, chemistry, and environmental law. During her time at Holy Cross, she conducted hydrologic and water quality research to investigate the impacts of road salt on the salinity of the Middle River in Worcester, MA.

#### **Education:**

Bachelor of Arts in Biology (Ecology emphasis) and Bachelor of Arts in Environmental Studies, College of the Holy Cross, 2021

#### **Professional Affiliations:**

Society of Wetland Scientists  
Massachusetts Association of Conservation Commissioners

#### **Certifications:**

Society of Wetland Scientists Wetland Professional In Training  
EPA Construction General Permit Site Inspector Certification



**Massachusetts Department of Environmental Protection**  
 Bureau of Resource Protection - Wetlands

**WPA Form 3 – Notice of Intent**

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

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MassDEP File Number

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Document Transaction Number

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Melrose

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City/Town

**Important:**

When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

**A. General Information**

1. Project Location (**Note:** electronic filers will click on button to locate project site):

<u>31 Cranmore Lane</u>	<u>Melrose</u>	<u>02176</u>
a. Street Address	b. City/Town	c. Zip Code
Latitude and Longitude:		
<u>E13</u>	<u>42.471240,</u>	<u>-71.052935</u>
f. Assessors Map/Plat Number	d. Latitude	e. Longitude
	<u>0 99</u>	
	g. Parcel /Lot Number	

2. Applicant:

<u>QUANG-DE</u>	<u>NGUYEN</u>	
a. First Name	b. Last Name	
-		
c. Organization		
<u>31 Cranmore Lane</u>		
d. Street Address		
<u>Melrose</u>	<u>MA</u>	<u>02176</u>
e. City/Town	f. State	g. Zip Code
-	-	<u>qdn175@gmail.com</u>
h. Phone Number	i. Fax Number	j. Email Address

3. Property owner (required if different from applicant):  Check if more than one owner

same as applicant

a. First Name	b. Last Name	
-	-	
c. Organization		
-		
d. Street Address		
-		
e. City/Town	f. State	g. Zip Code
-	-	-
h. Phone Number	i. Fax Number	j. Email address

4. Representative (if any):

<u>Kate</u>	<u>O'Donnell</u>	
a. First Name	b. Last Name	
<u>EcoTec, Inc.</u>		
c. Company		
<u>102 Grove Street</u>		
d. Street Address		
<u>Worcester</u>	<u>MA</u>	<u>01605</u>
e. City/Town	f. State	g. Zip Code
<u>508-752-9666</u>	-	<u>kodonnell@ecotecinc.com</u>
h. Phone Number	i. Fax Number	j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

<u>\$110.00</u>	<u>\$42.50</u>	<u>\$67.50</u>
a. Total Fee Paid	b. State Fee Paid	c. City/Town Fee Paid



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

# WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
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City/Town

## A. General Information (continued)

6. General Project Description:

Proposed pool, patio, infiltration system and associated site work. See cover letter for additional details.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

- 1.  Single Family Home
- 2.  Residential Subdivision
- 3.  Commercial/Industrial
- 4.  Dock/Pier
- 5.  Utilities
- 6.  Coastal engineering Structure
- 7.  Agriculture (e.g., cranberries, forestry)
- 8.  Transportation
- 9.  Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1.  Yes  No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Middlesex	-
a. County	b. Certificate # (if registered land)
80648	311
c. Book	d. Page Number

## B. Buffer Zone & Resource Area Impacts (temporary & permanent)

- 1.  Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
- 2.  Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.



**Massachusetts Department of Environmental Protection**  
 Bureau of Resource Protection - Wetlands

**WPA Form 3 – Notice of Intent**

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**B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)**

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. <input type="checkbox"/> Bank	- 1. linear feet	- 2. linear feet
b. <input type="checkbox"/> Bordering Vegetated Wetland	- 1. square feet	- 2. square feet
c. <input type="checkbox"/> Land Under Waterbodies and Waterways	- 1. square feet - 3. cubic yards dredged	- 2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. <input type="checkbox"/> Bordering Land Subject to Flooding	- 1. square feet - 3. cubic feet of flood storage lost	- 2. square feet - 4. cubic feet replaced
e. <input type="checkbox"/> Isolated Land Subject to Flooding	- 1. square feet - 2. cubic feet of flood storage lost	- 3. cubic feet replaced
f. <input type="checkbox"/> Riverfront Area	- 1. Name of Waterway (if available) - <b>specify coastal or inland</b>	

2. Width of Riverfront Area (check one):

- 25 ft. - Designated Densely Developed Areas only
- 100 ft. - New agricultural projects only
- 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: \_\_\_\_\_ square feet

4. Proposed alteration of the Riverfront Area:

\_\_\_\_\_ a. total square feet      \_\_\_\_\_ b. square feet within 100 ft.      \_\_\_\_\_ c. square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI?       Yes  No

6. Was the lot where the activity is proposed created prior to August 1, 1996?       Yes  No

3.  Coastal Resource Areas: (See 310 CMR 10.25-10.35)

**Note:** for coastal riverfront areas, please complete **Section B.2.f.** above.



**Massachusetts Department of Environmental Protection**  
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**B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)**

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users:  
 Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

<u>Resource Area</u>	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
a. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. <input type="checkbox"/> Land Under the Ocean	- 1. square feet	- 2. cubic yards dredged
c. <input type="checkbox"/> Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. <input type="checkbox"/> Coastal Beaches	- 1. square feet	- 2. cubic yards beach nourishment
e. <input type="checkbox"/> Coastal Dunes	- 1. square feet	- 2. cubic yards dune nourishment
	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
f. <input type="checkbox"/> Coastal Banks	- 1. linear feet	
g. <input type="checkbox"/> Rocky Intertidal Shores	- 1. square feet	
h. <input type="checkbox"/> Salt Marshes	- 1. square feet	- 2. sq ft restoration, rehab., creation
i. <input type="checkbox"/> Land Under Salt Ponds	- 1. square feet	
	- 2. cubic yards dredged	
j. <input type="checkbox"/> Land Containing Shellfish	- 1. square feet	
k. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	
	- 1. cubic yards dredged	
l. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	- 1. square feet	
4. <input type="checkbox"/> Restoration/Enhancement	If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.	
	- a. square feet of BVW	- b. square feet of Salt Marsh
5. <input type="checkbox"/> Project Involves Stream Crossings	- a. number of new stream crossings	- b. number of replacement stream crossings



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### C. Other Applicable Standards and Requirements

- This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

#### Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to [http://maps.massgis.state.ma.us/PRI\\_EST\\_HAB/viewer.htm](http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm).

- a.  Yes  No **If yes, include proof of mailing or hand delivery of NOI to:**

**Natural Heritage and Endangered Species Program  
Division of Fisheries and Wildlife  
1 Rabbit Hill Road  
Westborough, MA 01581**

6/1/2023

b. Date of map

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

- c. Submit Supplemental Information for Endangered Species Review\*

1.  Percentage/acreage of property to be altered:

(a) within wetland Resource Area - \_\_\_\_\_  
percentage/acreage

(b) outside Resource Area - \_\_\_\_\_  
percentage/acreage

2.  Assessor's Map or right-of-way plan of site

2.  Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work \*\*

(a)  Project description (including description of impacts outside of wetland resource area & buffer zone)

(b)  Photographs representative of the site

\* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see <https://www.mass.gov/endangered-species-act-mesa-regulatory-review>).

Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

\*\* MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.







**Massachusetts Department of Environmental Protection**  
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### C. Other Applicable Standards and Requirements (cont'd)

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?
- a.  Yes  No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.
- b. ACEC
5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
- a.  Yes  No
6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?
- a.  Yes  No
7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
- a.  Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
1.  Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
  2.  A portion of the site constitutes redevelopment
  3.  Proprietary BMPs are included in the Stormwater Management System.
- b.  No. Check why the project is exempt:
1.  Single-family house
  2.  Emergency road repair
  3.  Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

### D. Additional Information

- This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

**Online Users:** Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1.  USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
2.  Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

**Online Users:**  
Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

# WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:	
MassDEP File Number	
Document Transaction Number	
Melrose	
City/Town	

## D. Additional Information (cont'd)

3.  Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4.  List the titles and dates for all plans and other materials submitted with this NOI.

Civil Plan Set, 31 Cranmore Lane, Melrose, Sheets 1 and 2

a. Plan Title

Spruhan Engineering

Edmund Spruhan, PE

b. Prepared By

c. Signed and Stamped by

June 27, 2023

1"=20'

d. Final Revision Date

e. Scale

Existing Conditions Site Plan by Peter Nolan & Associates LLC

6/26/2023

f. Additional Plan or Document Title

g. Date

5.  If there is more than one property owner, please attach a list of these property owners not listed on this form.

6.  Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7.  Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8.  Attach NOI Wetland Fee Transmittal Form

9.  Attach Stormwater Report, if needed.

## E. Fees

1.  Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

116

2. Municipal Check Number

6/10/2023

3. Check date

115

4. State Check Number

6/10/2023

5. Check date

QUANGDE

6. Payor name on check: First Name

NGUYEN

7. Payor name on check: Last Name



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands

# WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Melrose
City/Town

## F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant	06/09/23
3. Signature of Property Owner (if different)	2. Date
5. Signature of Representative (if any)	4. Date
	6. Date

### For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

### For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

### Other:

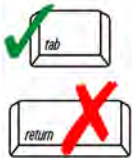
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.



**Massachusetts Department of Environmental Protection**  
 Bureau of Resource Protection - Wetlands  
**NOI Wetland Fee Transmittal Form**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



**A. Applicant Information**

1. Location of Project:

31 Cranmore Lane	Melrose
a. Street Address	b. City/Town
115	\$42.50
c. Check number	d. Fee amount

2. Applicant Mailing Address:

QUANG-DE	NGUYEN	
a. First Name	b. Last Name	
-	-	
c. Organization	-	
31 CRANMORE LANE	-	
d. Mailing Address	-	
MELROSE,	MA	02176
e. City/Town	f. State	g. Zip Code
-	-	-
h. Phone Number	i. Fax Number	j. Email Address
-	-	qdn175@gmail.com

3. Property Owner (if different):

same as applicant	-	
a. First Name	b. Last Name	
-	-	
c. Organization	-	
-	-	
d. Mailing Address	-	
-	-	-
e. City/Town	f. State	g. Zip Code
-	-	-
h. Phone Number	i. Fax Number	j. Email Address
-	-	-

**B. Fees**

Fee should be calculated using the following process & worksheet. **Please see Instructions before filling out worksheet.**

**Step 1/Type of Activity:** Describe each type of activity that will occur in wetland resource area and buffer zone.

**Step 2/Number of Activities:** Identify the number of each type of activity.

**Step 3/Individual Activity Fee:** Identify each activity fee from the six project categories listed in the instructions.

**Step 4/Subtotal Activity Fee:** Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

**Step 5/Total Project Fee:** Determine the total project fee by adding the subtotal amounts from Step 4.

**Step 6/Fee Payments:** To calculate the state share of the fee, divide the total fee in half and subtract \$12.50. To calculate the city/town share of the fee, divide the total fee in half and add \$12.50.

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).



Massachusetts Department of Environmental Protection  
 Bureau of Resource Protection - Wetlands  
**NOI Wetland Fee Transmittal Form**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

**B. Fees** (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Category 1.a. work on s/f house	1	\$110.00	\$110.00
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

**Step 5/Total Project Fee:** \$110.00

**Step 6/Fee Payments:**

Total Project Fee:	\$110.00
State share of filing Fee:	\$42.50
City/Town share of filing Fee:	\$67.50
	a. Total Fee from Step 5
	b. 1/2 Total Fee <b>less</b> \$12.50
	c. 1/2 Total Fee <b>plus</b> \$12.50

**C. Submittal Requirements**

- a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection  
 Box 4062  
 Boston, MA 02211

- b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

**To MassDEP Regional Office** (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

abutters_id_field	abutters_owner1	abutters_owner2	abutters_address
E13 0 103	ABBOTT JEFFREY	ABBOTT LINDA	38 CRANMORE LANE
E13 0 104	LYNCH,DAVID E	KERRY A LYNCH HWTE	34 CRANMORE LN
E13 0 105	KEYWORD IAN	HORTON AMY	28 CRANMORE LANE
E13 0 106	BRADY, SEAN M.	CHRISTINE M. BRADY, HWTE	22 CRANMORE LN
E13 0 97	HEALY, KEVIN P.	WENDY M. HEALY, HWTE	17 CRANMORE LN
E13 0 98	ROWE, KAREN M.	MARK P. ROWE, TE	23 CRANMORE LN
E13 0 99	QUANG-DE NGUYEN	HELEN LOUISE EVANS	31 CRANMORE LANE
F13 0 1	FAUCI, LOUIS J.	CARA B. FAUCI, HWTE	37 CRANMORE LANE
F13 0 2	GRAFTON, JAMES M+SHAUNEEN D TR	GRAFTON FAM. REV. TRUST	43 CRANMORE LANE
E14 0 125F	HUTCHINSON, MARK B	LINDA H BULMAN TRS	193 GREEN ST

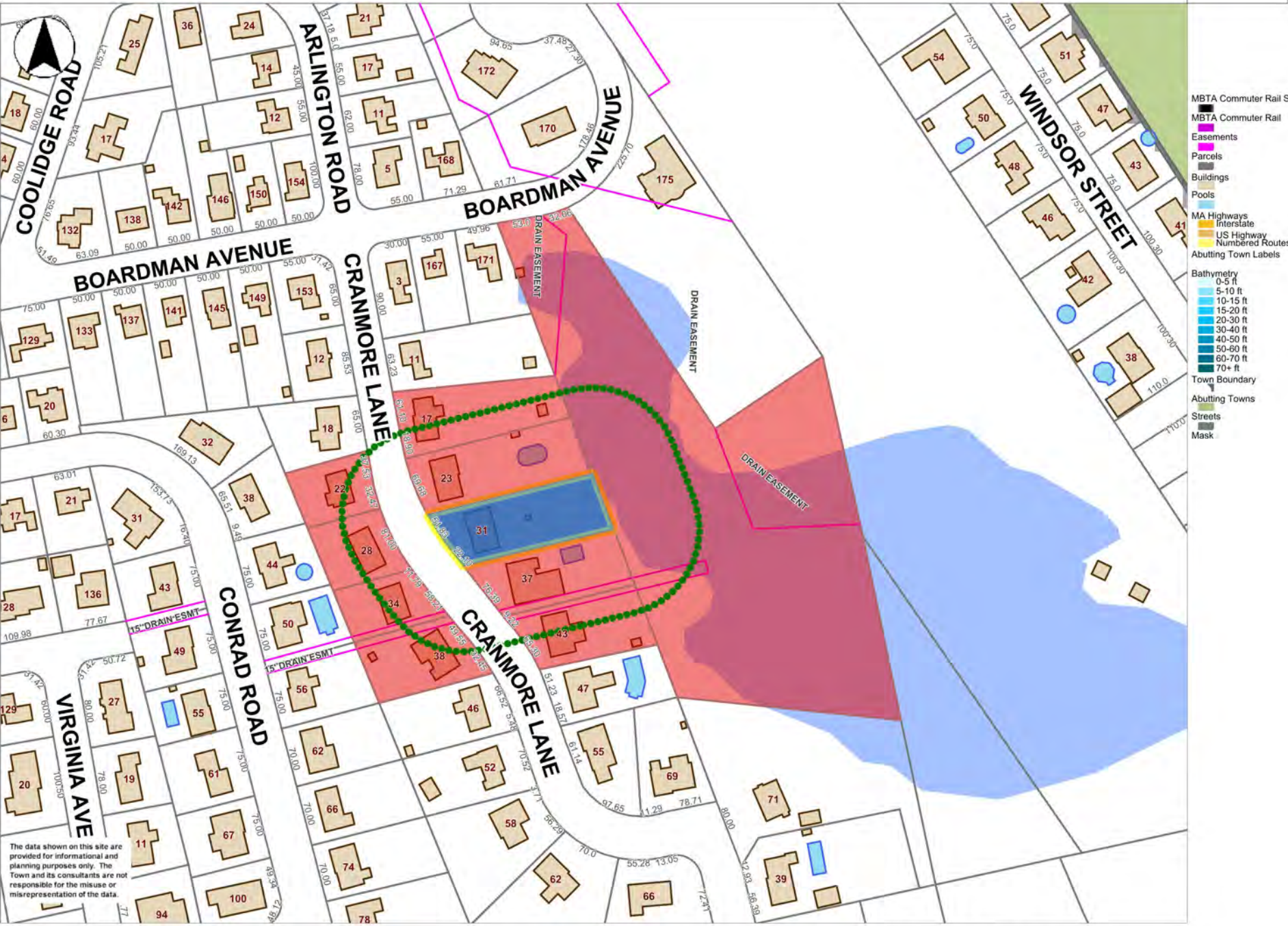
City Of Melrose Board Of Assessor's Certified Abutter's List

6/9/2023

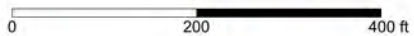


abutters_address2	abutters_town	abutters_state	abutters_zip	abutters_bookpage	abutters_location
	MELROSE	MA	02176	81277-299	38 CRANMORE LN
	MELROSE	MA	02176	23422-502	34 CRANMORE LN
	MELROSE	MA	02176	80119-163	28 CRANMORE LN
	MELROSE	MA	02176	62834-546	22 CRANMORE LN
	MELROSE	MA	02176	65870-350	17 CRANMORE LN
	MELROSE	MA	02176	67696-560	23 CRANMORE LN
	MELROSE	MA	02176	80648-311	31 CRANMORE LN
	MELROSE	MA	02176	72852-114	37 CRANMORE LN
	MELROSE	MA	02176	62445-60	43 CRANMORE LN
	MELROSE	MA	02176	1284-50	BOARDMAN AVE





The data shown on this site are provided for informational and planning purposes only. The Town and its consultants are not responsible for the misuse or misrepresentation of the data.



Printed on 06/09/2023 at 12:07 PM

# E13 0 99 abutters map

- MBTA Commuter Rail Station
- MBTA Commuter Rail
- Easements
- Parcels
- Buildings
- Pools
- MA Highways
- Interstate
- US Highway
- Numbered Routes
- Abutting Town Labels
- Bathymetry
- 0-5 ft
- 5-10 ft
- 10-15 ft
- 15-20 ft
- 20-30 ft
- 30-40 ft
- 40-50 ft
- 50-60 ft
- 60-70 ft
- 70+ ft
- Town Boundary
- Abutting Towns
- Streets
- Mask

Notification of Abutters Under the  
Massachusetts Wetlands Protection Act and the City of Melrose Wetlands Ordinance

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, you are hereby notified of the following:

- A. The name of the applicant is Quang-De Nguyen.
- B. The applicant has filed a Notice of Intent with the Conservation Commission for the municipality of Melrose seeking permission to construct a pool, patio, infiltration system, and associated site work within the 100-foot Buffer Zone to an Area Subject to Protection Under the Wetlands Protection Act (General Laws Chapter 131, Section 40) and the City of Melrose Wetlands Ordinance.
- C. The address where the planned activity will take place is 31 Cranmore Lane, Melrose, MA.
- D. Copies of the Notice of Intent may be examined at the Melrose Conservation Commission office during their normal business hours. For more information, call the Conservation Commission at 781-979-4312. Copies of the Notice of Intent may also be examined and obtained by making an appointment at EcoTec, Inc., 102 Grove Street, Worcester, MA, during regular business hours.
- E. For more information call or email Kate O'Donnell of EcoTec at (508) 752-9666 x228 or [kodonnell@ecotecinc.com](mailto:kodonnell@ecotecinc.com) to make an appointment to review the filing materials. This is the applicant's representative.
- F. Information regarding the date, time and place of the public hearing may be obtained from EcoTec, Inc., by calling this telephone number (508) 752-9666 during regular business hours. Or the Melrose Conservation Commission at 781-979-4312.

**NOTE: Notice of the public hearing, including the date, time and place will be published at least five (5) days in advance in the Melrose Free Press.**

**NOTE: Notice of the public hearing, including the date, time and place will be posted in the City or Town Hall not less than forty-eight (48) hours in advance.**

**NOTE: You also may contact your local Conservation Commission or the nearest Department of Environmental Protection Regional Office for more information about this application or the Wetlands Protection Act. To contact DEP, call:**

Northeast Region: 978-694-3200

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act

I, Kate O'Donnell, WPIT, hereby certify under the pains and penalties of perjury that on June 28, 2023, I gave notification to abutters in compliance with the Melrose Wetland Ordinance and the Massachusetts Wetlands Protection Act in connection with the following matter:

A Notice of Intent filed under the Melrose Wetland Ordinance and the Massachusetts Wetlands Protection Act by Quang-De Nguyen, with the Melrose Conservation Commission on June 28, 2023 for property located at 31 Cranmore Lane, Melrose, Massachusetts.

The form of the notification and a list of the abutters to whom it was given and their addresses, are provided with this Affidavit of Service.



\_\_\_\_\_  
Kate O'Donnell, WPIT, EcoTec, Inc.

June 28, 2023  
\_\_\_\_\_  
Date

SPRUHAN ENGINEERING, P.C.

# STORMWATER REPORT

31 CRANMORE LANE, MELROSE, MA



**Prepared By: Spruhan Engineering, P.C.**  
**June 27, 2023**  
**Revised: June 27, 2023**

<b>1.0</b>	<b>Introduction.....</b>	<b>3</b>
<b>2.0</b>	<b>Existing Conditions.....</b>	<b>2</b>
<b>3.0</b>	<b>Proposed Conditions.....</b>	<b>4</b>
<b>3.1</b>	<b>Project Description.....</b>	<b>4</b>
<b>3.2</b>	<b>Storm Water Runoff .....</b>	<b>4</b>
<b>3.3</b>	<b>Infiltration systems.....</b>	<b>4</b>
<b>3.4</b>	<b>Groundwater recharge calculations.....</b>	<b>5</b>
<b>4.0</b>	<b>Soil Information .....</b>	<b>6</b>
	<b>Appendix A – HydroCAD Calculations.....</b>	<b>9</b>
	<b>Appendix B – Soils Information .....</b>	<b>.71</b>

## **1.0 Introduction**

---

Spruhan Engineering, P.C. has prepared this Storm water Report for the proposed development located at 31 Cranmore LN, Melrose, Massachusetts.

The proposed development consists of a residential dwelling, paved driveway/parking, walkways, patios, and landscaped areas. The purpose of this report is to demonstrate that the proposed conditions do not create any increased flowrate or runoff from the site. This is achieved by proposing an infiltration system.

## **2.0 Existing Conditions**

---

The existing property is located at 31 Cranmore LN, Melrose, Massachusetts. The site is bounded by residential dwellings on the sides. The existing roof area is 1,395.19 S.F., the existing paved area (Driveway & walkway) is 872.85 S.F., the existing impervious areas (Deck, Porch, Retaining wall, Shed, Landing & Steps) are 664.32 S.F., and the remaining landscaped areas are 10,317.64 S.F.

### 3.0 Proposed Conditions

---

#### 3.1 Project Description

The development consists of a pool and patio (pavers). The existing roof to remaining will have an area of 1,395.19, the proposed pool patio will have an area of 1,565.67 S.F, the unconnected impervious will have an area of 708.88 S.F., the pool will have an area of 925.0 S.F. and the remaining landscaped portion will have a footprint of 7,782.41 S.F.

#### 3.2 Storm Water Runoff

HydroCAD was used to model the site for the existing and proposed conditions for the 2-year, 10-year, 25-year, and 100-year type III storm events based on Atlas-14 Rain information for Middlesex County Central Area. HydroCAD calculations can be seen in Appendix A. The following table shows a summary of the existing and proposed conditions on the site as they relate to flowrate and volume of storm water runoff for each of the storm events.

#### 3.3 Infiltration system

An infiltration system is proposed to control the runoff from the proposed pool patio. The system consists of 3 subsurface Stormtech plastic chambers with a 6 in crushed stone bed below.

The system is 11' x 21' x 4'.

<b><u>Summary Table (HydroCAD results)</u></b>				
<b>Storm Event</b>	<b>Runoff rate</b>		<b>Volume of runoff</b>	
	<b>Existing</b>	<b>Proposed</b>	<b>Existing</b>	<b>Proposed</b>
<b>2-Year</b>	0.43 cfs	0.38 cfs	1,461 cf	1,297 cf
<b>10-Year</b>	0.93 cfs	0.79 cfs	2,995 cf	2,574 cf
<b>25-Year</b>	1.28 cfs	1.08 cfs	4,063 cf	3,454 cf
<b>100-Year</b>	1.84 cfs	1.53 cfs	5,792 cf	5,003 cf

### 3.4 Groundwater recharge calculations.

#### System #1:

$$Time = \frac{rv}{(k)(Bottom\ Area)}$$

$$Time = \frac{466\ cf}{(1.02\ in/hr)(\frac{1ft}{12in})(231\ Sf)} = 23.73\ Hr$$

### 4.0 Soil Information

---

The NRCS Web Soil Survey shows one map unit inside our area of interest. Is listed next and the percentages of Area of Interest in the Map unit Legend Table:

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	0.2	52.8%
655	Udorhents, wet substratum	0.2	47.2%
<b>Totals for Area of Interest</b>		<b>0.4</b>	<b>100.0%</b>

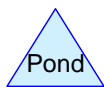
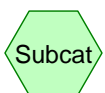
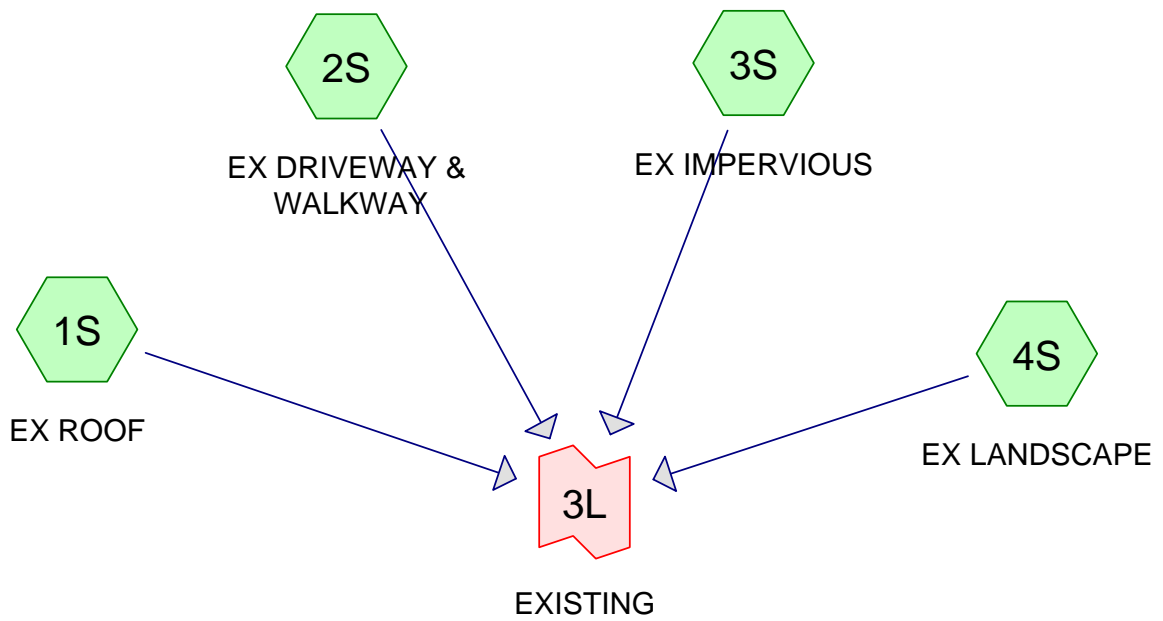
Map unit 51A refers to course sand, this soil have a Hydrological soil group “A”, this information is shown in Appendix B, in the Map unit descriptions.

Also, a test pit was performed on the site and the hole log shows Sandy Loam was found, which has the NRCS “A” properties and these properties were applied to the HydroCAD software calcs. Further detailed information is described in Appendix B.





## **Appendix A – HydroCAD Calculations**



**EXISTING**

Prepared by SPRUHAN ENGINEERING

Printed 6/27/2023

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Page 2

**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
10,318	69	50-75% Grass cover, Fair, HSG B (4S)
664	98	Deck/Porch/Retainaing wall/ Shed/ Landing & Steps) (3S)
873	98	Driveway & Walkway (2S)
1,395	98	Roofs, HSG B (1S)
<b>13,250</b>	<b>75</b>	<b>TOTAL AREA</b>

**EXISTING**

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
11,713	HSG B	1S, 4S
0	HSG C	
0	HSG D	
1,537	Other	2S, 3S
<b>13,250</b>		<b>TOTAL AREA</b>

**EXISTING**

Prepared by SPRUHAN ENGINEERING

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.29"

Printed 6/27/2023

Page 4

Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 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 1S: EX ROOF** Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=3.06"  
Tc=5.0 min CN=98 Runoff=0.11 cfs 355 cf

**Subcatchment 2S: EX DRIVEWAY &** Runoff Area=873 sf 100.00% Impervious Runoff Depth=3.06"  
Tc=5.0 min CN=98 Runoff=0.07 cfs 222 cf

**Subcatchment 3S: EX IMPERVIOUS** Runoff Area=664 sf 100.00% Impervious Runoff Depth=3.06"  
Tc=5.0 min CN=98 Runoff=0.05 cfs 169 cf

**Subcatchment 4S: EX LANDSCAPE** Runoff Area=10,318 sf 0.00% Impervious Runoff Depth=0.83"  
Tc=5.0 min CN=69 Runoff=0.21 cfs 714 cf

**Link 3L: EXISTING** Inflow=0.43 cfs 1,461 cf  
Primary=0.43 cfs 1,461 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 1,461 cf Average Runoff Depth = 1.32"**  
**77.87% Pervious = 10,318 sf 22.13% Impervious = 2,932 sf**

**EXISTING**

Prepared by SPRUHAN ENGINEERING

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.29"

Printed 6/27/2023

Page 5

**Summary for Subcatchment 1S: EX ROOF**

Runoff = 0.11 cfs @ 12.07 hrs, Volume= 355 cf, Depth= 3.06"

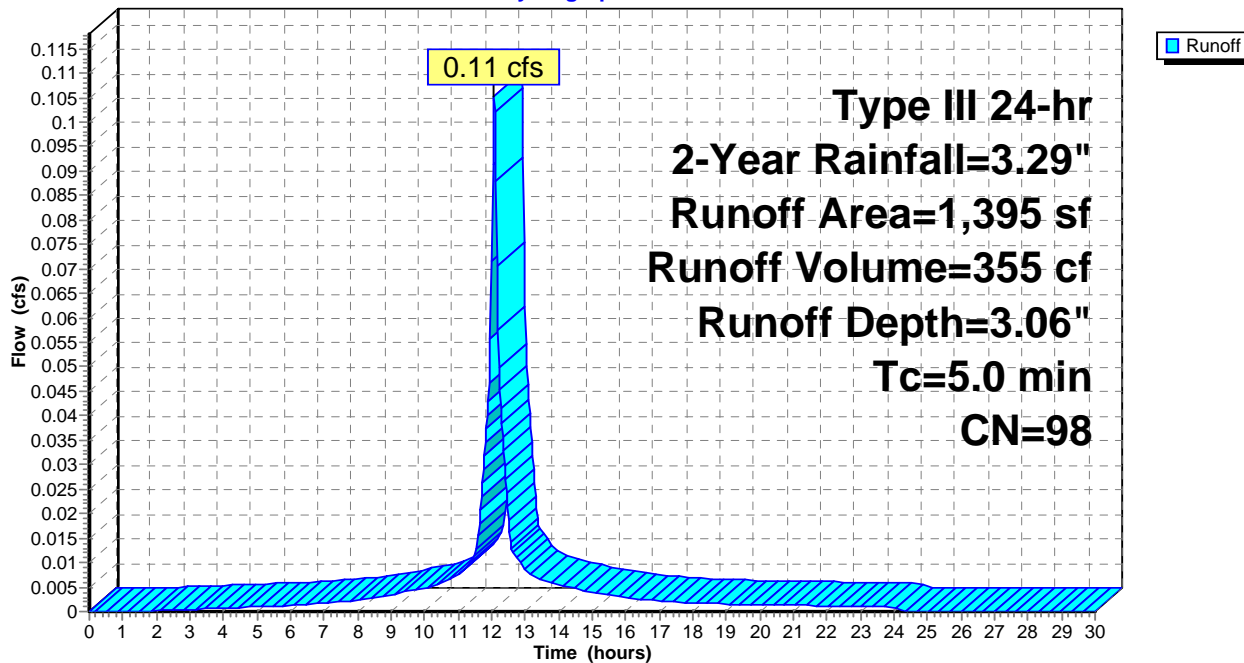
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
1,395	98	Roofs, HSG B
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX ROOF**

Hydrograph



**EXISTING**

Prepared by SPRUHAN ENGINEERING

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.29"

Printed 6/27/2023

Page 6

**Summary for Subcatchment 2S: EX DRIVEWAY & WALKWAY**

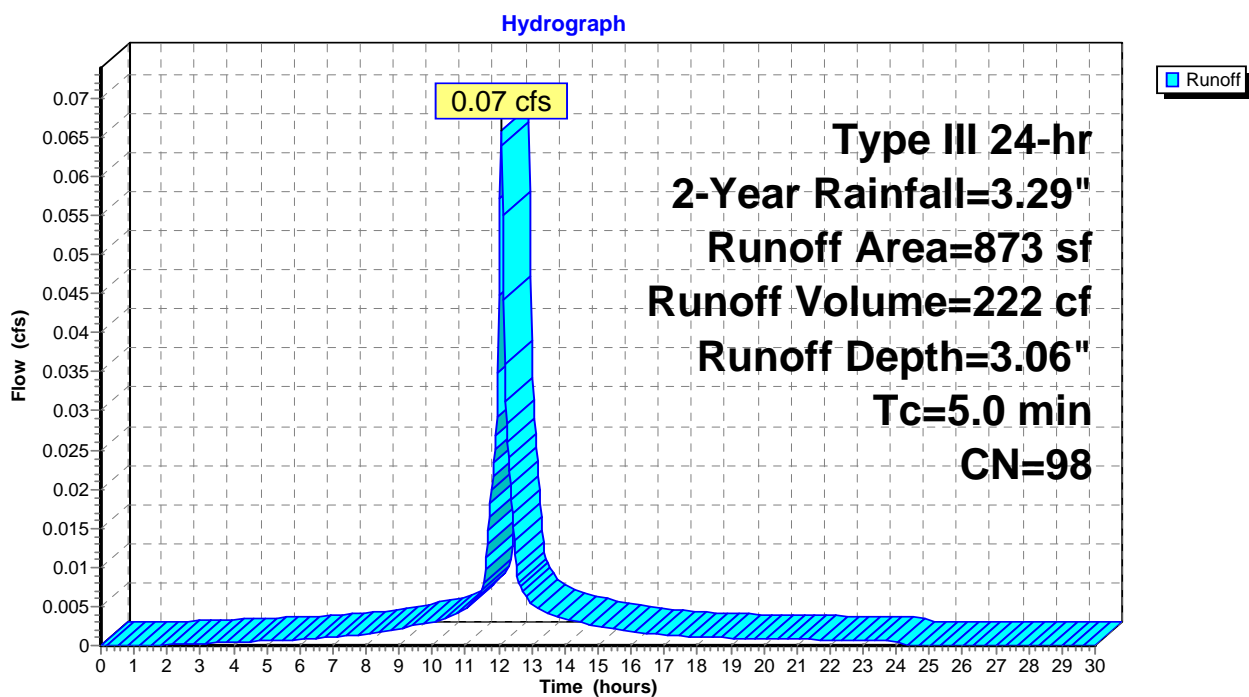
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 222 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
* 873	98	Driveway & Walkway
873		100.00% Impervious Area

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

**Subcatchment 2S: EX DRIVEWAY & WALKWAY**





**EXISTING**

Prepared by SPRUHAN ENGINEERING

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.29"

Printed 6/27/2023

Page 7

**Summary for Subcatchment 3S: EX IMPERVIOUS**

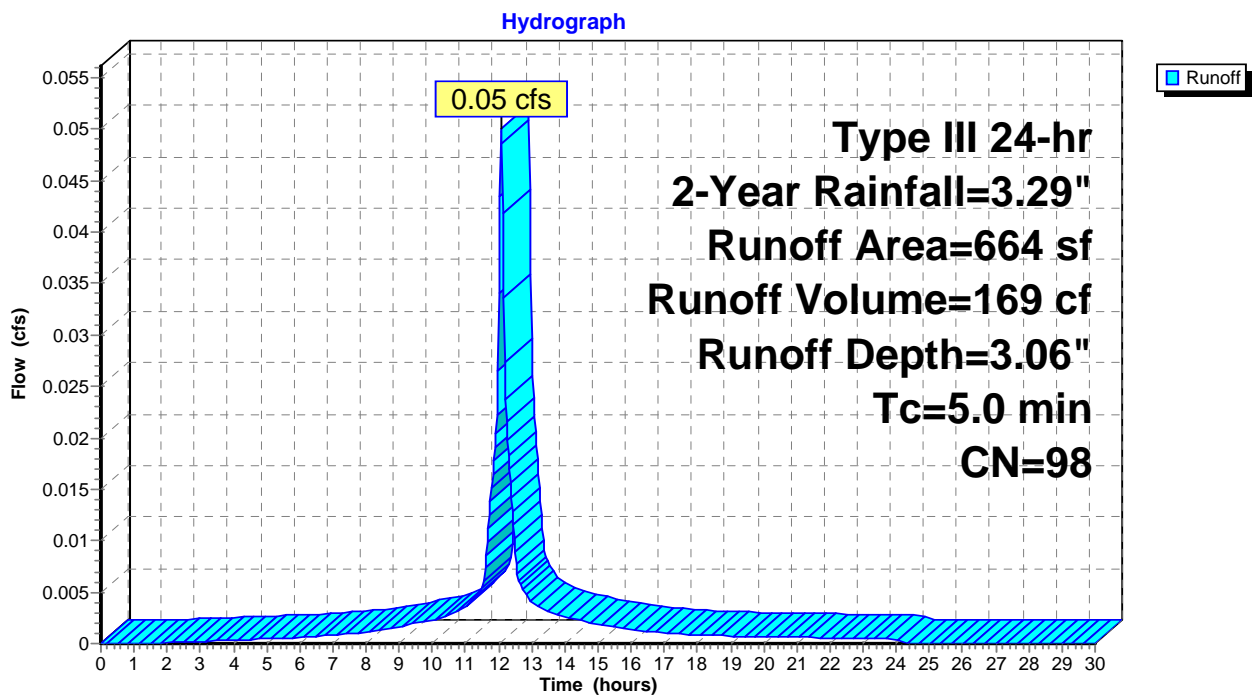
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 169 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
* 664	98	Deck/Porch/Retainaing wall/ Shed/ Landing & Steps)
664		100.00% Impervious Area

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

**Subcatchment 3S: EX IMPERVIOUS**



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Subcatchment 4S: EX LANDSCAPE**

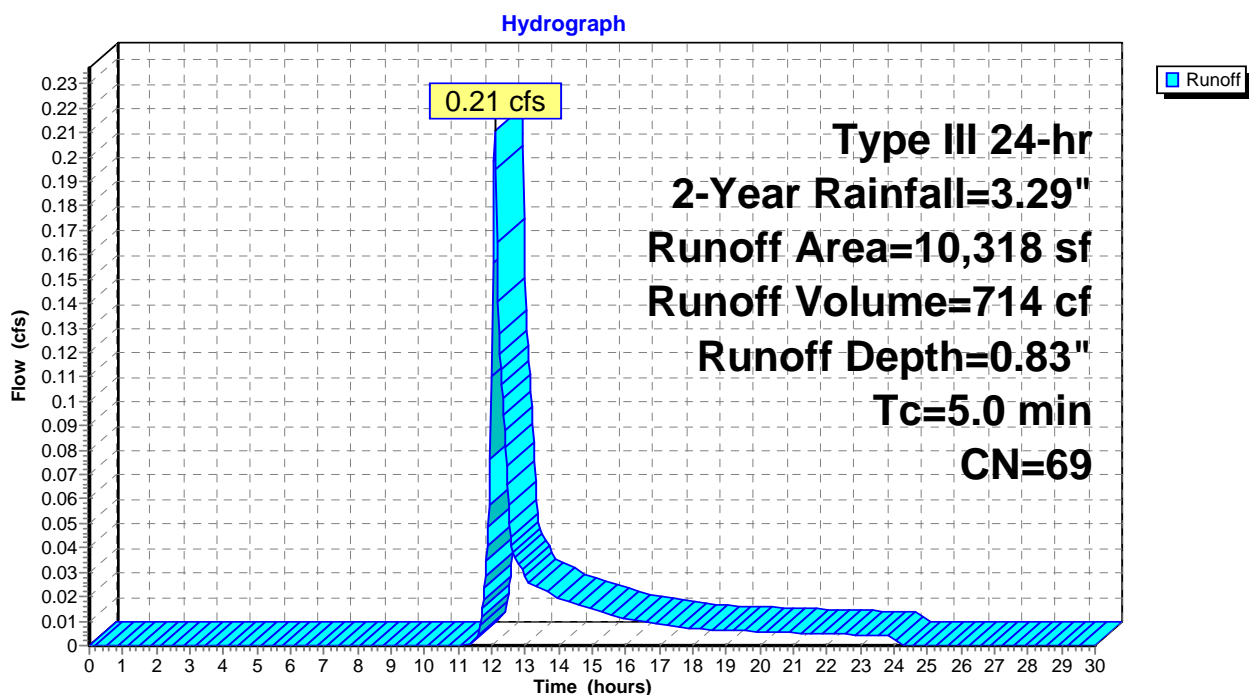
Runoff = 0.21 cfs @ 12.09 hrs, Volume= 714 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
10,318	69	50-75% Grass cover, Fair, HSG B
10,318		100.00% Pervious Area

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

**Subcatchment 4S: EX LANDSCAPE**



**EXISTING**

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Type III 24-hr 2-Year Rainfall=3.29"

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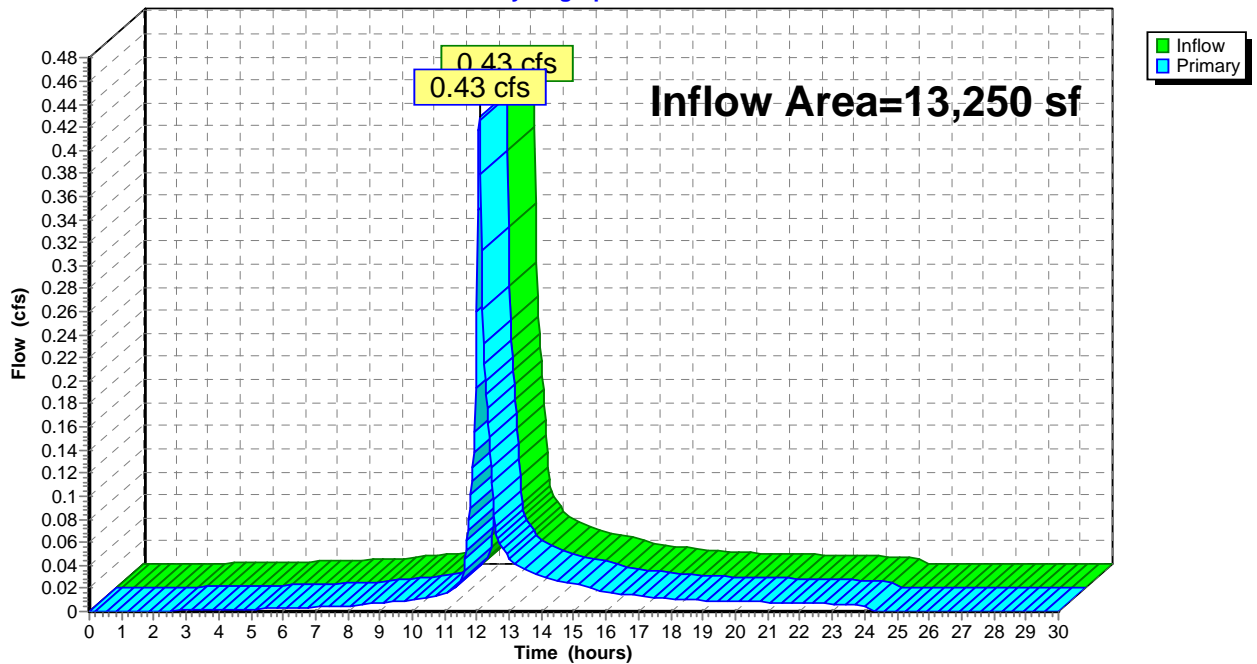
**Summary for Link 3L: EXISTING**

Inflow Area = 13,250 sf, 22.13% Impervious, Inflow Depth = 1.32" for 2-Year event  
Inflow = 0.43 cfs @ 12.08 hrs, Volume= 1,461 cf  
Primary = 0.43 cfs @ 12.08 hrs, Volume= 1,461 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: EXISTING**

Hydrograph



**EXISTING**

Type III 24-hr 10-Year Rainfall=5.17"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EX ROOF</b>	Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.17 cfs 573 cf
<b>Subcatchment 2S: EX DRIVEWAY &amp;</b>	Runoff Area=873 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.10 cfs 359 cf
<b>Subcatchment 3S: EX IMPERVIOUS</b>	Runoff Area=664 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.08 cfs 273 cf
<b>Subcatchment 4S: EX LANDSCAPE</b>	Runoff Area=10,318 sf 0.00% Impervious Runoff Depth=2.08" Tc=5.0 min CN=69 Runoff=0.58 cfs 1,790 cf
<b>Link 3L: EXISTING</b>	Inflow=0.93 cfs 2,995 cf Primary=0.93 cfs 2,995 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 2,995 cf Average Runoff Depth = 2.71"**  
**77.87% Pervious = 10,318 sf 22.13% Impervious = 2,932 sf**

**EXISTING**

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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 1S: EX ROOF**

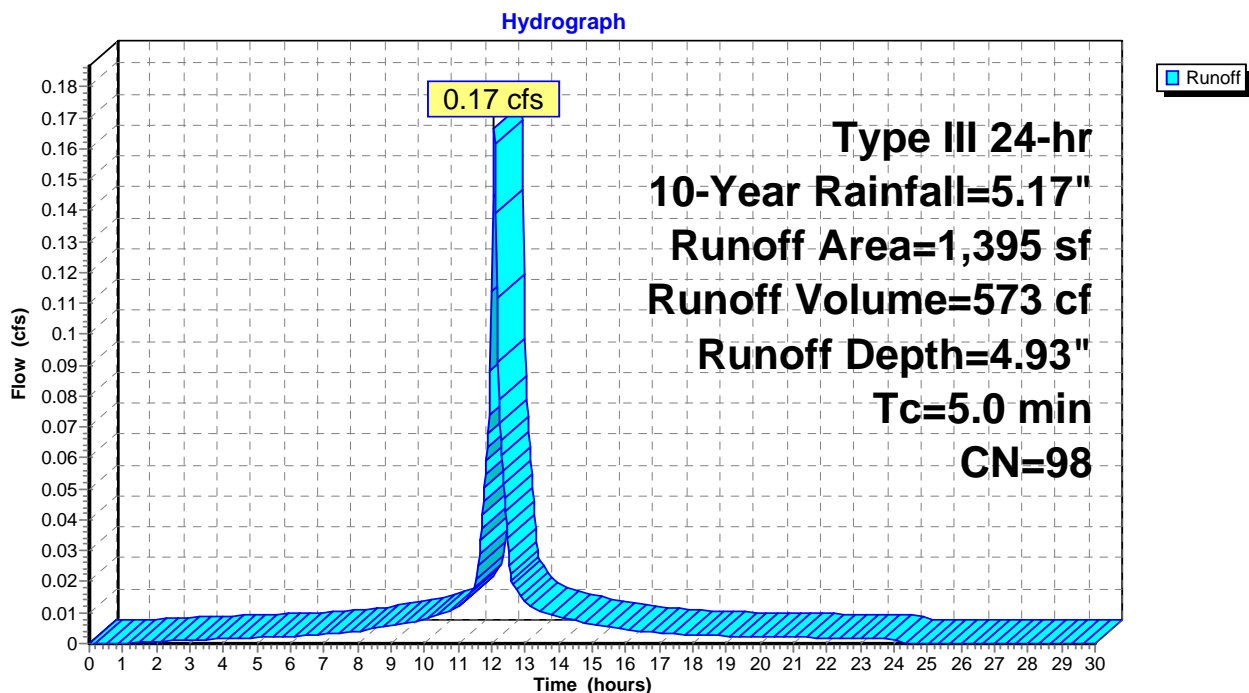
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 573 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
1,395	98	Roofs, HSG B
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX ROOF**



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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 2S: EX DRIVEWAY & WALKWAY**

Runoff = 0.10 cfs @ 12.07 hrs, Volume= 359 cf, Depth= 4.93"

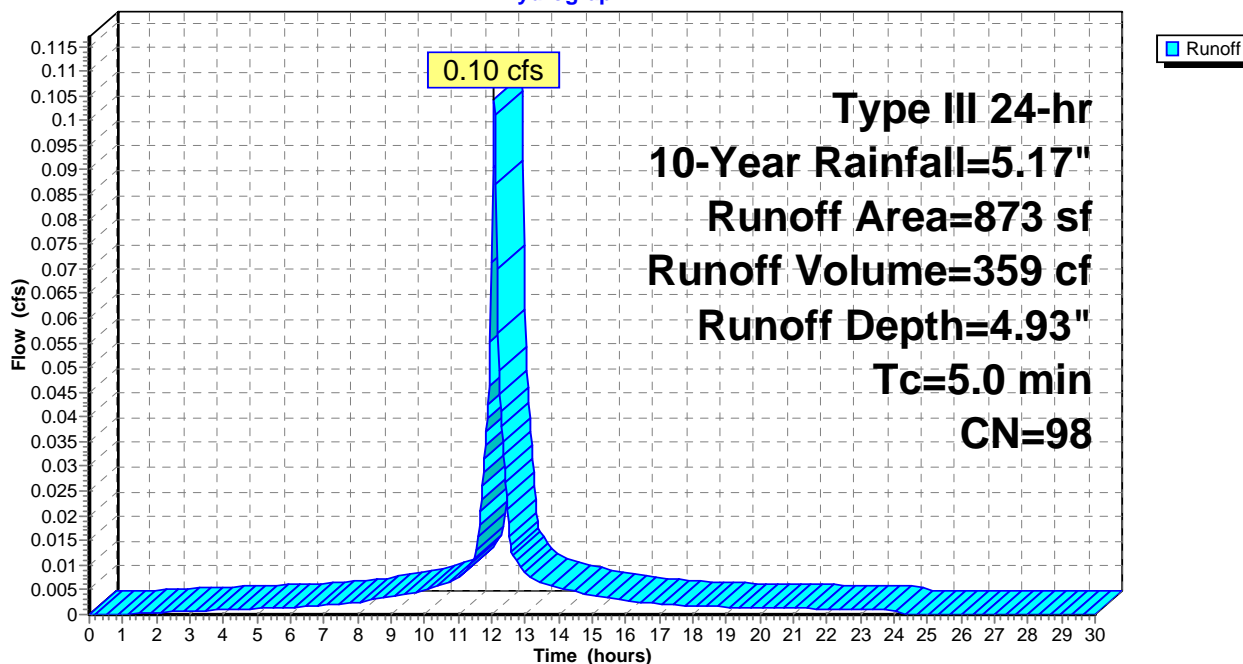
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
* 873	98	Driveway & Walkway
873		100.00% Impervious Area

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

**Subcatchment 2S: EX DRIVEWAY & WALKWAY**

Hydrograph



**EXISTING**

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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 3S: EX IMPERVIOUS**

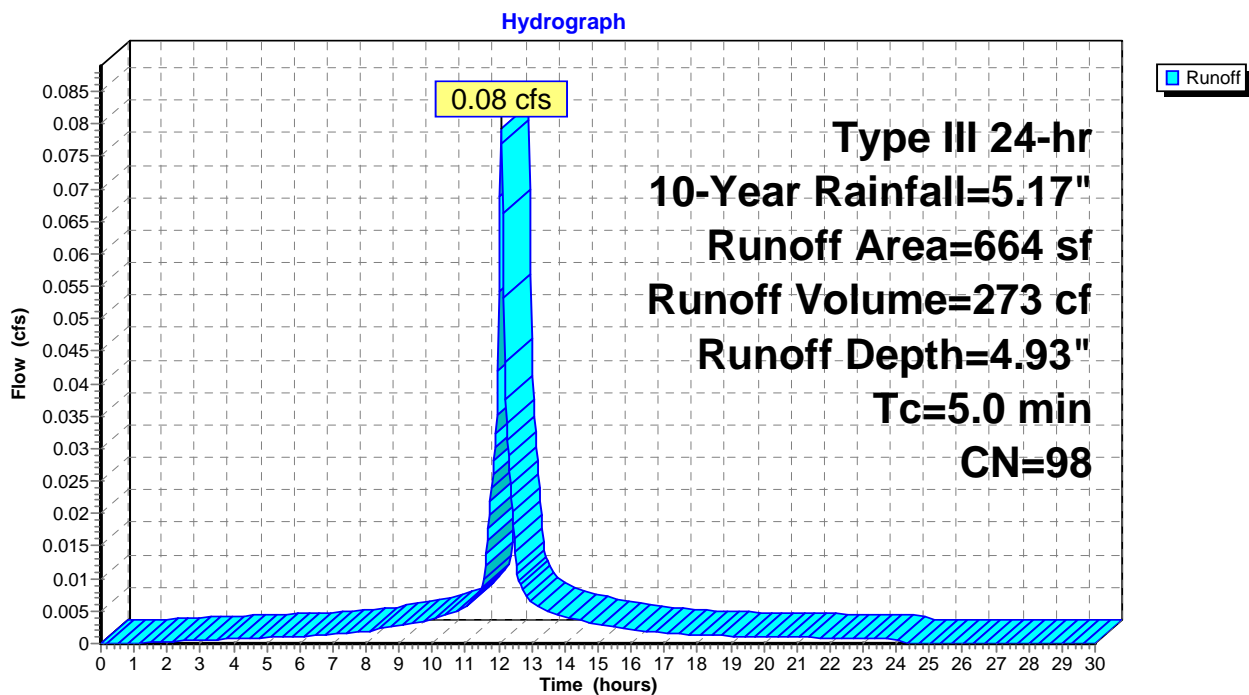
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 273 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
* 664	98	Deck/Porch/Retainaing wall/ Shed/ Landing & Steps)
664		100.00% Impervious Area

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

**Subcatchment 3S: EX IMPERVIOUS**



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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 4S: EX LANDSCAPE**

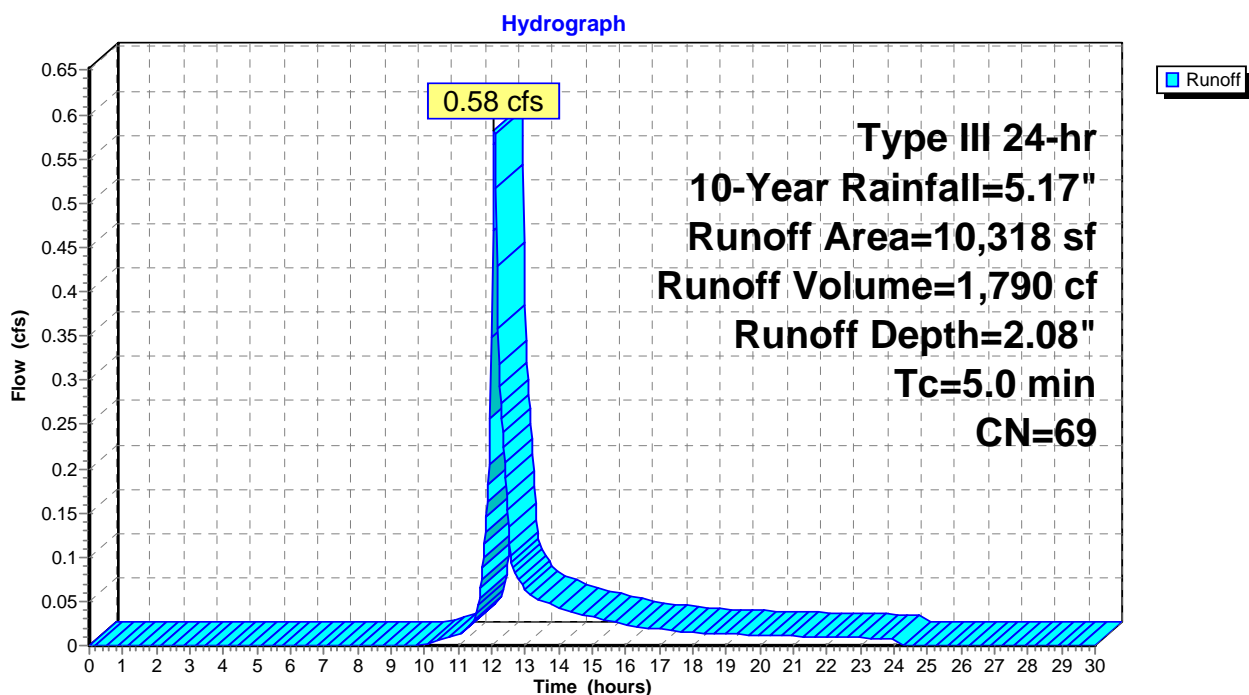
Runoff = 0.58 cfs @ 12.08 hrs, Volume= 1,790 cf, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
10,318	69	50-75% Grass cover, Fair, HSG B
10,318		100.00% Pervious Area

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

**Subcatchment 4S: EX LANDSCAPE**





**EXISTING**

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Type III 24-hr 10-Year Rainfall=5.17"

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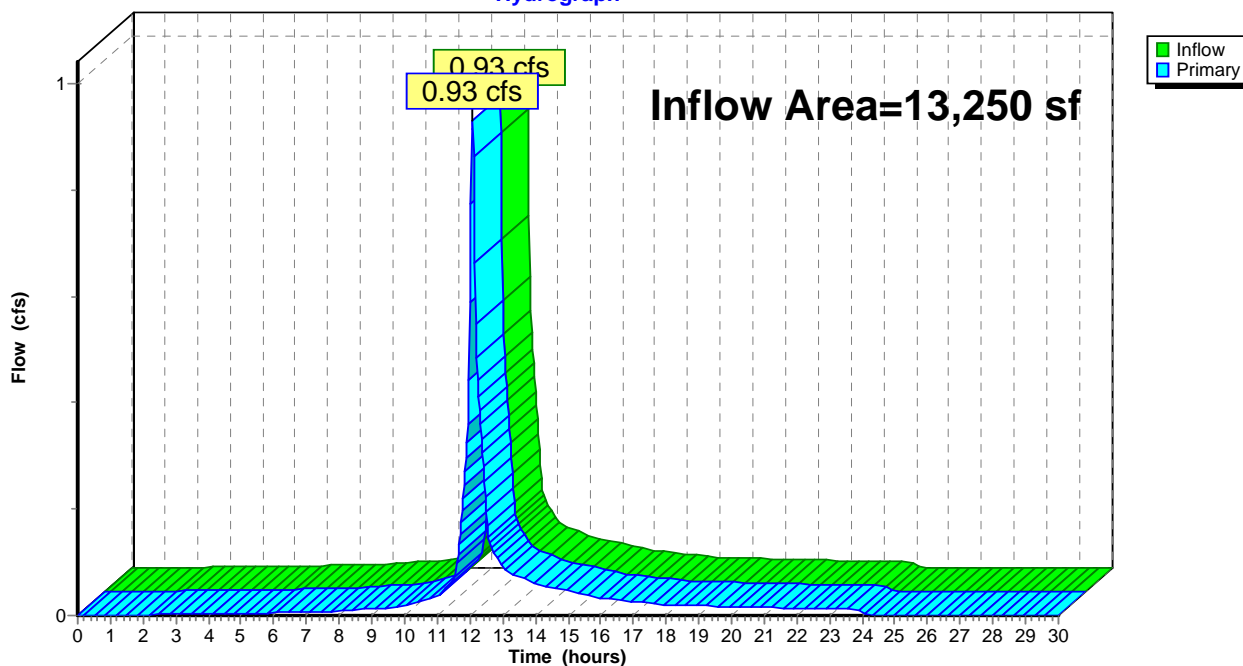
**Summary for Link 3L: EXISTING**

Inflow Area = 13,250 sf, 22.13% Impervious, Inflow Depth = 2.71" for 10-Year event  
Inflow = 0.93 cfs @ 12.08 hrs, Volume= 2,995 cf  
Primary = 0.93 cfs @ 12.08 hrs, Volume= 2,995 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: EXISTING**

Hydrograph



**EXISTING**

Type III 24-hr 25-Year Rainfall=6.35"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EX ROOF</b>	Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.21 cfs 710 cf
<b>Subcatchment 2S: EX DRIVEWAY &amp;</b>	Runoff Area=873 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.13 cfs 445 cf
<b>Subcatchment 3S: EX IMPERVIOUS</b>	Runoff Area=664 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.10 cfs 338 cf
<b>Subcatchment 4S: EX LANDSCAPE</b>	Runoff Area=10,318 sf 0.00% Impervious Runoff Depth=2.99" Tc=5.0 min CN=69 Runoff=0.85 cfs 2,570 cf
<b>Link 3L: EXISTING</b>	Inflow=1.28 cfs 4,063 cf Primary=1.28 cfs 4,063 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 4,063 cf Average Runoff Depth = 3.68"**  
**77.87% Pervious = 10,318 sf 22.13% Impervious = 2,932 sf**

**EXISTING**

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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 1S: EX ROOF**

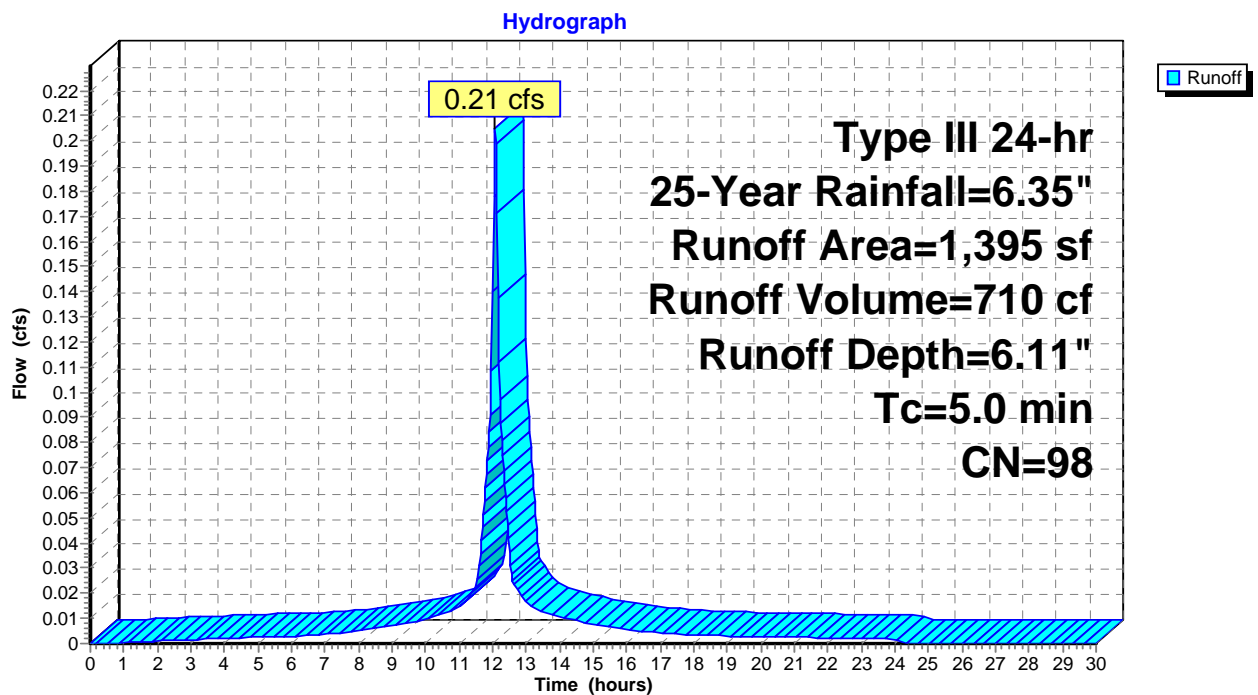
Runoff = 0.21 cfs @ 12.07 hrs, Volume= 710 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
1,395	98	Roofs, HSG B
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX ROOF**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 2S: EX DRIVEWAY & WALKWAY**

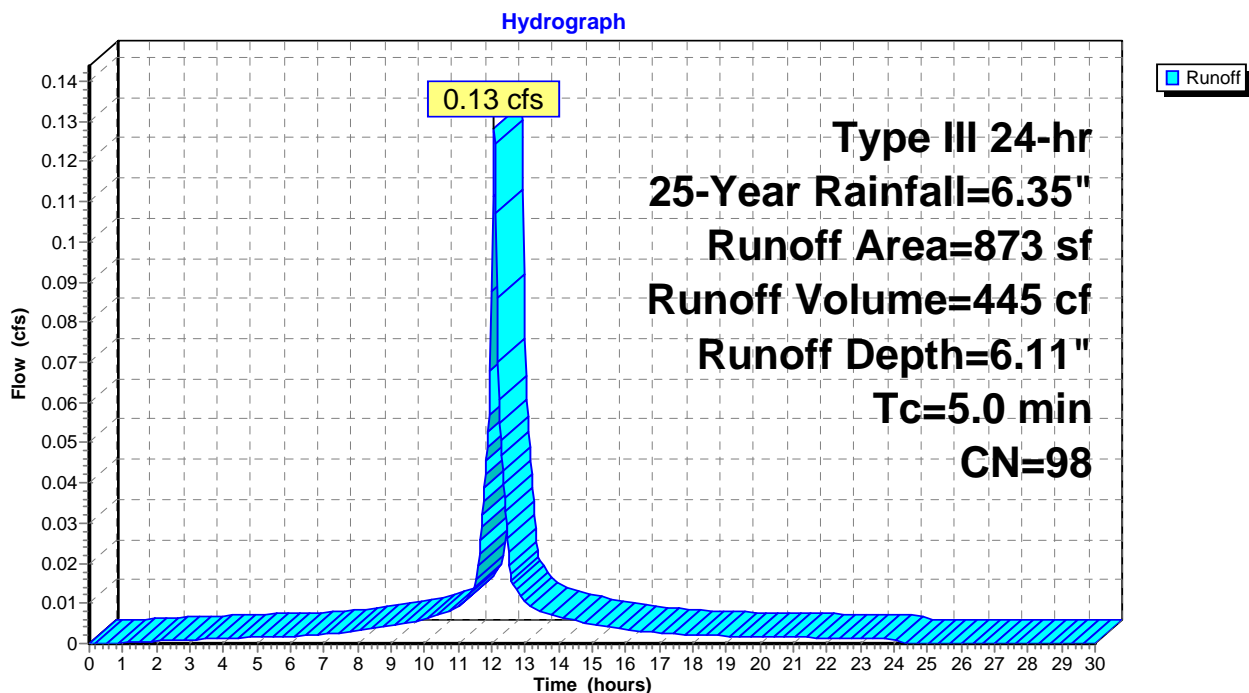
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 445 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
* 873	98	Driveway & Walkway
873		100.00% Impervious Area

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

**Subcatchment 2S: EX DRIVEWAY & WALKWAY**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 3S: EX IMPERVIOUS**

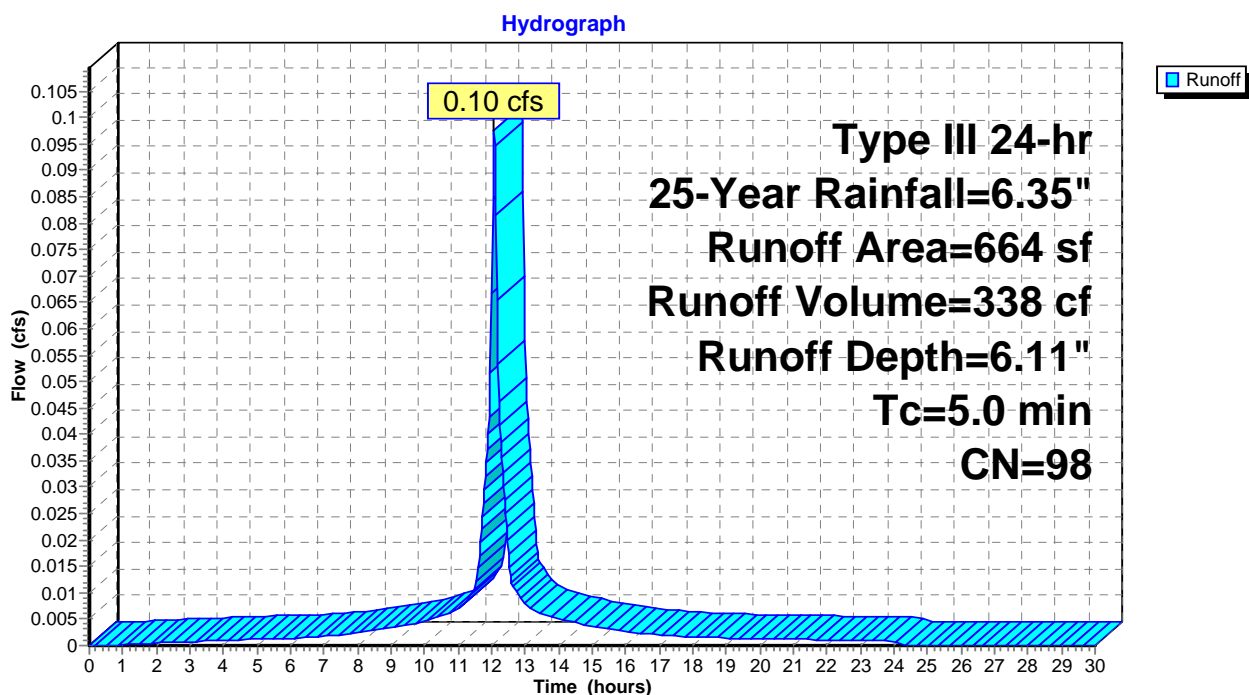
Runoff = 0.10 cfs @ 12.07 hrs, Volume= 338 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
* 664	98	Deck/Porch/Retainaing wall/ Shed/ Landing & Steps)
664		100.00% Impervious Area

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

**Subcatchment 3S: EX IMPERVIOUS**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 4S: EX LANDSCAPE**

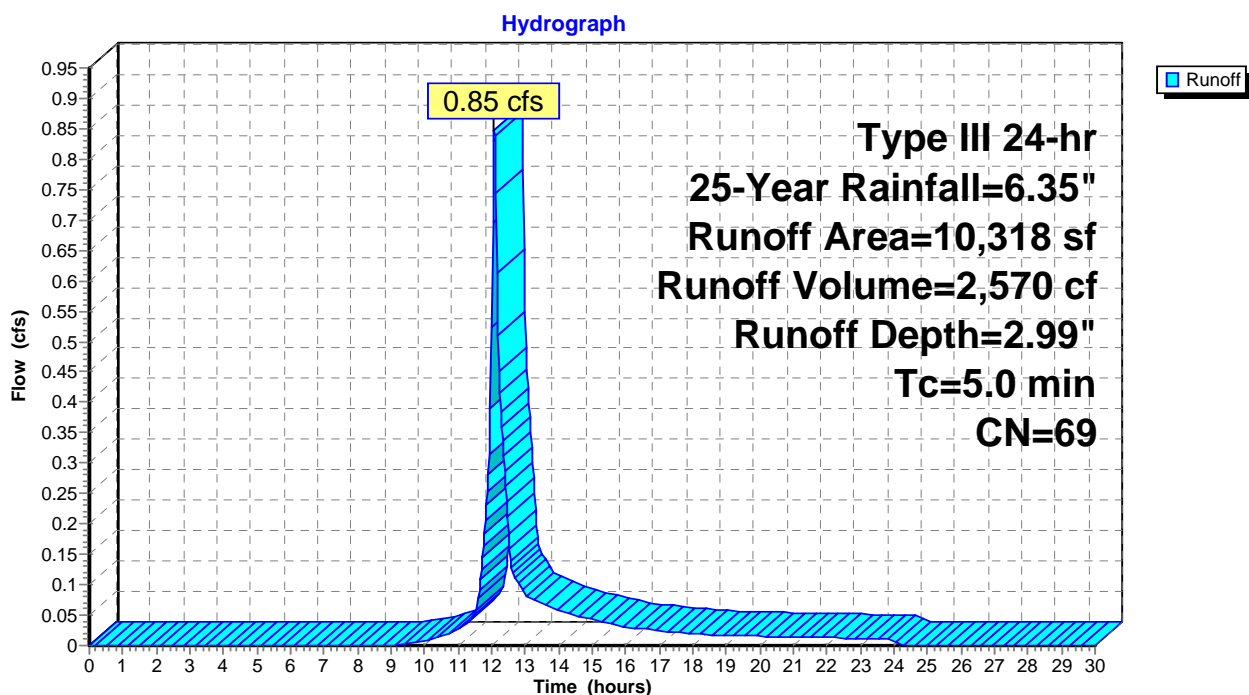
Runoff = 0.85 cfs @ 12.08 hrs, Volume= 2,570 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
10,318	69	50-75% Grass cover, Fair, HSG B
10,318		100.00% Pervious Area

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

**Subcatchment 4S: EX LANDSCAPE**



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Type III 24-hr 25-Year Rainfall=6.35"

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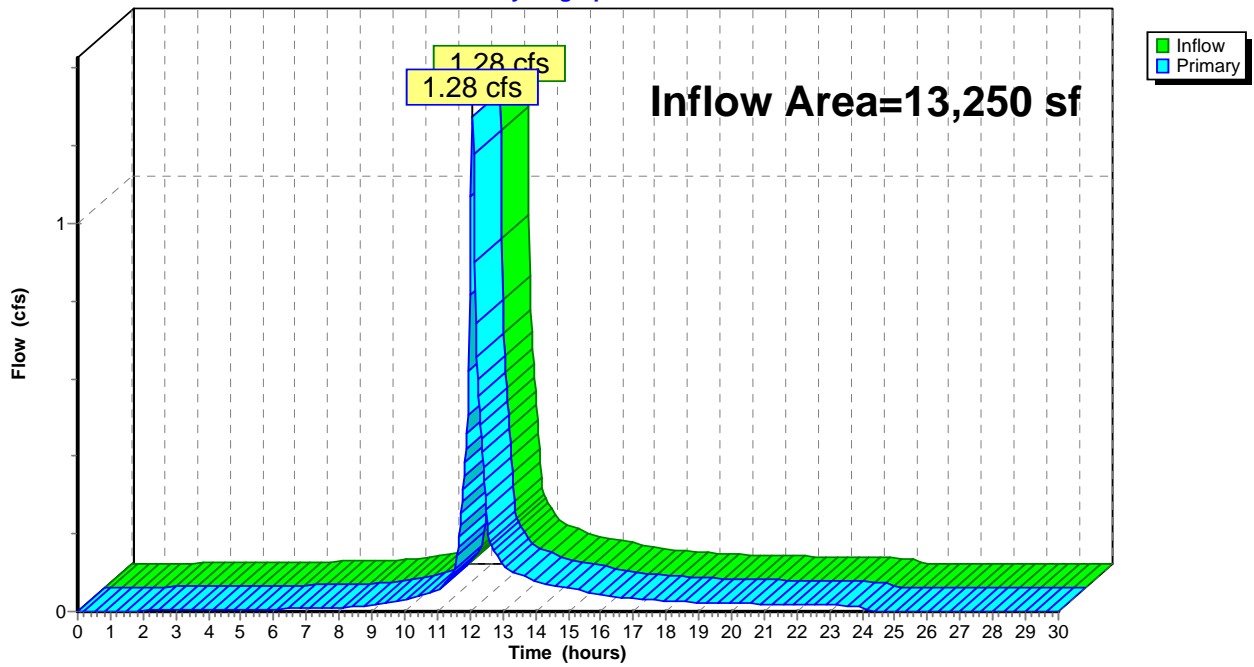
**Summary for Link 3L: EXISTING**

Inflow Area = 13,250 sf, 22.13% Impervious, Inflow Depth = 3.68" for 25-Year event  
Inflow = 1.28 cfs @ 12.08 hrs, Volume= 4,063 cf  
Primary = 1.28 cfs @ 12.08 hrs, Volume= 4,063 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: EXISTING**

Hydrograph



**EXISTING**

Type III 24-hr 100-Year Rainfall=8.16"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EX ROOF</b>	Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=7.92" Tc=5.0 min CN=98 Runoff=0.26 cfs 921 cf
<b>Subcatchment 2S: EX DRIVEWAY &amp;</b>	Runoff Area=873 sf 100.00% Impervious Runoff Depth=7.92" Tc=5.0 min CN=98 Runoff=0.17 cfs 576 cf
<b>Subcatchment 3S: EX IMPERVIOUS</b>	Runoff Area=664 sf 100.00% Impervious Runoff Depth=7.92" Tc=5.0 min CN=98 Runoff=0.13 cfs 438 cf
<b>Subcatchment 4S: EX LANDSCAPE</b>	Runoff Area=10,318 sf 0.00% Impervious Runoff Depth=4.49" Tc=5.0 min CN=69 Runoff=1.28 cfs 3,857 cf
<b>Link 3L: EXISTING</b>	Inflow=1.84 cfs 5,792 cf Primary=1.84 cfs 5,792 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 5,792 cf Average Runoff Depth = 5.25"**  
**77.87% Pervious = 10,318 sf 22.13% Impervious = 2,932 sf**



**EXISTING**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 1S: EX ROOF**

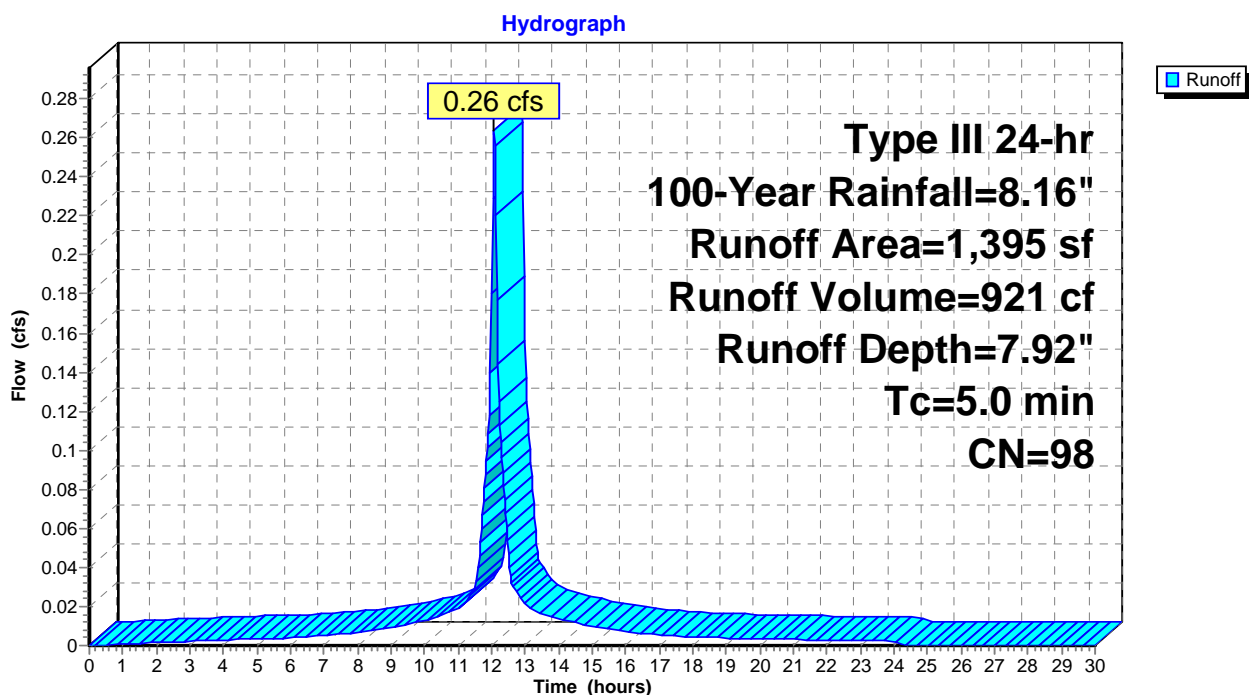
Runoff = 0.26 cfs @ 12.07 hrs, Volume= 921 cf, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
1,395	98	Roofs, HSG B
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX ROOF**



**EXISTING**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 2S: EX DRIVEWAY & WALKWAY**

Runoff = 0.17 cfs @ 12.07 hrs, Volume= 576 cf, Depth= 7.92"

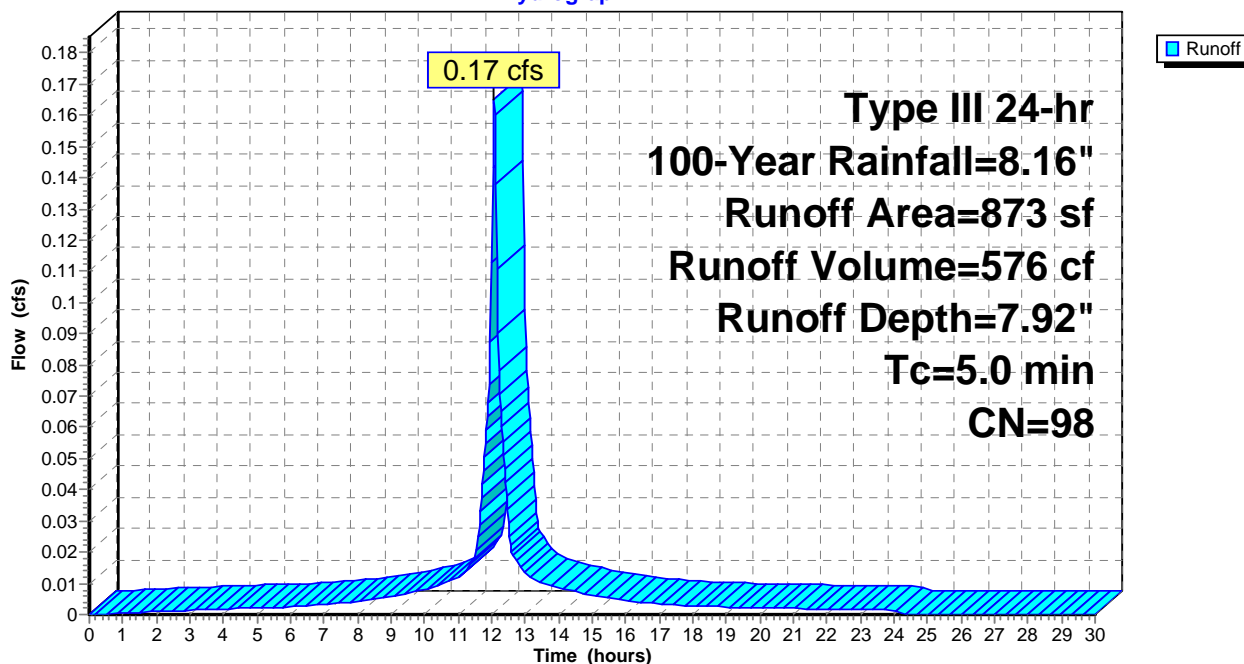
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
* 873	98	Driveway & Walkway
873		100.00% Impervious Area

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

**Subcatchment 2S: EX DRIVEWAY & WALKWAY**

Hydrograph



**EXISTING**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 3S: EX IMPERVIOUS**

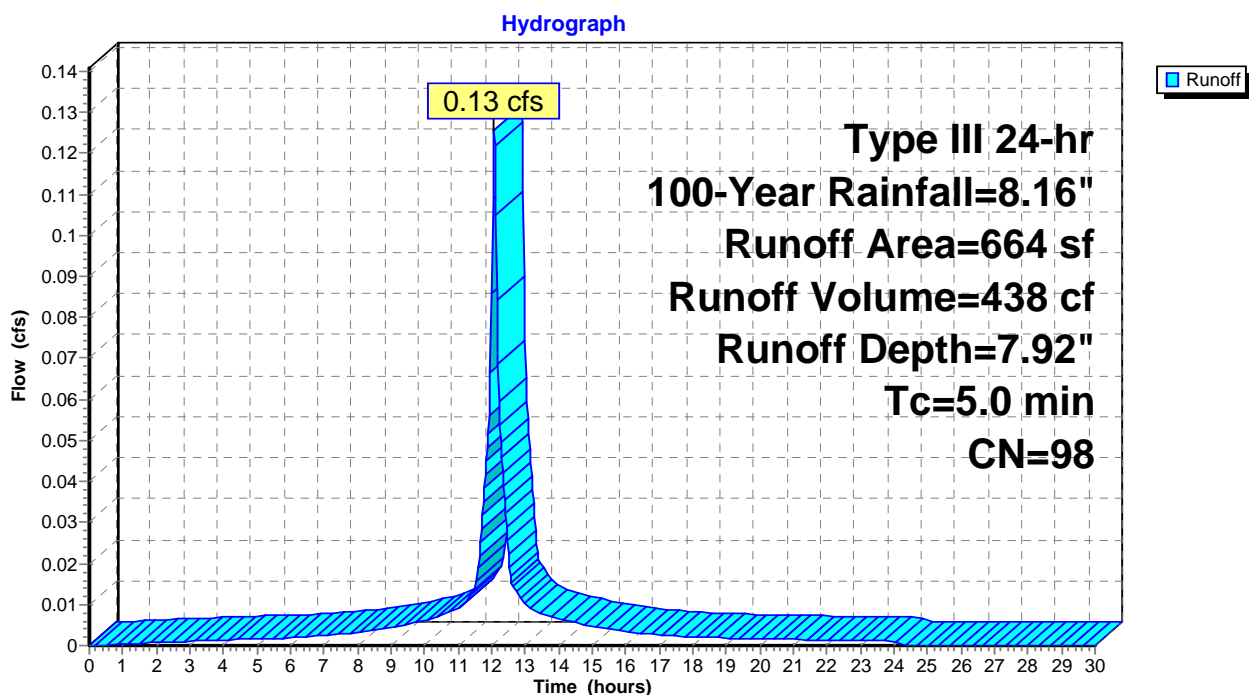
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 438 cf, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
* 664	98	Deck/Porch/Retainaing wall/ Shed/ Landing & Steps)
664		100.00% Impervious Area

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

**Subcatchment 3S: EX IMPERVIOUS**



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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 4S: EX LANDSCAPE**

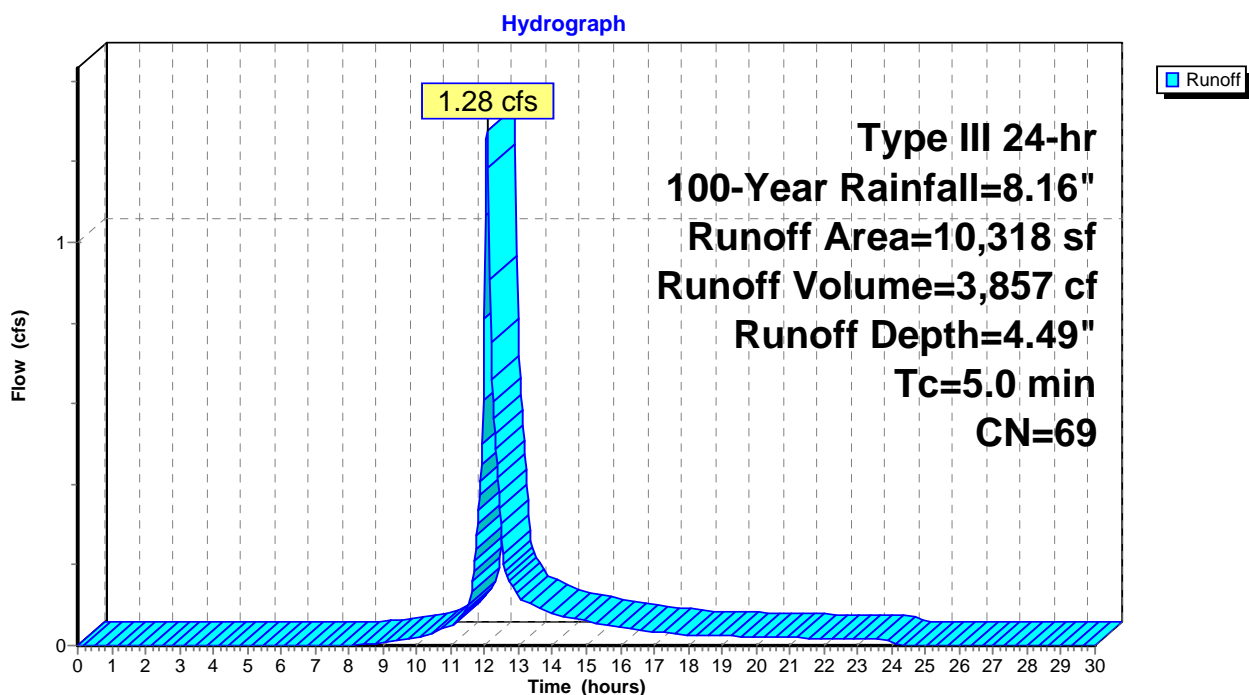
Runoff = 1.28 cfs @ 12.08 hrs, Volume= 3,857 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
10,318	69	50-75% Grass cover, Fair, HSG B
10,318		100.00% Pervious Area

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

**Subcatchment 4S: EX LANDSCAPE**



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Type III 24-hr 100-Year Rainfall=8.16"

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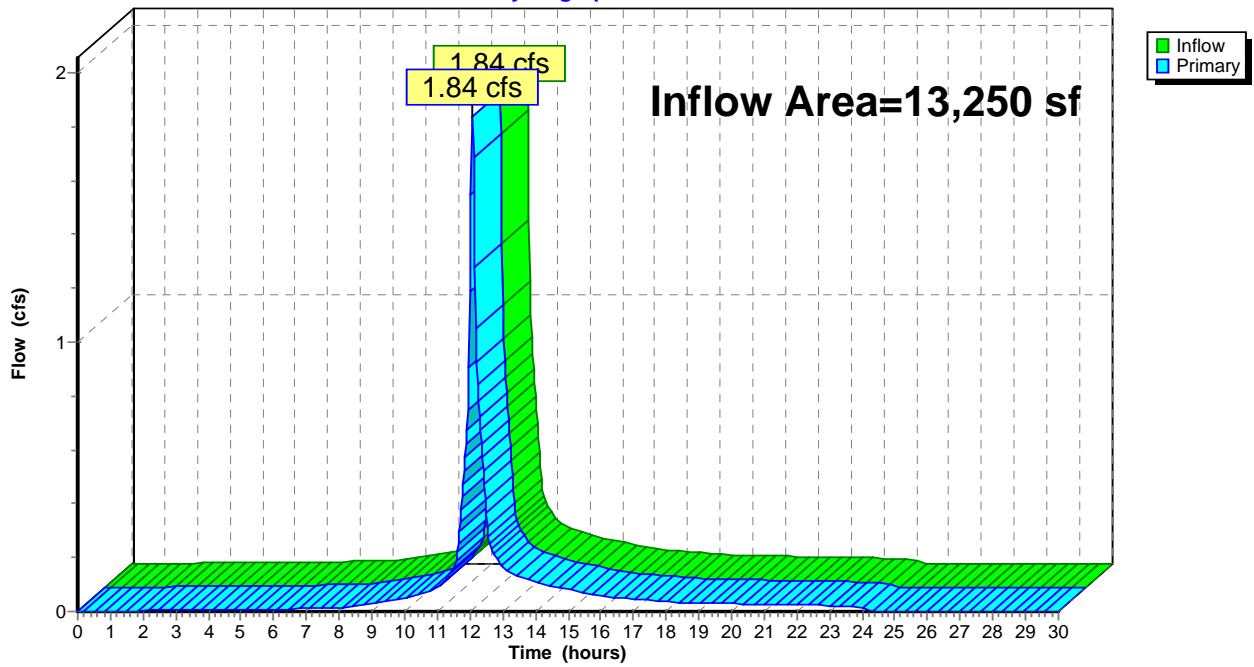
**Summary for Link 3L: EXISTING**

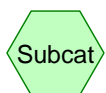
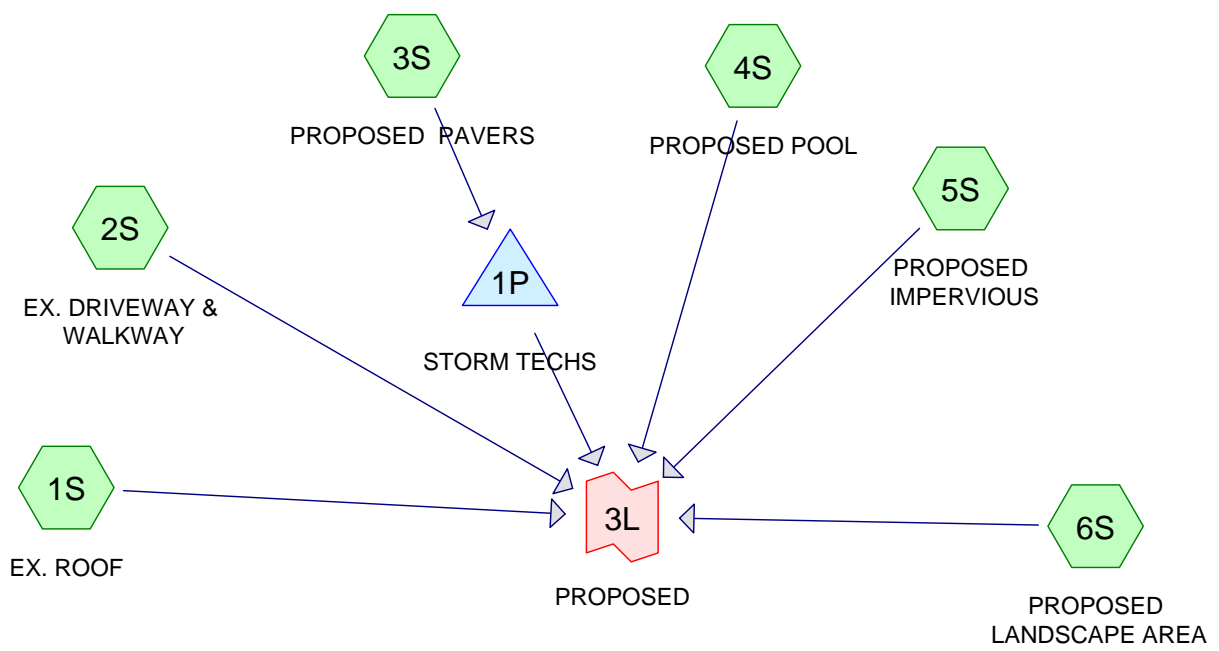
Inflow Area = 13,250 sf, 22.13% Impervious, Inflow Depth = 5.25" for 100-Year event  
Inflow = 1.84 cfs @ 12.07 hrs, Volume= 5,792 cf  
Primary = 1.84 cfs @ 12.07 hrs, Volume= 5,792 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: EXISTING**

Hydrograph

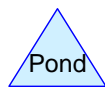




Subcat



Reach



Pond



Link

**Routing Diagram for PROPOSED**  
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**PROPOSED**

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**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,782	69	50-75% Grass cover, Fair, HSG B (6S)
709	98	Deck/Porch/Retaining Wall/Landing & Steps (5S)
873	98	Paved parking, HSG A (2S)
925	1	Pool (4S)
1,566	98	Pvers (3S)
1,395	98	Roofs, HSG A (1S)
<b>13,250</b>	<b>74</b>	<b>TOTAL AREA</b>

**PROPOSED**

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**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
2,268	HSG A	1S, 2S
7,782	HSG B	6S
0	HSG C	
0	HSG D	
3,200	Other	3S, 4S, 5S
<b>13,250</b>		<b>TOTAL AREA</b>



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Type III 24-hr 2-Year Rainfall=3.29"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 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 1S: EX. ROOF** Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=3.06"  
 Tc=5.0 min CN=98 Runoff=0.11 cfs 355 cf

**Subcatchment 2S: EX. DRIVEWAY &** Runoff Area=873 sf 100.00% Impervious Runoff Depth=3.06"  
 Tc=5.0 min CN=98 Runoff=0.07 cfs 222 cf

**Subcatchment 3S: PROPOSED** Runoff Area=1,566 sf 100.00% Impervious Runoff Depth=3.06"  
 Tc=5.0 min CN=98 Runoff=0.12 cfs 399 cf

**Subcatchment 4S: PROPOSED POOL** Runoff Area=925 sf 0.00% Impervious Runoff Depth=0.00"  
 Tc=5.0 min CN=1 Runoff=0.00 cfs 0 cf

**Subcatchment 5S: PROPOSED** Runoff Area=709 sf 100.00% Impervious Runoff Depth=3.06"  
 Tc=5.0 min CN=98 Runoff=0.05 cfs 181 cf

**Subcatchment 6S: PROPOSED** Runoff Area=7,782 sf 0.00% Impervious Runoff Depth=0.83"  
 Tc=5.0 min CN=69 Runoff=0.16 cfs 539 cf

**Pond 1P: STORM TECHS** Peak Elev=70.56' Storage=172 cf Inflow=0.12 cfs 399 cf  
 Discarded=0.01 cfs 399 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 399 cf

**Link 3L: PROPOSED** Inflow=0.38 cfs 1,297 cf  
 Primary=0.38 cfs 1,297 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 1,696 cf Average Runoff Depth = 1.54"**  
**65.71% Pervious = 8,707 sf 34.29% Impervious = 4,543 sf**

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**Summary for Subcatchment 1S: EX. ROOF**

Runoff = 0.11 cfs @ 12.07 hrs, Volume= 355 cf, Depth= 3.06"

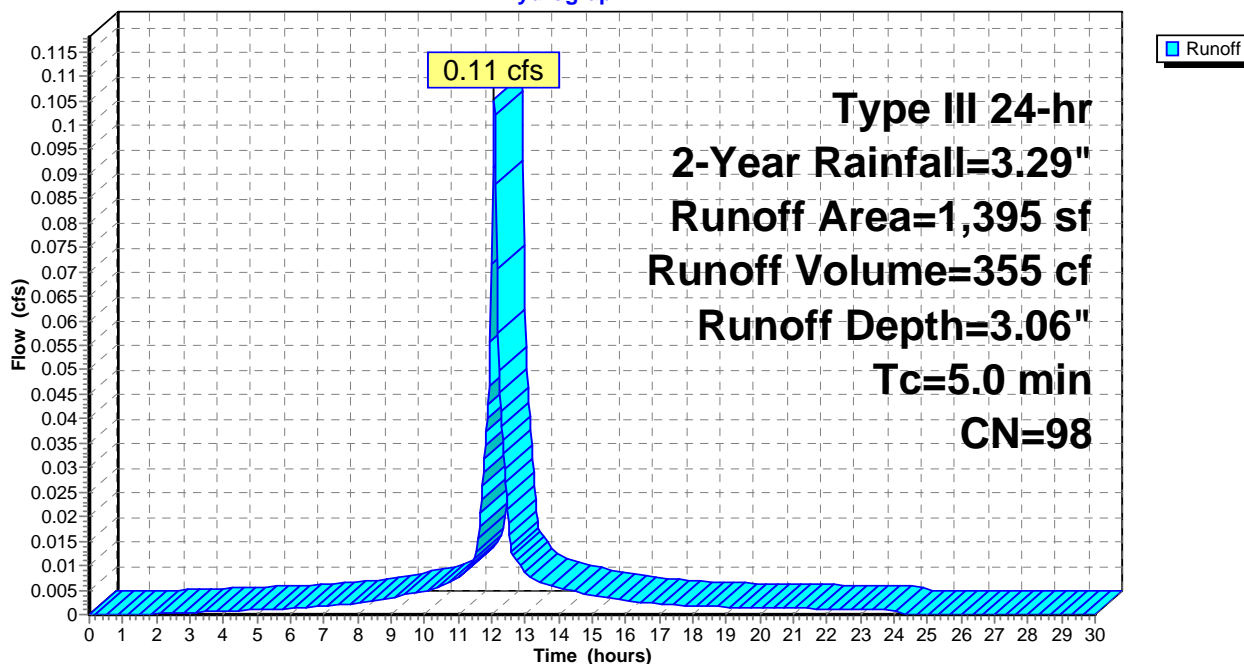
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
1,395	98	Roofs, HSG A
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX. ROOF**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Subcatchment 2S: EX. DRIVEWAY & WALKWAY**

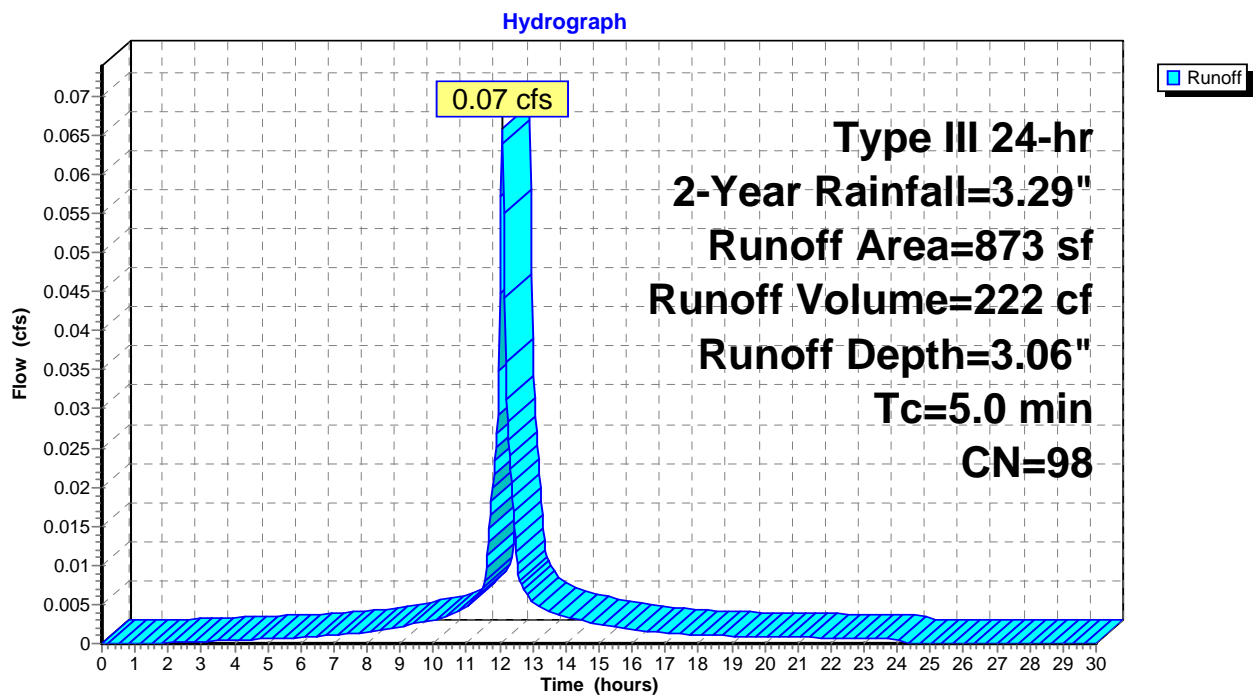
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 222 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
873	98	Paved parking, HSG A
873		100.00% Impervious Area

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

**Subcatchment 2S: EX. DRIVEWAY & WALKWAY**



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Subcatchment 3S: PROPOSED PAVERS**

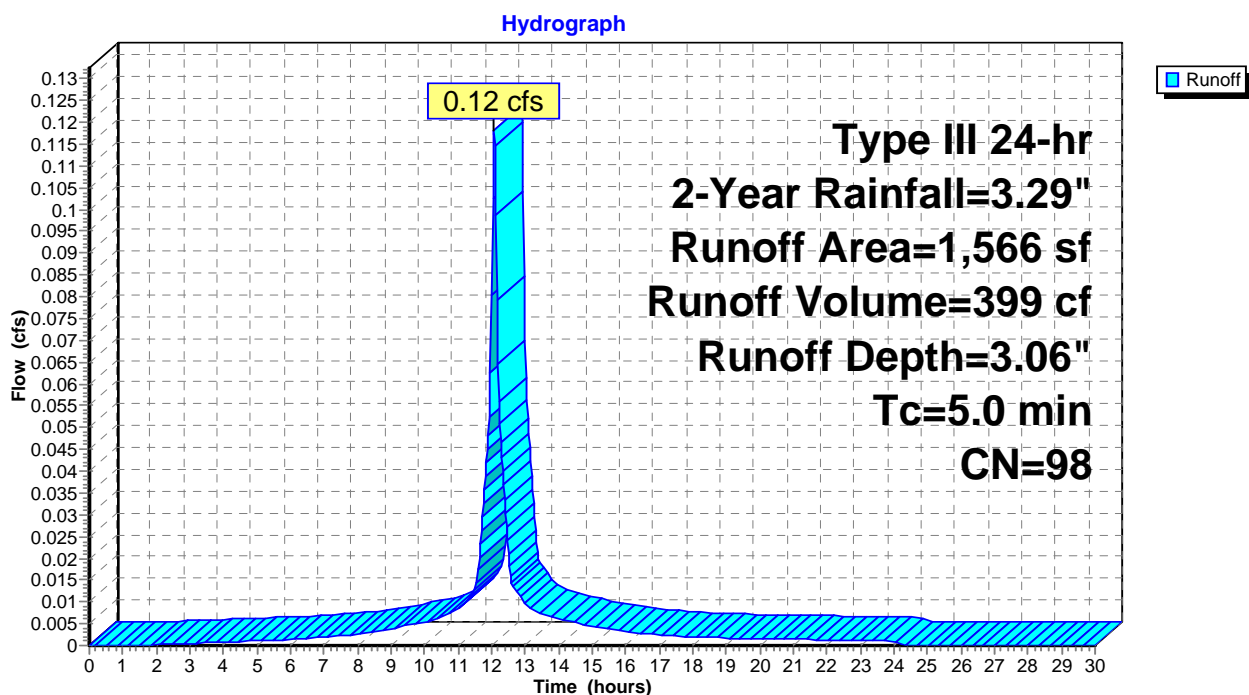
Runoff = 0.12 cfs @ 12.07 hrs, Volume= 399 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
* 1,566	98	Pvers
1,566		100.00% Impervious Area

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

**Subcatchment 3S: PROPOSED PAVERS**



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Subcatchment 4S: PROPOSED POOL**

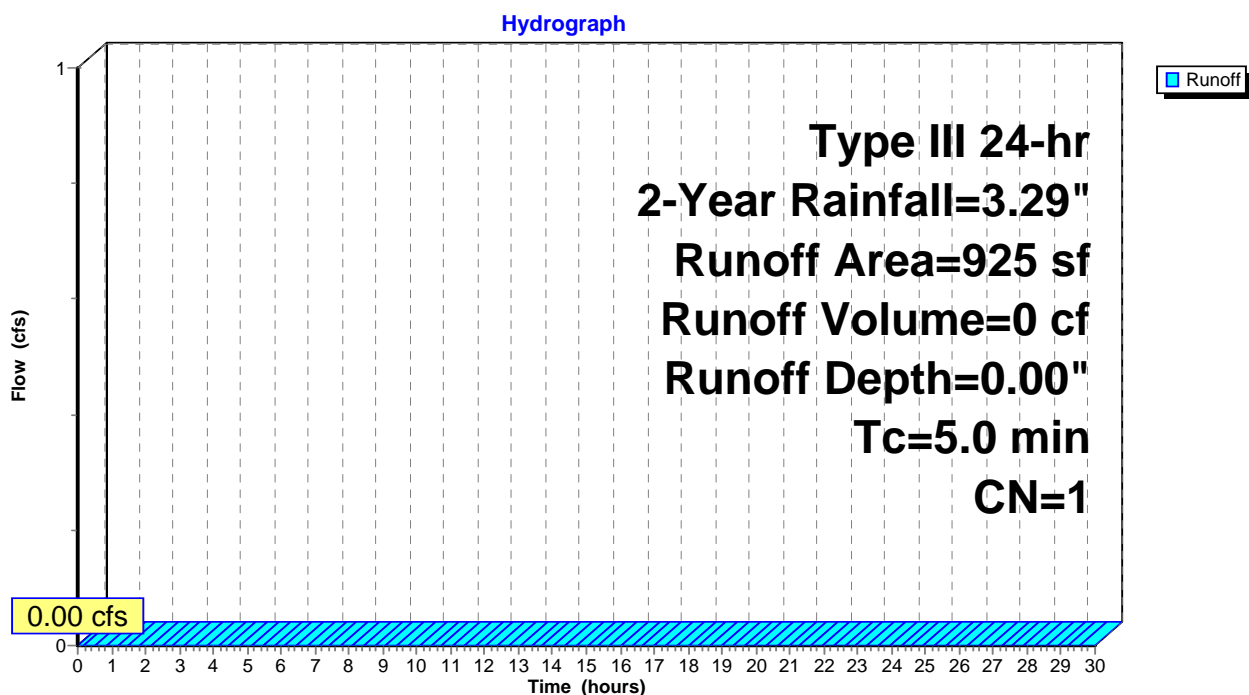
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
* 925	1	Pool
925		100.00% Pervious Area

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

**Subcatchment 4S: PROPOSED POOL**



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Subcatchment 5S: PROPOSED IMPERVIOUS**

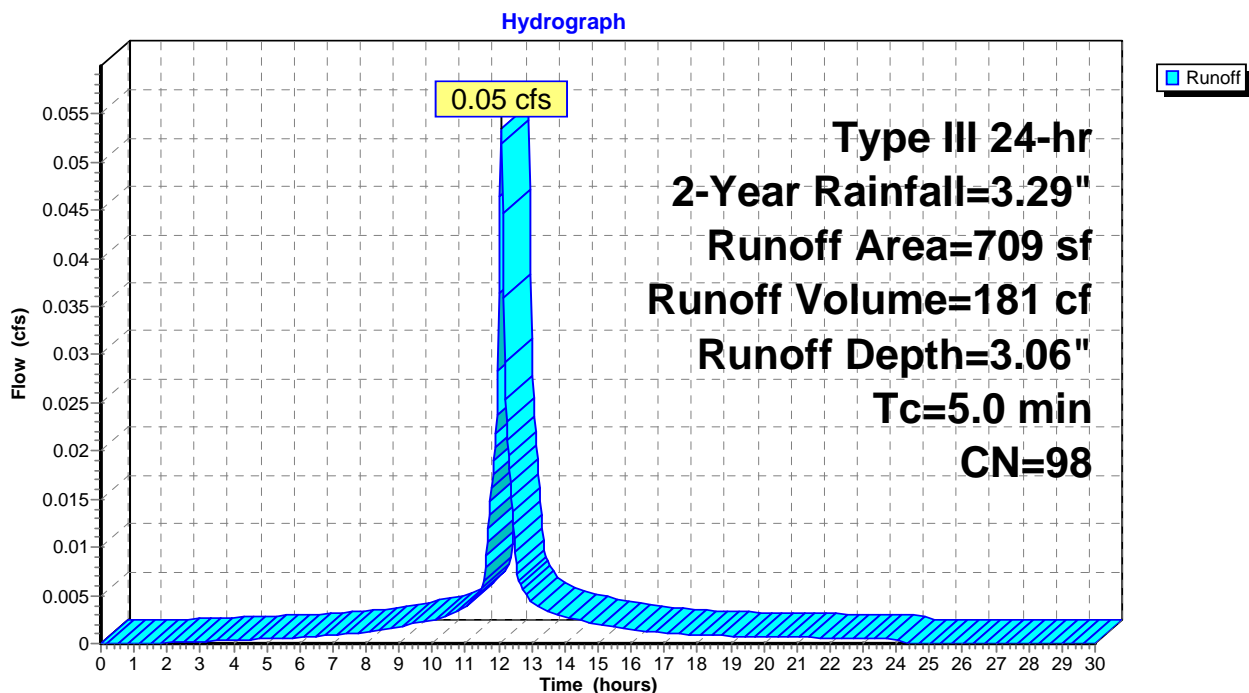
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 181 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
* 709	98	Deck/Porch/Retaining Wall/Landing & Steps
709		100.00% Impervious Area

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

**Subcatchment 5S: PROPOSED IMPERVIOUS**



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Subcatchment 6S: PROPOSED LANDSCAPE AREA**

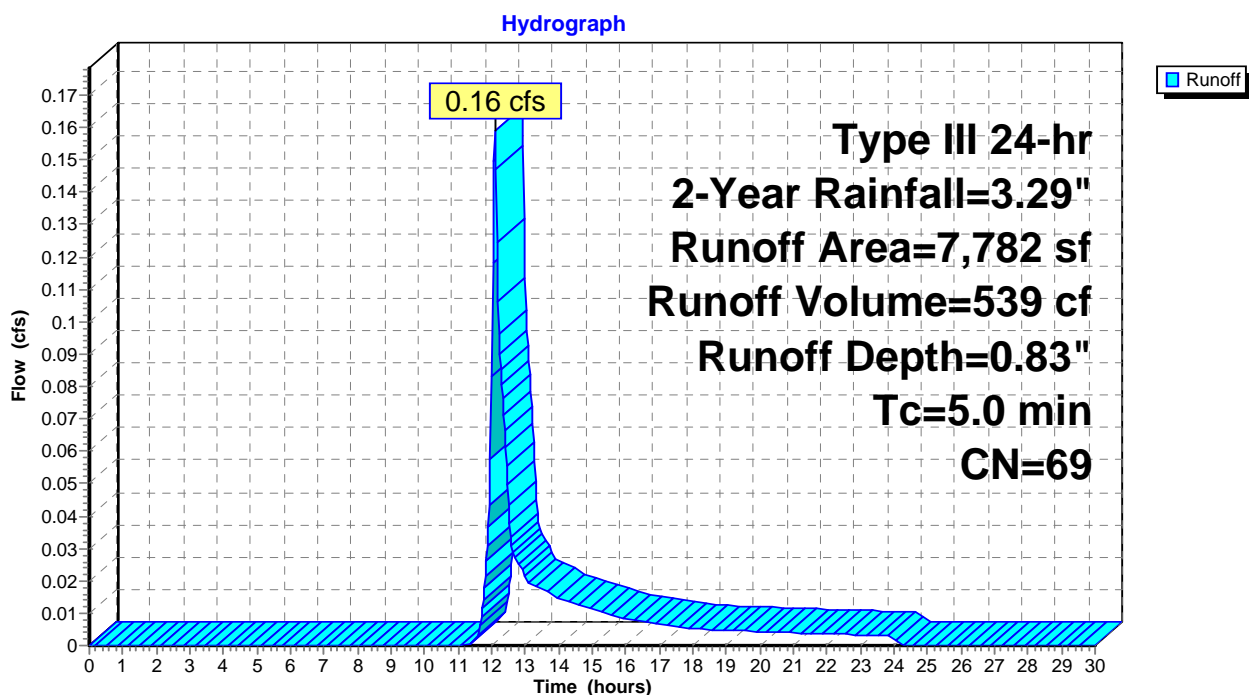
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 539 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.29"

Area (sf)	CN	Description
7,782	69	50-75% Grass cover, Fair, HSG B
7,782		100.00% Pervious Area

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

**Subcatchment 6S: PROPOSED LANDSCAPE AREA**



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Type III 24-hr 2-Year Rainfall=3.29"

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**Summary for Pond 1P: STORM TECHS**

Inflow Area = 1,566 sf, 100.00% Impervious, Inflow Depth = 3.06" for 2-Year event  
 Inflow = 0.12 cfs @ 12.07 hrs, Volume= 399 cf  
 Outflow = 0.01 cfs @ 13.35 hrs, Volume= 399 cf, Atten= 93%, Lag= 76.8 min  
 Discarded = 0.01 cfs @ 13.35 hrs, Volume= 399 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 70.56' @ 13.35 hrs Surf.Area= 233 sf Storage= 172 cf

Plug-Flow detention time= 192.0 min calculated for 399 cf (100% of inflow)  
 Center-of-Mass det. time= 191.9 min ( 946.8 - 754.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	69.00'	318 cf	<b>21.08'W x 11.07'L x 4.00'H Field A</b> 934 cf Overall - 138 cf Embedded = 796 cf x 40.0% Voids
#2A	70.00'	138 cf	<b>ADS_StormTech SC-740 +Cap x 3</b> Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Chambers in 3 Rows
#3	73.00'	10 cf	<b>Ponding</b> Listed below -Impervious
		466 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Cum.Store (cubic-feet)
73.00	0
74.00	5
74.20	10

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	<b>1.020 in/hr Exfiltration over Wetted area</b>
#2	Primary	72.90'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.01 cfs @ 13.35 hrs HW=70.56' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=69.00' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)



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Type III 24-hr 2-Year Rainfall=3.29"

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**Pond 1P: STORM TECHS - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 18.0" Spacing = 69.0" C-C Row Spacing

1 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 8.74' Row Length +14.0" End Stone x 2 = 11.07' Base Length

3 Rows x 51.0" Wide + 18.0" Spacing x 2 + 32.0" Side Stone x 2 = 21.08' Base Width

12.0" Base + 30.0" Chamber Height + 6.0" Cover = 4.00' Field Height

3 Chambers x 45.9 cf = 137.8 cf Chamber Storage

933.6 cf Field - 137.8 cf Chambers = 795.7 cf Stone x 40.0% Voids = 318.3 cf Stone Storage

Chamber Storage + Stone Storage = 456.1 cf = 0.010 af

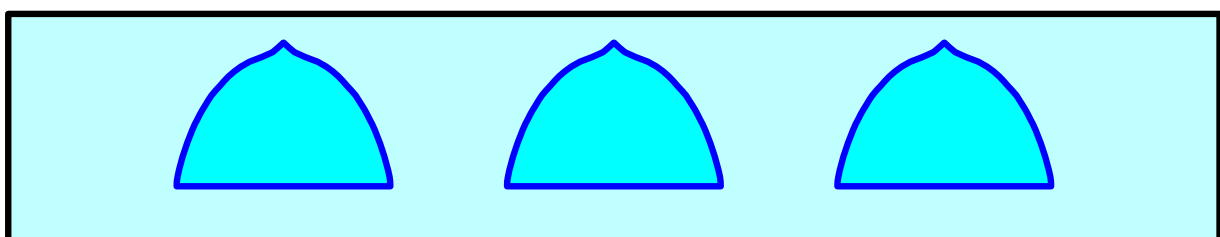
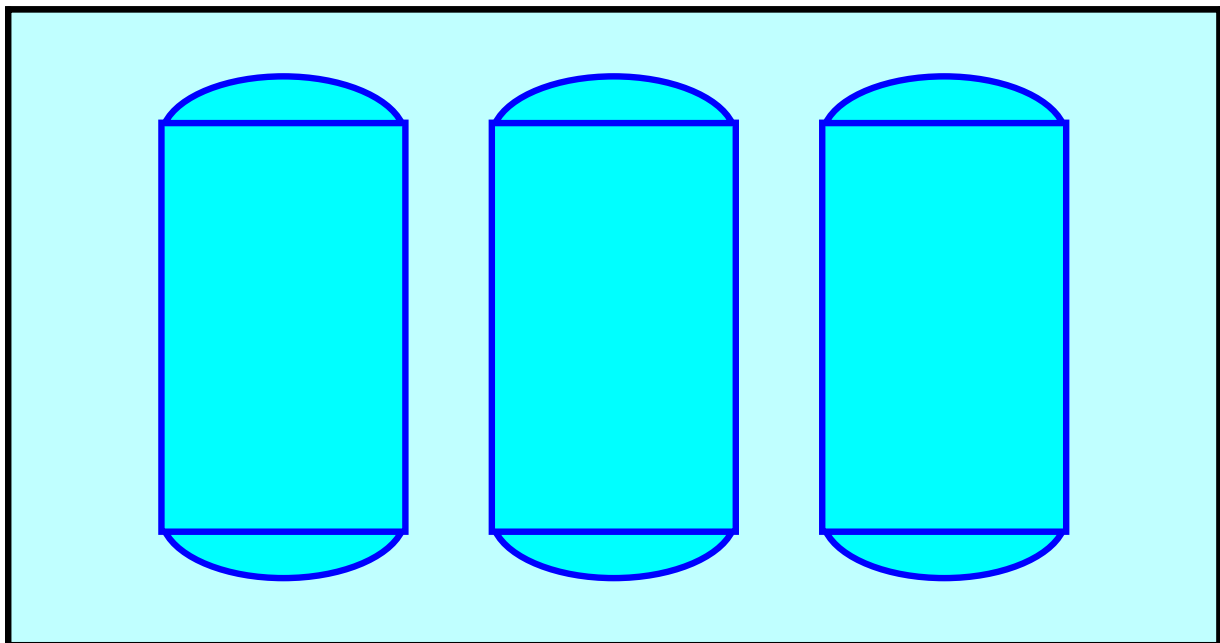
Overall Storage Efficiency = 48.9%

Overall System Size = 11.07' x 21.08' x 4.00'

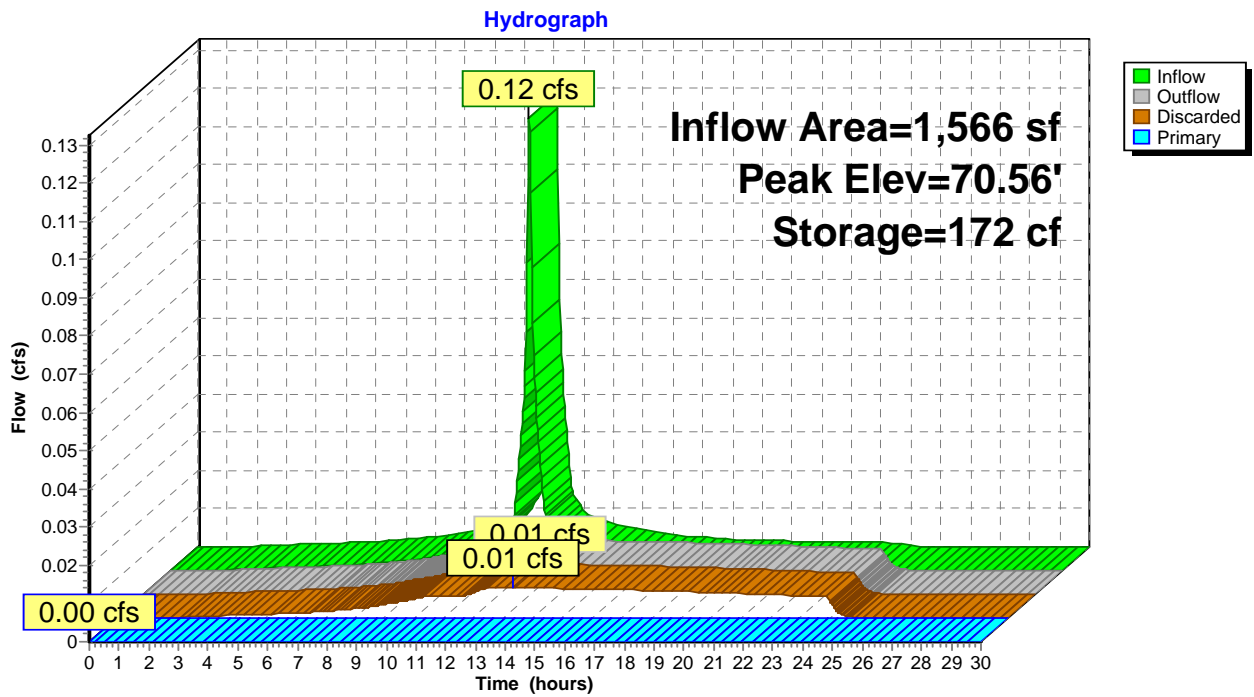
3 Chambers

34.6 cy Field

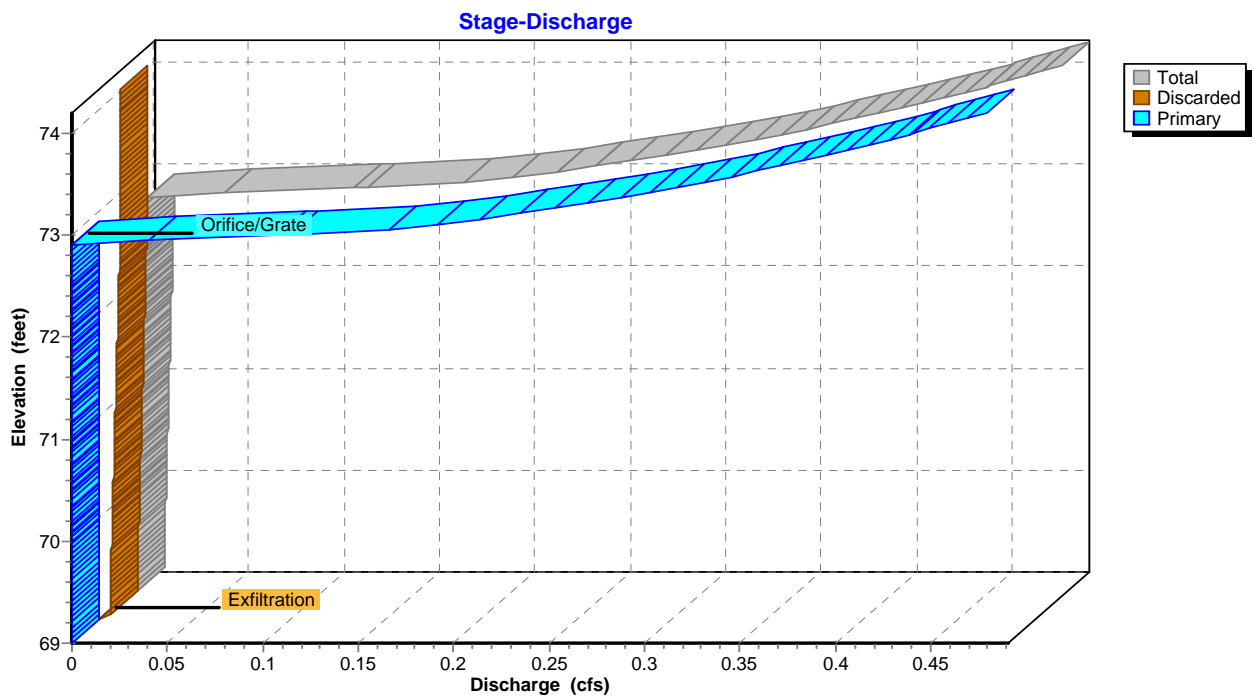
29.5 cy Stone



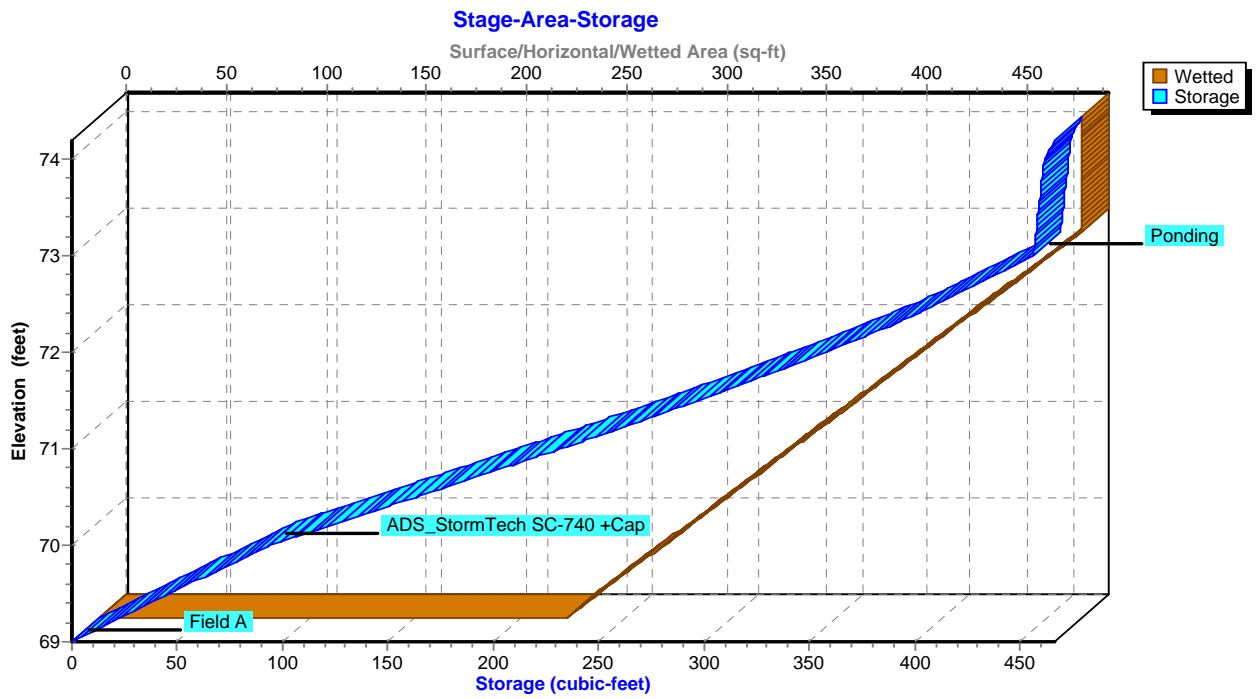
### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



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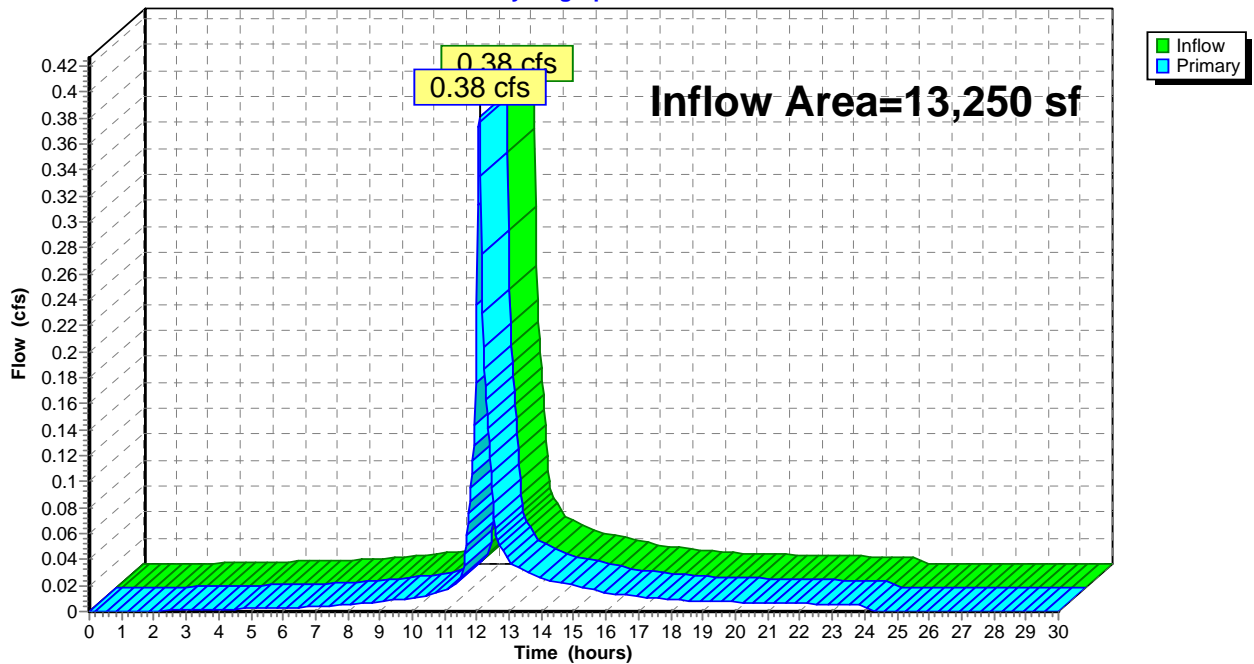
**Summary for Link 3L: PROPOSED**

Inflow Area = 13,250 sf, 34.29% Impervious, Inflow Depth = 1.17" for 2-Year event  
Inflow = 0.38 cfs @ 12.08 hrs, Volume= 1,297 cf  
Primary = 0.38 cfs @ 12.08 hrs, Volume= 1,297 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: PROPOSED**

Hydrograph



**PROPOSED**

Type III 24-hr 10-Year Rainfall=5.17"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EX. ROOF</b>	Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.17 cfs 573 cf
<b>Subcatchment 2S: EX. DRIVEWAY &amp;</b>	Runoff Area=873 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.10 cfs 359 cf
<b>Subcatchment 3S: PROPOSED</b>	Runoff Area=1,566 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.19 cfs 644 cf
<b>Subcatchment 4S: PROPOSED POOL</b>	Runoff Area=925 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=1 Runoff=0.00 cfs 0 cf
<b>Subcatchment 5S: PROPOSED</b>	Runoff Area=709 sf 100.00% Impervious Runoff Depth=4.93" Tc=5.0 min CN=98 Runoff=0.08 cfs 291 cf
<b>Subcatchment 6S: PROPOSED</b>	Runoff Area=7,782 sf 0.00% Impervious Runoff Depth=2.08" Tc=5.0 min CN=69 Runoff=0.44 cfs 1,350 cf
<b>Pond 1P: STORM TECHS</b>	Peak Elev=71.67' Storage=318 cf Inflow=0.19 cfs 644 cf Discarded=0.01 cfs 643 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 643 cf
<b>Link 3L: PROPOSED</b>	Inflow=0.79 cfs 2,574 cf Primary=0.79 cfs 2,574 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 3,218 cf Average Runoff Depth = 2.91"**  
**65.71% Pervious = 8,707 sf 34.29% Impervious = 4,543 sf**

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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 1S: EX. ROOF**

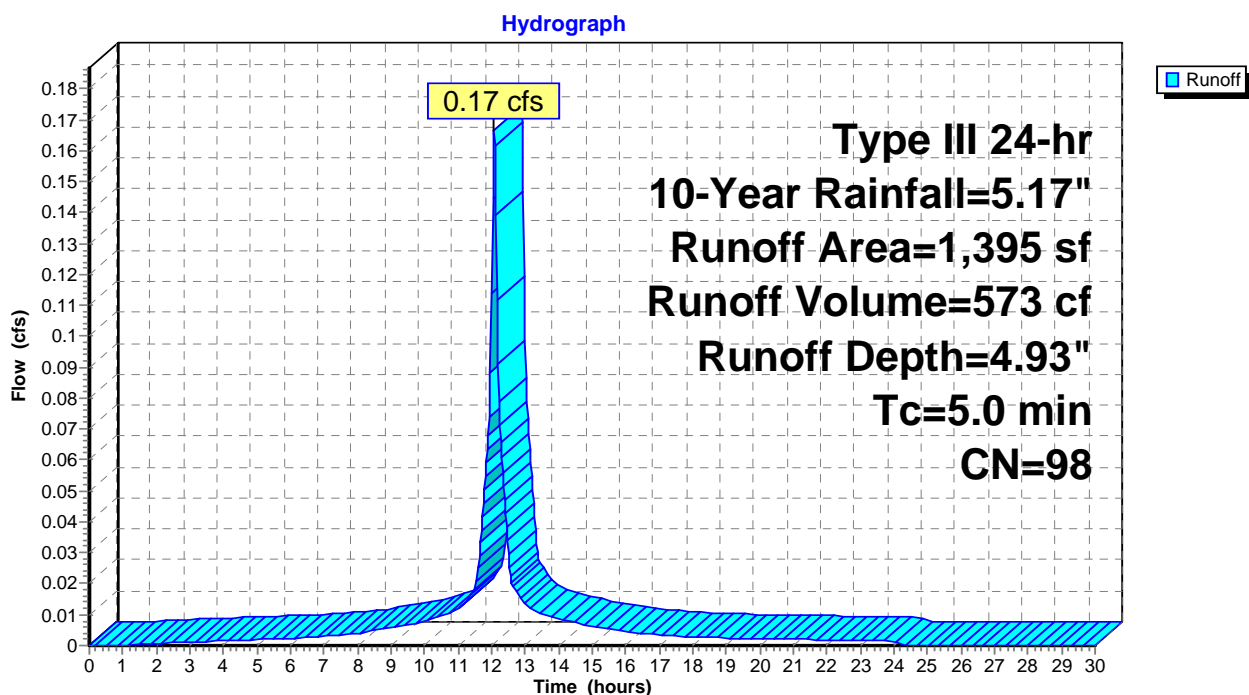
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 573 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
1,395	98	Roofs, HSG A
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX. ROOF**



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**Summary for Subcatchment 2S: EX. DRIVEWAY & WALKWAY**

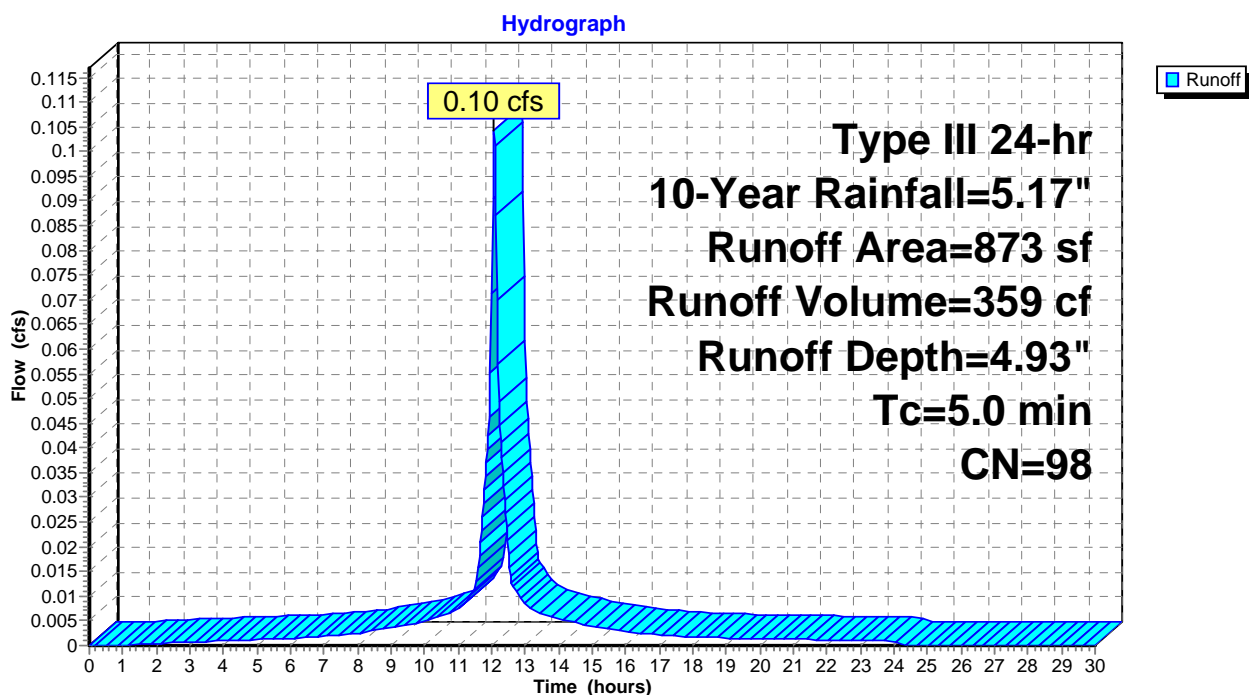
Runoff = 0.10 cfs @ 12.07 hrs, Volume= 359 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
873	98	Paved parking, HSG A
873		100.00% Impervious Area

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

**Subcatchment 2S: EX. DRIVEWAY & WALKWAY**



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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 3S: PROPOSED PAVERS**

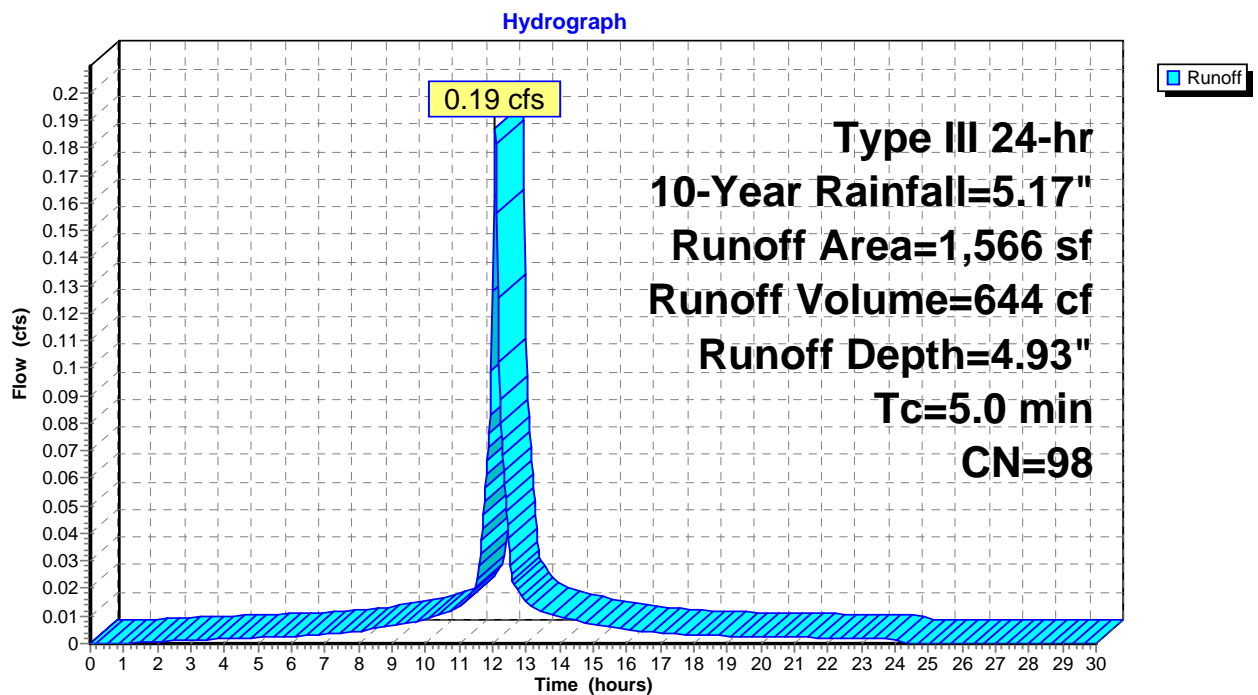
Runoff = 0.19 cfs @ 12.07 hrs, Volume= 644 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
* 1,566	98	Pvers
1,566		100.00% Impervious Area

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

**Subcatchment 3S: PROPOSED PAVERS**





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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 4S: PROPOSED POOL**

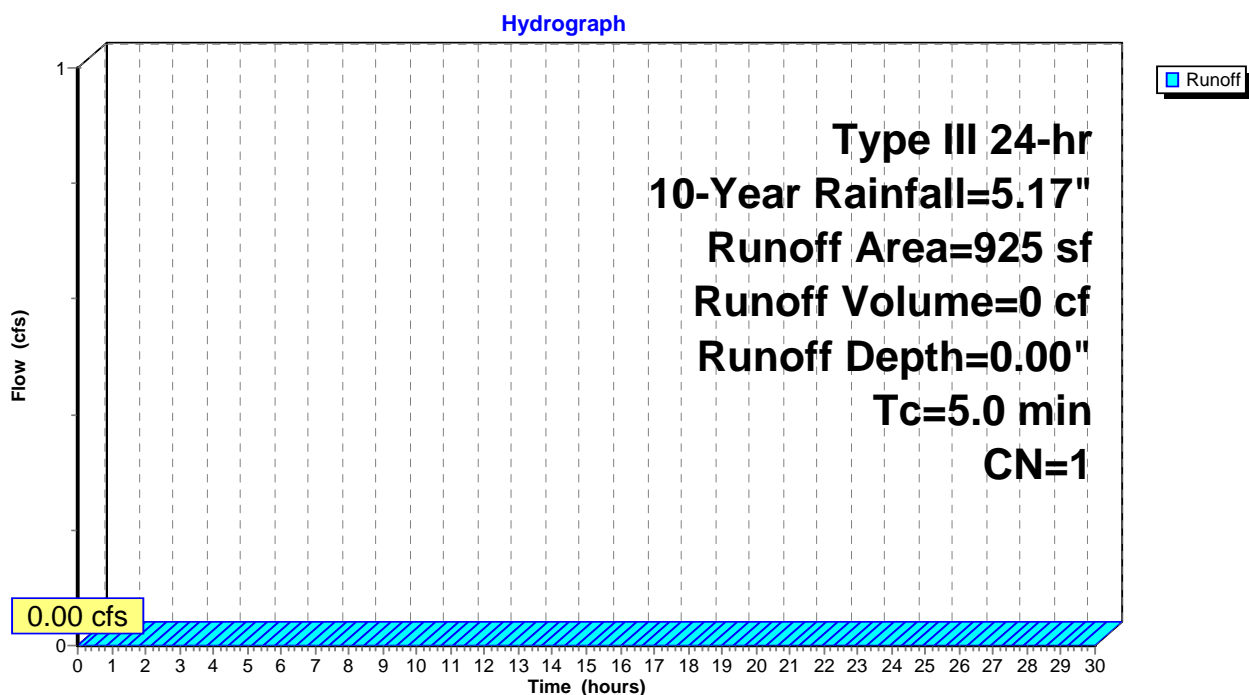
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
* 925	1	Pool
925		100.00% Pervious Area

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

**Subcatchment 4S: PROPOSED POOL**



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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 5S: PROPOSED IMPERVIOUS**

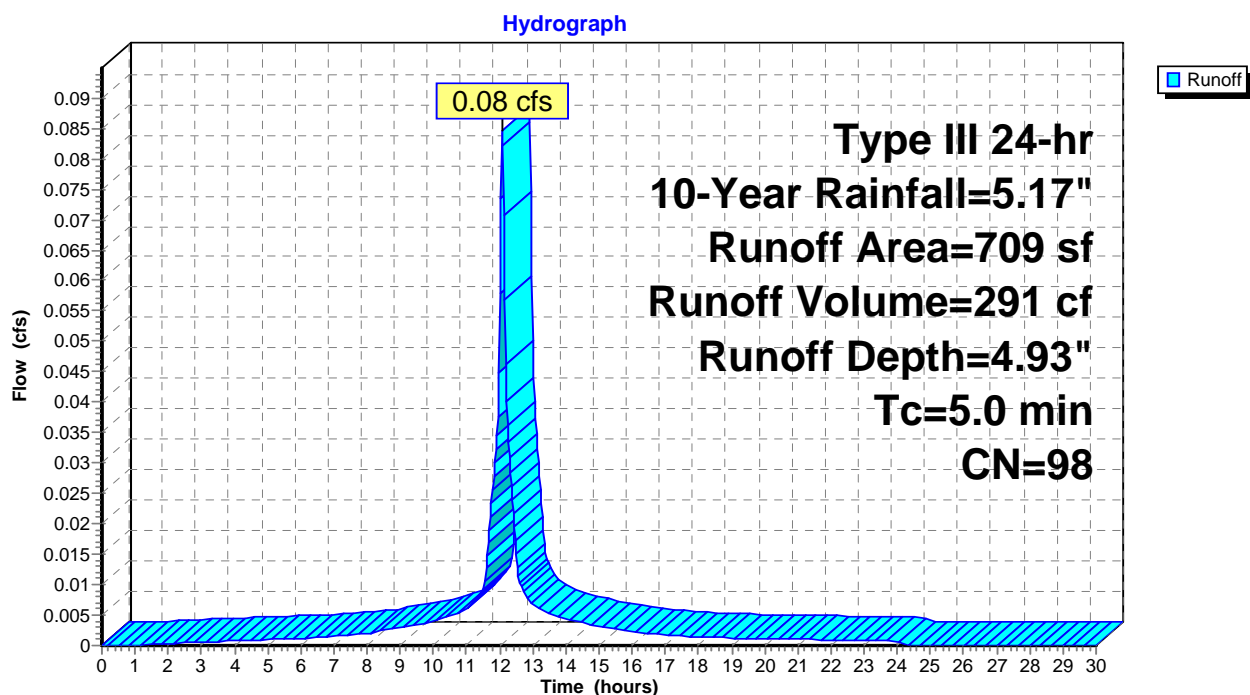
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 291 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
* 709	98	Deck/Porch/Retaining Wall/Landing & Steps
709		100.00% Impervious Area

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

**Subcatchment 5S: PROPOSED IMPERVIOUS**



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Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Subcatchment 6S: PROPOSED LANDSCAPE AREA**

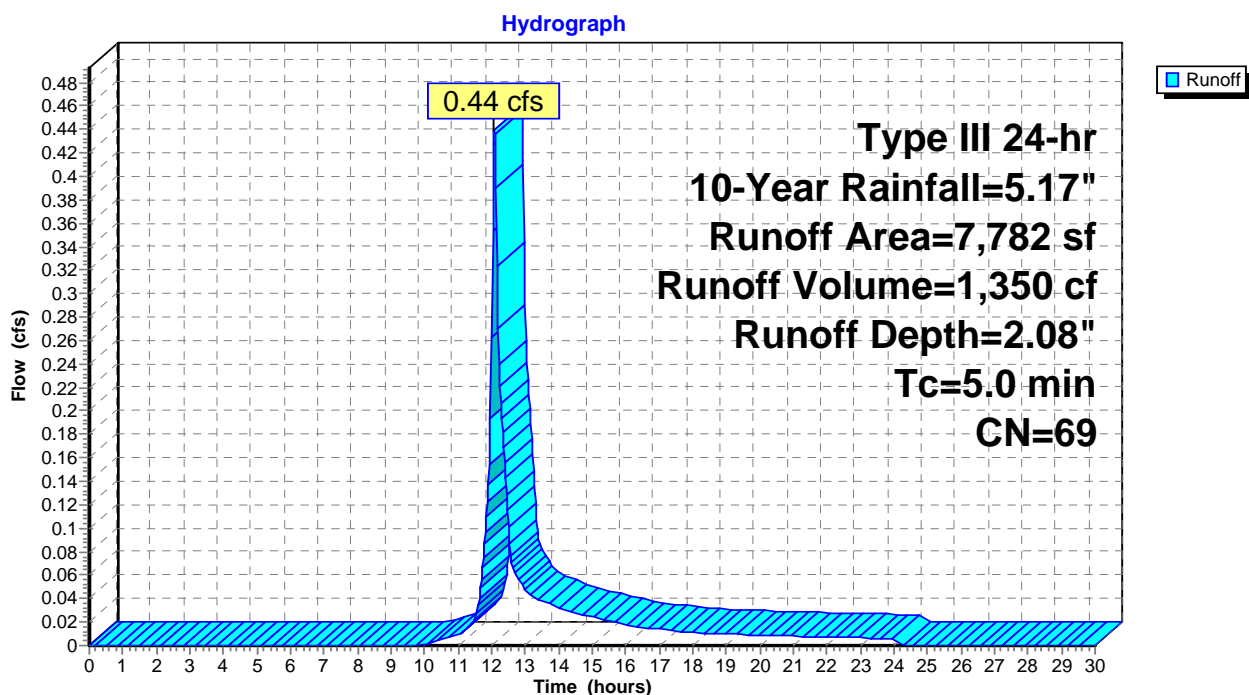
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 1,350 cf, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=5.17"

Area (sf)	CN	Description
7,782	69	50-75% Grass cover, Fair, HSG B
7,782		100.00% Pervious Area

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

**Subcatchment 6S: PROPOSED LANDSCAPE AREA**



**PROPOSED**

Type III 24-hr 10-Year Rainfall=5.17"

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**Summary for Pond 1P: STORM TECHS**

Inflow Area = 1,566 sf, 100.00% Impervious, Inflow Depth = 4.93" for 10-Year event  
 Inflow = 0.19 cfs @ 12.07 hrs, Volume= 644 cf  
 Outflow = 0.01 cfs @ 13.99 hrs, Volume= 643 cf, Atten= 95%, Lag= 115.1 min  
 Discarded = 0.01 cfs @ 13.99 hrs, Volume= 643 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 71.67' @ 13.99 hrs Surf.Area= 233 sf Storage= 318 cf

Plug-Flow detention time= 321.4 min calculated for 642 cf (100% of inflow)  
 Center-of-Mass det. time= 320.7 min ( 1,067.2 - 746.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	69.00'	318 cf	<b>21.08'W x 11.07'L x 4.00'H Field A</b> 934 cf Overall - 138 cf Embedded = 796 cf x 40.0% Voids
#2A	70.00'	138 cf	<b>ADS_StormTech SC-740 +Cap x 3</b> Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Chambers in 3 Rows
#3	73.00'	10 cf	<b>Ponding</b> Listed below -Impervious
		466 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Cum.Store (cubic-feet)
73.00	0
74.00	5
74.20	10

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	<b>1.020 in/hr Exfiltration over Wetted area</b>
#2	Primary	72.90'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.01 cfs @ 13.99 hrs HW=71.67' (Free Discharge)  
 ↖1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=69.00' (Free Discharge)  
 ↖2=Orifice/Grate ( Controls 0.00 cfs)

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Type III 24-hr 10-Year Rainfall=5.17"

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**Pond 1P: STORM TECHS - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 18.0" Spacing = 69.0" C-C Row Spacing

1 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 8.74' Row Length +14.0" End Stone x 2 = 11.07' Base Length

3 Rows x 51.0" Wide + 18.0" Spacing x 2 + 32.0" Side Stone x 2 = 21.08' Base Width

12.0" Base + 30.0" Chamber Height + 6.0" Cover = 4.00' Field Height

3 Chambers x 45.9 cf = 137.8 cf Chamber Storage

933.6 cf Field - 137.8 cf Chambers = 795.7 cf Stone x 40.0% Voids = 318.3 cf Stone Storage

Chamber Storage + Stone Storage = 456.1 cf = 0.010 af

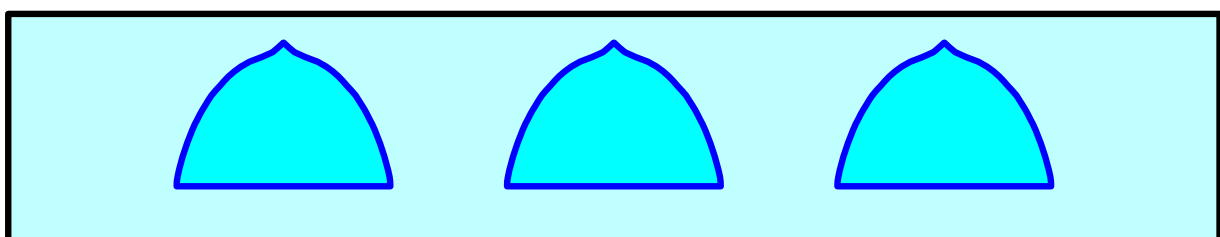
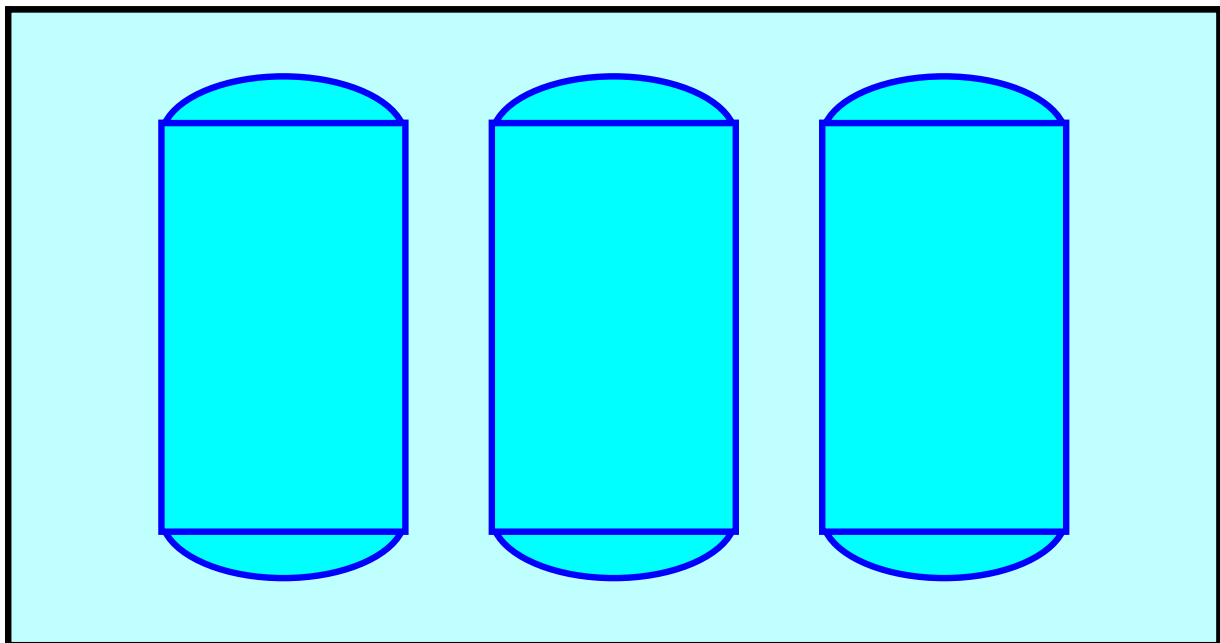
Overall Storage Efficiency = 48.9%

Overall System Size = 11.07' x 21.08' x 4.00'

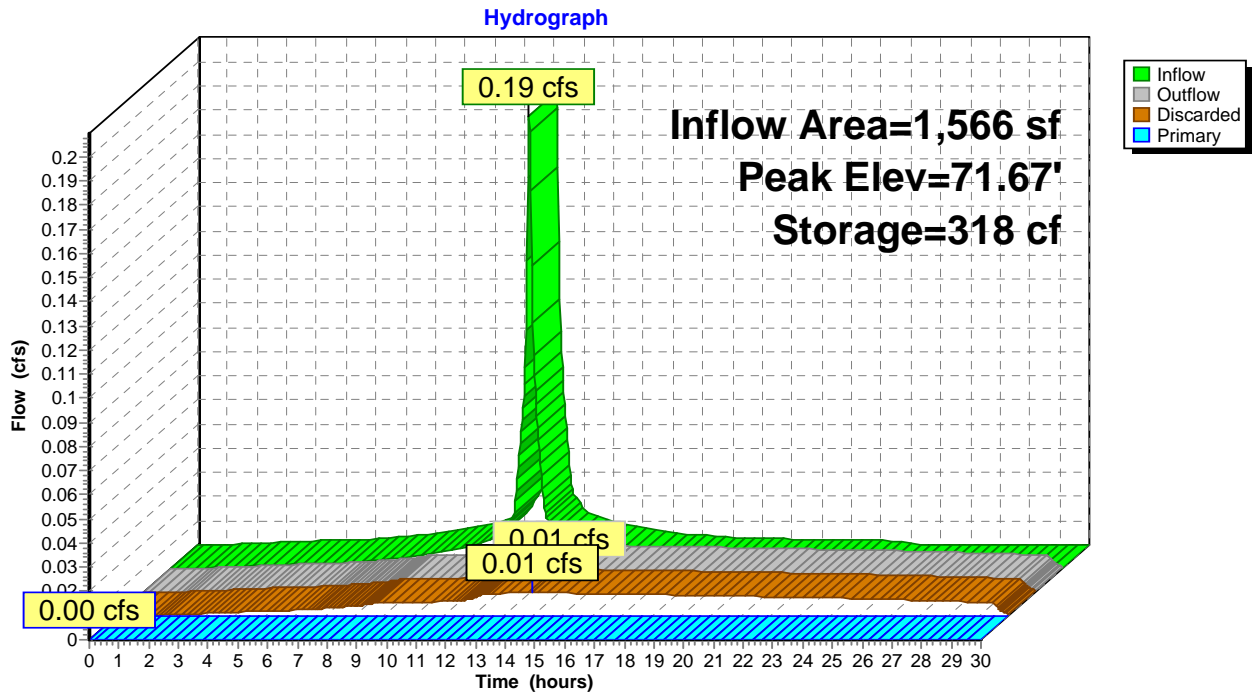
3 Chambers

34.6 cy Field

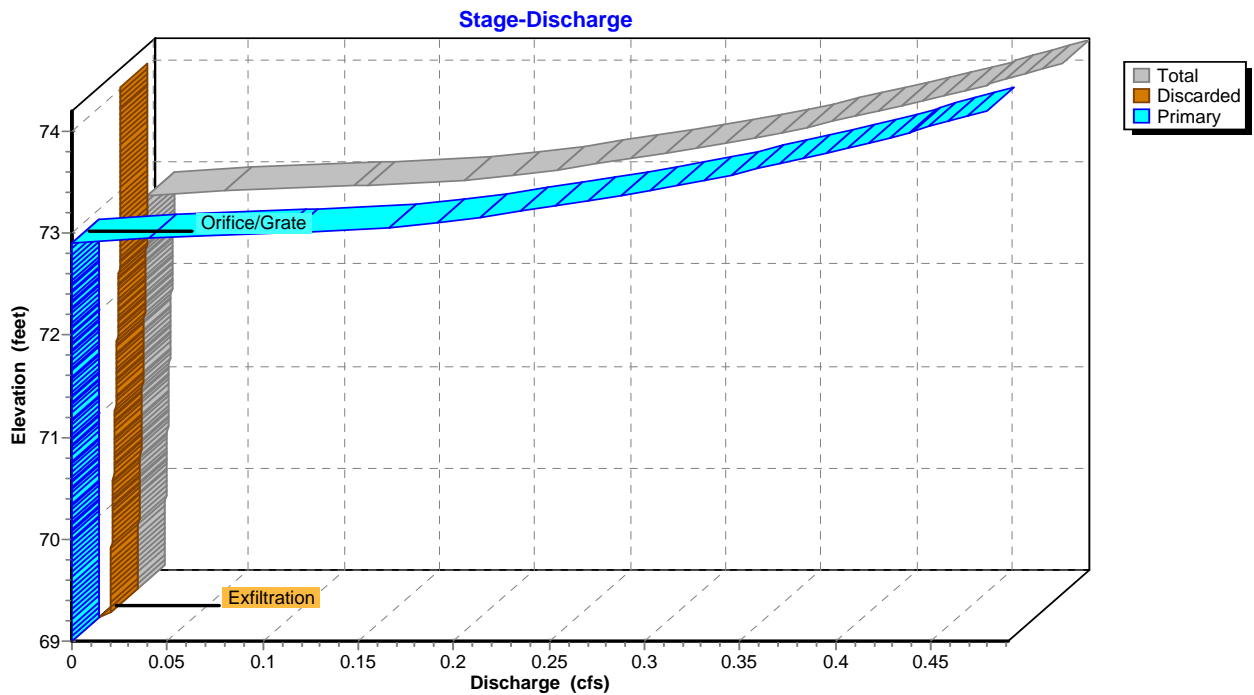
29.5 cy Stone



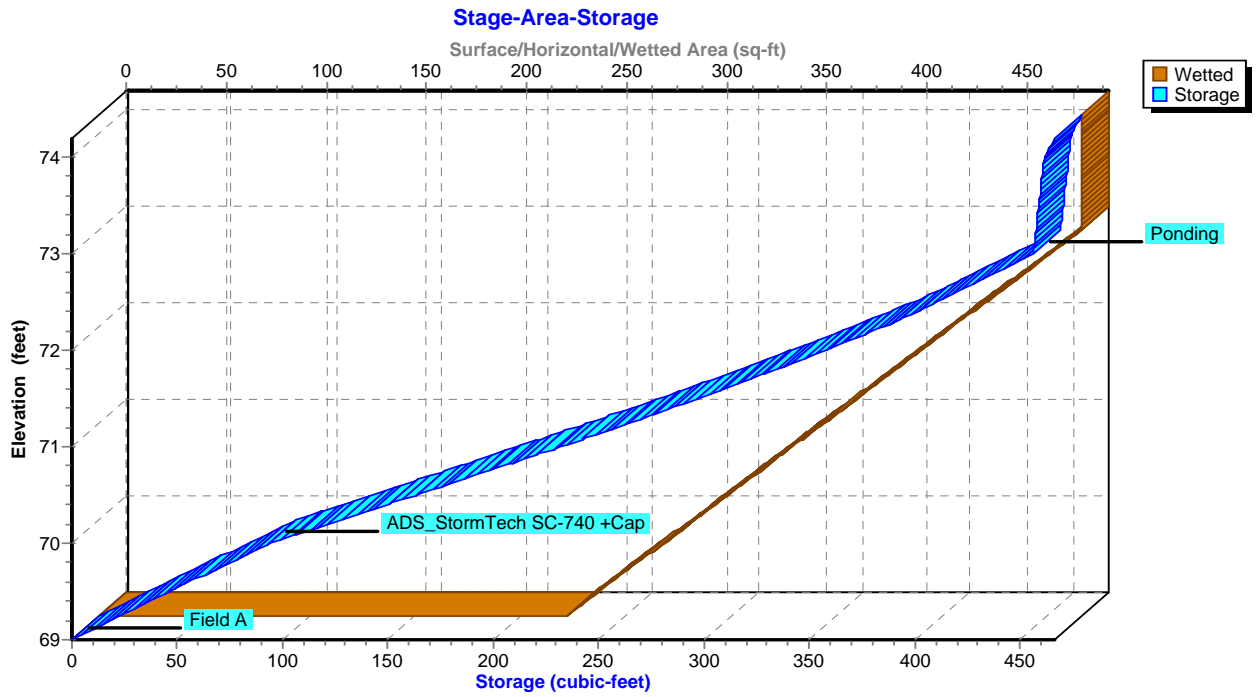
### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



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Type III 24-hr 10-Year Rainfall=5.17"

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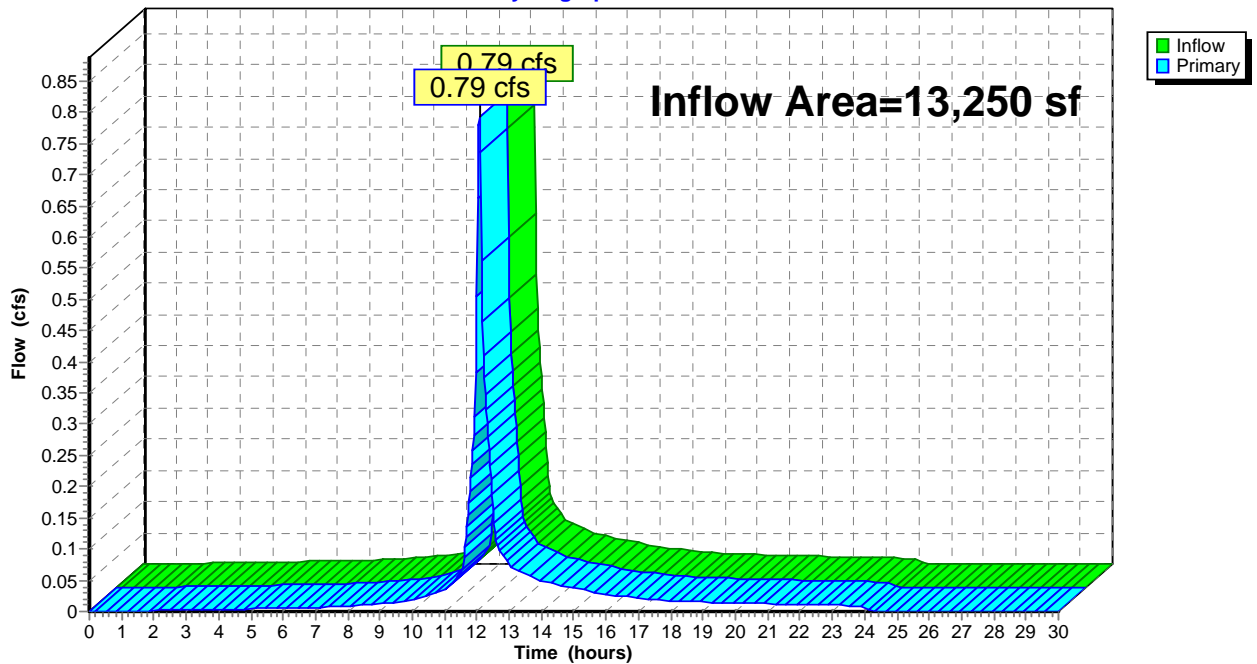
**Summary for Link 3L: PROPOSED**

Inflow Area = 13,250 sf, 34.29% Impervious, Inflow Depth = 2.33" for 10-Year event  
Inflow = 0.79 cfs @ 12.08 hrs, Volume= 2,574 cf  
Primary = 0.79 cfs @ 12.08 hrs, Volume= 2,574 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: PROPOSED**

Hydrograph





**PROPOSED**

Type III 24-hr 25-Year Rainfall=6.35"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EX. ROOF</b>	Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.21 cfs 710 cf
<b>Subcatchment 2S: EX. DRIVEWAY &amp;</b>	Runoff Area=873 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.13 cfs 445 cf
<b>Subcatchment 3S: PROPOSED</b>	Runoff Area=1,566 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.23 cfs 798 cf
<b>Subcatchment 4S: PROPOSED POOL</b>	Runoff Area=925 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=1 Runoff=0.00 cfs 0 cf
<b>Subcatchment 5S: PROPOSED</b>	Runoff Area=709 sf 100.00% Impervious Runoff Depth=6.11" Tc=5.0 min CN=98 Runoff=0.10 cfs 361 cf
<b>Subcatchment 6S: PROPOSED</b>	Runoff Area=7,782 sf 0.00% Impervious Runoff Depth=2.99" Tc=5.0 min CN=69 Runoff=0.64 cfs 1,938 cf
<b>Pond 1P: STORM TECHS</b>	Peak Elev=72.54' Storage=414 cf Inflow=0.23 cfs 798 cf Discarded=0.01 cfs 739 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 739 cf
<b>Link 3L: PROPOSED</b>	Inflow=1.08 cfs 3,454 cf Primary=1.08 cfs 3,454 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 4,252 cf Average Runoff Depth = 3.85"**  
**65.71% Pervious = 8,707 sf 34.29% Impervious = 4,543 sf**

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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 1S: EX. ROOF**

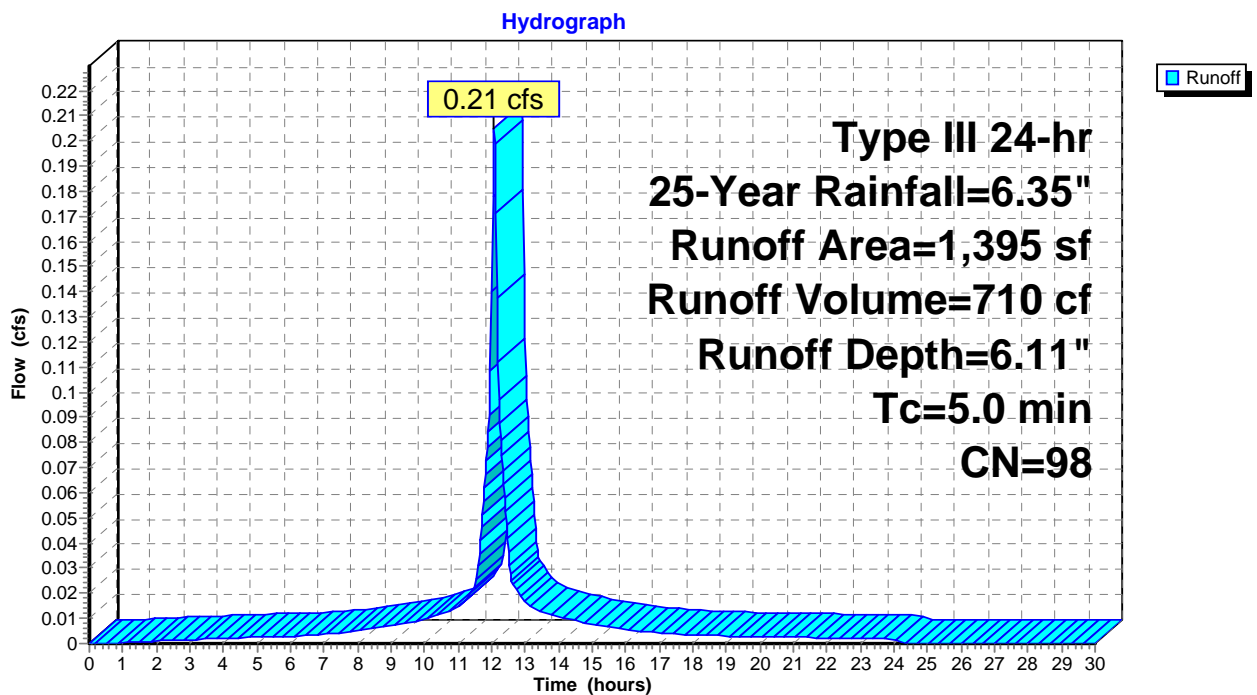
Runoff = 0.21 cfs @ 12.07 hrs, Volume= 710 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
1,395	98	Roofs, HSG A
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX. ROOF**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 2S: EX. DRIVEWAY & WALKWAY**

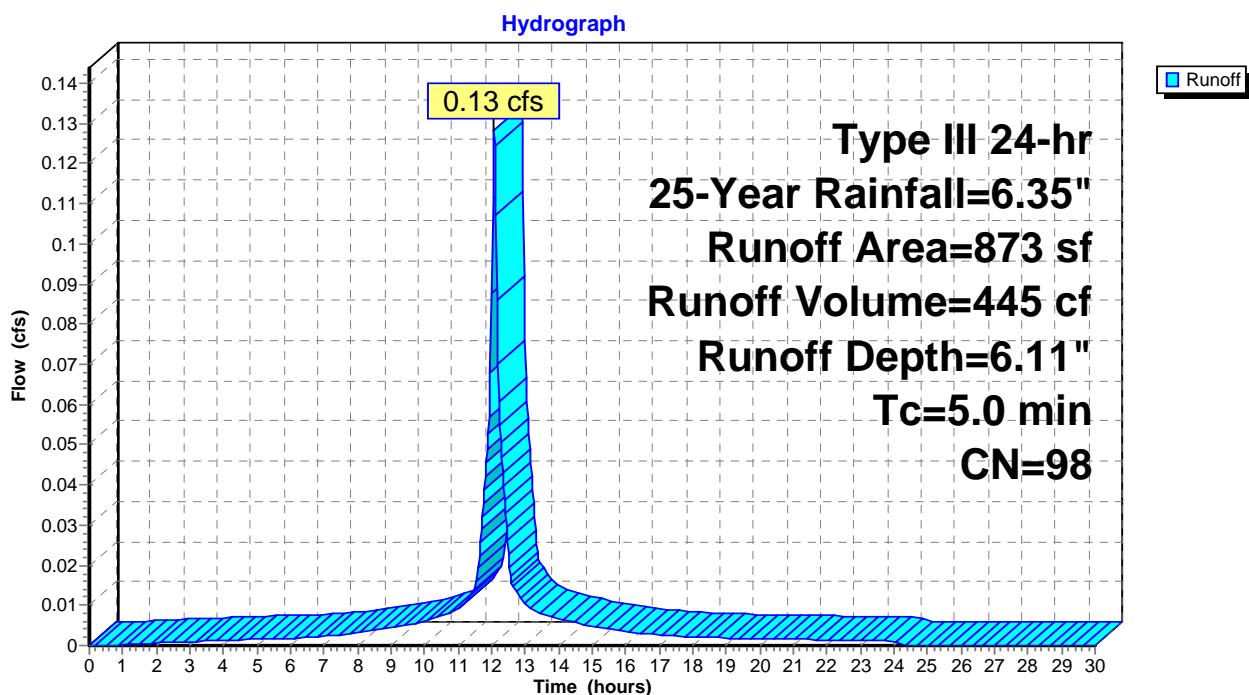
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 445 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
873	98	Paved parking, HSG A
873		100.00% Impervious Area

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

**Subcatchment 2S: EX. DRIVEWAY & WALKWAY**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 3S: PROPOSED PAVERS**

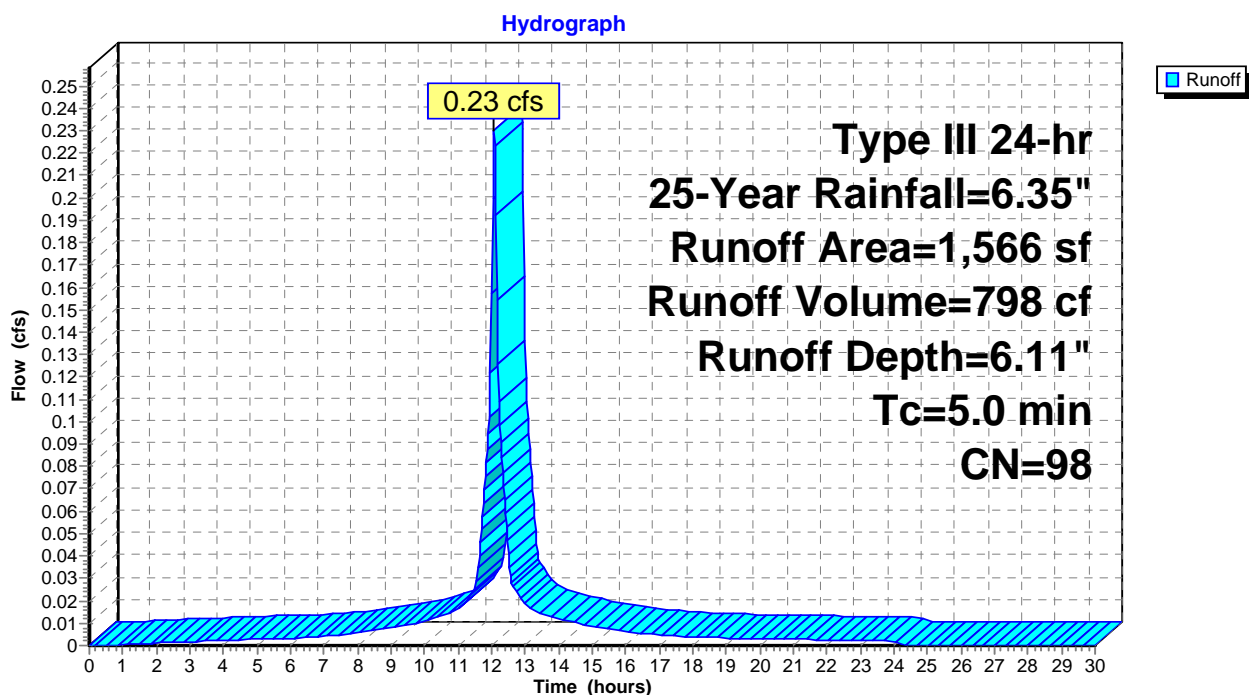
Runoff = 0.23 cfs @ 12.07 hrs, Volume= 798 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
* 1,566	98	Pvers
1,566		100.00% Impervious Area

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

**Subcatchment 3S: PROPOSED PAVERS**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 4S: PROPOSED POOL**

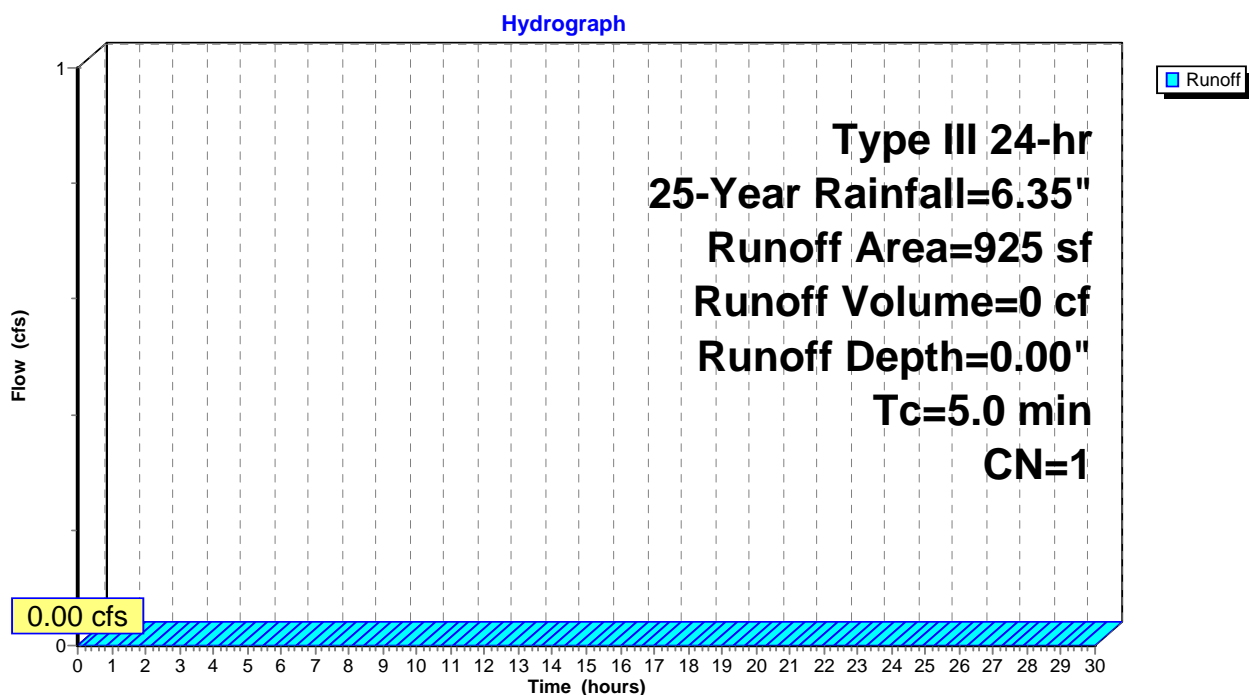
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
* 925	1	Pool
925		100.00% Pervious Area

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

**Subcatchment 4S: PROPOSED POOL**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 5S: PROPOSED IMPERVIOUS**

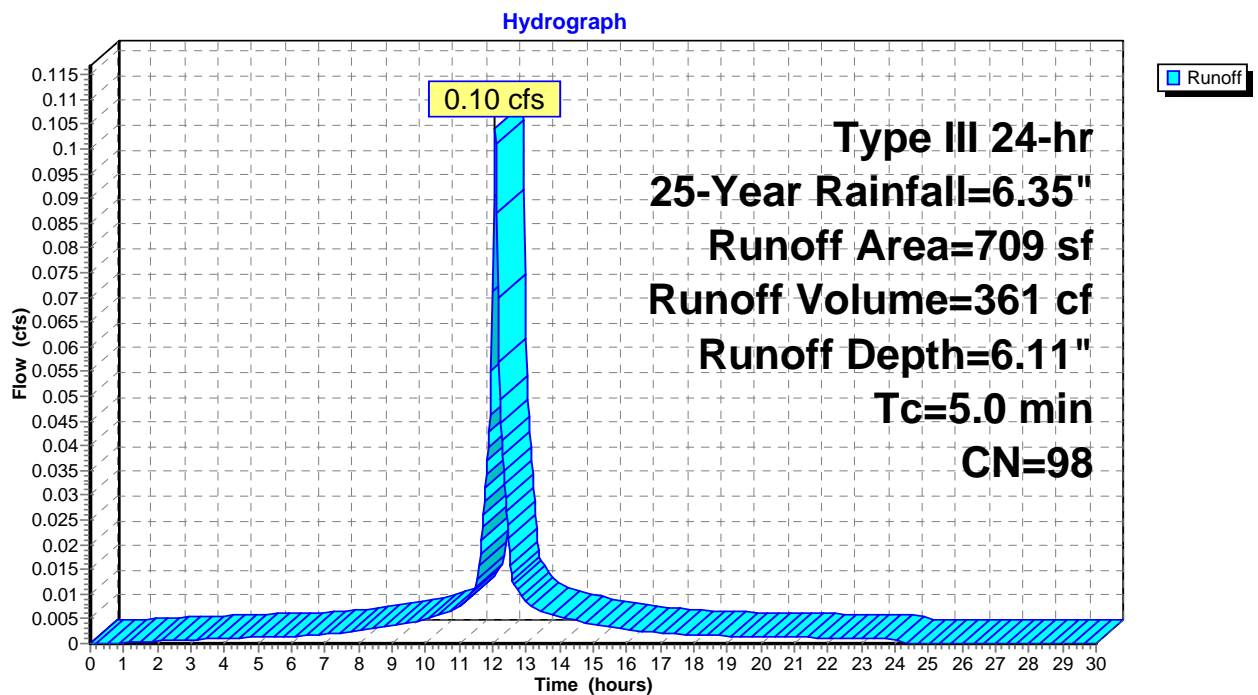
Runoff = 0.10 cfs @ 12.07 hrs, Volume= 361 cf, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
* 709	98	Deck/Porch/Retaining Wall/Landing & Steps
709		100.00% Impervious Area

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

**Subcatchment 5S: PROPOSED IMPERVIOUS**



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Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Subcatchment 6S: PROPOSED LANDSCAPE AREA**

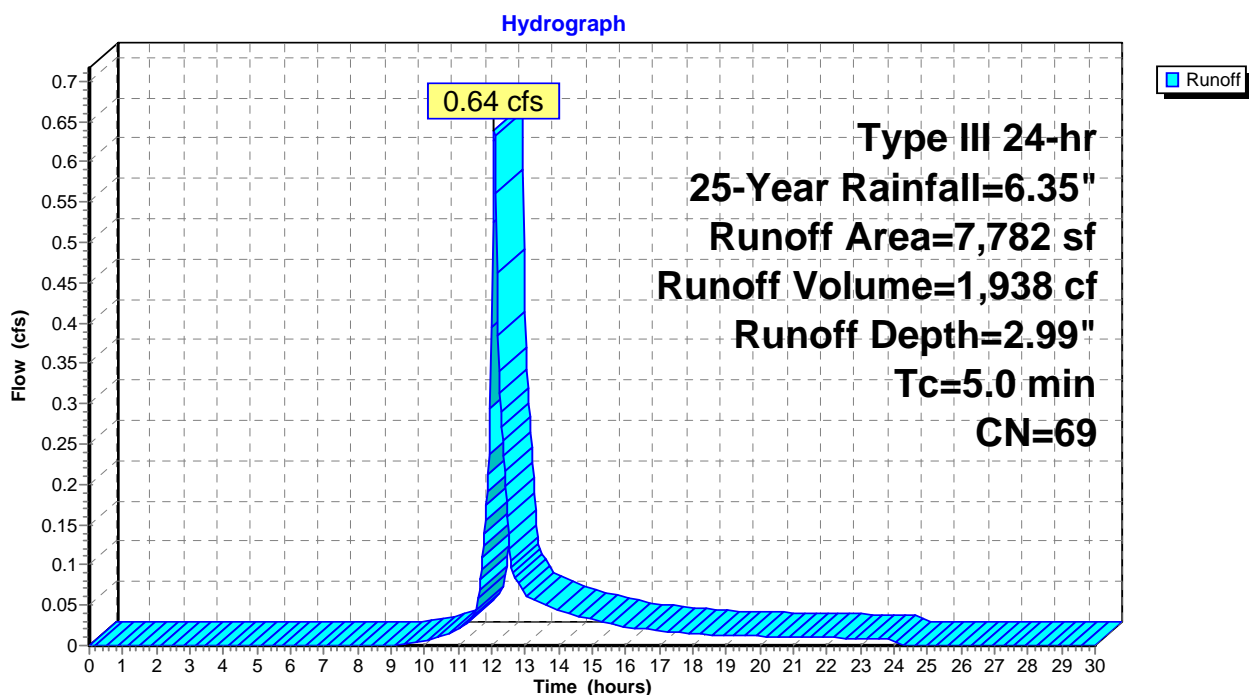
Runoff = 0.64 cfs @ 12.08 hrs, Volume= 1,938 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
7,782	69	50-75% Grass cover, Fair, HSG B
7,782		100.00% Pervious Area

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

**Subcatchment 6S: PROPOSED LANDSCAPE AREA**



**PROPOSED**

Type III 24-hr 25-Year Rainfall=6.35"

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**Summary for Pond 1P: STORM TECHS**

Inflow Area = 1,566 sf, 100.00% Impervious, Inflow Depth = 6.11" for 25-Year event  
 Inflow = 0.23 cfs @ 12.07 hrs, Volume= 798 cf  
 Outflow = 0.01 cfs @ 14.22 hrs, Volume= 739 cf, Atten= 95%, Lag= 128.8 min  
 Discarded = 0.01 cfs @ 14.22 hrs, Volume= 739 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 72.54' @ 14.22 hrs Surf.Area= 233 sf Storage= 414 cf

Plug-Flow detention time= 365.9 min calculated for 738 cf (93% of inflow)  
 Center-of-Mass det. time= 326.0 min ( 1,069.4 - 743.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	69.00'	318 cf	<b>21.08'W x 11.07'L x 4.00'H Field A</b> 934 cf Overall - 138 cf Embedded = 796 cf x 40.0% Voids
#2A	70.00'	138 cf	<b>ADS_StormTech SC-740 +Cap x 3</b> Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Chambers in 3 Rows
#3	73.00'	10 cf	<b>Ponding</b> Listed below -Impervious
		466 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Cum.Store (cubic-feet)
73.00	0
74.00	5
74.20	10

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	<b>1.020 in/hr Exfiltration over Wetted area</b>
#2	Primary	72.90'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.01 cfs @ 14.22 hrs HW=72.54' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=69.00' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)



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Type III 24-hr 25-Year Rainfall=6.35"

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**Pond 1P: STORM TECHS - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 18.0" Spacing = 69.0" C-C Row Spacing

1 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 8.74' Row Length +14.0" End Stone x 2 = 11.07' Base Length

3 Rows x 51.0" Wide + 18.0" Spacing x 2 + 32.0" Side Stone x 2 = 21.08' Base Width

12.0" Base + 30.0" Chamber Height + 6.0" Cover = 4.00' Field Height

3 Chambers x 45.9 cf = 137.8 cf Chamber Storage

933.6 cf Field - 137.8 cf Chambers = 795.7 cf Stone x 40.0% Voids = 318.3 cf Stone Storage

Chamber Storage + Stone Storage = 456.1 cf = 0.010 af

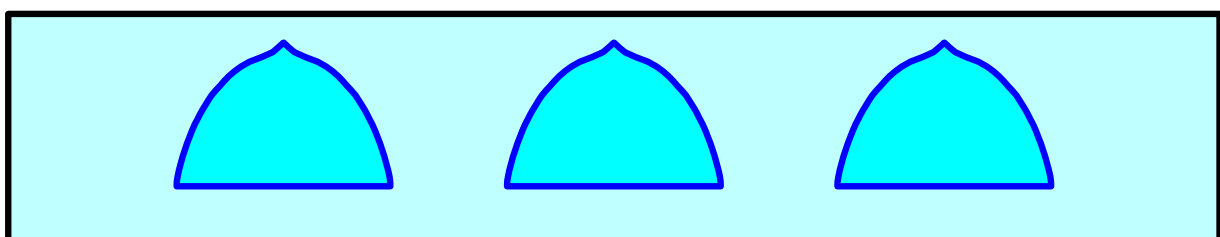
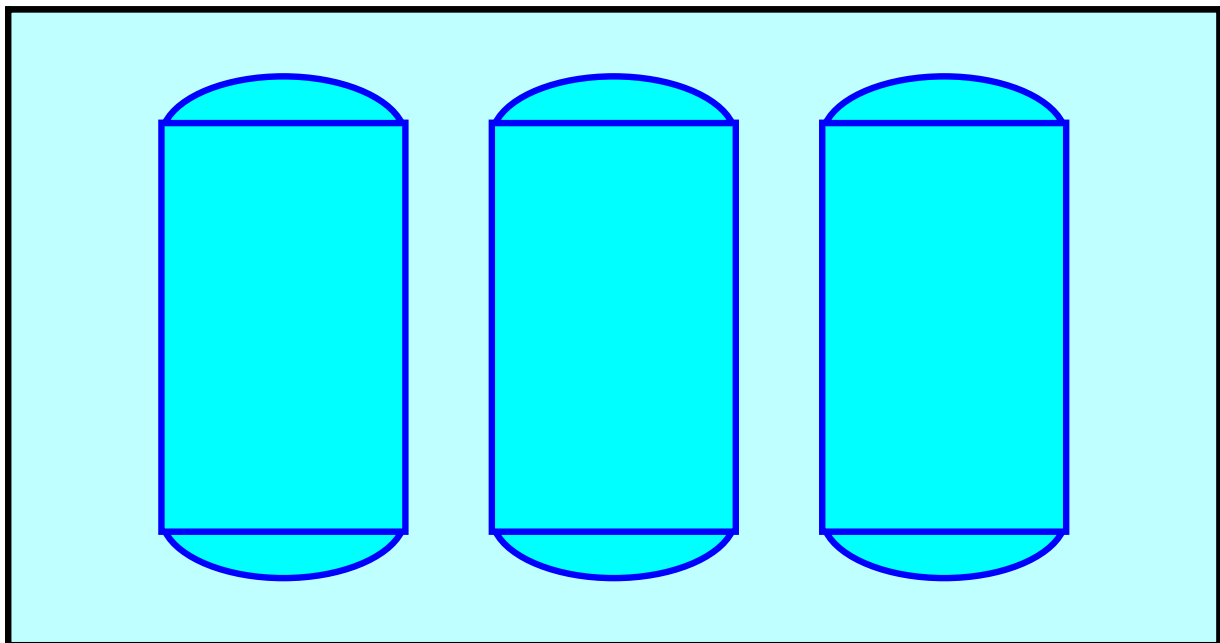
Overall Storage Efficiency = 48.9%

Overall System Size = 11.07' x 21.08' x 4.00'

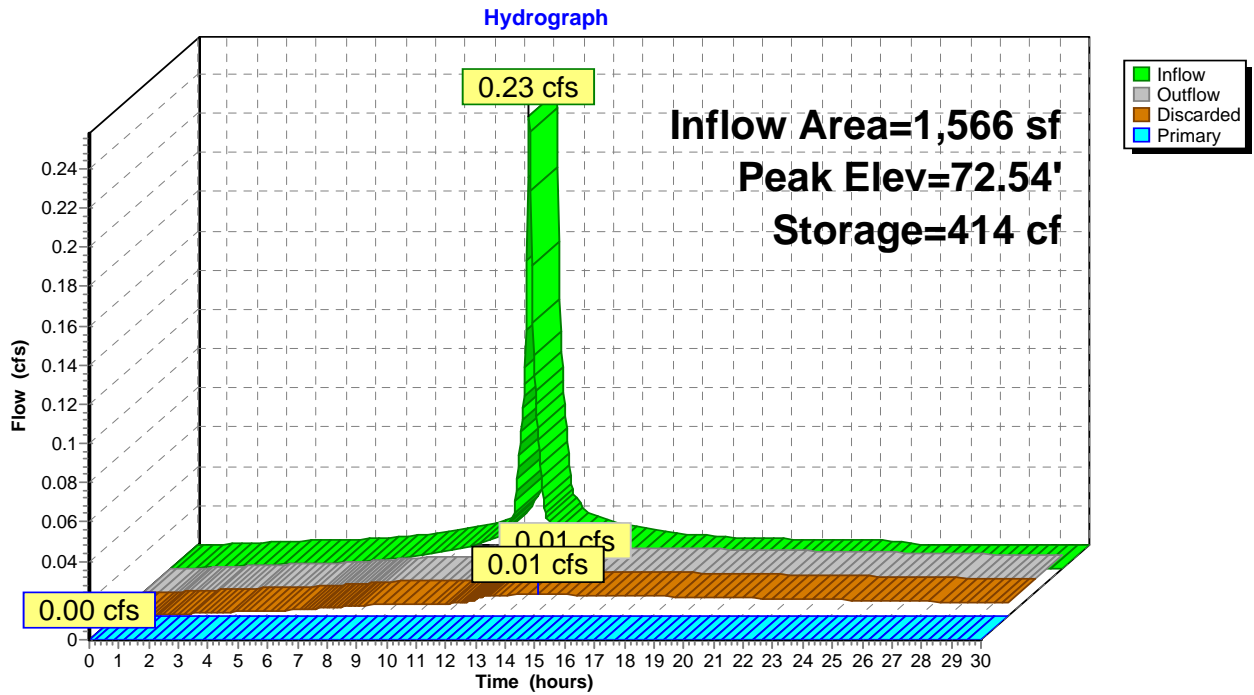
3 Chambers

34.6 cy Field

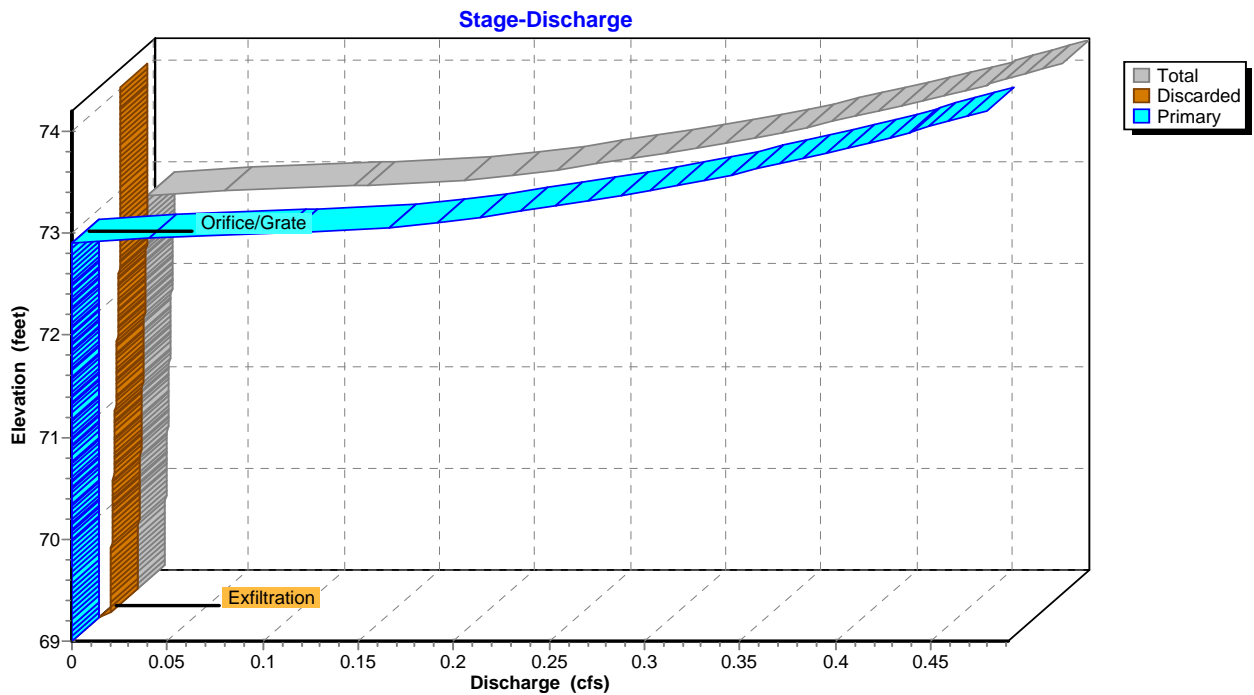
29.5 cy Stone



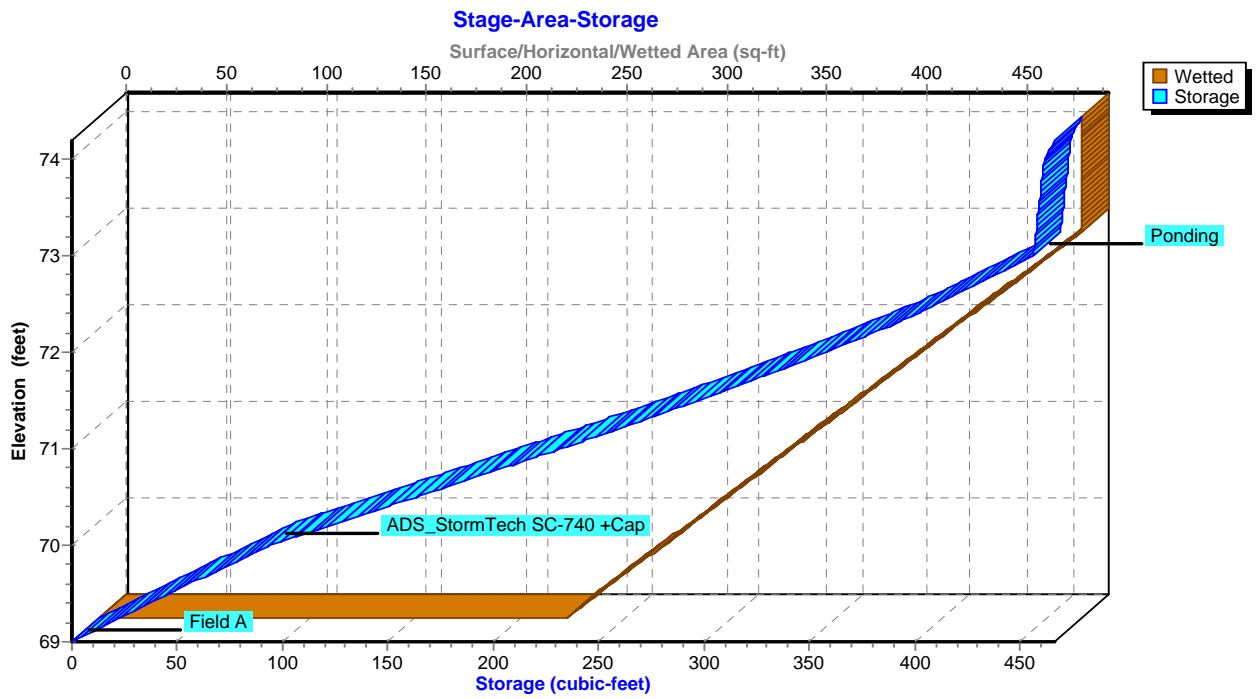
### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



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Type III 24-hr 25-Year Rainfall=6.35"

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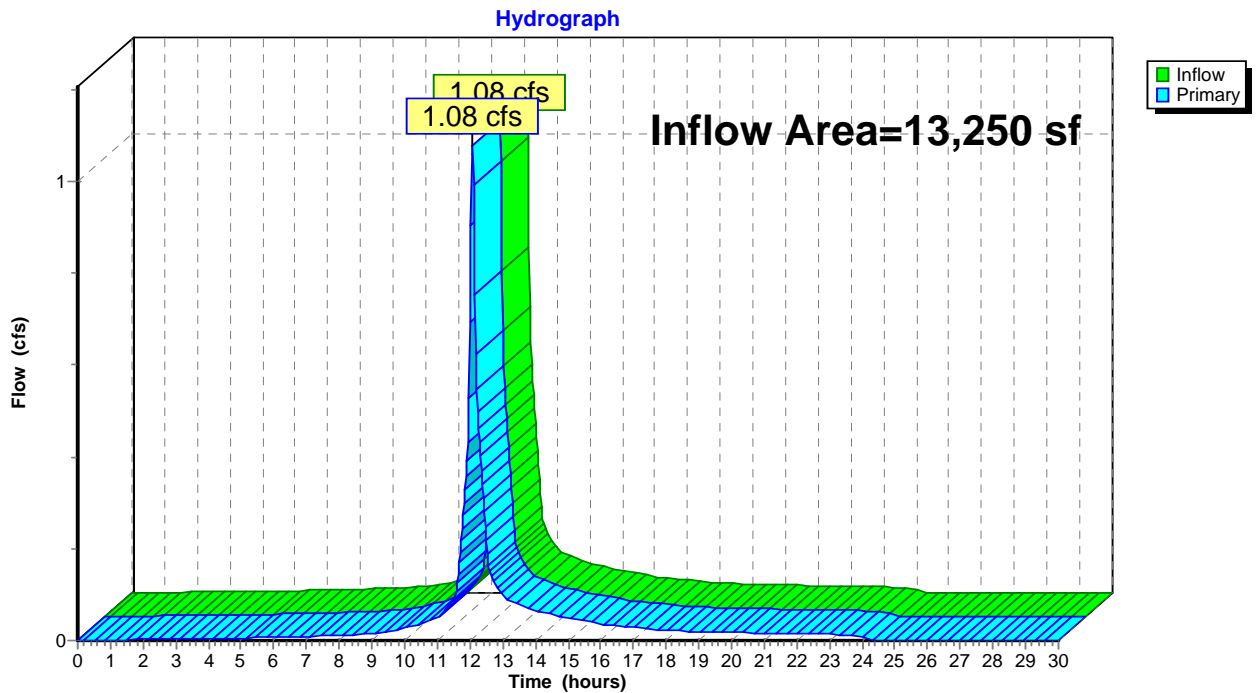
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**Summary for Link 3L: PROPOSED**

Inflow Area = 13,250 sf, 34.29% Impervious, Inflow Depth = 3.13" for 25-Year event  
Inflow = 1.08 cfs @ 12.07 hrs, Volume= 3,454 cf  
Primary = 1.08 cfs @ 12.07 hrs, Volume= 3,454 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: PROPOSED**



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Type III 24-hr 100-Year Rainfall=8.16"

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Time span=0.00-30.00 hrs, dt=0.03 hrs, 1001 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 1S: EX. ROOF** Runoff Area=1,395 sf 100.00% Impervious Runoff Depth=7.92"  
 Tc=5.0 min CN=98 Runoff=0.26 cfs 921 cf

**Subcatchment 2S: EX. DRIVEWAY &** Runoff Area=873 sf 100.00% Impervious Runoff Depth=7.92"  
 Tc=5.0 min CN=98 Runoff=0.17 cfs 576 cf

**Subcatchment 3S: PROPOSED** Runoff Area=1,566 sf 100.00% Impervious Runoff Depth=7.92"  
 Tc=5.0 min CN=98 Runoff=0.30 cfs 1,034 cf

**Subcatchment 4S: PROPOSED POOL** Runoff Area=925 sf 0.00% Impervious Runoff Depth=0.00"  
 Tc=5.0 min CN=1 Runoff=0.00 cfs 0 cf

**Subcatchment 5S: PROPOSED** Runoff Area=709 sf 100.00% Impervious Runoff Depth=7.92"  
 Tc=5.0 min CN=98 Runoff=0.13 cfs 468 cf

**Subcatchment 6S: PROPOSED** Runoff Area=7,782 sf 0.00% Impervious Runoff Depth=4.49"  
 Tc=5.0 min CN=69 Runoff=0.96 cfs 2,909 cf

**Pond 1P: STORM TECHS** Peak Elev=72.99' Storage=455 cf Inflow=0.30 cfs 1,034 cf  
 Discarded=0.01 cfs 806 cf Primary=0.09 cfs 129 cf Outflow=0.10 cfs 935 cf

**Link 3L: PROPOSED** Inflow=1.53 cfs 5,003 cf  
 Primary=1.53 cfs 5,003 cf

**Total Runoff Area = 13,250 sf Runoff Volume = 5,908 cf Average Runoff Depth = 5.35"**  
**65.71% Pervious = 8,707 sf 34.29% Impervious = 4,543 sf**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 1S: EX. ROOF**

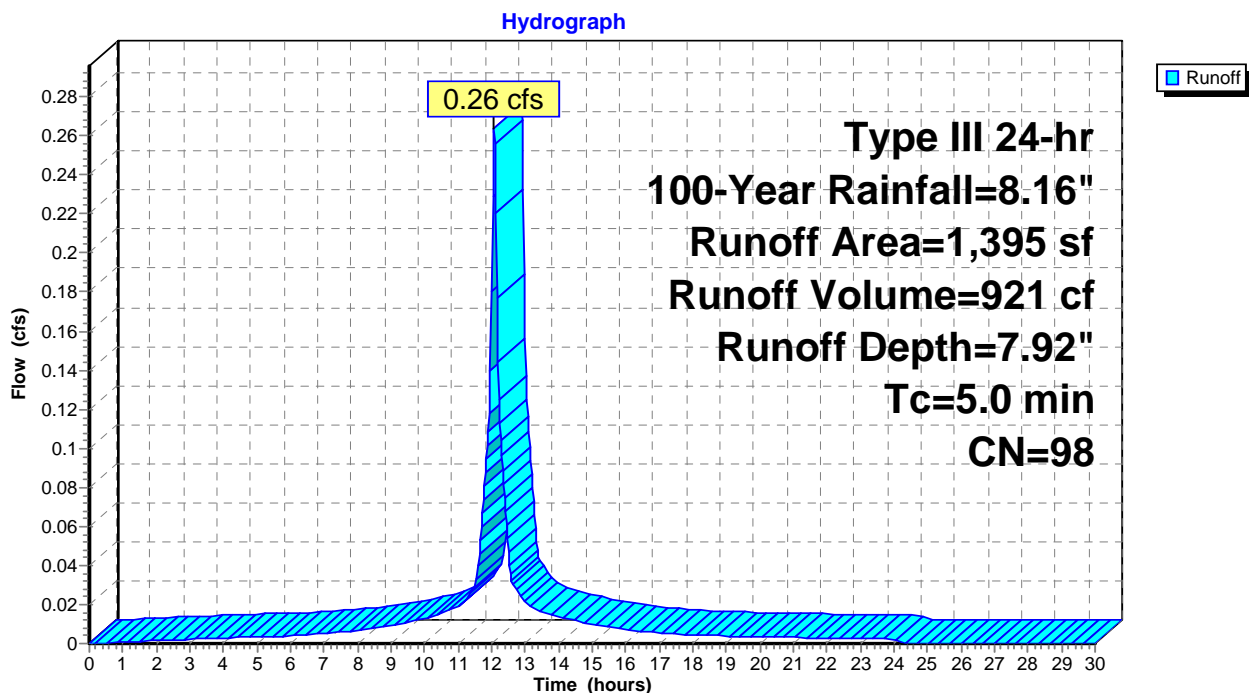
Runoff = 0.26 cfs @ 12.07 hrs, Volume= 921 cf, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
1,395	98	Roofs, HSG A
1,395		100.00% Impervious Area

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

**Subcatchment 1S: EX. ROOF**



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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 2S: EX. DRIVEWAY & WALKWAY**

Runoff = 0.17 cfs @ 12.07 hrs, Volume= 576 cf, Depth= 7.92"

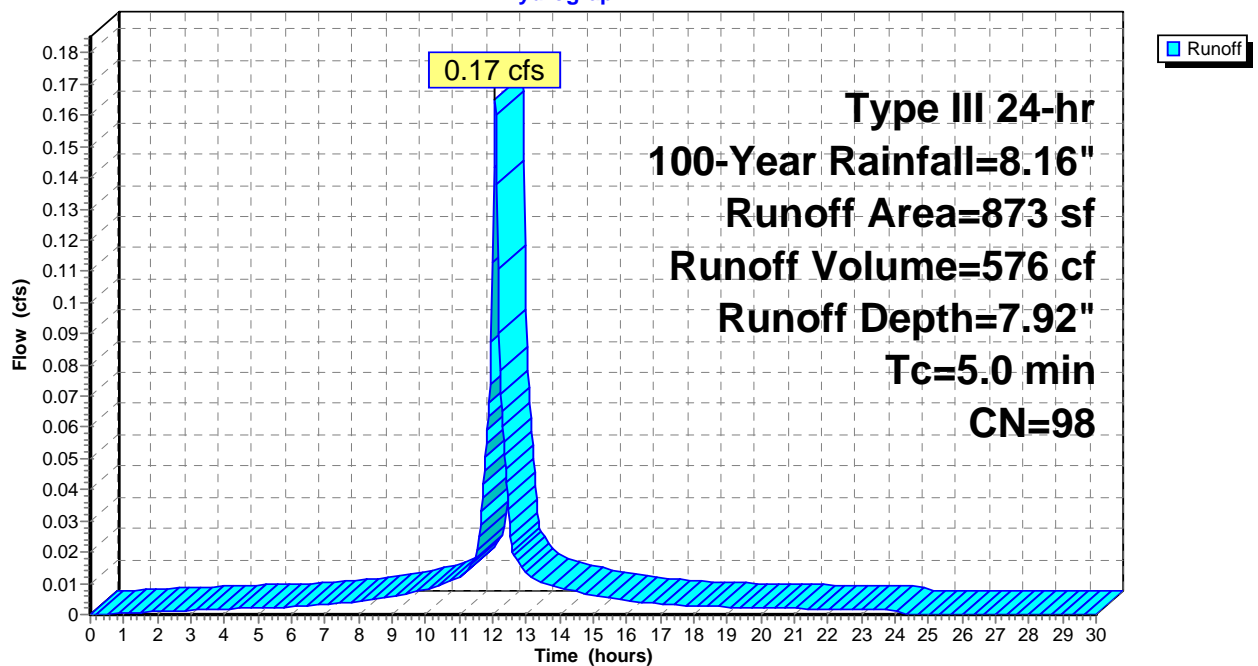
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
873	98	Paved parking, HSG A
873		100.00% Impervious Area

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

**Subcatchment 2S: EX. DRIVEWAY & WALKWAY**

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 3S: PROPOSED PAVERS**

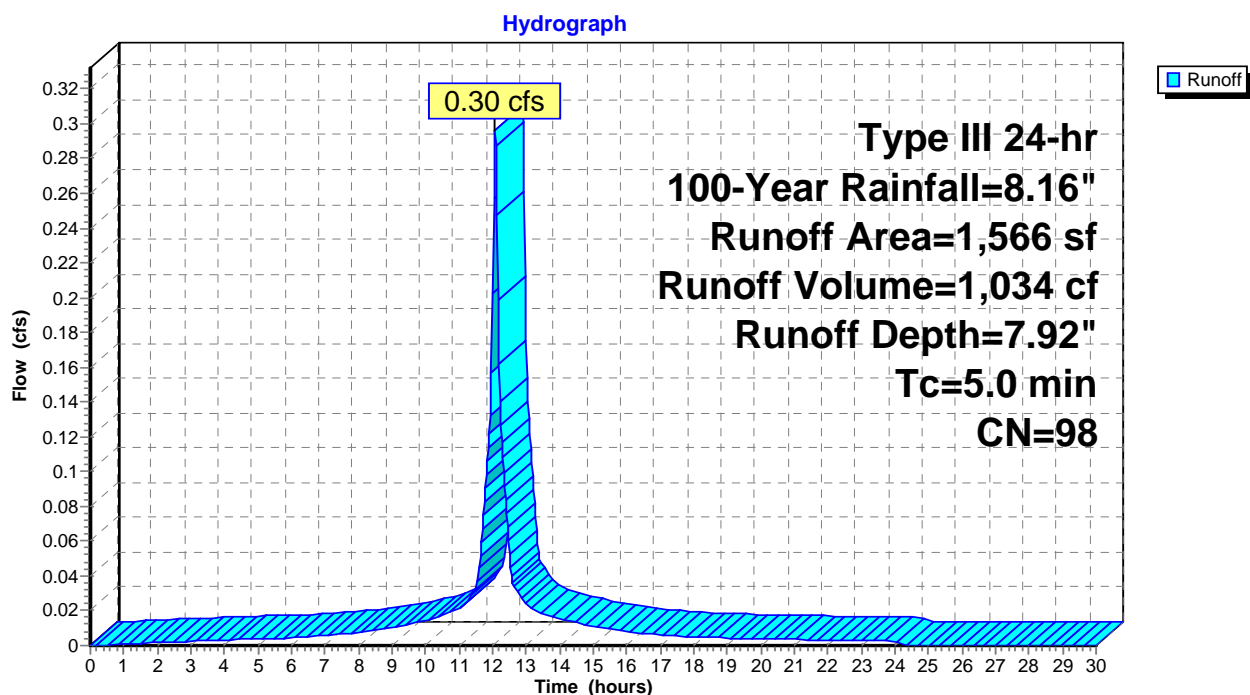
Runoff = 0.30 cfs @ 12.07 hrs, Volume= 1,034 cf, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
* 1,566	98	Pvers
1,566		100.00% Impervious Area

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

**Subcatchment 3S: PROPOSED PAVERS**





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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 4S: PROPOSED POOL**

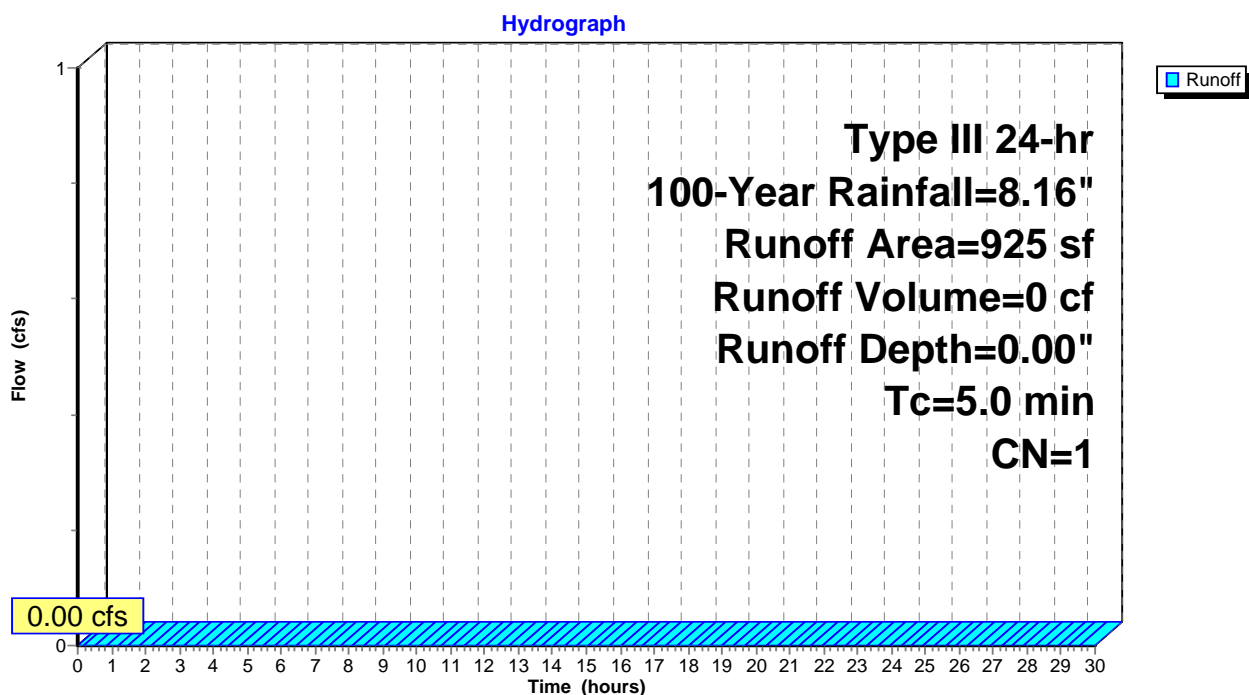
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
* 925	1	Pool
925		100.00% Pervious Area

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

**Subcatchment 4S: PROPOSED POOL**



**PROPOSED**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 5S: PROPOSED IMPERVIOUS**

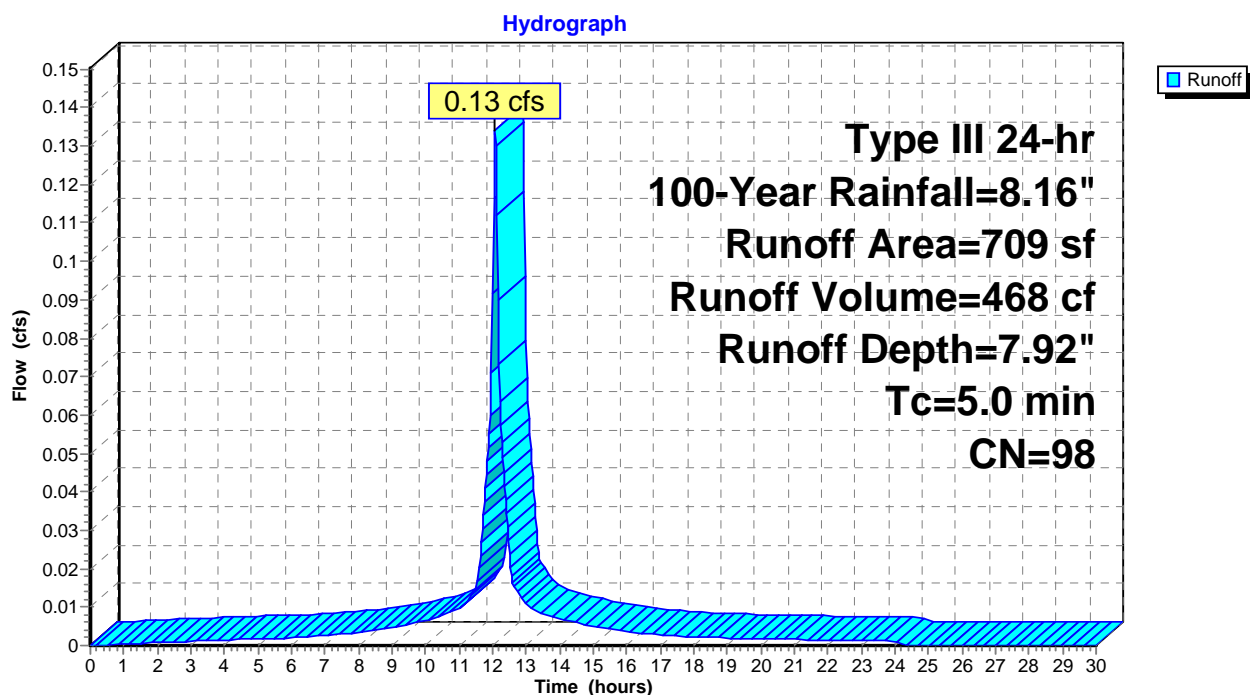
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 468 cf, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
* 709	98	Deck/Porch/Retaining Wall/Landing & Steps
709		100.00% Impervious Area

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

**Subcatchment 5S: PROPOSED IMPERVIOUS**



**PROPOSED**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Subcatchment 6S: PROPOSED LANDSCAPE AREA**

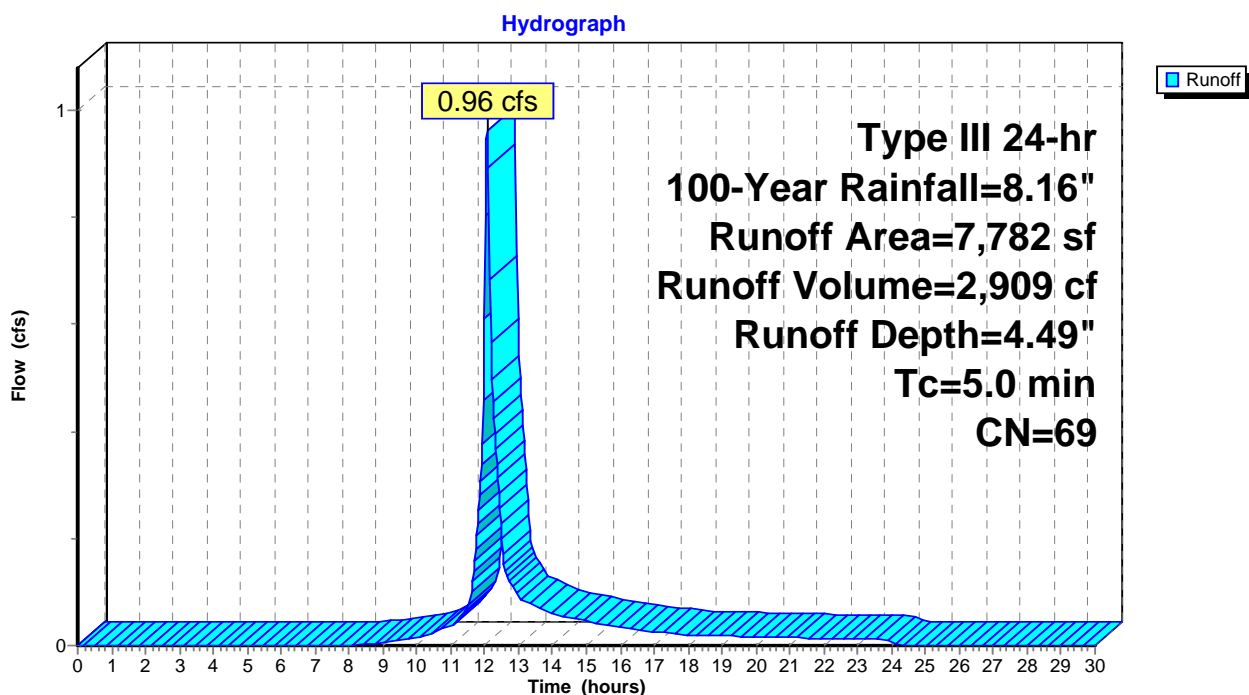
Runoff = 0.96 cfs @ 12.08 hrs, Volume= 2,909 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
7,782	69	50-75% Grass cover, Fair, HSG B
7,782		100.00% Pervious Area

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

**Subcatchment 6S: PROPOSED LANDSCAPE AREA**



**PROPOSED**

Type III 24-hr 100-Year Rainfall=8.16"

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**Summary for Pond 1P: STORM TECHS**

Inflow Area = 1,566 sf, 100.00% Impervious, Inflow Depth = 7.92" for 100-Year event  
 Inflow = 0.30 cfs @ 12.07 hrs, Volume= 1,034 cf  
 Outflow = 0.10 cfs @ 12.34 hrs, Volume= 935 cf, Atten= 66%, Lag= 16.3 min  
 Discarded = 0.01 cfs @ 12.34 hrs, Volume= 806 cf  
 Primary = 0.09 cfs @ 12.34 hrs, Volume= 129 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 72.99' @ 12.34 hrs Surf.Area= 233 sf Storage= 455 cf

Plug-Flow detention time= 321.7 min calculated for 934 cf (90% of inflow)  
 Center-of-Mass det. time= 273.3 min ( 1,013.4 - 740.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	69.00'	318 cf	<b>21.08'W x 11.07'L x 4.00'H Field A</b> 934 cf Overall - 138 cf Embedded = 796 cf x 40.0% Voids
#2A	70.00'	138 cf	<b>ADS_StormTech SC-740 +Cap x 3</b> Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Chambers in 3 Rows
#3	73.00'	10 cf	<b>Ponding</b> Listed below -Impervious
		466 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Cum.Store (cubic-feet)
73.00	0
74.00	5
74.20	10

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	<b>1.020 in/hr Exfiltration over Wetted area</b>
#2	Primary	72.90'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.01 cfs @ 12.34 hrs HW=72.98' (Free Discharge)  
 ↖1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.08 cfs @ 12.34 hrs HW=72.98' (Free Discharge)  
 ↖2=Orifice/Grate (Weir Controls 0.08 cfs @ 0.95 fps)

**PROPOSED**

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Type III 24-hr 100-Year Rainfall=8.16"

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**Pond 1P: STORM TECHS - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 18.0" Spacing = 69.0" C-C Row Spacing

1 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 8.74' Row Length +14.0" End Stone x 2 = 11.07' Base Length

3 Rows x 51.0" Wide + 18.0" Spacing x 2 + 32.0" Side Stone x 2 = 21.08' Base Width

12.0" Base + 30.0" Chamber Height + 6.0" Cover = 4.00' Field Height

3 Chambers x 45.9 cf = 137.8 cf Chamber Storage

933.6 cf Field - 137.8 cf Chambers = 795.7 cf Stone x 40.0% Voids = 318.3 cf Stone Storage

Chamber Storage + Stone Storage = 456.1 cf = 0.010 af

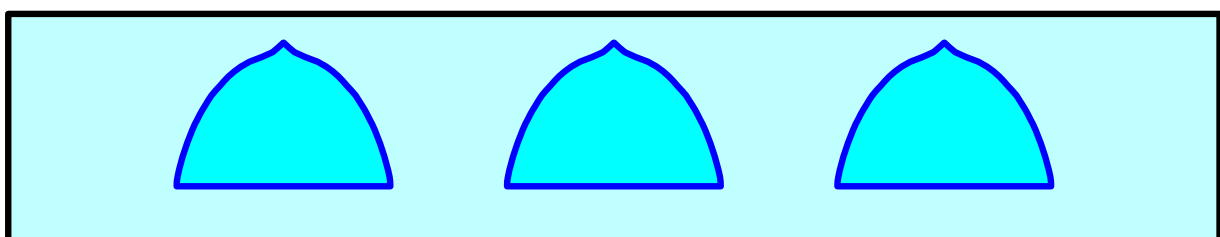
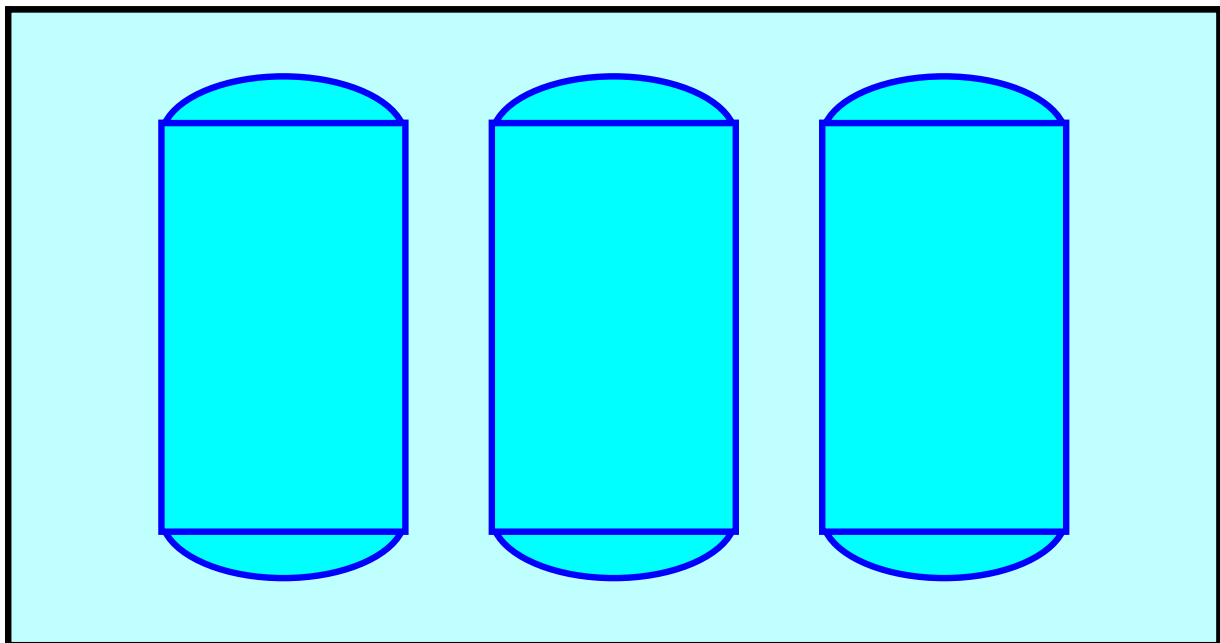
Overall Storage Efficiency = 48.9%

Overall System Size = 11.07' x 21.08' x 4.00'

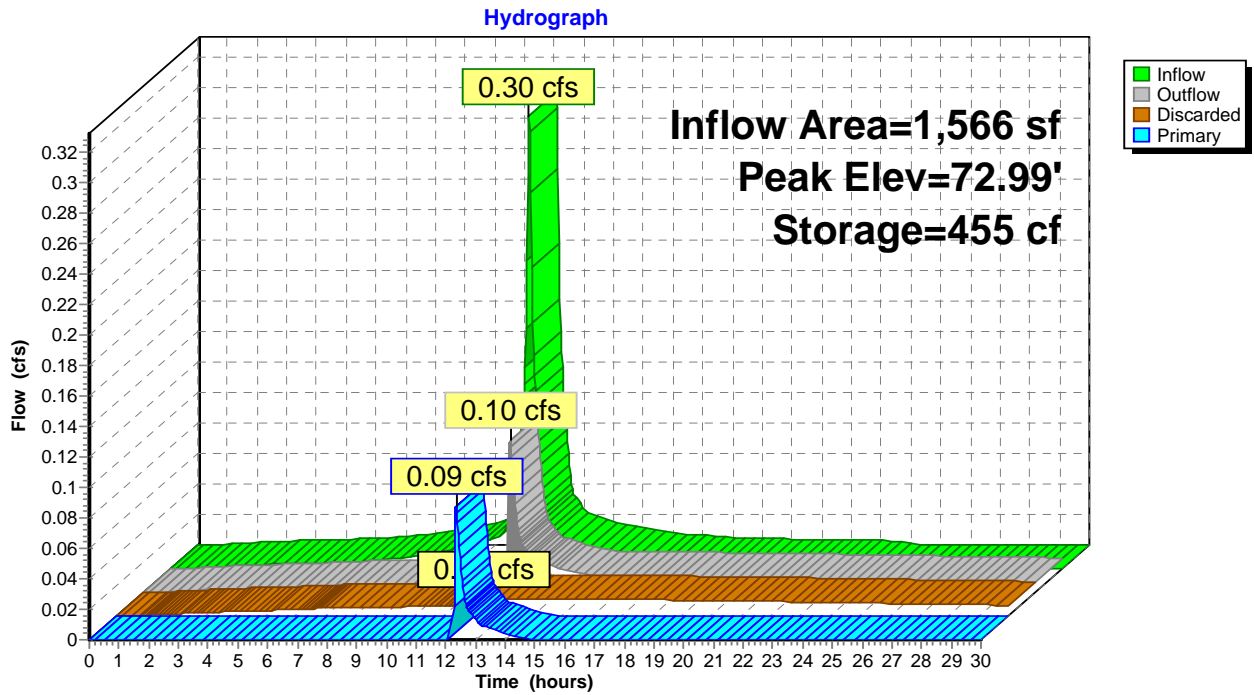
3 Chambers

34.6 cy Field

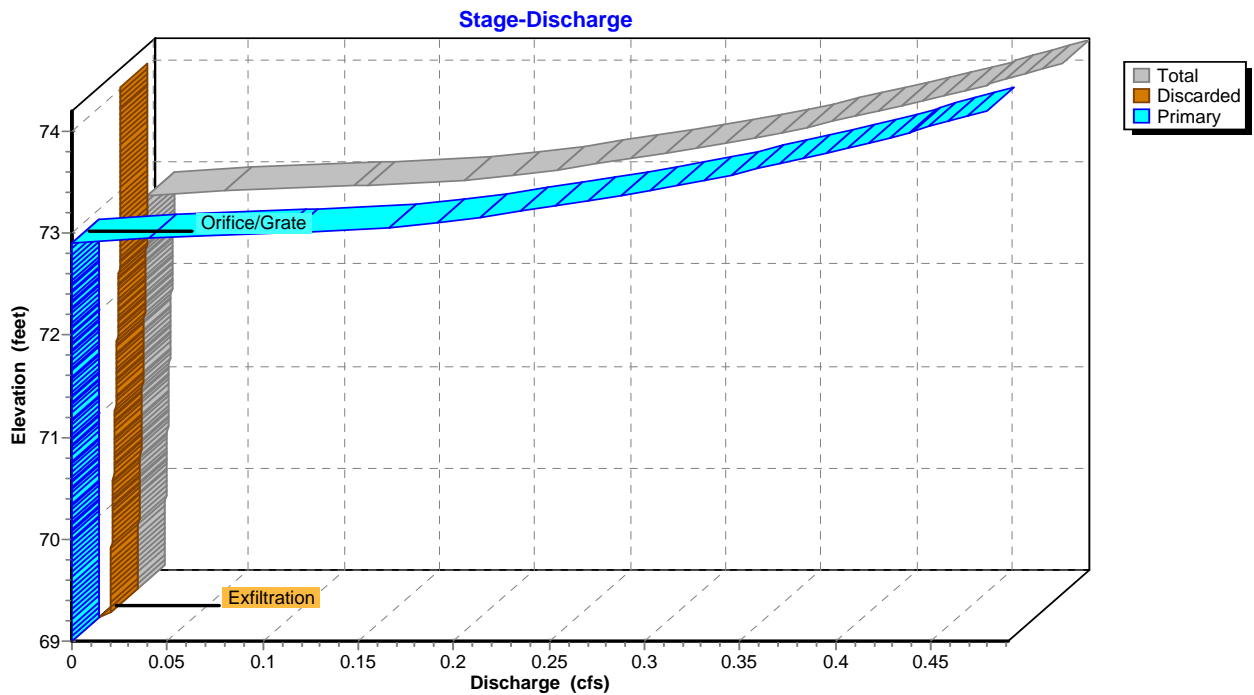
29.5 cy Stone



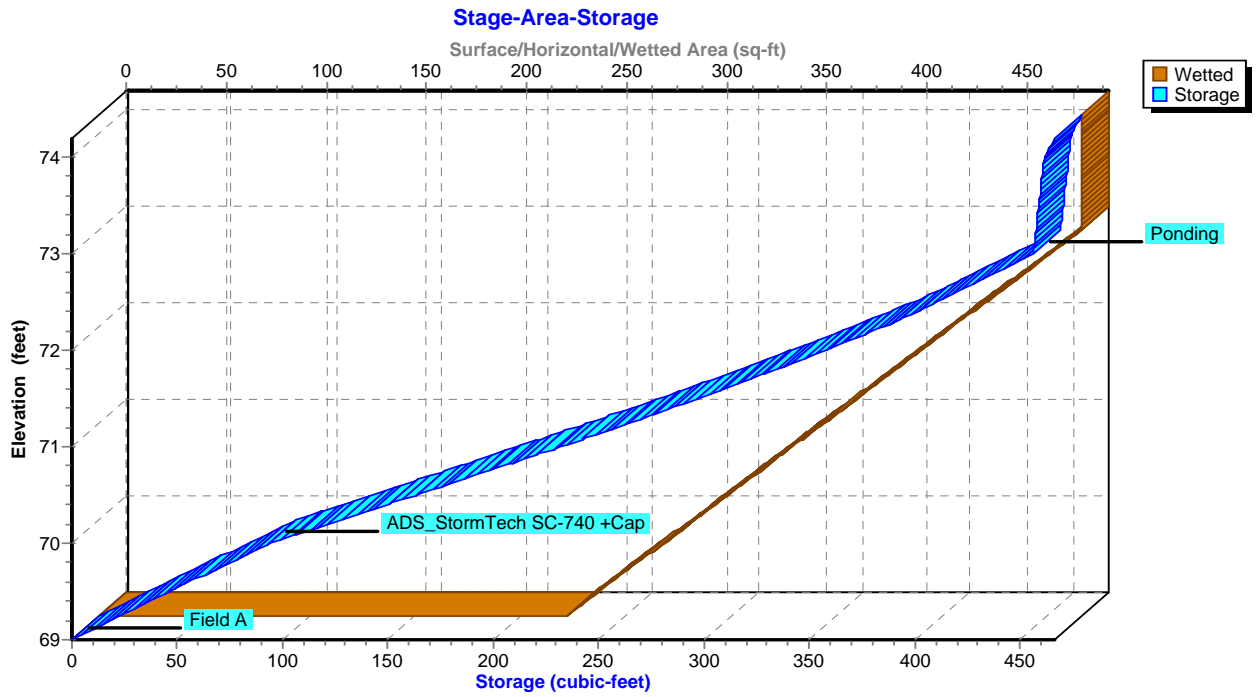
### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



### Pond 1P: STORM TECHS



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Type III 24-hr 100-Year Rainfall=8.16"

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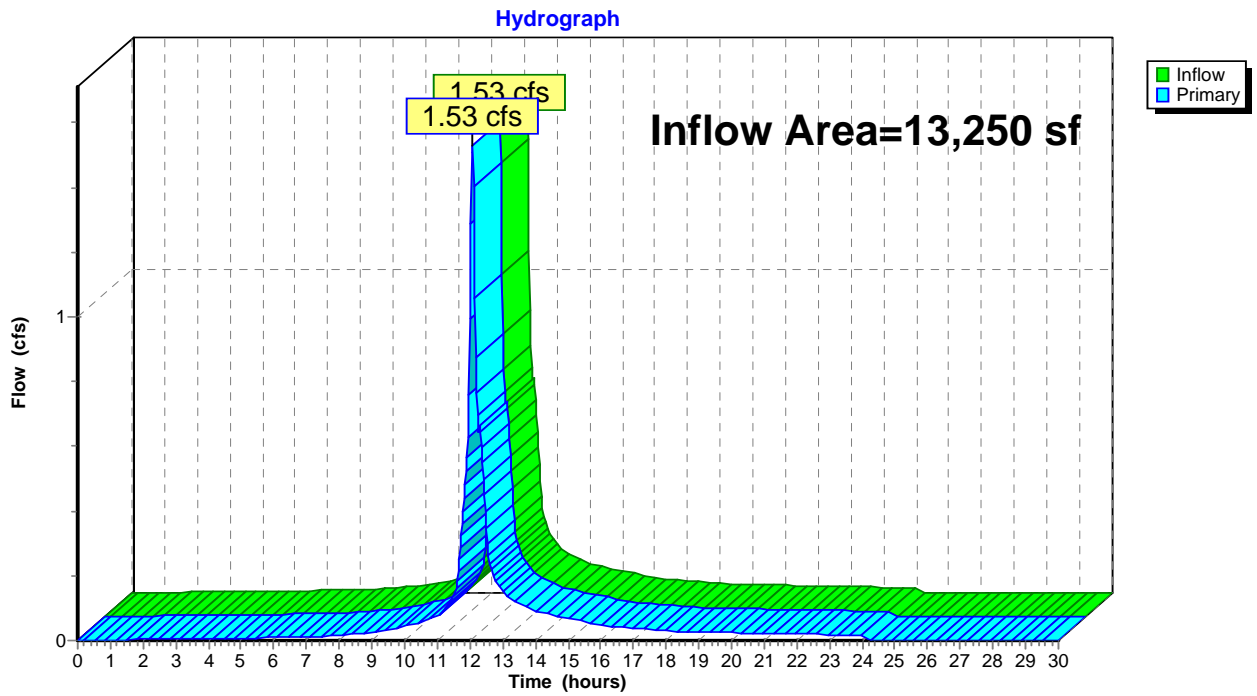
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**Summary for Link 3L: PROPOSED**

Inflow Area = 13,250 sf, 34.29% Impervious, Inflow Depth = 4.53" for 100-Year event  
Inflow = 1.53 cfs @ 12.07 hrs, Volume= 5,003 cf  
Primary = 1.53 cfs @ 12.07 hrs, Volume= 5,003 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.03 hrs

**Link 3L: PROPOSED**



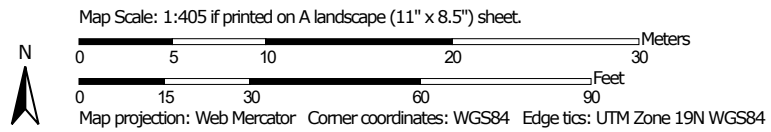


## **Appendix B – Soils Information**

# Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.



### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)


**Soils**


 Soil Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

**Special Point Features**

 Blowout

 Borrow Pit


 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip


 Sodic Spot


 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

**Water Features**

 Streams and Canals


**Transportation**

 Rails


 Interstate Highways

 US Routes

 Major Roads

 Local Roads

**Background**

 Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts  
 Survey Area Data: Version 22, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	0.2	52.8%
655	Udortheents, wet substratum	0.2	47.2%
<b>Totals for Area of Interest</b>		<b>0.4</b>	<b>100.0%</b>

## Map Unit Descriptions

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

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

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

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

## Custom Soil Resource Report

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

## Middlesex County, Massachusetts

### 51A—Swansea muck, 0 to 1 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2trl2  
*Elevation:* 0 to 1,140 feet  
*Mean annual precipitation:* 36 to 71 inches  
*Mean annual air temperature:* 39 to 55 degrees F  
*Frost-free period:* 140 to 240 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Swansea and similar soils:* 80 percent  
*Minor components:* 20 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Swansea

##### Setting

*Landform:* Bogs, swamps  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Parent material:* Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

##### Typical profile

*Oa1 - 0 to 24 inches:* muck  
*Oa2 - 24 to 34 inches:* muck  
*Cg - 34 to 79 inches:* coarse sand

##### Properties and qualities

*Slope:* 0 to 1 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Very poorly drained  
*Runoff class:* Negligible  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)  
*Depth to water table:* About 0 to 6 inches  
*Frequency of flooding:* Rare  
*Frequency of ponding:* Frequent  
*Available water supply, 0 to 60 inches:* Very high (about 16.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 8w  
*Hydrologic Soil Group:* B/D  
*Ecological site:* F144AY043MA - Acidic Organic Wetlands  
*Hydric soil rating:* Yes

#### Minor Components

##### Freetown

*Percent of map unit:* 10 percent  
*Landform:* Bogs, swamps

## Custom Soil Resource Report

*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

### **Scarboro**

*Percent of map unit:* 5 percent  
*Landform:* Drainageways, depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope, tread, dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

### **Whitman**

*Percent of map unit:* 5 percent  
*Landform:* Drainageways, depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

## **655—Udorthents, wet substratum**

### **Map Unit Setting**

*National map unit symbol:* vr1n  
*Elevation:* 0 to 3,000 feet  
*Mean annual precipitation:* 32 to 54 inches  
*Mean annual air temperature:* 43 to 54 degrees F  
*Frost-free period:* 110 to 240 days  
*Farmland classification:* Not prime farmland

### **Map Unit Composition**

*Udorthents, wet substratum, and similar soils:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Udorthents, Wet Substratum**

#### **Setting**

*Parent material:* Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

#### **Properties and qualities**

*Slope:* 0 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None

**Minor Components**

**Urban land**

*Percent of map unit:* 8 percent  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear

**Freetown**

*Percent of map unit:* 4 percent  
*Landform:* Depressions, bogs  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

**Swansea**

*Percent of map unit:* 3 percent  
*Landform:* Depressions, bogs  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes