# Stormwater Management Report

**For**

**22 Howe Street**
**Hingham, MA**

**July 9, 2026**

**Revised August 3, 2026**

**Prepared for:**
**Sean Marshall**
**22 Howe Street**
**Hingham, MA 02043**

**Prepared by:**
**Homestead Consulting Engineers, LLC**
**2 Sharp Street Unit A**
**Hingham, MA 02043**
**781-206-5770**

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# Section 1: Narrative

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## 1.1 EXECUTIVE SUMMARY

In accordance with the provisions of the Town of Hingham Site Plan Review, the Applicant, Sean Marshall proposes the reconstruction of a driveway, the construction of a new shed, patios, walkway, and sports court along with associated drainage improvements at 22 Howe Street.

The site consists of one parcel shown as Map 17 Lot 20 on the Hingham Assessors Maps. The parcel consists of approximately 0.59± acres of land and lies within the Residence A zoning district. The parcel is bound by Howe Street to the east, and residential properties to the north, south and west.

## 1.2 APPROVALS BEING SOUGHT

A Site Plan Review application is being filed with the Hingham Planning Board for the proposed work at 22 Howe Street.

The applicant requests that the permit approvals encompass the entirety of the scope listed below and as shown in the accompanying plan.

- The site preparation required to develop the location of the proposed driveway, patios, walkways and sports court.
- Installation of landscape areas and trees per the landscape plan (submitted by others)
- Associated drainage upgrades.

## 1.3 FEMA – FLOODPLAIN SUMMARY

The parcel is shown on FEMA Flood Insurance Rate Map Panel 25023C0019J dated 7/17/2012. The property is located within Zone X, which is defined as areas determined to be outside the 1% annual chance floodplain.

## 1.4 ON-SITE SOIL INFORMATION

The Natural Resource Conservation Service (NRCS) maps the site as primarily 340C: Broadbrook very fine sand loam, 8 to 15 percent slopes with a Hydrologic Soil Group (HSG) classified as C.

McSweeney Associates, Inc. completed soil testing on August, 8th 2024. Soils encountered during these tests consisted predominately of Sandy loams in the A, B, and C2 layers. In the C1 layer, from a depth of 28-108 inches, Silty Clay Loam was encountered. The location of the previously dug test pit was not included in the attached letter. However, the test pits appear to be relatively consistent with no groundwater indicators encountered, therefore we believe these test pits provide an overall soil profile for the site. Additional soil testing in the location of the proposed subsurface system is recommended prior to construction.

For modeling purposes, HSG C was used to represent surface soil conditions. The Cultec R-280HD subsurface drainage system was not modeled to include any infiltration in HydroCAD. In the attached stormwater calculations (section 4), for the purposes of drawdown we utilized 0.17 inches per hour for the recharge rate to demonstrate the system meets the required 72 hour maximum drawdown time.

Groundwater was not observed in the test hole up to depth of 128” below the surface grade. More

information regarding on site soil information can be found in Section 5 – Soils Testing Data.

### 1.5 WETLANDS AND ENVIRONMENTAL RESOURCE AREAS

The site does not contain wetlands regulated by the Wetlands Protection Act or the Town of Hingham. The site does not contain any areas designated as Estimated or priority Endangered Species Habitat, certified vernal pools, or Areas of Critical Environmental Concern (per MassGIS massmapper). There is no site activity proposed within wetlands or environmental resource areas. There are no trees expected to be removed for the purpose of this project.

### 1.6 OBJECTIVE OF CALCULATIONS

The purpose of this stormwater analysis is to examine the stormwater runoff from the proposed site based upon the Hingham Site Plan Review Requirements and applicable references to the Massachusetts Stormwater Standards.

The goal of the stormwater management system design on this project is to comply with the Town of Hingham regulations to provide improved water quality, meet or reduce post-development peak runoff rates below pre-development peak flow rates, maximize the opportunities for recharge and infiltration, and protect the surrounding area from any potential flooding and/or environmental impacts associated with the unmitigated condition. The following stormwater hydrology calculations were performed using 2-year, 10-year, and 100-year frequency, Type III, 24-hour SCS design storms and were compared for both pre-development and post-development conditions. The storms were evaluated to demonstrate the proposed peak rates of discharge do not exceed pre-development peak rates.

### 1.7 METHODOLOGY

We utilized the latest version of HydroCAD for the overall stormwater hydrology/routing analysis to assess and compare peak rates of runoff and volumes at the discharge points from the subject property.

Refer to Section 2 – HydroCAD Model, which includes the detailed print-out of the HydroCAD Model Reports for the 2, 10, and 100-year storms.

### 1.8 SITE HYDROLOGY

**<u>Existing Conditions</u>**

Please refer to the attached Existing Conditions Watershed Analysis Plan in Section 2.1. The property has been divided into two (2) sub catchment areas based on the existing site topography, roof drain locations and flow paths. The sub catchment areas have been analyzed and assigned an appropriate Curve Number to represent the existing surface cover and underlying conditions of soil. Time of concentration has been computed and the extent of pervious vs. impervious cover computed. This data was then input into HydroCAD to determine peak rates of runoff at the design point which provides the location for which to compare existing versus proposed conditions to document compliance that the peak rates and volumes have been reduced in the regulatory storm events as required. A summary table is provided in the Hydrology Model Results and Conclusions Section below. Sub catchment and Design Point #1 is the southwest property corner (1R) and Design Point #2 is Howe Road (2R). The project's watershed is approximately 25,878± square feet, consisting of an existing single-family dwelling, driveway, hardscape,

gravel and grass areas. The site generally conveys stormwater in the south and eastern directions, towards Howe Street and southwestern property line. Existing topography ranges a high of 74 el. to the north of the property to a low of 66 el. in the south. A more comprehensive description of the existing sub catchment areas is provided below:

- Sub catchment EX-1 is approximately 20,846± SF and is comprised of a majority of the existing dwellings roof, an existing gravel driveway, decks, and grass area (CN: 78). The minimum time of concentration of 6.0 minutes was used.
- Sub catchment EX-2 is approximately 5,032± SF and is comprised of the existing paved driveway, a portion of the roof which drains towards the road, and grass area (CN: 83). The minimum time of concentration of 6.0 minutes was used.

**Proposed Conditions**

The proposed project consists of the roofs, newly paved driveway and sports court, grass, gravel and impervious patios/walkways. The proposed paved parking, paved sports court, and existing roof area are to be tied into a subsurface drainage system consisting of connected roof drains, nyloplast/yard drains, trench drains and Cultec R-280HD subsurface drainage chambers. There is a total of 3,702± SF of new impervious area proposed for the property. Proposed topography follows a similar pathway as existing topography, with the site having the highest elevations in the north at 74.0± el. and lower elevations in the south at 66.0± el.

Please refer to the attached Proposed Conditions Watershed Plan. The proposed project has been divided into three (3) sub catchment areas and the various stormwater treatment and infiltration BMPs have been modeled. Appropriate Times of Concentration and Curve Numbers have been assigned for each catchment area. A more comprehensive description of the proposed sub catchment areas is provided below:

- Sub catchment PD-1 is approximately 15,653± SF consisting of patios, shed roof, gravel roads, and grass (CN:77). Stormwater runoff from this area flows to the southwestern property corner similar to existing conditions. The minimum time of concentration of 6.0 minutes is used.
- Sub catchment PD-2 is approximately 5,819± SF consisting of roofs, paved parking, and the paved sports court (CN:98). These watershed areas are conveyed through the proposed stormwater system and out towards the southwestern property corner. The minimum time of concentration of 6.0 minutes is used.
- Sub catchment PD-3 is approximately 4,406± SF consisting of paved, woods, and grass areas (CN:80). The minimum time of concentration of 6.0 minutes is used.

**Hydrology Model Results and Conclusions**

The results of the pre- and post-development hydrology calculations provided in Section 2 are summarized in the following tables:

Table 1.7 shows the peak rate of runoff at each design point for the existing site as well as for the developed site at 2, 10, and 100-year design storms.

| Peak Rates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Point of Analysis | 2-Year Storm (cfs) | | | 10-Year Storm (cfs) | | | 100-Year Storm (cfs) | | |
| | Pre | Post | Δ | Pre | Post | Δ | Pre | Post | Δ |
| R-1 | 0.77 | 0.76 | -0.01 | 1.60 | 1.44 | -0.16 | 3.01 | 2.60 | -0.41 |
| R-2 | 0.23 | 0.18 | -0.05 | 0.45 | 0.36 | -0.09 | 0.79 | 0.66 | -0.13 |

**Table 1.7**

As shown in Table 1.7., the peak stormwater runoff generated by the development is less or equal in post development conditions versus the existing conditions at all design points, for every storm. Refer to Section 2 for the complete HydroCAD Analysis that documents the above results as well as the Existing and Proposed Conditions Watershed Plans, also enclosed in Section 2.

### 1.9 STORMWATER MANAGEMENT

The following section describes each of the ten (10) Massachusetts Stormwater Management Standards and describes how the project complies with each.

Standard 1: No New Untreated Discharges – No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

**There are no new untreated stormwater conveyances that discharge directly to or cause erosion in wetlands or waters of the commonwealth. Outfalls have been sited outside all resource areas and buffers.**

Standard 2: Peak Rate Attenuation – Stormwater management systems should be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

**Please refer to Table 1.7. above. The stormwater management system reduces or maintains peak rates of runoff to below pre-development levels at all design points.**

Standard 3: Recharge – Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

**The stormwater system includes and one (1) subsurface chamber system. The stormwater system has been designed to comply with the recharge requirements of**

**the MA Stormwater Management Regulations and meets the requirements for new construction. Refer to Section 3.1 for a summary of the stormwater recharge calculations.**

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

**The pavement, sports court, and roof area on site have been directed to the subsurface drainage system with an isolator row to remove 80% of TSS.**

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPL) – For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

**The proposed project is associated with a Single-Family dwelling and is not a LUHPPL.**

Standard 6: Critical Areas – Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

**The project is not located within a critical area.**

Standard 7: Redevelopment and Other Projects Subject to the Standards only to the maximum extent practicable – A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

**This project would be classified as a new development. The project complies with all standards set forth by the Massachusetts Stormwater Handbook Standards.**

Standard 8: Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control – A plan to control construction-related impacts including

erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

**Erosion controls consisting of a combination of silt fence have been incorporated into the site plan.**

Standard 9: Operation and Maintenance Plan – A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

**An Operation and Maintenance Plan has been provided in Section 4 of this Report.**

Standard 10: Prohibition of Illicit Discharges – All illicit discharges to the stormwater management system are prohibited.

**No illicit discharges are to be connected or discharge to the stormwater management systems.**

**1.10 CONCLUSION**

In conclusion, the project has been designed in accordance with the requirements of the Hingham Planning Board Site Plan Review requirements.

**1.11 Figures**

FIG 1 Aerial MAP
FIG 2 FEMA FLOODPLAIN MAP
FIG 3 MASSDEP WETLANDS/NHESP MAP
FIG 4 USGS MAP

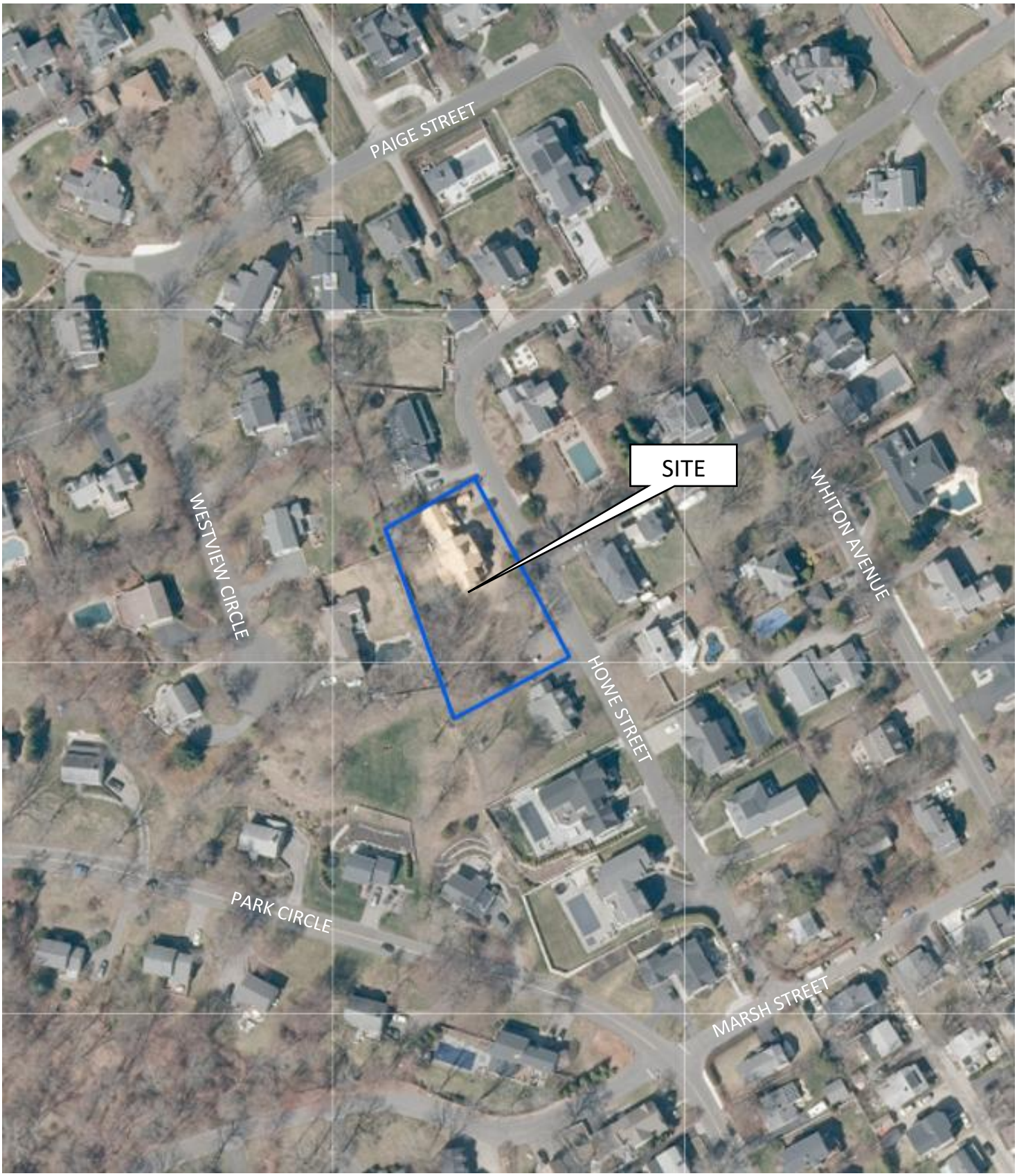


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**Figure 1: Aerial Map**
**22 Howe Street,**
**Hingham, MA 02043**

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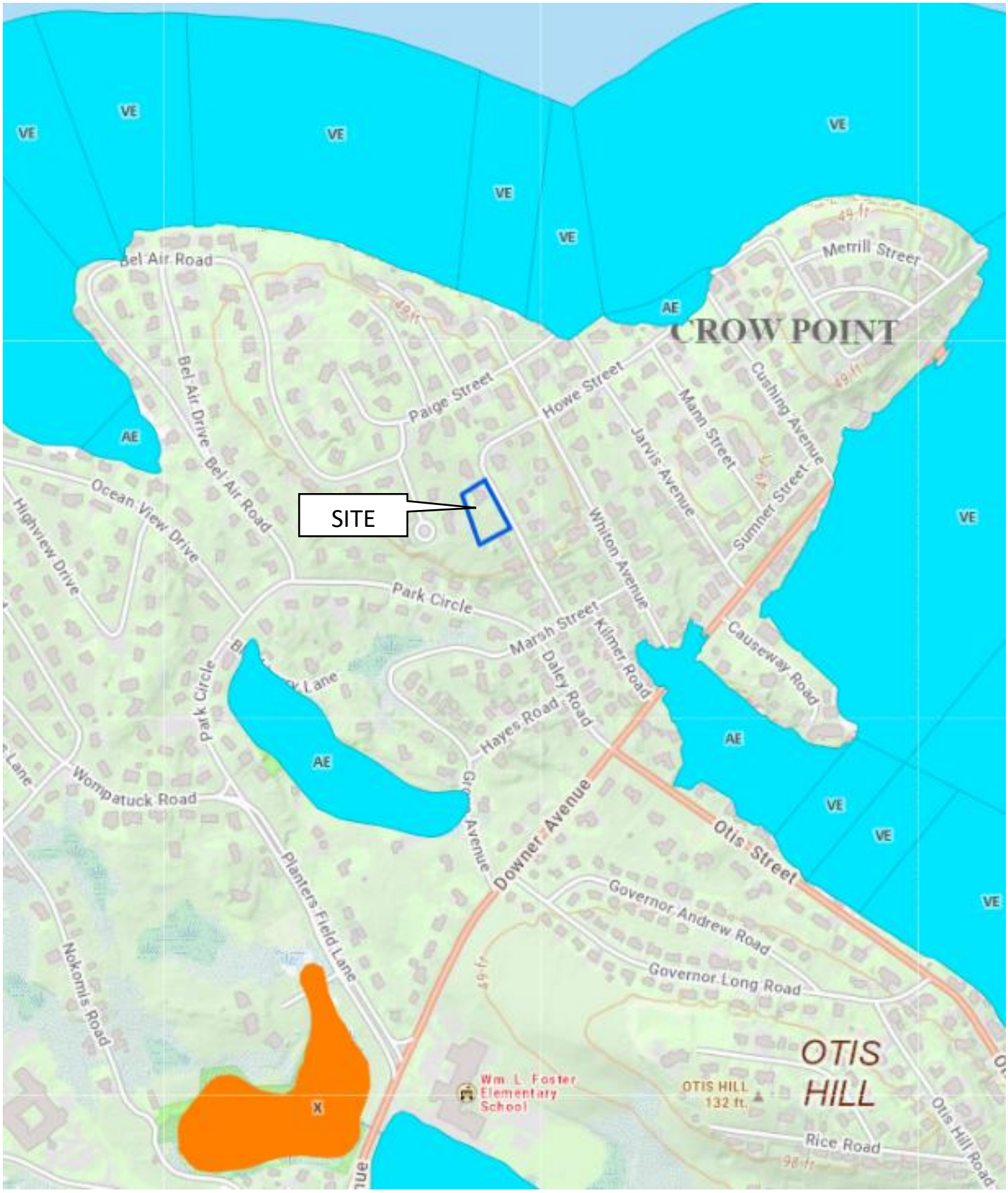


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**FEMA # 25023C0019J eff. 7/17/2012**
**Figure 2: FEMA Floodplain Map**
**Zone X – Area of Minimal Flood Hazard**
**22 Howe Street,**
**Hingham, MA 02043**

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**Figure 3: MASSDEP Wetlands/NHESP Map**
**Note* No NHESP or Wetlands present.**
**22 Howe Street,**
**Hingham, MA 02043**

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**Figure 4: Site Locus USGS Map**
**22 Howe Street,**
**Hingham, MA 02043**

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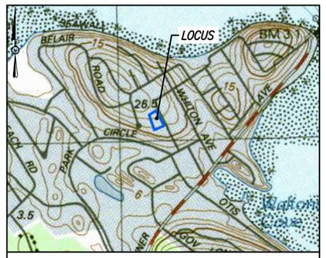
# Section 2: HydroCAD Model




LOCATION MAP SCALE: 1" = 1000'±

**RECORD OWNER:**
ASSESSORS MAP 17 LOT 20
22 HOWE STREET
HINGHAM, MA 02043

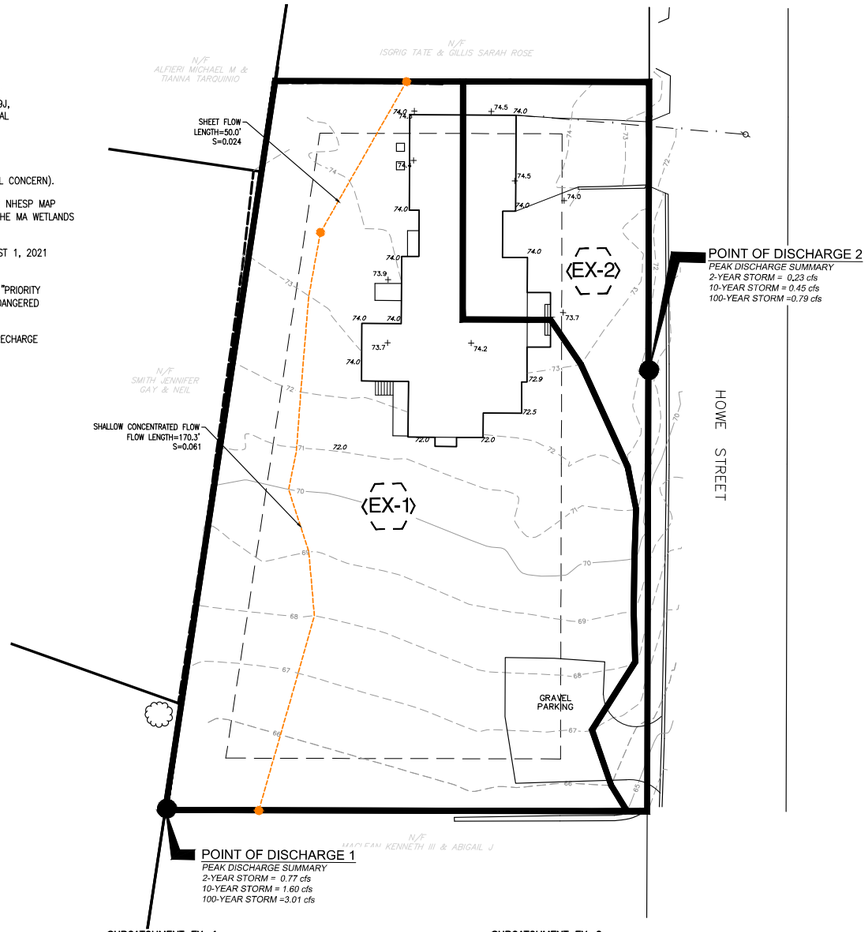
SEAN & MAIREN MARSHALL
22 HOWE STREET
HINGHAM, MA 02043
DEED BOOK 61124, PAGE 208
PLAN BOOK 1, PAGE 256

**FLOOD NOTE:**
BY GRAPHIC PLOTTING ONLY, THIS PROPERTY IS LOCATED IN ZONE "X" OF THE FLOOD INSURANCE RATE MAP, AS SHOWN ON COMMUNITY MAP No. 25023C0019J, WHICH BEARS AN EFFECTIVE DATE OF JULY 17, 2012, AND IS NOT IN A SPECIAL FLOOD HAZARD AREA.

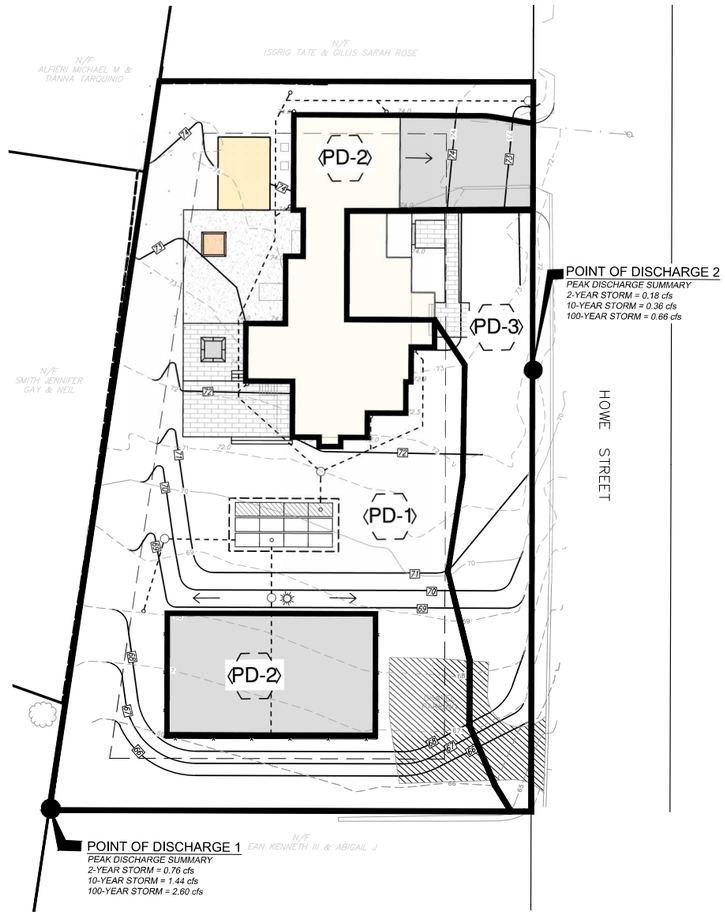
**ENVIRONMENTAL NOTES:**

1. SITE IS NOT LOCATED WITHIN AN A.C.E.C. (AREA OF CRITICAL ENVIRONMENTAL CONCERN).
2. SITE IS NOT WITHIN AN AREA OF ESTIMATED HABITAT OF RARE WILDLIFE PER NHESP MAP AUGUST 1, 2021 "ESTIMATED HABITATS OF RARE WILDLIFE" FOR USE WITH THE MA WETLANDS PROTECTION ACT REGULATIONS (310 CMR 10)."
3. SITE DOES NOT CONTAIN A CERTIFIED VERNAL POOL PER NHESP MAP AUGUST 1, 2021 "CERTIFIED VERNAL POOLS."
4. SITE IS NOT WITHIN A PRIORITY HABITAT PER NHESP MAP AUGUST 1, 2021 "PRIORITY HABITATS OF RARE SPECIES" FOR SPECIES UNDER THE MASSACHUSETTS ENDANGERED SPECIES ACT, REGULATIONS (321 CMR10).
5. SITE IS NOT LOCATED WITHIN A STATE APPROVED ZONE II GROUND WATER RECHARGE PROTECTION AREA.

## EXISTING WATERSHED




## PROPOSED WATERSHED




**SUBCATCHMENT EX-1**
ROOFS (HSG C): 2,203± SF
DECK (HSG C): 114± SF
GRASS, GOOD (HSG C): 17,264± SF
GRAVEL ROADS (HSG C): 1,265± SF
TOTAL AREA: 20,846± SF
CN: 78
TC: 6.0 MIN.

**SUBCATCHMENT EX-2**
ROOFS (HSG C): 1,020± SF
GRASS, GOOD (HSG C): 3,107± SF
PAVED PARKING (HSG C): 905± SF
TOTAL AREA: 5,032± SF
CN: 83
TC: 6.0 MIN

**SUBCATCHMENT PD-1**
PATIO/WALKWAY (HSG C): 795± SF
SHED (HSG C): 315± SF
GRAVEL ROADS (HSG C): 1,025± SF
GRASS, GOOD (HSG C): 13,518± SF
TOTAL AREA: 15,653± SF
CN: 77
TC: 6.0 MIN

**SUBCATCHMENT PD-2**
ROOFS (HSG C): 2,684± SF PAVED
PARKING (HSG C): 1,035± SF
SPORTS COURT (HSG C): 2,100± SF
TOTAL AREA: 5,819± SF
CN: 98
TC: 6.0 MIN

**SUBCATCHMENT PD-3**
ROOFS (HSG C): 539± SF
WALKWAY (HSG C): 476± SF
GRASS, GOOD (HSG C): 3,391± SF
TOTAL AREA: 4,406± SF
CN: 80
TC: 6.0 MIN

20 0 20 40 60
SCALE IN FEET

| REVISIONS | DATE |
|---|---|
| PEER REVIEW COMMENTS | 7/22/2026 |

EXHIBIT

HOMESTEAD CONSULTING ENGINEERS
2 SHARP STREET, UNIT A HINGHAM, MA 02043
HOMESTEADENG.COM

# WATERSHED PLAN
22 HOWE STREET
HINGHAM, MASSACHUSETTS 02043

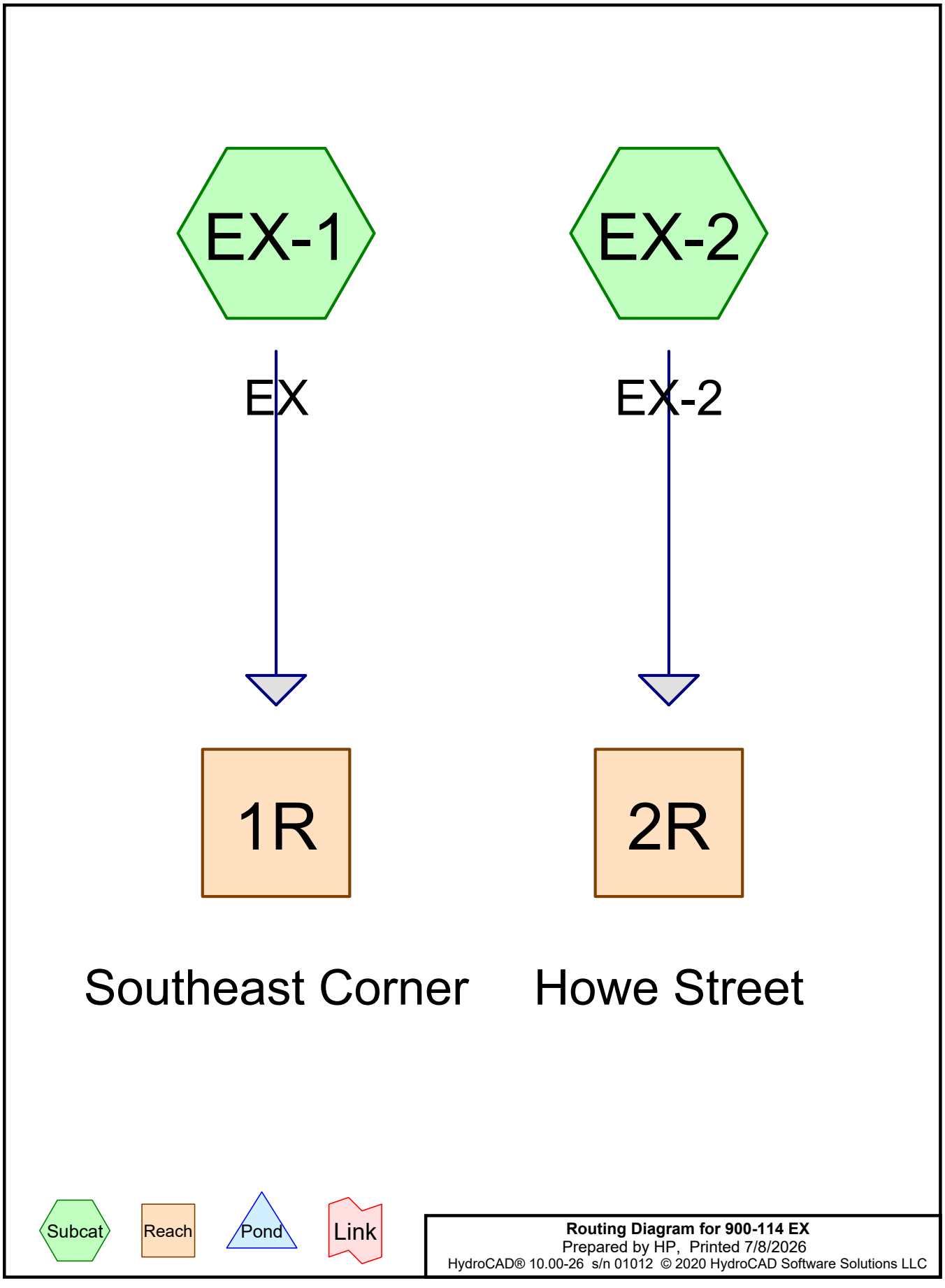
APPLICANT SEAN MARSHALL
22 HOWE STREET
HINGHAM, MA 02043

PROJECT NO: 900-1114
SCALE: 1" = 20'
DATE: 07-09-26

DRAWN BY: JRJ
DESIGNED BY:
CHECKED BY: JLG

WATERSHED PLAN

SHEET 1 OF 1




**Routing Diagram for 900-114 EX**
Prepared by HP, Printed 7/8/2026

## Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 20,371 | 74 | >75% Grass cover, Good, HSG C (EX-1, EX-2) |
| 114 | 98 | Deck, HSG C (EX-1) |
| 1,265 | 89 | Gravel roads, HSG C (EX-1) |
| 905 | 98 | Paved parking, HSG C (EX-2) |
| 3,223 | 98 | Roofs, HSG C (EX-1, EX-2) |
| **25,878** | **79** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (sq-ft) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0 | HSG A | |
| 0 | HSG B | |
| 25,878 | HSG C | EX-1, EX-2 |
| 0 | HSG D | |
| 0 | Other | |
| **25,878** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (sq-ft) | HSG-B (sq-ft) | HSG-C (sq-ft) | HSG-D (sq-ft) | Other (sq-ft) | Total (sq-ft) | Ground Cover | Su Nu |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 20,371 | 0 | 0 | 20,371 | >75% Grass cover, Good | |
| 0 | 0 | 114 | 0 | 0 | 114 | Deck | |
| 0 | 0 | 1,265 | 0 | 0 | 1,265 | Gravel roads | |
| 0 | 0 | 905 | 0 | 0 | 905 | Paved parking | |
| 0 | 0 | 3,223 | 0 | 0 | 3,223 | Roofs | |
| **0** | **0** | **25,878** | **0** | **0** | **25,878** | **TOTAL AREA** | |

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 EX-1: EX** Runoff Area=20,846 sf 11.11% Impervious Runoff Depth=1.41"
Tc=6.0 min CN=78 Runoff=0.77 cfs 2,457 cf

**Subcatchment EX-2: EX-2** Runoff Area=5,032 sf 38.26% Impervious Runoff Depth=1.77"
Tc=6.0 min CN=83 Runoff=0.23 cfs 741 cf

**Reach 1R: Southeast Corner** Inflow=0.77 cfs 2,457 cf
Outflow=0.77 cfs 2,457 cf

**Reach 2R: Howe Street** Inflow=0.23 cfs 741 cf
Outflow=0.23 cfs 741 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 3,198 cf Average Runoff Depth = 1.48"**
**83.61% Pervious = 21,636 sf 16.39% Impervious = 4,242 sf**

## Summary for Subcatchment EX-1: EX

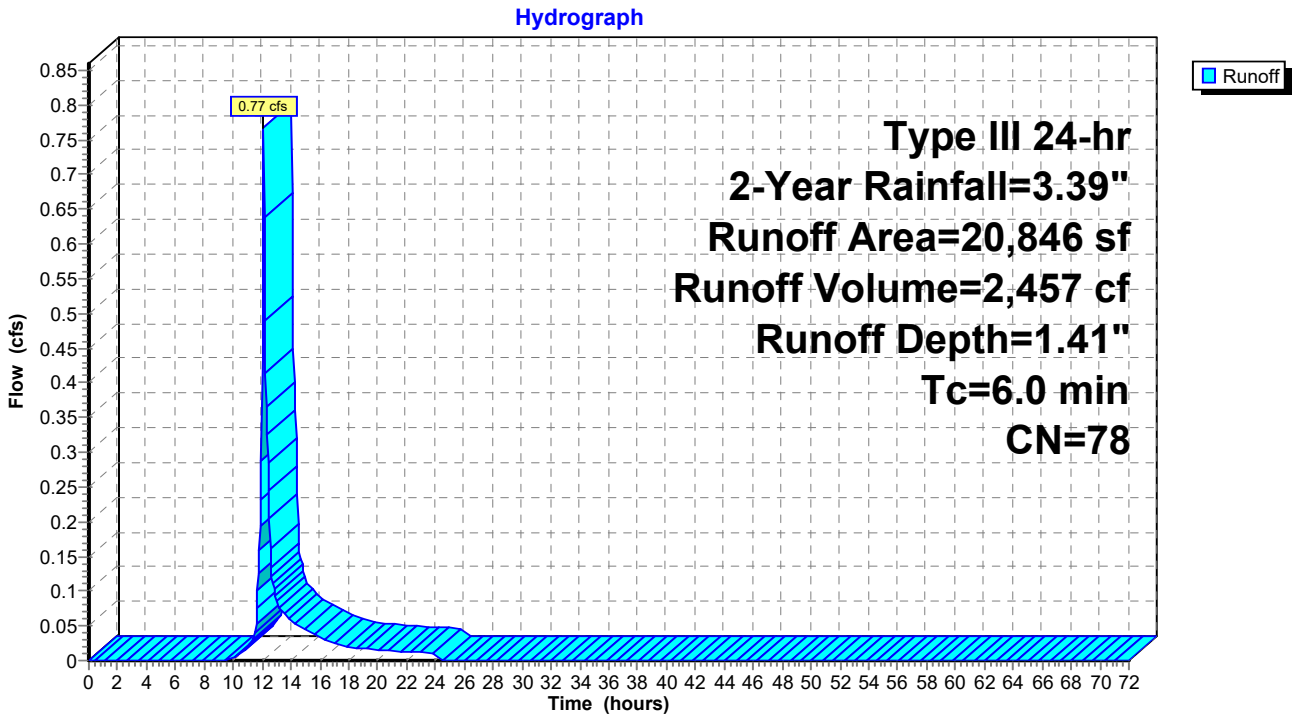
Runoff = 0.77 cfs @ 12.10 hrs, Volume= 2,457 cf, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,203 | 98 | Roofs, HSG C |
| | 17,264 | 74 | >75% Grass cover, Good, HSG C |
| | 1,265 | 89 | Gravel roads, HSG C |
| * | 114 | 98 | Deck, HSG C |
| | 20,846 | 78 | Weighted Average |
| | 18,529 | | 88.89% Pervious Area |
| | 2,317 | | 11.11% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-1: EX



## Summary for Subcatchment EX-2: EX-2

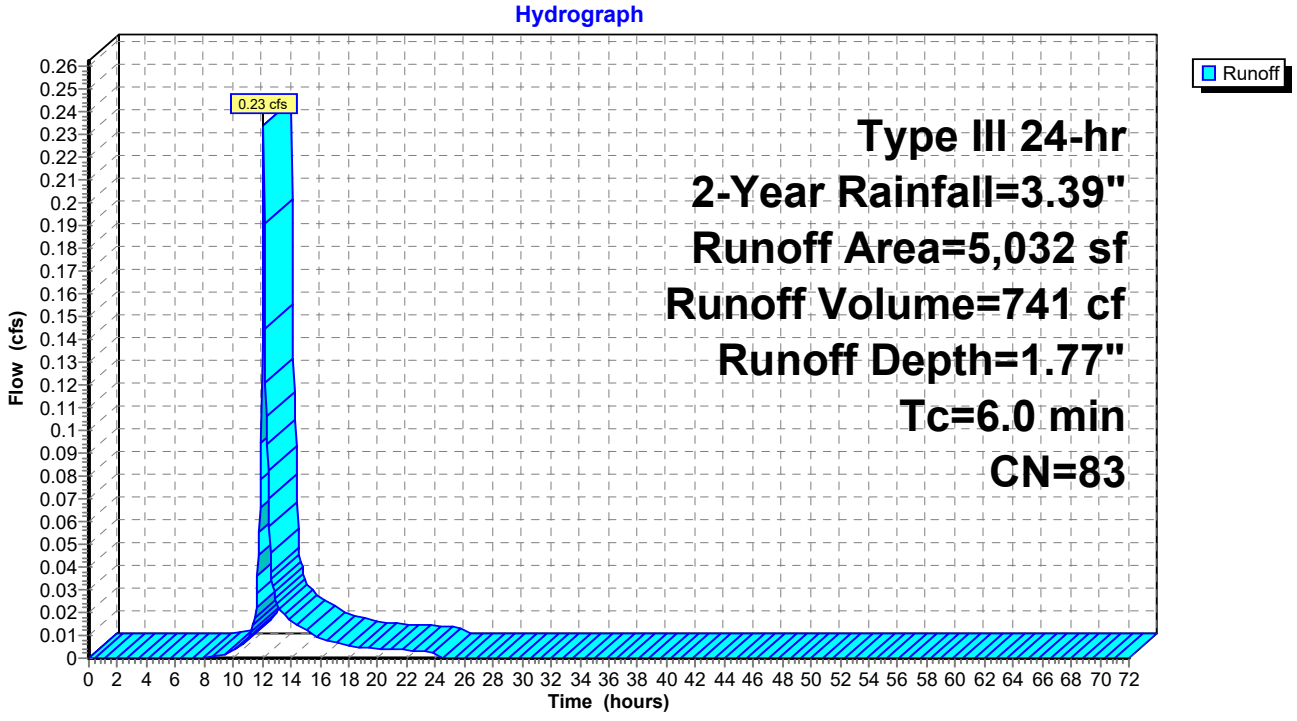
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 741 cf, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.39"

| Area (sf) | CN | Description |
|---|---|---|
| 905 | 98 | Paved parking, HSG C |
| 3,107 | 74 | >75% Grass cover, Good, HSG C |
| 1,020 | 98 | Roofs, HSG C |
| 5,032 | 83 | Weighted Average |
| 3,107 | | 61.74% Pervious Area |
| 1,925 | | 38.26% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-2: EX-2

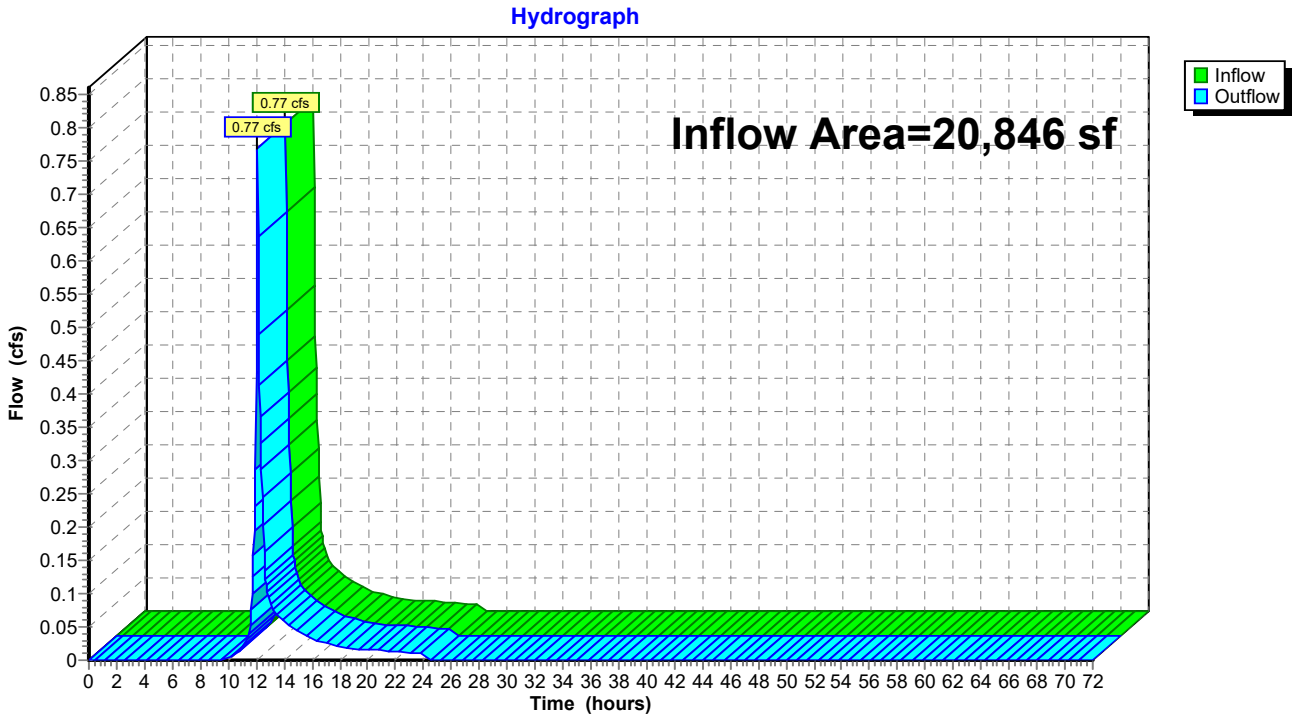


## Summary for Reach 1R: Southeast Corner

Inflow Area = 20,846 sf, 11.11% Impervious, Inflow Depth = 1.41" for 2-Year event
Inflow = 0.77 cfs @ 12.10 hrs, Volume= 2,457 cf
Outflow = 0.77 cfs @ 12.10 hrs, Volume= 2,457 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 1R: Southeast Corner

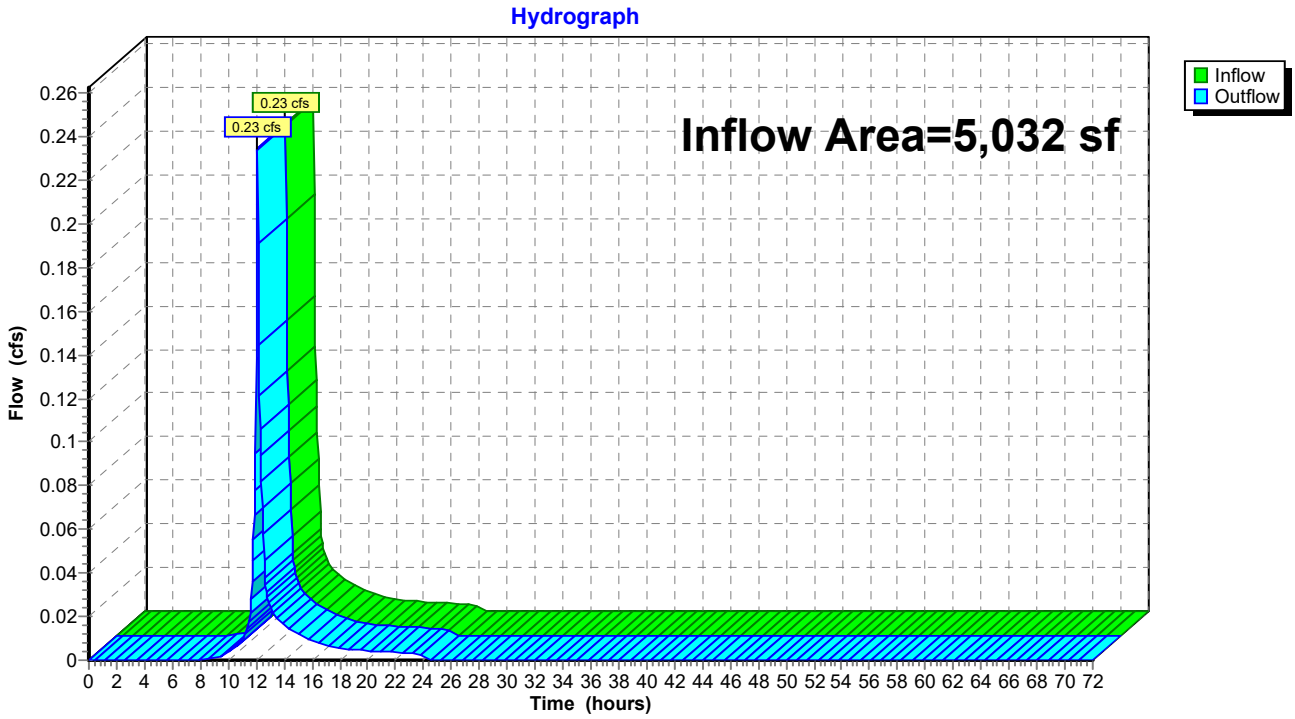


## Summary for Reach 2R: Howe Street

Inflow Area = 5,032 sf, 38.26% Impervious, Inflow Depth = 1.77" for 2-Year event
Inflow = 0.23 cfs @ 12.09 hrs, Volume= 741 cf
Outflow = 0.23 cfs @ 12.09 hrs, Volume= 741 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 2R: Howe Street



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 EX-1: EX** Runoff Area=20,846 sf 11.11% Impervious Runoff Depth=2.91"
Tc=6.0 min CN=78 Runoff=1.60 cfs 5,052 cf

**Subcatchment EX-2: EX-2** Runoff Area=5,032 sf 38.26% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=83 Runoff=0.45 cfs 1,419 cf

**Reach 1R: Southeast Corner** Inflow=1.60 cfs 5,052 cf
Outflow=1.60 cfs 5,052 cf

**Reach 2R: Howe Street** Inflow=0.45 cfs 1,419 cf
Outflow=0.45 cfs 1,419 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 6,470 cf Average Runoff Depth = 3.00"**
**83.61% Pervious = 21,636 sf 16.39% Impervious = 4,242 sf**

## Summary for Subcatchment EX-1: EX

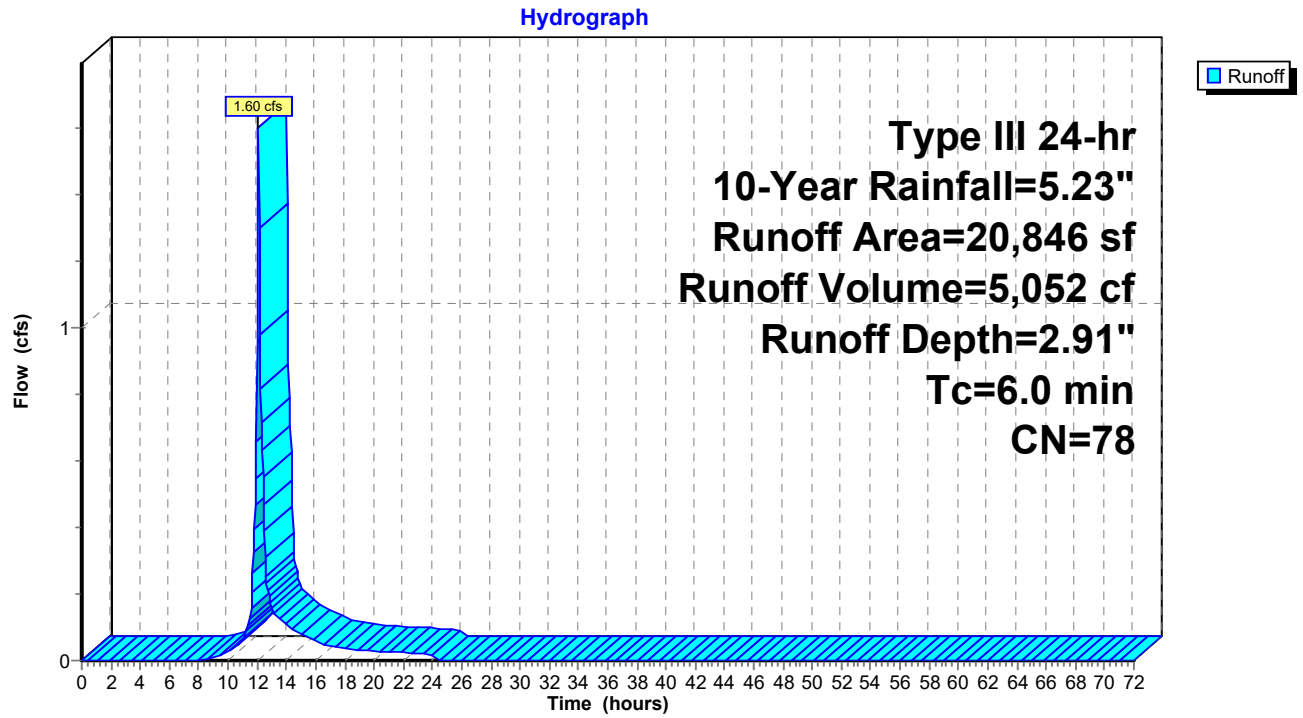
Runoff = 1.60 cfs @ 12.09 hrs, Volume= 5,052 cf, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.23"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,203 | 98 | Roofs, HSG C |
| | 17,264 | 74 | >75% Grass cover, Good, HSG C |
| | 1,265 | 89 | Gravel roads, HSG C |
| * | 114 | 98 | Deck, HSG C |
| | 20,846 | 78 | Weighted Average |
| | 18,529 | | 88.89% Pervious Area |
| | 2,317 | | 11.11% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-1: EX



## Summary for Subcatchment EX-2: EX-2

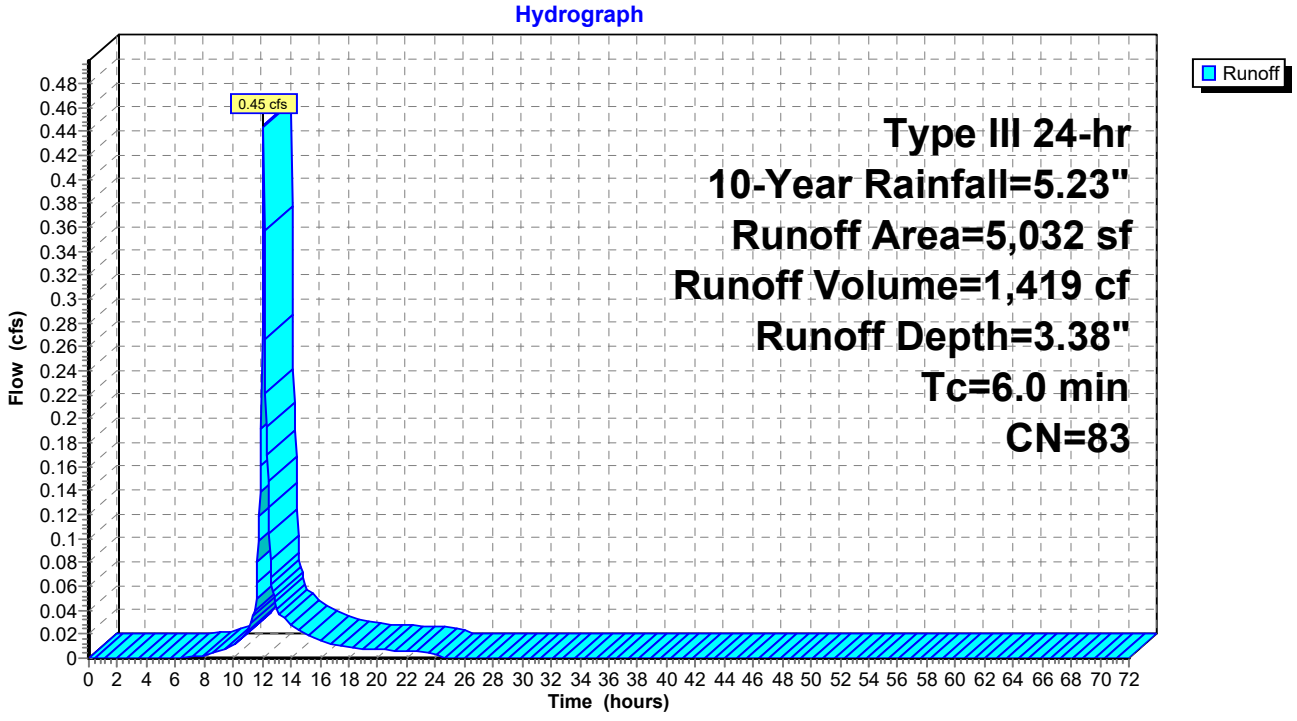
Runoff = 0.45 cfs @ 12.09 hrs, Volume= 1,419 cf, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.23"

| Area (sf) | CN | Description |
|---|---|---|
| 905 | 98 | Paved parking, HSG C |
| 3,107 | 74 | >75% Grass cover, Good, HSG C |
| 1,020 | 98 | Roofs, HSG C |
| 5,032 | 83 | Weighted Average |
| 3,107 | | 61.74% Pervious Area |
| 1,925 | | 38.26% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-2: EX-2

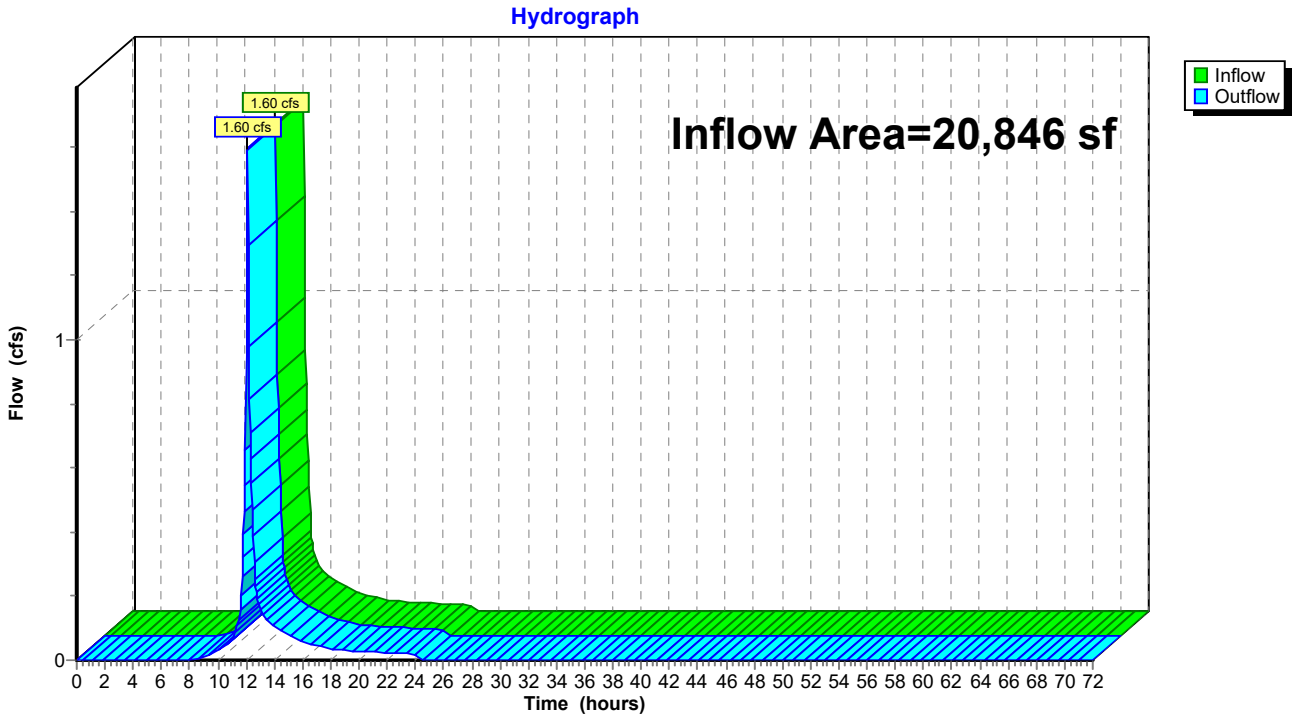


## Summary for Reach 1R: Southeast Corner

Inflow Area = 20,846 sf, 11.11% Impervious, Inflow Depth = 2.91" for 10-Year event
Inflow = 1.60 cfs @ 12.09 hrs, Volume= 5,052 cf
Outflow = 1.60 cfs @ 12.09 hrs, Volume= 5,052 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 1R: Southeast Corner

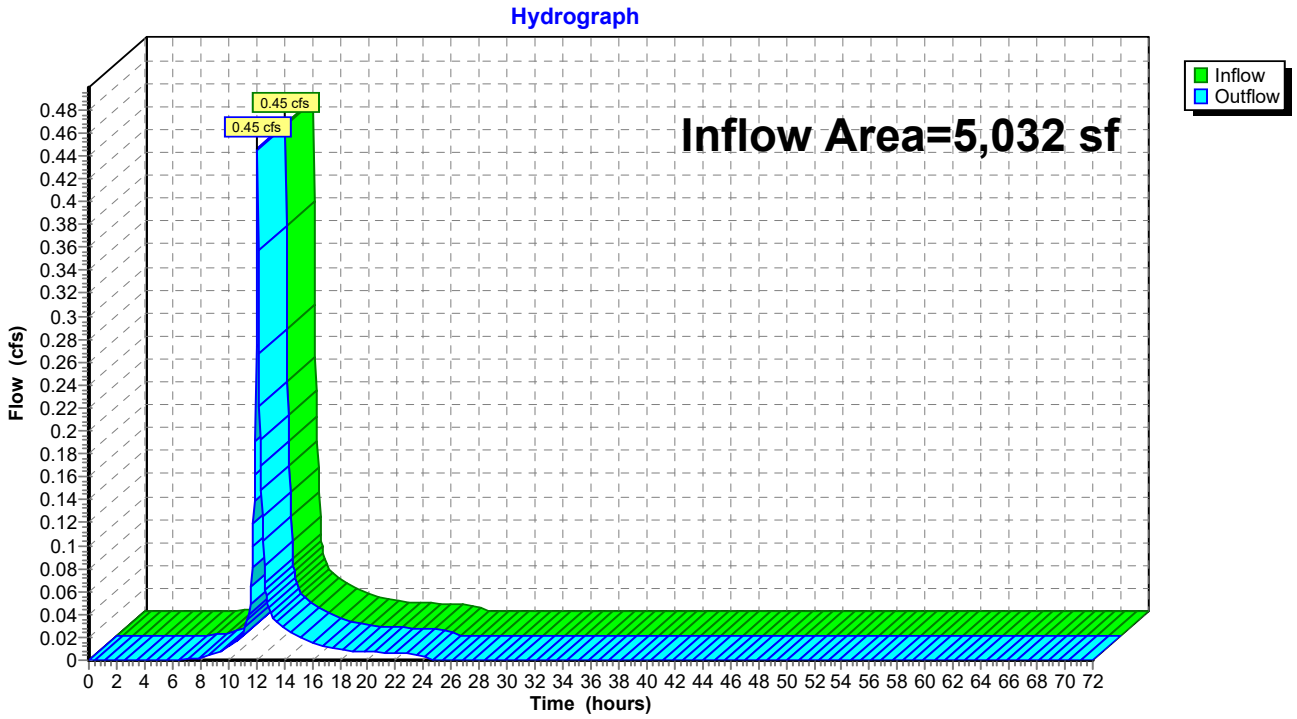


## Summary for Reach 2R: Howe Street

Inflow Area = 5,032 sf, 38.26% Impervious, Inflow Depth = 3.38" for 10-Year event
Inflow = 0.45 cfs @ 12.09 hrs, Volume= 1,419 cf
Outflow = 0.45 cfs @ 12.09 hrs, Volume= 1,419 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 2R: Howe Street



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 EX-1: EX** Runoff Area=20,846 sf 11.11% Impervious Runoff Depth=3.92"
Tc=6.0 min CN=78 Runoff=2.15 cfs 6,804 cf

**Subcatchment EX-2: EX-2** Runoff Area=5,032 sf 38.26% Impervious Runoff Depth=4.45"
Tc=6.0 min CN=83 Runoff=0.58 cfs 1,864 cf

**Reach 1R: Southeast Corner** Inflow=2.15 cfs 6,804 cf
Outflow=2.15 cfs 6,804 cf

**Reach 2R: Howe Street** Inflow=0.58 cfs 1,864 cf
Outflow=0.58 cfs 1,864 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 8,668 cf Average Runoff Depth = 4.02"**
**83.61% Pervious = 21,636 sf 16.39% Impervious = 4,242 sf**

## Summary for Subcatchment EX-1: EX

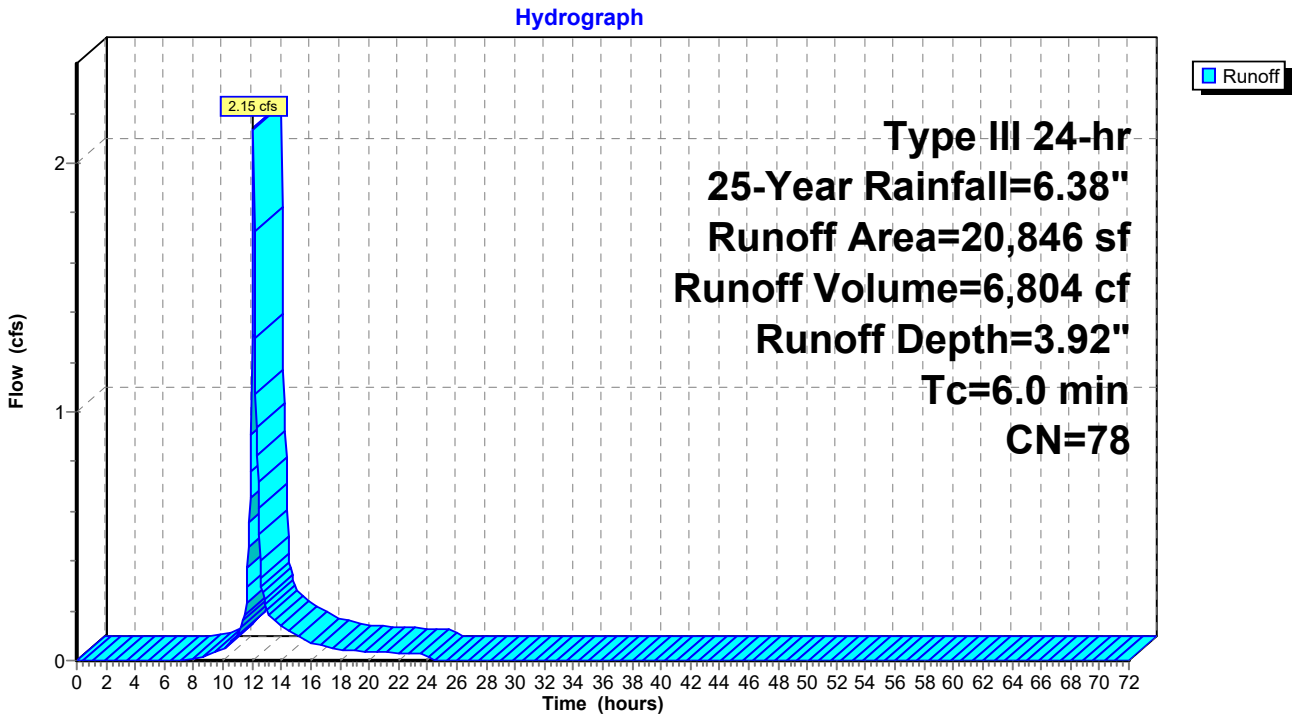
Runoff = 2.15 cfs @ 12.09 hrs, Volume= 6,804 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.38"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,203 | 98 | Roofs, HSG C |
| | 17,264 | 74 | >75% Grass cover, Good, HSG C |
| | 1,265 | 89 | Gravel roads, HSG C |
| * | 114 | 98 | Deck, HSG C |
| | 20,846 | 78 | Weighted Average |
| | 18,529 | | 88.89% Pervious Area |
| | 2,317 | | 11.11% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-1: EX



## Summary for Subcatchment EX-2: EX-2

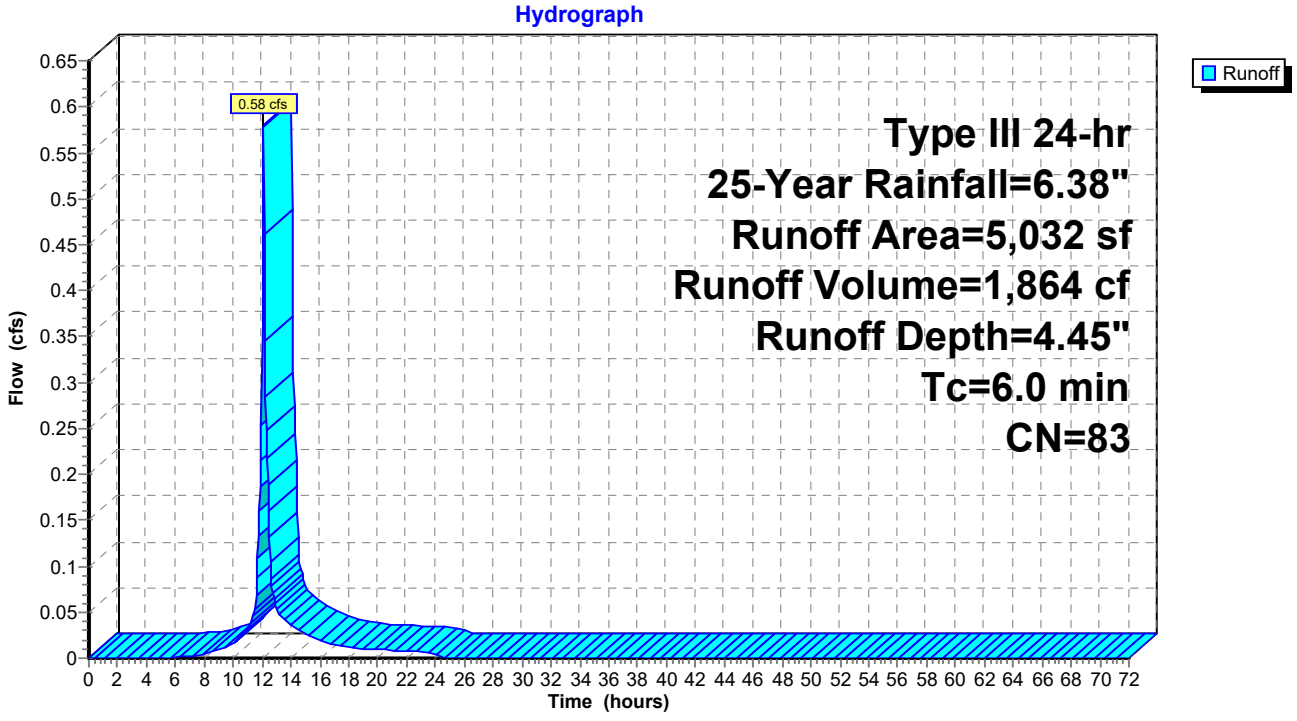
Runoff = 0.58 cfs @ 12.09 hrs, Volume= 1,864 cf, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.38"

| Area (sf) | CN | Description |
|---|---|---|
| 905 | 98 | Paved parking, HSG C |
| 3,107 | 74 | >75% Grass cover, Good, HSG C |
| 1,020 | 98 | Roofs, HSG C |
| 5,032 | 83 | Weighted Average |
| 3,107 | | 61.74% Pervious Area |
| 1,925 | | 38.26% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-2: EX-2

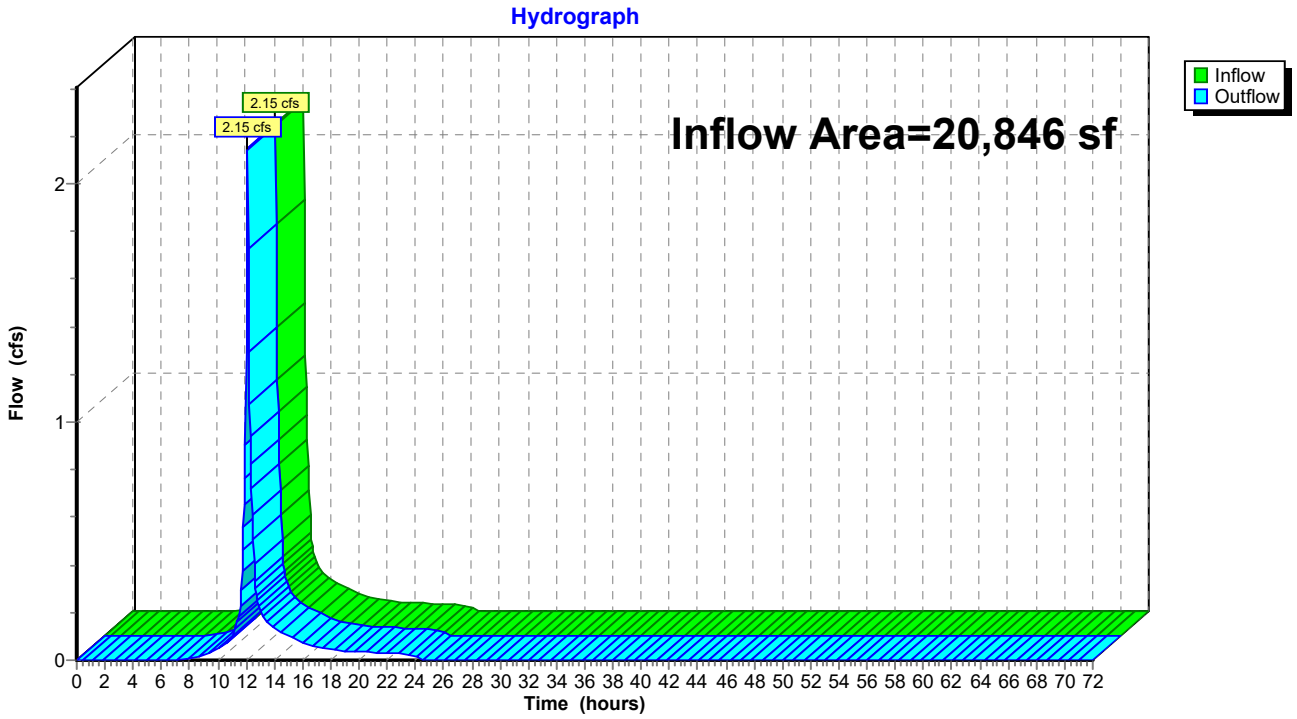


## Summary for Reach 1R: Southeast Corner

Inflow Area = 20,846 sf, 11.11% Impervious, Inflow Depth = 3.92" for 25-Year event
Inflow = 2.15 cfs @ 12.09 hrs, Volume= 6,804 cf
Outflow = 2.15 cfs @ 12.09 hrs, Volume= 6,804 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 1R: Southeast Corner

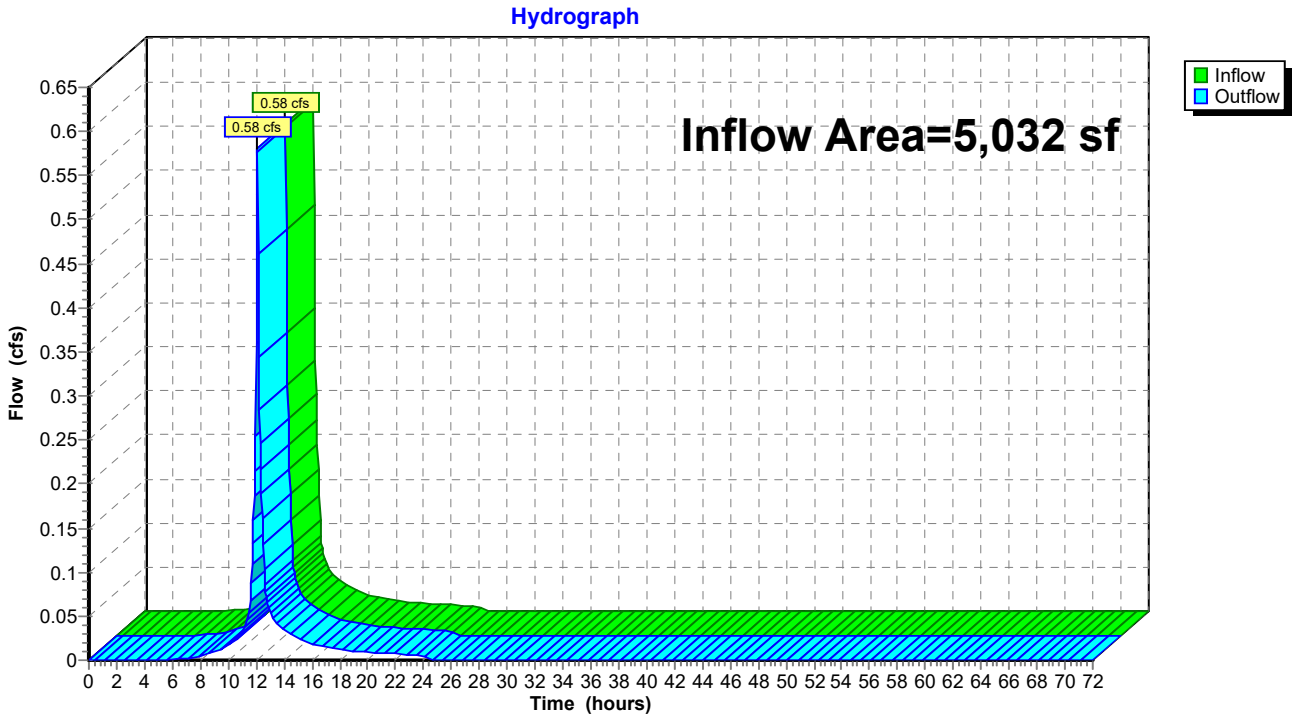


## Summary for Reach 2R: Howe Street

Inflow Area = 5,032 sf, 38.26% Impervious, Inflow Depth = 4.45" for 25-Year event
Inflow = 0.58 cfs @ 12.09 hrs, Volume= 1,864 cf
Outflow = 0.58 cfs @ 12.09 hrs, Volume= 1,864 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 2R: Howe Street



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 EX-1: EX** Runoff Area=20,846 sf 11.11% Impervious Runoff Depth=5.54"
Tc=6.0 min CN=78 Runoff=3.01 cfs 9,622 cf

**Subcatchment EX-2: EX-2** Runoff Area=5,032 sf 38.26% Impervious Runoff Depth=6.13"
Tc=6.0 min CN=83 Runoff=0.79 cfs 2,571 cf

**Reach 1R: Southeast Corner** Inflow=3.01 cfs 9,622 cf
Outflow=3.01 cfs 9,622 cf

**Reach 2R: Howe Street** Inflow=0.79 cfs 2,571 cf
Outflow=0.79 cfs 2,571 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 12,193 cf Average Runoff Depth = 5.65"**
**83.61% Pervious = 21,636 sf 16.39% Impervious = 4,242 sf**

## Summary for Subcatchment EX-1: EX

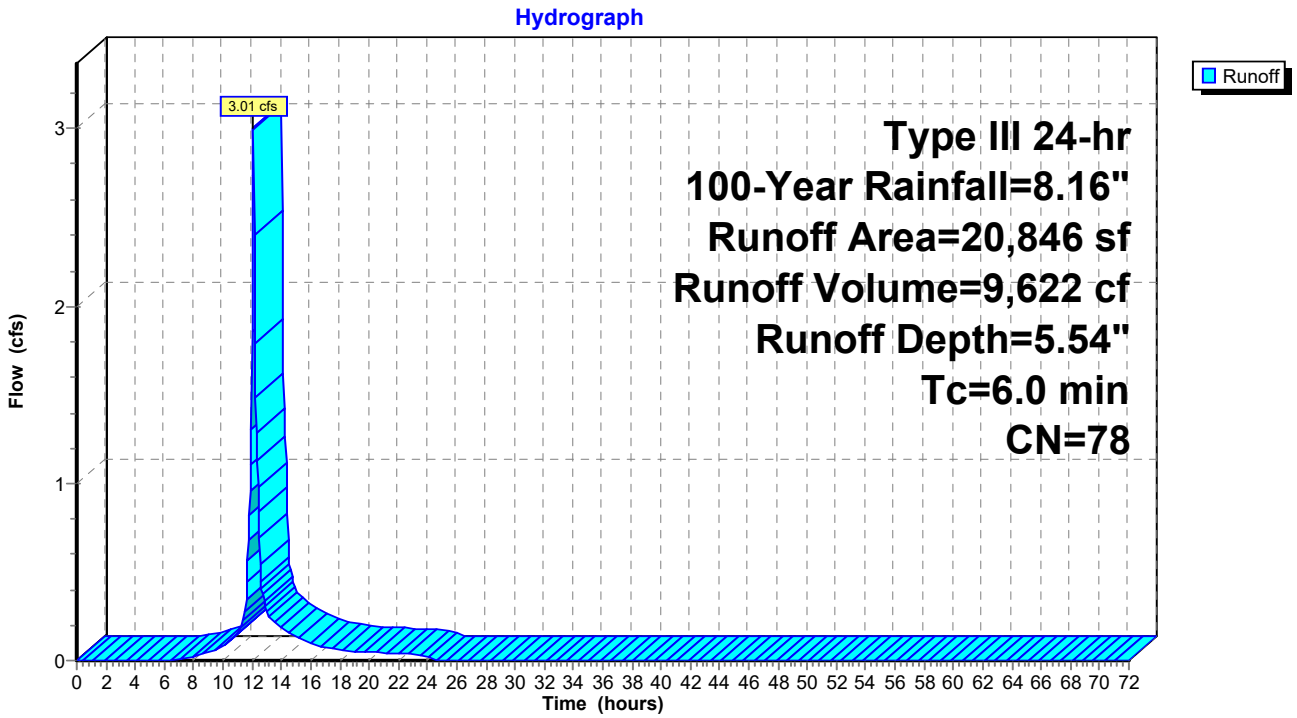
Runoff = 3.01 cfs @ 12.09 hrs, Volume= 9,622 cf, Depth= 5.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,203 | 98 | Roofs, HSG C |
| | 17,264 | 74 | >75% Grass cover, Good, HSG C |
| | 1,265 | 89 | Gravel roads, HSG C |
| * | 114 | 98 | Deck, HSG C |
| | 20,846 | 78 | Weighted Average |
| | 18,529 | | 88.89% Pervious Area |
| | 2,317 | | 11.11% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-1: EX



## Summary for Subcatchment EX-2: EX-2

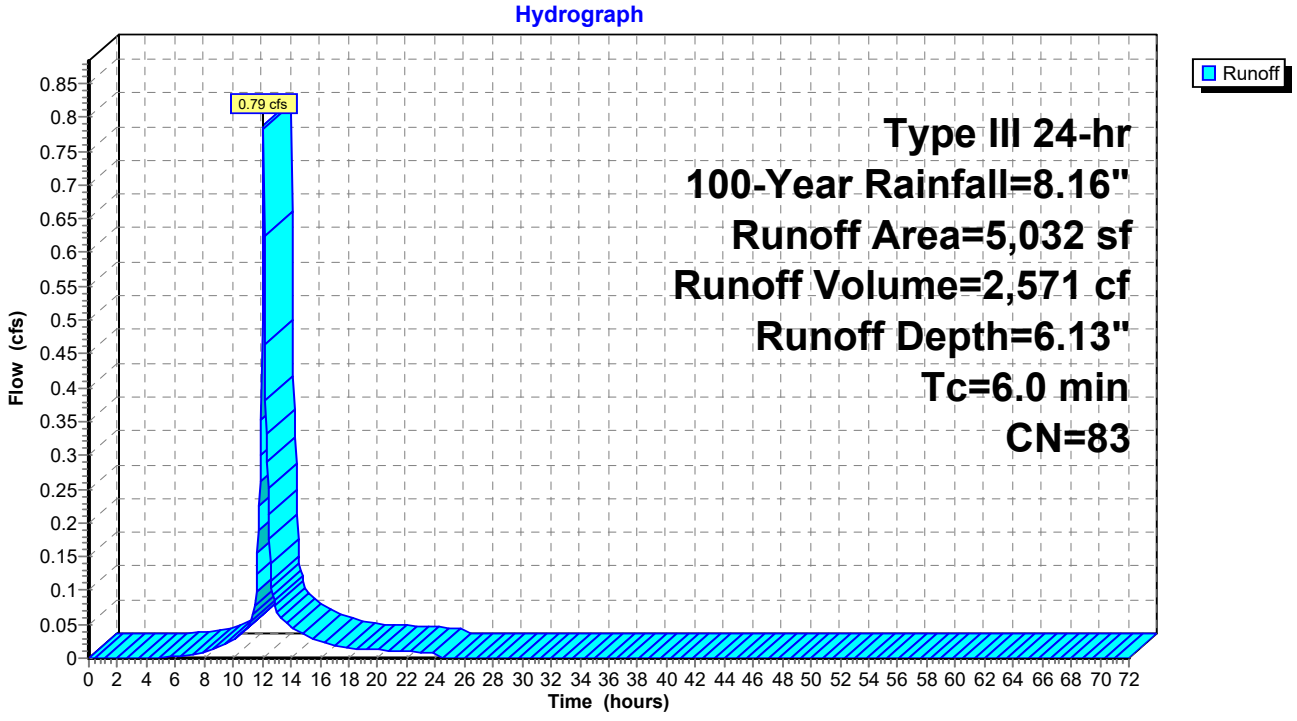
Runoff = 0.79 cfs @ 12.09 hrs, Volume= 2,571 cf, Depth= 6.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

| Area (sf) | CN | Description |
|---|---|---|
| 905 | 98 | Paved parking, HSG C |
| 3,107 | 74 | >75% Grass cover, Good, HSG C |
| 1,020 | 98 | Roofs, HSG C |
| 5,032 | 83 | Weighted Average |
| 3,107 | | 61.74% Pervious Area |
| 1,925 | | 38.26% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment EX-2: EX-2

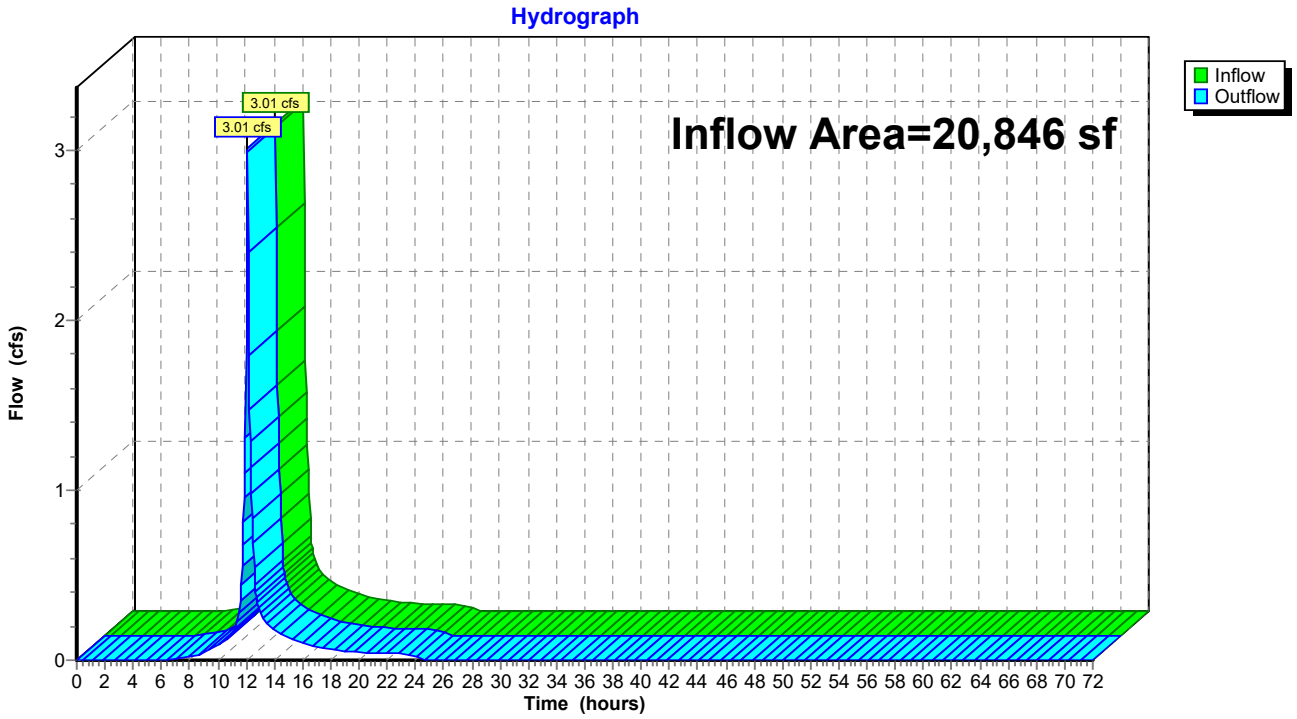


## Summary for Reach 1R: Southeast Corner

Inflow Area = 20,846 sf, 11.11% Impervious, Inflow Depth = 5.54" for 100-Year event
Inflow = 3.01 cfs @ 12.09 hrs, Volume= 9,622 cf
Outflow = 3.01 cfs @ 12.09 hrs, Volume= 9,622 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 1R: Southeast Corner

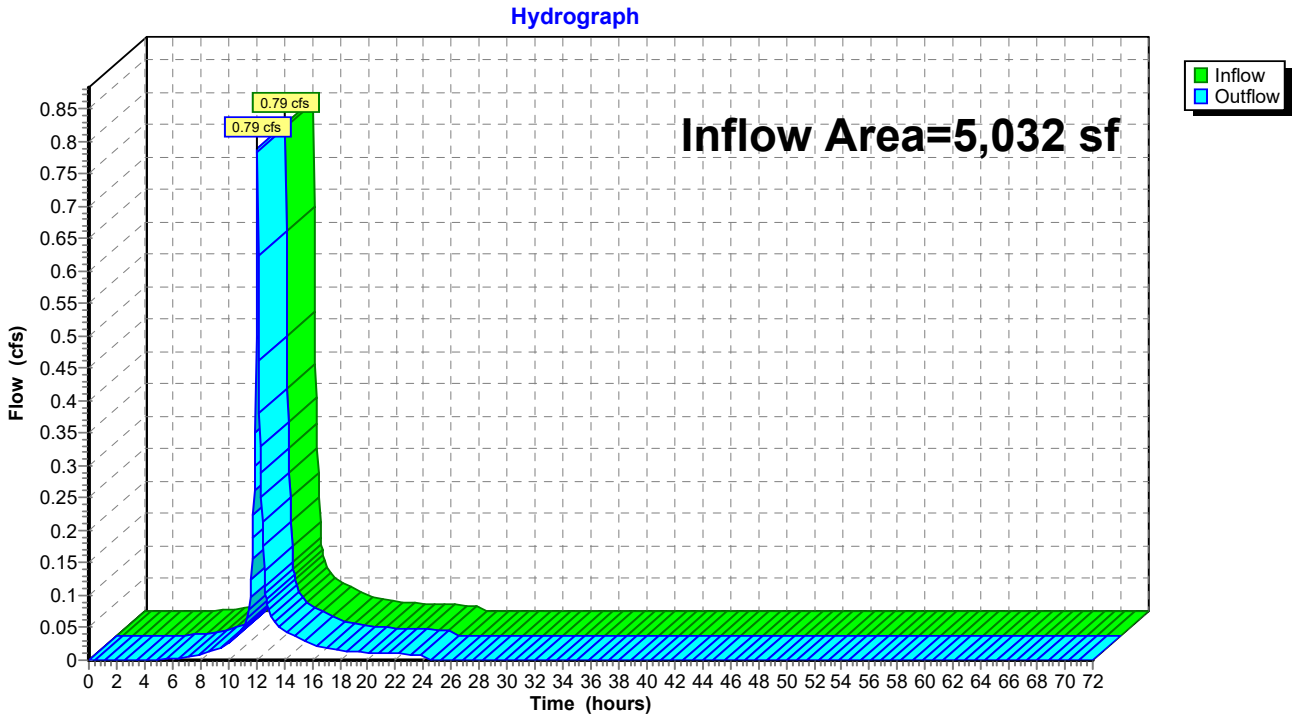


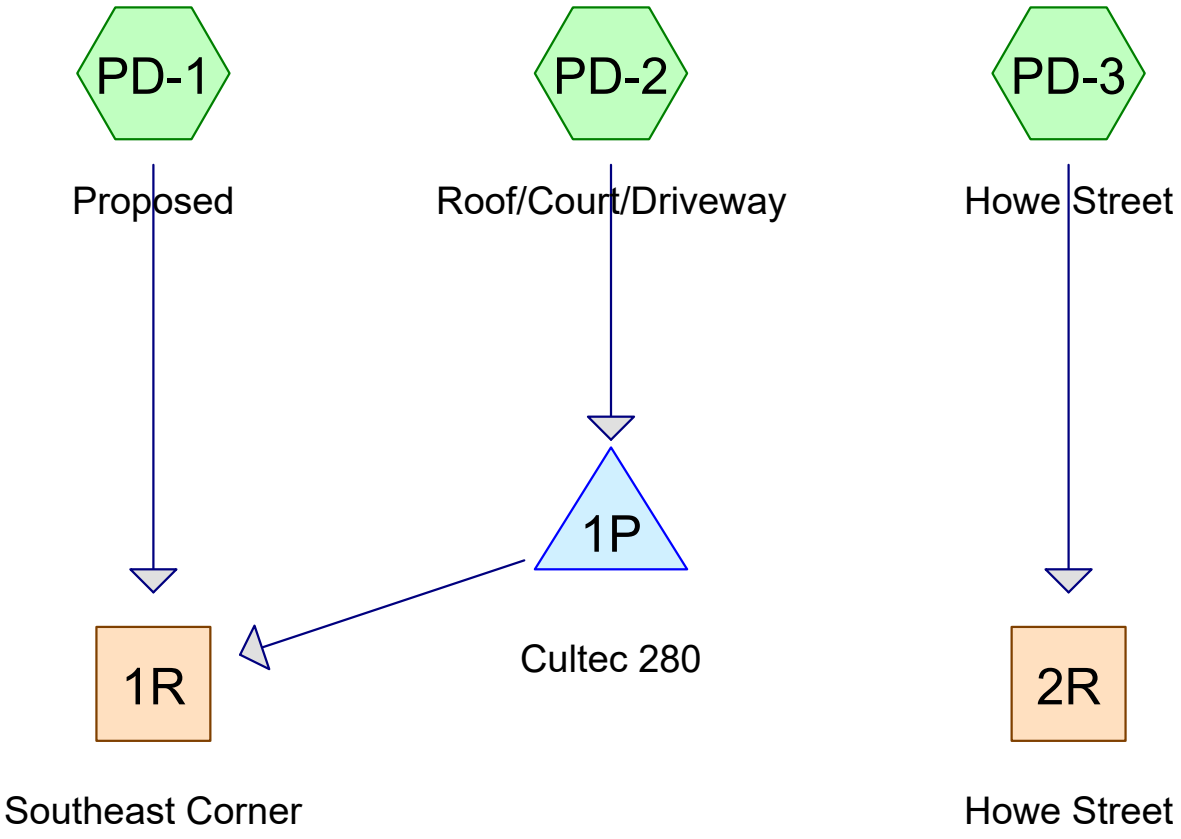
## Summary for Reach 2R: Howe Street

Inflow Area = 5,032 sf, 38.26% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 2,571 cf
Outflow = 0.79 cfs @ 12.09 hrs, Volume= 2,571 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 2R: Howe Street






Subcat Reach Pond Link

**Routing Diagram for 900-114 PD**
Prepared by HP, Printed 7/22/2026

## Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 16,909 | 74 | >75% Grass cover, Good, HSG C (PD-1, PD-3) |
| 476 | 98 | Front Walk, HSG C (PD-3) |
| 1,025 | 89 | Gravel roads, HSG C (PD-1) |
| 795 | 98 | Patios/Walkway, HSG C (PD-1) |
| 1,035 | 98 | Paved parking, HSG C (PD-2) |
| 3,223 | 98 | Roofs, HSG C (PD-2, PD-3) |
| 315 | 98 | Shed, HSG C (PD-1) |
| 2,100 | 98 | Sports Court, HSG C (PD-2) |
| **25,878** | **82** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (sq-ft) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0 | HSG A | |
| 0 | HSG B | |
| 25,878 | HSG C | PD-1, PD-2, PD-3 |
| 0 | HSG D | |
| 0 | Other | |
| **25,878** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (sq-ft) | HSG-B (sq-ft) | HSG-C (sq-ft) | HSG-D (sq-ft) | Other (sq-ft) | Total (sq-ft) | Ground Cover | Su Nu |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 16,909 | 0 | 0 | 16,909 | >75% Grass cover, Good | |
| 0 | 0 | 476 | 0 | 0 | 476 | Front Walk | |
| 0 | 0 | 1,025 | 0 | 0 | 1,025 | Gravel roads | |
| 0 | 0 | 795 | 0 | 0 | 795 | Patios/Walkway | |
| 0 | 0 | 1,035 | 0 | 0 | 1,035 | Paved parking | |
| 0 | 0 | 3,223 | 0 | 0 | 3,223 | Roofs | |
| 0 | 0 | 315 | 0 | 0 | 315 | Shed | |
| 0 | 0 | 2,100 | 0 | 0 | 2,100 | Sports Court | |
| **0** | **0** | **25,878** | **0** | **0** | **25,878** | **TOTAL AREA** | |

## Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1P | 65.50 | 65.44 | 5.7 | 0.0105 | 0.012 | 4.0 | 0.0 | 0.0 |

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 PD-1: Proposed** Runoff Area=15,653 sf 7.09% Impervious Runoff Depth=1.35"
Tc=6.0 min CN=77 Runoff=0.55 cfs 1,760 cf

**Subcatchment PD-2: Roof/Court/Driveway** Runoff Area=5,819 sf 100.00% Impervious Runoff Depth=3.16"
Tc=6.0 min CN=98 Runoff=0.43 cfs 1,531 cf

**Subcatchment PD-3: Howe Street** Runoff Area=4,406 sf 23.04% Impervious Runoff Depth=1.55"
Tc=6.0 min CN=80 Runoff=0.18 cfs 569 cf

**Reach 1R: Southeast Corner** Inflow=0.76 cfs 3,074 cf
Outflow=0.76 cfs 3,074 cf

**Reach 2R: Howe Street** Inflow=0.18 cfs 569 cf
Outflow=0.18 cfs 569 cf

**Pond 1P: Cultec 280** Peak Elev=66.17' Storage=468 cf Inflow=0.43 cfs 1,531 cf
4.0" Round Culvert n=0.012 L=5.7' S=0.0105 '/' Outflow=0.24 cfs 1,314 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 3,860 cf Average Runoff Depth = 1.79"**
**69.30% Pervious = 17,934 sf 30.70% Impervious = 7,944 sf**

## Summary for Subcatchment PD-1: Proposed

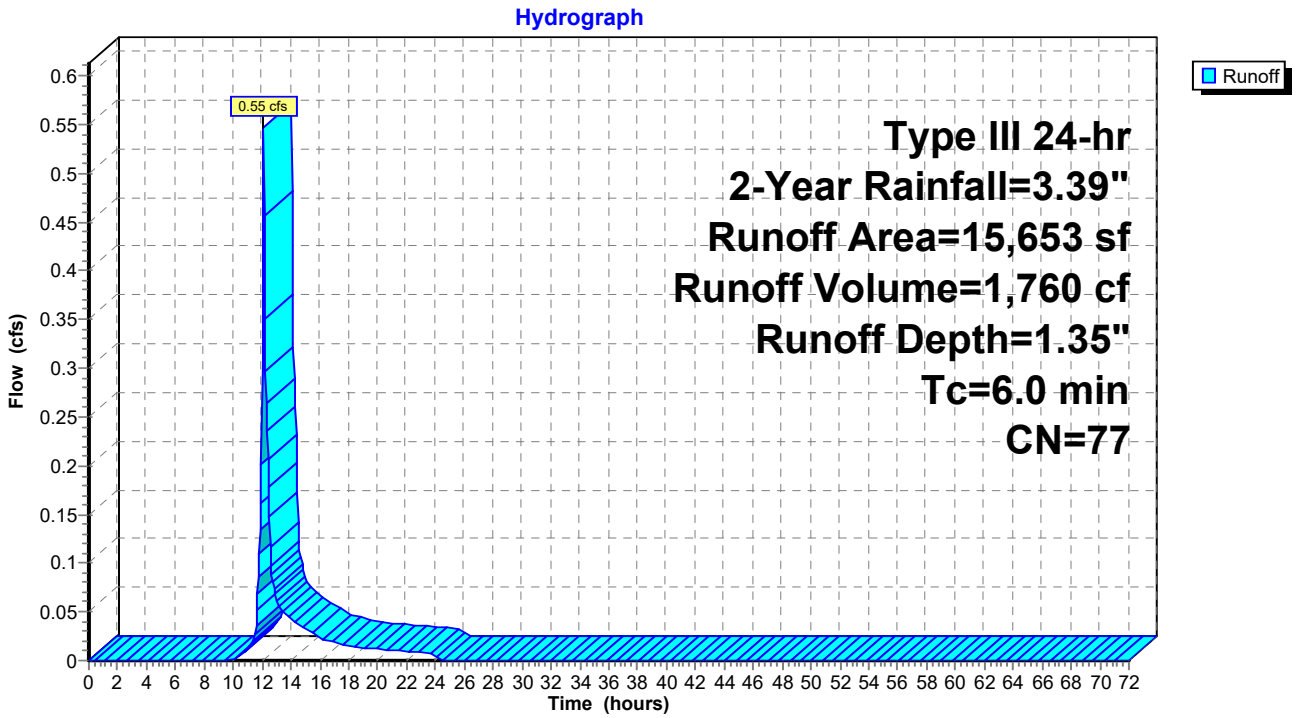
Runoff = 0.55 cfs @ 12.10 hrs, Volume= 1,760 cf, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 795 | 98 | Patios/Walkway, HSG C |
| * | 315 | 98 | Shed, HSG C |
| | 1,025 | 89 | Gravel roads, HSG C |
| | 13,518 | 74 | >75% Grass cover, Good, HSG C |
| | 15,653 | 77 | Weighted Average |
| | 14,543 | | 92.91% Pervious Area |
| | 1,110 | | 7.09% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

### Subcatchment PD-1: Proposed



## Summary for Subcatchment PD-2: Roof/Court/Driveway

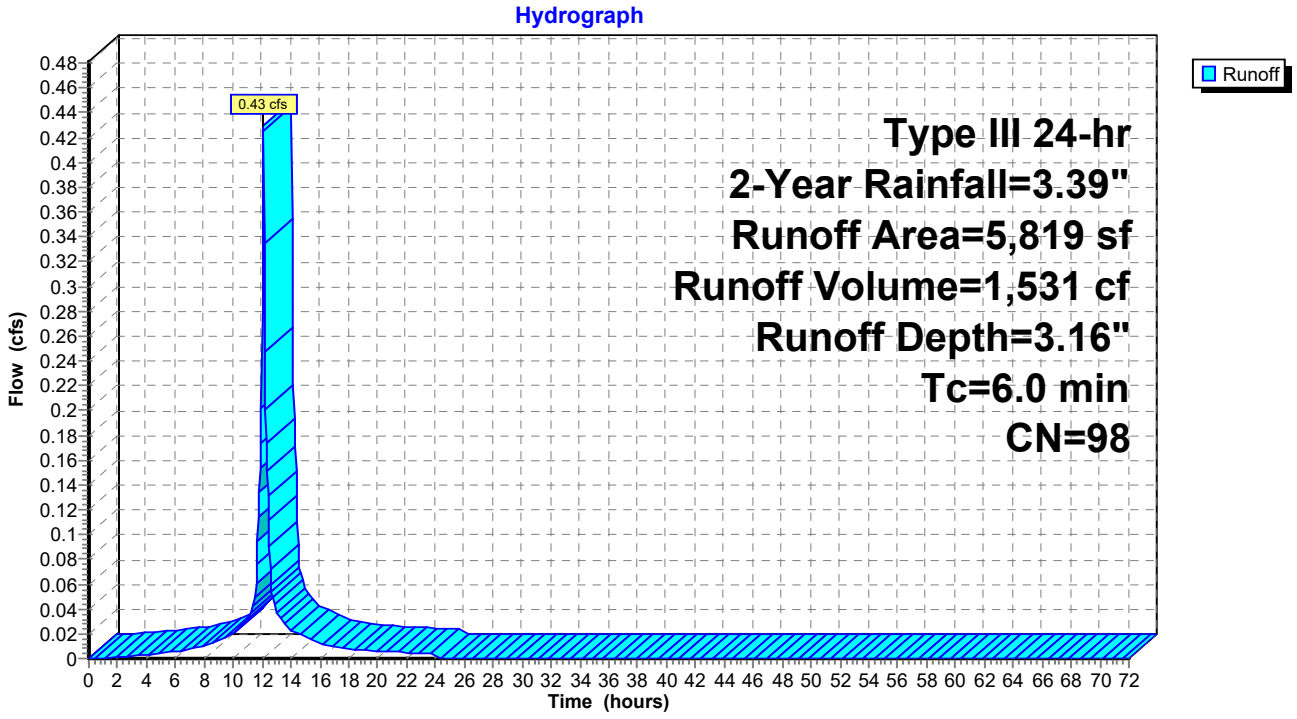
Runoff = 0.43 cfs @ 12.09 hrs, Volume= 1,531 cf, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,684 | 98 | Roofs, HSG C |
| | 1,035 | 98 | Paved parking, HSG C |
| * | 2,100 | 98 | Sports Court, HSG C |
| | 5,819 | 98 | Weighted Average |
| | 5,819 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-2: Roof/Court/Driveway



## Summary for Subcatchment PD-3: Howe Street

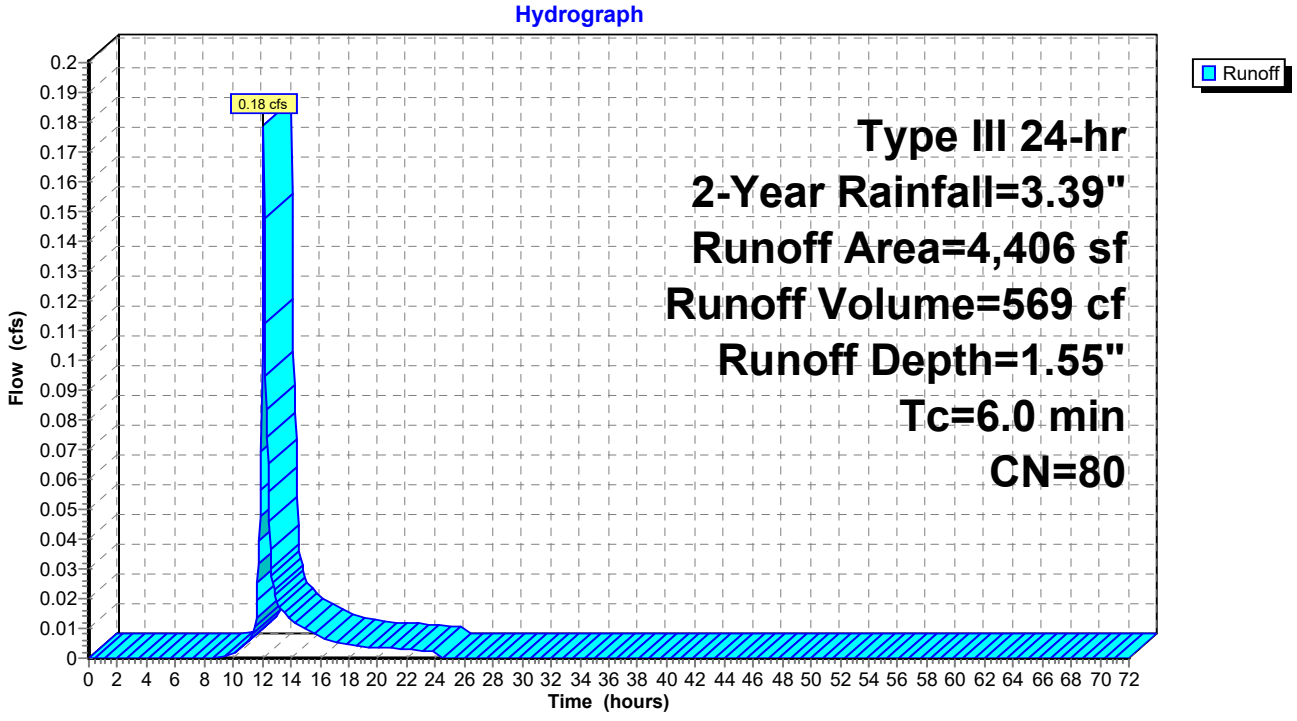
Runoff = 0.18 cfs @ 12.10 hrs, Volume= 569 cf, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 539 | 98 | Roofs, HSG C |
| * | 476 | 98 | Front Walk, HSG C |
| | 3,391 | 74 | >75% Grass cover, Good, HSG C |
| | 4,406 | 80 | Weighted Average |
| | 3,391 | | 76.96% Pervious Area |
| | 1,015 | | 23.04% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-3: Howe Street

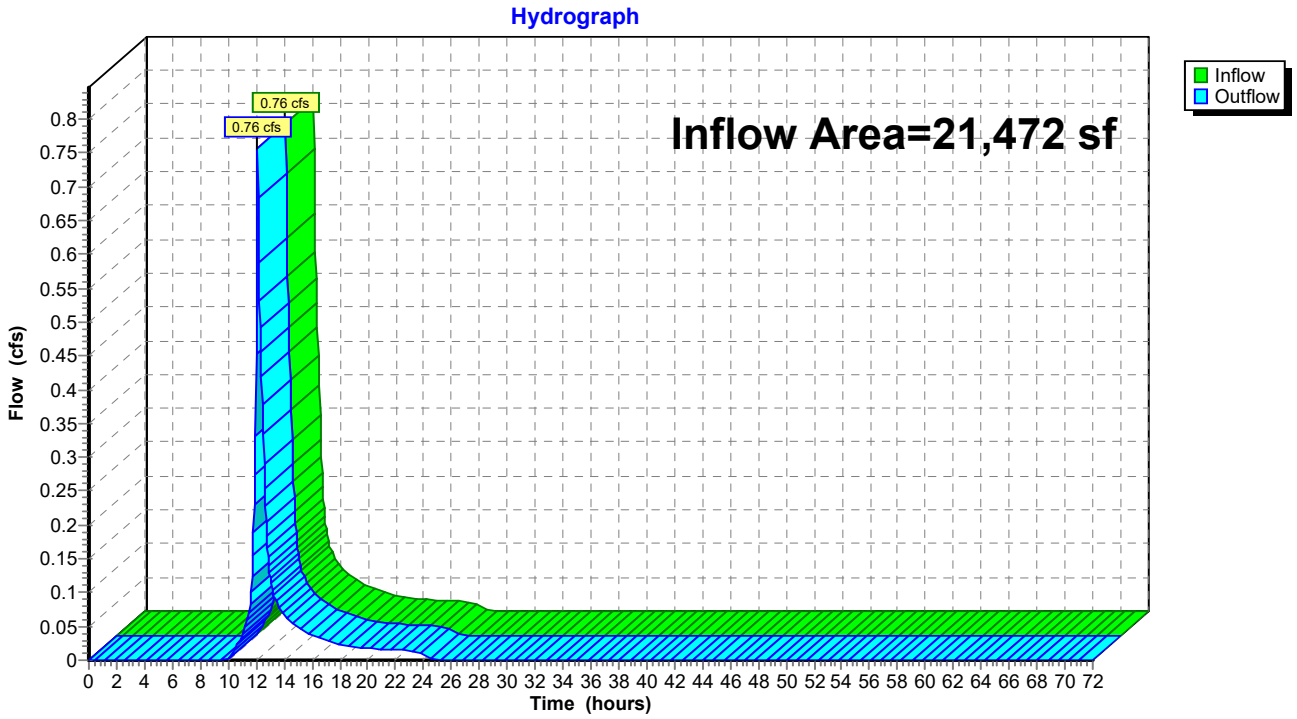


## Summary for Reach 1R: Southeast Corner

Inflow Area = 21,472 sf, 32.27% Impervious, Inflow Depth = 1.72" for 2-Year event
Inflow = 0.76 cfs @ 12.10 hrs, Volume= 3,074 cf
Outflow = 0.76 cfs @ 12.10 hrs, Volume= 3,074 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 1R: Southeast Corner

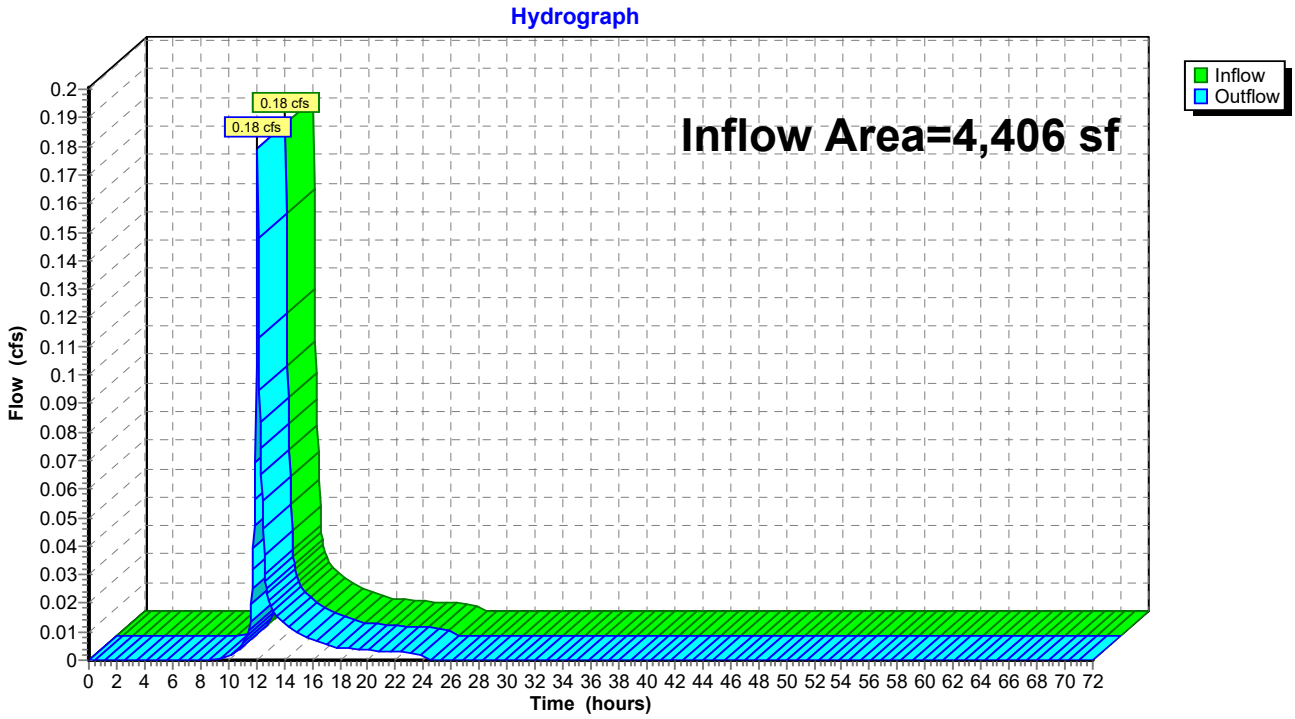


## Summary for Reach 2R: Howe Street

Inflow Area = 4,406 sf, 23.04% Impervious, Inflow Depth = 1.55" for 2-Year event
Inflow = 0.18 cfs @ 12.10 hrs, Volume= 569 cf
Outflow = 0.18 cfs @ 12.10 hrs, Volume= 569 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 2R: Howe Street



## Summary for Pond 1P: Cultec 280

Inflow Area = 5,819 sf,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 1,531 cf
Outflow = 0.24 cfs @ 12.22 hrs, Volume= 1,314 cf, Atten= 45%, Lag= 7.8 min
Primary = 0.24 cfs @ 12.22 hrs, Volume= 1,314 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 66.17' @ 12.22 hrs Surf.Area= 480 sf Storage= 468 cf

Plug-Flow detention time= 140.0 min calculated for 1,314 cf (86% of inflow)
Center-of-Mass det. time= 77.0 min ( 832.2 - 755.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 64.69' | 405 cf | **15.25'W x 31.50'L x 3.21'H Field A**<br>1,541 cf Overall - 528 cf Embedded = 1,013 cf x 40.0% Voids |
| #2A | 65.19' | 528 cf | **Cultec R-280HD** x 12 Inside #1<br>Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf<br>Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap<br>Row Length Adjustment= +1.00' x 6.07 sf x 3 rows |
| | | 933 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 65.50' | **4.0" Round Culvert**<br>L= 5.7' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 65.50' / 65.44' S= 0.0105 '/' Cc= 0.900<br>n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.09 sf |

**Primary OutFlow** Max=0.24 cfs @ 12.22 hrs HW=66.17' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.24 cfs @ 2.70 fps)

## Pond 1P: Cultec 280 - Chamber Wizard Field A

**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 3 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

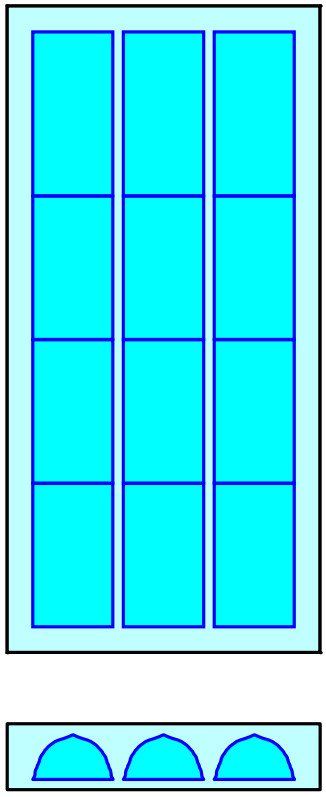
4 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 29.00' Row Length +15.0" End Stone x 2 = 31.50' Base Length
3 Rows x 47.0" Wide + 6.0" Spacing x 2 + 15.0" Side Stone x 2 = 15.25' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

12 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 3 Rows = 528.2 cf Chamber Storage

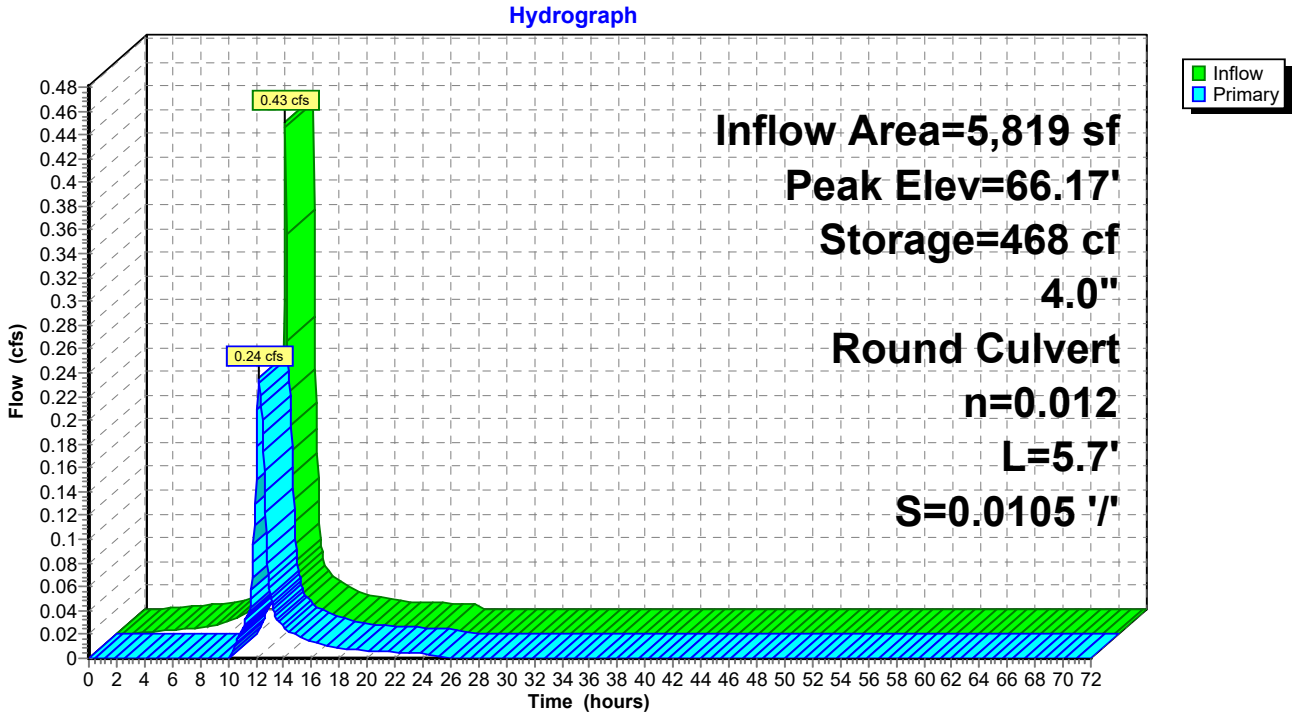
1,541.2 cf Field - 528.2 cf Chambers = 1,013.0 cf Stone x 40.0% Voids = 405.2 cf Stone Storage

Chamber Storage + Stone Storage = 933.4 cf = 0.021 af
Overall Storage Efficiency = 60.6%
Overall System Size = 31.50' x 15.25' x 3.21'

12 Chambers
57.1 cy Field
37.5 cy Stone



## Pond 1P: Cultec 280



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 PD-1: Proposed** Runoff Area=15,653 sf 7.09% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=77 Runoff=1.16 cfs 3,674 cf

**Subcatchment PD-2: Roof/Court/Driveway** Runoff Area=5,819 sf 100.00% Impervious Runoff Depth=4.99"
Tc=6.0 min CN=98 Runoff=0.67 cfs 2,421 cf

**Subcatchment PD-3: Howe Street** Runoff Area=4,406 sf 23.04% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=80 Runoff=0.36 cfs 1,136 cf

**Reach 1R: Southeast Corner** Inflow=1.44 cfs 5,878 cf
Outflow=1.44 cfs 5,878 cf

**Reach 2R: Howe Street** Inflow=0.36 cfs 1,136 cf
Outflow=0.36 cfs 1,136 cf

**Pond 1P: Cultec 280** Peak Elev=66.64' Storage=629 cf Inflow=0.67 cfs 2,421 cf
4.0" Round Culvert n=0.012 L=5.7' S=0.0105 '/' Outflow=0.33 cfs 2,204 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 7,231 cf Average Runoff Depth = 3.35"**
**69.30% Pervious = 17,934 sf 30.70% Impervious = 7,944 sf**

## Summary for Subcatchment PD-1: Proposed

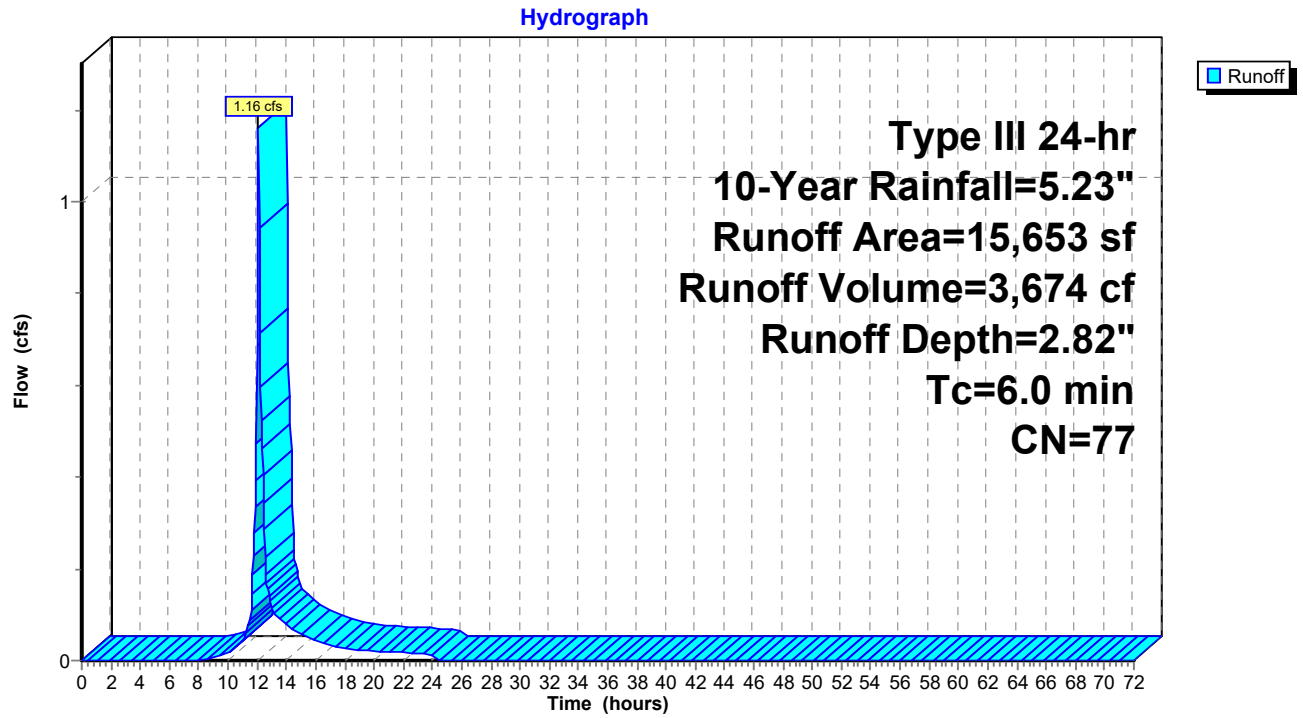
Runoff = 1.16 cfs @ 12.09 hrs, Volume= 3,674 cf, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.23"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 795 | 98 | Patios/Walkway, HSG C |
| * | 315 | 98 | Shed, HSG C |
| | 1,025 | 89 | Gravel roads, HSG C |
| | 13,518 | 74 | >75% Grass cover, Good, HSG C |
| | 15,653 | 77 | Weighted Average |
| | 14,543 | | 92.91% Pervious Area |
| | 1,110 | | 7.09% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-1: Proposed



## Summary for Subcatchment PD-2: Roof/Court/Driveway

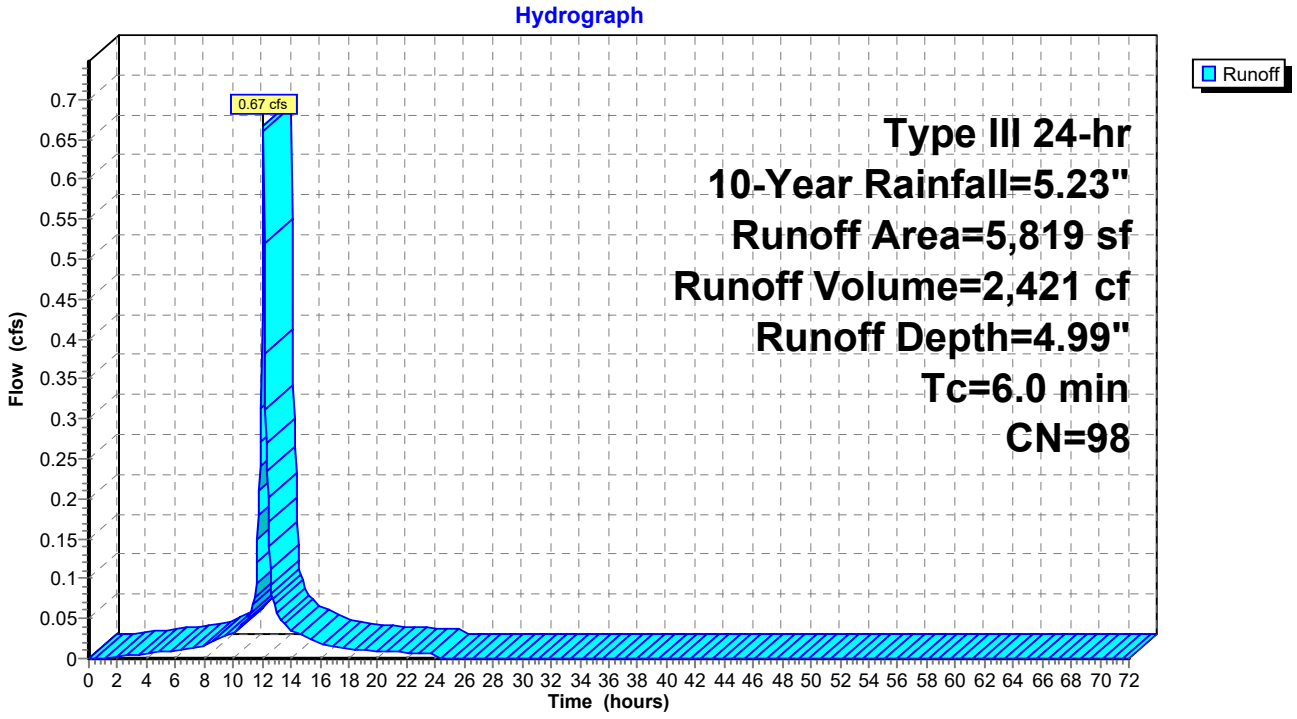
Runoff = 0.67 cfs @ 12.09 hrs, Volume= 2,421 cf, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.23"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,684 | 98 | Roofs, HSG C |
| | 1,035 | 98 | Paved parking, HSG C |
| * | 2,100 | 98 | Sports Court, HSG C |
| | 5,819 | 98 | Weighted Average |
| | 5,819 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-2: Roof/Court/Driveway



## Summary for Subcatchment PD-3: Howe Street

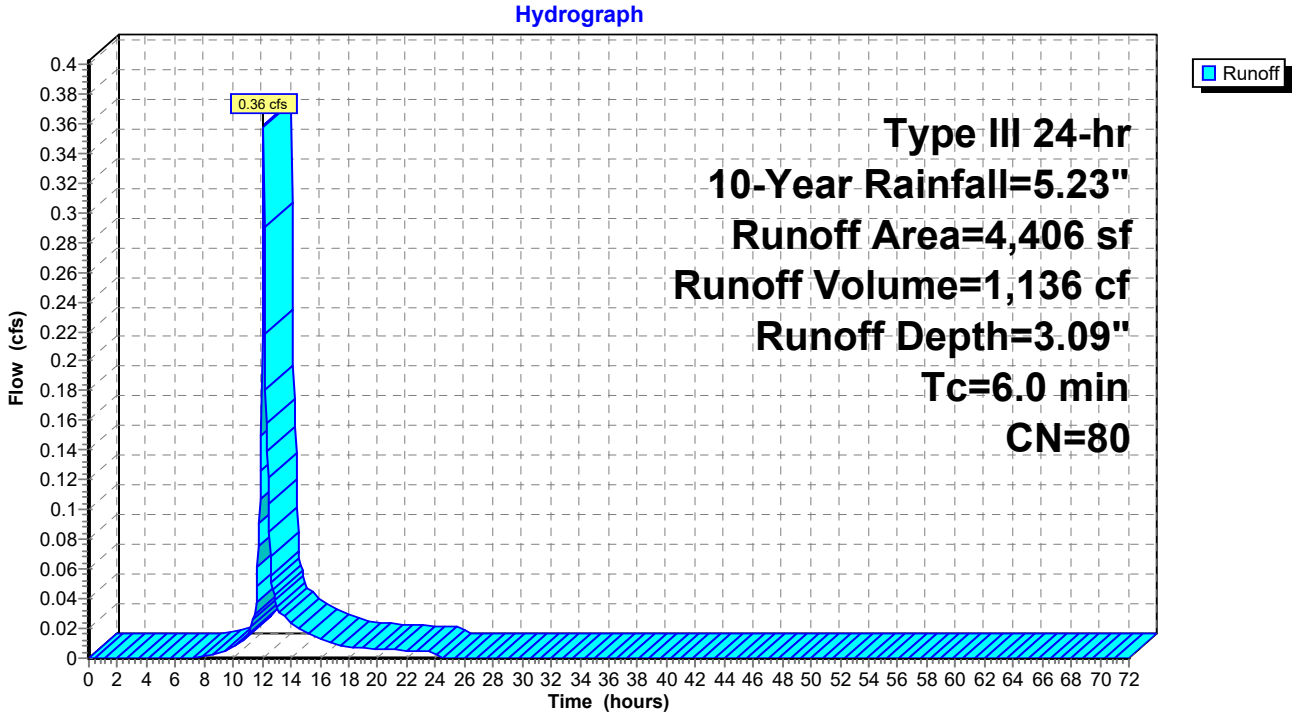
Runoff = 0.36 cfs @ 12.09 hrs, Volume= 1,136 cf, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.23"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 539 | 98 | Roofs, HSG C |
| * | 476 | 98 | Front Walk, HSG C |
| | 3,391 | 74 | >75% Grass cover, Good, HSG C |
| | 4,406 | 80 | Weighted Average |
| | 3,391 | | 76.96% Pervious Area |
| | 1,015 | | 23.04% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-3: Howe Street

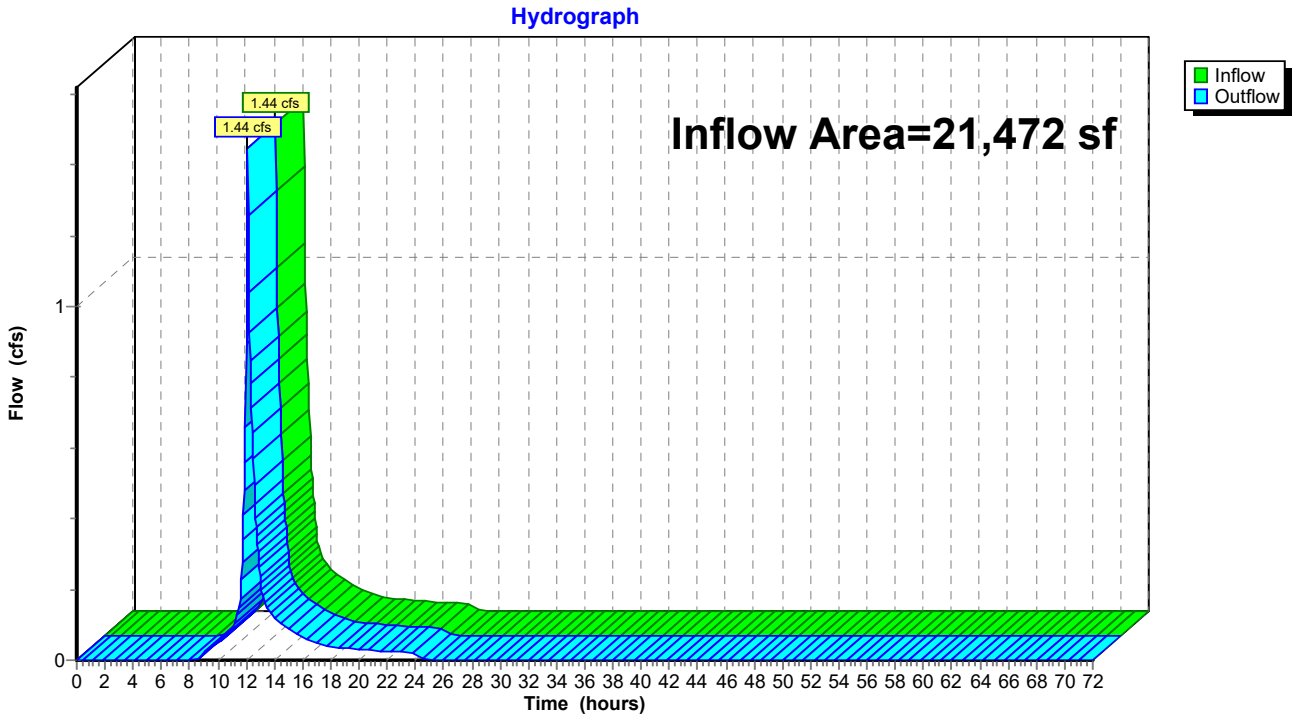


## Summary for Reach 1R: Southeast Corner

Inflow Area = 21,472 sf, 32.27% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 1.44 cfs @ 12.10 hrs, Volume= 5,878 cf
Outflow = 1.44 cfs @ 12.10 hrs, Volume= 5,878 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 1R: Southeast Corner

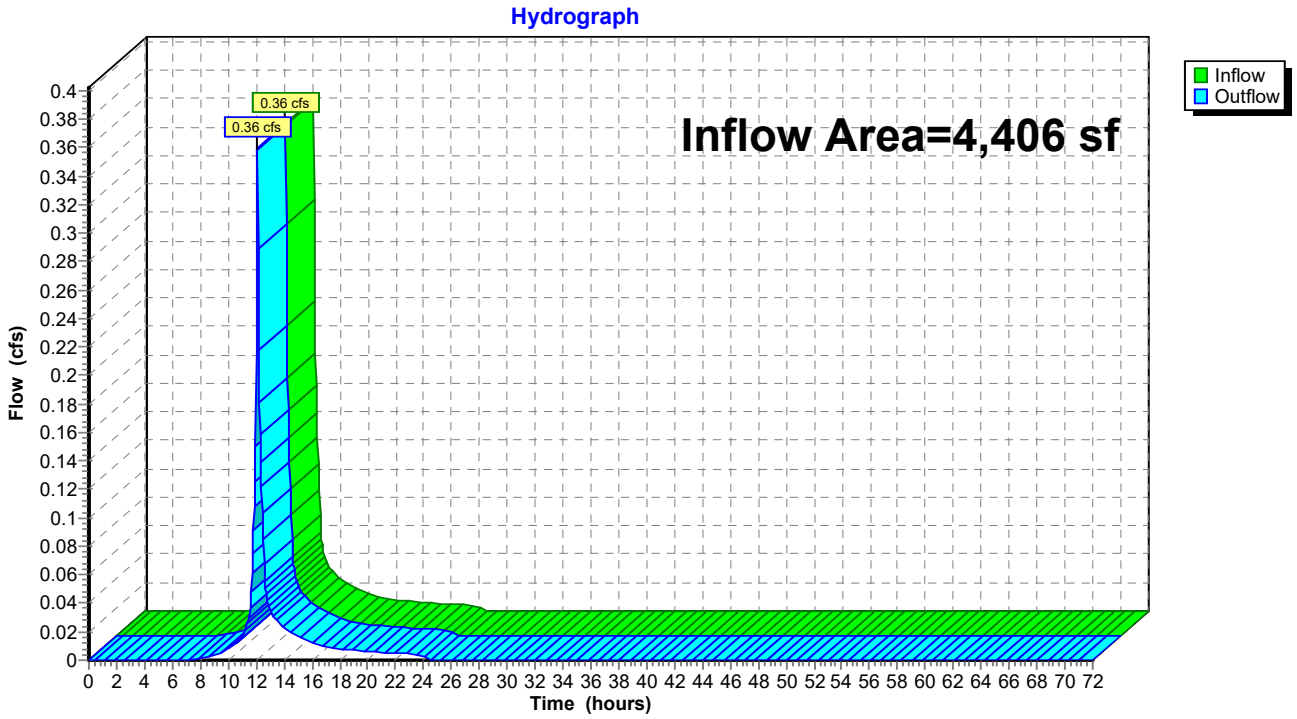


## Summary for Reach 2R: Howe Street

Inflow Area = 4,406 sf, 23.04% Impervious, Inflow Depth = 3.09" for 10-Year event
Inflow = 0.36 cfs @ 12.09 hrs, Volume= 1,136 cf
Outflow = 0.36 cfs @ 12.09 hrs, Volume= 1,136 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 2R: Howe Street



## Summary for Pond 1P: Cultec 280

Inflow Area = 5,819 sf,100.00% Impervious, Inflow Depth = 4.99" for 10-Year event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 2,421 cf
Outflow = 0.33 cfs @ 12.24 hrs, Volume= 2,204 cf, Atten= 51%, Lag= 9.5 min
Primary = 0.33 cfs @ 12.24 hrs, Volume= 2,204 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 66.64' @ 12.24 hrs Surf.Area= 480 sf Storage= 629 cf

Plug-Flow detention time= 109.5 min calculated for 2,203 cf (91% of inflow)
Center-of-Mass det. time= 63.9 min ( 811.2 - 747.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 64.69' | 405 cf | **15.25'W x 31.50'L x 3.21'H Field A**<br>1,541 cf Overall - 528 cf Embedded = 1,013 cf x 40.0% Voids |
| #2A | 65.19' | 528 cf | **Cultec R-280HD** x 12 Inside #1<br>Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf<br>Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap<br>Row Length Adjustment= +1.00' x 6.07 sf x 3 rows |
| | | 933 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 65.50' | **4.0" Round Culvert**<br>L= 5.7' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 65.50' / 65.44' S= 0.0105 '/' Cc= 0.900<br>n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.09 sf |

**Primary OutFlow** Max=0.33 cfs @ 12.24 hrs HW=66.63' (Free Discharge)
**1=Culvert** (Inlet Controls 0.33 cfs @ 3.74 fps)

## Pond 1P: Cultec 280 - Chamber Wizard Field A

**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 3 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

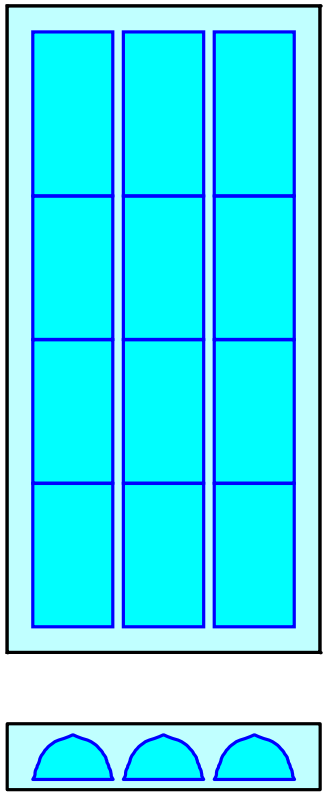
4 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 29.00' Row Length +15.0" End Stone x 2 = 31.50' Base Length
3 Rows x 47.0" Wide + 6.0" Spacing x 2 + 15.0" Side Stone x 2 = 15.25' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

12 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 3 Rows = 528.2 cf Chamber Storage

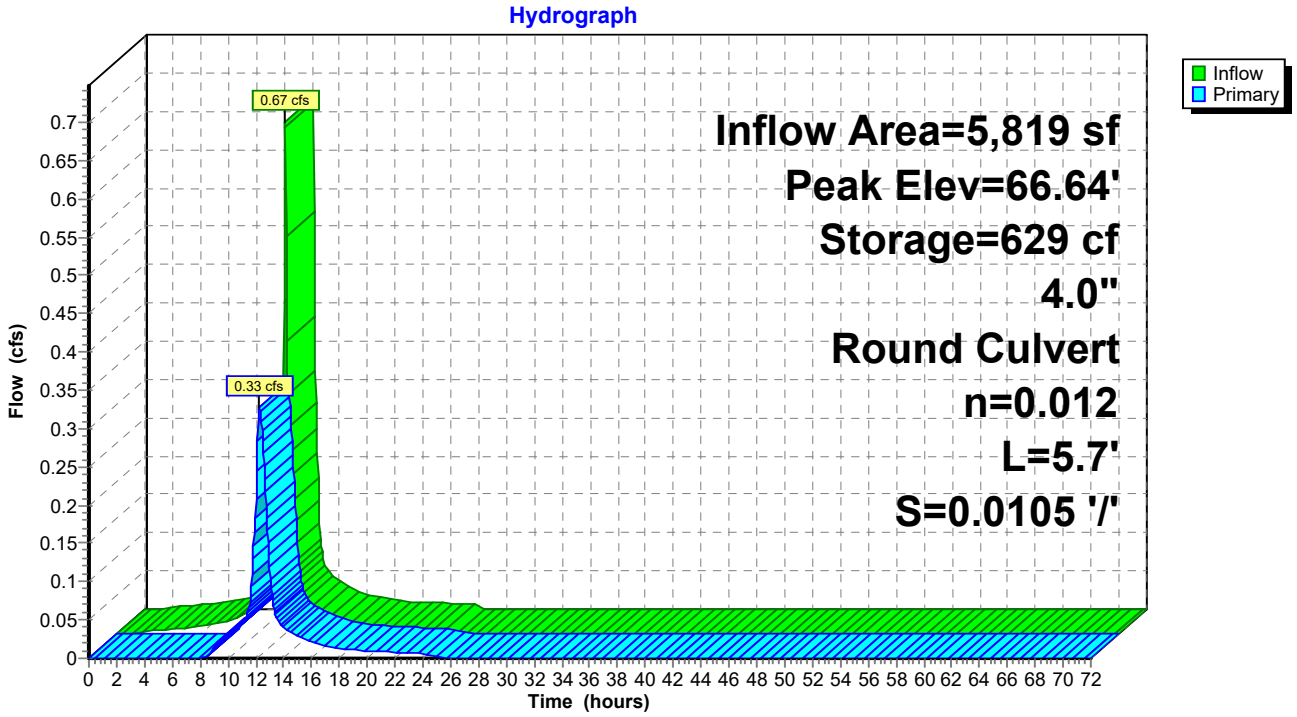
1,541.2 cf Field - 528.2 cf Chambers = 1,013.0 cf Stone x 40.0% Voids = 405.2 cf Stone Storage

Chamber Storage + Stone Storage = 933.4 cf = 0.021 af
Overall Storage Efficiency = 60.6%
Overall System Size = 31.50' x 15.25' x 3.21'

12 Chambers
57.1 cy Field
37.5 cy Stone



## Pond 1P: Cultec 280



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 PD-1: Proposed** Runoff Area=15,653 sf 7.09% Impervious Runoff Depth=5.42"
Tc=6.0 min CN=77 Runoff=2.22 cfs 7,072 cf

**Subcatchment PD-2: Roof/Court/Driveway** Runoff Area=5,819 sf 100.00% Impervious Runoff Depth=7.92"
Tc=6.0 min CN=98 Runoff=1.05 cfs 3,841 cf

**Subcatchment PD-3: Howe Street** Runoff Area=4,406 sf 23.04% Impervious Runoff Depth=5.78"
Tc=6.0 min CN=80 Runoff=0.66 cfs 2,120 cf

**Reach 1R: Southeast Corner** Inflow=2.60 cfs 10,696 cf
Outflow=2.60 cfs 10,696 cf

**Reach 2R: Howe Street** Inflow=0.66 cfs 2,120 cf
Outflow=0.66 cfs 2,120 cf

**Pond 1P: Cultec 280** Peak Elev=67.77' Storage=908 cf Inflow=1.05 cfs 3,841 cf
4.0" Round Culvert n=0.012 L=5.7' S=0.0105 '/' Outflow=0.48 cfs 3,624 cf

**Total Runoff Area = 25,878 sf Runoff Volume = 13,033 cf Average Runoff Depth = 6.04"**
**69.30% Pervious = 17,934 sf 30.70% Impervious = 7,944 sf**

## Summary for Subcatchment PD-1: Proposed

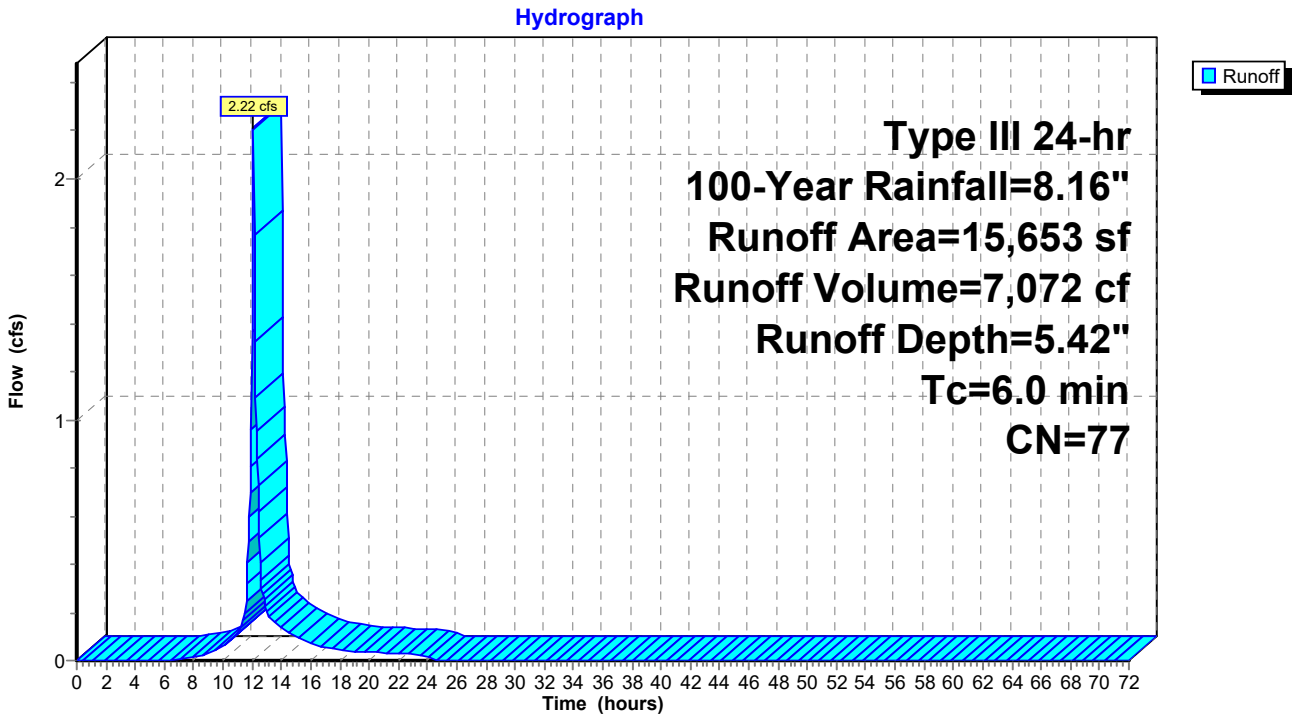
Runoff = 2.22 cfs @ 12.09 hrs, Volume= 7,072 cf, Depth= 5.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 795 | 98 | Patios/Walkway, HSG C |
| * | 315 | 98 | Shed, HSG C |
| | 1,025 | 89 | Gravel roads, HSG C |
| | 13,518 | 74 | >75% Grass cover, Good, HSG C |
| | 15,653 | 77 | Weighted Average |
| | 14,543 | | 92.91% Pervious Area |
| | 1,110 | | 7.09% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-1: Proposed



## Summary for Subcatchment PD-2: Roof/Court/Driveway

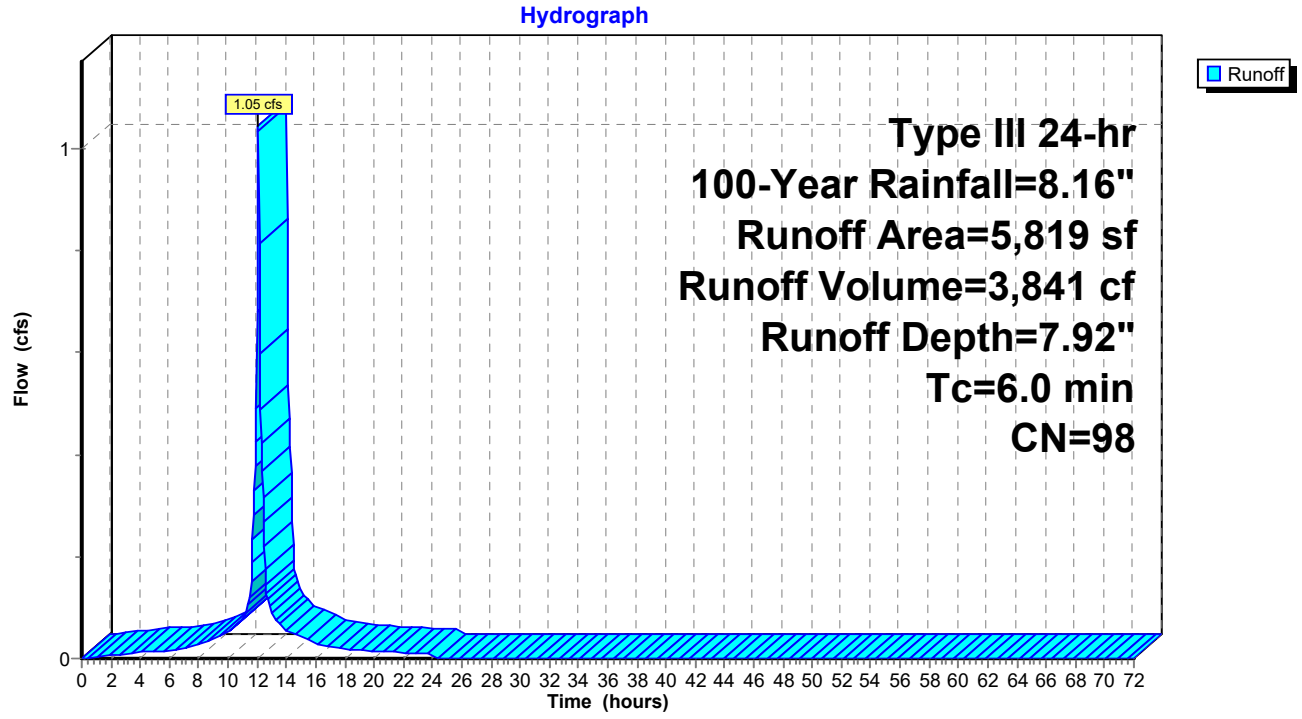
Runoff = 1.05 cfs @ 12.09 hrs, Volume= 3,841 cf, Depth= 7.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,684 | 98 | Roofs, HSG C |
| | 1,035 | 98 | Paved parking, HSG C |
| * | 2,100 | 98 | Sports Court, HSG C |
| | 5,819 | 98 | Weighted Average |
| | 5,819 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-2: Roof/Court/Driveway



## Summary for Subcatchment PD-3: Howe Street

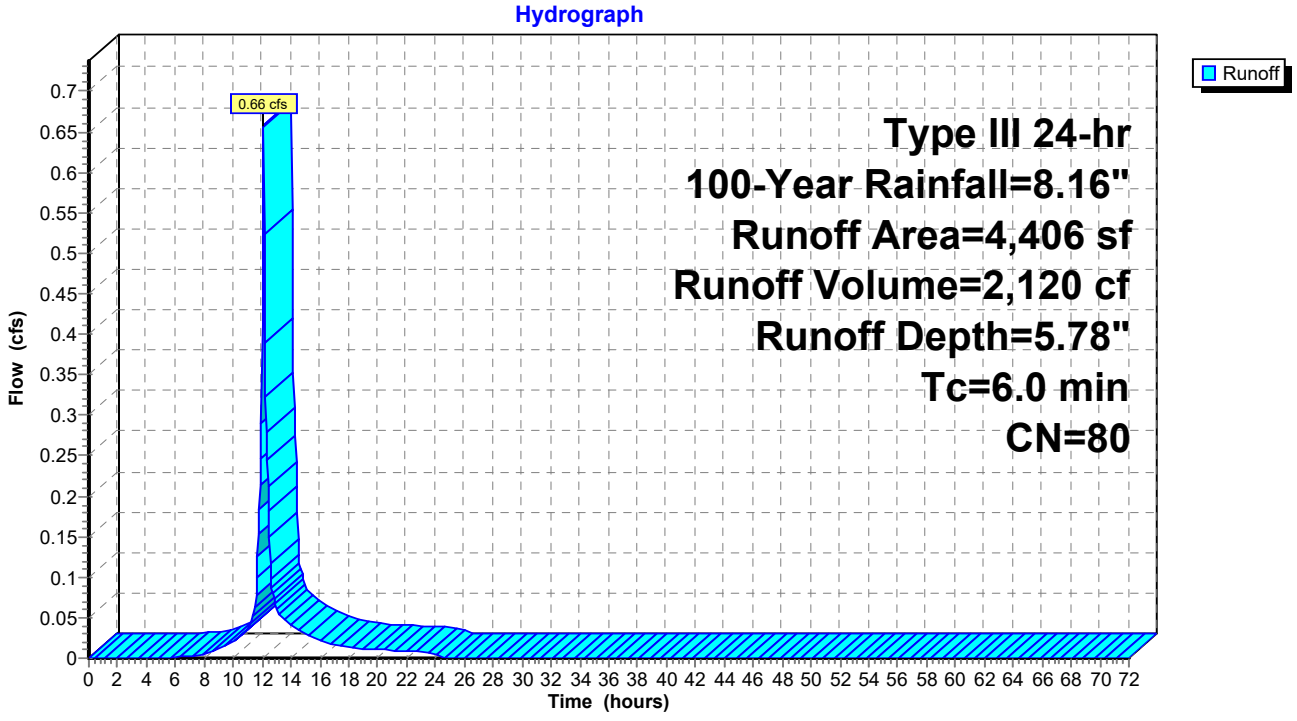
Runoff = 0.66 cfs @ 12.09 hrs, Volume= 2,120 cf, Depth= 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.16"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 539 | 98 | Roofs, HSG C |
| * | 476 | 98 | Front Walk, HSG C |
| | 3,391 | 74 | >75% Grass cover, Good, HSG C |
| | 4,406 | 80 | Weighted Average |
| | 3,391 | | 76.96% Pervious Area |
| | 1,015 | | 23.04% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.0 | | | | | **Direct Entry,** |

## Subcatchment PD-3: Howe Street

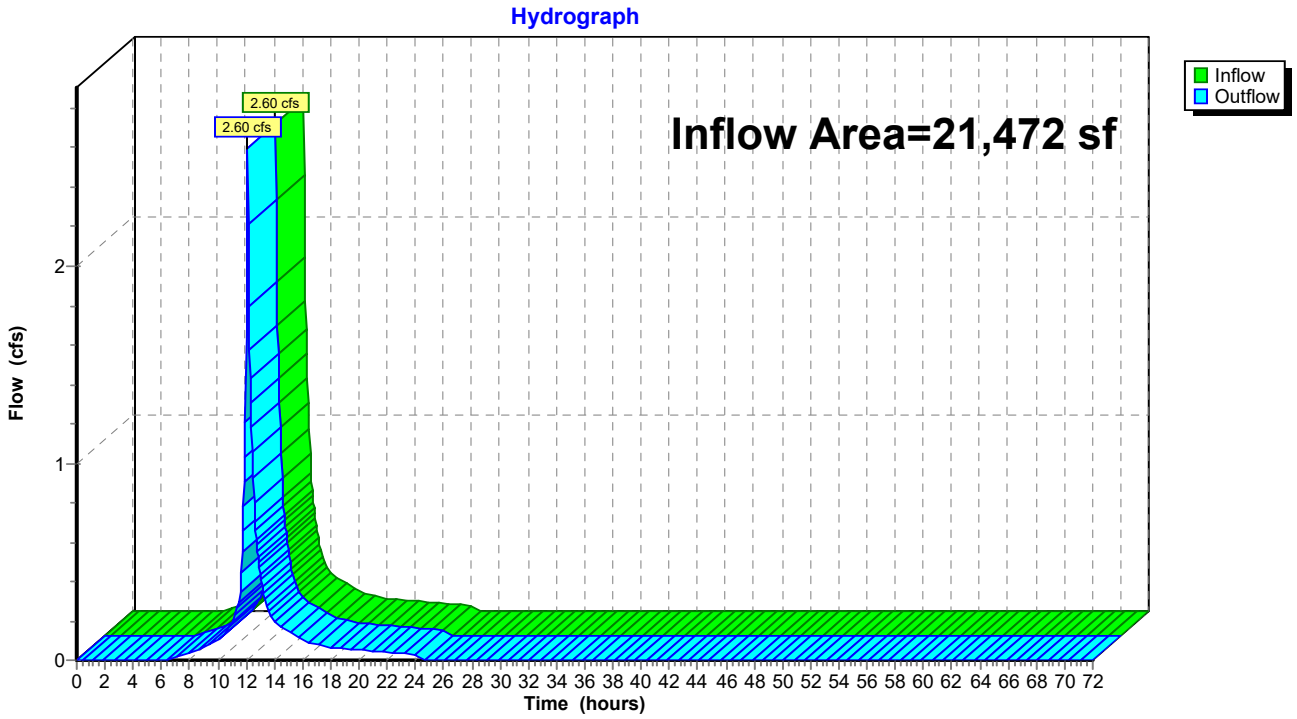


## Summary for Reach 1R: Southeast Corner

Inflow Area = 21,472 sf, 32.27% Impervious, Inflow Depth = 5.98" for 100-Year event
Inflow = 2.60 cfs @ 12.09 hrs, Volume= 10,696 cf
Outflow = 2.60 cfs @ 12.09 hrs, Volume= 10,696 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 1R: Southeast Corner

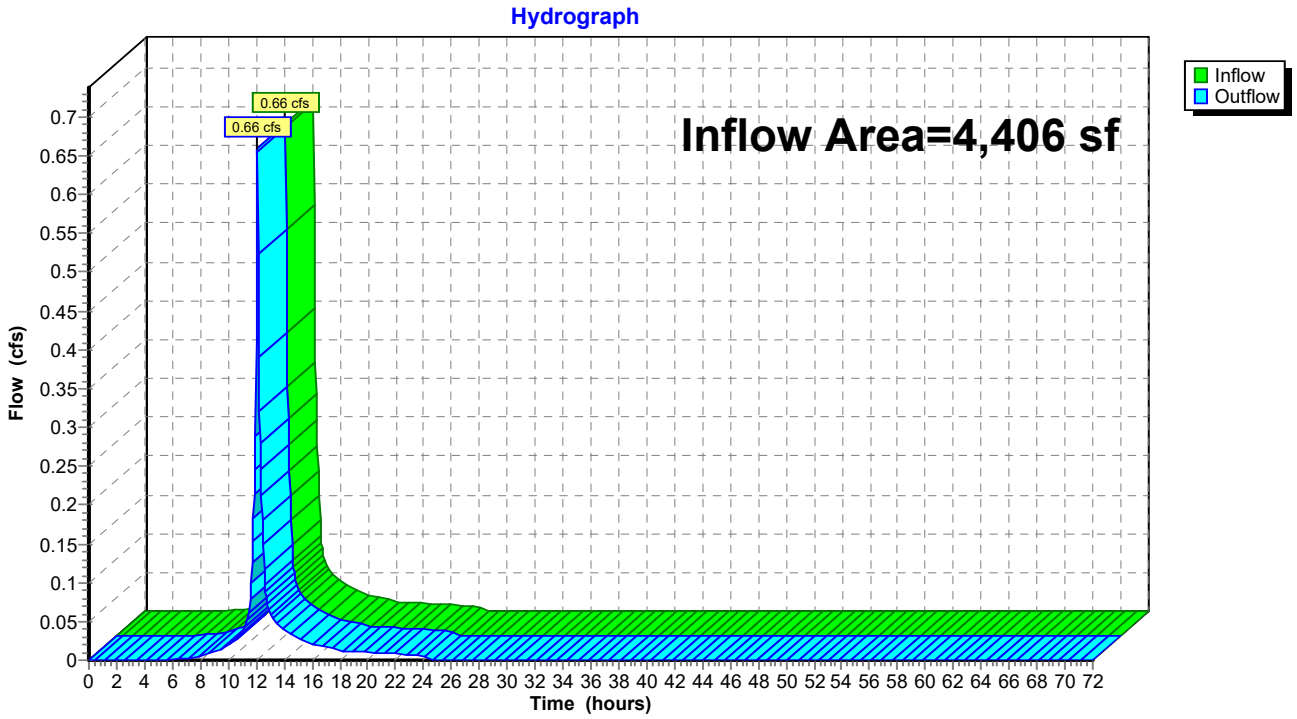


## Summary for Reach 2R: Howe Street

Inflow Area = 4,406 sf, 23.04% Impervious, Inflow Depth = 5.78" for 100-Year event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 2,120 cf
Outflow = 0.66 cfs @ 12.09 hrs, Volume= 2,120 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

## Reach 2R: Howe Street



## Summary for Pond 1P: Cultec 280

Inflow Area = 5,819 sf,100.00% Impervious, Inflow Depth = 7.92" for 100-Year event
Inflow = 1.05 cfs @ 12.09 hrs, Volume= 3,841 cf
Outflow = 0.48 cfs @ 12.26 hrs, Volume= 3,624 cf, Atten= 54%, Lag= 10.5 min
Primary = 0.48 cfs @ 12.26 hrs, Volume= 3,624 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 67.77' @ 12.26 hrs Surf.Area= 480 sf Storage= 908 cf

Plug-Flow detention time= 86.3 min calculated for 3,624 cf (94% of inflow)
Center-of-Mass det. time= 52.9 min ( 793.9 - 741.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 64.69' | 405 cf | **15.25'W x 31.50'L x 3.21'H Field A**<br>1,541 cf Overall - 528 cf Embedded = 1,013 cf x 40.0% Voids |
| #2A | 65.19' | 528 cf | **Cultec R-280HD** x 12 Inside #1<br>Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf<br>Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap<br>Row Length Adjustment= +1.00' x 6.07 sf x 3 rows |
| | | 933 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 65.50' | **4.0" Round Culvert**<br>L= 5.7' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 65.50' / 65.44' S= 0.0105 '/' Cc= 0.900<br>n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.09 sf |

**Primary OutFlow** Max=0.48 cfs @ 12.26 hrs HW=67.76' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.48 cfs @ 5.50 fps)

## Pond 1P: Cultec 280 - Chamber Wizard Field A

**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 3 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

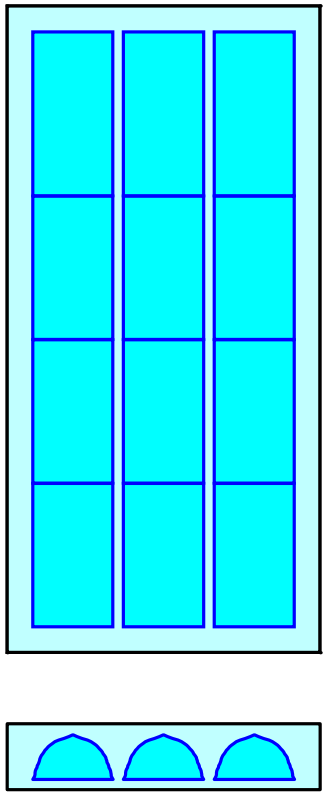
4 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 29.00' Row Length +15.0" End Stone x 2 = 31.50' Base Length
3 Rows x 47.0" Wide + 6.0" Spacing x 2 + 15.0" Side Stone x 2 = 15.25' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

12 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 3 Rows = 528.2 cf Chamber Storage

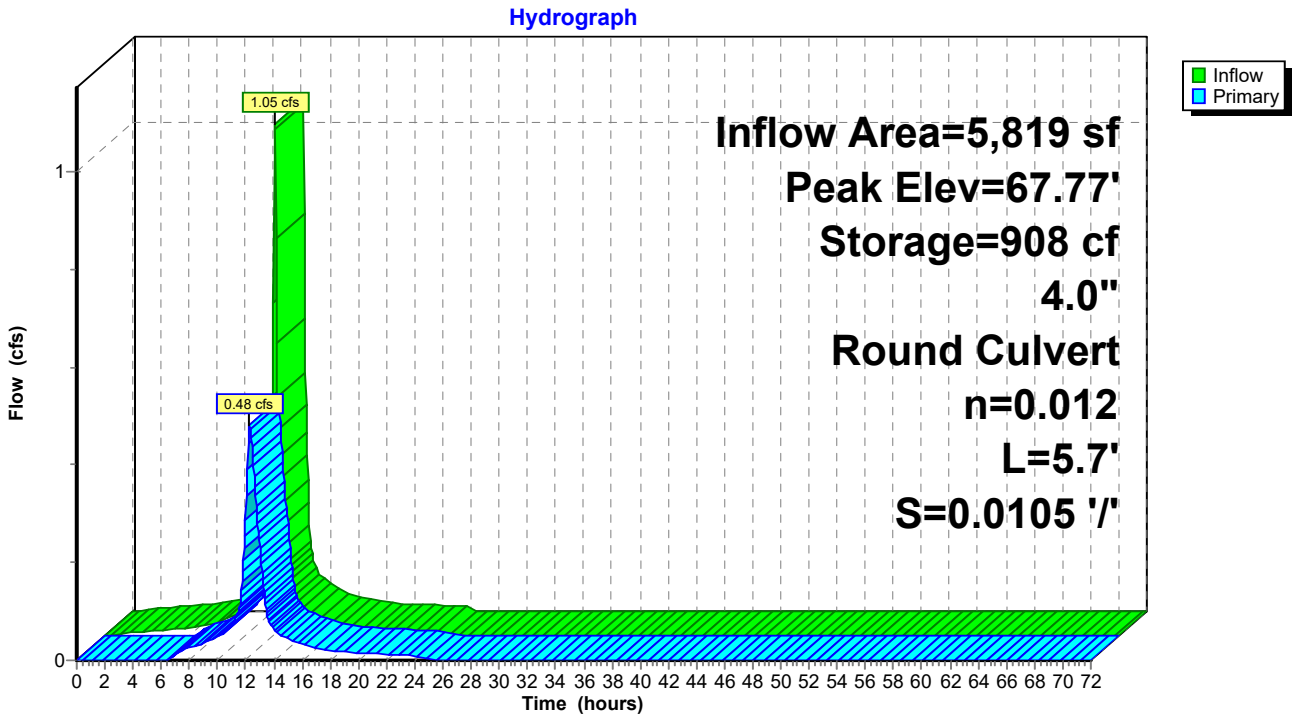
1,541.2 cf Field - 528.2 cf Chambers = 1,013.0 cf Stone x 40.0% Voids = 405.2 cf Stone Storage

Chamber Storage + Stone Storage = 933.4 cf = 0.021 af
Overall Storage Efficiency = 60.6%
Overall System Size = 31.50' x 15.25' x 3.21'

12 Chambers
57.1 cy Field
37.5 cy Stone



## Pond 1P: Cultec 280



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# Section 3: Stormwater Management Calculations

## 3.1 STANDARD 3: RECHARGE CALCULATIONS

The Required Recharge Volume is computed using the equation provided in the 2008 Massachusetts Stormwater Handbook. The volume is computed as an equivalent depth of rainfall over the proposed impervious areas in accordance with a Target Depth Factor based on the soil classifications. The Calculations is as follows:

**Rv = (F) X (Impervious Area)**
*(Equation 1) Volume 3, Ch 1, page 15*

- Rv = Required Recharge Volume, expressed in cubic feet, cubic yards, or acre-feet
- F = Target Depth Factor associated with each Hydrologic Soil Group (HSG)
- Impervious Area = new pavement and new rooftop area
- The Target Depth Factor "F" per Table 2.3.2, Volume 3, Chapter 1 for each soil classification is as follows:
    - A soils = 0.60 inches
    - B soils = 0.35 inches
    - C soils = 0.25 inches
    - D soils = 0.10 inches

Total proposed impervious area within limit of work is 3,702± SF (pavement, buildings, patios).

Underground infiltration chambers are utilized as infiltration BMPs for the site. Based on the test pits performed, groundwater elevations have been established taken from the test pit data collected at each system area. It appears that each recharge system has a minimum of 2-feet of separation between the bottom of the recharge structure and seasonal high groundwater.

Based on the above formula, the minimum required recharge volume for the site is as follows:

Per Section 1.3, the onsite soils are considered "C" soils:

- (C soils) = 0.25 inches
- Impervious Area = 3,702± SF

Rv = (F) X (Impervious Area)
Rv= (0.25 in) x (1ft/12 in) x 3,702 SF = 77 CF

**TOTAL RECHARGE VOLUME REQUIRED = 77± CF**

**Recharge Volume BMP Table**

| Infiltration BMP | Infiltration Rate (in/hr) k | Storage (Recharge) Volume (CF) Rv |
|---|---|---|
| Subsurface System | 0.17 | 213 |
| **Totals** | | **213** |
| *k = saturated hydraulic conductivity (in/hr)*<br>*Rv = storage volume (CF)*<br>*Volume 3, Chapter 1 of the MA Stormwater Handbook* | | |

**TOTAL RECHARGE VOLUME PROVIDED =213± CF**

**Conclusion:**

We feel that this design recharges to the maximum extent practicable and exceeds the standard for recharge for new development.

## 3.2 DRAWDOWN TIME

Below are the drawdown time calculations for the infiltration systems proposed on the site. The calculation uses estimated hydraulic conductivity values "*K*" in accordance with the Rawls Rates table. The formula below utilized the recommended formula per the MA Stormwater Handbook as follows:

**Drawdown Time = Rv / [(K*Bottom Area)*( 1FT/12IN)]**

- Rv = Storage Volume (CF)
- K = Saturated Hydraulic Conductivity per Rawls Rate Table
- Bottom Area = Area of Bottom of Proposed Recharge Structure

Below is a summary table of the drawdown calculations:

| DRAWDOWN CALCULATIONS | | | | |
|---|---|---|---|---|
| **Infiltration BMP** | **Infiltration Rate (IN/HR) k** | **Storage (Recharge) Volume Provided (CF) Rv** | **Bottom Area (SF)** | **Draw Down Time (HR)** |
| Subsurface System | 0.17 | 213 | 480 | 31.3 |
| **Totals** | | **213** | | |
| *k = saturated hydraulic conductivity (IN/HR)*<br>*Rv = storage volume (CF)*<br>*Bottom Area (SF)*<br>*Volume 3, Chapter 1 of the MA Stormwater Handbook* | | | | |

**Conclusion:**

The calculations show that the infiltration BMP draws down in less than 72 hours, as required.

## 3.3 STANDARD 4: WATER QUALITY and TSS

Stormwater runoff for the paved driveway is proposed to be treated through the isolator row within the proposed subsurface system. Please see attached TSS calculations showing atleast 80% of TSS removal.

| SEPERATOR ROW | UNIT TYPE | Treated flow per unit | Flow required to be treated | Number of units Provided | Treated Flow per Isolator Row |
|---|---|---|---|---|---|
| | | cfs | cfs | | cfs |
| **UG-1** | R-280HD | 0.13 | 0.17 | **4** | 0.52 |

## Water Quality Unit Sizing Using Equivalent Flow from 1" Rainfall Depth

| UG Basin / Isolator row | Tributary Area (acres) | Tributary Area (sq miles) | Pervious (sf) | Impervious % | CN Value Actual | WQRD (In) | Q Volun (cf) | Tc (min) | qu (csm/in) | WQF = qu A Q (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **UG-1** | 0.14 | 0.0002 | - | 100% | 98 | 1.00 | 493 | 6 | 795 | 0.17 |

| SEPERATOR ROW | UNIT TYPE | Treated flow per unit cfs | Flow required to be treated cfs | Number of units Provided | Treated Flow per Isolator cfs |
|---|---|---|---|---|---|
| **UG-1** | R-280HD | 0.13 | 0.17 | **4** | 0.52 |

INSTRUCTIONS:

*Non-automated: Mar. 4, 2008*

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: **Cultec R-280HD**

## TSS Removal Calculation Worksheet

| A<br>BMP[1] | B<br>TSS Removal Rate[1] | C<br>Starting TSS Load* | D<br>Amount Removed (B*C) | E<br>Remaining Load (C-D) |
|---|---|---|---|---|
| **Subsurface Infiltration** | **0.80** | **1.00** | **0.80** | **0.20** |
| | **0.00** | **0.20** | **0.00** | **0.20** |
| | **0.00** | **0.20** | **0.00** | **0.20** |
| | **0.00** | **0.20** | **0.00** | **0.20** |
| | **0.00** | **0.20** | **0.00** | **0.20** |

**Total TSS Removal =** **80%**

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project: **22 Howe Street**
Prepared By: **JRJ**
Date: **6/26/2026**

*Equals remaining load from previous BMP (E) which enters the BMP

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# Section 4: Operation & Maintenance Plan

# LONG-TERM STORMWATER OPERATION & MAINTENANCE PLAN

22 Howe Street
Hingham, MA 02043

**PROJECT OVERVIEW:**

The Applicant proposes a project consisting of a repaved driveway, sports court, patios and walkways, and subsurface drainage system.

Appended to this document is a sample maintenance form and a chart describing the anticipated frequency of tasks.

**OWNER AND RESPONSIBLE PARTY:**

***Current Land Owner:***
Greenman Industries, Inc.
41 Jarvis Avenue
Hingham, MA 02043

***Proposed Site Contractor:***
TBD

**MAINTENANCE LOG**

The Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including location of disposal) during the life of the project. Records will be maintained for at least 3 years and be made available to the Massachusetts Department of Environmental Protection or the Town of Hingham in accordance with the provisions of the Massachusetts Stormwater Handbook. A sample of such a maintenance log is provided.

**STORMWATER BMP MAINTENANCE**

The proposed stormwater management system has been designed with appropriate BMPs aimed at reducing the pollutants discharge based upon the intended use of the property. All BMPs require regular maintenance to function as intended.

A description of the non-structural and structural approaches to be incorporated is indicated below. The following best management practices are proposed to be incorporated into the stormwater management design to reduce source runoff and improve stormwater runoff discharge quality.

**STRUCTURAL BMPs**

Subsurface Drainage Systems

The subsurface system (Cultec R-280) has been designed with an inspection port for the periodic visual evaluation of how the system is functioning. Periodic inspections should occur with a greater number occurring during the system's start-up to identify any issues of concern as they may arise. Cleaning will take place at the completion of construction as deemed necessary based on the inspections. Similarly, if sediment build up is observed during periodic inspections (quarterly) then cleaning of the system may be required. To clean the system, the homeowner should contract with a company experienced in cleaning and maintaining subsurface infiltration systems. This process usually includes "vacuuming" the system and if this method is chosen, the outfalls of the system should be protected, and erosion measure installed to prevent sediment from migrating off property.

Inlets and Outlets

The inlets that convey water to the subsurface system should be inspected annually and cleaned to prevent build up of debris and migration of debris to other BMPs.

The yard drain acting as an overflow should be inspected twice annually (spring and fall) for debris and cleaned to ensure that the overflow functions properly in large storm events.

**The below agrees to operate, maintain, finance, and repair as needed the systems and components described above and depicted on the corresponding site plan.**

| _____ | _____ | _____ | _____ |
|---|---|---|---|
| Signature | Name | Role/Title | Date |

# Stormwater BMP Inspection and Maintenance Log

| | |
|---|---|
| Facility Name | |
| Address | |
| Begin Date | End Date |

| Date | BMP ID# | BMP Description | Inspected by: | Cause for Inspection | Exceptions Noted | Comments and Actions Taken |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Instructions:** Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the annual independent inspectors' report to the municipality and start a new log at that time.

BMP ID# — Always use ID# from the Operation and Maintenance Manual.

Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.

Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.

Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.

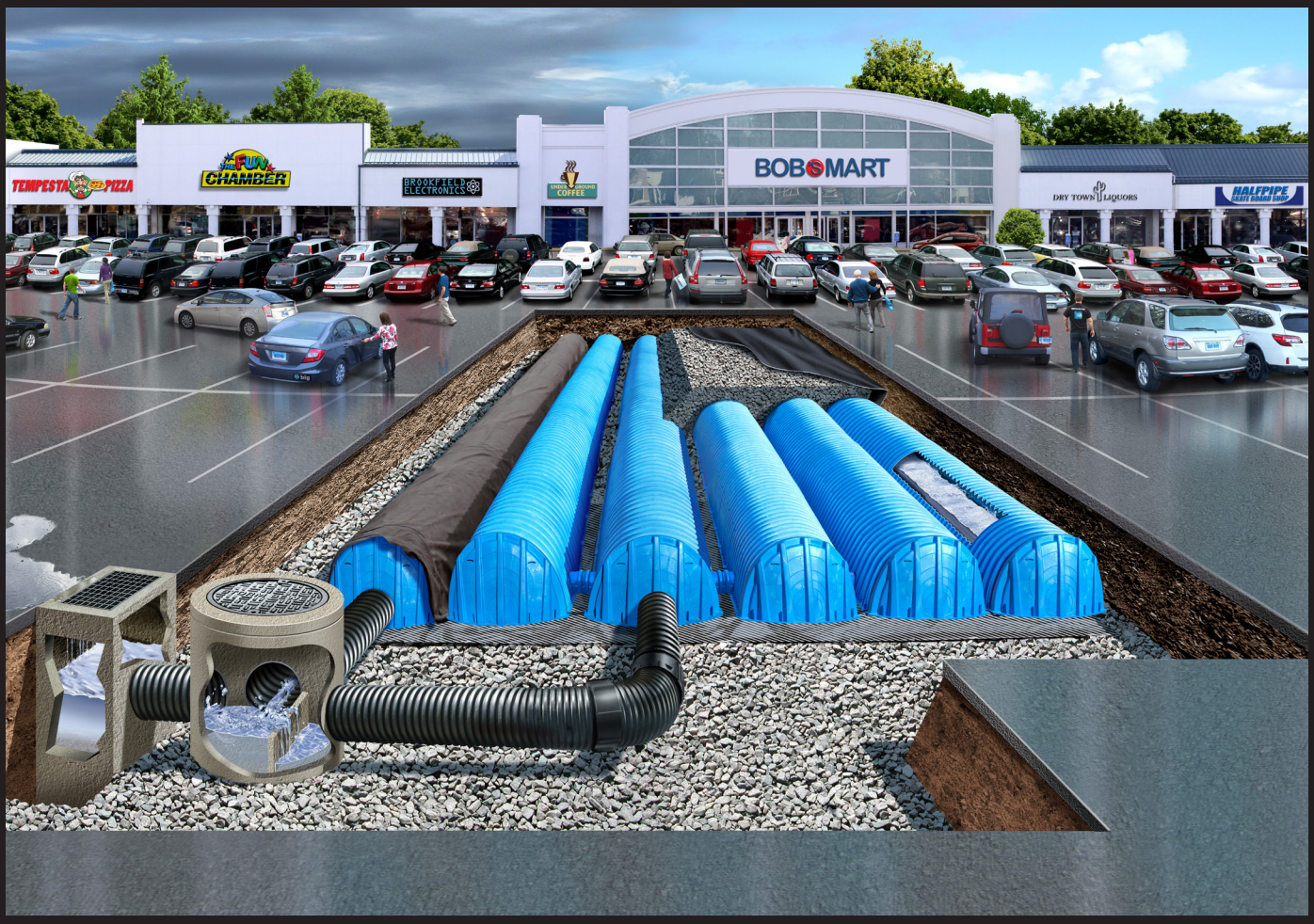
Comments and actions taken — Describe any maintenance done and need for follow-up.

# Stormwater BMP Inspection Matrix

| Conventional & LID Best Management Practices | **Inspection & Maint. Frequency** | **Erosion& Scour** | **Obstructions** | **Trash & Debris** | **Sediment Build-Up Removal** | **Vegetation Cover** | **Remove/Reset Filter Fabric & Stone As Required** | **Vac Truck Sediment & Contaminants** | **Remove/Reset Riprap as Required** |
|---|---|---|---|---|---|---|---|---|---|
| Subsurface Infiltration Chambers | Quarterly | | | | | | | | |
| Inlets (Conveyance Pipes and Gutters) | Annually | | | | | | | | |

# ADS Isolator® Row PLUS

## WATER QUALITY SYSTEM




## O&M MANUAL

**FOR CULTEC STORMWATER MANAGEMENT SYSTEMS**



CULTEC®

# The ADS Isolator Row Plus

## Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The ADS Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) with easy access for inspection and maintenance.

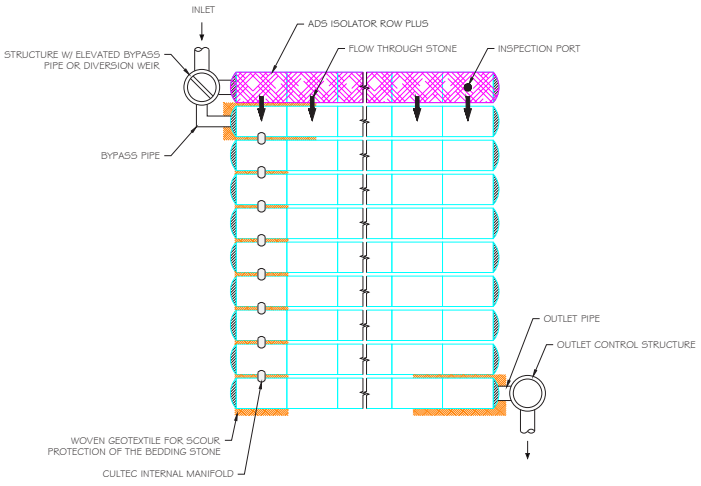
## The ADS Isolator Row Plus

The Isolator Row Plus is a row of CULTEC chambers, either 100HD, 150XLHD, 180HD, 300HD, 330XLHD, 360HD, or 902HD models, which are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS Isolator Row Plus fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, CULTEC recommends using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.




ADS Isolator Row Plus with Overflow Structure
(not to scale)

# ADS Isolator Row Plus Inspection/Maintenance

## Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, CULTEC recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3” (75 mm) throughout the length of the Isolator Row Plus, clean-out should be performed.

## Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entry.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. CULTEC recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, CULTEC recommends Isolator Row Plus lengths up to 200’ (61 m). **The JetVac process shall only be performed on ADS Isolator Row Plus that have ADS Plus Fabric (as specified by CULTEC) over their angular base stone.**

High pressure water nozzle


Cleaning ADS Isolator Row PLUS and pipes with high pressure water nozzle

# ADS Isolator Row Plus Step By Step Maintenance Procedures

## Step 1

Inspect ADS Isolator Row Plus for sediment.

A. Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection port riser
   iii. Using a flashlight and stadia rod, measure the depth of sediment and record the results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B. All Isolator Row Plus
   i. Remove cover from manhole at upstream end of Isolator Row Plus
   ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering a manhole
   iii. If sediment appears to cover the width and length of the row, proceed to Step 2. If not, proceed to Step 3.

## Step 2

Clean out ADS Isolator Row Plus using the JetVac process.

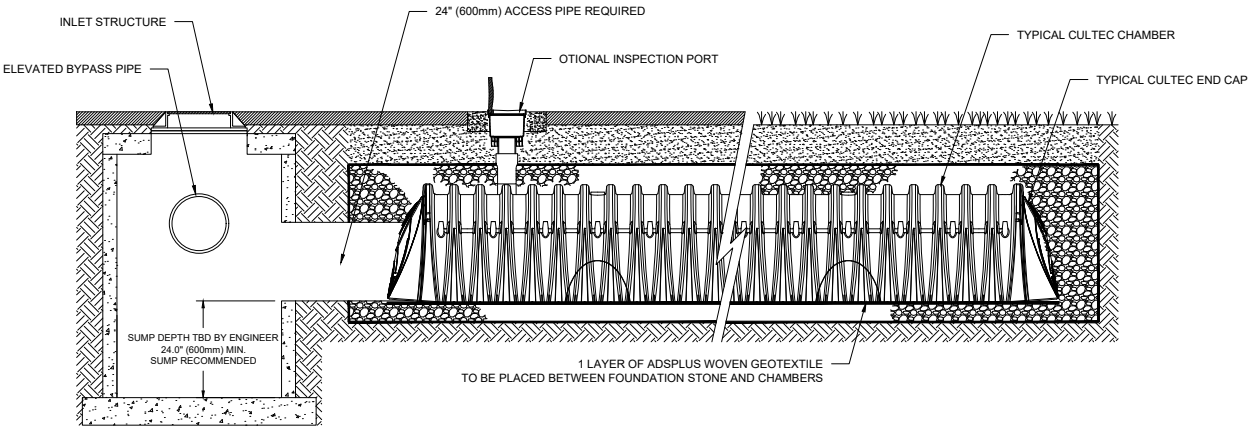
A. A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B. Apply multiple passes of JetVac until backflush water is clean
C. Vacuum manhole sump as required

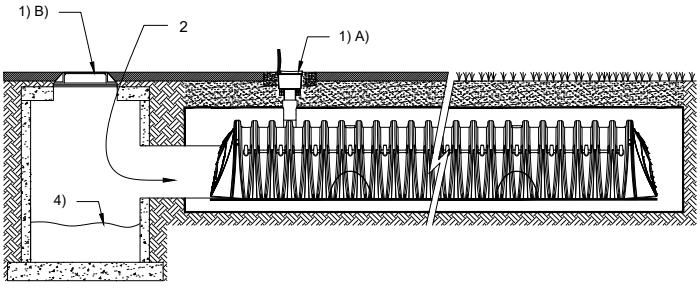
## Step 3

Replace all caps, lids and covers, record observations and actions.

## Step 4

Inspect and clean catchbasins and manholes upstream of the CULTEC system.




### Sample Maintenance Log

| Date | Stadia Rod Readings: Fixed point to chamber bottom (1) | Stadia Rod Readings: Fixed point to top of sediment (2) | Sediment Depth (1)-(2) | Observations/Actions | Inspector |
|---|---|---|---|---|---|
| 3/15/11 | 6.3 ft | none | | New installation. Fixed point is CI frame at grade. | DPG |
| 9/24/11 | | 6.2 | 0.1 ft | Some grit felt | SM |
| 6/20/13 | | 5.8 | 0.5 ft | Mucky feel, debris visible in manhole and in Isolator Row Plus, maintenance due. | NV |
| 7/7/13 | 6.3 ft | | 0 | System jetted and vacuumed | DJM |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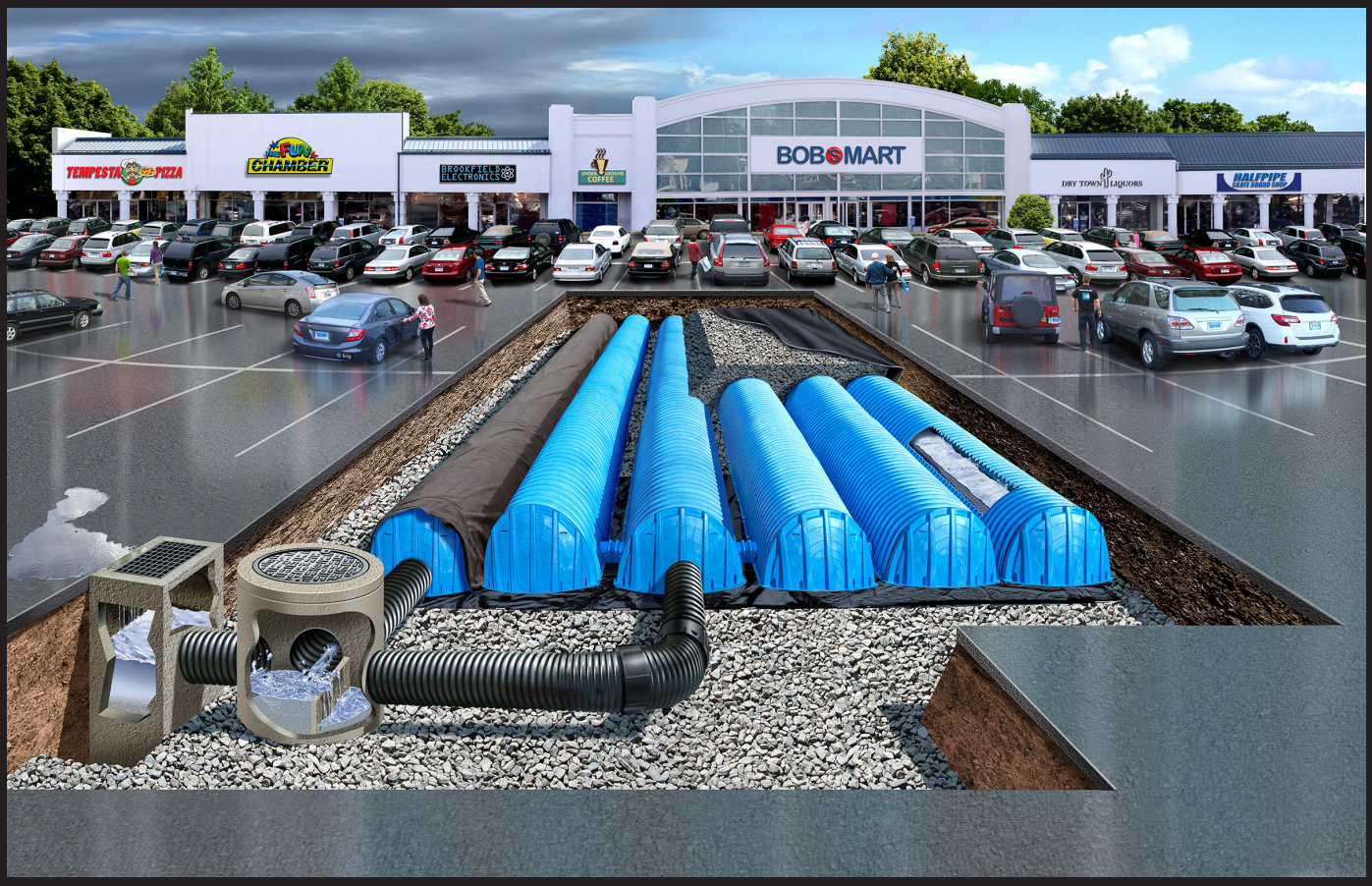
# CONTACTOR® & RECHARGER®

## STORMWATER MANAGEMENT SOLUTIONS




# OPERATION & MAINTENANCE GUIDELINES

## FOR CULTEC STORMWATER MANAGEMENT SYSTEMS



CULTEC®

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Doc ID: CLT057 11-23
November 2023

*These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.*
*All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.*
*Actual designs may vary.*

*This manual contains guidelines recommended by CULTEC and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.*

## Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

## Operation and Maintenance Requirements

### I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

### II. Inspection and Maintenance Options

**A.** The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

**B.** If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

**1. Manhole Access**
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

**2. StormFilter Access**
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

**C.** The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

## III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

**A.** The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

**B.** The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

**C.** Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

**D.** Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

## IV. Suggested Maintenance Schedules

**A. Minor Maintenance**
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

| Frequency | Action |
|---|---|
| Monthly in first year | Check inlets and outlets for clogging and remove any debris, as required. |
| Spring and Fall | Check inlets and outlets for clogging and remove any debris, as required. |
| One year after commissioning and every third year following | Check inlets and outlets for clogging and remove any debris, as required. |

**B. Major Maintenance**
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

| | Frequency | Action |
|---|---|---|
| Inlets and Outlets | Every 3 years | • Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended. |
| | Spring and Fall | • Check inlet and outlets for clogging and remove any debris as required. |
| CULTEC Stormwater Chambers | 2 years after commissioning | • Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.<br>• Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated. |
| | 9 years after commissioning every 9 years following | • Clean stormwater management chambers and feed connectors of any debris.<br>• Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.<br>• Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. |
| | 45 years after commissioning | • Clean stormwater management chambers and feed connectors of any debris.<br>• Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.<br>• Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.<br>• Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.<br>• Attain the appropriate approvals as required.<br>• Establish a new operation and maintenance schedule. |
| Surrounding Site | Monthly in 1st year | • Check for depressions in areas over and surrounding the stormwater management system. |
| | Spring and Fall | • Check for depressions in areas over and surrounding the stormwater management system. |
| | Yearly | • Confirm that no unauthorized modifications have been performed to the site. |

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC at 1-800-428-5832.

# WQMP
# Operation & Maintenance (O&M) Plan

Project Name:_____

**Prepared for:**

Project Name: _____

Address:_____

City, State Zip:_____

**Prepared on:**

Date:_____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

### 8.1.1 Project Information

| | |
|---|---|
| Project name | |
| Address | |
| City, State Zip | |
| Site size | |
| List of structural BMPs, number of each | |
| Other notes | |

### 8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

| | |
|---|---|
| Name of Person or HOA Property Manager | |
| Address | |
| City, State Zip | |
| Phone number | |
| 24-Hour Emergency Contact number | |
| Email | |

### 8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

### 8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

## Appendix ____

## BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

# BMP OPERATION & MAINTENANCE LOG

Project Name: _____

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

| BMP Name (As Shown in O&M Plan) | Brief Description of Implementation, Maintenance, and Inspection Activity Performed |
|---|---|
| | |
| | |
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| | |
| | |
| | |
| | |

## Minor Maintenance

| Frequency | | Action |
|---|---|---|
| **Monthly in first year** | | Check inlets and outlets for clogging and remove any debris, as required. |
| | | Notes |
| □ Month 1 | Date: | |
| □ Month 2 | Date: | |
| □ Month 3 | Date: | |
| □ Month 4 | Date | |
| □ Month 5 | Date: | |
| □ Month 6 | Date: | |
| □ Month 7 | Date: | |
| □ Month 8 | Date: | |
| □ Month 9 | Date: | |
| □ Month 10 | Date: | |
| □ Month 11 | Date: | |
| □ Month 12 | Date: | |
| **Spring and Fall** | | Check inlets and outlets for clogging and remove any debris, as required. |
| | | Notes |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| **One year after commissioning and every third year following** | | Check inlets and outlets for clogging and remove any debris, as required. |
| | | Notes |
| □ Year 1 | Date: | |
| □ Year 4 | Date: | |
| □ Year 7 | Date: | |
| □ Year 10 | Date: | |
| □ Year 13 | Date: | |
| □ Year 16 | Date: | |
| □ Year 19 | Date: | |
| □ Year 22 | Date: | |

## Major Maintenance

| | Frequency | | Action |
|---|---|---|---|
| **Inlets and Outlets** | **Every 3 years** | | Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended. |
| | | | Notes |
| | □ Year 1 | Date: | |
| | □ Year 4 | Date: | |
| | □ Year 7 | Date: | |
| | □ Year 10 | Date: | |
| | □ Year 13 | Date: | |
| | □ Year 16 | Date: | |
| | □ Year 19 | Date: | |
| | □ Year 22 | Date: | |
| | **Spring and Fall** | | Check inlet and outlets for clogging and remove any debris, as required. |
| | | | Notes |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| **CULTEC Stormwater Chambers** | **2 years after commissioning** | | □ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.<br><br>□ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated. |
| | | | Notes |
| | □ Year 2 | Date: | |

## Major Maintenance

| | Frequency | | Action |
|---|---|---|---|
| CULTEC Stormwater Chambers | **9 years after commissioning every 9 years following** | | □ Clean stormwater management chambers and feed connectors of any debris.<br><br>□ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.<br><br>□ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. |
| | | | Notes |
| | □ Year 9 | Date: | |
| | □ Year 18 | Date: | |
| | □ Year 27 | Date: | |
| | □ Year 36 | Date: | |
| | **45 years after commissioning** | | □ Clean stormwater management chambers and feed connectors of any debris.<br><br>□ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.<br><br>□ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.<br><br>□ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.<br><br>□ Attain the appropriate approvals as required.<br><br>□ Establish a new operation and maintenance schedule. |
| | | | Notes |
| | □ Year 45 | Date: | |

## Major Maintenance

| | Frequency | | Action |
|---|---|---|---|
| Surrounding Site | **Monthly in 1st year** | | □ Check for depressions in areas over and surrounding the stormwater management system. |
| | | | Notes |
| | □ Month 1 | Date: | |
| | □ Month 2 | Date: | |
| | □ Month 3 | Date: | |
| | □ Month 4 | Date: | |
| | □ Month 5 | Date: | |
| | □ Month 6 | Date: | |
| | □ Month 7 | Date: | |
| | □ Month 8 | Date: | |
| | □ Month 9 | Date: | |
| | □ Month 10 | Date: | |
| | □ Month 11 | Date: | |
| | □ Month 12 | Date: | |
| | **Spring and Fall** | | □ Check for depressions in areas over and surrounding the stormwater management system. |
| | | | Notes |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | **Yearly** | | □ Confirm that no unauthorized modifications have been performed to the site. |
| | | | Notes |
| | □ Year 1 | Date: | |
| | □ Year 2 | Date: | |
| | □ Year 3 | Date: | |
| | □ Year 4 | Date: | |
| | □ Year 5 | Date: | |
| | □ Year 6 | Date: | |
| | □ Year 7 | Date: | |

**CULTEC**
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P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • www.cultec.com

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# Section 5: Soil Testing Data

Soil Map—Plymouth County, Massachusetts


Map Scale: 1:532 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

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

## MAP LEGEND

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

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

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

**Water Features**
- Streams and Canals

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

**Background**
- Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 18, Sep 5, 2025

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 |
|---|---|---|---|
| 340B | Broadbrook very fine sandy loam, 3 to 8 percent slopes | 0.1 | 7.5% |
| 340C | Broadbrook very fine sandy loam, 8 to 15 percent slopes | 0.8 | 92.5% |
| **Totals for Area of Interest** | | **0.8** | **100.0%** |

# Plymouth County, Massachusetts

## 340B—Broadbrook very fine sandy loam, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 9y4f
*Landscape:* Uplands
*Elevation:* 50 to 400 feet
*Mean annual precipitation:* 41 to 54 inches
*Mean annual air temperature:* 43 to 54 degrees F
*Frost-free period:* 145 to 240 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

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

### Description of Broadbrook

#### Setting

*Landscape:* Uplands
*Landform:* Till plains, Drumlins, Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Coarse-loamy eolian deposits over coarse-loamy lodgment till

#### Typical profile

*Oi - 0 to 2 inches:* slightly decomposed plant material
*Oe - 2 to 4 inches:* moderately decomposed plant material
*A - 4 to 6 inches:* very fine sandy loam
*Bw1 - 6 to 18 inches:* very fine sandy loam
*Bw2 - 18 to 30 inches:* very fine sandy loam
*2Cd1 - 30 to 44 inches:* gravelly fine sandy loam
*2Cd2 - 44 to 63 inches:* gravelly sandy loam

#### Properties and qualities

*Slope:* 3 to 8 percent
*Depth to restrictive feature:* 20 to 39 inches to densic material
*Drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 4.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* F144AY007CT - Well Drained Dense Till Uplands
*Hydric soil rating:* No

## Minor Components

**Paxton**

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Ground moraines, Till plains, Drumlins, Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

**Woodbridge**

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Till plains, Drumlins, Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Hydric soil rating:* No

**Montauk**

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Ground moraines, Till plains, Drumlins
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

**Canton**

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Till plains, Ridges, Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex

*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 18, Sep 5, 2025

# Plymouth County, Massachusetts

## 340C—Broadbrook very fine sandy loam, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 9y4b
*Landscape:* Uplands
*Elevation:* 50 to 400 feet
*Mean annual precipitation:* 41 to 54 inches
*Mean annual air temperature:* 43 to 54 degrees F
*Frost-free period:* 145 to 240 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

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

### Description of Broadbrook

#### Setting

*Landscape:* Uplands
*Landform:* Till plains, Drumlins, Hills
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Coarse-loamy eolian deposits over coarse-loamy lodgment till

#### Typical profile

*Oi - 0 to 2 inches:* slightly decomposed plant material
*Oe - 2 to 4 inches:* moderately decomposed plant material
*A - 4 to 6 inches:* very fine sandy loam
*Bw1 - 6 to 18 inches:* very fine sandy loam
*Bw2 - 18 to 30 inches:* very fine sandy loam
*2Cd1 - 30 to 44 inches:* gravelly fine sandy loam
*2Cd2 - 44 to 63 inches:* gravelly sandy loam

#### Properties and qualities

*Slope:* 8 to 15 percent
*Depth to restrictive feature:* 20 to 39 inches to densic material
*Drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 4.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* C
*Ecological site:* F144AY007CT - Well Drained Dense Till Uplands
*Hydric soil rating:* No

## Minor Components

### Montauk

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Ground moraines, Till plains, Drumlins
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

### Woodbridge

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Till plains, Drumlins, Hills
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Concave
*Hydric soil rating:* No

### Canton

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Till plains, Ridges, Hills
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

### Paxton

*Percent of map unit:* 5 percent
*Landscape:* Uplands
*Landform:* Ground moraines, Till plains, Drumlins, Hills
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex

*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 18, Sep 5, 2025

McS

McSweeney Associates, Inc. Environmental Engineering Services

Thomas F. McSweeney *1894-1977*
Brian McSweeney *1923-2015*
Terence K. McSweeney
Colin T. McSweeney

745 Winter Street
Hanson, MA 02341
(781) 826-4571
(781) 570-9381

August 8, 2024

Leo Yazykov
By email at: leo.yazykov@gmail.com

RE: 22 Howe Street
Hingham, MA

Dear Mr. Yazykov,

I completed a soil analysis at the referenced property on July 8, 2024 using the procedures described at 310 CMR 15,00 et. seq., commonly known as "Title V" of the State Environmental Code. This inspection was completed in order to determine the elevation of historical high groundwater at the site, relative to the proposed building foundation. My evaluation was conducted utilizing a test hole installed immediately adjacent to the proposed foundation location.

In the fall of 1997, I was approved by the Massachusetts Department of Environmental Protection (MaDEP) as a Soils Evaluator; my evaluation in the referenced matter was conducted in accordance with the training, experience, and expertise described at 310 CMR 15.018(2). Summarized below are the results of my analysis; as indicated, no water table was observed in the test hole through the total depth of 128" below surface grade. The elevation of the surface of the ground at the test hole location was 73.22' NAVD88. A vertical bench mark of 75.6' NAVD88 had already been established at the first floor elevation of the existing dwelling.

## RESULTS OF SOILS ANALYSIS

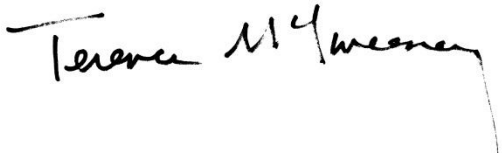
22 Howe Street, Hingham, Massachusetts

| Depth (inches) | Elevation (NAVD) | Horizon | Soil Texture | Soil Color | Mottle/Other |
|---|---|---|---|---|---|
| 0-14 | 73.22'-72.05' | A | Sandy Loam | 10YR 3/2 | None |
| 14-28 | 72.05'-70.89' | B | Sandy Loam | 10YR 4/6 | None |
| 28-108 | 70.89'-64.22' | C1 | Silt Clay Loam | 2.5Y 6/3 | None |
| 108-128 | 64.22'-62.55' | C2 | Sandy Loam | 2.5Y 6/2 | None |

The Town of Hingham Board of Health Supplementary Rules and Regulations for the Disposal of Sanitary Sewage, Section VII.P., requires an 18" vertical separation between historical high groundwater and the bottom of the cellar floor slab. Therefore, to be compliant with this regulation, the bottom of the new cellar slab can be no lower than 64.05' NAVD88, and the top of the 4" slab can be no lower than 64.38' NAVD88.

Please feel free to contact me if I may be of any further assistance in this matter.

Sincerely,
McSweeney Associates, Inc.



Terence McSweeney, R.S.
President
Massachusetts Approved Soil Evaluator (#SE1594)

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# Section 6: Project Plans (Under Separate Cover)