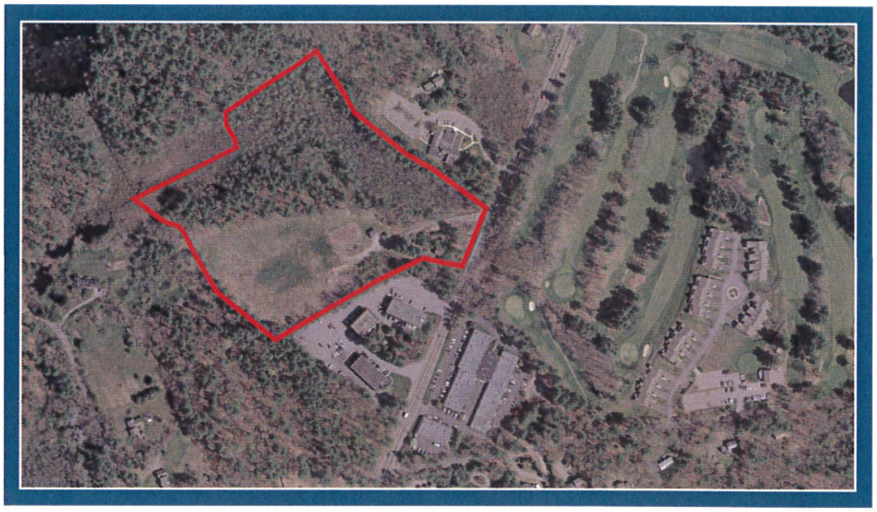
ALLEN & MAJOR
ASSOCIATES, INC.

SITE LOCUS: N.T.S.



ELDERLY HOUSING DEVELOPMENT
470 BOSTON STREET
TOPSFIELD, MASSACHUSETTS
DRAINAGE REPORT

DATE PREPARED:
OCTOBER 13, 2016

REVISED:
JANUARY 17, 2017
FEBRUARY 27, 2017

APPLICANT:
SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
P.O. BOX 2118
100 COMMERCE WAY
WOBURN, MASSACHUSETTS 01888-0118

2/27/17

COMMONWEALTH OF MASSACHUSETTS
TIMOTHY
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CIVIL
No. 43119
REGISTERED
PROFESSIONAL ENGINEER

A&M PROJECT NO. : 2165-01A

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A&M PROJECT #2165-01A

Section 1.0 – Project Narrative and Stormwater Checklist

Section 1.0 - Revised February 27, 2017

Section 2.0 - Included in October, 2016 Drainage Report, O&M Narrative Revised January 17, 2017

Section 3.0 - Included in October, 2016 Drainage Report

Section 4.0 - Revised February 27, 2017

Section 5.0 - Revised February 27, 2017

Section 6.0 - Included in October, 2016 Drainage Report, Section 6.2 Revised January 17, 2017, Sections 6.6, 6.7 & 6.8 Revised February 27, 2017

INTRODUCTION

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the proposed site development at #470 Boston Street in Topsfield, MA. The report will show by means of narrative, calculations, and exhibits that the proposed stormwater management system will meet or exceed the 10 Massachusetts Department of Environment Protection (DEP) stormwater standards, as well as the Town of Topsfield's Stormwater Management Regulations.

The proposed site improvements include construction of 15 condominium-style duplexes consisting of 30 elderly housing units, as well as two common area structures, pedestrian sidewalks, paved drives, landscaped islands, grading, underground utilities, and associated site work. Proposed site improvements also include Best Management Practices (BMP) to effectively handle stormwater runoff from the site.

The proposed Stormwater Management System (SMS) incorporates structural and non-structural BMPs to provide stormwater peak flow mitigation, quality treatment, stormwater infiltration and conveyance. The SMS includes roof drains, drain manholes, underground piping, deep-sump catch basins, proprietary hydro-dynamic separators, infiltration chambers to treat roof runoff, a surface detention/infiltration basin, and a long term Operation and Maintenance Plan.

SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed site improvements at #470 Boston Street are considered a new development under the MA DEP Stormwater Management Standards.

All improvements are considered a "new" development and shall comply with all ten (10) of the MA DEP Stormwater Management Standards. Furthermore, the Town of Topsfield Conservation Commission has eleven (11) Stormwater Standards of their own, which the project will comply with as well.

SITE LOCATION AND ACCESS

The project site is located at #470 Boston Street and is identified on the Town of Topsfield's Assessor's Map #7, Lot #3. The site is a single lot with frontage on Boston Street (Route 1). The site is comprised of 16.32± acres located within both the towns of Topsfield (13.24± acres) and Ipswich (3.08 ± acres), is located approximately 5.0 miles north of the Exit 50 off-ramp from Route 95 Northbound, and is owned by Sarkis Development Company. The site contains approximately 9.45± acres of "upland" area, which are considered buildable areas located outside of flagged bordering vegetated wetland resource areas.

The site has one existing paved access driveway from Boston Street, a public right-of-way 66 feet in width, also known as Route 1. This access drive will continue to serve as the primary access point for the development of the parcel. A gated emergency egress drive is proposed to be constructed just south of the existing drive, with access to Boston Street.

WATERSHED

The project site is located within the Ipswich River Watershed. The site primarily drains into surrounding wetlands to the north of the site, with a relatively small amount draining to a wetland along Boston Street.

EXISTING SITE CONDITIONS

The Site consists of approximately 16.32± acres, all of which is located within the Elderly Housing District (EHD) Overlay, known as "Rolling Green Elderly Housing District," per Article 33 of Annual and Special Town Meeting Warrant for fiscal year 2017, from the May 3, 2016 Town Meeting. The lot is currently occupied by a garage with a paved drive and gravel area nearby, as well as grassed meadow areas, a small garden area, vegetated wetlands and treed woodlands.

Southeast of the garage, is an abandoned residential dwelling, which is proposed to be razed. A concrete surface detention structure and associated catch basins and a drain manhole are also located on-site. The parcel is identified as Map #7 Lot #3 on the Town of Topsfield's Assessor's Maps. The surrounding land uses are primarily Business Park District (BP) and Outlying Residential and Agricultural District (ORA).

Areas of Bordering Vegetated Wetlands (BVW) to the southeast of the site were flagged by Seekamp Environmental Consulting on or between June 27 and June 30, 2016. **With the exception of the possible gravel emergency drive and an 18" outlet pipe mandated by the Town Planning Board and Conservation Commission, respectively, it should be noted that all construction for the project is proposed outside of the 100' wetland buffer. No work is proposed to disturb the existing BVW.**

The majority of the site is comprised of undeveloped meadow and woodland. There is also a large wetland area to the north and a small wetland area abutting Boston Street. An impervious drive and a gravel area outside of the existing garage area slope towards existing catch basins and a drain manhole, which outlet to an existing concrete detention structure located on-site. The site generally slopes from south to north from approximate El. 84+/- at the southwestern property corner to El. 57+/- at the Bordering Vegetated Wetlands (BVW) to the north. See the attached Existing Watershed Plan (EWP) and Aerial Photo (EX-1).

Drainage peak flows and volumes were analyzed at three (3) Study Points:

- Study point 1: This point represents flows to the existing wetlands near Boston Street. Runoff from subcatchments areas E-1 and E-2 eventually collect at Study Point 1. Stormwater runoff from E-1 flows over the paved drive, to the existing catch basins within the existing drive, to a drain manhole, where it is eventually routed to an existing concrete surface detention basin. Overflow from the basin flows overland to the existing downgradient wetlands along Boston Street, designated as Study Point 1, where it is recharged to groundwater. Runoff from E-2 flows overland to the wetland area, defined as Study Point 1.

- Study Point 2 is a large wetland resource area on the northern portion of the site. Runoff from subcatchment area E-3 flows overland and eventually reaches the wetland area, where it is recharged to groundwater.

- Study Point 3 is a large wetland resource area on the northern portion of the site. Runoff from subcatchment area E-4 flows overland and eventually reaches the wetland area, where it is recharged to groundwater.

EXISTING SOIL CONDITIONS

The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Essex County. The site's soil types and corresponding Hydrologic Soil Groups (HSG) include:

- 52A (HSG - B/D) - Freetown Muck, 0-3% slopes
- 420B (HSG - A) - Canton Fine Sandy Loam, 3-8% slopes
- 420C (HSG - A) - Canton Fine Sandy Loam, 8-15% slopes
- 421C (HSG - C) - Canton Fine Sandy Loam, 8-15% slopes (Very stony)
- 421D (HSG - C) - Canton Fine Sandy Loam, 15-25% slopes (Very stony)

See the Section 6.1 of the Appendix of this report for a copy of the soil mapping with Hydrological Soil Groups (HSG).

FEMA FLOODPLAIN/ENVIRONMENTAL DUE DILIGENCE

An environmental due diligence was completed by consulting the latest Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) dated July 3, 2012 noted as community panel #25009CO266F (Exhibit 3 - FEMA FIRM). A portion of the project site lies within a 100-year floodplain area (Zone A – Areas subject to inundation by the 1-

percent-annual-chance flood, with no Base Flood Elevation (BFE)). No portion of the project site lies within the 500-year floodplain.

A review of the latest Massachusetts Natural Heritage Atlas (13th Edition) reveals that there are no Estimated Habitats, Priority Habitats or Certified Vernal Pools onsite or directly adjacent to the site (Exhibit 4 - Priority & Estimated Habitats). Additionally, the site is not located within any Areas of Critical Environmental Concern (ACEC).

On or between June 27 to June 30, 2016, approximately 1,600± linear feet of Bordering Vegetated Wetland to the north of the site was delineated by Seekamp Environmental Consultants, Inc. (SEC). Approximately 300± linear feet of Bordering Vegetated Wetland to the east of the site was delineated by SEC. In total, approximately, 1,900± linear feet of Bordering Vegetated Wetland were delineated on-site. The BVW and its associated buffer zone (100 ft. State Jurisdictional and Local Buffer) are shown on the plans.

DRAINAGE ANALYSIS METHODOLOGY

Peak rates of runoff were determined using techniques and data found in the following reference materials:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service (SCS), June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.

2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.00, 2013. The HydroCAD© program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD© uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

3. Soil Survey of Essex County Massachusetts by United States Department of Agriculture, NRCS. Soil types and boundaries were obtained from this reference.

PEAK RATE OF RUNOFF

The storm water runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR-55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Furthermore, the analysis has been prepared in accordance with the MA DEP and the Town of Topsfield requirements, as well as standard engineering practices. The peak rates of runoff have been estimated for each watershed for the theoretical 2-, 10-, and 25-year storm events.

A surface infiltration basin and subsurface infiltration chambers will receive stormwater directly from the proposed roofs and pretreated impervious site areas (parking lots and driveways). Pretreatment for runoff from paved surfaces is provided by deep sump catch basins and proprietary hydro-dynamic separators which prevents sediment from being deposited into the infiltration systems, inhibiting stormwater treatment. The systems have been designed to mitigate the required recharge and water quality volume generated on the developed surfaces. The systems maintain at least two (2) feet of separation from groundwater and drain down within the required 72 hours.

The HydroCAD storm water runoff model shows that ***the proposed site development reduces the overall peak rate of runoff at all identified points of analysis***. The following tables provide a summary of the estimated peak flow rate and peak volume at each Study Point during each of the design storm events. The HydroCAD worksheets are included in Section 4 of this report.

STUDY POINT #1 (Flow to wetland near Boston Street)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.07	0.58	1.14
Proposed Runoff (CFS)	0.01	0.18	0.45
% REDUCTION	85.7%	69.0%	60.5%

STUDY POINT #1 (Flow to wetland near Boston Street)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.05	0.15	0.23	0.34
Proposed Runoff (AF)	0.01	0.07	0.12	0.20
% REDUCTION	80.0%	53.3%	47.8%	41.2%

STUDY POINT #2 (Flow to wetland to northeast of the project site)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.08	0.62	1.52
Proposed Runoff (CFS)	0.01	0.21	0.67
% REDUCTION	87.5%	66.1%	55.9%

STUDY POINT #2 (Flow to wetland to northeast of the project site)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.05	0.21	0.36	0.59
Proposed Runoff (AF)	0.01	0.10	0.19	0.42
% REDUCTION	80.0%	52.4%	47.2%	28.8%

STUDY POINT #3 (Flow to wetland to northwest of the project site)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.08	0.82	2.29
Proposed Runoff (CFS)	0.01	0.32	1.22
% REDUCTION	87.5%	61.0%	46.7%

STUDY POINT #3 (Flow to wetland to northwest of the project site)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.06	0.29	0.53	0.89
Proposed Runoff (AF)	0.01	0.15	0.41	0.87
% REDUCTION	83.3%	48.3%	22.6%	2.2%

As described in the tables above, the total existing storm water peak flow and volume decrease in the post-construction watershed, as compared to the pre-construction watershed. Therefore, based on the HydroCAD model, the proposed watershed area will not increase in flow and/or volume.

MA DEP STORMWATER PERFORMANCE STANDARDS

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for storm water management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System (SMS) meets the standards set forth by the Policy.

Stormwater Best Management Practices (BMPs) implemented in the proposed SMS design include:

Deep Sump Catch Basins with Hoods
Surface Infiltration Basin
Subsurface Infiltration Chambers
Proprietary Hydro-dynamic Separators

Stormwater BMPs have been incorporated into the design of the project to mitigate the anticipated pollutant loading. Temporary erosion and sedimentation controls will be incorporated during the construction phase of the project. These temporary controls include coir logs and/or silt fence barriers, inlet sediment traps, diversion channels, slope stabilization and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10)

Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are as follows:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

   The proposed development will not introduce any new outfalls with direct discharge to a wetland areas or waters of the Commonwealth of Massachusetts. All discharges will be treated for water quality.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   The proposed development has been designed such that the post-development peak discharge rates do not exceed the pre-development peak discharge rates. A summary of the existing and proposed discharge rates is included within this document.

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

   The existing annual recharge for the site has been approximated in the developed condition. Subsurface infiltration chambers and a surface infiltration basin have been designed to meet this requirement. Soil test data can be found in the appendix of this report. The proposed Recharge Volume is based on the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1.

   The primary on-site soils are classified as follows by the USDA NRSC:

- 52A (HSG - B/D) - Freetown Muck, 0-3% slopes
- 420B (HSG - A) - Canton Fine Sandy Loam, 3-8% slopes
- 420C (HSG - A) - Canton Fine Sandy Loam, 8-15% slopes
- 421C (HSG - C) - Canton Fine Sandy Loam, 8-15% slopes (Very stony)

- 421D (HSG - C) - Canton Fine Sandy Loam, 15-25% slopes (Very stony)

See attached Standard DEP Calculations in the appendix of this report for Recharge Volume and 72-hour drawdown time calculations.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*
    a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
    b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
    c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The proposed stormwater management system has been designed such that the 80% TSS removal standard will be met for each drainage area. Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long Term Pollution Prevention Plan.

Water quality volume for the developed site will be captured and treated using deep sump catch basins and proprietary hydro-dynamic separators. All systems will be sized to meet the water quality flow rate for the ½” storm event.

The TSS removal efficiencies for the deep sump catch basins and infiltration basin are based on the values assigned under the MA DEP Stormwater handbook. All proprietary separators have been sized using ***water quality discharge flow rate*** and for a minimum TSS removal based on values assigned by the PC version of EPA’s Stormwater Management Model (PCSWMM).

The PCSWMM program was used to size the proprietary separators. Water Quality Units #2 and #3 shall be Stormceptor STC-900 units, which will remove a minimum of 80% of total suspended solids (TSS). Water Quality Unit #1 is sized to be a Stormceptor 450i treatment unit, and in combination with catch basins with deep sumps and hoods as well as Underground Infiltration System #1 with an isolator row wrapped in filter fabric will achieve a minimum of 80% TSS removal. See the MADEP TSS removal worksheets in the Appendix for more data.

Standard #4 also requires that suitable source control measures are identified in the Long Term Pollution Prevention Plan including street sweeping and proper cleaning of the water quality swale, drainage structures (catch basins), and proprietary separators.

See attached Standard DEP Calculations in the appendix of this report for TSS removal and water quality discharge flow rate calculations.

5. *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. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

   The proposed development is not considered a land use with higher potential pollutant loads (LUHPPL).

6. *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. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314*

CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

The project site does not discharge stormwater within a Zone II and Interim Wellhead Protection Area or near a critical area.

7. *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.*

   The proposed project is not considered a re-development project under the Stormwater Management Handbook guidelines because while there is an existing, abandoned structure, driveway, and garage, the total impervious area for the site will increase.

8. *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.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation and Maintenance (O&M) Plan has been developed for the proposed stormwater management system and can be found within this Drainage Report.

10. *All illicit discharges to the stormwater management system are prohibited.*

There are no expected illicit discharges to the stormwater management system. An Illicit Discharge Compliance Statement is attached in the Appendix of this report.

TOWN OF TOPSFIELD STORMWATER PERFORMANCE STANDARDS

The Town of Topsfield has also developed their own Stormwater Standards to ensure that the waters within the town are protected.

1) *Stormwater run-off directed or channeled into any resource area has the potential of degrading or altering that area as a result of pollution conveyed and/or the disposition of silt and sediments into that area. It is presumed that a fully viable resource area is significantly to the interests of the Act and the Bylaw. Therefore, any discharge of any stormwater directed or channeled into a resource area by any new or repaired stormwater management system shall conform to all listed standards contained in the* ***Massachusetts Stormwater Management Regulations*** *adopted by the Mass Department of Environmental Protection as they may amended from time to time, hereafter called the Stormwater Regulations, and the provisions of 310 CMR-10.05, paragraphs: (k), (m), (n), (p), and (q), as they may be amended over time. Detailed performance requirements of stormwater management systems constructed in compliance with the above standards are found in the* ***Massachusetts Stormwater Handbook volumes 1-4.***

   The proposed Stormwater Management System has been designed to meet or exceed all ten (10) of the Massachusetts Stormwater Standards (see section entitled "MA DEP Stormwater Performance Standards", above.

2) *Any lot proposed for development, redevelopment, or additional development that borders on or contains any resource area protected by the Act and the Bylaw located in the red zone of the Soils Map or on a drumlin shall demonstrate by engineered design that stormwater runoff from the proposed construction would be retained on-site in either bio-retention ponds, rain gardens, drywells, or similarly functioning low impact features. Where that is proved not to be feasible, the drainage system shall be designed to intercept suspended solids and hydrocarbon pollutants using best management practices (BMP's) in conformance with standard four of the Stormwater Regulations prior to being discharged into the resource area.*

   The proposed Stormwater Management System has been designed to meet Standard #4 in the Massachusetts Stormwater Handbook. Subsurface infiltration chambers and an infiltration basin are used to ensure waters are kept on site and charged to groundwater.

3) *All designs and BMPs managing stormwater runoff shall be sized to accommodate a 100-year storm frequency event without causing erosion or siltation of the retention area.*

   The analysis shows the overall volume has been reduced for the 100-year storm and no erosion or scouring will be caused to the retention areas.

4) *During the construction of the proposed development and until such time that the disturbed soil has been stabilized appropriately, erosion and sedimentation control measures shall be installed around the perimeter of the construction site in accordance with standard eight of the Stormwater Regulations. Erosion and sedimentation controls for the proposed construction site shall be approved by the Topsfield Conservation Commission or its designated agent prior to the start of any work onsite. All soils stored at the construction site for greater than 24 hours shall be covered by a waterproof tarpaulin or equivalent rainwater protection.*

   A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

5) *No snow hauled from parking lots or public ways shall be deposited in any resource area under the jurisdiction of the Topsfield Conservation Commission unless authorized under (permit) conditions deemed necessary by the Topsfield Conservation Commission to protect interests of the Act and the Bylaw.*

   Snow storage regulations have been included as part of the O&M Plan. See also the Snow Storage Plan.

6) *All stormwater management systems permitted hereunder shall have operations and maintenance plans approved by the Commission in conformance with standard nine of the Stormwater Regulations.*

   An Operation and Maintenance (O&M) Plan is included within this drainage report. As part of the O&M Plan, there is an attachment entitled “Snow Disposal Guidance” issued by the MassDEP which outlines appropriate snow disposal methods.

7) *Impervious areas such as driveways, patios, and parking lots shall be graded to facilitate stormwater runoff into adjacent grassy swales or catchment areas. No driveway shall be constructed or modified with a pitch such that runoff is directed onto a public road or street. Wherever possible, vegetated drainage swales and rain gardens shall be located to retain stormwater runoff onsite. The Commission encourages the use of pervious pavement materials such as pavers and porous asphalt. For information on porous asphalt contact: National Asphalt Pavement Assoc.*

   The proposed Stormwater Management System has been designed such that all stormwater remains on site. Subsurface infiltration chambers and a surface infiltration system infiltration the majority of the sites runoff back to groundwater. However, during intense storm events, the emergency overflow outlets both the subsurface infiltration chambers and the surface infiltration basin outlet to the abutting wetlands to prevent onsite flooding.

8) *As part of new construction and modifications to existing structures, stormwater runoff from all roof drains shall be conveyed into infiltration trenches, drywells, rain gardens, or similar BMPs to facilitate groundwater recharge and protect water quality.*

   All proposed roof drains are conveyed to infiltration chambers.

9) *Developments or construction in Riverfront Areas or Buffer Zones shall be designed to be in conformance with LID practices.*

   The proposed site development is not located within a Riverfront Area and primarily avoids work within the wetland buffer zone, with the exception of the gravel emergency access driveway requested by the Town Planning Board. The access road will primarily be gravel to promote infiltration and an LID practice.

10) *As-built plans of stormwater management systems permitted hereunder shall be submitted to the Conservation Commission upon completion of the construction together with a certificate signed by an engineer or professional land surveyor that the system meets the relevant requirements of the Stormwater Regulations. This submission is required at least 14 days prior to the issuance of a Certificate of Compliance by the Commission.*

    An as-built plan shall be submitted to the Topsfield Conservation Commission before the issuance of the Certificate of Compliance.

MA DEP CHECKLIST FOR STORMWATER REPORTS

See following pages.

Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The proposed development is not considered a land use with higher potential pollutant loads (LUHPPL).

6. *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. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

   The project site does not discharge stormwater within a Zone II and Interim Wellhead Protection Area or near a critical area.

7. *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.*

   The proposed project is not considered a re-development project under the Stormwater Management Handbook guidelines because while there is an existing, abandoned structure, driveway, and garage, the total impervious area for the site will increase.

8. *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.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation and Maintenance (O&M) Plan has been developed for the proposed stormwater management system and can be found within this Drainage Report.

10. *All illicit discharges to the stormwater management system are prohibited.*

    There are no expected illicit discharges to the stormwater management system. An Illicit Discharge Compliance Statement is attached in the Appendix of this report.

TOWN OF TOPSFIELD STORMWATER PERFORMANCE STANDARDS

The Town of Topsfield has also developed their own Stormwater Standards to ensure that the waters within the town are protected.

1) *Stormwater run-off directed or channeled into any resource area has the potential of degrading or altering that area as a result of pollution conveyed and/or the disposition of silt and sediments into that area. It is presumed that a fully viable resource area is significantly to the interests of the Act and the Bylaw. Therefore, any discharge of any stormwater directed or channeled into a resource area by any new or repaired stormwater management system shall conform to all listed standards contained in the* ***Massachusetts Stormwater Management Regulations*** *adopted by the Mass Department of Environmental Protection as they may amended from time to time, hereafter called the Stormwater Regulations, and the provisions of 310 CMR-10.05, paragraphs: (k), (m), (n), (p), and (q), as they may be amended over time. Detailed performance requirements of stormwater management systems constructed in compliance with the above standards are found in the* ***Massachusetts Stormwater Handbook volumes 1-4.***

   The proposed Stormwater Management System has been designed to meet or exceed all ten (10) of the Massachusetts Stormwater Standards (see section entitled "MA DEP Stormwater Performance Standards", above.

2) *Any lot proposed for development, redevelopment, or additional development that borders on or contains any resource area protected by the Act and the Bylaw located in the red zone of the Soils Map or on a drumlin shall demonstrate by engineered design that stormwater runoff from the proposed construction would be retained on-site in either bio-retention ponds, rain gardens, drywells, or similarly functioning low impact features. Where that is proved not to be feasible, the drainage system shall be designed to intercept suspended solids and hydrocarbon pollutants using best management practices (BMP's) in conformance with standard four of the Stormwater Regulations prior to being discharged into the resource area.*

   The proposed Stormwater Management System has been designed to meet Standard #4 in the Massachusetts Stormwater Handbook. Subsurface infiltration chambers and an infiltration basin are used to ensure waters are kept on site and charged to groundwater.

3) *All designs and BMPs managing stormwater runoff shall be sized to accommodate a 100-year storm frequency event without causing erosion or siltation of the retention area.*

   The analysis shows the overall volume has been reduced for the 100-year storm and no erosion or scouring will be caused to the retention areas.

4) *During the construction of the proposed development and until such time that the disturbed soil has been stabilized appropriately, erosion and sedimentation control measures shall be installed around the perimeter of the construction site in accordance with standard eight of the Stormwater Regulations. Erosion and sedimentation controls for the proposed construction site shall be approved by the Topsfield Conservation Commission or its designated agent prior to the start of any work onsite. All soils stored at the construction site for greater than 24 hours shall be covered by a waterproof tarpaulin or equivalent rainwater protection.*

   A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

5) *No snow hauled from parking lots or public ways shall be deposited in any resource area under the jurisdiction of the Topsfield Conservation Commission unless authorized under (permit) conditions deemed necessary by the Topsfield Conservation Commission to protect interests of the Act and the Bylaw.*

   Snow storage regulations have been included as part of the O&M Plan. See also the Snow Storage Plan.

6) *All stormwater management systems permitted hereunder shall have operations and maintenance plans approved by the Commission in conformance with standard nine of the Stormwater Regulations.*

   An Operation and Maintenance (O&M) Plan is included within this drainage report. As part of the O&M Plan, there is an attachment entitled "Snow Disposal Guidance" issued by the MassDEP which outlines appropriate snow disposal methods.

7) *Impervious areas such as driveways, patios, and parking lots shall be graded to facilitate stormwater runoff into adjacent grassy swales or catchment areas. No driveway shall be constructed or modified with a pitch such that runoff is directed onto a public road or street. Wherever possible, vegetated drainage swales and rain gardens shall be located to retain stormwater runoff onsite. The Commission encourages the use of pervious pavement materials such as pavers and porous asphalt. For information on porous asphalt contact: National Asphalt Pavement Assoc.*

   The proposed Stormwater Management System has been designed such that all stormwater remains on site. Subsurface infiltration chambers and a surface infiltration system infiltration the majority of the sites runoff back to groundwater. However, during intense storm events, the emergency overflow outlets both the subsurface infiltration chambers and the surface infiltration basin outlet to the abutting wetlands to prevent onsite flooding.

8) *As part of new construction and modifications to existing structures, stormwater runoff from all roof drains shall be conveyed into infiltration trenches, drywells, rain gardens, or similar BMPs to facilitate groundwater recharge and protect water quality.*

   All proposed roof drains are conveyed to infiltration chambers.

9) *Developments or construction in Riverfront Areas or Buffer Zones shall be designed to be in conformance with LID practices.*

   The proposed site development is not located within a Riverfront Area and primarily avoids work within the wetland buffer zone, with the exception of the gravel emergency access driveway requested by the Town Planning Board. The access road will primarily be gravel to promote infiltration and an LID practice.

10) *As-built plans of stormwater management systems permitted hereunder shall be submitted to the Conservation Commission upon completion of the construction together with a certificate signed by an engineer or professional land surveyor that the system meets the relevant requirements of the Stormwater Regulations. This submission is required at least 14 days prior to the issuance of a Certificate of Compliance by the Commission.*

    An as-built plan shall be submitted to the Topsfield Conservation Commission before the issuance of the Certificate of Compliance.

MA DEP CHECKLIST FOR STORMWATER REPORTS

See following pages.

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

Checklist for Stormwater Report

A. Introduction

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

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
TIMOTHY J. WILLIAMS
CIVIL
No. 43119
REGISTERED PROFESSIONAL ENGINEER

2/27/17

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☒ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface infiltration systems, possible gravel emergency access road versus paved, if required.

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:
- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☒ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Section 2.0 – Operation & Maintenance Plan

OPERATION AND MAINTENANCE PLAN

In accordance with the standards set forth by the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), Allen & Major Associates, Inc. (A&M) has prepared the following Operation and Maintenance plan for the proposed elderly housing development and drainage improvements at #470 Boston Street (Route 1).

This plan is broken into three major sections. The first section describes construction-related erosion and sedimentation controls (Construction Period). The second section describes the long term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is devoted to a post-development operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan). An operation and maintenance schedule has been included with this report.

Stormwater Management System Owner: Sarkis Development Company
2 Elm Square
Andover, MA 01810

Emergency Contact Information:

- Sarkis Development Company (Owner) Phone (978) 475-4055
- Allen & Major Associates, Inc. (Site Civil Engineer) Phone (781) 935-6889
- Topsfield Public Works - Water Phone (978) 887-1517
- Topsfield Public Works – Highway Phone (978) 887-1542
- Topsfield Conservation Commission Phone (978) 887-1510
- Topsfield Fire Department (non-emergency line) Phone (978) 887-5148
- DEP Emergency Response (Mass DEP) Phone (888) 304-1133

INTRODUCTION

The stormwater management system (SMS) for this project is owned by Sarkis Development Company, and shall be legally responsible for long-term operation and maintenance for this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change the succeeding owner will be presented with this O&M Plan and supporting attachments at or before legal conveyance of ownership and will assume the obligations of the O&M Plan.

In the event that the SMS will be operated and maintained by an entity other than that listed in this document, the applicant shall provide a plan and easement deed that provides a right of access for the legal entity to be able to perform said operation and maintenance functions. In the event the SMS will serve multiple lots/owners, the applicant shall also provide a copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the entire SMS.

DEMOLITION & CONSRUCTION MAINTENANCE PLAN

1. Contact the Topsfield Conservation Commission Agent at least three (3) days prior to start of demolition and/or construction activities.

2. Install Erosion Control measures as shown on the Plans prepared by A&M. The Topsfield Conservation agent shall approve the installation of coir logs and silt fencing prior to the start of any site demolition work. Install construction fencing, if determined to be necessary, at the commencement of construction.

3. Install construction entrances, coir logs and silt fence at the locations shown on the Demolition and Erosion Control Plan prepared by A&M.

4. Site access shall be achieved only from the designated construction entrances.

5. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

6. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.

7. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on site for review.

8. All erosion control measures shall be maintained, repaired or replaced as required or at the direction of the owner's engineer or the Town Conservation Agent.

9. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.

10. Silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack

replaced if torn or damaged. Install stone check dams on site during construction as needed; refer to the erosion control details. Temporary sediment basins combined with stone check dams shall be installed on site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.

11. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.

12. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.

13. Dust pollution shall be controlled using on-site water trucks and or an approved soil stabilization product.

14. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly to the Conservation agent. The report shall document any deficiencies and corrective actions taken by the applicant.

LONG TERM POLLUTION PREVENTION PLAN

Standard #4 from the MA DEP Stormwater Management Handbook requires that a Long Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures for the LTPPP.

- **HOUSEKEEPING**

The proposed site development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland area. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

- **STORING OF MATERIALS AND WASTE PRODUCTS**

There are no proposed exterior (un-covered) storage areas.. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- **VEHICLE WASHING**

The proposed project does not include any designated vehicle washing areas.

- **SPILL PREVENTION AND RESPONSE**

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

LANDSCAPE MAINTENANCE PLAN

- **MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPED AREAS**

It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff / landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis.

- **Fertilizer**

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Both slow-release organic fertilizers and synthetic fertilizers can be used onsite. Fertilization of the planting, lawns and mulch areas will be performed within manufacturers labeling instructions. Examples of some fertilizers options include but is not limited to:

LESCO® 28-0-12 (Lawn Fertilizer)
MERIT® 0.2 Plus Turf Fertilizer
MOMENTUM™ Force Weed & Feed

- **Landscape Maintenance Program Practices:**
  - **Lawn**
    1. Mow a minimum of once a week in spring, to a height of 2” to 2 1/2” high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
    2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.

3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

- ♦ **Shrubs**

1. Mulch not more than 3" depth with shredded pine or fir bark.
2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
3. Hand prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

- ♦ **Trees**

1. Provide aftercare for new tree plantings for the first three years.
2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
3. Water once a week for the first year; twice a month the second, once a month the third year.
4. Prune trees on a four-year cycle.

- ♦ **Invasive Species**

1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

- **STORAGE AND USE OF HERBICIDES AND PESTICIDES**

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) will be retained who is licensed with the Commonwealth of Massachusetts Executive

Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor or structural pests. 333 CMR 13.08.

Before beginning each application, the applicator must inform the conservation commission and post a state and local approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company
2. Date and time of the application;
3. Name and license number of the applicator
4. Target pests
5. Name and EPA Registration Number of pesticide products applied

The notification must be made in writing. The intent is so that individuals, who wish to avoid exposure or want to avoid encountering the applicator, can make necessary arrangements. Applicators are required by law to follow all directions on the pesticide label and must take all steps necessary to avoid applications with people present in a room or area to be treated. Individuals occupying a room or area to be treated at the time of application shall be informed of the procedure. Whenever possible, the applicator should not apply pesticides with anyone present. That may mean treating other areas and returning when occupants have left, asking people to leave the area while the work is being done, or treating before or after people occupy the room. If people do not leave, the applicator must make it clear that he is there to apply pesticides. The applicator will be prepared to provide whatever information possible about the pesticides and techniques used.

- **MANAGEMENT OF DEICING CHEMICALS AND SNOW**

It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to Massachusetts DEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations.

The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. The de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. De-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand and salt to the amounts needed for public safety.

POST CONSRUCTION MAINTENANCE PLAN

The SMS shall be inspected immediately after construction. A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

<u>Inspection and Maintenance Frequency and Corrective Measures:</u>
In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the foot print of the SMS.

<u>Structural Pretreatment BMPs:</u> Regular maintenance of these BMPs is especially critical because they typically receive the highest concentration of suspended solids during the first flush of a storm event.

Deep Sump Catch Basins:
Inspect or clean catch basins at least 4 times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four (4) times a year or whenever the depth of the deposits is greater than or equal to open half of the bottom of the invert of the lowest pipe in the basin. Structures will be skimmed of floatable debris at each inspection and if the basin outlet is designed with a hood to trap floatable materials (i.e. Snout), check to ensure watertight seal is working. Clamshell buckets or vacuum trucks are typically used, however, vacuum trucks are preferred.

Proprietary Separators:
Proprietary Separators will be inspected and cleaned out in accordance with the manufacturer's requirements, or at least twice per year. Sediments and debris removed should be disposed of in accordance with all applicable local, state and federal laws and regulations including M.G.L.c. 21C and 310 CMR 30.00.

Cultec Isolator Row:
At a minimum, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observations. However, the isolator row should be inspected at least once a year. A stadia rod should be used during inspection to measure the depth of sediment in the isolator row. Once there is three inches (3") of sediment throughout the bottom of the isolator row, a clean-out should be performed. The isolator row should be cleaned using a JetVac process.

<u>Infiltration BMPs:</u>

Stormwater Infiltration Basin:
The basin must be inspected and preventive maintenance must be performed at least twice a year and after every time drainage discharges through the high outlet orifice. Maintenance of upstream pre-treatment measures is critically important to the function of infiltration BMPs. Pre-treatment BMPs should be inspected for sediment and floatables accumulation and maintained at least twice per year (every other month recommended) and after every major storm event.

<u>Other BMPs and Accessories:</u>

Culverts:
Inspect culverts 2 times per year (preferably in spring and fall) to ensure that the culverts are working in their intended fashion and that they are free of debris. Remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit and to repair any erosion damage at the culvert's inlet and outlet.

Surface Infiltration Basin:

The operation and maintenance plan required must include inspections and preventative maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. The basin should be inspected after every major storm event for the first few months to ensure it is stabilized and functioning properly. Note how long water remain in the basin after a major storm event; standing water within 48 to 72 hours of an event may indicate the infiltration capacity may have been overestimated.

Thereafter, inspect the infiltration basin at least twice a year. Important items to check include:

- Signs of differential settlement
- Cracking
- Erosion
- Leakage of embankments
- Tree growth on embankments
- Condition of rip-rap
- Sediment accumulation
- The health of the turf

At least twice a year the side slopes, buffer area, and basin bottom need to be mowed. Glass clippings should be removed to prevent an organic, impervious mat from forming.

Roadways and Parking Surfaces:
Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

Level Spreaders, Check Dams, and Rip-rap:
These accessories will be inspected twice a year for erosion, debris accumulation, and unwanted vegetation. Erosion will be stabilized and sediment, debris, and wood vegetation shall be removed.

OPERATION & MAINTENANCE PLAN SCHEDULE

Project: #470 Boston Street
Address: Topsfield, MA

Party Responsible for O & M Plan: Sarkis Development Company
Address: 2 Elm Square
Andover, MA 01810
Phone: (978) 475-4055

Date: 10/13/2016
Revised 2/27/2017

Structure or Task	Maintenance Activity	Schedule/Notes	Annual Maintenance Cost	Inspection Performed Date:	Inspection Performed By:
Street Sweeping	Sweep, power broom or vacuum paved areas.	Sweep paved areas as needed, but not less than four times annually.	$2,000		
		Submit information that confirms that all street sweepings have been disposed in accordance with state and local requirements			
Infiltration Basin	Inspect basin to make sure vegetation is adequate and slopes are not eroding	Perform every six months and after rain event larger than 3".	$500		
	Remove trash, debris, leaves and grass clippings				
	Check Outlets for clogging				
	Remove tree seedings before they become established				
	Mow basin bottom, side slopes, and buffer area twice a year	72 hours after major rain events. See also note #1 below.			
Deep Sump Catch Basins(s)	Clam shell or vacuum sumps (vacuum preferred)	Inspect at least twice annually. Clean when sediment is within 2.5 feet of the outlet invert.	$500		
		Submit information that confirms that all catch basin sediments have been disposed in accordance with state and local requirements			
Storm Water Management System					
Proprietary Separators	See the Stormceptor maintenance package for the inspection and cleaning procedure	Inspect at least four times annually as well as following storms exceeding 1" of rainfall. Devices shall be cleaned at leaast once annually or when sediment reaches 6 inches of depth whichever is more frequent. See also note #1 below.	$250		
		Submit information that confirms that all water quality inlets sediments have been disposed in accordance with state and local requirements			
Subsurface Infiltration Systems	Inspect to ensure it is draining properly.	Perform every other month as well as after every storm event over 1/2". See also note #1 below.	$500		
	Inspect isolator row using inspection ports and remove any accumulated sediment when average depth reaches 1" per the manufacturers recommendation.	On a semi-annual basis.			
Outlet Control Structure(s)	Vacuum.	Periodic cleaning of Outlet Control Structures as needed.	$50		
Mosquito Control	CB management targeted larviciding treatment to CB's and all storm drains to control mosquitoes in their aquatic stages.	Surveillance is a non chemical inspection method that involves classification of mosquito breeding sites, larval presents, and survey.	$100		
Snow Storage	Debris shall be cleared from the site and properly disposed of at the end of the snow season, but shall be cleared no later than May 15.	Avoid dumping snow removal over catch basins, in detention ponds, sediment forebays, rivers, wetlands, and flood plain. It is also prohibited to dump snow in the bioretention basins or gravel swales. (See Site Plan for appropriate locations)	$500		

Snow Disposal Guidance

Effective Date: March 8, 2001

Guideline No. BRPG01-01

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: BRP Snow Disposal Guideline BRPG97-1 issued 12/19/97, and all previous snow disposal guidance

Approved by: Glenn Haas, Assistant Commissioner for Resource Protection

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are acceptable to the Department of Environmental Protection, Bureau of Resource Protection.

APPLICABILITY: These Guidelines are issued by the Bureau of Resource Protection on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to public agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While we are all aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything we do on the land has the potential to impact our water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter.

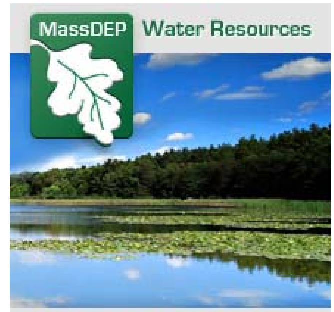
RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris which can be removed in the springtime. The following areas should be avoided:

- Avoid dumping of snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Do not dump snow within a Zone II or Interim Wellhead Protection Area (IWPA) of a public water supply well or within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater (see the next page for information on ordering maps from MassGIS showing the locations of aquifers, Zone II's, and IWPAs in your community).
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.



A to Z Quick Links

Water Resources Index

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Site Selection Procedures

1. It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:
2. Estimate how much snow disposal capacity is needed for the season so that an adequate number of disposal sites can be selected and prepared.
3. Identify sites that could potentially be used for snow disposal such as municipal open space (e.g., parking lots or parks).
4. Sites located in upland locations that are not likely to impact sensitive environmental resources should be selected first.
5. If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

MassGIS Maps of Open Space and Water Resources

If local maps do not show the information you need to select appropriate snow disposal sites, you may order maps from MassGIS (Massachusetts Geographic Information System) which show publicly owned open spaces and approximate locations of sensitive environmental resources (locations should be field-verified where possible). Different coverages or map themes depicting sensitive environmental resources are available from MassGIS on the map you order. At a minimum, you should order the Priority Resources Map. The Priority Resources Map includes aquifers, public water supplies, MassDEP-approved Zone II's, Interim Wellhead Protection Areas, Wetlands, Open Space, Areas of Critical Environmental Concern, NHESP Wetlands Habitats, MassDEP Permitted Solid Waste facilities, Surface Water Protection areas (Zone A's) and base map features. The cost of this map is $25.00. Other coverages or map themes you may consider, depending on the location of your city or town, include Outstanding Resource Waters and MassDEP Eelgrass Resources. These are available at $25.00 each, with each map theme being depicted on a separate map. Maps should be ordered from MassGIS . Maps may also be ordered by fax at 617-626-1249 (order form available from the MassGIS web site) or mail. For further information, contact MassGIS at 617-626-1189.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- To filter pollutants out of the meltwater, a 50-foot vegetative buffer strip should be maintained during the growth season between the disposal site and adjacent waterbodies.
- Debris should be cleared from the site prior to using the site for snow disposal.
- Debris should be cleared from the site and properly disposed of at the end of the snow season and no later than May 15.

3. EMERGENCY SNOW DISPOSAL

As mentioned earlier, it is important to estimate the amount of snow disposal capacity you will need so that an adequate number of upland disposal sites can be selected and prepared.

If despite your planning, upland disposal sites have been exhausted, snow may be disposed of near waterbodies. A vegetated buffer of at least 50 feet should still be maintained between the site and the waterbody in these situations. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed in certain waterbodies under certain conditions. In these dire situations, notify your Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody.

Use the following guidelines in these emergency situations:

- Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
- Do not dispose of snow in saltmarshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
- Do not dispose of snow where trucks may cause shoreline damage or erosion.
- Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local

ordinances and bylaws.

FOR MORE INFORMATION

If you need more information, contact one of MassDEP's Regional Service Centers:

Northeast Regional Office, Wilmington, 978-694-3200
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7683
Western Regional Office, Springfield, 413-755-2214

or

Call Thomas Maguire of DEP's Bureau of Resource Protection in Boston at 617-292-5602.

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

<u>Post-Construction Stormwater Treatment Practices</u>

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or “dead” zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs)*, the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Contactor® & Recharger®
Stormwater Chambers The Chamber With The Stripe®

Operation and Maintenance Guidelines

CULTEC™

Operation & Maintenance

This manual contains guidelines recommended by CULTEC, Inc. 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 determine 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)

Major Maintenance *(continued)*

	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. • 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. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • 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. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.
	45 to 50 years after commissioning	• Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • 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, Inc. at 1-800-428-5832.

CULTEC™

Chamber of Choice™

CULTEC, Inc.
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Phone: 203-775-4416 • Toll Free: 800-4-CULTEC • Fax: 203-775-1462
Web: www.cultec.com • E-mail: custservice@cultec.com

MAINTENANCE

Inspection and Maintenance. Easy. Convenient.

When it rains, oils, sediment and other contaminants are captured and contained by over 40,000 Stormceptor units operating worldwide. While Stormceptor's patented scour prevention technology ensures captured pollutants remain in the unit during all rainfall events, the accumulated pollutants must eventually be removed as part of a regular maintenance program.

If neglected, oil and sediment gradually build up and diminish any BMP's efficiency, harming the environment and leaving owners and operators vulnerable to fines, surcharges and bad publicity.

Maintenance is a must

Ease, frequency and cost of maintenance are often overlooked by specifiers when considering the merits of a stormwater treatment system. In reality, maintenance is fundamental to the long-term performance of any stormwater quality treatment device.

While regular maintenance is crucial, it shouldn't be complicated. An ongoing maintenance program with Stormceptor is convenient and practically effortless. With virtually no disruptions, you can concentrate on your core business.

Quick inspections

Inspections are easily carried out above ground from any standard surface access cover through a visual inspection of the orifice and drop tee components. A sludge judge and oil dip-stick are all that are needed for sediment and oil depth measurements.

Easy unit access

Maintenance is typically conducted from the same surface access cover, eliminating the need for confined space entry into the unit. Your site remains undisturbed, saving you time and money.

No muss, no fuss and fast

Maintenance is performed quickly and inexpensively with a standard vacuum truck. Servicing usually takes less than two hours, with no disruption to your site.

A complete stormwater management plan for Stormceptor extends beyond installation and performance to regular maintenance. It's the smart, cost-effective way to ensure your unit continues to remove more pollutants than any other separator for decades to come.

Stormceptor maintenance recommendations

- Units should be inspected post-construction, prior to being put into service.
- Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.
- In subsequent years, inspections can be based on first-year observations or local requirements.
- Cleaning is recommended once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Local regulations for maintenance frequency may vary.
- Inspect the unit immediately after an oil, fuel or chemical spill.
- A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

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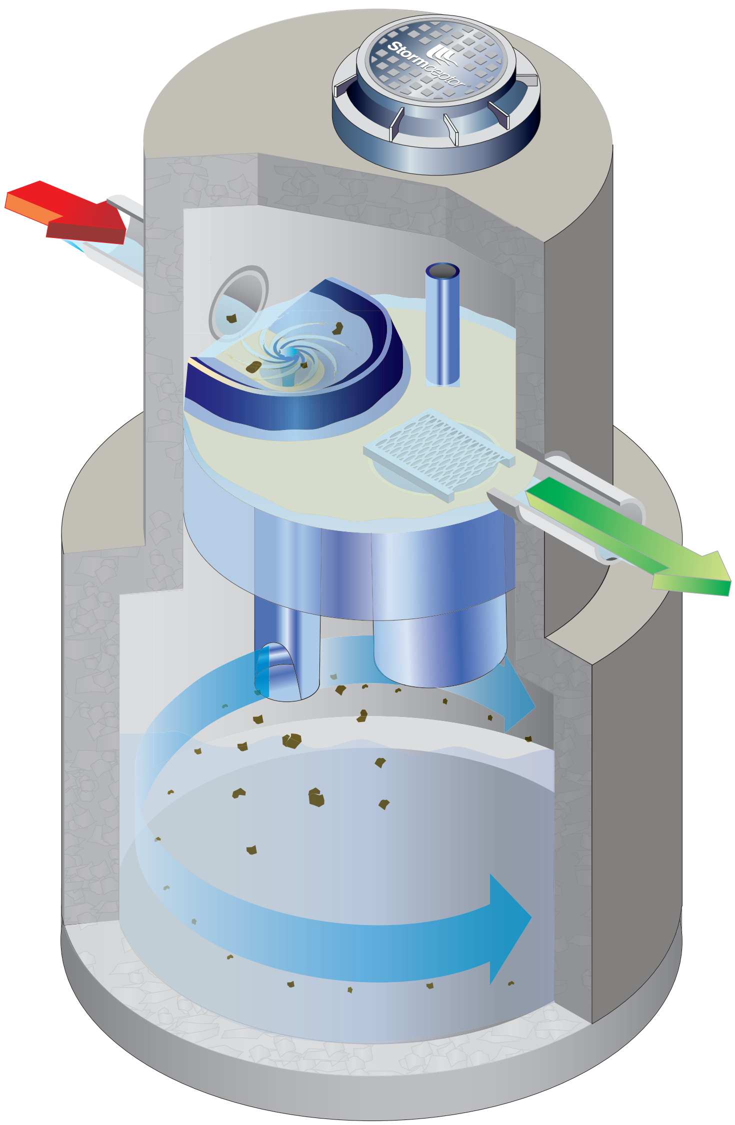
Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

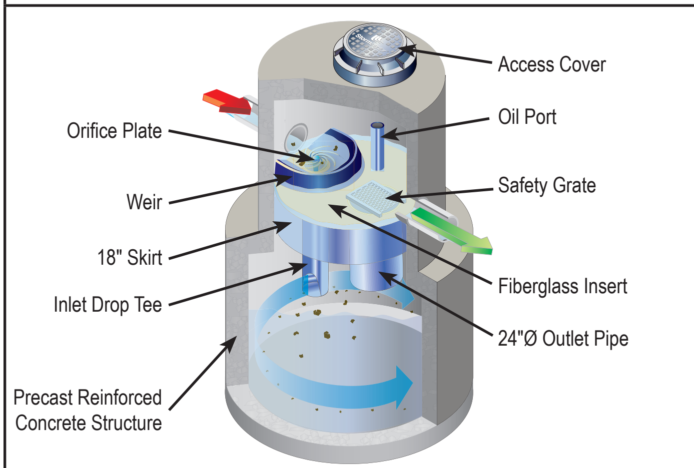
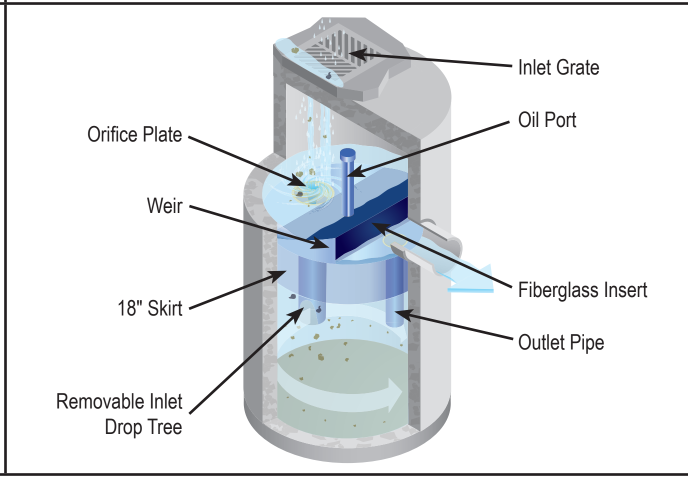


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models
Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)	EOS Model	Insert to Base (in.)	OSR Model	Insert to Base (in.)	Typical STF m (in.)
450	60	4-175	60	65	60	1.5 (60)
900	55	9-365	55	140	55	1.5 (61)
1200	71	12-590	71			1.8 (73)
1800	105	18-1000	105			2.9 (115)
2400	94	24-1400	94	250	94	2.3 (89)
3600	134	36-1700	134			3.2 (127)
4800	128	48-2000	128	390	128	2.9 (113)
6000	150	60-2500	150			3.5 (138)
7200	134	72-3400	134	560	134	3.3 (128)
11000*	128	110-5000*	128	780*	128	
13000*	150	130-6000*	150			
16000*	134	160-7800*	134	1125*	134	

Notes:
1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)	EOS Model	Insert to Base (m)	OSR Model	Insert to Base (m)	Typical STF m (in.)
300	1.5	300	1.5	300	1.7	1.5 (60)
750	1.5	750	1.5	750	1.6	1.5 (61)
1000	1.8	1000	1.8			1.8 (73)
1500	2.8					2.9 (115)
2000	2.8	2000	2.8	2000	2.6	2.3 (89)
3000	3.7	3000	3.7			3.2 (127)
4000	3.4	4000	3.4	4000	3.6	2.9 (113)
5000	4.0	5000	4.0			3.5 (138)
6000	3.7	6000	3.7	6000	3.7	3.3 (128)
9000*	3.4	9000*	3.4	9000*	3.6	
11000*	4.0	10000*	4.0			
14000*	3.7	14000*	3.7	14000*	3.7	

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	EOS Model	Hydrocarbon Storage Capacity gal	OSR Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	89	**9-365**	365	**140**	233	58
1200	251	127	**12-590**	591			
1800	251	207	**18-1000**	1198			
2400	840	205	**24-1400**	1457	**250**	792	156
3600	840	373	**36-1700**	1773			
4800	909	543	**48-2000**	2005	**390**	1233	465
6000	909	687	**60-2500**	2514			
7200	1059	839	**72-3400**	3418	**560**	1384	690
11000*	2797	1089	**110-5000***	5023	**780***	2430	930
13000*	2797	1374	**130-6000***	6041			
16000*	3055	1677	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:
1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?
- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?
- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

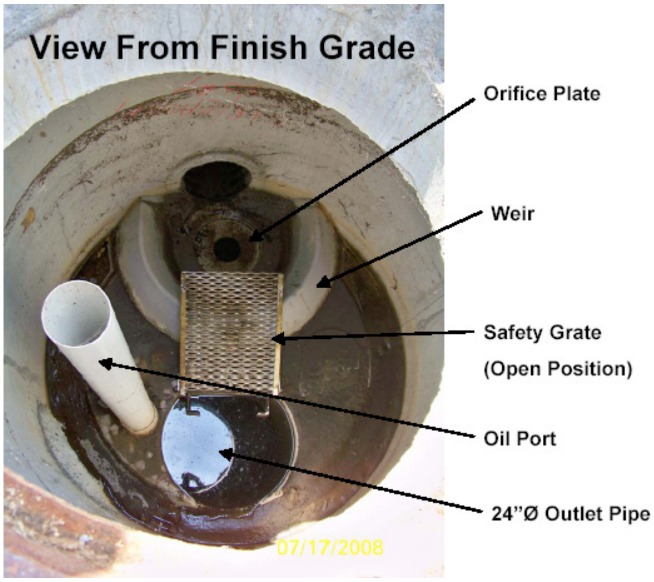
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

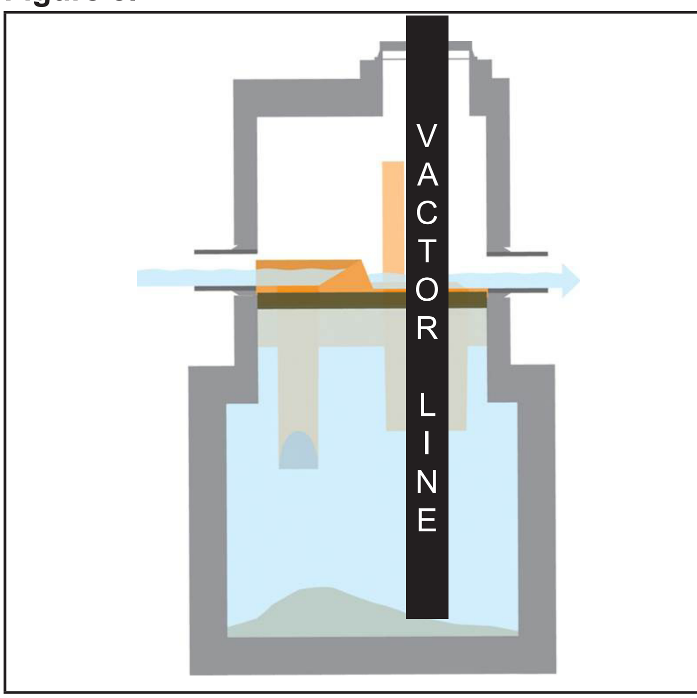
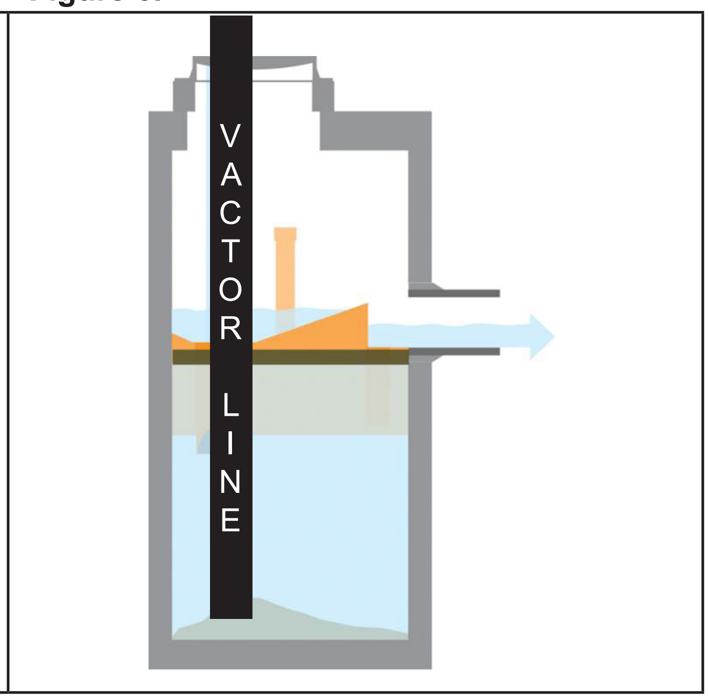


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: ______________________________

Allowable Sediment Depth: ______________________________

Serial Number: ______________________________

Installation Date: ______________________________

Location Description of Unit: ______________________________

Other Comments: ______________________________

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.	
www.lafargepipe.com	
403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK
Langley Concrete Group	
www.langleyconcretegroup.com	
604-502-5236	BC
Hanson Pipe & Precast Inc.	
www.hansonpipeandprecast.com	
519-622-7574 / 1-888-888-3222	ON
Lécuyer et Fils Ltée.	
www.lecuyerbeton.com	
450-454-3928 / 1-800-561-0970	QC
Strescon Limited	
www.strescon.com	
902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

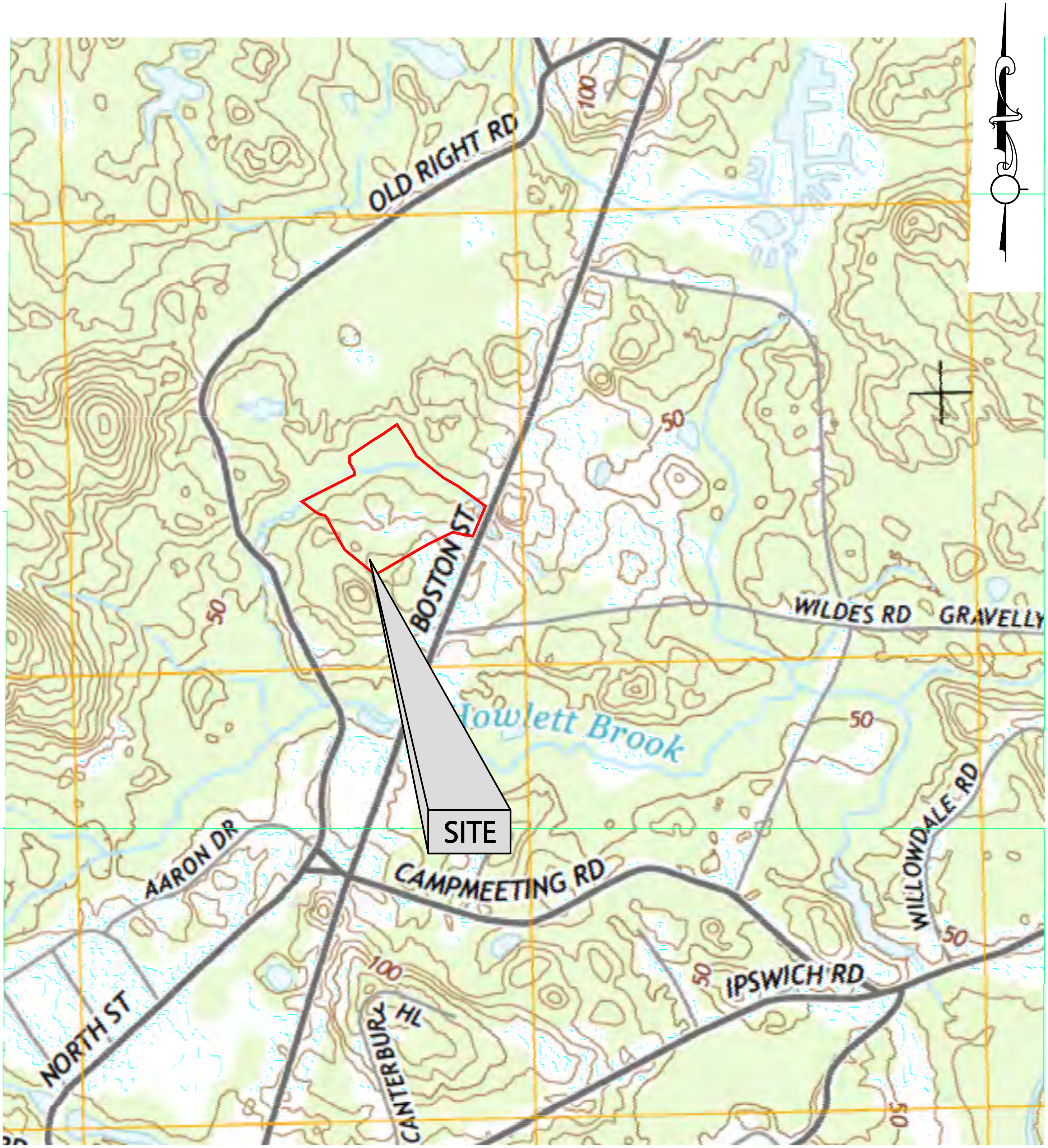
Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827
Email	info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

Section 3.0 – Exhibits



PREPARED BY:

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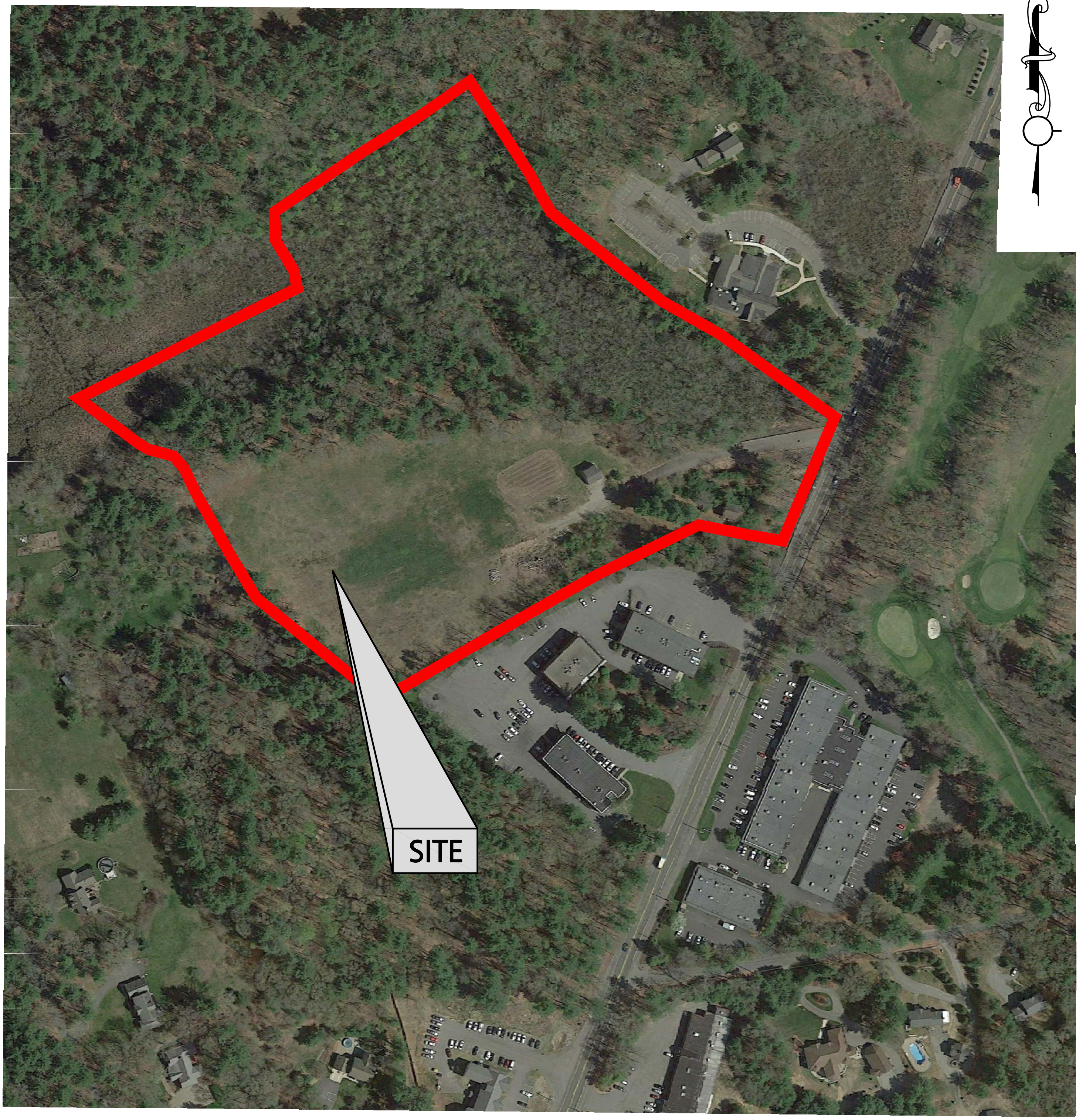
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET
TOPSFIELD, MA

USGS SITE LOCUS MAP

PROJECT NO.	2165-01A	DATE:	09-09-16
SCALE:	1"=1000'	DWG. NAME:	EXHIBITS
DESIGNED BY:	SM	CHECKED BY:	RB

SHEET No.
EX-1



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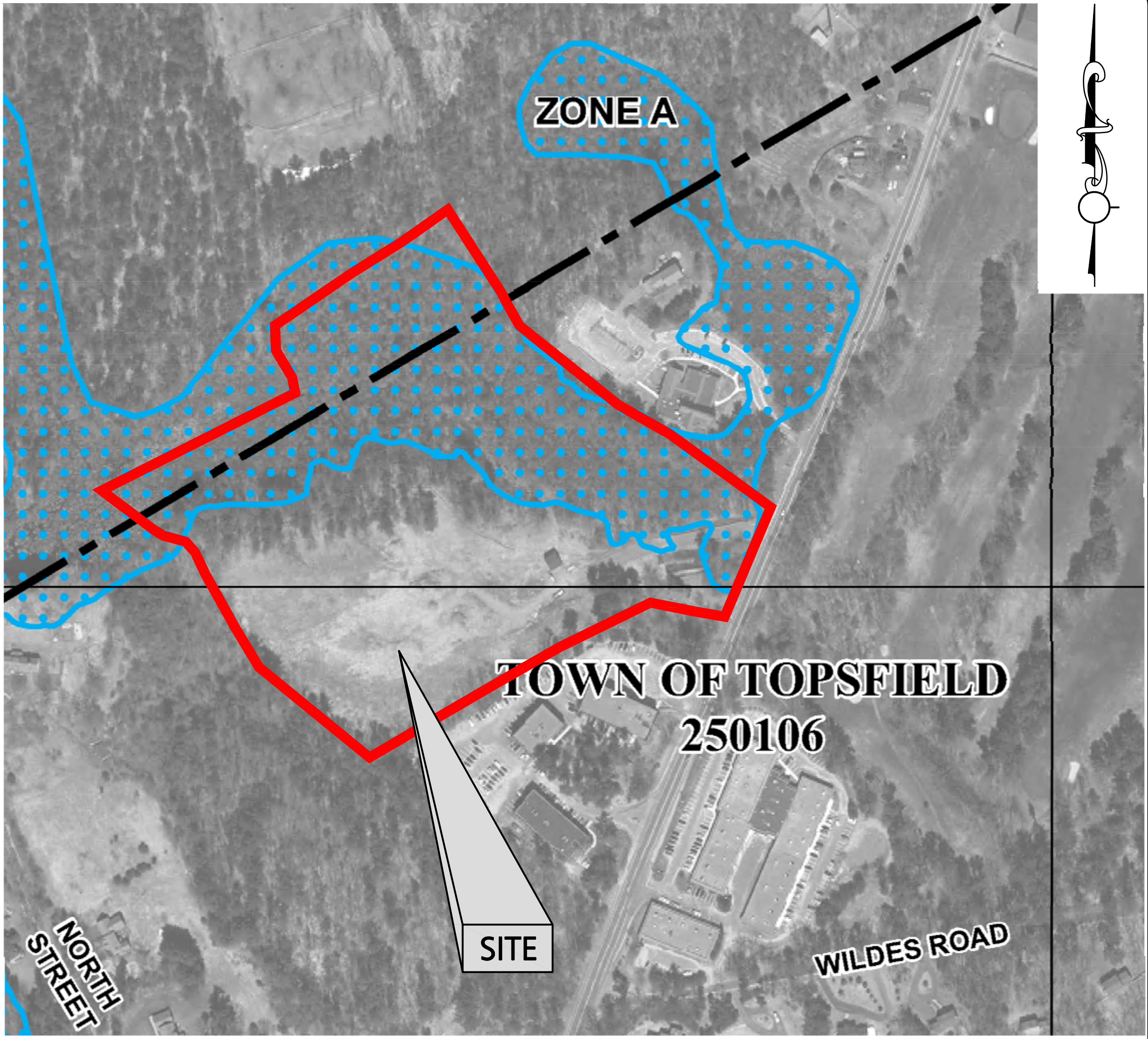
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET
TOPSFIELD, MA

AERIAL PHOTO

PROJECT NO.	2165-01A	DATE:	09-09-16
SCALE:	1" = 250'	DWG. NAME:	EXHIBITS
DESIGNED BY:	SM	CHECKED BY:	RB

SHEET No.
EX-2



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

FEMA FLOOD INSURANCE RATE MAP
ESSEX COUNTY, MASSACHUSETTS
MAP NUMBER, 25009C0266F
REVISED: JULY 3, 2012

PREPARED BY:
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WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

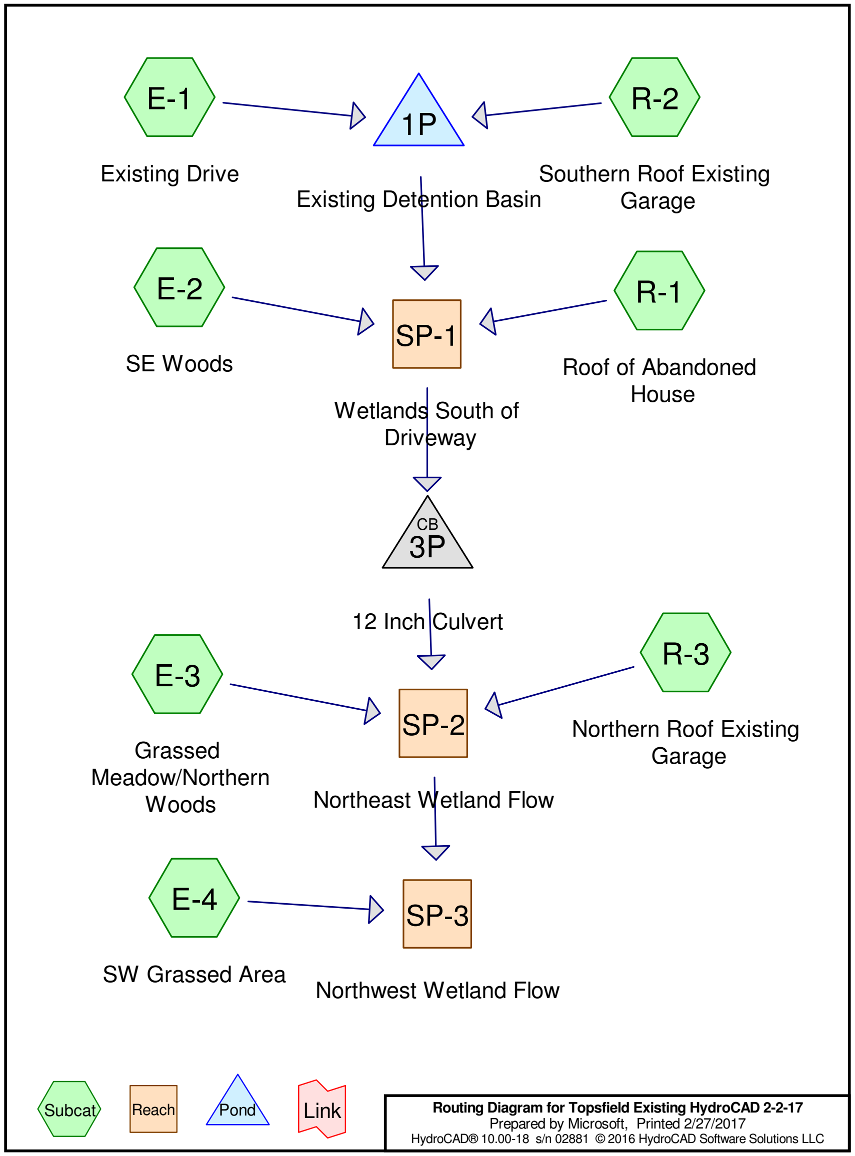
PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET
TOPSFIELD, MA

FEMA FIRM MAP

PROJECT NO.	2165-01A	DATE:	09-09-16
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	SM	CHECKED BY:	RB

SHEET No.
EX-3

Section 4.0 – HydroCAD Reports



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.186	49	50-75% Grass cover, Fair, HSG A (E-1, E-2)
0.059	79	50-75% Grass cover, Fair, HSG C (E-1, E-2)
3.887	39	>75% Grass cover, Good, HSG A (E-3, E-4)
0.872	74	>75% Grass cover, Good, HSG C (E-3, E-4)
0.094	96	Gravel surface, HSG A (E-1)
0.320	98	Paved parking, HSG A (E-1)
0.026	98	Roofs, HSG A (R-1, R-3)
0.081	98	Unconnected pavement, HSG A (E-2)
0.008	98	Unconnected roofs, HSG A (R-2)
3.217	30	Woods, Good, HSG A (E-1, E-2, E-3, E-4)
0.315	55	Woods, Good, HSG B (E-3)
0.803	70	Woods, Good, HSG C (E-1, E-2, E-3, E-4)
0.140	77	Woods, Good, HSG D (E-2)
10.008	**46**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
7.819	HSG A	E-1, E-2, E-3, E-4, R-1, R-2, R-3
0.315	HSG B	E-3
1.734	HSG C	E-1, E-2, E-3, E-4
0.140	HSG D	E-2
0.000	Other	
10.008		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.186	0.000	0.059	0.000	0.000	0.244	50-75% Grass cover, Fair	E-1, E-2
3.887	0.000	0.872	0.000	0.000	4.759	>75% Grass cover, Good	E-3, E-4
0.094	0.000	0.000	0.000	0.000	0.094	Gravel surface	E-1
0.320	0.000	0.000	0.000	0.000	0.320	Paved parking	E-1
0.026	0.000	0.000	0.000	0.000	0.026	Roofs	R-1, R-3
0.081	0.000	0.000	0.000	0.000	0.081	Unconnected pavement	E-2
0.008	0.000	0.000	0.000	0.000	0.008	Unconnected roofs	R-2
3.217	0.315	0.803	0.140	0.000	4.474	Woods, Good	E-1, E-2, E-3, E-4
7.819	**0.315**	**1.734**	**0.140**	**0.000**	**10.008**	**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	E-1	0.00	0.00	25.0	0.0100	0.015	12.0	0.0	0.0
2	3P	56.51	56.38	51.0	0.0025	0.011	12.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 E-1: Existing Drive Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>2.16"
Flow Length=444' Tc=10.2 min CN=91 Runoff=1.15 cfs 0.095 af

Subcatchment E-2: SE Woods Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>0.17"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=0.05 cfs 0.016 af

Subcatchment E-3: Grassed Meadow/Northern Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.00"
Flow Length=465' Tc=12.3 min CN=41 Runoff=0.00 cfs 0.001 af

Subcatchment E-4: SW Grassed Area Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.01"
Flow Length=622' Tc=15.7 min CN=43 Runoff=0.01 cfs 0.005 af

Subcatchment R-1: Roof of Abandoned House Runoff Area=787 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment R-2: Southern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.02 cfs 0.002 af

Subcatchment R-3: Northern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.02 cfs 0.002 af

Reach SP-1: Wetlands South of Driveway Inflow=0.07 cfs 0.049 af
Outflow=0.07 cfs 0.049 af

Reach SP-2: Northeast Wetland Flow Inflow=0.08 cfs 0.052 af
Outflow=0.08 cfs 0.052 af

Reach SP-3: Northwest Wetland Flow Inflow=0.08 cfs 0.057 af
Outflow=0.08 cfs 0.057 af

Pond 1P: Existing Detention Basin Peak Elev=58.23' Storage=3,183 cf Inflow=1.16 cfs 0.097 af
Outflow=0.05 cfs 0.028 af

Pond 3P: 12 Inch Culvert Peak Elev=56.68' Inflow=0.07 cfs 0.049 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=0.07 cfs 0.049 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.125 af Average Runoff Depth = 0.15"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

Summary for Subcatchment E-1: Existing Drive

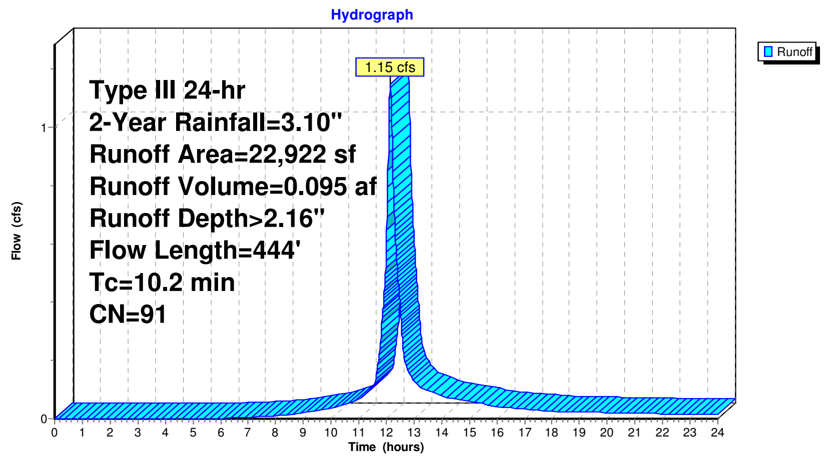
Runoff = 1.15 cfs @ 12.14 hrs, Volume= 0.095 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		**Shallow Concentrated Flow, C-D**
					Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		**Shallow Concentrated Flow, D-E**
					Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		**Shallow Concentrated Flow, E-F**
					Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	**Pipe Channel, F-G**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

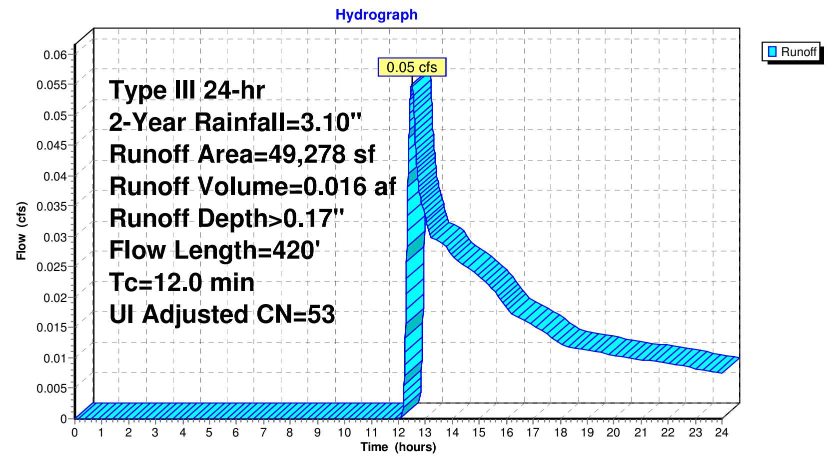
Runoff = 0.05 cfs @ 12.49 hrs, Volume= 0.016 af, Depth> 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
3,550	98		Unconnected pavement, HSG A
7,582	49		50-75% Grass cover, Fair, HSG A
1,887	79		50-75% Grass cover, Fair, HSG C
18,787	30		Woods, Good, HSG A
11,389	70		Woods, Good, HSG C
6,083	77		Woods, Good, HSG D
49,278	55	53	Weighted Average, UI Adjusted
45,728			92.80% Pervious Area
3,550			7.20% Impervious Area
3,550			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.8	75	0.0930	1.52		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.4	35	0.0430	1.45		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.5	260	0.0370	0.96		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.0	420	Total			

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

[73] Warning: Peak may fall outside time span

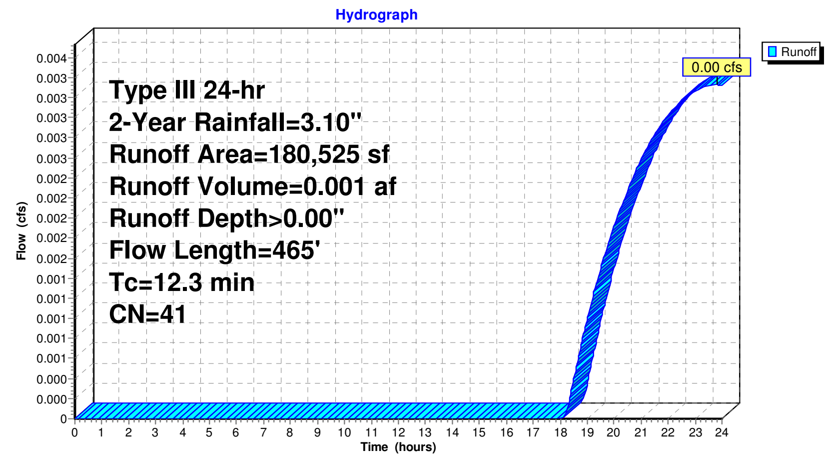
Runoff = 0.00 cfs @ 23.82 hrs, Volume= 0.001 af, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



Summary for Subcatchment E-4: SW Grassed Area

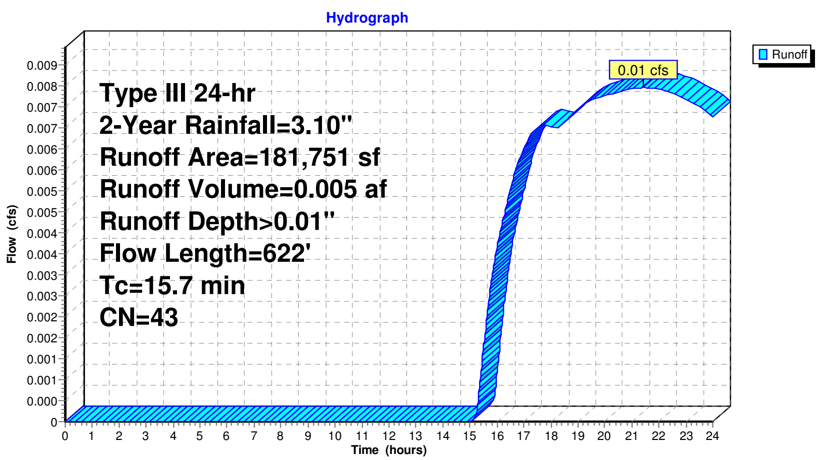
Runoff = 0.01 cfs @ 21.44 hrs, Volume= 0.005 af, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	622	Total			

Subcatchment E-4: SW Grassed Area



Summary for Subcatchment R-1: Roof of Abandoned House

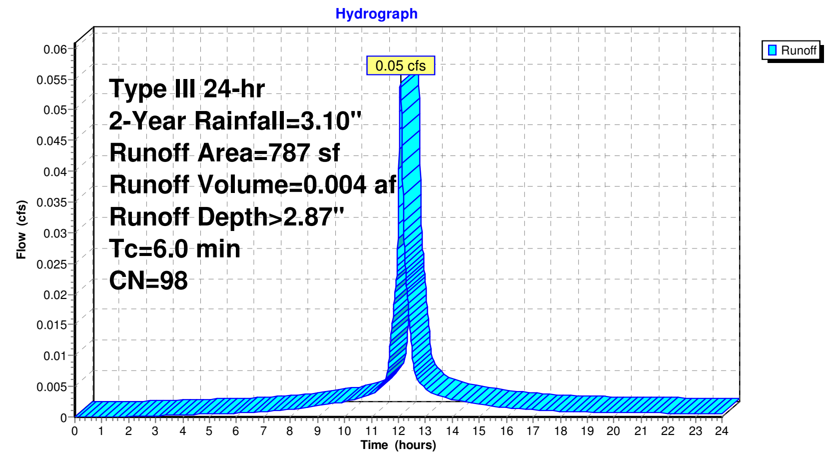
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House



Summary for Subcatchment R-2: Southern Roof Existing Garage

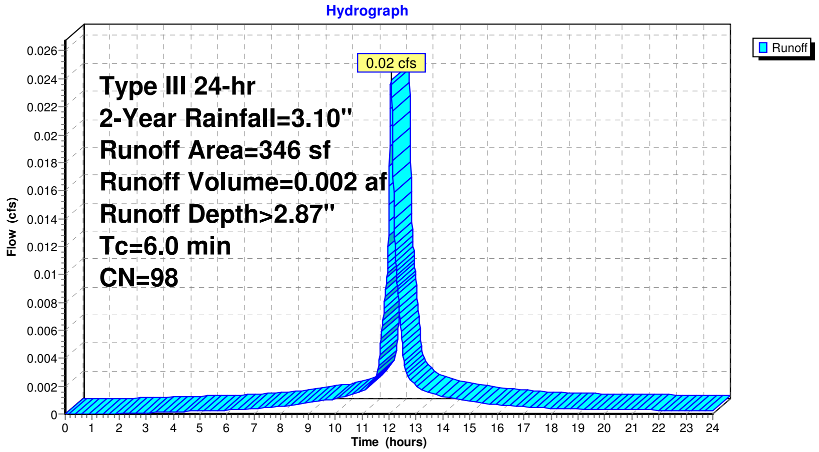
Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

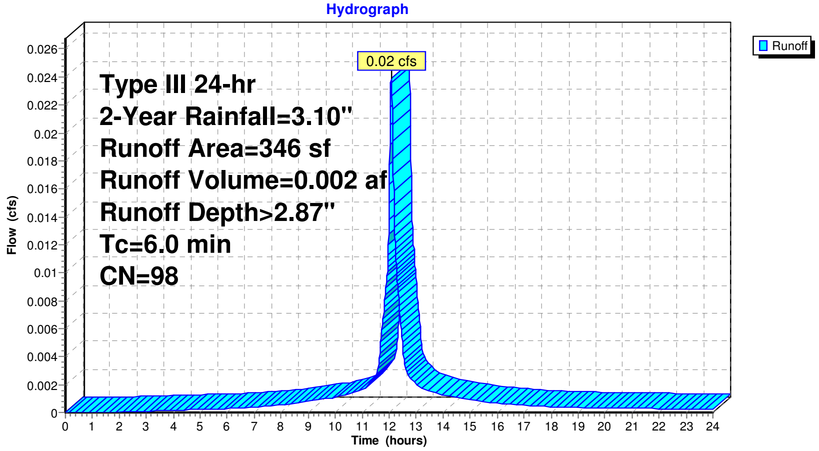
Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage



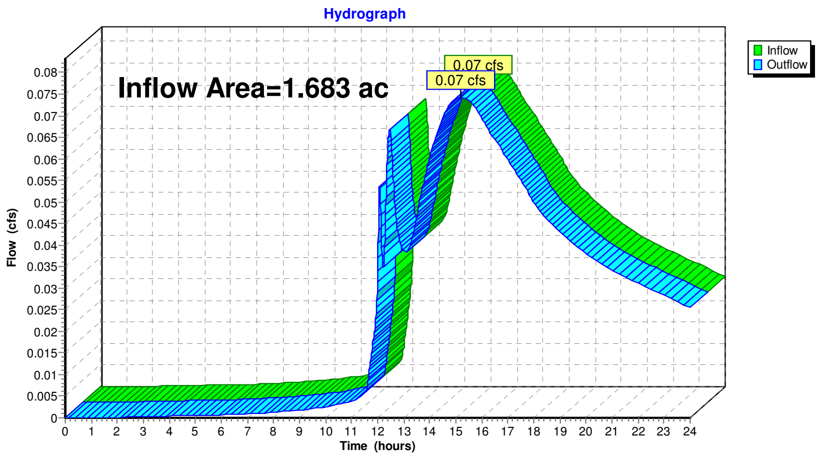
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 0.35" for 2-Year event
Inflow = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af
Outflow = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



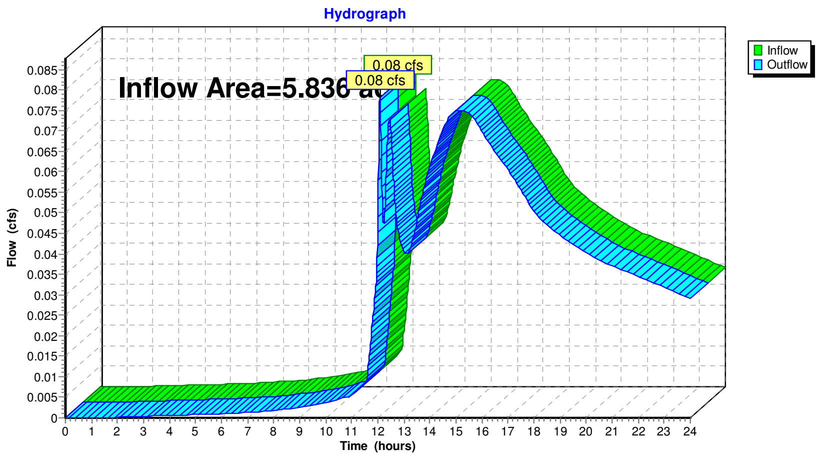
Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.836 ac, 7.47% Impervious, Inflow Depth > 0.11" for 2-Year event
Inflow = 0.08 cfs @ 12.08 hrs, Volume= 0.052 af
Outflow = 0.08 cfs @ 12.08 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Northeast Wetland Flow



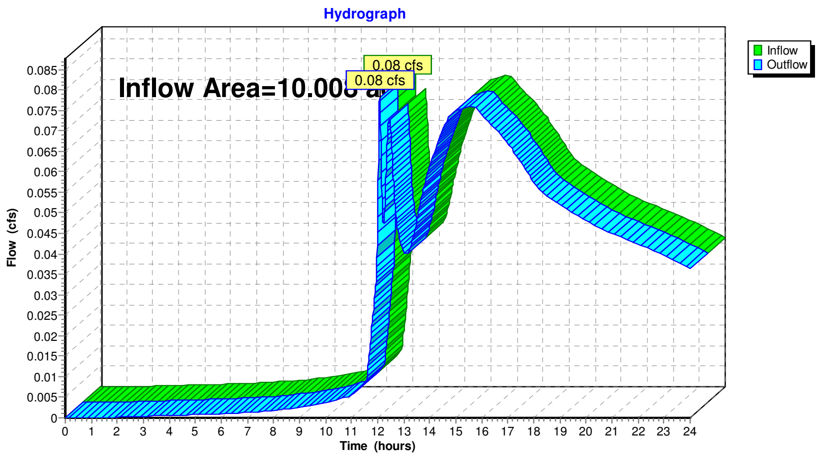
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 0.07" for 2-Year event
Inflow = 0.08 cfs @ 12.08 hrs, Volume= 0.057 af
Outflow = 0.08 cfs @ 12.08 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 2.17" for 2-Year event
Inflow = 1.16 cfs @ 12.14 hrs, Volume= 0.097 af
Outflow = 0.05 cfs @ 15.56 hrs, Volume= 0.028 af, Atten= 96%, Lag= 205.6 min
Primary = 0.05 cfs @ 15.56 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.23' @ 15.56 hrs Surf.Area= 3,090 sf Storage= 3,183 cf

Plug-Flow detention time= 409.2 min calculated for 0.028 af (29% of inflow)
Center-of-Mass det. time= 270.3 min (1,075.8 - 805.5)

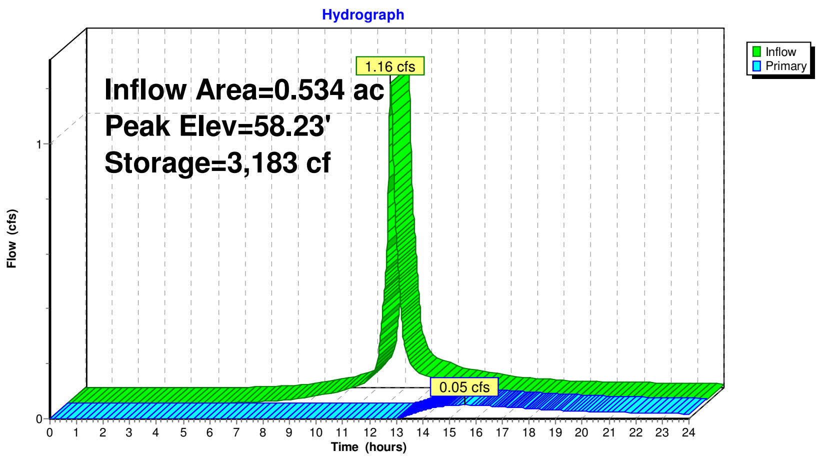
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.05 cfs @ 15.56 hrs HW=58.23' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.32 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Existing Detention Basin



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 56.68' (Flood elevation advised)

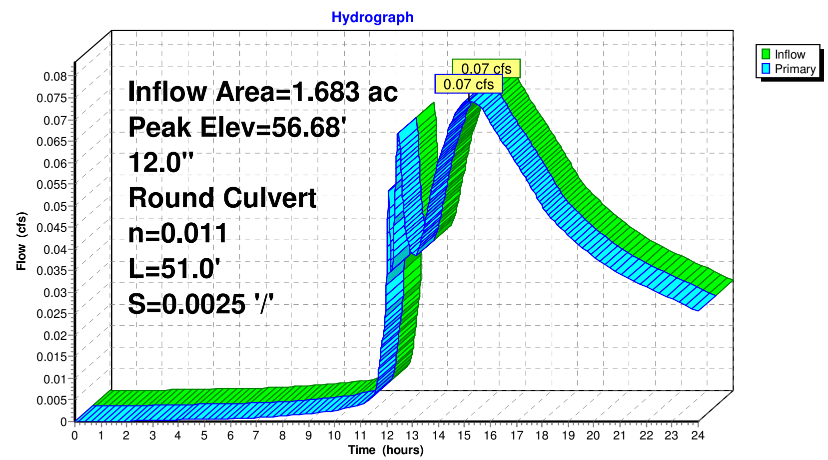
Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 0.35" for 2-Year event
Inflow = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af
Outflow = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min
Primary = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.68' @ 15.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round Culvert** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.07 cfs @ 15.19 hrs HW=56.68' (Free Discharge)
└1=Culvert (Barrel Controls 0.07 cfs @ 1.30 fps)

Pond 3P: 12 Inch Culvert



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 E-1: Existing Drive Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>3.49"
Flow Length=444' Tc=10.2 min CN=91 Runoff=1.81 cfs 0.153 af

Subcatchment E-2: SE Woods Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>0.64"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=0.44 cfs 0.060 af

Subcatchment E-3: Grassed Meadow/Northern Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.16"
Flow Length=465' Tc=12.3 min CN=41 Runoff=0.10 cfs 0.056 af

Subcatchment E-4: SW Grassed Area Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.22"
Flow Length=622' Tc=15.7 min CN=43 Runoff=0.22 cfs 0.078 af

Subcatchment R-1: Roof of Abandoned House Runoff Area=787 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.08 cfs 0.006 af

Subcatchment R-2: Southern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.03 cfs 0.003 af

Subcatchment R-3: Northern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.03 cfs 0.003 af

Reach SP-1: Wetlands South of Driveway Inflow=0.58 cfs 0.153 af
Outflow=0.58 cfs 0.153 af

Reach SP-2: Northeast Wetland Flow Inflow=0.62 cfs 0.212 af
Outflow=0.62 cfs 0.212 af

Reach SP-3: Northwest Wetland Flow Inflow=0.82 cfs 0.290 af
Outflow=0.82 cfs 0.290 af

Pond 1P: Existing Detention Basin Peak Elev=58.52' Storage=4,084 cf Inflow=1.84 cfs 0.156 af
Outflow=0.22 cfs 0.086 af

Pond 3P: 12 Inch Culvert Peak Elev=56.97' Inflow=0.58 cfs 0.153 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=0.58 cfs 0.153 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.360 af Average Runoff Depth = 0.43"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

Summary for Subcatchment E-1: Existing Drive

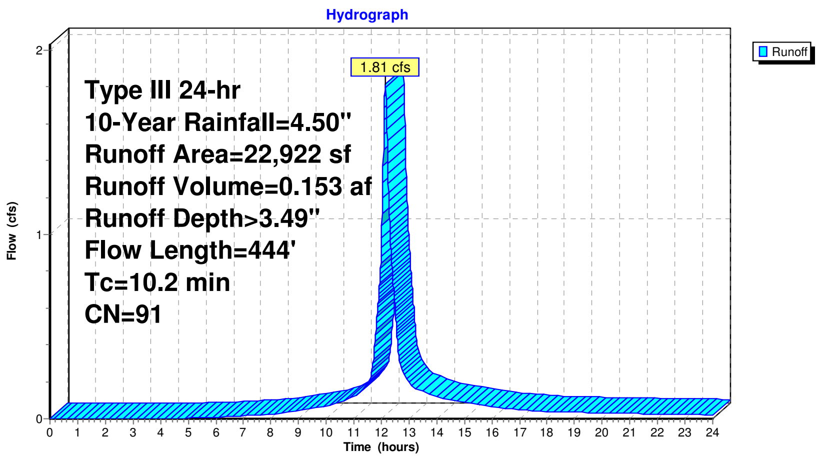
Runoff = 1.81 cfs @ 12.14 hrs, Volume= 0.153 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

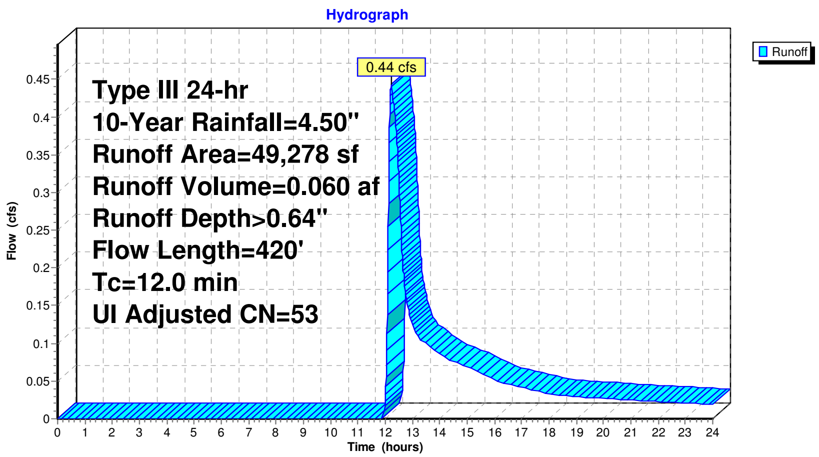
Runoff = 0.44 cfs @ 12.23 hrs, Volume= 0.060 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
3,550	98		Unconnected pavement, HSG A
7,582	49		50-75% Grass cover, Fair, HSG A
1,887	79		50-75% Grass cover, Fair, HSG C
18,787	30		Woods, Good, HSG A
11,389	70		Woods, Good, HSG C
6,083	77		Woods, Good, HSG D
49,278	55	53	Weighted Average, UI Adjusted
45,728			92.80% Pervious Area
3,550			7.20% Impervious Area
3,550			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.8	75	0.0930	1.52		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.4	35	0.0430	1.45		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.5	260	0.0370	0.96		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.0	420	Total			

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

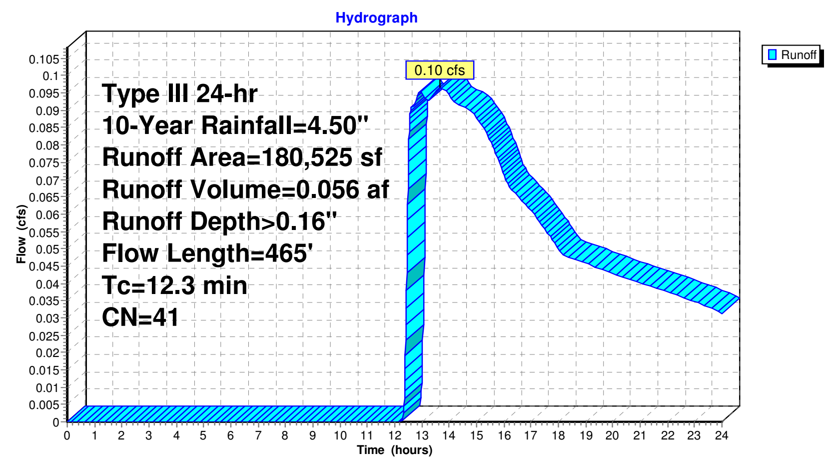
Runoff = 0.10 cfs @ 13.68 hrs, Volume= 0.056 af, Depth> 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



Summary for Subcatchment E-4: SW Grassed Area

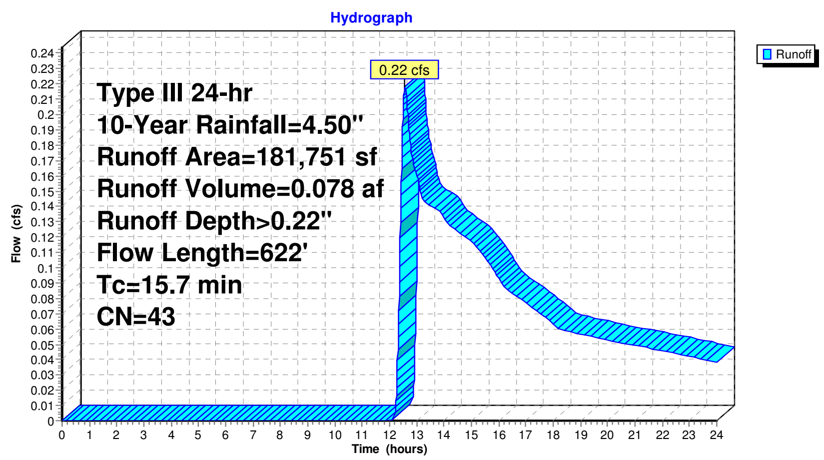
Runoff = 0.22 cfs @ 12.57 hrs, Volume= 0.078 af, Depth> 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	622	Total			

Subcatchment E-4: SW Grassed Area



Summary for Subcatchment R-1: Roof of Abandoned House

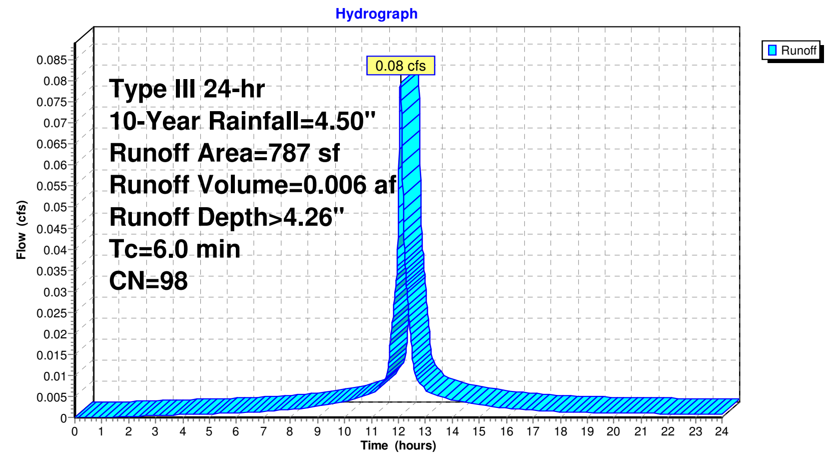
Runoff = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House



Summary for Subcatchment R-2: Southern Roof Existing Garage

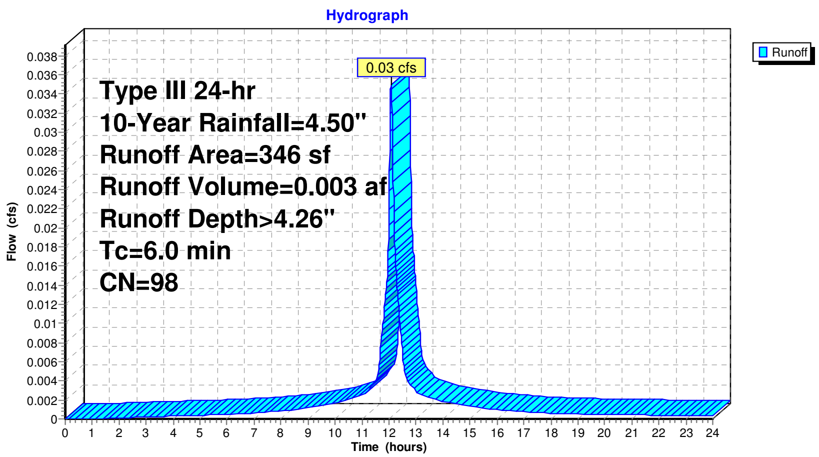
Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

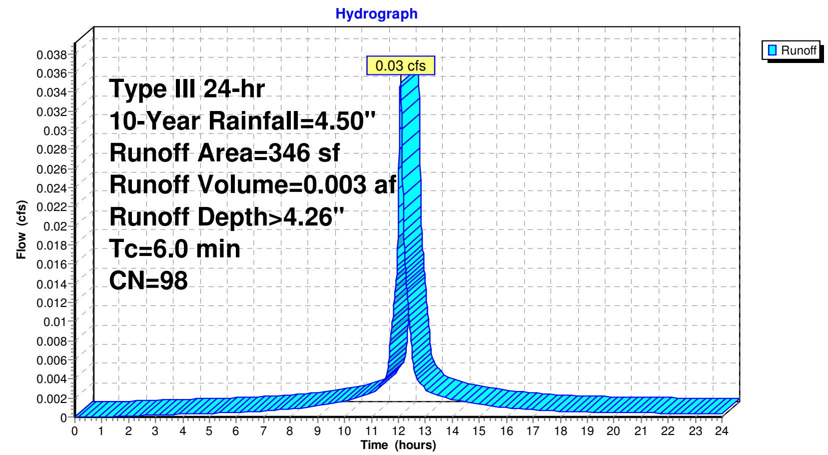
Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage



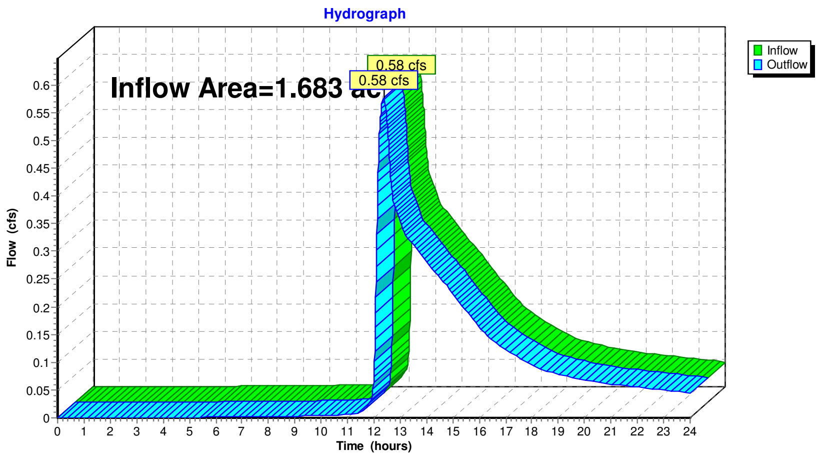
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 1.09" for 10-Year event
Inflow = 0.58 cfs @ 12.36 hrs, Volume= 0.153 af
Outflow = 0.58 cfs @ 12.36 hrs, Volume= 0.153 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



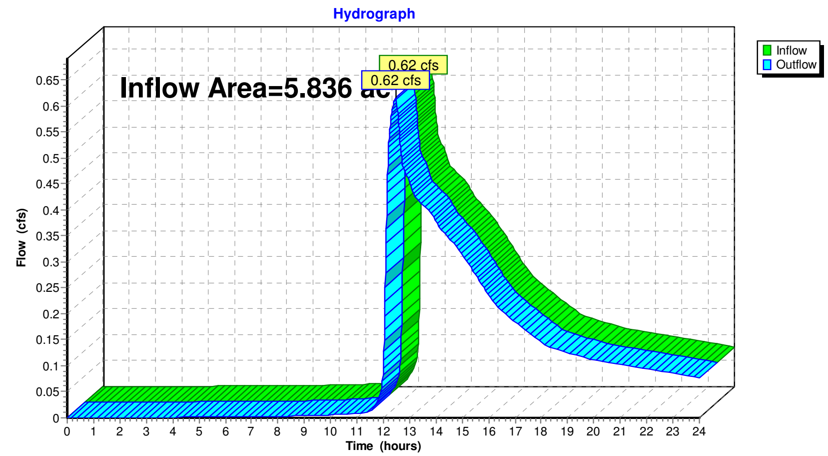
Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.836 ac, 7.47% Impervious, Inflow Depth > 0.44" for 10-Year event
Inflow = 0.62 cfs @ 12.47 hrs, Volume= 0.212 af
Outflow = 0.62 cfs @ 12.47 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Northeast Wetland Flow



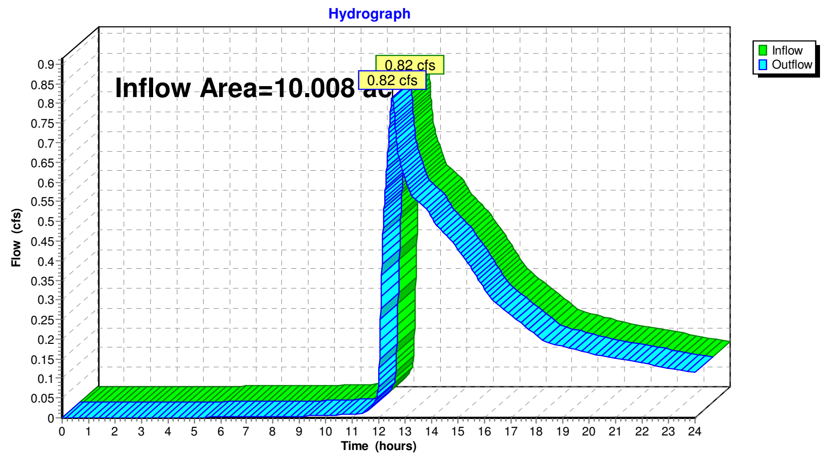
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	10.008 ac,	4.35% Impervious, Inflow Depth > 0.35"	for 10-Year event	
Inflow =	0.82 cfs @	12.51 hrs, Volume=	0.290 af	
Outflow =	0.82 cfs @	12.51 hrs, Volume=	0.290 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area =	0.534 ac,	61.44% Impervious, Inflow Depth > 3.50"	for 10-Year event	
Inflow =	1.84 cfs @	12.14 hrs, Volume=	0.156 af	
Outflow =	0.22 cfs @	12.91 hrs, Volume=	0.086 af,	Atten= 88%, Lag= 46.1 min
Primary =	0.22 cfs @	12.91 hrs, Volume=	0.086 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.52' @ 12.91 hrs Surf.Area= 3,090 sf Storage= 4,084 cf

Plug-Flow detention time= 265.0 min calculated for 0.086 af (55% of inflow)
Center-of-Mass det. time= 157.9 min (950.3 - 792.4)

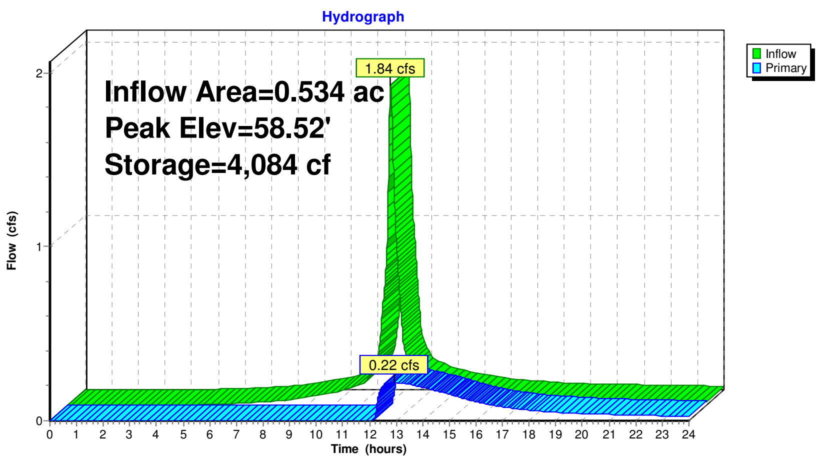
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.22 cfs @ 12.91 hrs HW=58.52' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.22 cfs @ 2.53 fps)
└—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Existing Detention Basin



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 56.97' (Flood elevation advised)

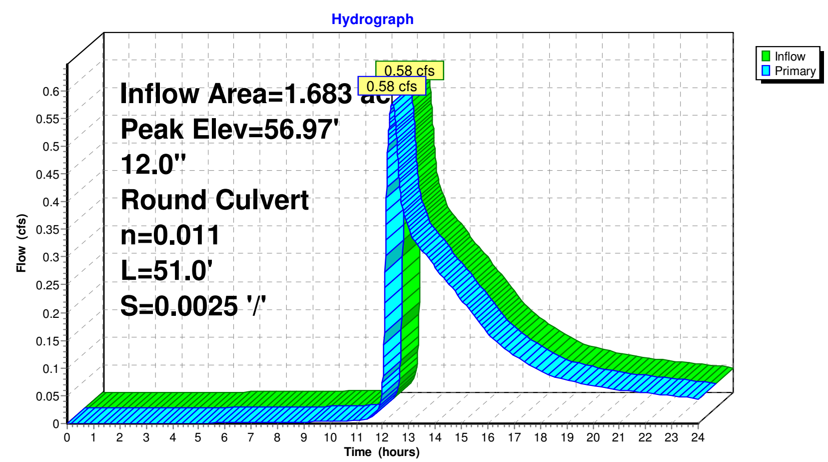
Inflow Area =	1.683 ac, 25.41% Impervious, Inflow Depth > 1.09" for 10-Year event		
Inflow =	0.58 cfs @ 12.36 hrs, Volume=	0.153 af	
Outflow =	0.58 cfs @ 12.36 hrs, Volume=	0.153 af, Atten= 0%, Lag= 0.0 min	
Primary =	0.58 cfs @ 12.36 hrs, Volume=	0.153 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.97' @ 12.36 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round Culvert** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.58 cfs @ 12.36 hrs HW=56.97' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.58 cfs @ 2.37 fps)

Pond 3P: 12 Inch Culvert



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 E-1: Existing Drive Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>4.36"
Flow Length=444' Tc=10.2 min CN=91 Runoff=2.24 cfs 0.191 af

Subcatchment E-2: SE Woods Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>1.05"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=0.90 cfs 0.099 af

Subcatchment E-3: Grassed Meadow/Northern Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.37"
Flow Length=465' Tc=12.3 min CN=41 Runoff=0.55 cfs 0.129 af

Subcatchment E-4: SW Grassed Area Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.47"
Flow Length=622' Tc=15.7 min CN=43 Runoff=0.79 cfs 0.163 af

Subcatchment R-1: Roof of Abandoned House Runoff Area=787 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af

Subcatchment R-2: Southern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.04 cfs 0.003 af

Subcatchment R-3: Northern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.04 cfs 0.003 af

Reach SP-1: Wetlands South of Driveway Inflow=1.14 cfs 0.231 af
Outflow=1.14 cfs 0.231 af

Reach SP-2: Northeast Wetland Flow Inflow=1.52 cfs 0.363 af
Outflow=1.52 cfs 0.363 af

Reach SP-3: Northwest Wetland Flow Inflow=2.29 cfs 0.526 af
Outflow=2.29 cfs 0.526 af

Pond 1P: Existing Detention Basin Peak Elev=58.81' Storage=4,979 cf Inflow=2.27 cfs 0.195 af
Outflow=0.32 cfs 0.124 af

Pond 3P: 12 Inch Culvert Peak Elev=57.18' Inflow=1.14 cfs 0.231 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=1.14 cfs 0.231 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.597 af Average Runoff Depth = 0.72"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

Summary for Subcatchment E-1: Existing Drive

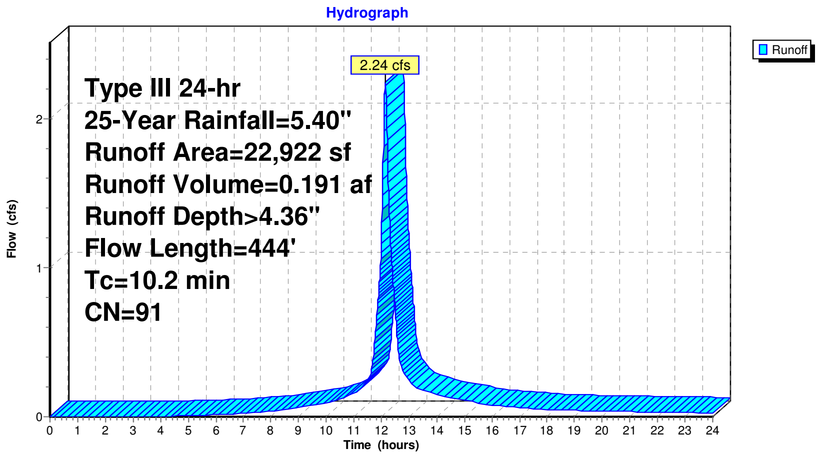
Runoff = 2.24 cfs @ 12.14 hrs, Volume= 0.191 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

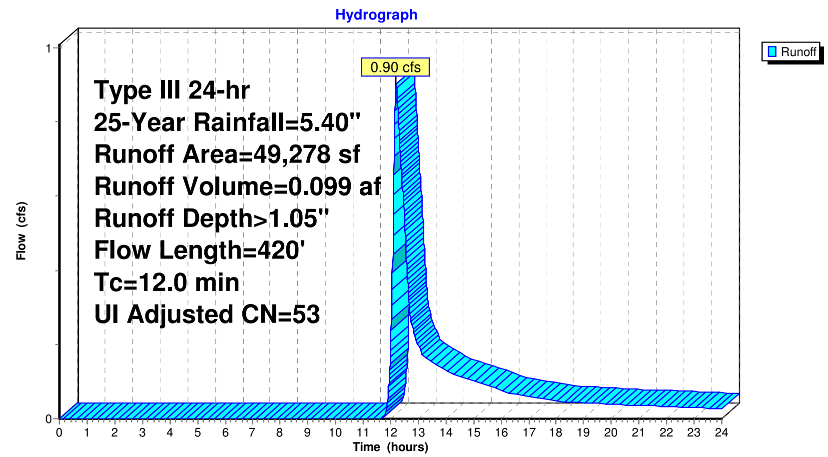
Runoff = 0.90 cfs @ 12.20 hrs, Volume= 0.099 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Adj	Description
3,550	98		Unconnected pavement, HSG A
7,582	49		50-75% Grass cover, Fair, HSG A
1,887	79		50-75% Grass cover, Fair, HSG C
18,787	30		Woods, Good, HSG A
11,389	70		Woods, Good, HSG C
6,083	77		Woods, Good, HSG D
49,278	55	53	Weighted Average, UI Adjusted
45,728			92.80% Pervious Area
3,550			7.20% Impervious Area
3,550			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.8	75	0.0930	1.52		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.4	35	0.0430	1.45		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.5	260	0.0370	0.96		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.0	420	Total			

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

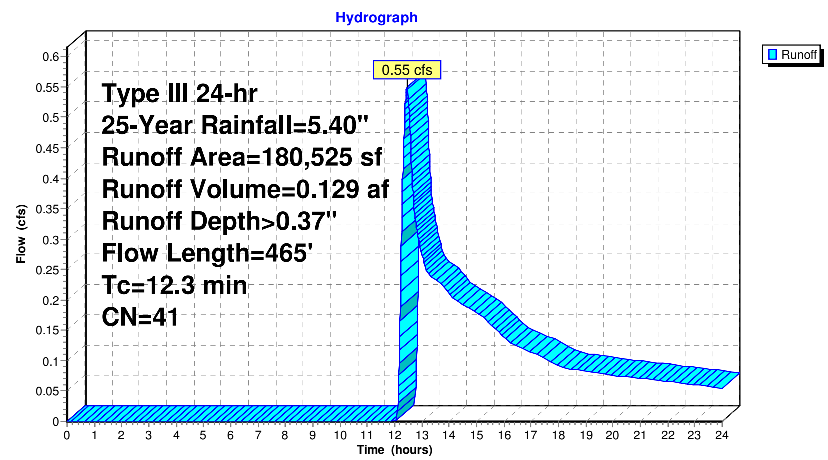
Runoff = 0.55 cfs @ 12.45 hrs, Volume= 0.129 af, Depth> 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



Summary for Subcatchment E-4: SW Grassed Area

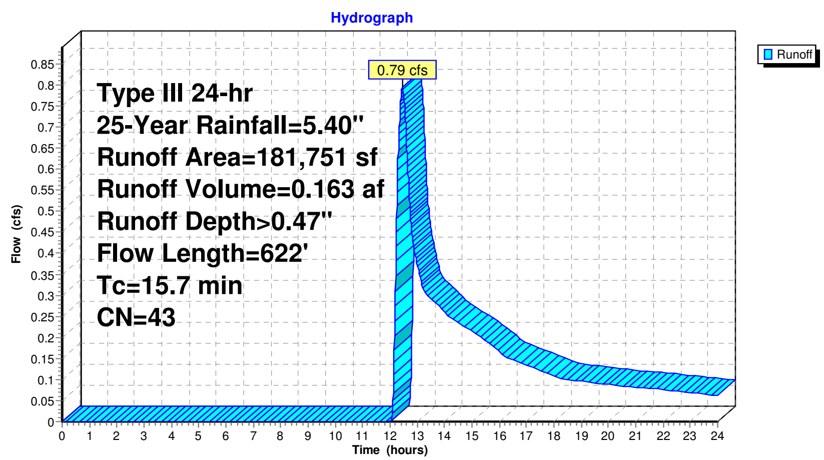
Runoff = 0.79 cfs @ 12.47 hrs, Volume= 0.163 af, Depth> 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	622	Total			

Subcatchment E-4: SW Grassed Area



Summary for Subcatchment R-1: Roof of Abandoned House

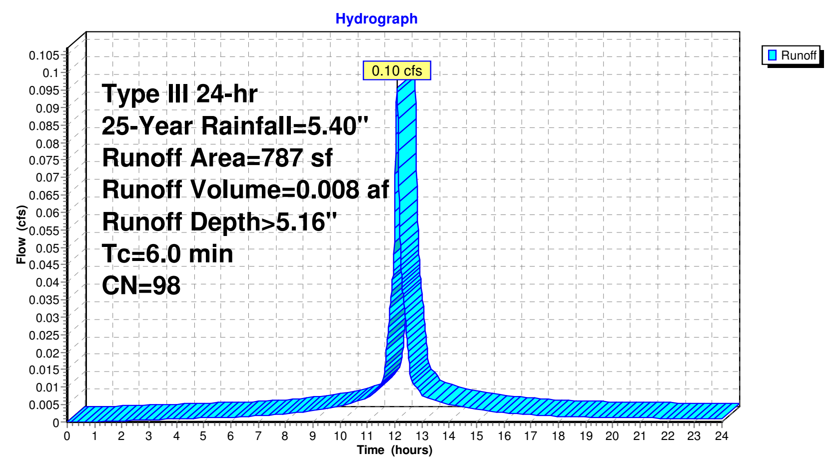
Runoff = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House



Summary for Subcatchment R-2: Southern Roof Existing Garage

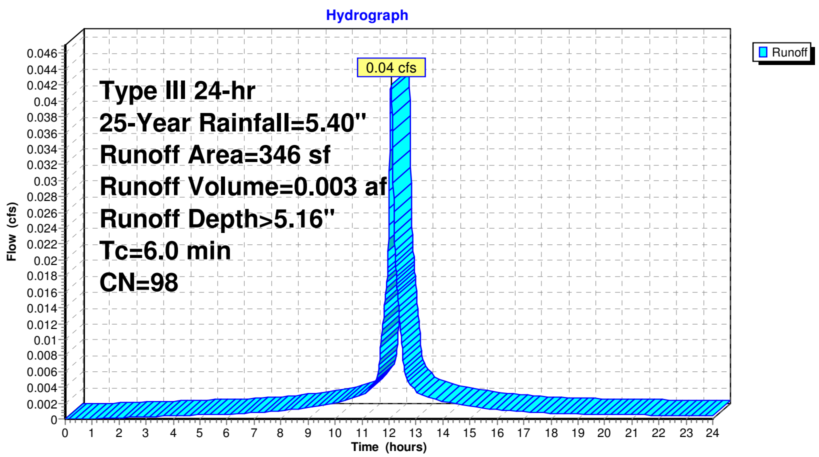
Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

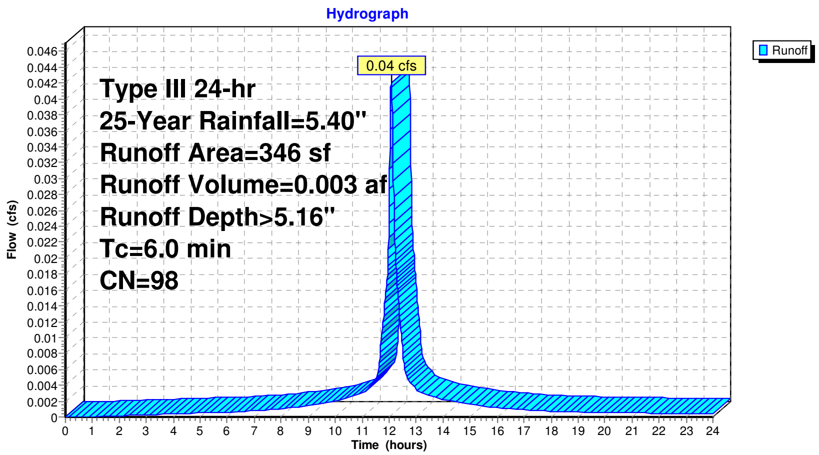
Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage



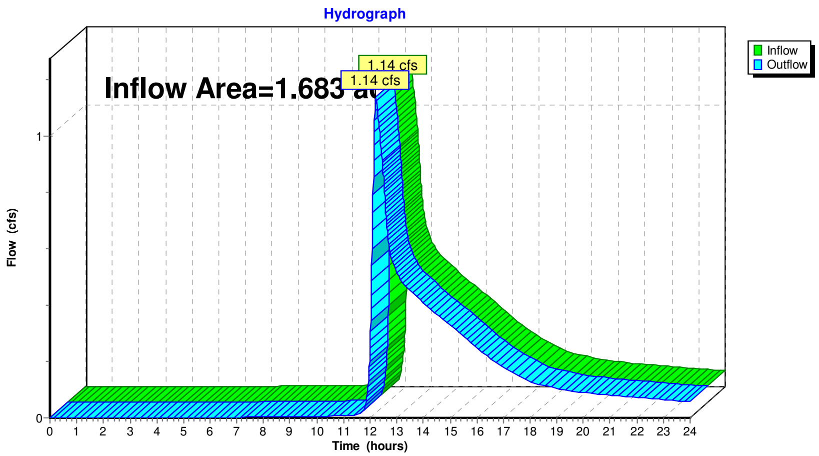
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 1.65" for 25-Year event
Inflow = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af
Outflow = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



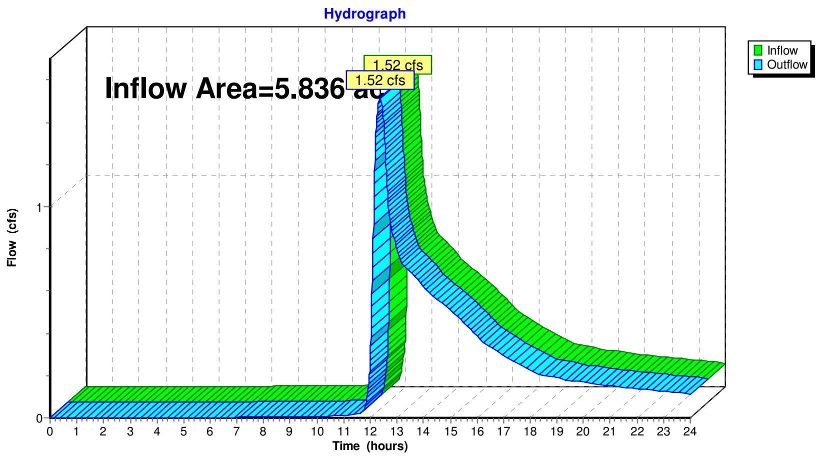
Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.836 ac, 7.47% Impervious, Inflow Depth > 0.75" for 25-Year event
Inflow = 1.52 cfs @ 12.38 hrs, Volume= 0.363 af
Outflow = 1.52 cfs @ 12.38 hrs, Volume= 0.363 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Northeast Wetland Flow



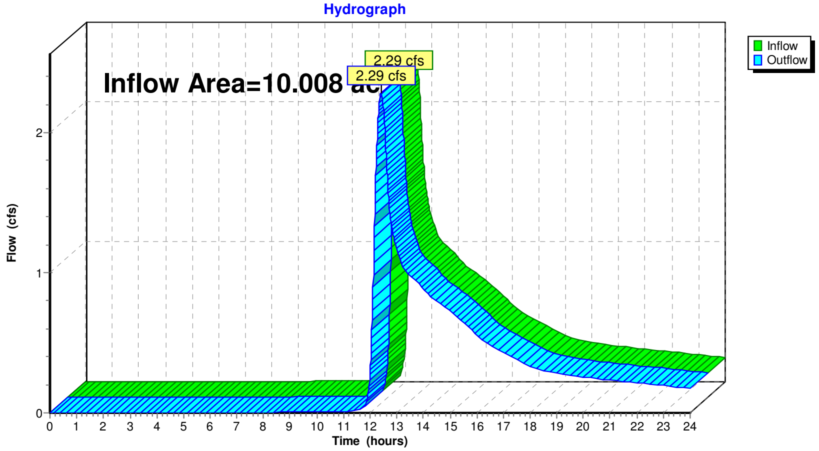
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 0.63" for 25-Year event
Inflow = 2.29 cfs @ 12.42 hrs, Volume= 0.526 af
Outflow = 2.29 cfs @ 12.42 hrs, Volume= 0.526 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 4.38" for 25-Year event
Inflow = 2.27 cfs @ 12.14 hrs, Volume= 0.195 af
Outflow = 0.32 cfs @ 12.76 hrs, Volume= 0.124 af, Atten= 86%, Lag= 37.5 min
Primary = 0.32 cfs @ 12.76 hrs, Volume= 0.124 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.81' @ 12.76 hrs Surf.Area= 3,090 sf Storage= 4,979 cf

Plug-Flow detention time= 248.3 min calculated for 0.124 af (64% of inflow)
Center-of-Mass det. time= 149.9 min (936.4 - 786.5)

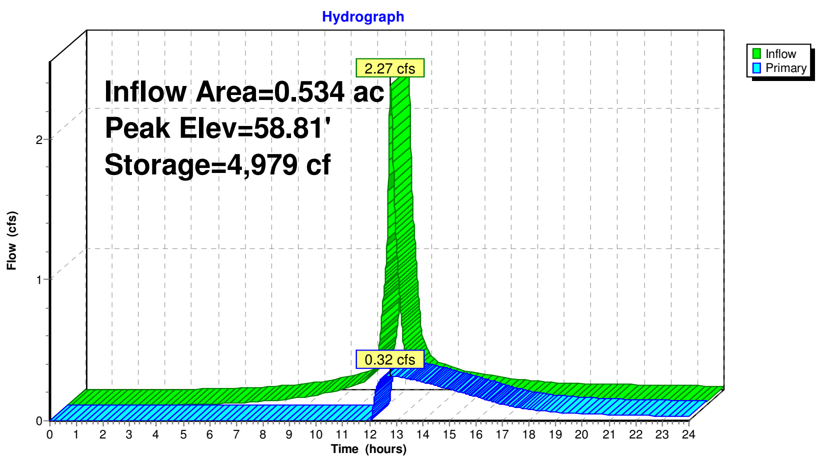
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.32 cfs @ 12.76 hrs HW=58.81' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.32 cfs @ 3.62 fps)
2=Orifice/Grate (Orifice Controls 0.00 cfs @ 0.36 fps)

Pond 1P: Existing Detention Basin



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 57.18' (Flood elevation advised)

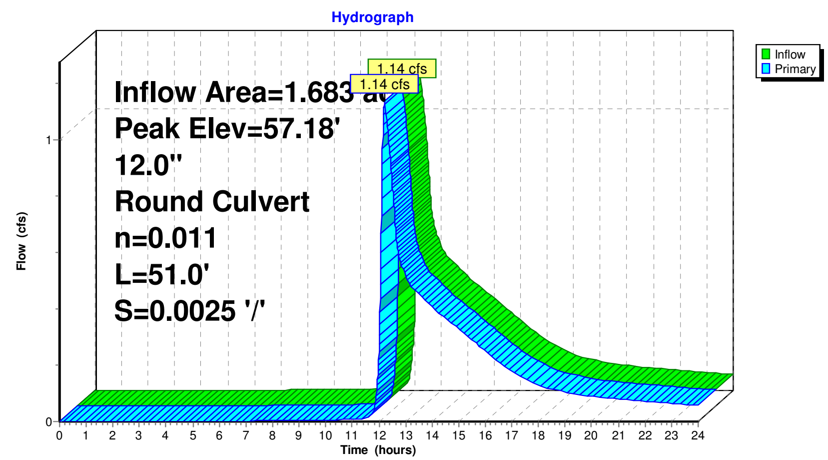
Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 1.65" for 25-Year event
Inflow = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af
Outflow = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af, Atten= 0%, Lag= 0.0 min
Primary = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.18' @ 12.21 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round Culvert** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.14 cfs @ 12.21 hrs HW=57.18' (Free Discharge)
↑**1=Culvert** (Barrel Controls 1.14 cfs @ 2.87 fps)

Pond 3P: 12 Inch Culvert



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 E-1: Existing Drive Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>5.44"
Flow Length=444' Tc=10.2 min CN=91 Runoff=2.76 cfs 0.239 af

Subcatchment E-2: SE Woods Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>1.64"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=1.57 cfs 0.154 af

Subcatchment E-3: Grassed Meadow/Northern Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.72"
Flow Length=465' Tc=12.3 min CN=41 Runoff=1.50 cfs 0.250 af

Subcatchment E-4: SW Grassed Area Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.86"
Flow Length=622' Tc=15.7 min CN=43 Runoff=1.94 cfs 0.299 af

Subcatchment R-1: Roof of Abandoned House Runoff Area=787 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment R-2: Southern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment R-3: Northern Roof Existing Runoff Area=346 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Reach SP-1: Wetlands South of Driveway Inflow=1.93 cfs 0.335 af
Outflow=1.93 cfs 0.335 af

Reach SP-2: Northeast Wetland Flow Inflow=3.31 cfs 0.589 af
Outflow=3.31 cfs 0.589 af

Reach SP-3: Northwest Wetland Flow Inflow=5.19 cfs 0.889 af
Outflow=5.19 cfs 0.889 af

Pond 1P: Existing Detention Basin Peak Elev=59.10' Storage=5,880 cf Inflow=2.80 cfs 0.243 af
Outflow=0.67 cfs 0.171 af

Pond 3P: 12 Inch Culvert Peak Elev=57.44' Inflow=1.93 cfs 0.335 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=1.93 cfs 0.335 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.960 af Average Runoff Depth = 1.15"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

Summary for Subcatchment E-1: Existing Drive

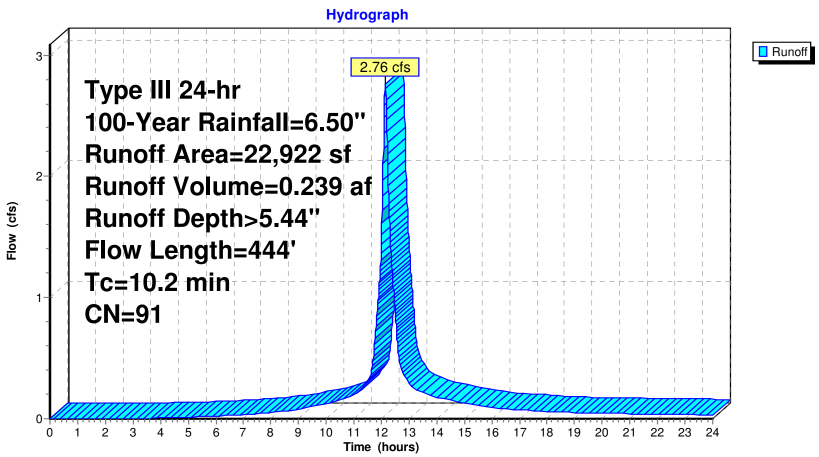
Runoff = 2.76 cfs @ 12.14 hrs, Volume= 0.239 af, Depth> 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

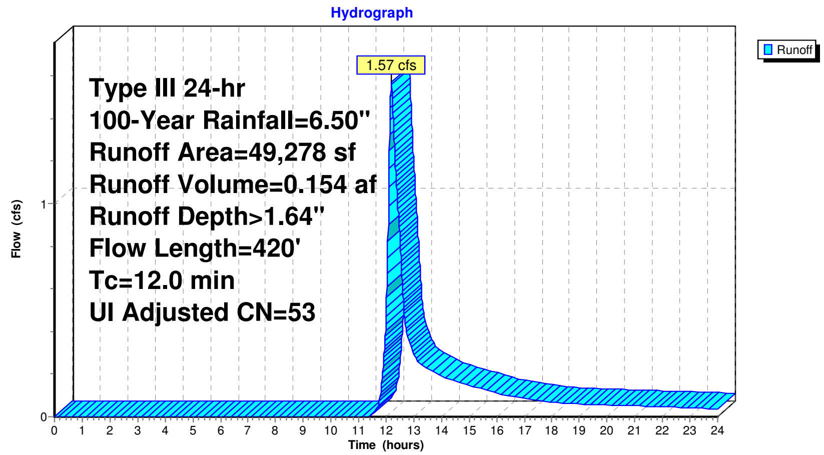
Runoff = 1.57 cfs @ 12.18 hrs, Volume= 0.154 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
3,550	98		Unconnected pavement, HSG A
7,582	49		50-75% Grass cover, Fair, HSG A
1,887	79		50-75% Grass cover, Fair, HSG C
18,787	30		Woods, Good, HSG A
11,389	70		Woods, Good, HSG C
6,083	77		Woods, Good, HSG D
49,278	55	53	Weighted Average, UI Adjusted
45,728			92.80% Pervious Area
3,550			7.20% Impervious Area
3,550			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.8	75	0.0930	1.52		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.4	35	0.0430	1.45		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.5	260	0.0370	0.96		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.0	420	Total			

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

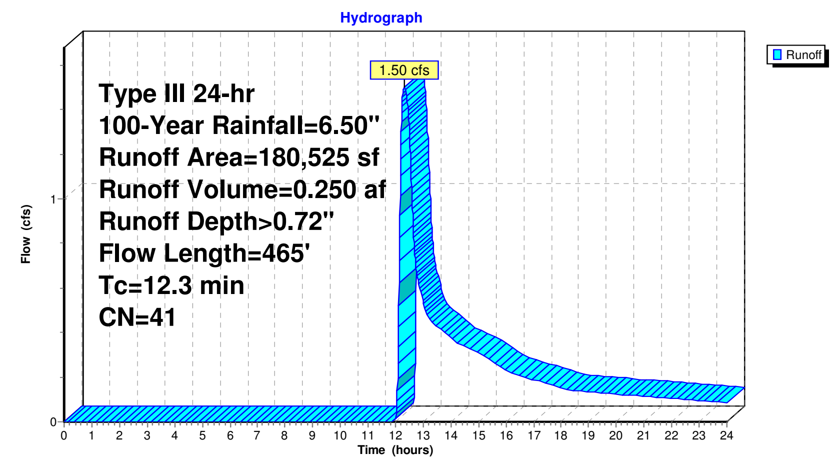
Runoff = 1.50 cfs @ 12.34 hrs, Volume= 0.250 af, Depth> 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



Summary for Subcatchment E-4: SW Grassed Area

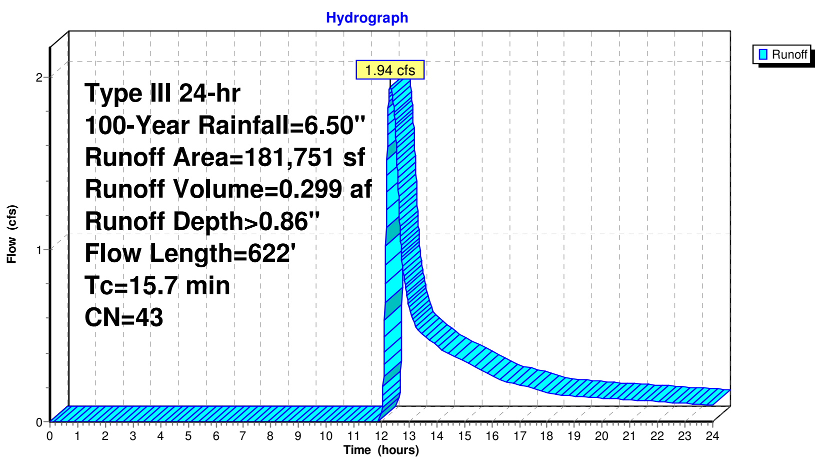
Runoff = 1.94 cfs @ 12.33 hrs, Volume= 0.299 af, Depth> 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	622	Total			

Subcatchment E-4: SW Grassed Area



Summary for Subcatchment R-1: Roof of Abandoned House

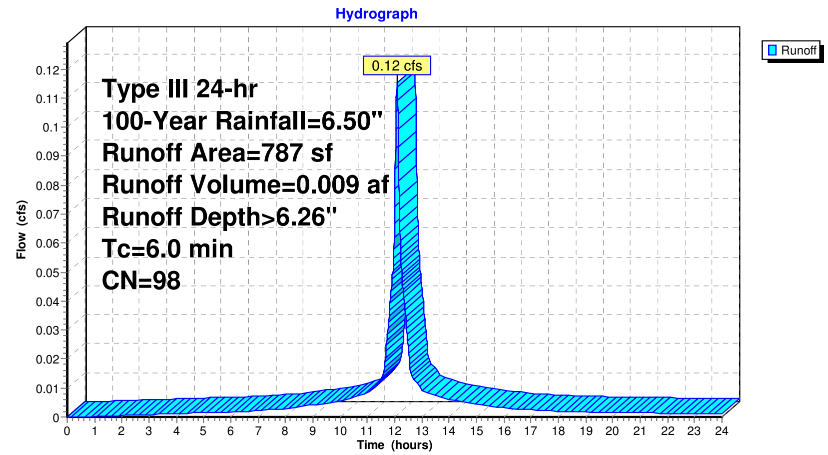
Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House



Summary for Subcatchment R-2: Southern Roof Existing Garage

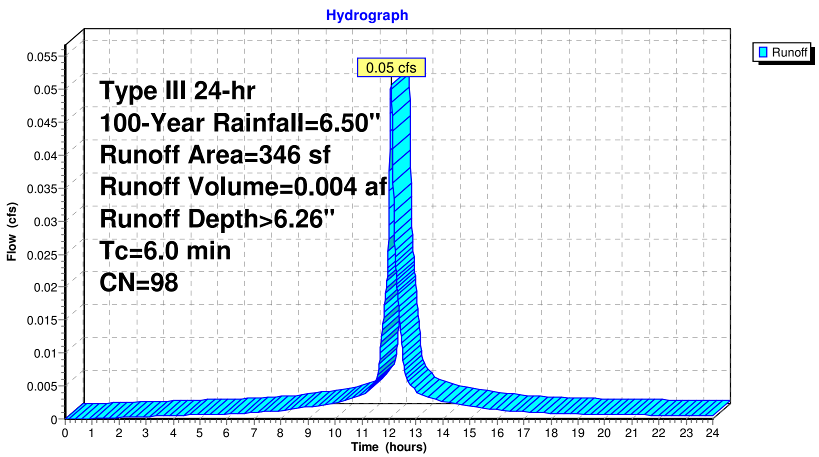
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

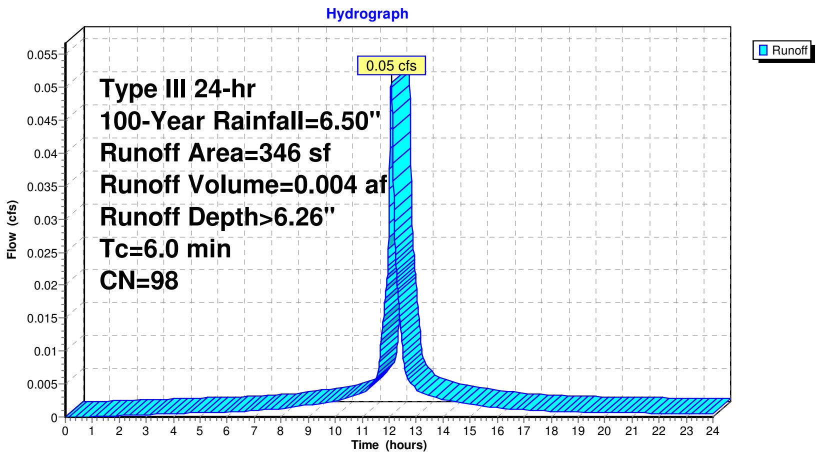
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage



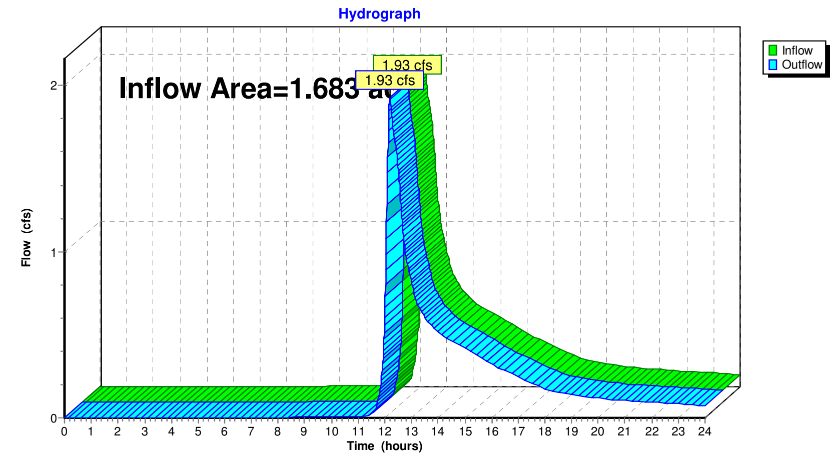
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 2.39" for 100-Year event
Inflow = 1.93 cfs @ 12.19 hrs, Volume= 0.335 af
Outflow = 1.93 cfs @ 12.19 hrs, Volume= 0.335 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



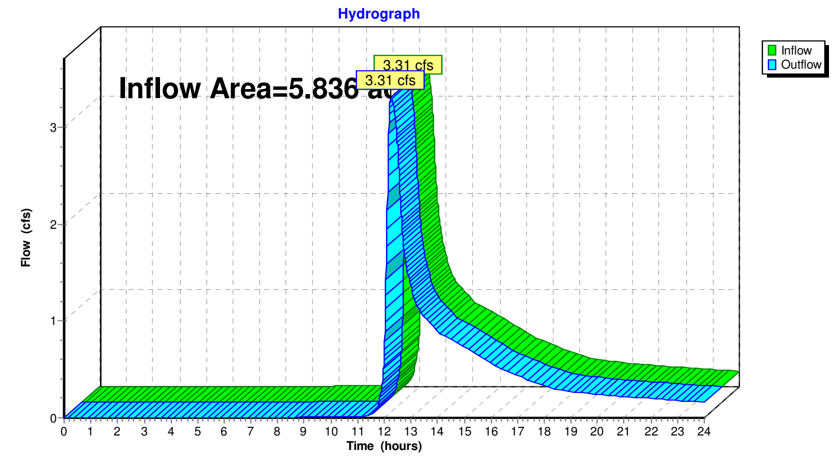
Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.836 ac, 7.47% Impervious, Inflow Depth > 1.21" for 100-Year event
Inflow = 3.31 cfs @ 12.23 hrs, Volume= 0.589 af
Outflow = 3.31 cfs @ 12.23 hrs, Volume= 0.589 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Northeast Wetland Flow



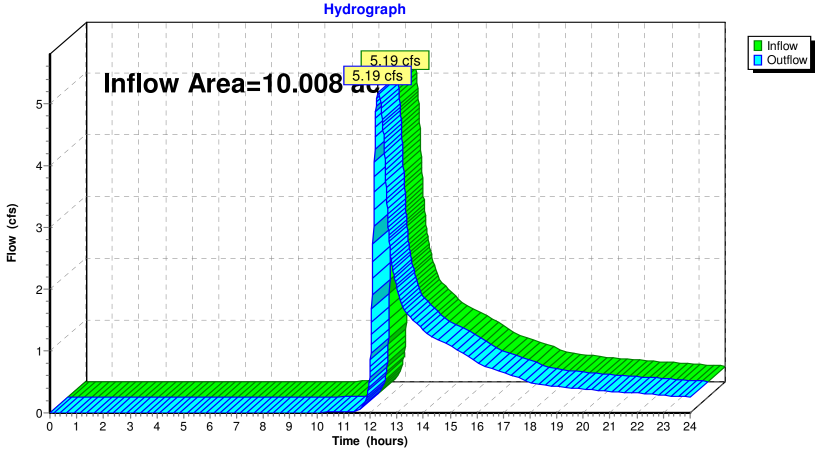
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 1.07" for 100-Year event
Inflow = 5.19 cfs @ 12.30 hrs, Volume= 0.889 af
Outflow = 5.19 cfs @ 12.30 hrs, Volume= 0.889 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 5.45" for 100-Year event
Inflow = 2.80 cfs @ 12.14 hrs, Volume= 0.243 af
Outflow = 0.67 cfs @ 12.57 hrs, Volume= 0.171 af, Atten= 76%, Lag= 25.8 min
Primary = 0.67 cfs @ 12.57 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.10' @ 12.57 hrs Surf.Area= 3,206 sf Storage= 5,880 cf

Plug-Flow detention time= 228.3 min calculated for 0.171 af (71% of inflow)
Center-of-Mass det. time= 138.2 min (919.0 - 780.8)

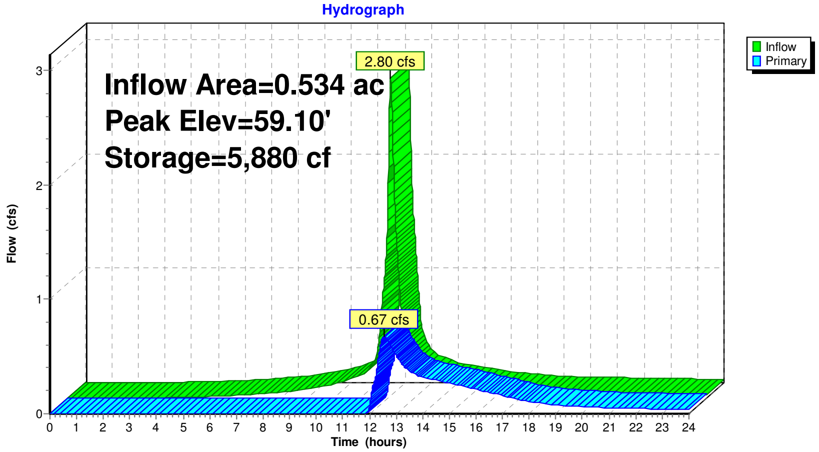
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.67 cfs @ 12.57 hrs HW=59.10' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.39 cfs @ 4.45 fps)
2=Orifice/Grate (Orifice Controls 0.29 cfs @ 1.87 fps)

Pond 1P: Existing Detention Basin



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 57.44' (Flood elevation advised)

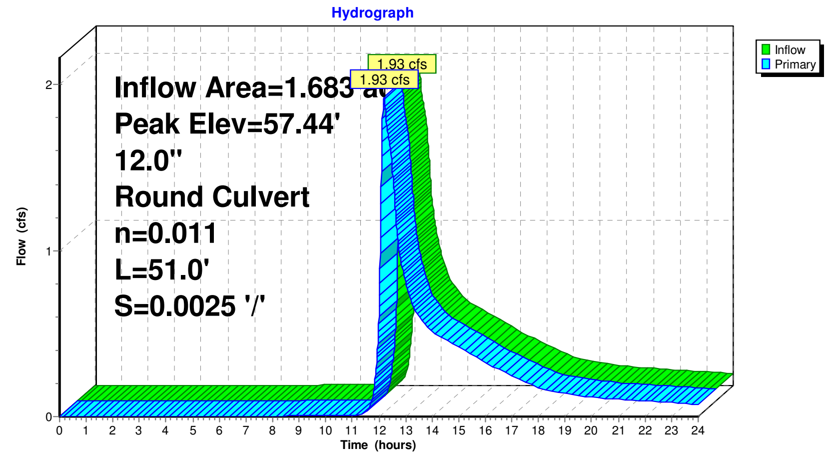
Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 2.39" for 100-Year event
Inflow = 1.93 cfs @ 12.19 hrs, Volume= 0.335 af
Outflow = 1.93 cfs @ 12.19 hrs, Volume= 0.335 af, Atten= 0%, Lag= 0.0 min
Primary = 1.93 cfs @ 12.19 hrs, Volume= 0.335 af

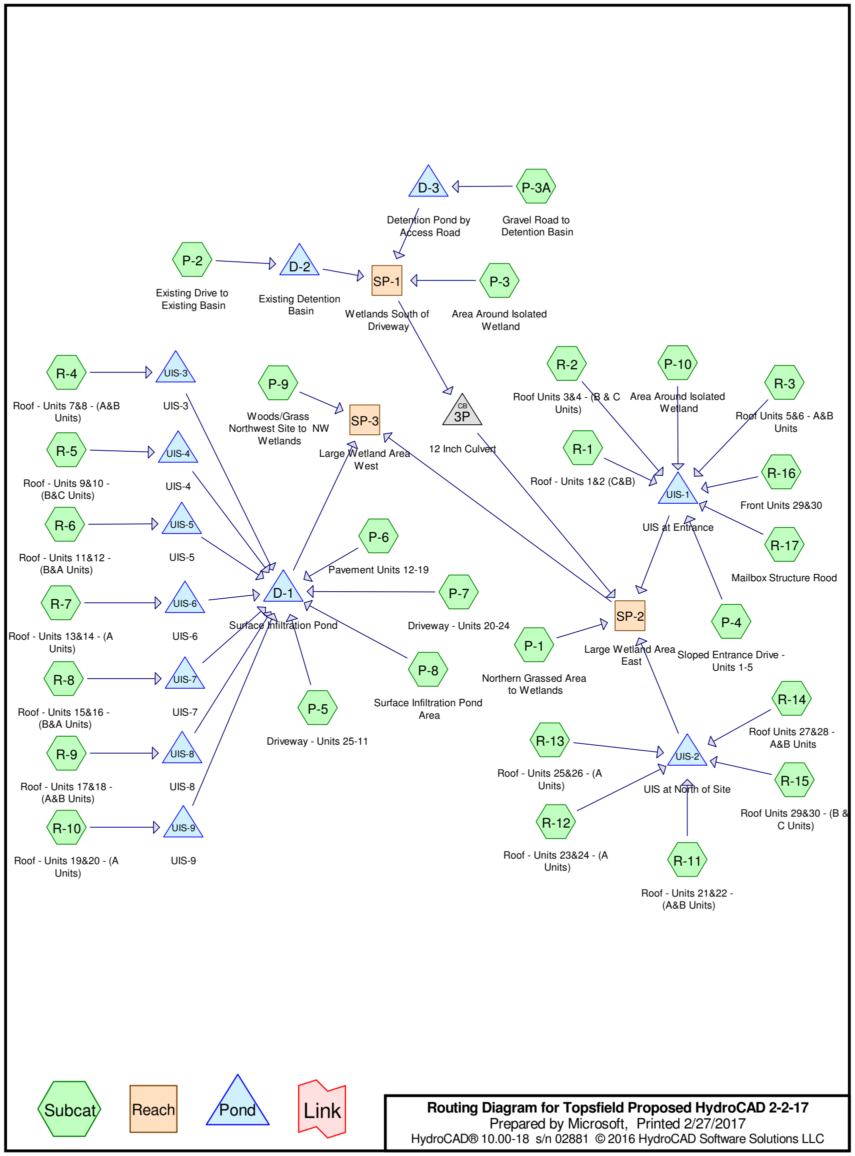
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.44' @ 12.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round Culvert** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.93 cfs @ 12.19 hrs HW=57.44' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 1.93 cfs @ 3.32 fps)

Pond 3P: 12 Inch Culvert





Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.376	49	50-75% Grass cover, Fair, HSG A (P-6, P-7)
2.356	39	>75% Grass cover, Good, HSG A (P-1, P-2, P-3, P-3A, P-4, P-5, P-8, P-9)
0.926	74	>75% Grass cover, Good, HSG C (P-10, P-2, P-3, P-4, P-5, P-9)
0.090	72	Dirt roads, HSG A (P-1, P-9)
0.101	76	Gravel roads, HSG A (P-2, P-3, P-3A)
1.245	98	Paved parking, HSG A (P-3A, P-4, P-5, P-6, P-7, P-8)
0.166	98	Roofs, HSG A (R-14, R-3)
0.322	98	Unconnected pavement, HSG A (P-1, P-2, P-3, P-9)
0.083	98	Unconnected pavement, HSG B (P-2)
0.088	98	Unconnected pavement, HSG C (P-2, P-5)
1.123	98	Unconnected roofs, HSG A (P-10, R-1, R-10, R-11, R-12, R-13, R-15, R-16, R-17, R-2, R-4, R-5, R-6, R-7, R-8, R-9)
2.393	30	Woods, Good, HSG A (P-1, P-3, P-9)
0.323	55	Woods, Good, HSG B (P-1, P-9)
0.297	70	Woods, Good, HSG C (P-1, P-3)
0.118	77	Woods, Good, HSG D (P-3)
10.007	**61**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.172	HSG A	P-1, P-10, P-2, P-3, P-3A, P-4, P-5, P-6, P-7, P-8, P-9, R-1, R-10, R-11, R-12, R-13, R-14, R-15, R-16, R-17, R-2, R-3, R-4, R-5, R-6, R-7, R-8, R-9
0.407	HSG B	P-1, P-2, P-9
1.310	HSG C	P-1, P-10, P-2, P-3, P-4, P-5, P-9
0.118	HSG D	P-3
0.000	Other	
10.007		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.376	0.000	0.000	0.000	0.000	0.376	50-75% Grass cover, Fair	P-6, P-7
2.356	0.000	0.926	0.000	0.000	3.281	>75% Grass cover, Good	P-1, P-10, P-2, P-3, P-3A, P-4, P-5, P-8, P-9
0.090	0.000	0.000	0.000	0.000	0.090	Dirt roads	P-1, P-9
0.101	0.000	0.000	0.000	0.000	0.101	Gravel roads	P-2, P-3, P-3A
1.245	0.000	0.000	0.000	0.000	1.245	Paved parking	P-3A, P-4, P-5, P-6, P-7, P-8
0.166	0.000	0.000	0.000	0.000	0.166	Roofs	R-14, R-3
0.322	0.083	0.088	0.000	0.000	0.492	Unconnected pavement	P-1, P-2, P-3, P-5, P-9
1.123	0.000	0.000	0.000	0.000	1.123	Unconnected roofs	P-10, R-1, R-10, R-11, R-12, R-13, R-15, R-16, R-17, R-2, R-4, R-5, R-6, R-7, R-8, R-9
2.393	0.323	0.297	0.118	0.000	3.131	Woods, Good	P-1, P-3, P-9
8.172	**0.407**	**1.310**	**0.118**	**0.000**	**10.007**	**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	3P	56.51	56.38	51.0	0.0025	0.011	12.0	0.0	0.0
2	D-1	70.10	67.00	234.0	0.0132	0.015	18.0	0.0	0.0
3	UIS-3	73.40	70.70	30.0	0.0900	0.011	6.0	0.0	0.0
4	UIS-4	74.20	74.06	30.0	0.0047	0.011	6.0	0.0	0.0
5	UIS-5	74.80	74.60	22.0	0.0091	0.011	6.0	0.0	0.0
6	UIS-6	74.00	72.18	106.0	0.0172	0.011	6.0	0.0	0.0
7	UIS-7	73.50	73.00	17.5	0.0286	0.011	6.0	0.0	0.0
8	UIS-8	72.80	72.18	37.0	0.0168	0.011	6.0	0.0	0.0
9	UIS-9	72.18	71.38	79.0	0.0101	0.011	6.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Northern Grassed Area to Runoff Area=81,776 sf 1.57% Impervious Runoff Depth>0.01"
Tc=6.0 min UI Adjusted CN=42 Runoff=0.00 cfs 0.001 af

Subcatchment P-10: Area Around Isolated Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>1.03"
Tc=6.0 min UI Adjusted CN=75 Runoff=0.83 cfs 0.062 af

Subcatchment P-2: Existing Drive to Existing Runoff Area=22,978 sf 59.84% Impervious Runoff Depth>1.39"
Tc=6.0 min CN=81 Runoff=0.85 cfs 0.061 af

Subcatchment P-3: Area Around Isolated Runoff Area=27,549 sf 12.75% Impervious Runoff Depth>0.11"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.01 cfs 0.006 af

Subcatchment P-3A: Gravel Road to Detention Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>0.82"
Tc=6.0 min CN=71 Runoff=0.10 cfs 0.008 af

Subcatchment P-4: Sloped Entrance Drive - Runoff Area=21,239 sf 62.65% Impervious Runoff Depth>1.32"
Tc=6.0 min CN=80 Runoff=0.75 cfs 0.054 af

Subcatchment P-5: Driveway - Units 25-11 Runoff Area=39,272 sf 52.13% Impervious Runoff Depth>0.97"
Tc=6.0 min CN=74 Runoff=0.97 cfs 0.073 af

Subcatchment P-6: Pavement Units 12-19 Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>1.20"
Tc=6.0 min CN=78 Runoff=0.60 cfs 0.044 af

Subcatchment P-7: Driveway - Units 20-24 Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>0.82"
Tc=6.0 min CN=71 Runoff=0.31 cfs 0.024 af

Subcatchment P-8: Surface Infiltration Pond Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.01"
Tc=6.0 min CN=43 Runoff=0.00 cfs 0.000 af

Subcatchment P-9: Woods/Grass Northwest Runoff Area=102,567 sf 2.25% Impervious Runoff Depth=0.00"
Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment R-1: Roof - Units 1&2 (C&B) Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.017 af

Subcatchment R-10: Roof - Units 19&20 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af

Subcatchment R-11: Roof - Units 21&22 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-12: Roof - Units 23&24 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af

Subcatchment R-13: Roof - Units 25&26 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af

Subcatchment R-14: Roof Units 27&28 - A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-15: Roof Units 29&30 - (B & C Runoff Area=1,705 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment R-16: Front Units 29&30 Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af

Subcatchment R-17: Mailbox Structure Rood Runoff Area=120 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.01 cfs 0.001 af

Subcatchment R-2: Roof Units 3&4 - (B & C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af

Subcatchment R-3: Roof Units 5&6 - A&B Units Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-4: Roof - Units 7&8 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-5: Roof - Units 9&10 - (B&C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af

Subcatchment R-6: Roof - Units 11&12 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-7: Roof - Units 13&14 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af

Subcatchment R-8: Roof - Units 15&16 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-9: Roof - Units 17&18 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Reach SP-1: Wetlands South of Driveway Inflow=0.01 cfs 0.006 af
Outflow=0.01 cfs 0.006 af

Reach SP-2: Large Wetland Area East Inflow=0.01 cfs 0.007 af
Outflow=0.01 cfs 0.007 af

Reach SP-3: Large Wetland Area West Inflow=0.01 cfs 0.007 af
Outflow=0.01 cfs 0.007 af

Pond 3P: 12 Inch Culvert Peak Elev=56.57' Inflow=0.01 cfs 0.006 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=0.01 cfs 0.006 af

Pond D-1: Surface Infiltration Pond Peak Elev=68.76' Storage=7,349 cf Inflow=3.58 cfs 0.236 af
Discarded=0.09 cfs 0.086 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.086 af

Pond D-2: Existing Detention Basin Peak Elev=58.06' Storage=2,660 cf Inflow=0.85 cfs 0.061 af
Outflow=0.00 cfs 0.000 af

Pond D-3: Detention Pond by Access Road Peak Elev=63.24' Storage=81 cf Inflow=0.10 cfs 0.008 af
Discarded=0.02 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.008 af

Pond UIS-1: UIS at Entrance Peak Elev=62.02' Storage=4,431 cf Inflow=2.38 cfs 0.179 af
Discarded=0.08 cfs 0.100 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.100 af

Pond UIS-2: UIS at North of Site Peak Elev=63.00' Storage=956 cf Inflow=1.16 cfs 0.092 af
Discarded=0.23 cfs 0.092 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.092 af

Pond UIS-3: UIS-3 Peak Elev=73.67' Storage=130 cf Inflow=0.25 cfs 0.020 af
Discarded=0.00 cfs 0.004 af Primary=0.25 cfs 0.013 af Outflow=0.25 cfs 0.017 af

Pond UIS-4: UIS-4 Peak Elev=74.55' Storage=134 cf Inflow=0.22 cfs 0.018 af
Discarded=0.00 cfs 0.004 af Primary=0.21 cfs 0.011 af Outflow=0.22 cfs 0.015 af

Pond UIS-5: UIS-5 Peak Elev=75.17' Storage=136 cf Inflow=0.25 cfs 0.020 af
Discarded=0.00 cfs 0.004 af Primary=0.24 cfs 0.013 af Outflow=0.24 cfs 0.017 af

Pond UIS-6: UIS-6 Peak Elev=74.39' Storage=137 cf Inflow=0.27 cfs 0.021 af
Discarded=0.00 cfs 0.004 af Primary=0.26 cfs 0.015 af Outflow=0.26 cfs 0.019 af

Pond UIS-7: UIS-7 Peak Elev=73.87' Storage=136 cf Inflow=0.25 cfs 0.020 af
Discarded=0.00 cfs 0.004 af Primary=0.24 cfs 0.013 af Outflow=0.24 cfs 0.017 af

Pond UIS-8: UIS-8 Peak Elev=73.17' Storage=136 cf Inflow=0.25 cfs 0.020 af
Discarded=0.00 cfs 0.004 af Primary=0.24 cfs 0.013 af Outflow=0.24 cfs 0.017 af

Pond UIS-9: UIS-9 Peak Elev=72.57' Storage=81 cf Inflow=0.27 cfs 0.021 af
Discarded=0.00 cfs 0.004 af Primary=0.26 cfs 0.016 af Outflow=0.26 cfs 0.020 af

Total Runoff Area = 10.007 ac Runoff Volume = 0.628 af Average Runoff Depth = 0.75"
69.75% Pervious = 6.980 ac 30.25% Impervious = 3.027 ac

Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

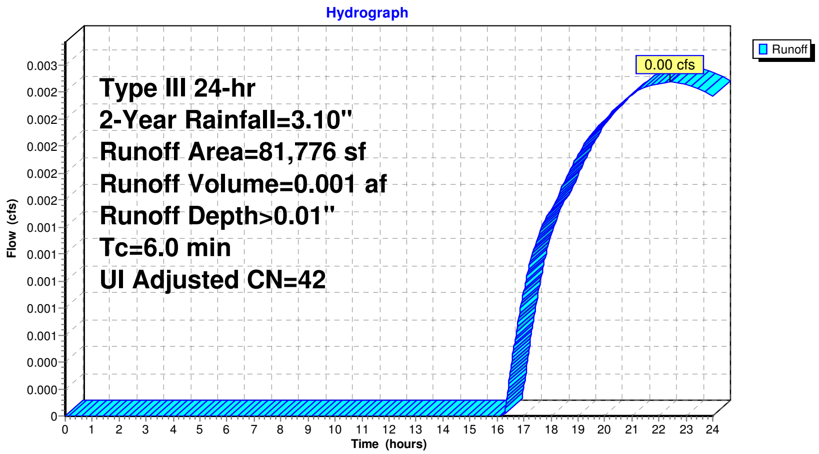
Runoff = 0.00 cfs @ 22.42 hrs, Volume= 0.001 af, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
36,287	30		Woods, Good, HSG A
10,782	70		Woods, Good, HSG C
9,419	55		Woods, Good, HSG B
22,149	39		>75% Grass cover, Good, HSG A
1,287	98		Unconnected pavement, HSG A
1,852	72		Dirt roads, HSG A
81,776	43	42	Weighted Average, UI Adjusted
80,489			98.43% Pervious Area
1,287			1.57% Impervious Area
1,287			100.00% Unconnected

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

Subcatchment P-1: Northern Grassed Area to Wetlands



Summary for Subcatchment P-10: Area Around Isolated Wetland

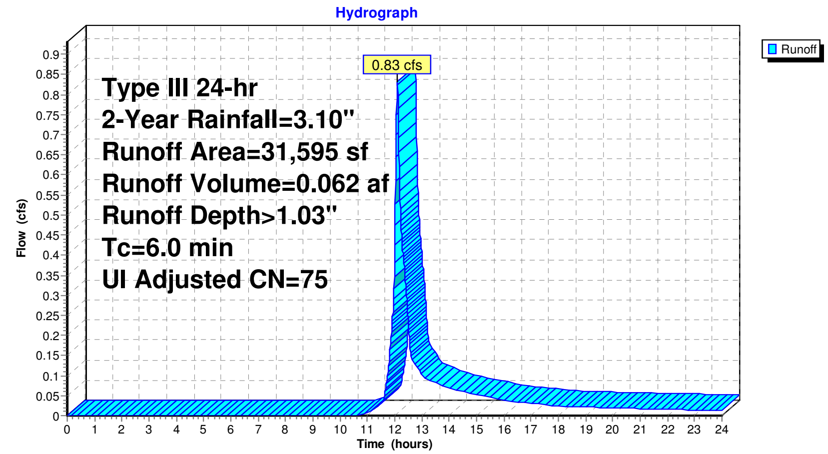
Runoff = 0.83 cfs @ 12.10 hrs, Volume= 0.062 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

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

Subcatchment P-10: Area Around Isolated Wetland



Summary for Subcatchment P-2: Existing Drive to Existing Basin

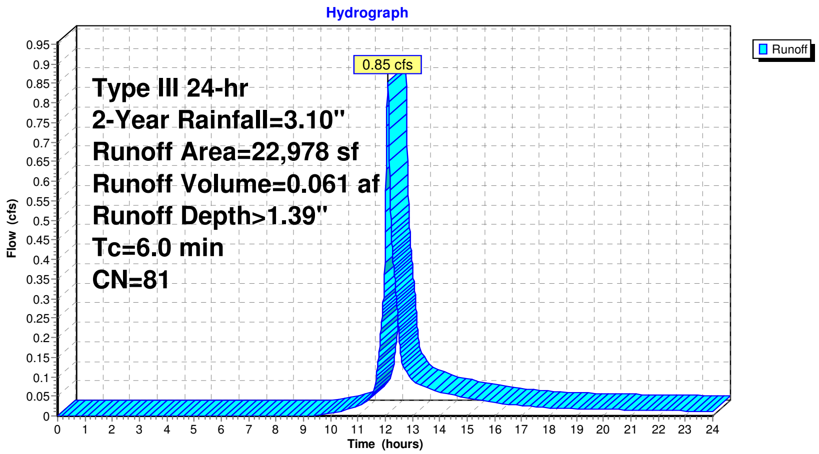
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.061 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
6,902	98	Unconnected pavement, HSG A
1,353	76	Gravel roads, HSG A
4,824	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
3,632	98	Unconnected pavement, HSG B
3,217	98	Unconnected pavement, HSG C
22,978	81	Weighted Average
9,227		40.16% Pervious Area
13,751		59.84% Impervious Area
13,751		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6.0 TC**

Subcatchment P-2: Existing Drive to Existing Basin



Summary for Subcatchment P-3: Area Around Isolated Wetland

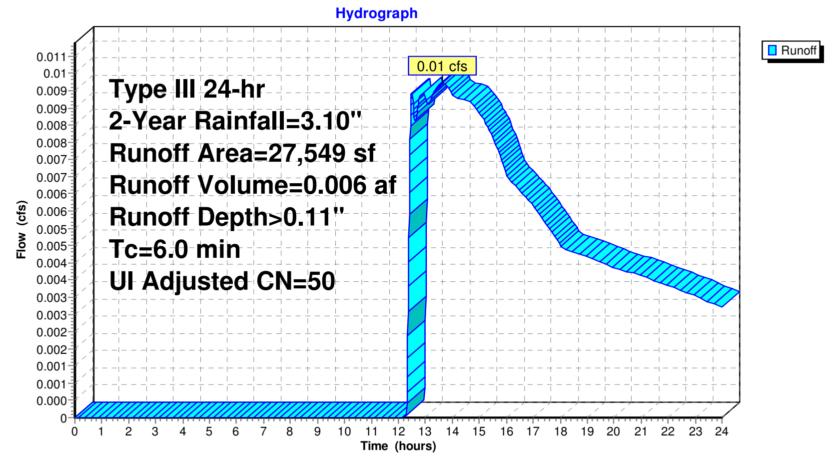
Runoff = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af, Depth> 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
3,512	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,549	53	50	Weighted Average, UI Adjusted
24,037			87.25% Pervious Area
3,512			12.75% Impervious Area
3,512			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

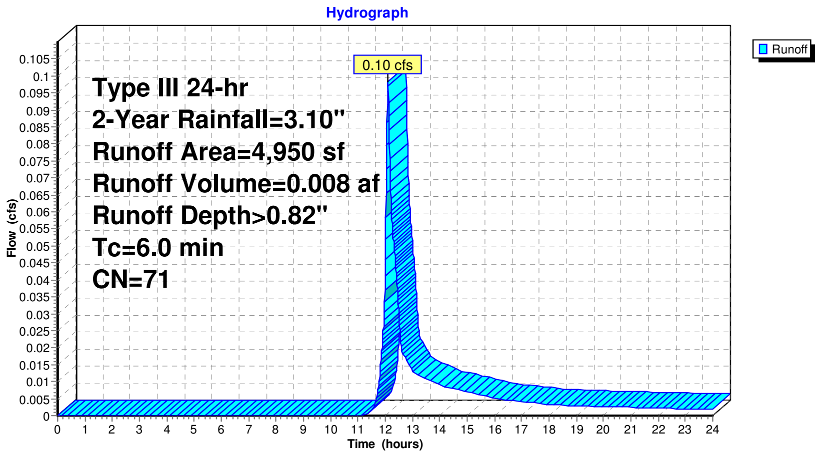
Runoff = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

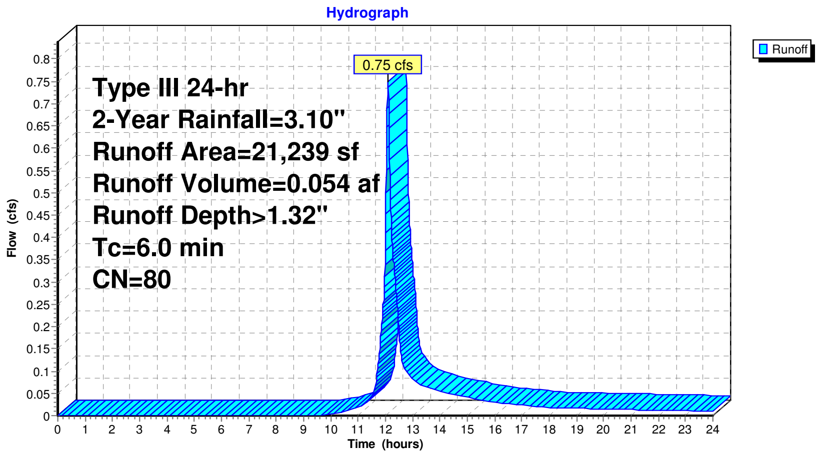
Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.054 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
13,306	98	Paved parking, HSG A
5,234	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,239	80	Weighted Average
7,933		37.35% Pervious Area
13,306		62.65% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

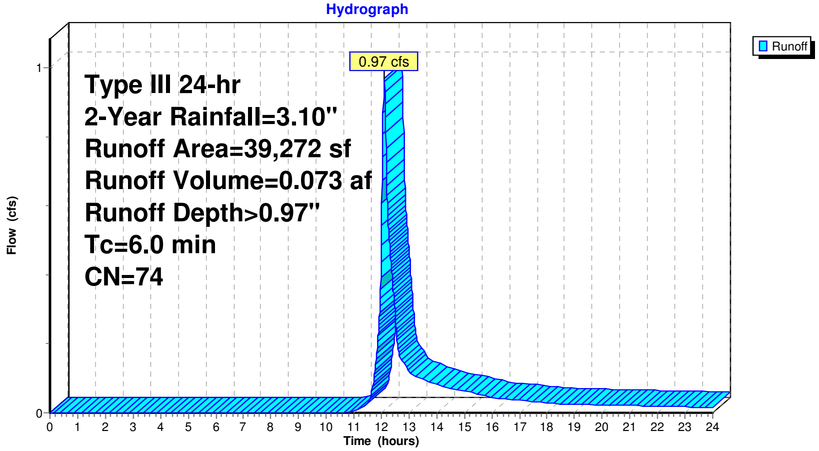
Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.073 af, Depth> 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
19,875	98	Paved parking, HSG A
14,088	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
596	98	Unconnected pavement, HSG C
39,272	74	Weighted Average
18,801		47.87% Pervious Area
20,471		52.13% Impervious Area
596		2.91% Unconnected

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

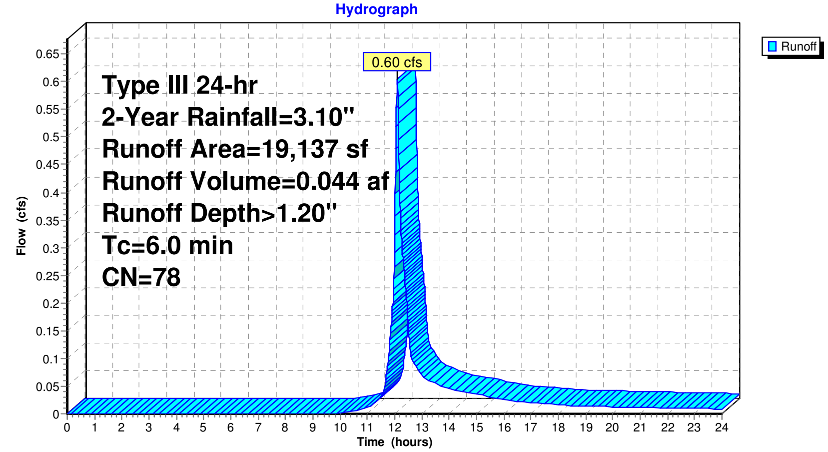
Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.044 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

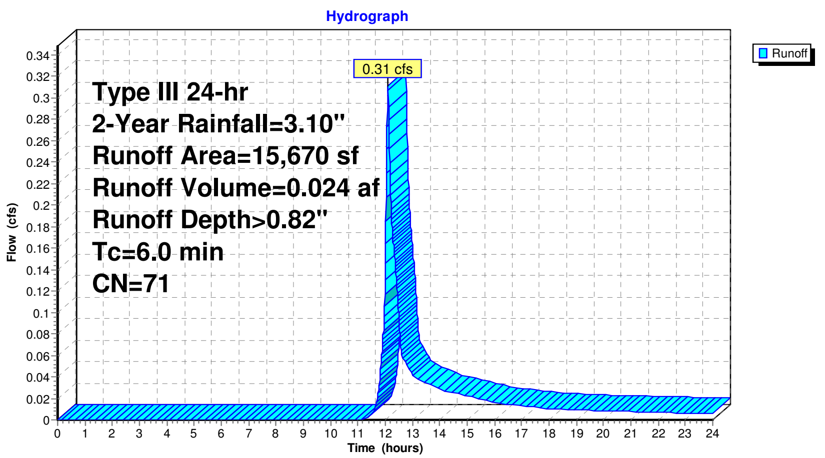
Runoff = 0.31 cfs @ 12.10 hrs, Volume= 0.024 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Summary for Subcatchment P-8: Surface Infiltration Pond Area

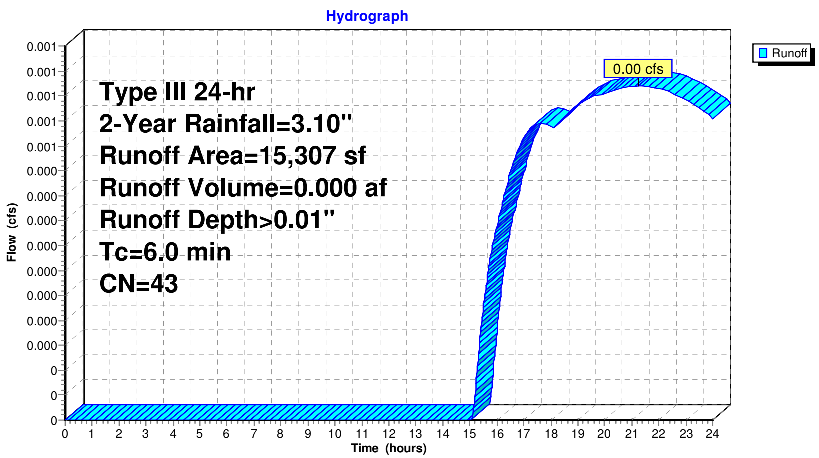
Runoff = 0.00 cfs @ 21.26 hrs, Volume= 0.000 af, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

[45] Hint: Runoff=Zero

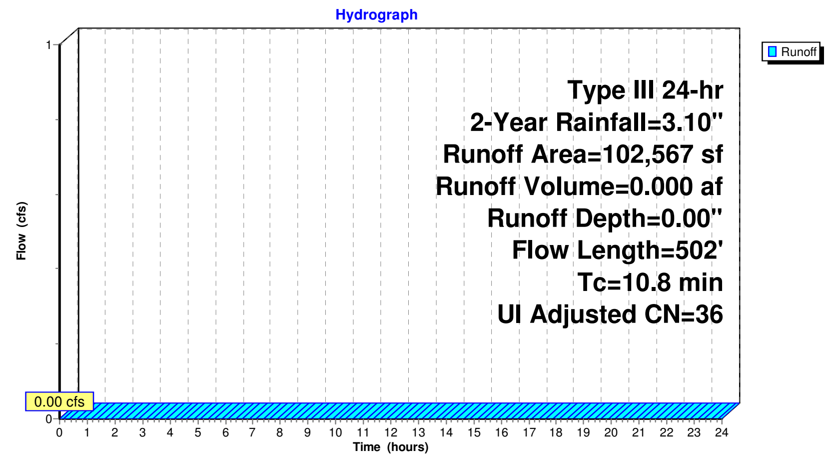
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.8	502	Total			

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands



Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

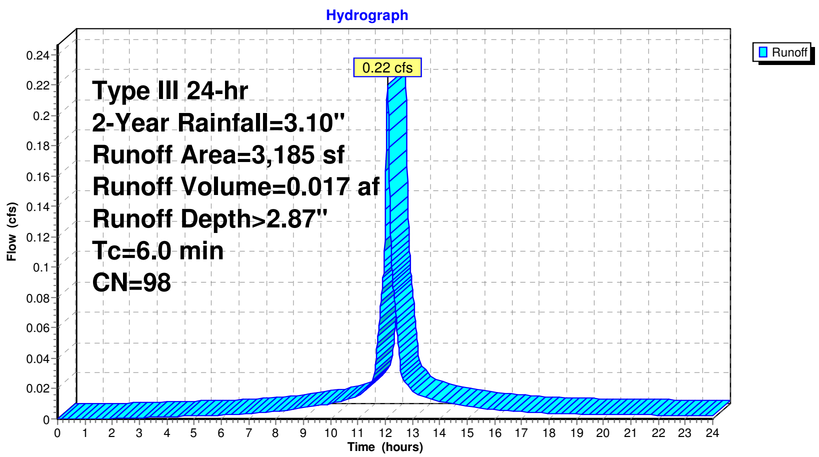
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.017 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

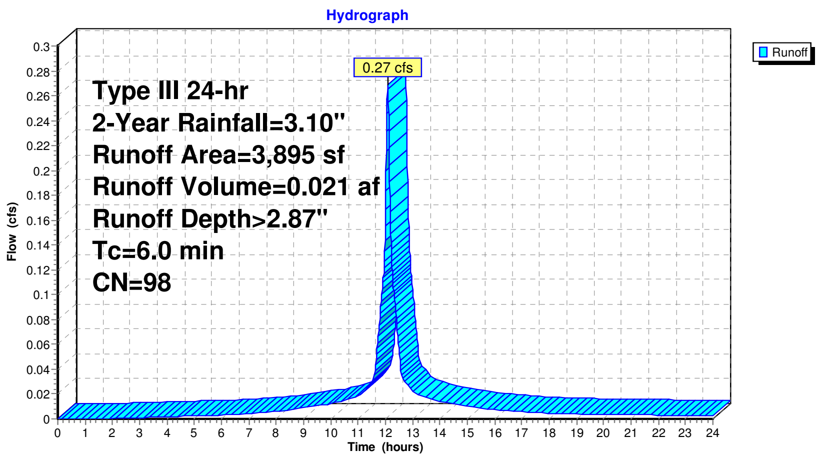
Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

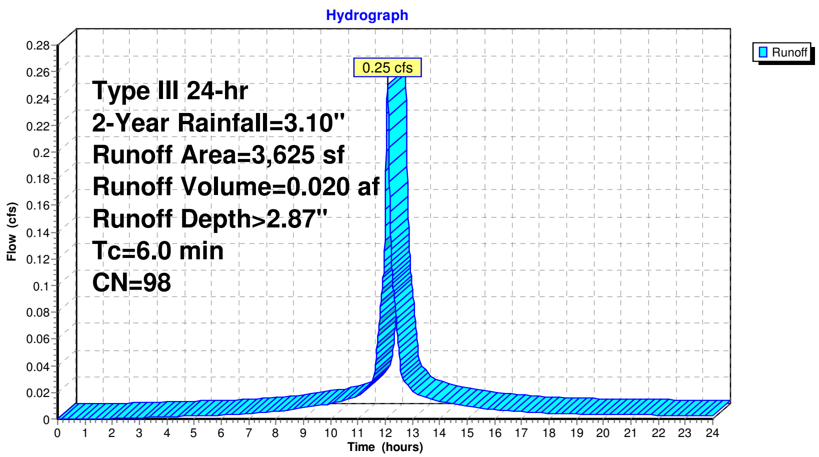
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

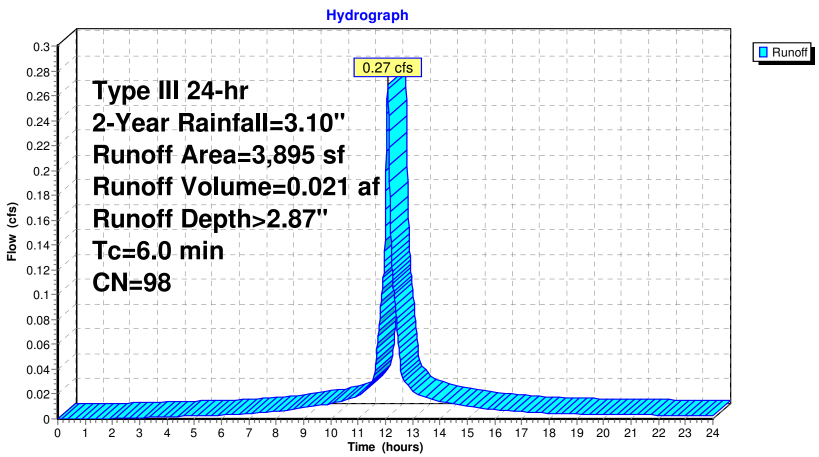
Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)



Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

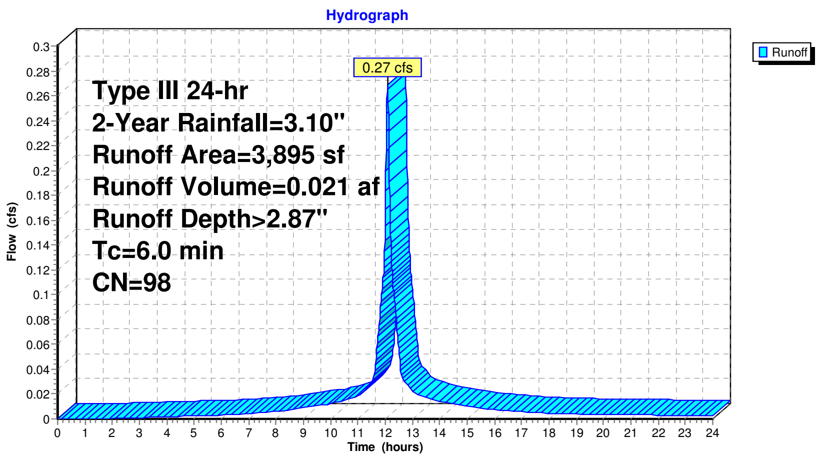
Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

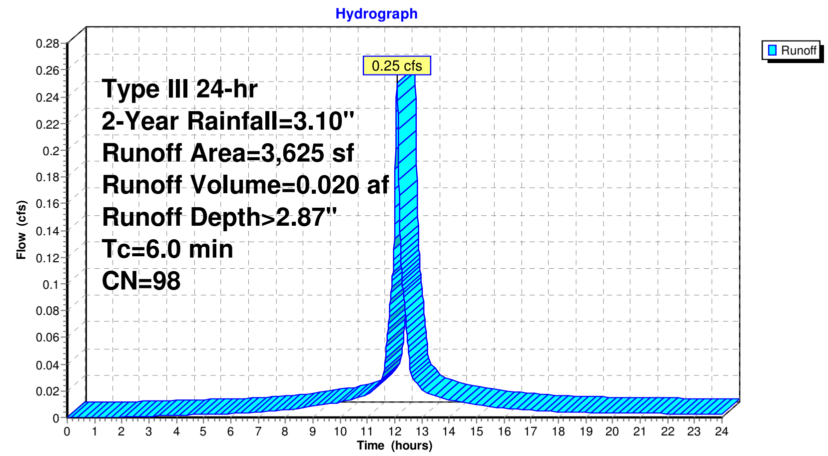
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

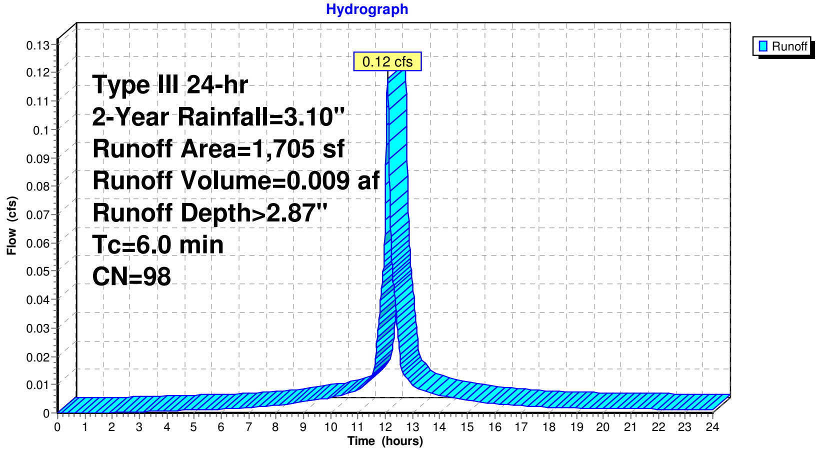
Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,705	98	Unconnected roofs, HSG A
1,705		100.00% Impervious Area
1,705		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

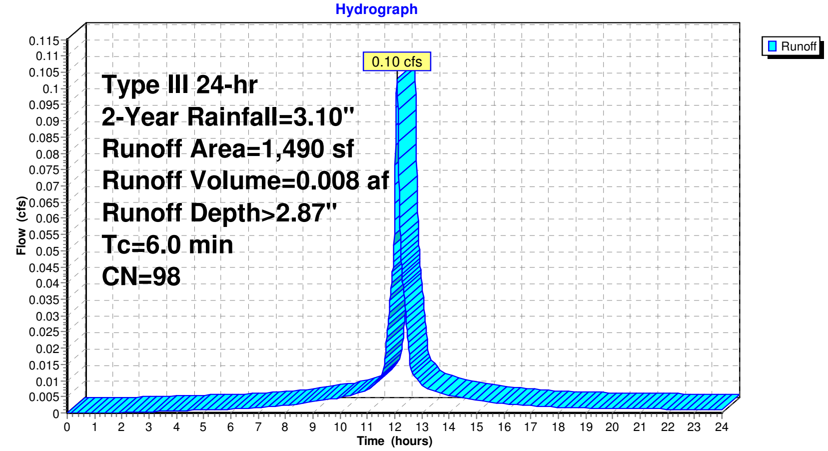
Runoff = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

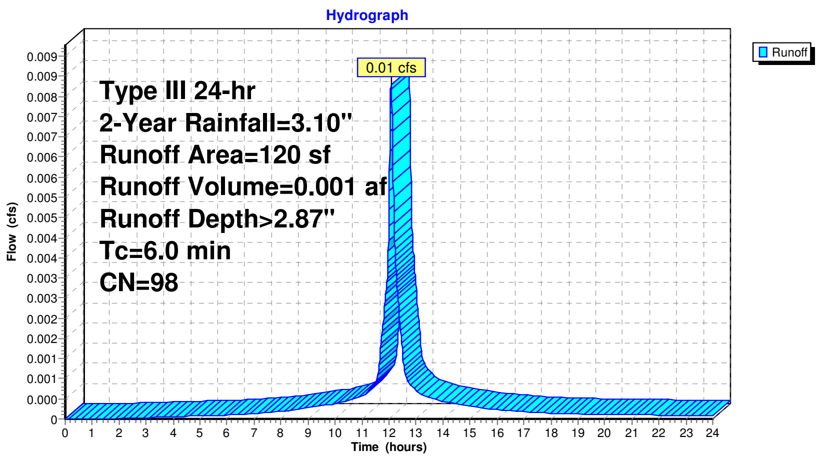
Runoff = 0.01 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

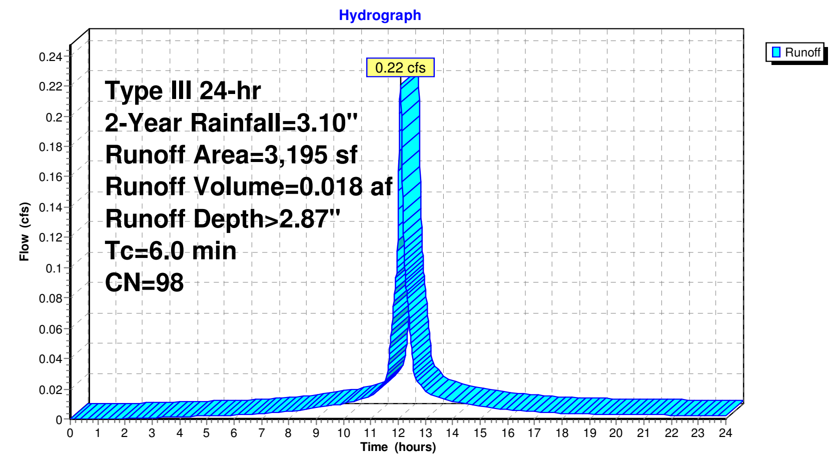
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

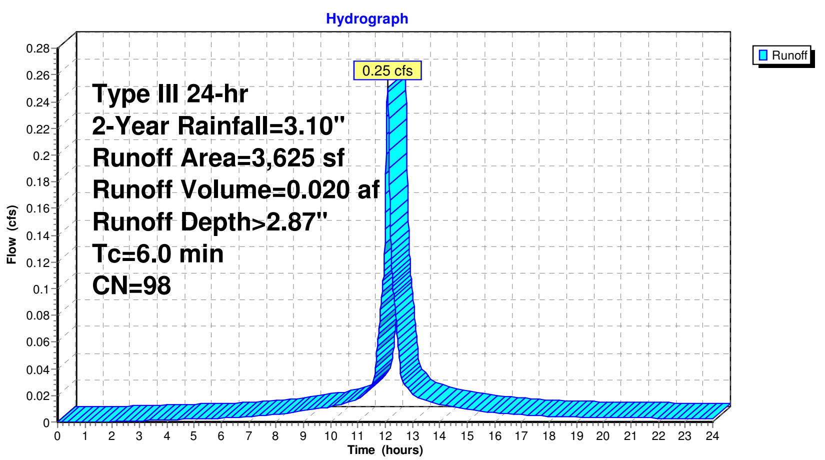
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

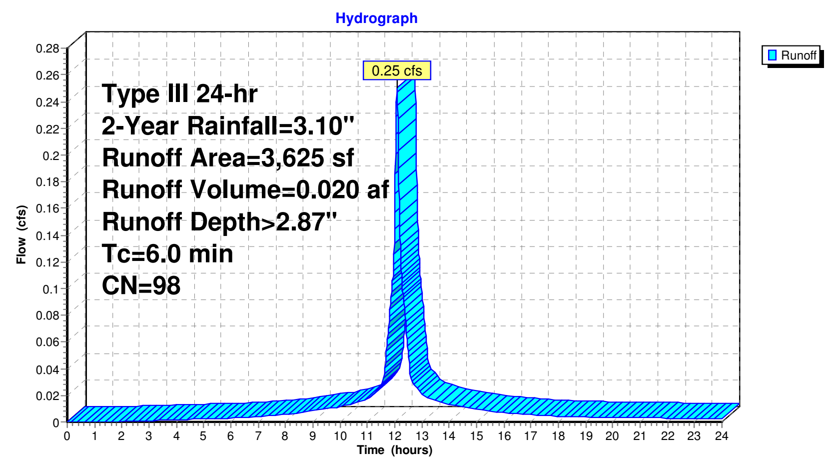
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

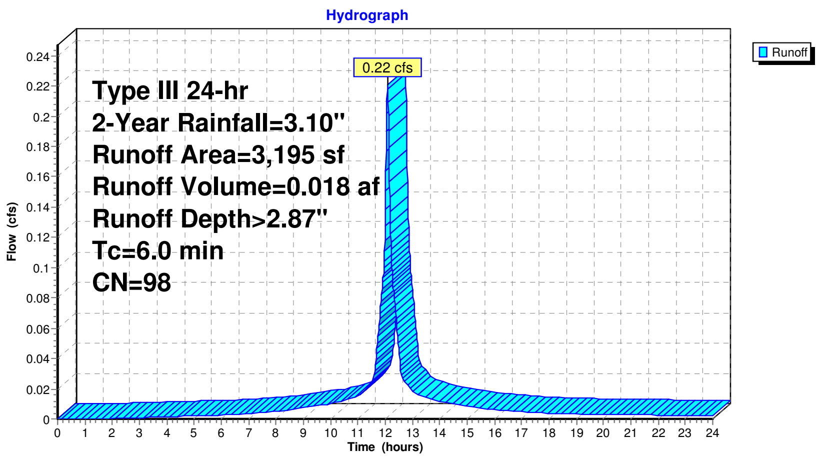
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

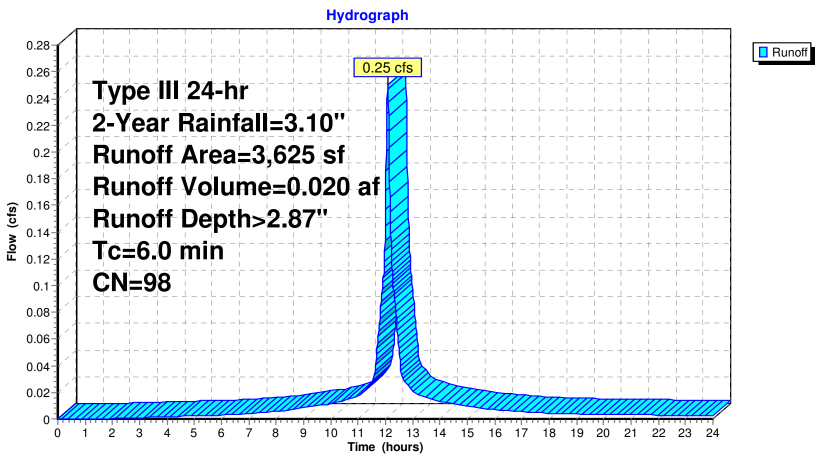
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

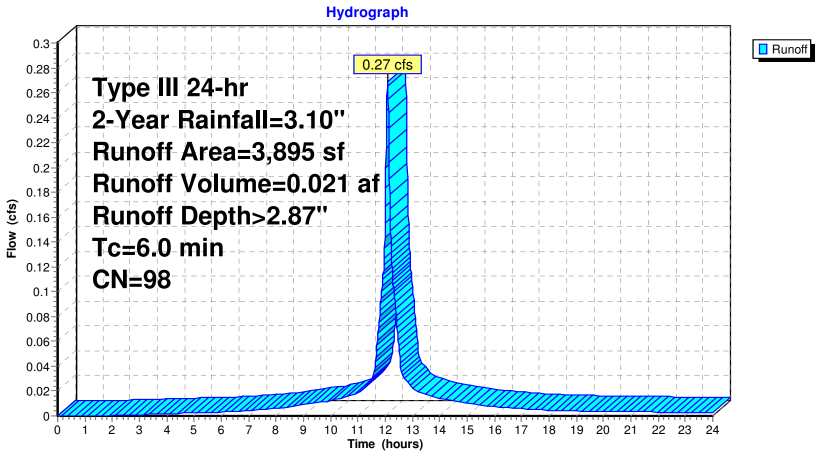
Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

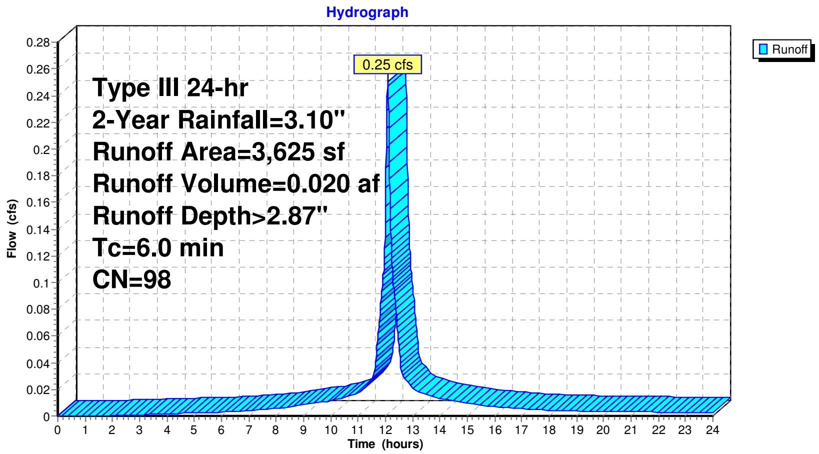
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

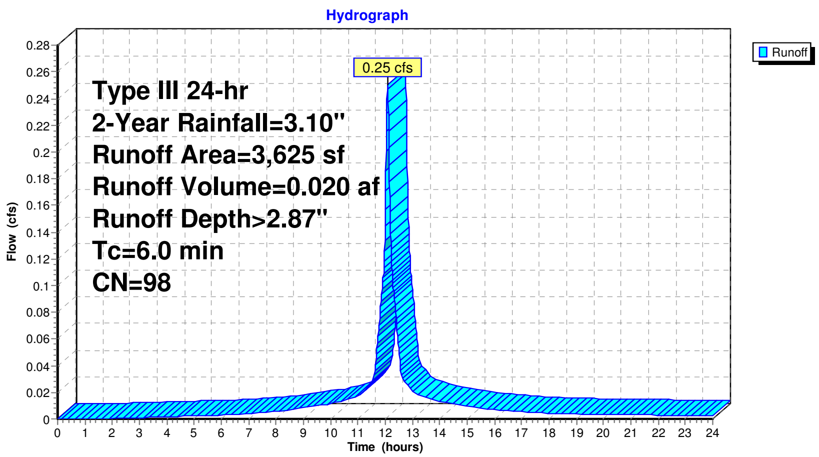
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)



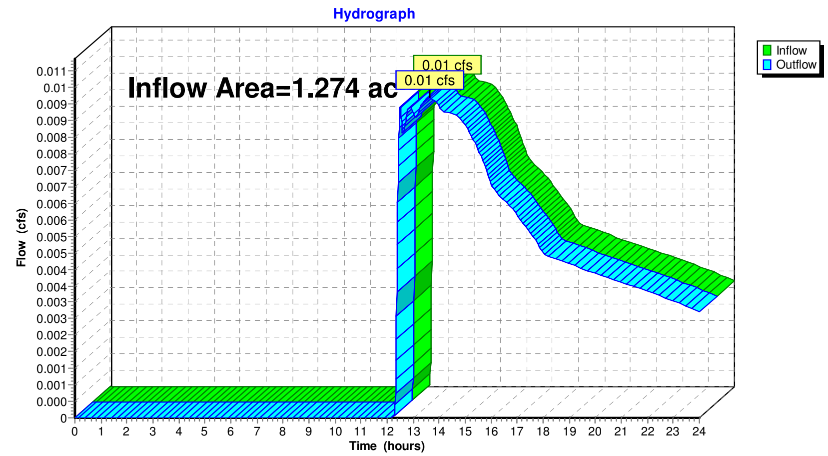
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 0.05" for 2-Year event
Inflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



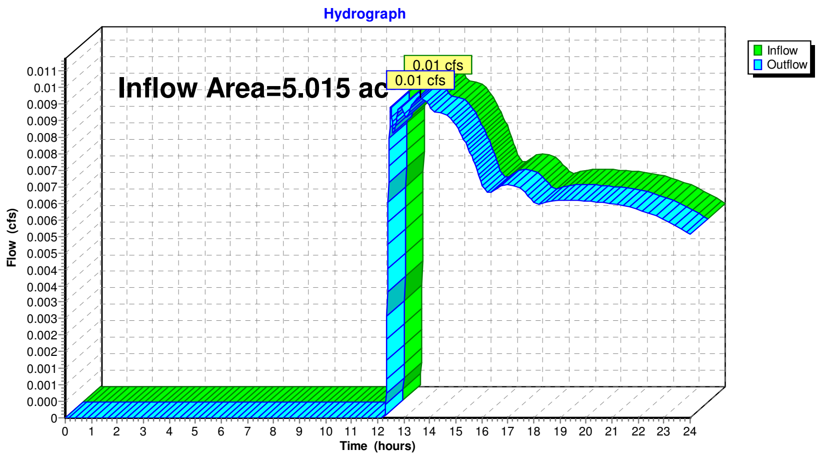
Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.015 ac, 29.33% Impervious, Inflow Depth > 0.02" for 2-Year event
Inflow = 0.01 cfs @ 13.62 hrs, Volume= 0.007 af
Outflow = 0.01 cfs @ 13.62 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Large Wetland Area East



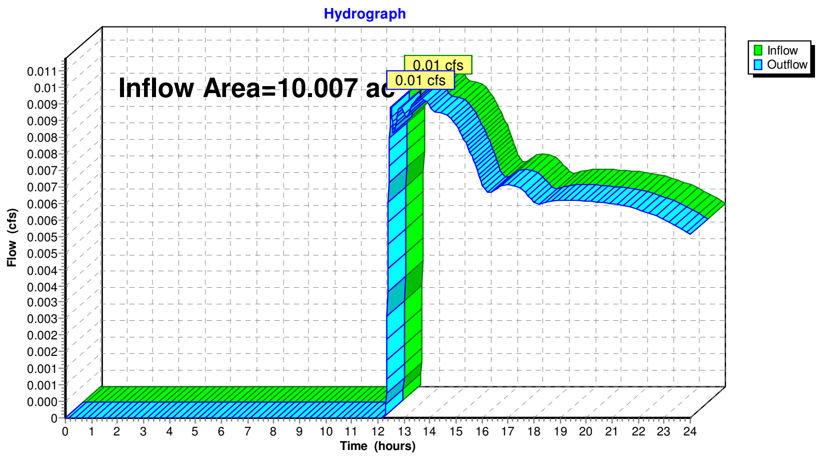
Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.007 ac, 30.25% Impervious, Inflow Depth > 0.01" for 2-Year event
Inflow = 0.01 cfs @ 13.62 hrs, Volume= 0.007 af
Outflow = 0.01 cfs @ 13.62 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Large Wetland Area West



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 56.57' (Flood elevation advised)

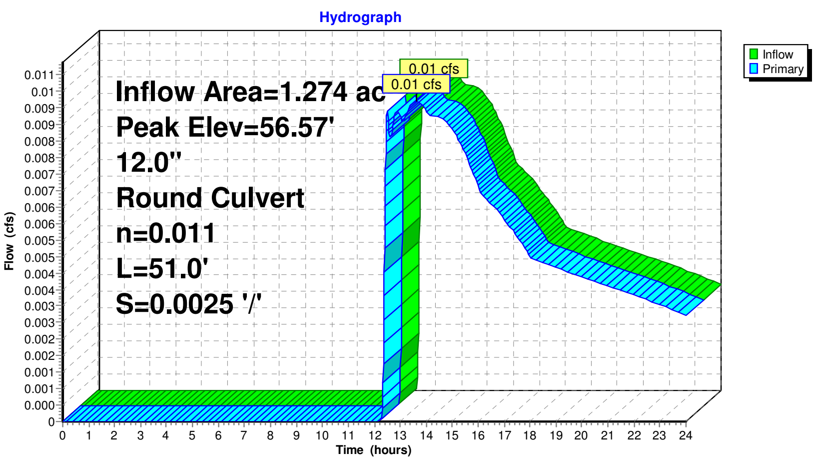
Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 0.05" for 2-Year event
Inflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min
Primary = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.57' @ 13.62 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round RCP_Round 12"** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.01 cfs @ 13.62 hrs HW=56.57' (Free Discharge)
└─**1=RCP_Round 12"** (Barrel Controls 0.01 cfs @ 0.70 fps)

Pond 3P: 12 Inch Culvert



Summary for Pond D-1: Surface Infiltration Pond

Inflow Area = 2.637 ac, 56.99% Impervious, Inflow Depth > 1.07" for 2-Year event
Inflow = 3.58 cfs @ 12.10 hrs, Volume= 0.236 af
Outflow = 0.09 cfs @ 17.35 hrs, Volume= 0.086 af, Atten= 98%, Lag= 315.0 min
Discarded = 0.09 cfs @ 17.35 hrs, Volume= 0.086 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 68.76' @ 17.35 hrs Surf.Area= 3,625 sf Storage= 7,349 cf
Flood Elev= 70.00' Surf.Area= 4,583 sf Storage= 12,420 cf

Plug-Flow detention time= 352.4 min calculated for 0.086 af (36% of inflow)
Center-of-Mass det. time= 241.3 min (1,068.4 - 827.1)

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

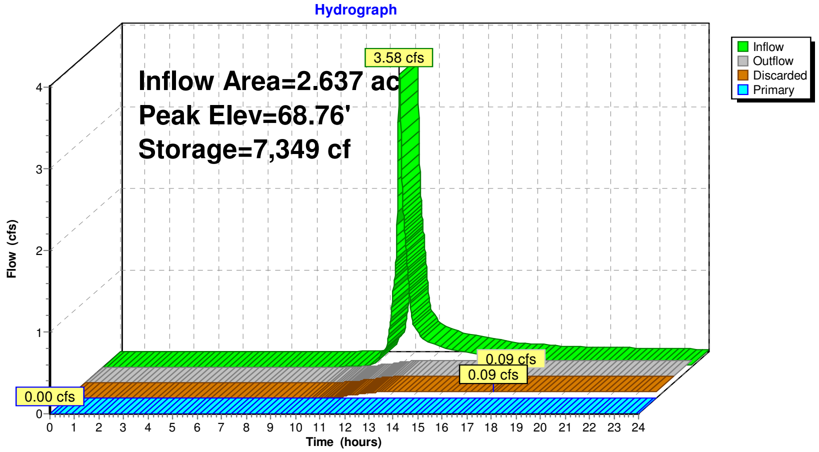
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	70.10'	**18.0" Round Culvert** L= 234.0' Ke= 0.200 Inlet / Outlet Invert= 70.10' / 67.00' S= 0.0132 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.09 cfs @ 17.35 hrs HW=68.76' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=66.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

Inflow Area = 0.528 ac, 59.84% Impervious, Inflow Depth > 1.39" for 2-Year event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.061 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.06' @ 24.00 hrs Surf.Area= 3,090 sf Storage= 2,660 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

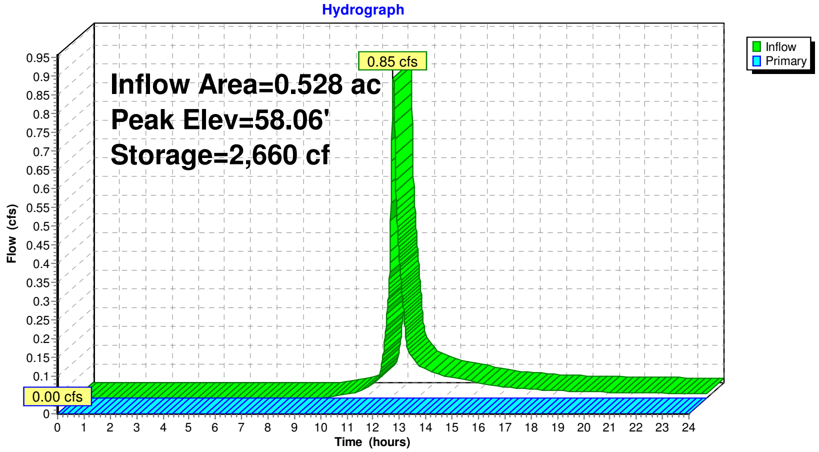
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=57.20' (Free Discharge)
1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 0.82" for 2-Year event
Inflow = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 12.58 hrs, Volume= 0.008 af, Atten= 78%, Lag= 28.7 min
Discarded = 0.02 cfs @ 12.58 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.24' @ 12.58 hrs Surf.Area= 386 sf Storage= 81 cf

Plug-Flow detention time= 26.9 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 26.3 min (899.9 - 873.6)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

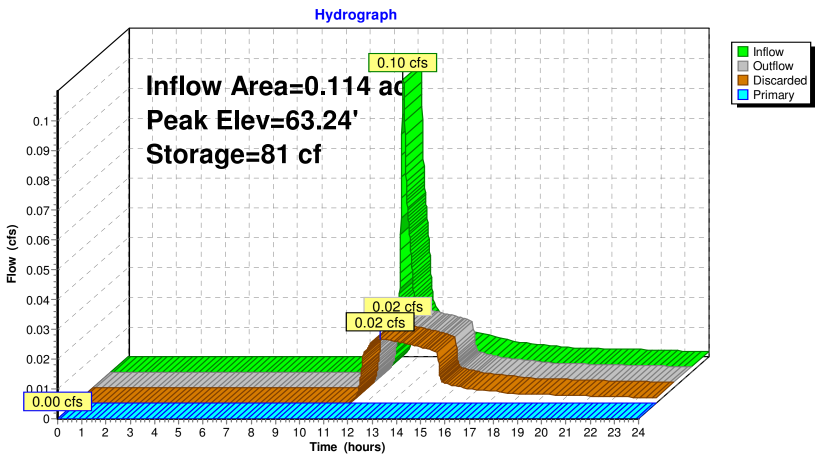
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	**2.410 in/hr Exfiltration over Horizontal area**

Discarded OutFlow Max=0.02 cfs @ 12.58 hrs HW=63.24' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

Inflow Area = 1.480 ac, 42.24% Impervious, Inflow Depth > 1.46" for 2-Year event
Inflow = 2.38 cfs @ 12.09 hrs, Volume= 0.179 af
Outflow = 0.08 cfs @ 11.28 hrs, Volume= 0.100 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.08 cfs @ 11.28 hrs, Volume= 0.100 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 62.02' @ 16.38 hrs Surf.Area= 3,486 sf Storage= 4,431 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,981 cf

Plug-Flow detention time= 293.3 min calculated for 0.100 af (55% of inflow)
Center-of-Mass det. time= 172.2 min (990.5 - 818.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,786 cf	**50.50'W x 69.03'L x 6.50'H Field A** 22,660 cf Overall - 8,195 cf Embedded = 14,465 cf x 40.0% Voids
#2A	61.00'	8,195 cf	**Cultec R-902HD** x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
		13,981 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	68.40'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 11.28 hrs HW=60.08' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=60.00' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

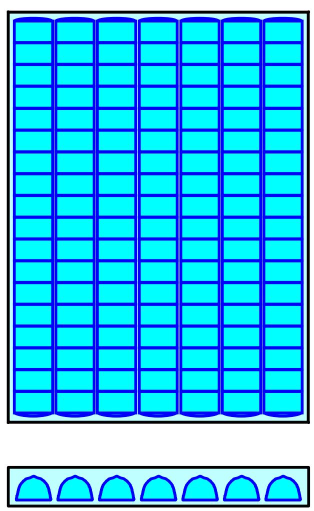
18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03' Base Length
7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width
12.0" Base + 48.0" Chamber Height + 18.0" Cover = 6.50' Field Height

126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.3 cf Chamber Storage

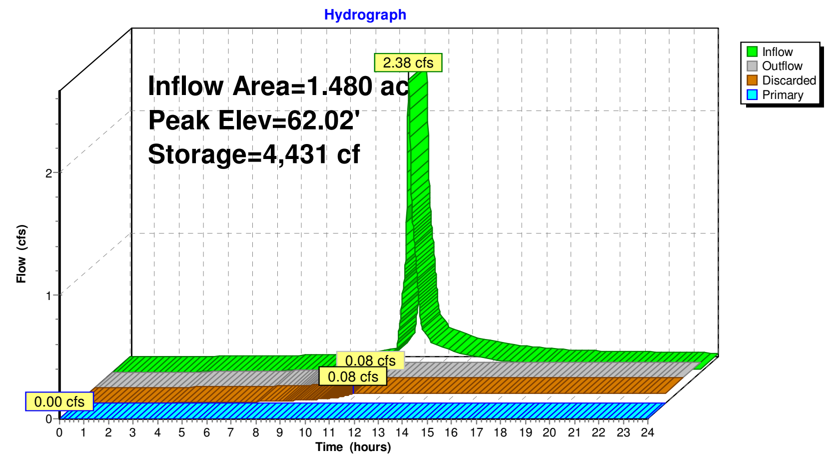
22,660.2 cf Field - 8,195.3 cf Chambers = 14,464.9 cf Stone x 40.0% Voids = 5,786.0 cf Stone Storage

Chamber Storage + Stone Storage = 13,981.2 cf = 0.321 af
Overall Storage Efficiency = 61.7%
Overall System Size = 69.03' x 50.50' x 6.50'

126 Chambers
839.3 cy Field
535.7 cy Stone



Pond UIS-1: UIS at Entrance



Summary for Pond UIS-2: UIS at North of Site

Inflow Area =	0.384 ac,100.00% Impervious,	Inflow Depth > 2.87"	for 2-Year event
Inflow =	1.16 cfs @ 12.08 hrs,	Volume=	0.092 af
Outflow =	0.23 cfs @ 11.72 hrs,	Volume=	0.092 af, Atten= 81%, Lag= 0.0 min
Discarded =	0.23 cfs @ 11.72 hrs,	Volume=	0.092 af
Primary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.00' @ 12.51 hrs Surf.Area= 1,176 sf Storage= 956 cf
Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 22.6 min calculated for 0.092 af (100% of inflow)
Center-of-Mass det. time= 22.3 min (778.8 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	**16.00'W x 73.50'L x 4.04'H Field A** 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	68.25'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.72 hrs HW=61.57' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.50' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

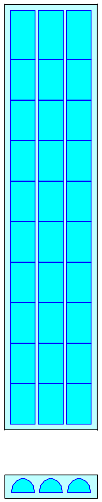
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

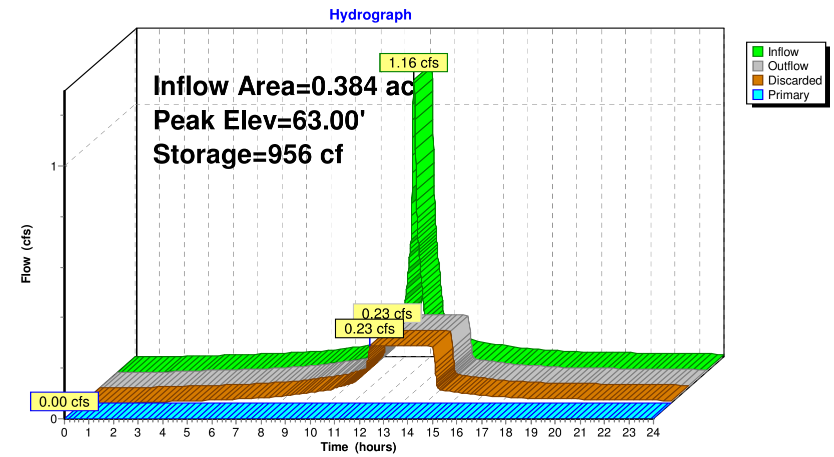
4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af
Overall Storage Efficiency = 60.2%
Overall System Size = 73.50' x 16.00' x 4.04'

30 Chambers
176.0 cy Field
116.8 cy Stone



Pond UIS-2: UIS at North of Site



Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.46' above defined flood level

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af
Outflow = 0.25 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 1%, Lag= 0.7 min
Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af
Primary = 0.25 cfs @ 12.10 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.67' @ 12.10 hrs Surf.Area= 103 sf Storage= 130 cf
Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 87.7 min calculated for 0.017 af (87% of inflow)
Center-of-Mass det. time= 29.7 min (786.3 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.40'	**6.0" Round Culvert** L= 30.0' Ke= 0.200
			Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=71.72' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=73.67' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.24 cfs @ 2.23 fps)

Pond UIS-3: UIS-3 - 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 2 rows

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

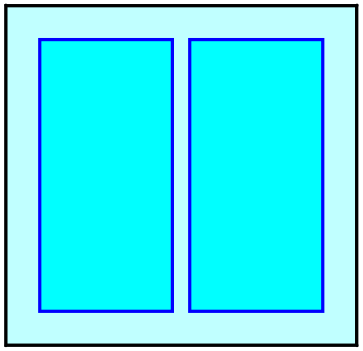
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

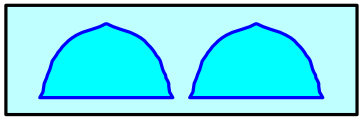
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

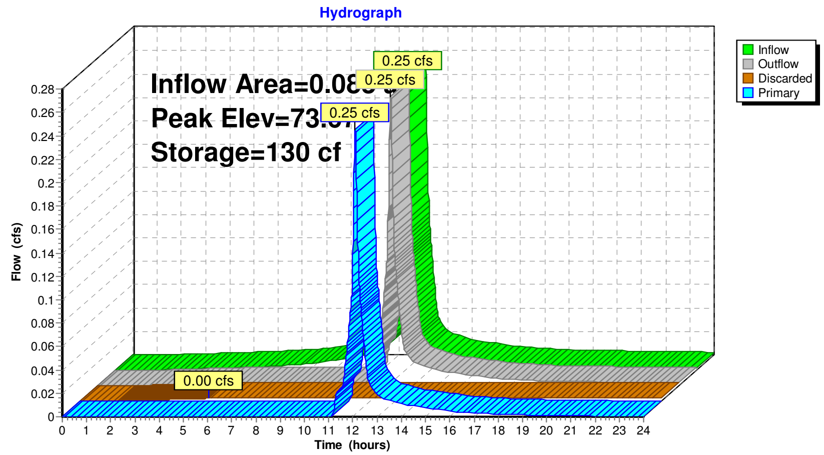
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-3: UIS-3



Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.35' above defined flood level

Inflow Area =	0.073 ac,100.00% Impervious,	Inflow Depth > 2.87"	for 2-Year event
Inflow =	0.22 cfs @ 12.08 hrs, Volume=	0.018 af	
Outflow =	0.22 cfs @ 12.10 hrs, Volume=	0.015 af, Atten= 2%, Lag= 1.1 min	
Discarded =	0.00 cfs @ 5.85 hrs, Volume=	0.004 af	
Primary =	0.21 cfs @ 12.10 hrs, Volume=	0.011 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.55' @ 12.10 hrs Surf.Area= 103 sf Storage= 134 cf
Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 94.4 min calculated for 0.015 af (86% of inflow)
Center-of-Mass det. time= 32.3 min (788.8 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.20'	**6.0" Round Culvert** L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.85 hrs HW=72.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.21 cfs @ 12.10 hrs HW=74.55' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.21 cfs @ 2.01 fps)

Pond UIS-4: UIS-4 - 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 2 rows

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

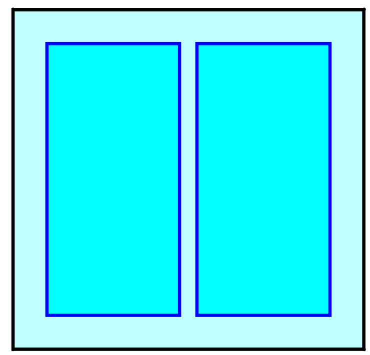
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

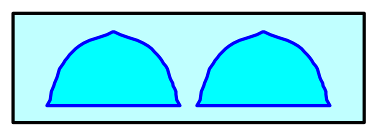
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

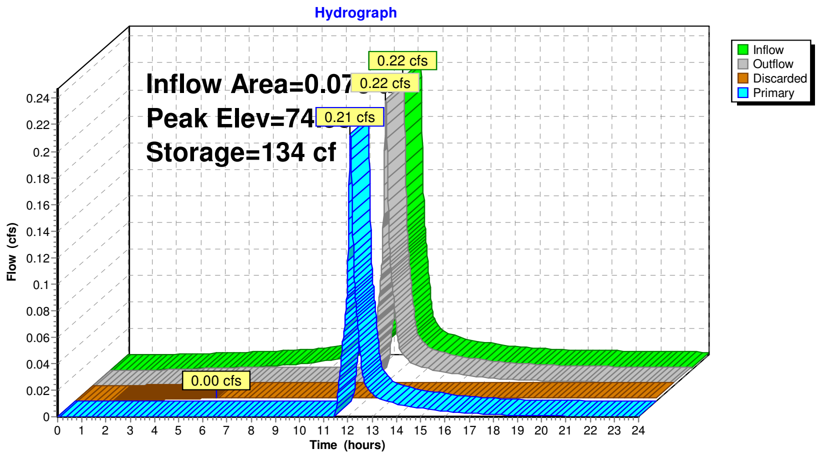
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-4: UIS-4



Summary for Pond UIS-5: UIS-5

Inflow Area =	0.083 ac,100.00% Impervious,	Inflow Depth > 2.87"	for 2-Year event
Inflow =	0.25 cfs @ 12.08 hrs, Volume=	0.020 af	
Outflow =	0.24 cfs @ 12.10 hrs, Volume=	0.017 af, Atten= 2%, Lag= 1.0 min	
Discarded =	0.00 cfs @ 5.30 hrs, Volume=	0.004 af	
Primary =	0.24 cfs @ 12.10 hrs, Volume=	0.013 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 75.17' @ 12.10 hrs Surf.Area= 103 sf Storage= 136 cf

Plug-Flow detention time= 88.8 min calculated for 0.017 af (87% of inflow)
Center-of-Mass det. time= 30.6 min (787.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.80'	**6.0" Round Culvert** L= 22.0' Ke= 1.000
			Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=73.12' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=75.17' (Free Discharge)
2=Culvert (Inlet Controls 0.24 cfs @ 1.55 fps)

Pond UIS-5: UIS-5 - 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 2 rows

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

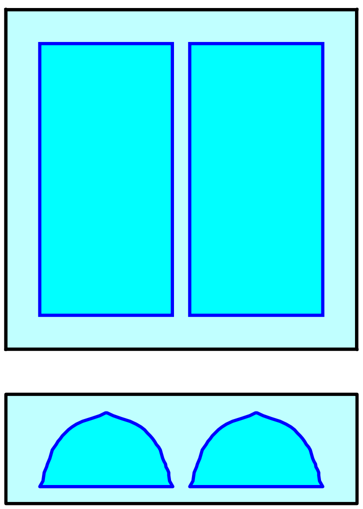
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

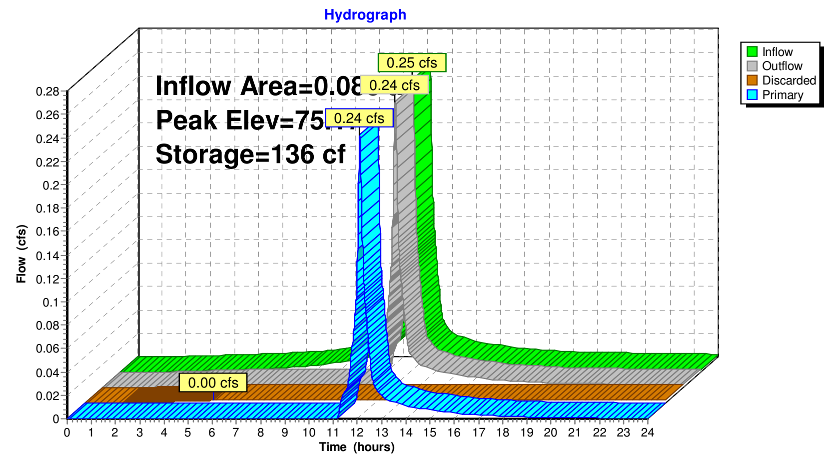
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-5: UIS-5



Summary for Pond UIS-6: UIS-6

Inflow Area =	0.089 ac,100.00% Impervious,	Inflow Depth > 2.87"	for 2-Year event	
Inflow =	0.27 cfs @	12.08 hrs, Volume=	0.021 af	
Outflow =	0.26 cfs @	12.10 hrs, Volume=	0.019 af,	Atten= 2%, Lag= 1.0 min
Discarded =	0.00 cfs @	5.03 hrs, Volume=	0.004 af	
Primary =	0.26 cfs @	12.10 hrs, Volume=	0.015 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.39' @ 12.10 hrs Surf.Area= 103 sf Storage= 137 cf

Plug-Flow detention time= 85.5 min calculated for 0.019 af (88% of inflow)
Center-of-Mass det. time= 30.0 min (786.5 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.00'	**6.0" Round Culvert** L= 106.0' Ke= 1.000 Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.03 hrs HW=72.32' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.26 cfs @ 12.10 hrs HW=74.39' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.26 cfs @ 1.59 fps)

Pond UIS-6: UIS-6 - 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 2 rows

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

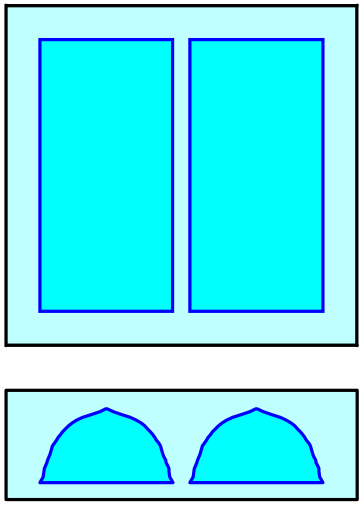
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

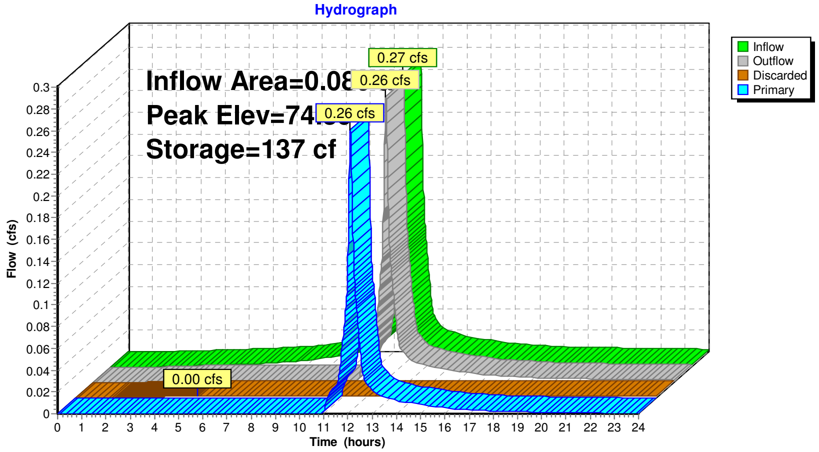
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-6: UIS-6



Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af
Outflow = 0.24 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 2%, Lag= 1.0 min
Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af
Primary = 0.24 cfs @ 12.10 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.87' @ 12.10 hrs Surf.Area= 103 sf Storage= 136 cf

Plug-Flow detention time= 88.8 min calculated for 0.017 af (87% of inflow)
Center-of-Mass det. time= 30.6 min (787.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.50'	**6.0" Round Culvert** L= 17.5' Ke= 1.000
			Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=71.82' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=73.87' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.24 cfs @ 1.55 fps)

Pond UIS-7: UIS-7 - 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 2 rows

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

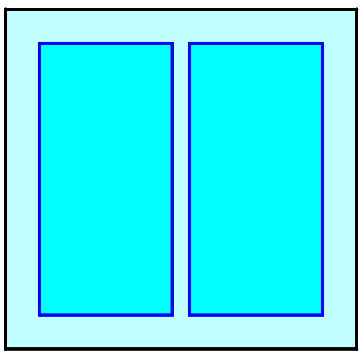
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

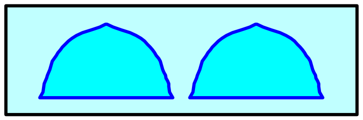
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

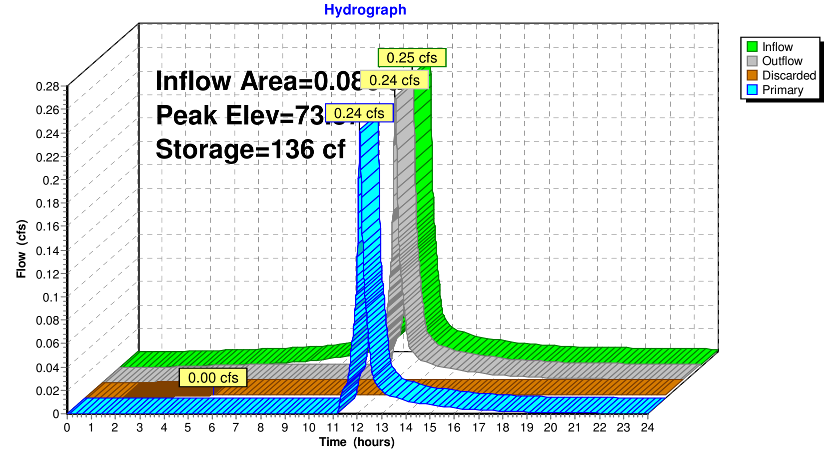
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-7: UIS-7



Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af
Outflow = 0.24 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 2%, Lag= 1.0 min
Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af
Primary = 0.24 cfs @ 12.10 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.17' @ 12.10 hrs Surf.Area= 103 sf Storage= 136 cf

Plug-Flow detention time= 88.8 min calculated for 0.017 af (87% of inflow)
Center-of-Mass det. time= 30.6 min (787.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.80'	**6.0" Round Culvert** L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=71.12' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=73.17' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.24 cfs @ 1.55 fps)

Pond UIS-8: UIS-8 - 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 2 rows

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

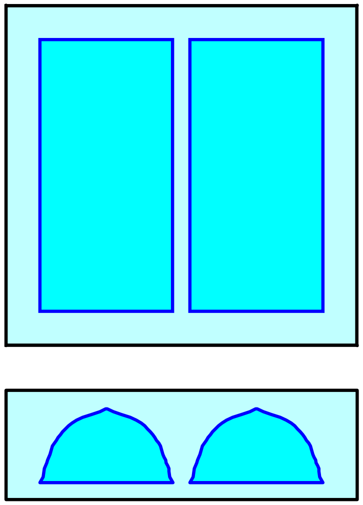
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

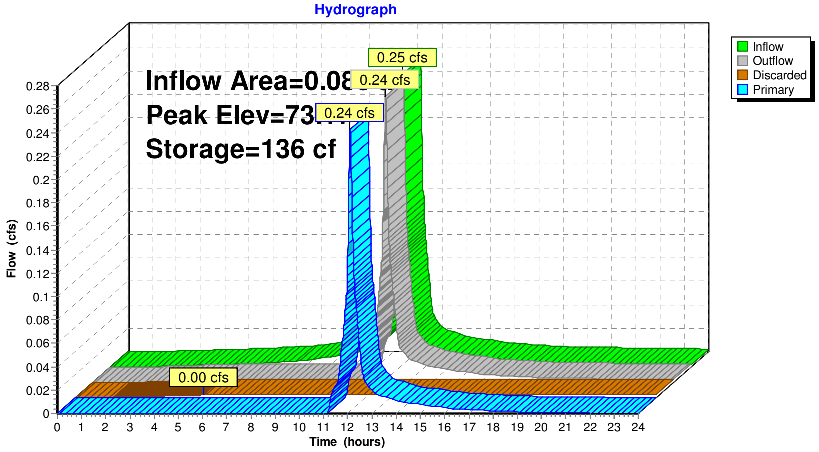
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-8: UIS-8



Summary for Pond UIS-9: UIS-9

Inflow Area = 0.089 ac,100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af
Outflow = 0.26 cfs @ 12.10 hrs, Volume= 0.020 af, Atten= 3%, Lag= 1.2 min
Discarded = 0.00 cfs @ 5.03 hrs, Volume= 0.004 af
Primary = 0.26 cfs @ 12.10 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 72.57' @ 12.10 hrs Surf.Area= 103 sf Storage= 81 cf

Plug-Flow detention time= 51.1 min calculated for 0.020 af (94% of inflow)
Center-of-Mass det. time= 19.6 min (776.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.18'	**6.0" Round Culvert** L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.03 hrs HW=71.31' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.26 cfs @ 12.10 hrs HW=72.57' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.26 cfs @ 1.59 fps)

Pond UIS-9: UIS-9 - 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 2 rows

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

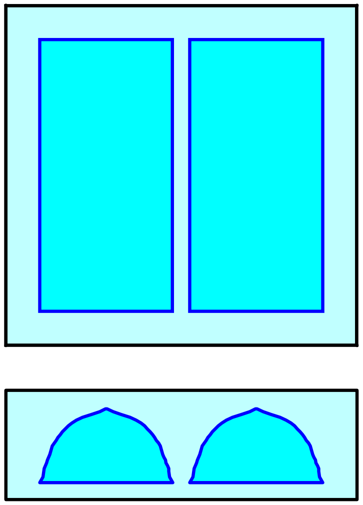
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

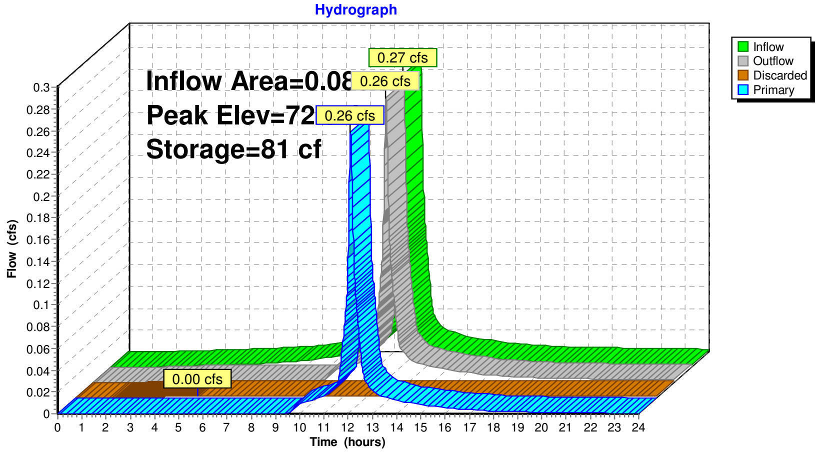
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-9: UIS-9



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Northern Grassed Area to Runoff Area=81,776 sf 1.57% Impervious Runoff Depth>0.19"
Tc=6.0 min UI Adjusted CN=42 Runoff=0.08 cfs 0.030 af

Subcatchment P-10: Area Around Isolated Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>2.05"
Tc=6.0 min UI Adjusted CN=75 Runoff=1.73 cfs 0.124 af

Subcatchment P-2: Existing Drive to Existing Runoff Area=22,978 sf 59.84% Impervious Runoff Depth>2.55"
Tc=6.0 min CN=81 Runoff=1.58 cfs 0.112 af

Subcatchment P-3: Area Around Isolated Runoff Area=27,549 sf 12.75% Impervious Runoff Depth>0.50"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.18 cfs 0.026 af

Subcatchment P-3A: Gravel Road to Detention Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>1.74"
Tc=6.0 min CN=71 Runoff=0.23 cfs 0.017 af

Subcatchment P-4: Sloped Entrance Drive - Runoff Area=21,239 sf 62.65% Impervious Runoff Depth>2.46"
Tc=6.0 min CN=80 Runoff=1.41 cfs 0.100 af

Subcatchment P-5: Driveway - Units 25-11 Runoff Area=39,272 sf 52.13% Impervious Runoff Depth>1.97"
Tc=6.0 min CN=74 Runoff=2.06 cfs 0.148 af

Subcatchment P-6: Pavement Units 12-19 Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>2.29"
Tc=6.0 min CN=78 Runoff=1.18 cfs 0.084 af

Subcatchment P-7: Driveway - Units 20-24 Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>1.74"
Tc=6.0 min CN=71 Runoff=0.72 cfs 0.052 af

Subcatchment P-8: Surface Infiltration Pond Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.23"
Tc=6.0 min CN=43 Runoff=0.02 cfs 0.007 af

Subcatchment P-9: Woods/Grass Northwest Runoff Area=102,567 sf 2.25% Impervious Runoff Depth>0.05"
Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.01 cfs 0.009 af

Subcatchment R-1: Roof - Units 1&2 (C&B) Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af

Subcatchment R-10: Roof - Units 19&20 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-11: Roof - Units 21&22 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment R-12: Roof - Units 23&24 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-13: Roof - Units 25&26 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-14: Roof Units 27&28 - A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment R-15: Roof Units 29&30 - (B & C Runoff Area=1,705 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.17 cfs 0.014 af

Subcatchment R-16: Front Units 29&30 Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.15 cfs 0.012 af

Subcatchment R-17: Mailbox Structure Rood Runoff Area=120 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.01 cfs 0.001 af

Subcatchment R-2: Roof Units 3&4 - (B & C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af

Subcatchment R-3: Roof Units 5&6 - A&B Units Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment R-4: Roof - Units 7&8 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment R-5: Roof - Units 9&10 - (B&C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af

Subcatchment R-6: Roof - Units 11&12 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment R-7: Roof - Units 13&14 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-8: Roof - Units 15&16 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment R-9: Roof - Units 17&18 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Reach SP-1: Wetlands South of Driveway Inflow=0.18 cfs 0.069 af
Outflow=0.18 cfs 0.069 af

Reach SP-2: Large Wetland Area East Inflow=0.21 cfs 0.099 af
Outflow=0.21 cfs 0.099 af

Reach SP-3: Large Wetland Area West Inflow=0.32 cfs 0.152 af
Outflow=0.32 cfs 0.152 af

Pond 3P: 12 Inch Culvert Peak Elev=56.77' Inflow=0.18 cfs 0.069 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=0.18 cfs 0.069 af

Pond D-1: Surface Infiltration Pond Peak Elev=70.27' Storage=13,673 cf Inflow=6.42 cfs 0.451 af
Discarded=0.11 cfs 0.118 af Primary=0.16 cfs 0.044 af Outflow=0.27 cfs 0.162 af

Pond D-2: Existing Detention Basin Peak Elev=58.27' Storage=3,319 cf Inflow=1.58 cfs 0.112 af
Outflow=0.08 cfs 0.043 af

Pond D-3: Detention Pond by Access Road Peak Elev=63.62' Storage=253 cf Inflow=0.23 cfs 0.017 af
Discarded=0.03 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.017 af

Pond UIS-1: UIS at Entrance Peak Elev=63.84' Storage=9,451 cf Inflow=4.31 cfs 0.318 af
Discarded=0.08 cfs 0.109 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.109 af

Pond UIS-2: UIS at North of Site Peak Elev=63.82' Storage=1,729 cf Inflow=1.69 cfs 0.136 af
Discarded=0.23 cfs 0.136 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.136 af

Pond UIS-3: UIS-3 Peak Elev=73.74' Storage=135 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.36 cfs 0.023 af Outflow=0.36 cfs 0.027 af

Pond UIS-4: UIS-4 Peak Elev=74.65' Storage=141 cf Inflow=0.32 cfs 0.026 af
Discarded=0.00 cfs 0.004 af Primary=0.31 cfs 0.019 af Outflow=0.32 cfs 0.023 af

Pond UIS-5: UIS-5 Peak Elev=75.29' Storage=144 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.35 cfs 0.023 af Outflow=0.35 cfs 0.027 af

Pond UIS-6: UIS-6 Peak Elev=74.53' Storage=146 cf Inflow=0.39 cfs 0.032 af
Discarded=0.00 cfs 0.004 af Primary=0.38 cfs 0.025 af Outflow=0.38 cfs 0.029 af

Pond UIS-7: UIS-7 Peak Elev=73.99' Storage=144 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.35 cfs 0.023 af Outflow=0.35 cfs 0.027 af

Pond UIS-8: UIS-8 Peak Elev=73.29' Storage=144 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.35 cfs 0.023 af Outflow=0.35 cfs 0.027 af

Pond UIS-9: UIS-9 Peak Elev=72.71' Storage=91 cf Inflow=0.39 cfs 0.032 af
Discarded=0.00 cfs 0.004 af Primary=0.37 cfs 0.026 af Outflow=0.38 cfs 0.031 af

Total Runoff Area = 10.007 ac Runoff Volume = 1.147 af Average Runoff Depth = 1.38"
69.75% Pervious = 6.980 ac 30.25% Impervious = 3.027 ac

Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

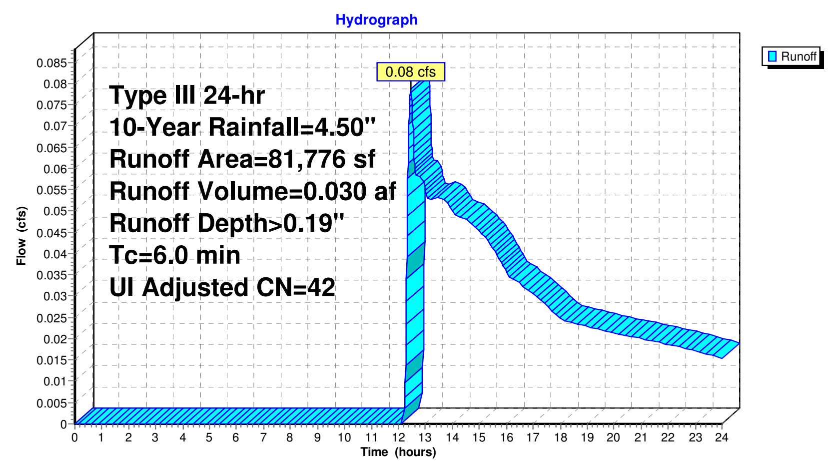
Runoff = 0.08 cfs @ 12.46 hrs, Volume= 0.030 af, Depth> 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
36,287	30		Woods, Good, HSG A
10,782	70		Woods, Good, HSG C
9,419	55		Woods, Good, HSG B
22,149	39		>75% Grass cover, Good, HSG A
1,287	98		Unconnected pavement, HSG A
1,852	72		Dirt roads, HSG A
81,776	43	42	Weighted Average, UI Adjusted
80,489			98.43% Pervious Area
1,287			1.57% Impervious Area
1,287			100.00% Unconnected

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

Subcatchment P-1: Northern Grassed Area to Wetlands



Summary for Subcatchment P-10: Area Around Isolated Wetland

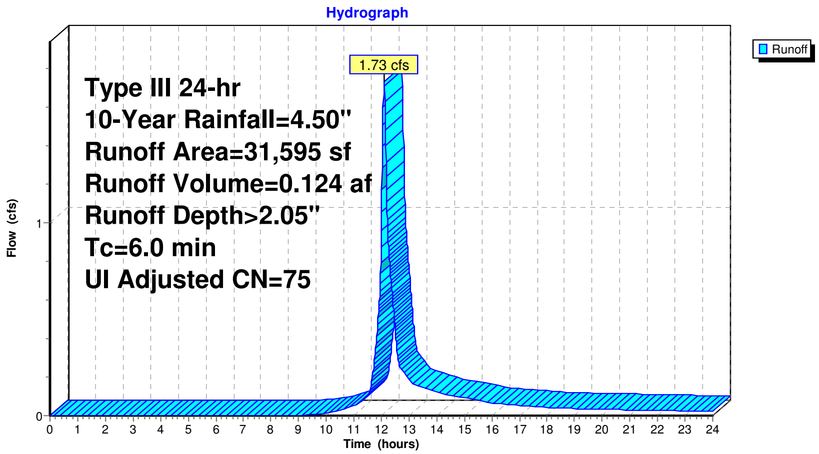
Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.124 af, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

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

Subcatchment P-10: Area Around Isolated Wetland



Summary for Subcatchment P-2: Existing Drive to Existing Basin

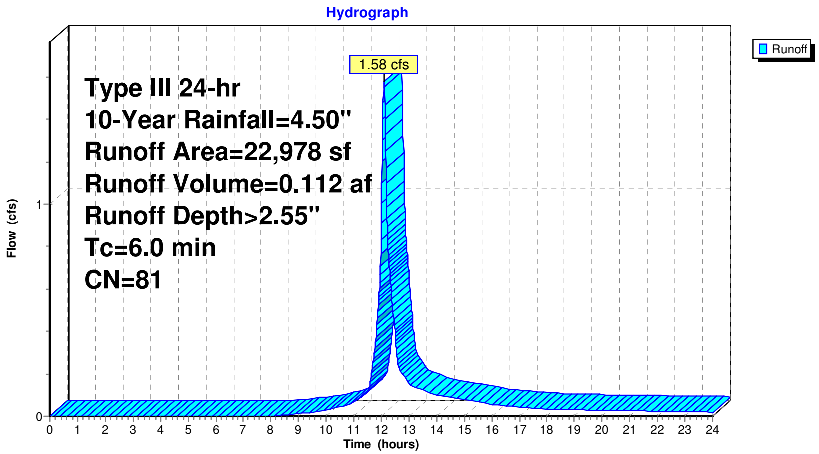
Runoff = 1.58 cfs @ 12.09 hrs, Volume= 0.112 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
6,902	98	Unconnected pavement, HSG A
1,353	76	Gravel roads, HSG A
4,824	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
3,632	98	Unconnected pavement, HSG B
3,217	98	Unconnected pavement, HSG C
22,978	81	Weighted Average
9,227		40.16% Pervious Area
13,751		59.84% Impervious Area
13,751		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6.0 TC**

Subcatchment P-2: Existing Drive to Existing Basin



Summary for Subcatchment P-3: Area Around Isolated Wetland

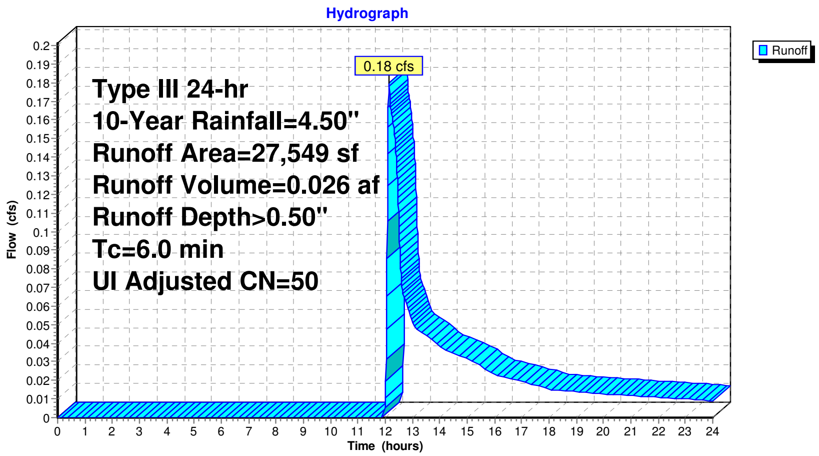
Runoff = 0.18 cfs @ 12.14 hrs, Volume= 0.026 af, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
3,512	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,549	53	50	Weighted Average, UI Adjusted
24,037			87.25% Pervious Area
3,512			12.75% Impervious Area
3,512			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

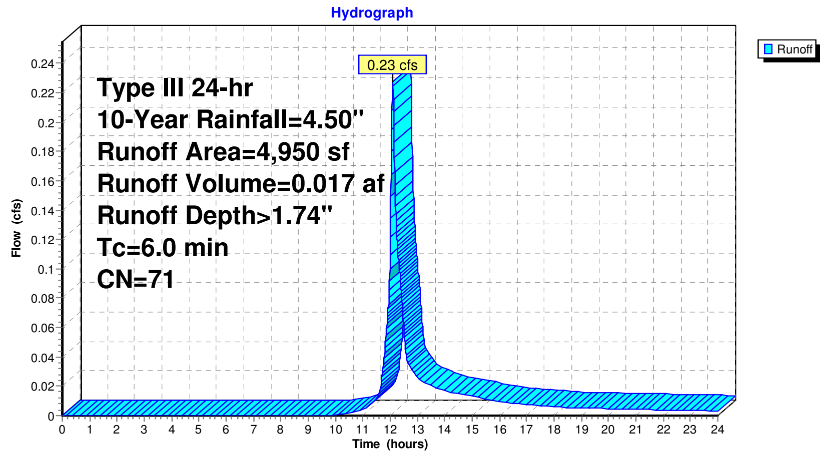
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 0.017 af, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

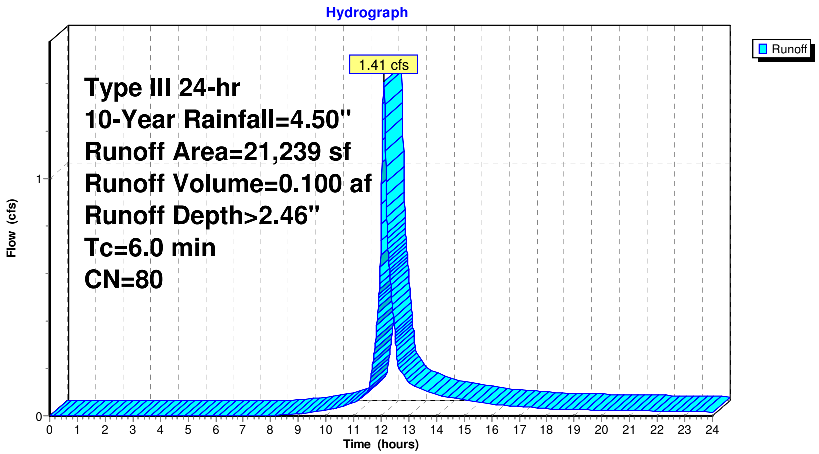
Runoff = 1.41 cfs @ 12.09 hrs, Volume= 0.100 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
13,306	98	Paved parking, HSG A
5,234	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,239	80	Weighted Average
7,933		37.35% Pervious Area
13,306		62.65% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

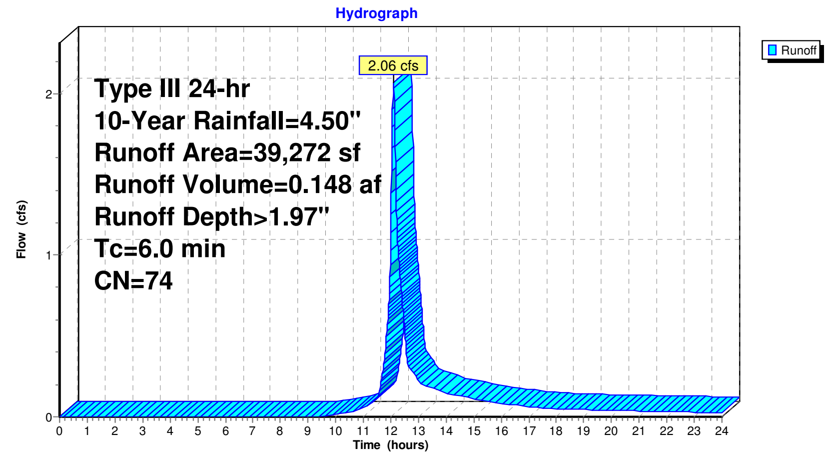
Runoff = 2.06 cfs @ 12.09 hrs, Volume= 0.148 af, Depth> 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
19,875	98	Paved parking, HSG A
14,088	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
596	98	Unconnected pavement, HSG C
39,272	74	Weighted Average
18,801		47.87% Pervious Area
20,471		52.13% Impervious Area
596		2.91% Unconnected

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

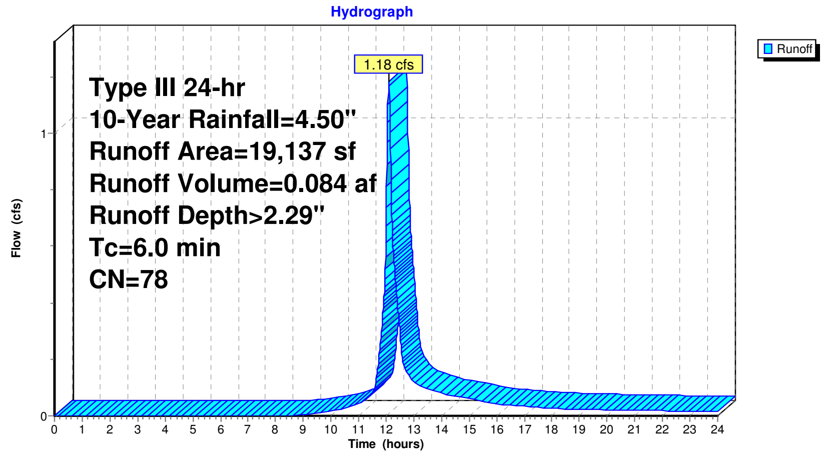
Runoff = 1.18 cfs @ 12.09 hrs, Volume= 0.084 af, Depth> 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

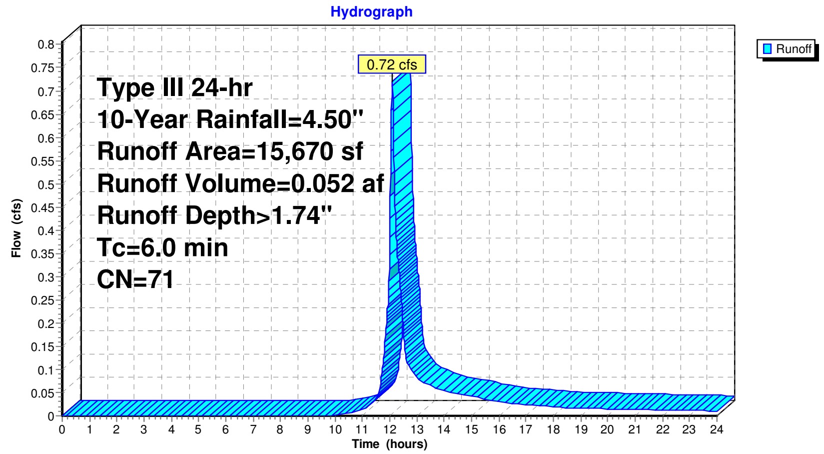
Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Summary for Subcatchment P-8: Surface Infiltration Pond Area

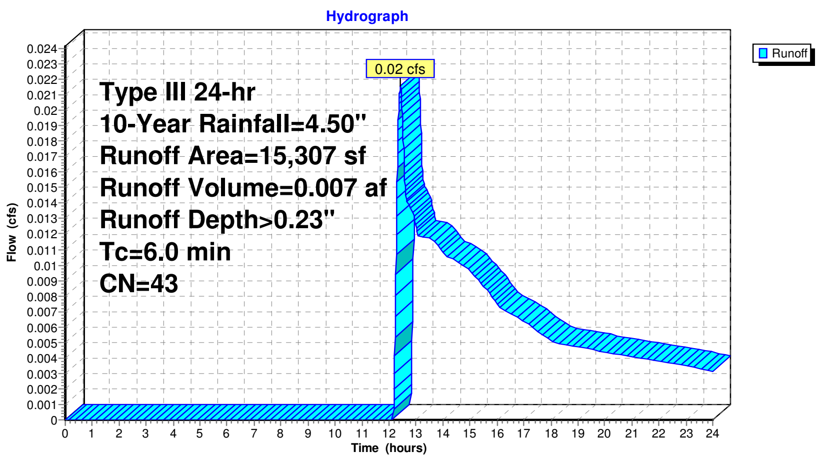
Runoff = 0.02 cfs @ 12.42 hrs, Volume= 0.007 af, Depth> 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

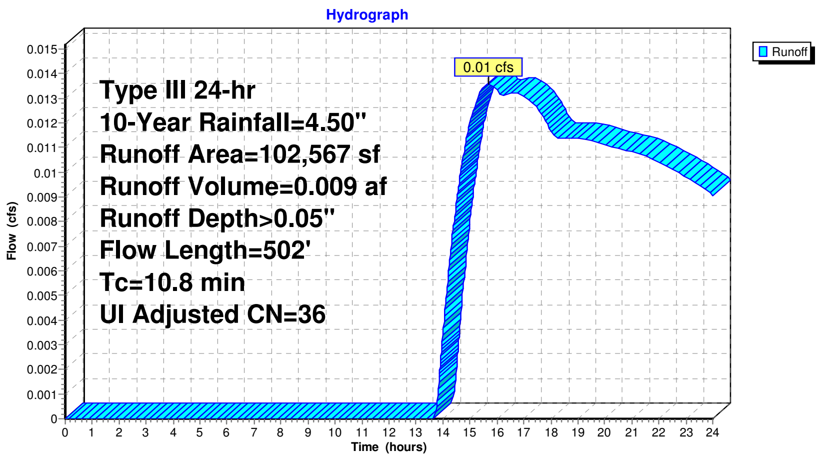
Runoff = 0.01 cfs @ 15.71 hrs, Volume= 0.009 af, Depth> 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.8	502	Total			

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands



Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

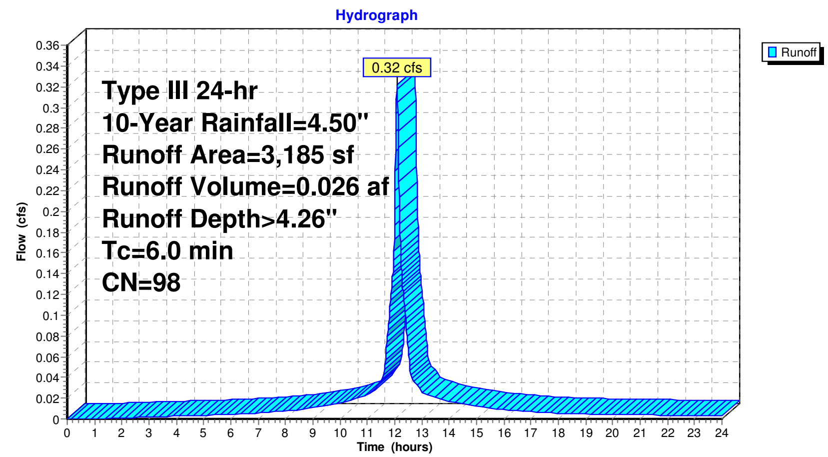
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

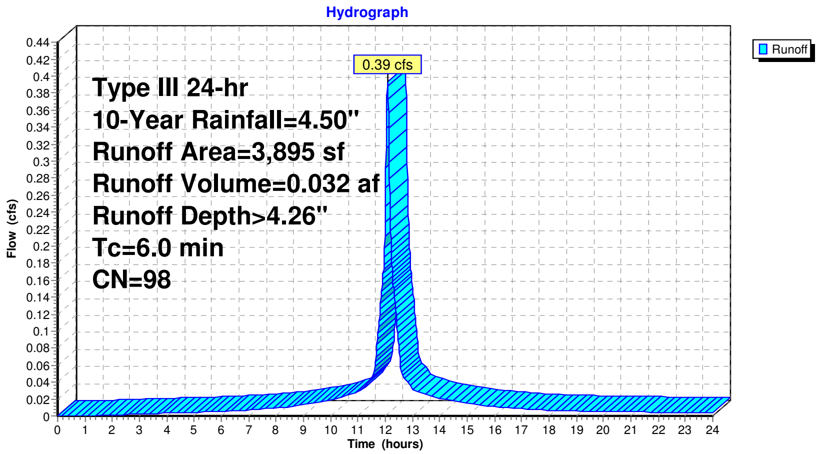
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

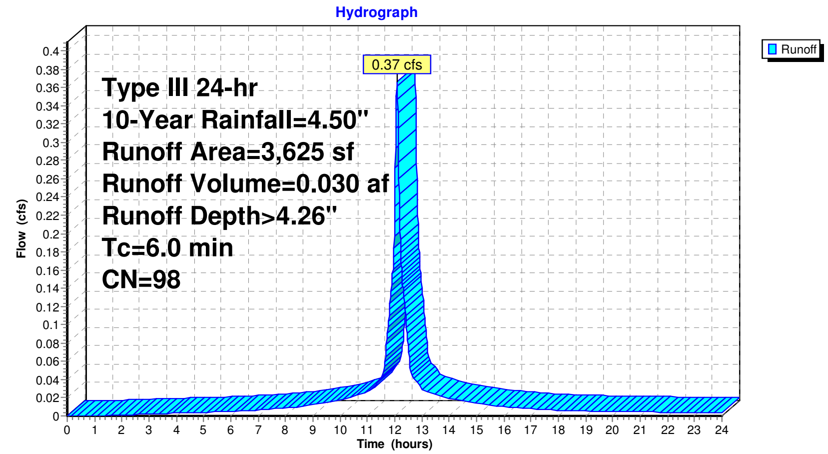
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

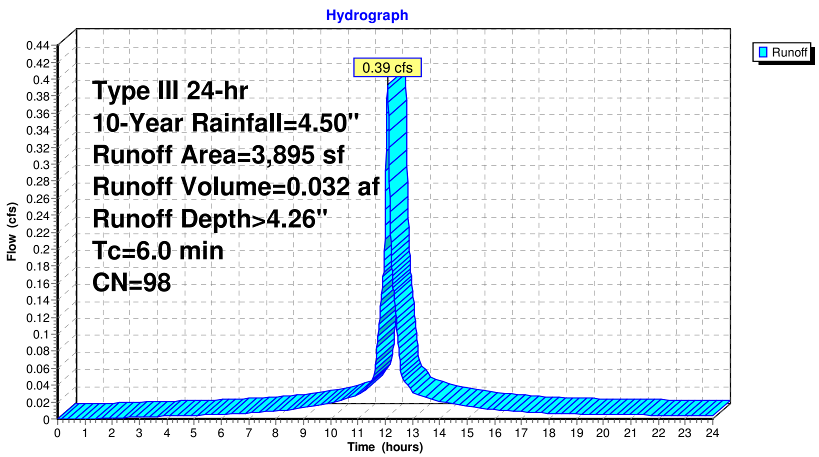
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)



Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

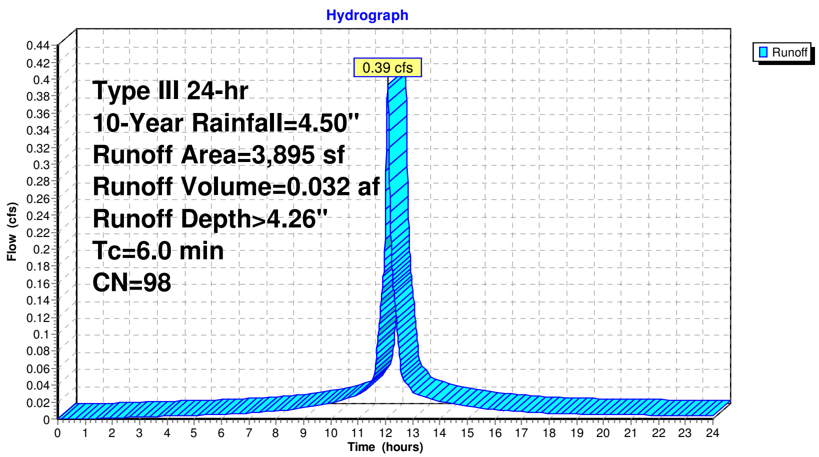
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

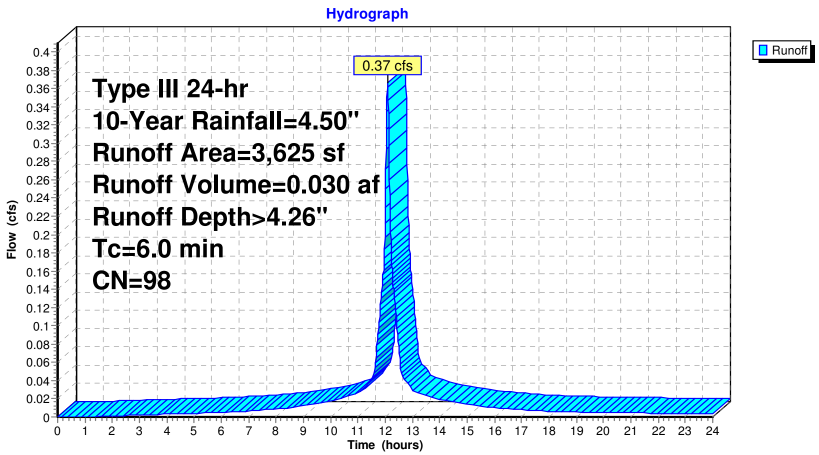
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

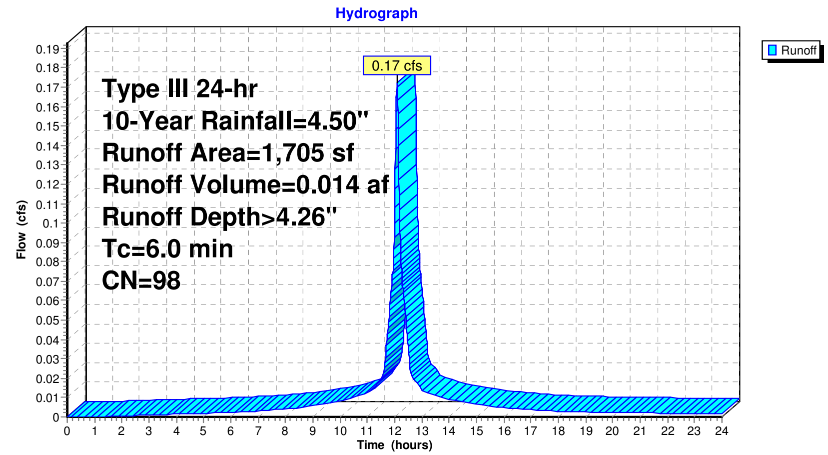
Runoff = 0.17 cfs @ 12.08 hrs, Volume= 0.014 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,705	98	Unconnected roofs, HSG A
1,705		100.00% Impervious Area
1,705		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

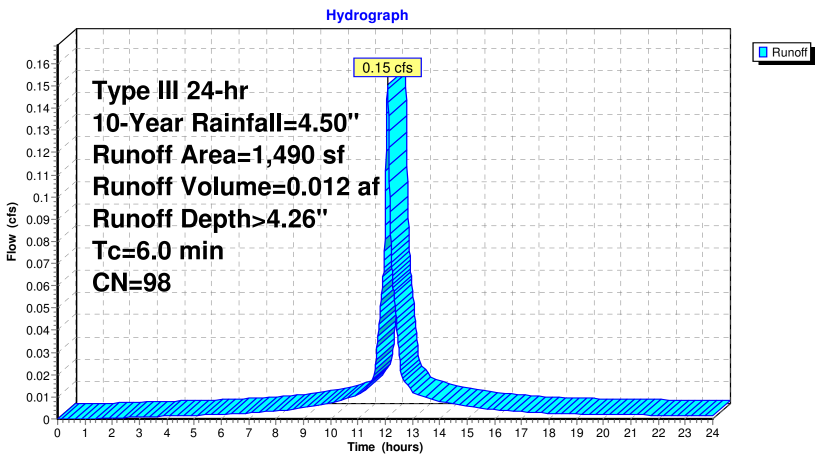
Runoff = 0.15 cfs @ 12.08 hrs, Volume= 0.012 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

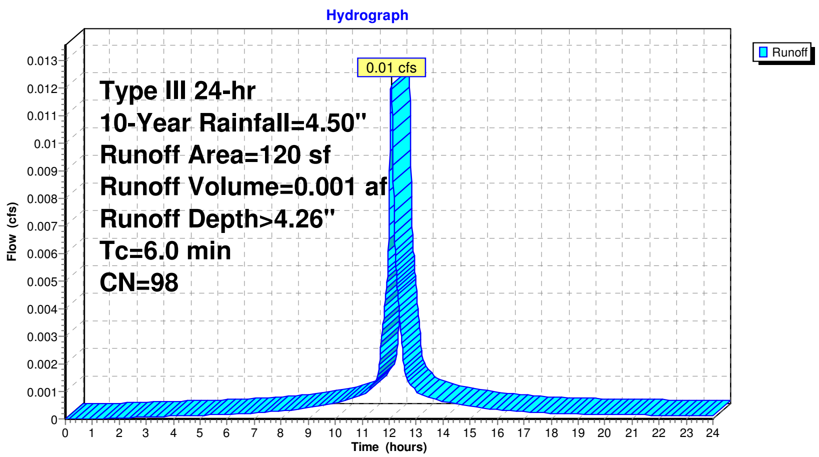
Runoff = 0.01 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

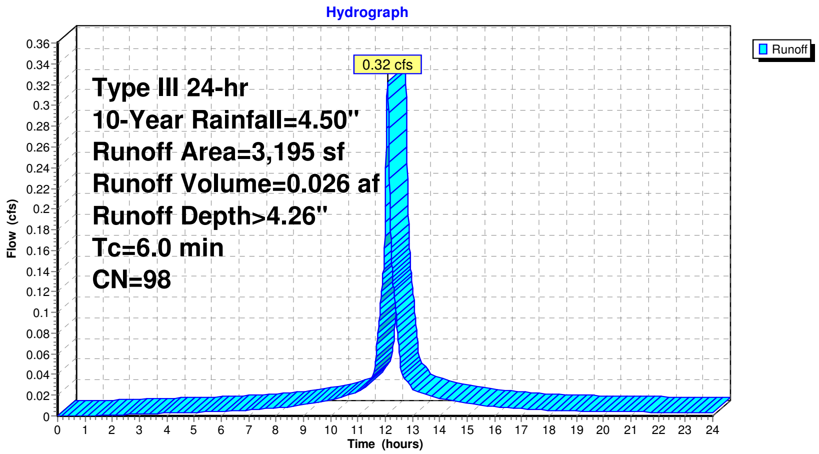
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

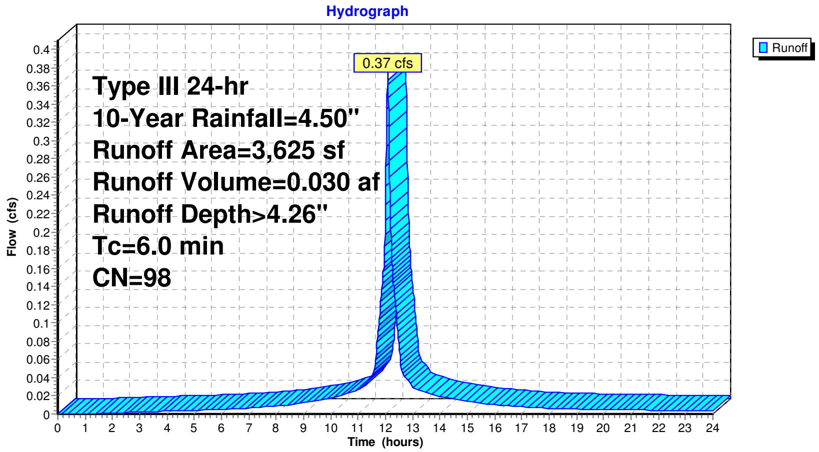
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

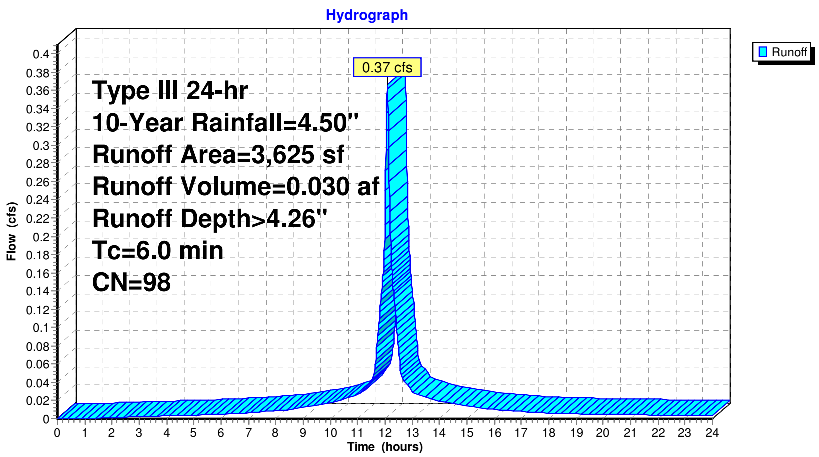
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

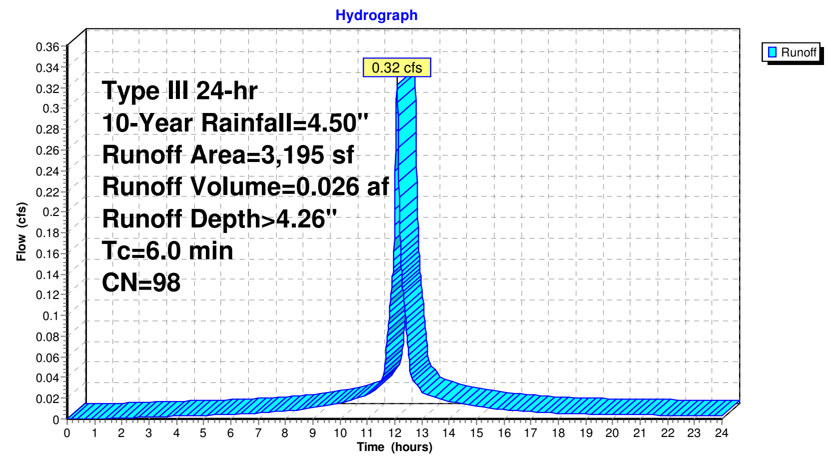
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

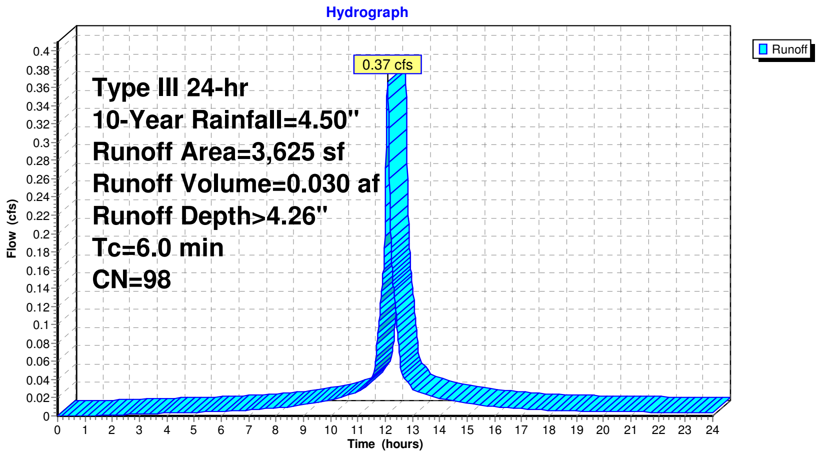
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

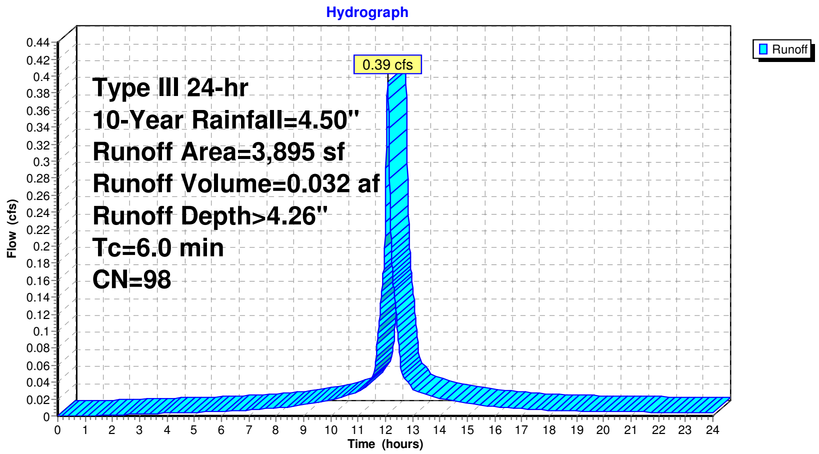
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

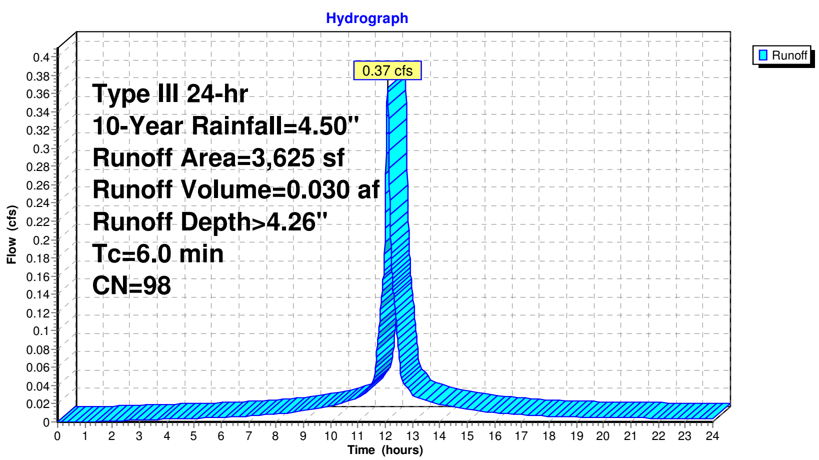
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

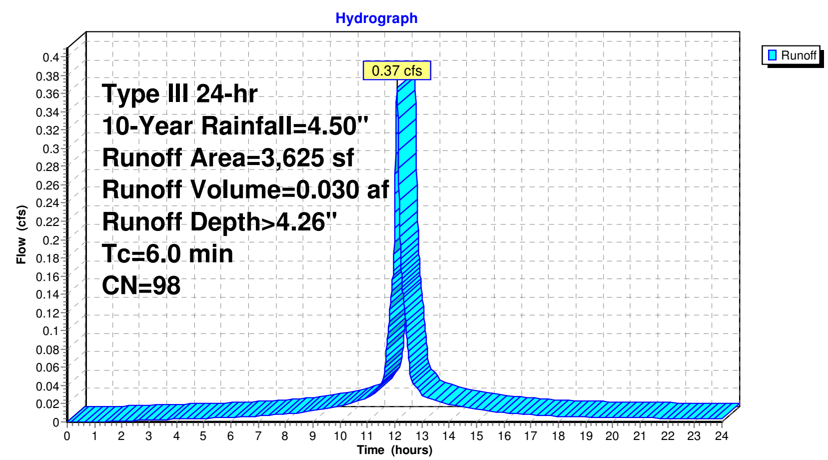
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)



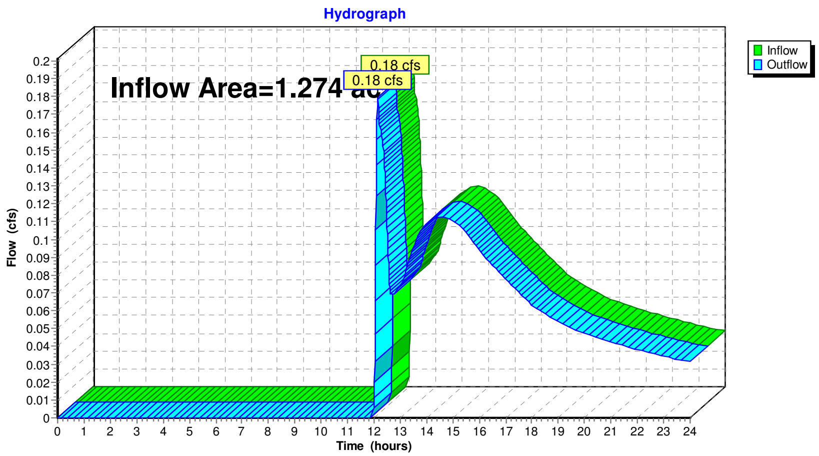
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 0.65" for 10-Year event
Inflow = 0.18 cfs @ 12.14 hrs, Volume= 0.069 af
Outflow = 0.18 cfs @ 12.14 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



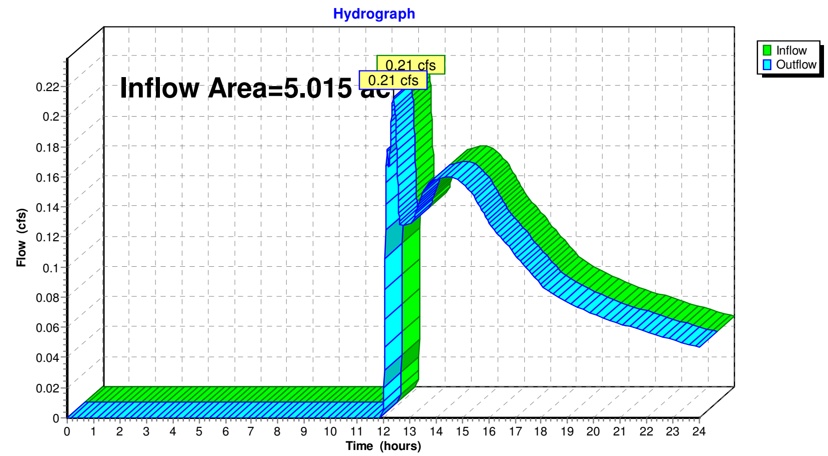
Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.015 ac, 29.33% Impervious, Inflow Depth > 0.24" for 10-Year event
Inflow = 0.21 cfs @ 12.39 hrs, Volume= 0.099 af
Outflow = 0.21 cfs @ 12.39 hrs, Volume= 0.099 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Large Wetland Area East



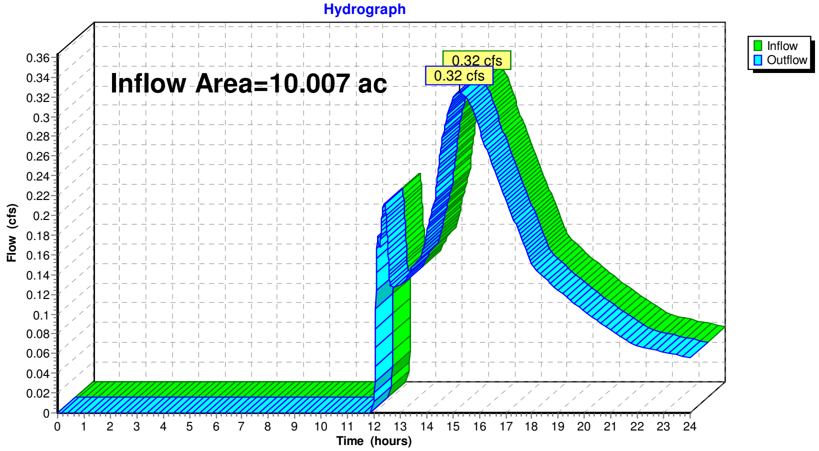
Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.007 ac, 30.25% Impervious, Inflow Depth > 0.18" for 10-Year event
Inflow = 0.32 cfs @ 15.26 hrs, Volume= 0.152 af
Outflow = 0.32 cfs @ 15.26 hrs, Volume= 0.152 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Large Wetland Area West



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 56.77' (Flood elevation advised)

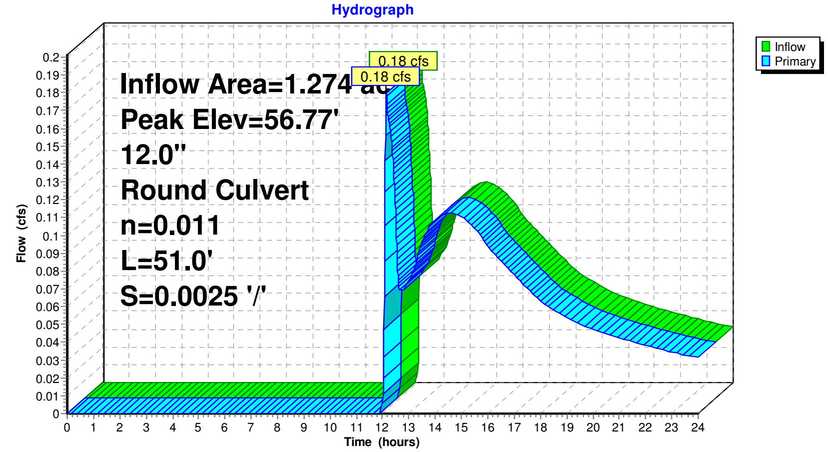
Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 0.65" for 10-Year event
Inflow = 0.18 cfs @ 12.14 hrs, Volume= 0.069 af
Outflow = 0.18 cfs @ 12.14 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min
Primary = 0.18 cfs @ 12.14 hrs, Volume= 0.069 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.77' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round RCP_Round 12"** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.18 cfs @ 12.14 hrs HW=56.77' (Free Discharge)
↑1=RCP_Round 12" (Barrel Controls 0.18 cfs @ 1.69 fps)

Pond 3P: 12 Inch Culvert



Summary for Pond D-1: Surface Infiltration Pond

[58] Hint: Peaked 0.27' above defined flood level

Inflow Area = 2.637 ac, 56.99% Impervious, Inflow Depth > 2.05" for 10-Year event
Inflow = 6.42 cfs @ 12.10 hrs, Volume= 0.451 af
Outflow = 0.27 cfs @ 15.40 hrs, Volume= 0.162 af, Atten= 96%, Lag= 198.5 min
Discarded = 0.11 cfs @ 15.40 hrs, Volume= 0.118 af
Primary = 0.16 cfs @ 15.40 hrs, Volume= 0.044 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 70.27' @ 15.40 hrs Surf.Area= 4,802 sf Storage= 13,673 cf
Flood Elev= 70.00' Surf.Area= 4,583 sf Storage= 12,420 cf

Plug-Flow detention time= 331.7 min calculated for 0.162 af (36% of inflow)
Center-of-Mass det. time= 215.1 min (1,034.1 - 819.1)

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

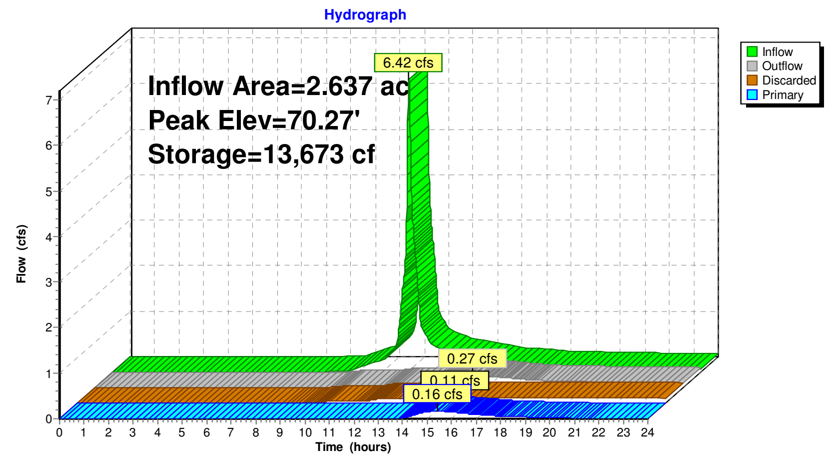
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	70.10'	**18.0" Round Culvert** L= 234.0' Ke= 0.200 Inlet / Outlet Invert= 70.10' / 67.00' S= 0.0132 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.11 cfs @ 15.40 hrs HW=70.27' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.15 cfs @ 15.40 hrs HW=70.27' (Free Discharge)
↑**2=Culvert** (Barrel Controls 0.15 cfs @ 2.10 fps)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

[58] Hint: Peaked 0.19' above defined flood level

Inflow Area = 0.528 ac, 59.84% Impervious, Inflow Depth > 2.55" for 10-Year event
Inflow = 1.58 cfs @ 12.09 hrs, Volume= 0.112 af
Outflow = 0.08 cfs @ 14.89 hrs, Volume= 0.043 af, Atten= 95%, Lag= 168.0 min
Primary = 0.08 cfs @ 14.89 hrs, Volume= 0.043 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.27' @ 14.89 hrs Surf.Area= 3,090 sf Storage= 3,319 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

Plug-Flow detention time= 343.1 min calculated for 0.043 af (38% of inflow)
Center-of-Mass det. time= 220.0 min (1,042.9 - 822.9)

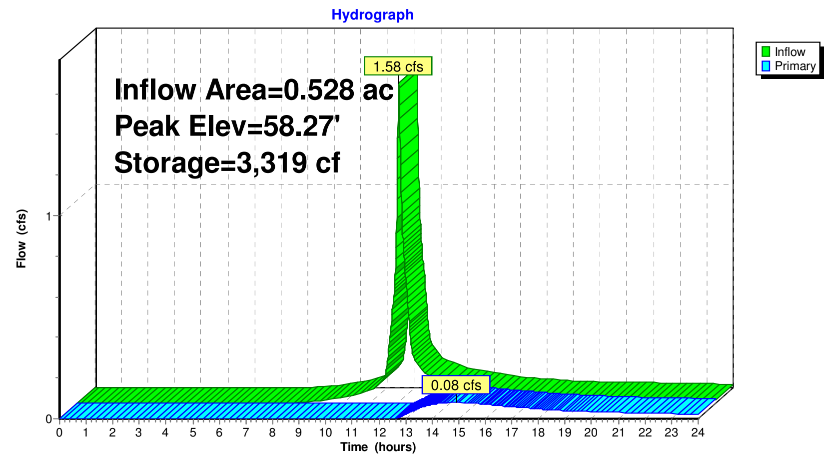
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.08 cfs @ 14.89 hrs HW=58.27' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.08 cfs @ 1.50 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 1.74" for 10-Year event
Inflow = 0.23 cfs @ 12.09 hrs, Volume= 0.017 af
Outflow = 0.03 cfs @ 12.89 hrs, Volume= 0.017 af, Atten= 87%, Lag= 48.1 min
Discarded = 0.03 cfs @ 12.89 hrs, Volume= 0.017 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.62' @ 12.89 hrs Surf.Area= 517 sf Storage= 253 cf

Plug-Flow detention time= 83.5 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 83.0 min (933.0 - 850.0)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

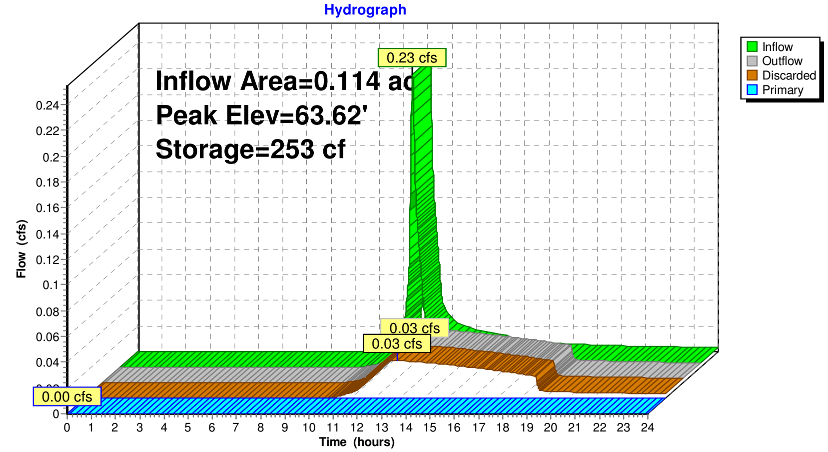
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	**2.410 in/hr Exfiltration over Horizontal area**

Discarded OutFlow Max=0.03 cfs @ 12.89 hrs HW=63.62' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

Inflow Area =	1.480 ac, 42.24% Impervious, Inflow Depth > 2.58" for 10-Year event		
Inflow =	4.31 cfs @ 12.09 hrs, Volume=	0.318 af	
Outflow =	0.08 cfs @ 10.15 hrs, Volume=	0.109 af,	Atten= 98%, Lag= 0.0 min
Discarded =	0.08 cfs @ 10.15 hrs, Volume=	0.109 af	
Primary =	0.00 cfs @ 0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.84' @ 18.94 hrs Surf.Area= 3,486 sf Storage= 9,451 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,981 cf

Plug-Flow detention time= 284.6 min calculated for 0.109 af (34% of inflow)
Center-of-Mass det. time= 141.9 min (950.2 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,786 cf	**50.50'W x 69.03'L x 6.50'H Field A** 22,660 cf Overall - 8,195 cf Embedded = 14,465 cf x 40.0% Voids
#2A	61.00'	8,195 cf	**Cultec R-902HD** x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
		13,981 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	68.40'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 10.15 hrs HW=60.08' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=60.00' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

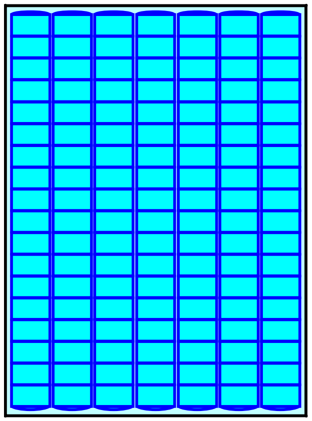
18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03' Base Length
7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width
12.0" Base + 48.0" Chamber Height + 18.0" Cover = 6.50' Field Height

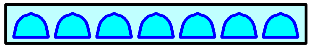
126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.3 cf Chamber Storage

22,660.2 cf Field - 8,195.3 cf Chambers = 14,464.9 cf Stone x 40.0% Voids = 5,786.0 cf Stone Storage

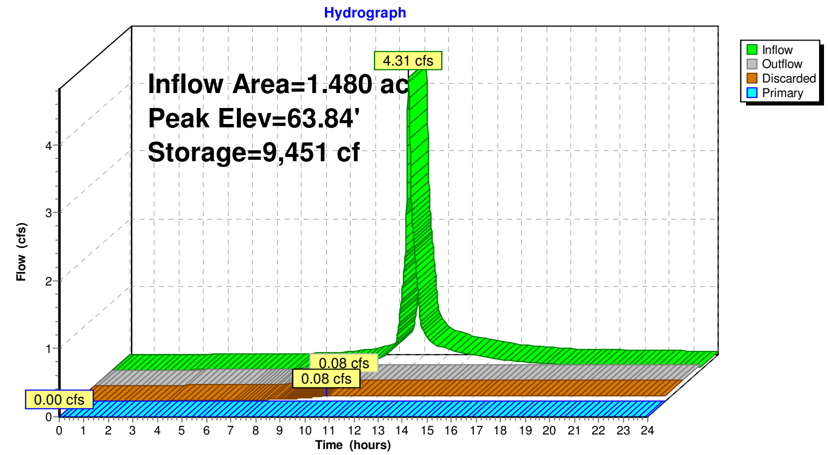
Chamber Storage + Stone Storage = 13,981.2 cf = 0.321 af
Overall Storage Efficiency = 61.7%
Overall System Size = 69.03' x 50.50' x 6.50'

126 Chambers
839.3 cy Field
535.7 cy Stone





Pond UIS-1: UIS at Entrance



Summary for Pond UIS-2: UIS at North of Site

Inflow Area = 0.384 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 1.69 cfs @ 12.08 hrs, Volume= 0.136 af
Outflow = 0.23 cfs @ 11.63 hrs, Volume= 0.136 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.23 cfs @ 11.63 hrs, Volume= 0.136 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.82' @ 12.60 hrs Surf.Area= 1,176 sf Storage= 1,729 cf
Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 45.8 min calculated for 0.136 af (100% of inflow)
Center-of-Mass det. time= 45.6 min (794.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	**16.00'W x 73.50'L x 4.04'H Field A** 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	68.25'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.63 hrs HW=61.57' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.50' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

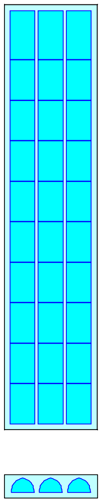
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

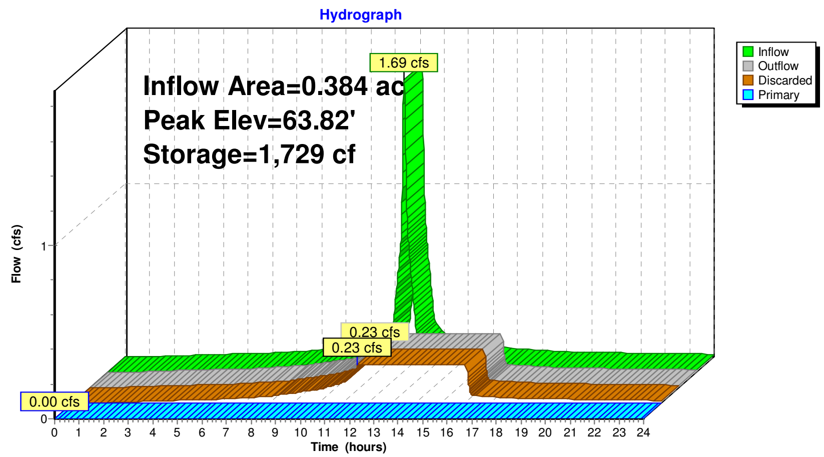
4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af
Overall Storage Efficiency = 60.2%
Overall System Size = 73.50' x 16.00' x 4.04'

30 Chambers
176.0 cy Field
116.8 cy Stone



Pond UIS-2: UIS at North of Site



Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.53' above defined flood level

Inflow Area =	0.083 ac,100.00% Impervious,	Inflow Depth > 4.26"	for 10-Year event	
Inflow =	0.37 cfs @	12.08 hrs, Volume=	0.030 af	
Outflow =	0.36 cfs @	12.09 hrs, Volume=	0.027 af,	Atten= 1%, Lag= 0.7 min
Discarded =	0.00 cfs @	3.34 hrs, Volume=	0.004 af	
Primary =	0.36 cfs @	12.09 hrs, Volume=	0.023 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.74' @ 12.09 hrs Surf.Area= 103 sf Storage= 135 cf
Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 72.9 min calculated for 0.027 af (91% of inflow)
Center-of-Mass det. time= 28.0 min (777.3 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.40'	**6.0" Round Culvert** L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=71.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.36 cfs @ 12.09 hrs HW=73.74' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.36 cfs @ 2.50 fps)

Pond UIS-3: UIS-3 - 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 2 rows

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

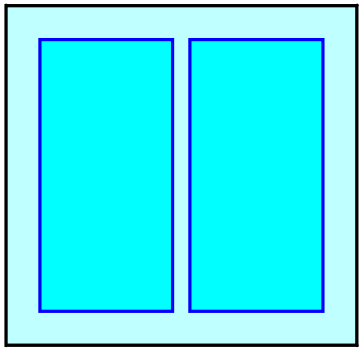
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

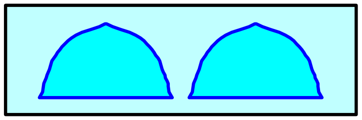
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

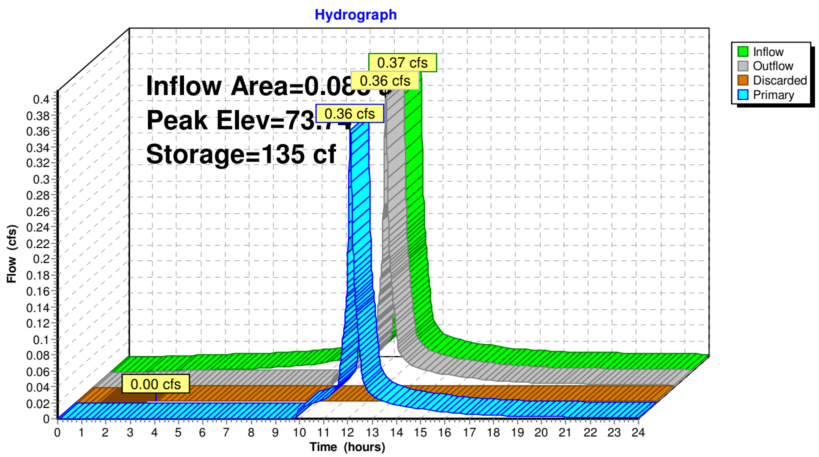
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-3: UIS-3



Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.45' above defined flood level

Inflow Area = 0.073 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af
Outflow = 0.32 cfs @ 12.10 hrs, Volume= 0.023 af, Atten= 2%, Lag= 1.0 min
Discarded = 0.00 cfs @ 3.68 hrs, Volume= 0.004 af
Primary = 0.31 cfs @ 12.10 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.65' @ 12.10 hrs Surf.Area= 103 sf Storage= 141 cf
Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 78.6 min calculated for 0.023 af (90% of inflow)
Center-of-Mass det. time= 29.9 min (779.1 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.20'	**6.0" Round Culvert** L= 30.0' Ke= 1.000
			Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.68 hrs HW=72.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.31 cfs @ 12.10 hrs HW=74.65' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.31 cfs @ 2.20 fps)

Pond UIS-4: UIS-4 - 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 2 rows

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

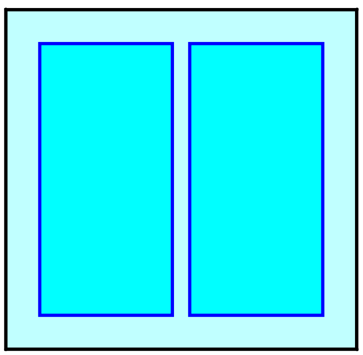
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

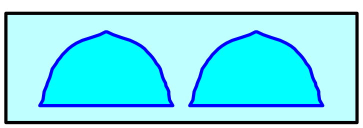
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

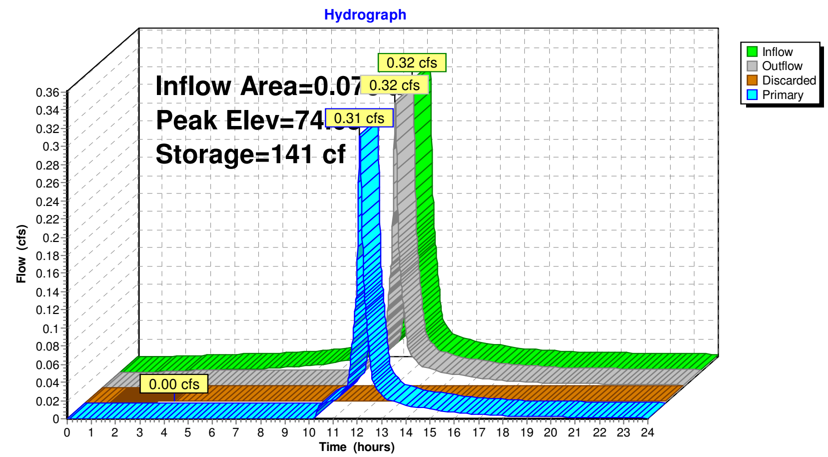
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-4: UIS-4



Summary for Pond UIS-5: UIS-5

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af
Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 3%, Lag= 1.3 min
Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af
Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 75.29' @ 12.10 hrs Surf.Area= 103 sf Storage= 144 cf

Plug-Flow detention time= 73.6 min calculated for 0.027 af (91% of inflow)
Center-of-Mass det. time= 28.5 min (777.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.80'	**6.0" Round Culvert** L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=73.12' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.35 cfs @ 12.10 hrs HW=75.29' (Free Discharge)
2=Culvert (Inlet Controls 0.35 cfs @ 1.80 fps)

Pond UIS-5: UIS-5 - 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 2 rows

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

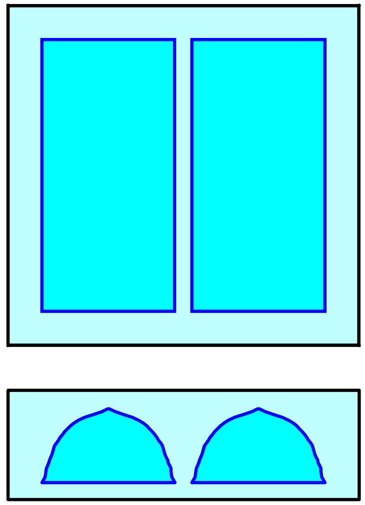
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

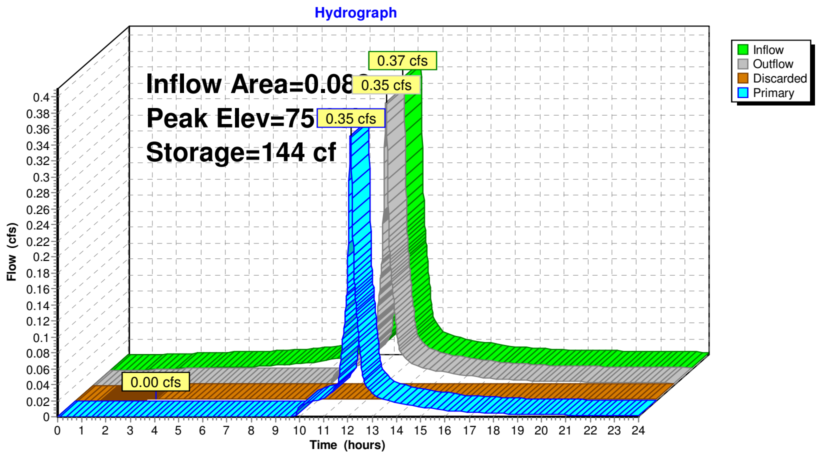
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-5: UIS-5



Summary for Pond UIS-6: UIS-6

Inflow Area = 0.089 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.38 cfs @ 12.11 hrs, Volume= 0.029 af, Atten= 4%, Lag= 1.3 min
Discarded = 0.00 cfs @ 3.17 hrs, Volume= 0.004 af
Primary = 0.38 cfs @ 12.11 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.53' @ 12.11 hrs Surf.Area= 103 sf Storage= 146 cf

Plug-Flow detention time= 70.5 min calculated for 0.029 af (92% of inflow)
Center-of-Mass det. time= 27.8 min (777.1 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.00'	**6.0" Round Culvert** L= 106.0' Ke= 1.000
			Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.17 hrs HW=72.32' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.38 cfs @ 12.11 hrs HW=74.53' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.38 cfs @ 1.92 fps)

Pond UIS-6: UIS-6 - 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 2 rows

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

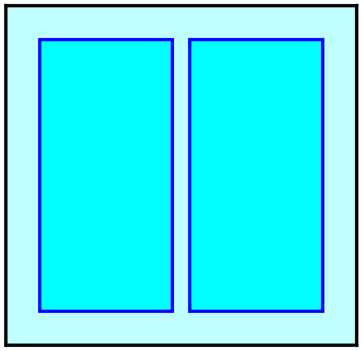
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

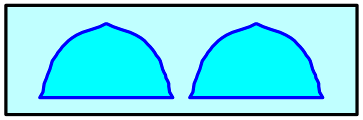
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

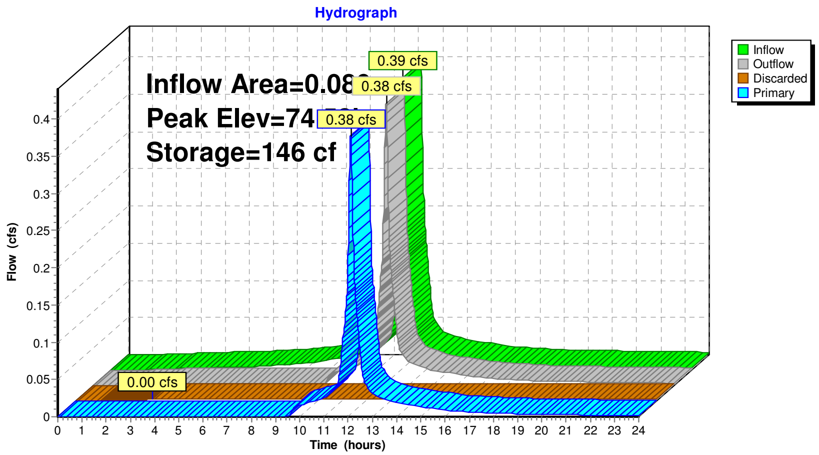
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-6: UIS-6



Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af
Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 3%, Lag= 1.3 min
Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af
Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.99' @ 12.10 hrs Surf.Area= 103 sf Storage= 144 cf

Plug-Flow detention time= 73.6 min calculated for 0.027 af (91% of inflow)
Center-of-Mass det. time= 28.5 min (777.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.50'	**6.0" Round Culvert** L= 17.5' Ke= 1.000 Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=71.82' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.35 cfs @ 12.10 hrs HW=73.99' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.35 cfs @ 1.80 fps)

Pond UIS-7: UIS-7 - 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 2 rows

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

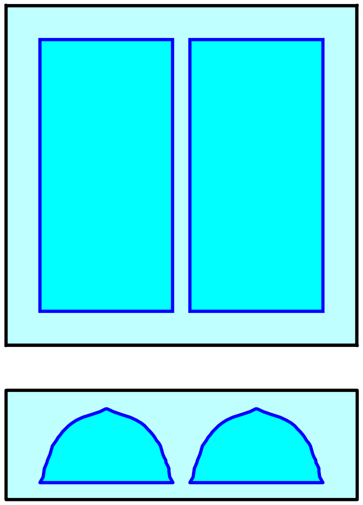
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

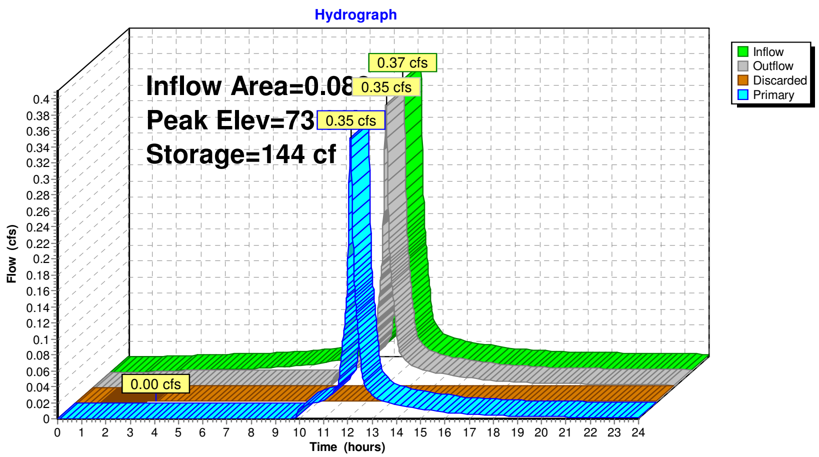
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-7: UIS-7



Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af
Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 3%, Lag= 1.3 min
Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af
Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.29' @ 12.10 hrs Surf.Area= 103 sf Storage= 144 cf

Plug-Flow detention time= 73.6 min calculated for 0.027 af (91% of inflow)
Center-of-Mass det. time= 28.5 min (777.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.80'	**6.0" Round Culvert** L= 37.0' Ke= 1.000
			Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=71.12' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.35 cfs @ 12.10 hrs HW=73.29' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.35 cfs @ 1.80 fps)

Pond UIS-8: UIS-8 - 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 2 rows

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

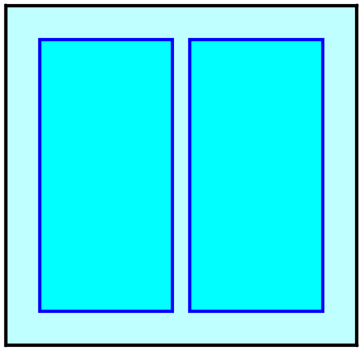
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

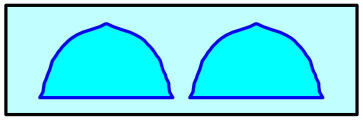
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

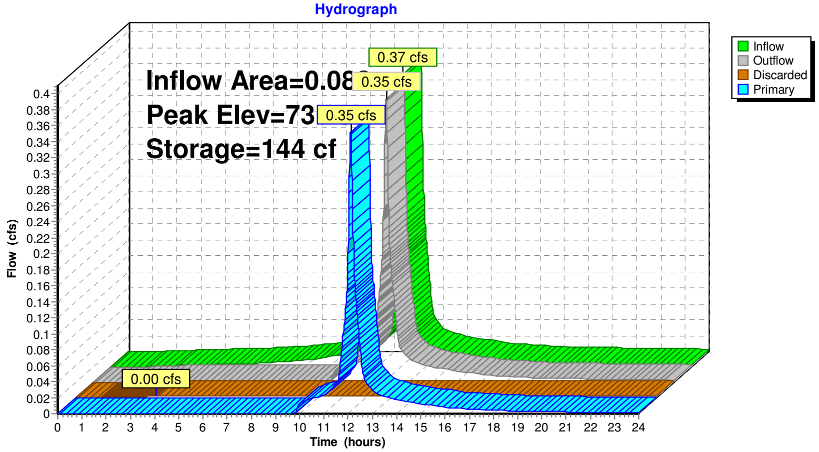
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-8: UIS-8



Summary for Pond UIS-9: UIS-9

Inflow Area =	0.089 ac,100.00% Impervious,	Inflow Depth > 4.26"	for 10-Year event
Inflow =	0.39 cfs @ 12.08 hrs,	Volume= 0.032 af	
Outflow =	0.38 cfs @ 12.11 hrs,	Volume= 0.031 af,	Atten= 4%, Lag= 1.5 min
Discarded =	0.00 cfs @ 3.17 hrs,	Volume= 0.004 af	
Primary =	0.37 cfs @ 12.11 hrs,	Volume= 0.026 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 72.71' @ 12.11 hrs Surf.Area= 103 sf Storage= 91 cf

Plug-Flow detention time= 40.7 min calculated for 0.031 af (96% of inflow)
Center-of-Mass det. time= 17.5 min (766.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.18'	**6.0" Round Culvert** L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.17 hrs HW=71.31' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.37 cfs @ 12.11 hrs HW=72.71' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.37 cfs @ 1.90 fps)

Pond UIS-9: UIS-9 - 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 2 rows

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

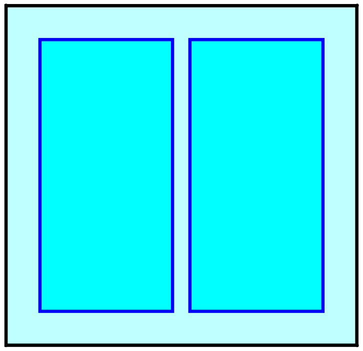
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

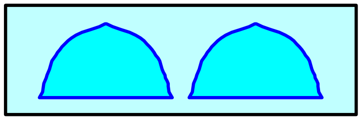
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

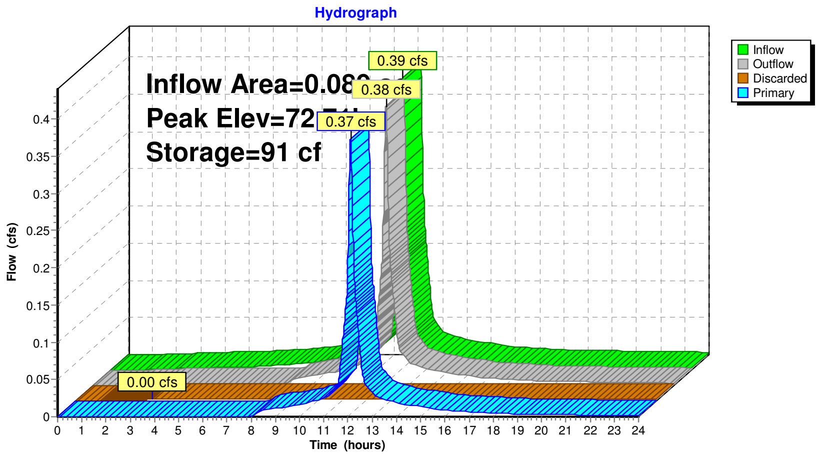
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-9: UIS-9



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Northern Grassed Area to Runoff Area=81,776 sf 1.57% Impervious Runoff Depth>0.42"
Tc=6.0 min UI Adjusted CN=42 Runoff=0.33 cfs 0.066 af

Subcatchment P-10: Area Around Isolated Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>2.77"
Tc=6.0 min UI Adjusted CN=75 Runoff=2.36 cfs 0.168 af

Subcatchment P-2: Existing Drive to Existing Runoff Area=22,978 sf 59.84% Impervious Runoff Depth>3.34"
Tc=6.0 min CN=81 Runoff=2.06 cfs 0.147 af

Subcatchment P-3: Area Around Isolated Runoff Area=27,549 sf 12.75% Impervious Runoff Depth>0.86"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.45 cfs 0.045 af

Subcatchment P-3A: Gravel Road to Detention Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>2.42"
Tc=6.0 min CN=71 Runoff=0.32 cfs 0.023 af

Subcatchment P-4: Sloped Entrance Drive - Runoff Area=21,239 sf 62.65% Impervious Runoff Depth>3.24"
Tc=6.0 min CN=80 Runoff=1.85 cfs 0.132 af

Subcatchment P-5: Driveway - Units 25-11 Runoff Area=39,272 sf 52.13% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=74 Runoff=2.84 cfs 0.202 af

Subcatchment P-6: Pavement Units 12-19 Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>3.05"
Tc=6.0 min CN=78 Runoff=1.57 cfs 0.112 af

Subcatchment P-7: Driveway - Units 20-24 Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>2.42"
Tc=6.0 min CN=71 Runoff=1.01 cfs 0.073 af

Subcatchment P-8: Surface Infiltration Pond Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.47"
Tc=6.0 min CN=43 Runoff=0.07 cfs 0.014 af

Subcatchment P-9: Woods/Grass Northwest Runoff Area=102,567 sf 2.25% Impervious Runoff Depth>0.17"
Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.06 cfs 0.034 af

Subcatchment R-1: Roof - Units 1&2 (C&B) Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.031 af

Subcatchment R-10: Roof - Units 19&20 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-11: Roof - Units 21&22 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-12: Roof - Units 23&24 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-13: Roof - Units 25&26 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-14: Roof Units 27&28 - A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-15: Roof Units 29&30 - (B & C Runoff Area=1,705 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.21 cfs 0.017 af

Subcatchment R-16: Front Units 29&30 Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.18 cfs 0.015 af

Subcatchment R-17: Mailbox Structure Rood Runoff Area=120 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.01 cfs 0.001 af

Subcatchment R-2: Roof Units 3&4 - (B & C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-3: Roof Units 5&6 - A&B Units Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-4: Roof - Units 7&8 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-5: Roof - Units 9&10 - (B&C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-6: Roof - Units 11&12 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-7: Roof - Units 13&14 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-8: Roof - Units 15&16 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-9: Roof - Units 17&18 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Reach SP-1: Wetlands South of Driveway Inflow=0.45 cfs 0.122 af
Outflow=0.45 cfs 0.122 af

Reach SP-2: Large Wetland Area East Inflow=0.67 cfs 0.188 af
Outflow=0.67 cfs 0.188 af

Reach SP-3: Large Wetland Area West Inflow=1.22 cfs 0.405 af
Outflow=1.22 cfs 0.405 af

Pond 3P: 12 Inch Culvert Peak Elev=56.92' Inflow=0.45 cfs 0.122 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=0.45 cfs 0.122 af

Pond D-1: Surface Infiltration Pond Peak Elev=70.47' Storage=14,656 cf Inflow=8.39 cfs 0.603 af
Discarded=0.12 cfs 0.124 af Primary=0.77 cfs 0.183 af Outflow=0.89 cfs 0.307 af

Pond D-2: Existing Detention Basin Peak Elev=58.41' Storage=3,738 cf Inflow=2.06 cfs 0.147 af
Outflow=0.17 cfs 0.077 af

Pond D-3: Detention Pond by Access Road Peak Elev=63.86' Storage=390 cf Inflow=0.32 cfs 0.023 af
Discarded=0.03 cfs 0.023 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.023 af

Pond UIS-1: UIS at Entrance Peak Elev=65.94' Storage=13,194 cf Inflow=5.62 cfs 0.414 af
Discarded=0.08 cfs 0.114 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.114 af

Pond UIS-2: UIS at North of Site Peak Elev=64.45' Storage=2,255 cf Inflow=2.03 cfs 0.165 af
Discarded=0.23 cfs 0.165 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.165 af

Pond UIS-3: UIS-3 Peak Elev=73.79' Storage=137 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.43 cfs 0.029 af Outflow=0.44 cfs 0.033 af

Pond UIS-4: UIS-4 Peak Elev=74.73' Storage=146 cf Inflow=0.39 cfs 0.032 af
Discarded=0.00 cfs 0.004 af Primary=0.37 cfs 0.024 af Outflow=0.38 cfs 0.029 af

Pond UIS-5: UIS-5 Peak Elev=75.40' Storage=151 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.42 cfs 0.029 af Outflow=0.42 cfs 0.033 af

Pond UIS-6: UIS-6 Peak Elev=74.65' Storage=154 cf Inflow=0.47 cfs 0.038 af
Discarded=0.00 cfs 0.005 af Primary=0.45 cfs 0.031 af Outflow=0.45 cfs 0.036 af

Pond UIS-7: UIS-7 Peak Elev=74.10' Storage=151 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.42 cfs 0.029 af Outflow=0.42 cfs 0.033 af

Pond UIS-8: UIS-8 Peak Elev=73.40' Storage=151 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.42 cfs 0.029 af Outflow=0.42 cfs 0.033 af

Pond UIS-9: UIS-9 Peak Elev=72.82' Storage=99 cf Inflow=0.47 cfs 0.038 af
Discarded=0.00 cfs 0.005 af Primary=0.44 cfs 0.033 af Outflow=0.45 cfs 0.037 af

Total Runoff Area = 10.007 ac Runoff Volume = 1.545 af Average Runoff Depth = 1.85"
69.75% Pervious = 6.980 ac 30.25% Impervious = 3.027 ac

Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

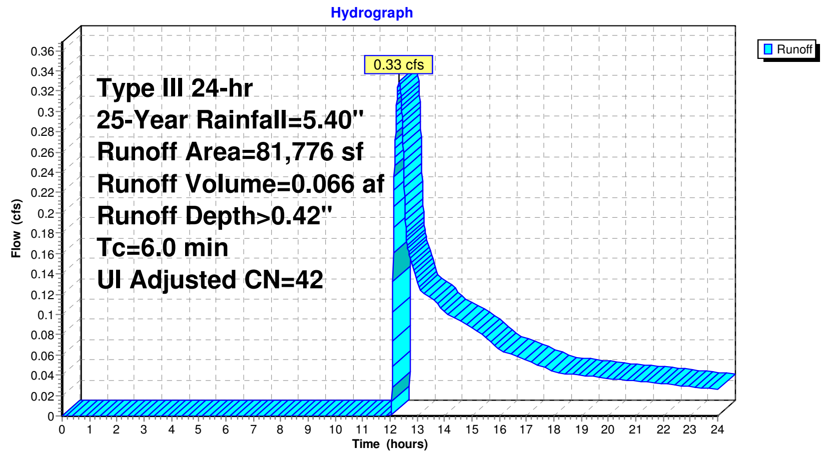
Runoff = 0.33 cfs @ 12.33 hrs, Volume= 0.066 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Adj	Description
36,287	30		Woods, Good, HSG A
10,782	70		Woods, Good, HSG C
9,419	55		Woods, Good, HSG B
22,149	39		>75% Grass cover, Good, HSG A
1,287	98		Unconnected pavement, HSG A
1,852	72		Dirt roads, HSG A
81,776	43	42	Weighted Average, UI Adjusted
80,489			98.43% Pervious Area
1,287			1.57% Impervious Area
1,287			100.00% Unconnected

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

Subcatchment P-1: Northern Grassed Area to Wetlands



Summary for Subcatchment P-10: Area Around Isolated Wetland

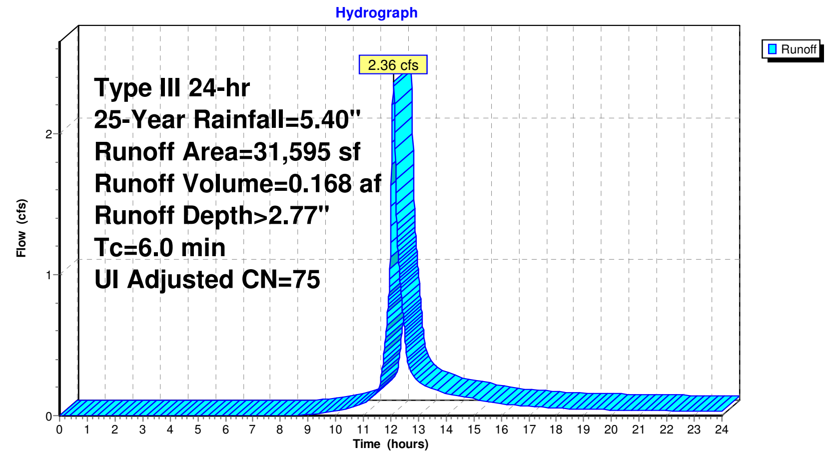
Runoff = 2.36 cfs @ 12.09 hrs, Volume= 0.168 af, Depth> 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

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

Subcatchment P-10: Area Around Isolated Wetland



Summary for Subcatchment P-2: Existing Drive to Existing Basin

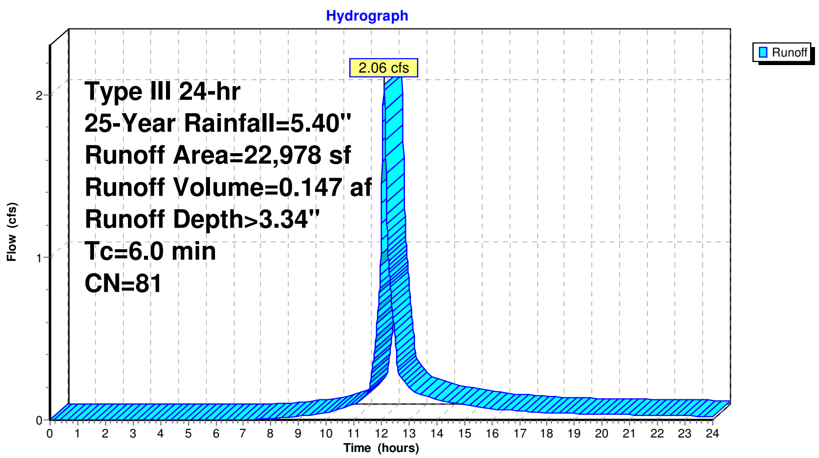
Runoff = 2.06 cfs @ 12.09 hrs, Volume= 0.147 af, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
6,902	98	Unconnected pavement, HSG A
1,353	76	Gravel roads, HSG A
4,824	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
3,632	98	Unconnected pavement, HSG B
3,217	98	Unconnected pavement, HSG C
22,978	81	Weighted Average
9,227		40.16% Pervious Area
13,751		59.84% Impervious Area
13,751		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6.0 TC**

Subcatchment P-2: Existing Drive to Existing Basin



Summary for Subcatchment P-3: Area Around Isolated Wetland

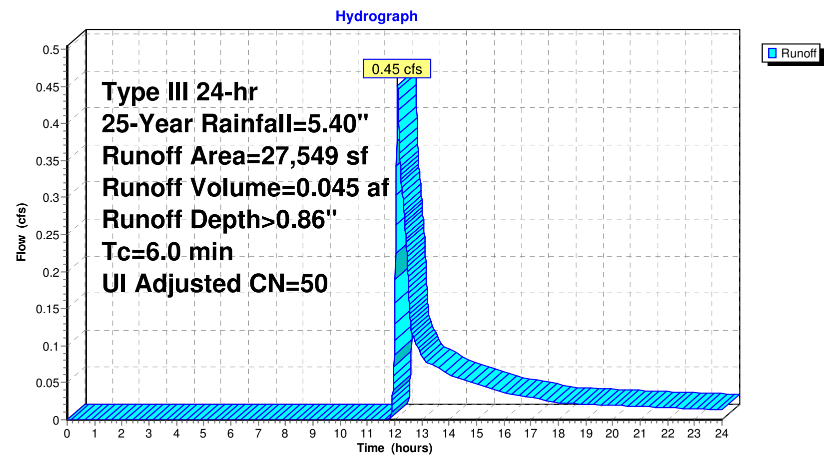
Runoff = 0.45 cfs @ 12.11 hrs, Volume= 0.045 af, Depth> 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Adj	Description
3,512	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,549	53	50	Weighted Average, UI Adjusted
24,037			87.25% Pervious Area
3,512			12.75% Impervious Area
3,512			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

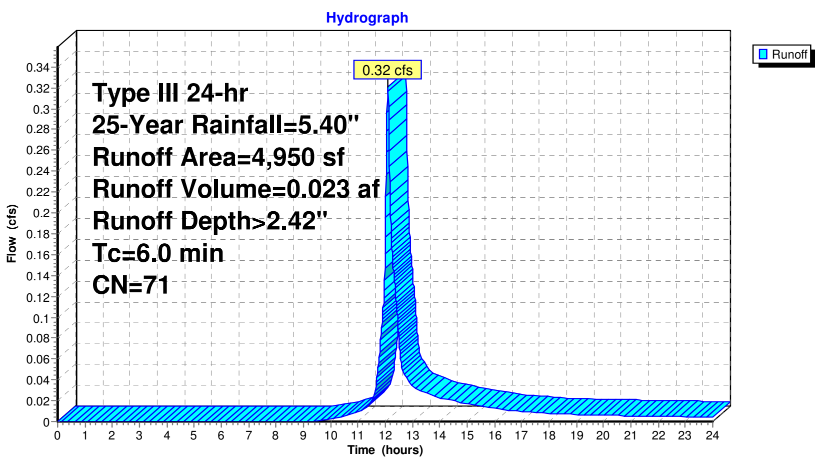
Runoff = 0.32 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

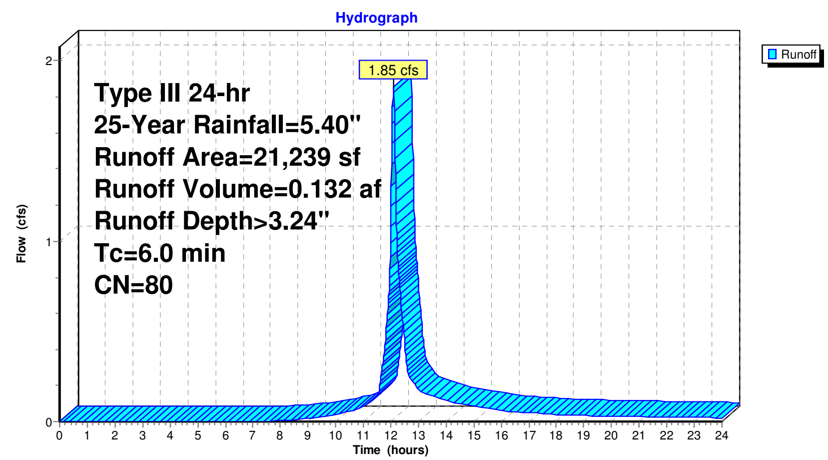
Runoff = 1.85 cfs @ 12.09 hrs, Volume= 0.132 af, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
13,306	98	Paved parking, HSG A
5,234	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,239	80	Weighted Average
7,933		37.35% Pervious Area
13,306		62.65% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

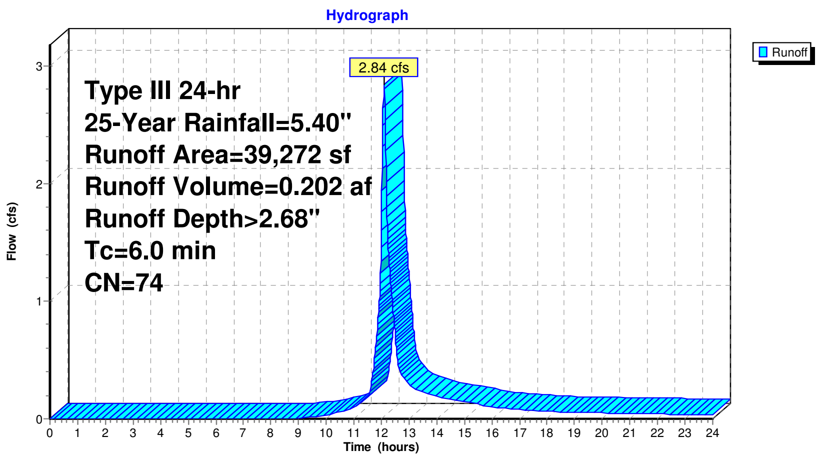
Runoff = 2.84 cfs @ 12.09 hrs, Volume= 0.202 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
19,875	98	Paved parking, HSG A
14,088	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
596	98	Unconnected pavement, HSG C
39,272	74	Weighted Average
18,801		47.87% Pervious Area
20,471		52.13% Impervious Area
596		2.91% Unconnected

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

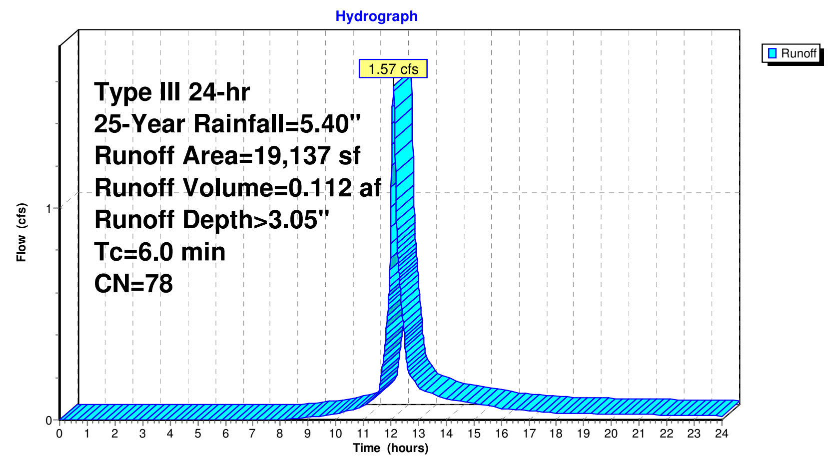
Runoff = 1.57 cfs @ 12.09 hrs, Volume= 0.112 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

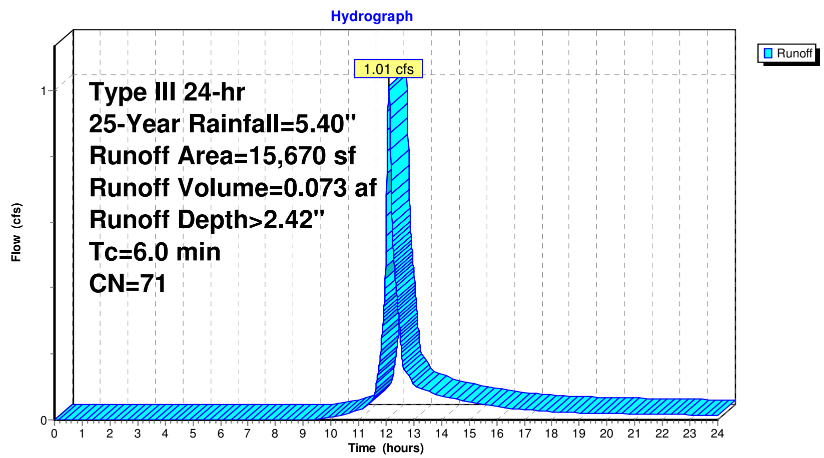
Runoff = 1.01 cfs @ 12.09 hrs, Volume= 0.073 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Summary for Subcatchment P-8: Surface Infiltration Pond Area

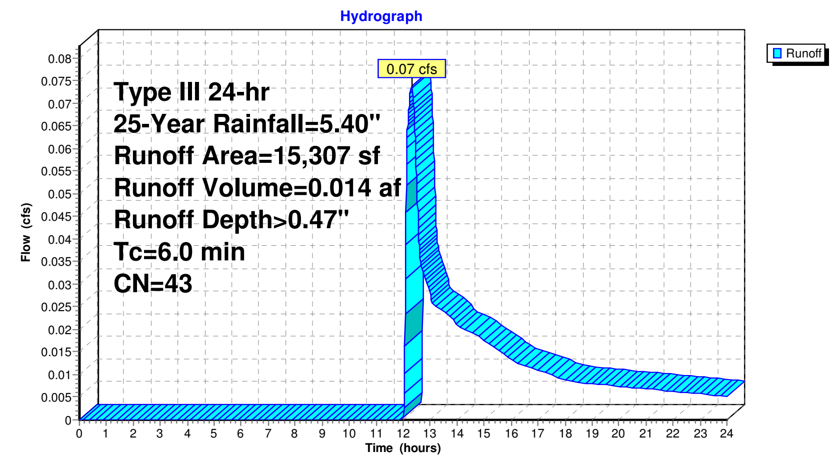
Runoff = 0.07 cfs @ 12.31 hrs, Volume= 0.014 af, Depth> 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

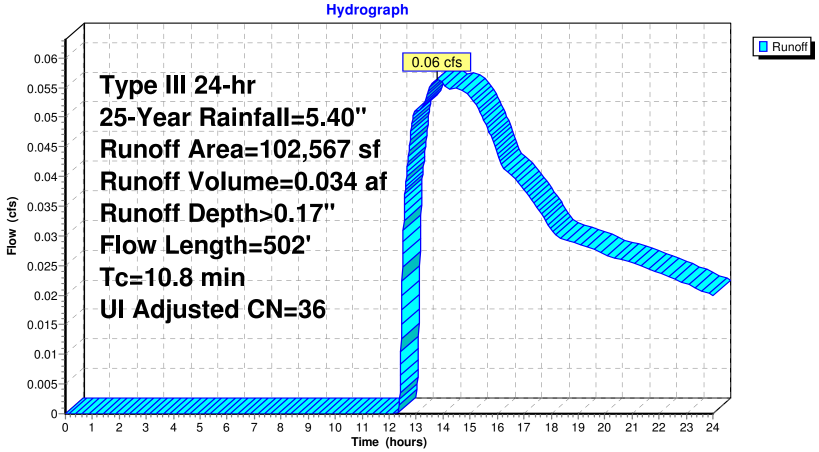
Runoff = 0.06 cfs @ 13.79 hrs, Volume= 0.034 af, Depth> 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.8	502	Total			

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands



Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

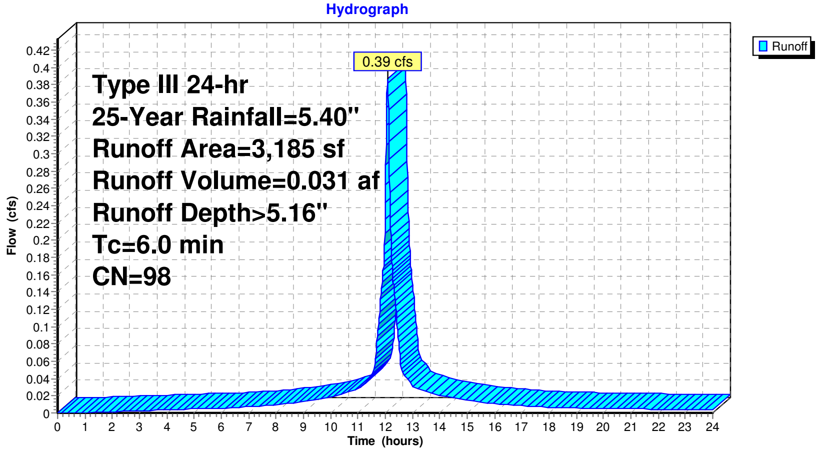
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.031 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

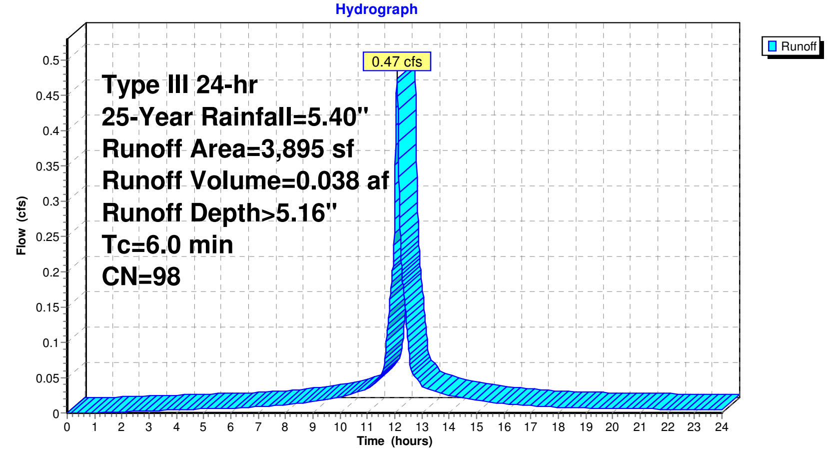
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

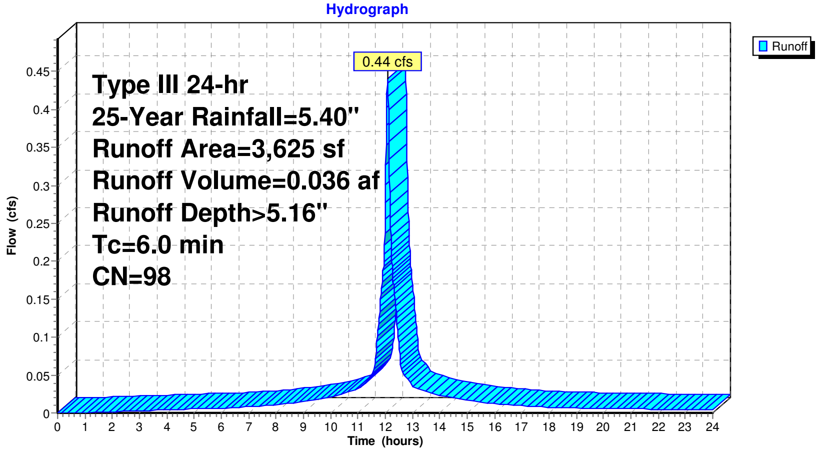
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

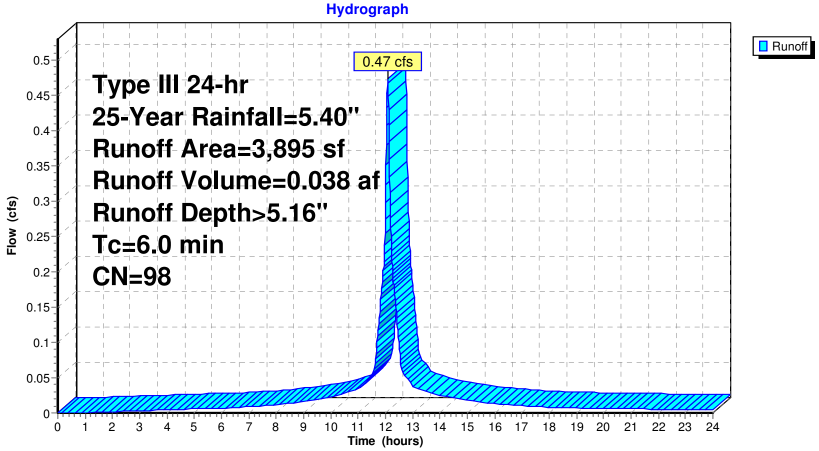
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)



Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

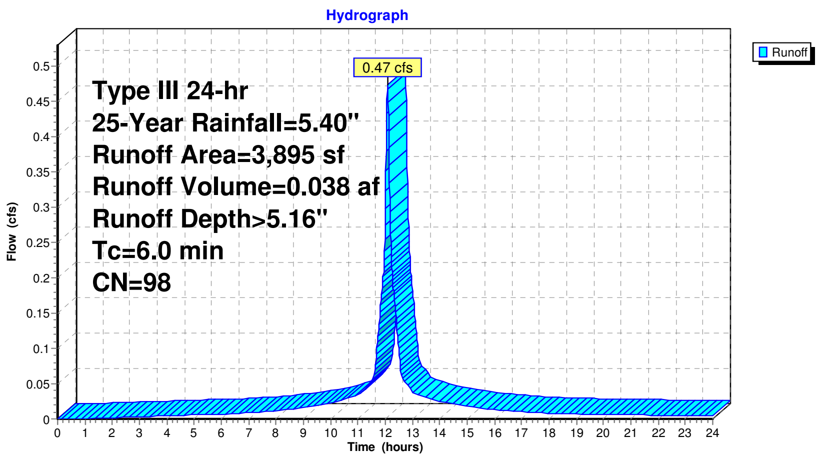
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

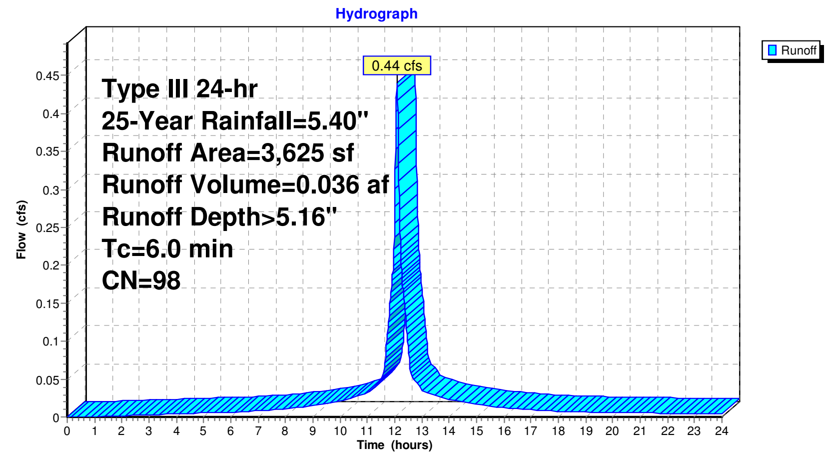
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

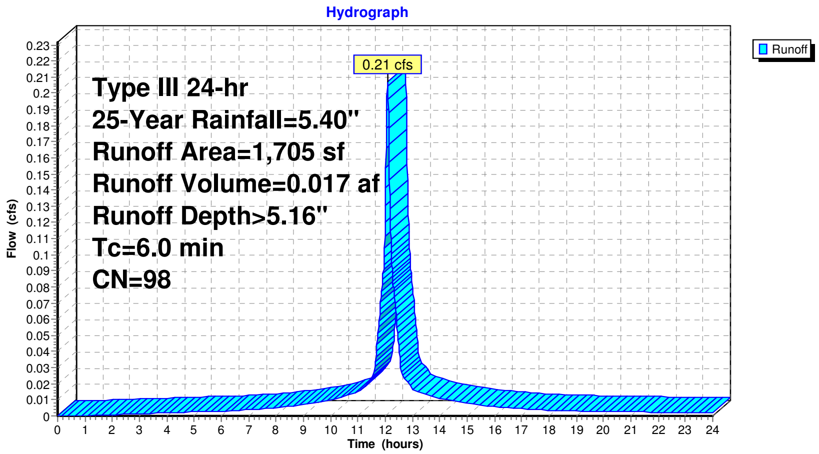
Runoff = 0.21 cfs @ 12.08 hrs, Volume= 0.017 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,705	98	Unconnected roofs, HSG A
1,705		100.00% Impervious Area
1,705		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

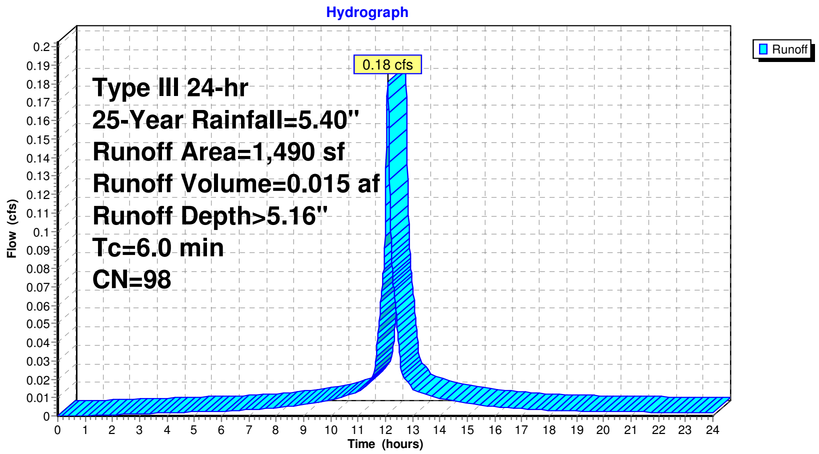
Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.015 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

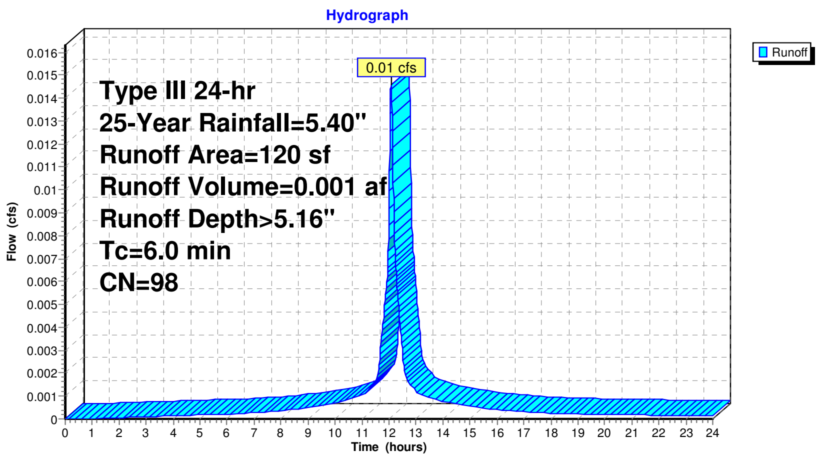
Runoff = 0.01 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

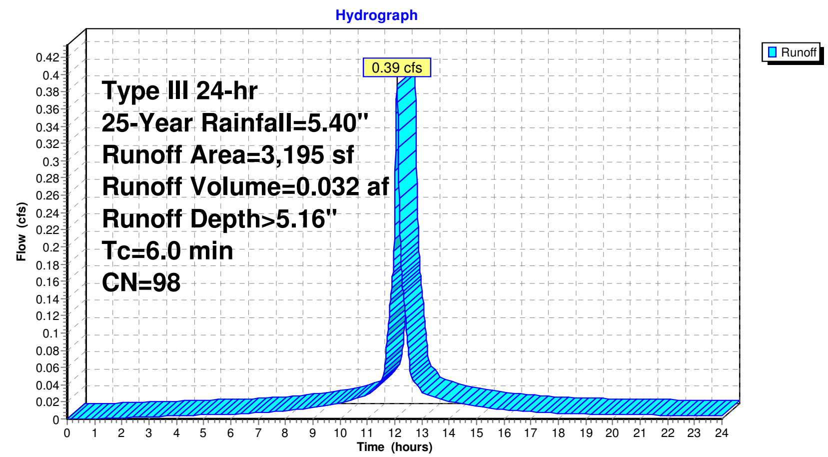
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

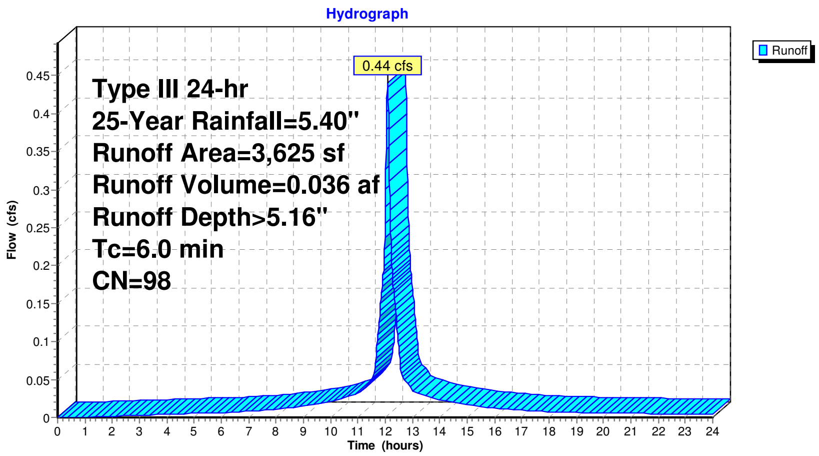
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

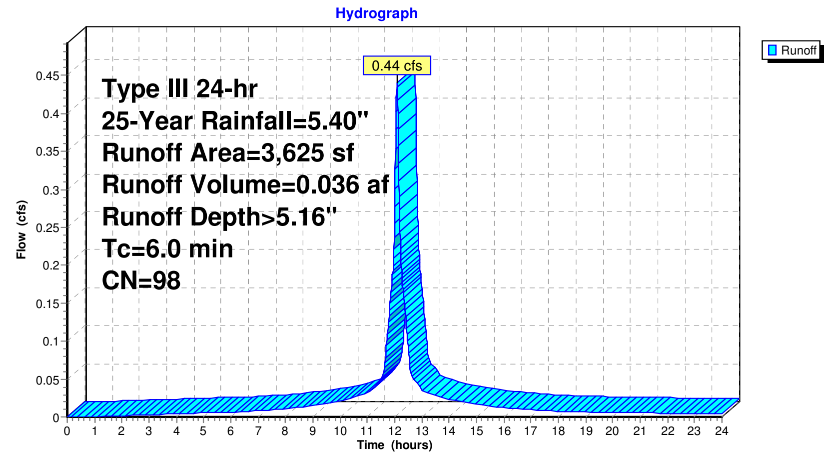
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

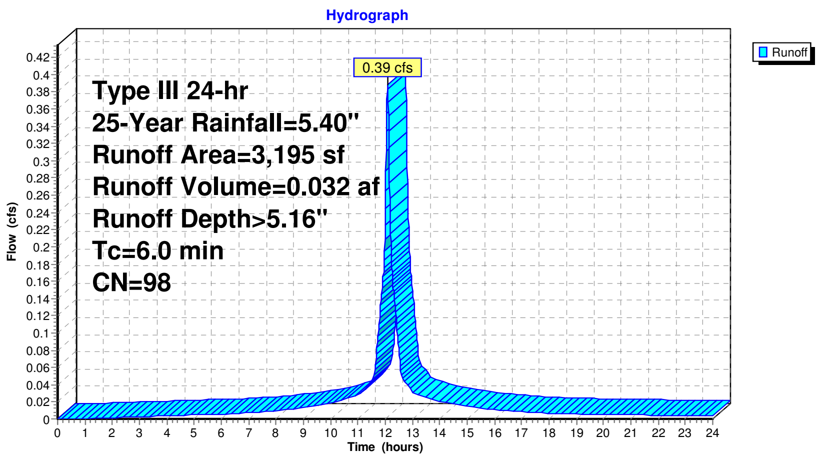
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

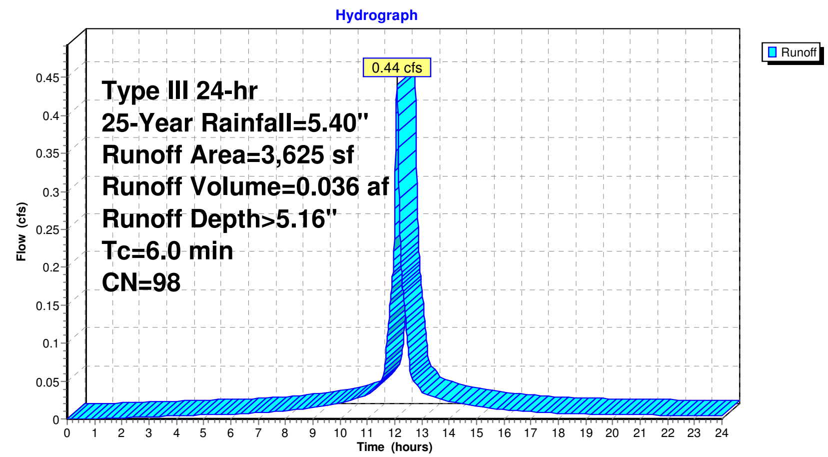
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

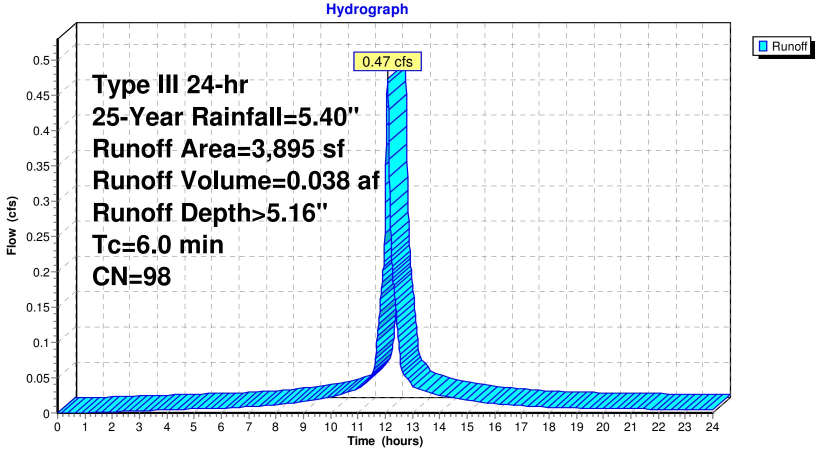
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

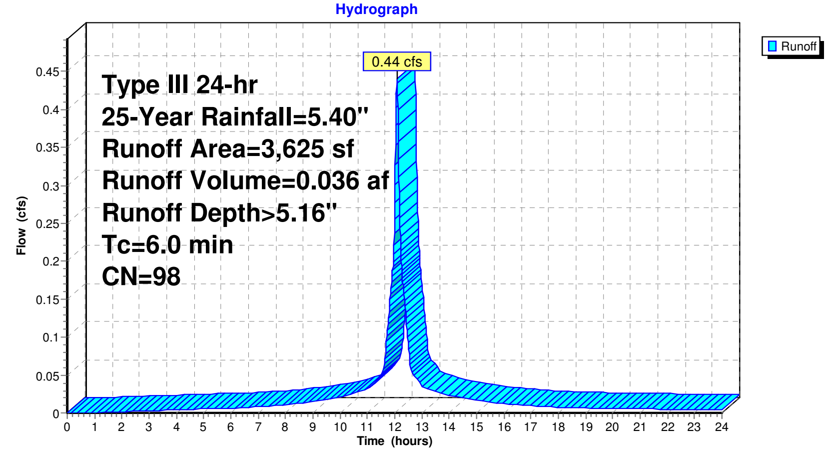
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

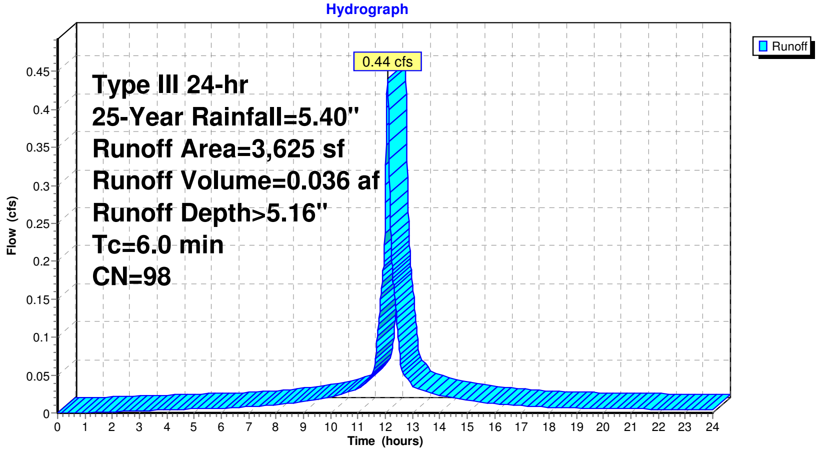
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)



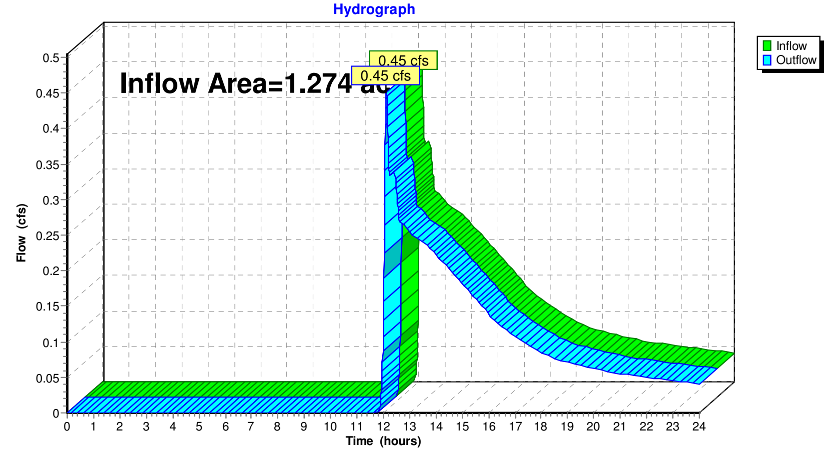
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 1.15" for 25-Year event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 0.122 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



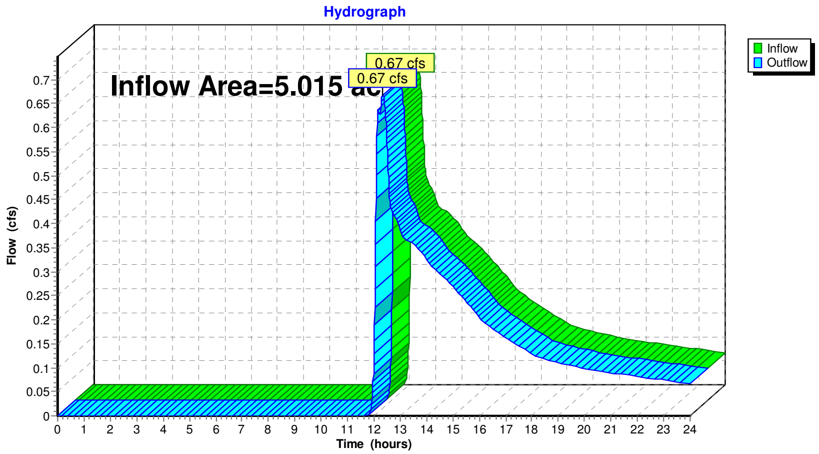
Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.015 ac, 29.33% Impervious, Inflow Depth > 0.45" for 25-Year event
Inflow = 0.67 cfs @ 12.34 hrs, Volume= 0.188 af
Outflow = 0.67 cfs @ 12.34 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Large Wetland Area East



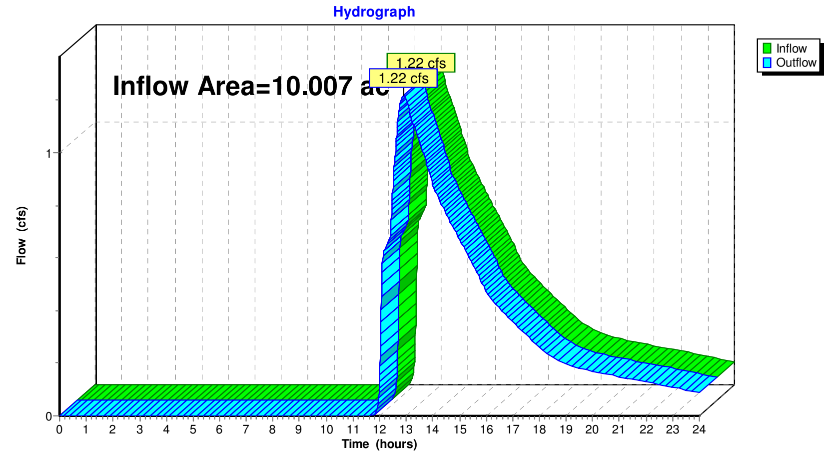
Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.007 ac, 30.25% Impervious, Inflow Depth > 0.49" for 25-Year event
Inflow = 1.22 cfs @ 12.90 hrs, Volume= 0.405 af
Outflow = 1.22 cfs @ 12.90 hrs, Volume= 0.405 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Large Wetland Area West



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 56.92' (Flood elevation advised)

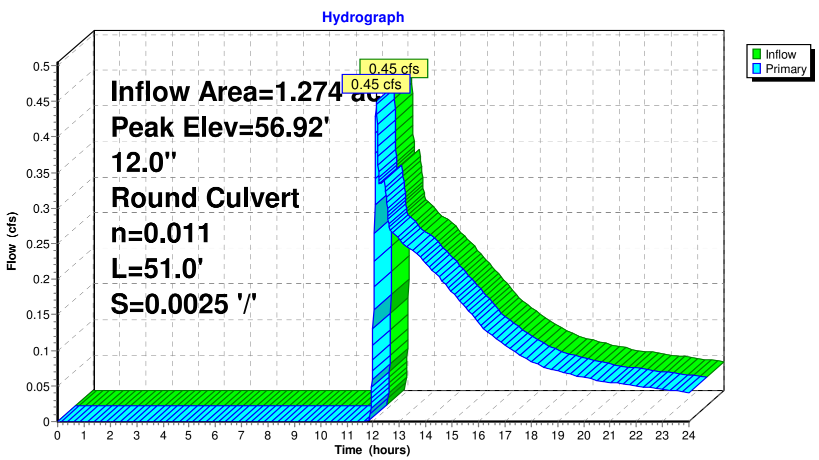
Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 1.15" for 25-Year event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 0.122 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Primary = 0.45 cfs @ 12.11 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.92' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round RCP_Round 12"** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.45 cfs @ 12.11 hrs HW=56.92' (Free Discharge)
↑**1=RCP_Round 12"** (Barrel Controls 0.45 cfs @ 2.21 fps)

Pond 3P: 12 Inch Culvert



Summary for Pond D-1: Surface Infiltration Pond

[58] Hint: Peaked 0.47' above defined flood level

Inflow Area = 2.637 ac, 56.99% Impervious, Inflow Depth > 2.74" for 25-Year event
Inflow = 8.39 cfs @ 12.10 hrs, Volume= 0.603 af
Outflow = 0.89 cfs @ 12.95 hrs, Volume= 0.307 af, Atten= 89%, Lag= 51.1 min
Discarded = 0.12 cfs @ 12.95 hrs, Volume= 0.124 af
Primary = 0.77 cfs @ 12.95 hrs, Volume= 0.183 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 70.47' @ 12.95 hrs Surf.Area= 4,967 sf Storage= 14,656 cf
Flood Elev= 70.00' Surf.Area= 4,583 sf Storage= 12,420 cf

Plug-Flow detention time= 245.6 min calculated for 0.307 af (51% of inflow)
Center-of-Mass det. time= 137.6 min (951.6 - 814.0)

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

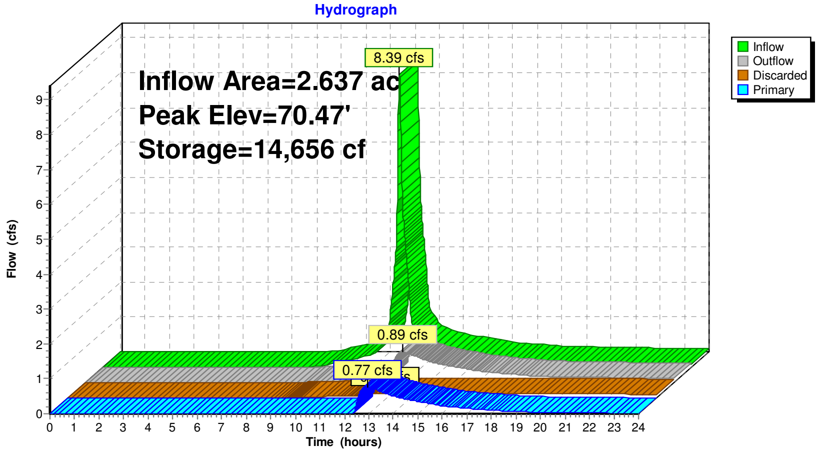
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	70.10'	**18.0" Round Culvert** L= 234.0' Ke= 0.200 Inlet / Outlet Invert= 70.10' / 67.00' S= 0.0132 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.12 cfs @ 12.95 hrs HW=70.47' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.76 cfs @ 12.95 hrs HW=70.47' (Free Discharge)
↑**2=Culvert** (Barrel Controls 0.76 cfs @ 3.40 fps)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

[58] Hint: Peaked 0.33' above defined flood level

Inflow Area = 0.528 ac, 59.84% Impervious, Inflow Depth > 3.34" for 25-Year event
Inflow = 2.06 cfs @ 12.09 hrs, Volume= 0.147 af
Outflow = 0.17 cfs @ 13.21 hrs, Volume= 0.077 af, Atten= 92%, Lag= 67.5 min
Primary = 0.17 cfs @ 13.21 hrs, Volume= 0.077 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.41' @ 13.21 hrs Surf.Area= 3,090 sf Storage= 3,738 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

Plug-Flow detention time= 270.1 min calculated for 0.077 af (52% of inflow)
Center-of-Mass det. time= 158.9 min (974.1 - 815.2)

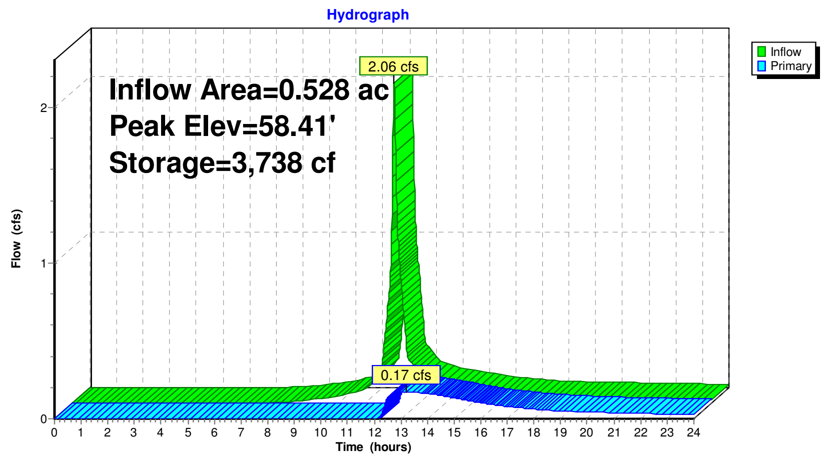
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.17 cfs @ 13.21 hrs HW=58.41' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.17 cfs @ 1.95 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 2.42" for 25-Year event
Inflow = 0.32 cfs @ 12.09 hrs, Volume= 0.023 af
Outflow = 0.03 cfs @ 13.03 hrs, Volume= 0.023 af, Atten= 90%, Lag= 56.1 min
Discarded = 0.03 cfs @ 13.03 hrs, Volume= 0.023 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.86' @ 13.03 hrs Surf.Area= 602 sf Storage= 390 cf

Plug-Flow detention time= 118.7 min calculated for 0.023 af (100% of inflow)
Center-of-Mass det. time= 118.2 min (958.6 - 840.3)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

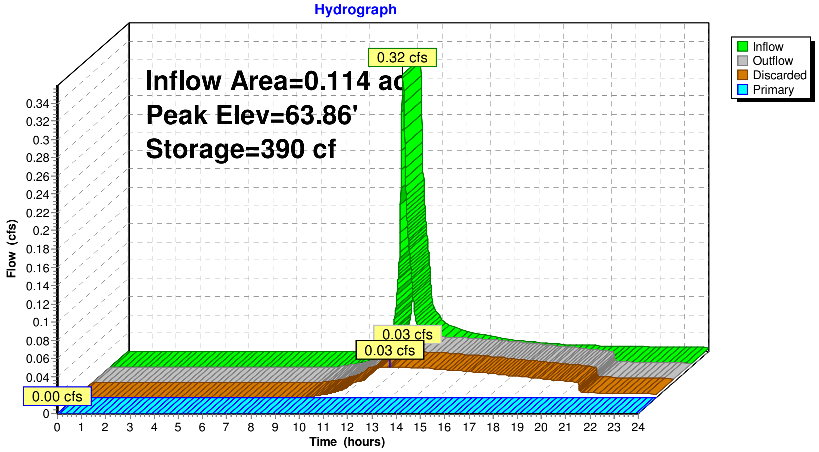
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	**2.410 in/hr Exfiltration over Horizontal area**

Discarded OutFlow Max=0.03 cfs @ 13.03 hrs HW=63.86' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

Inflow Area = 1.480 ac, 42.24% Impervious, Inflow Depth > 3.36" for 25-Year event
Inflow = 5.62 cfs @ 12.09 hrs, Volume= 0.414 af
Outflow = 0.08 cfs @ 9.47 hrs, Volume= 0.114 af, Atten= 99%, Lag= 0.0 min
Discarded = 0.08 cfs @ 9.47 hrs, Volume= 0.114 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.94' @ 21.25 hrs Surf.Area= 3,486 sf Storage= 13,194 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,981 cf

Plug-Flow detention time= 283.5 min calculated for 0.114 af (27% of inflow)
Center-of-Mass det. time= 126.3 min (929.4 - 803.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,786 cf	**50.50'W x 69.03'L x 6.50'H Field A** 22,660 cf Overall - 8,195 cf Embedded = 14,465 cf x 40.0% Voids
#2A	61.00'	8,195 cf	**Cultec R-902HD** x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
		13,981 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	68.40'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 9.47 hrs HW=60.08' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=60.00' (Free Discharge)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

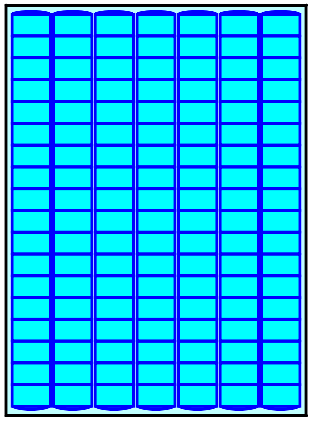
18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03' Base Length
7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width
12.0" Base + 48.0" Chamber Height + 18.0" Cover = 6.50' Field Height

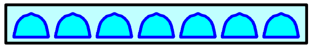
126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.3 cf Chamber Storage

22,660.2 cf Field - 8,195.3 cf Chambers = 14,464.9 cf Stone x 40.0% Voids = 5,786.0 cf Stone Storage

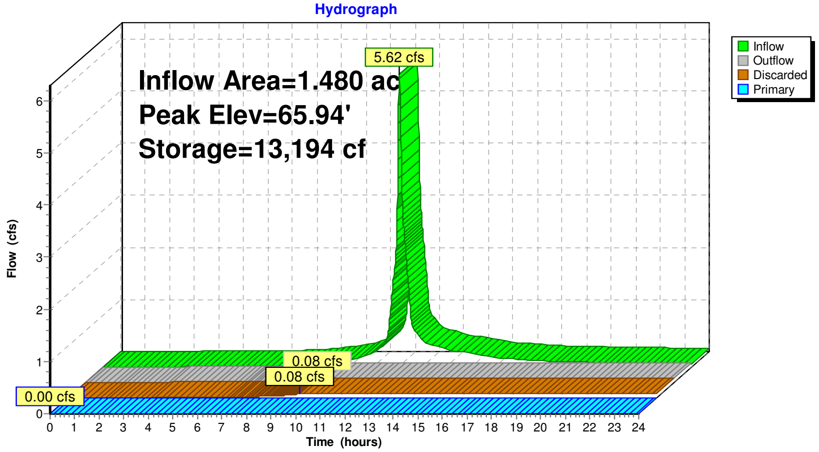
Chamber Storage + Stone Storage = 13,981.2 cf = 0.321 af
Overall Storage Efficiency = 61.7%
Overall System Size = 69.03' x 50.50' x 6.50'

126 Chambers
839.3 cy Field
535.7 cy Stone





Pond UIS-1: UIS at Entrance



Summary for Pond UIS-2: UIS at North of Site

Inflow Area =	0.384 ac,100.00% Impervious,	Inflow Depth > 5.16"	for 25-Year event
Inflow =	2.03 cfs @ 12.08 hrs,	Volume=	0.165 af
Outflow =	0.23 cfs @ 11.53 hrs,	Volume=	0.165 af, Atten= 89%, Lag= 0.0 min
Discarded =	0.23 cfs @ 11.53 hrs,	Volume=	0.165 af
Primary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 64.45' @ 12.72 hrs Surf.Area= 1,176 sf Storage= 2,255 cf
Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 63.5 min calculated for 0.165 af (100% of inflow)
Center-of-Mass det. time= 63.3 min (809.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	**16.00'W x 73.50'L x 4.04'H Field A** 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	68.25'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.53 hrs HW=61.57' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.50' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

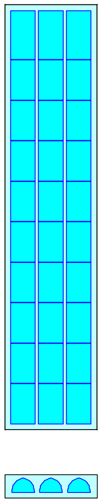
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

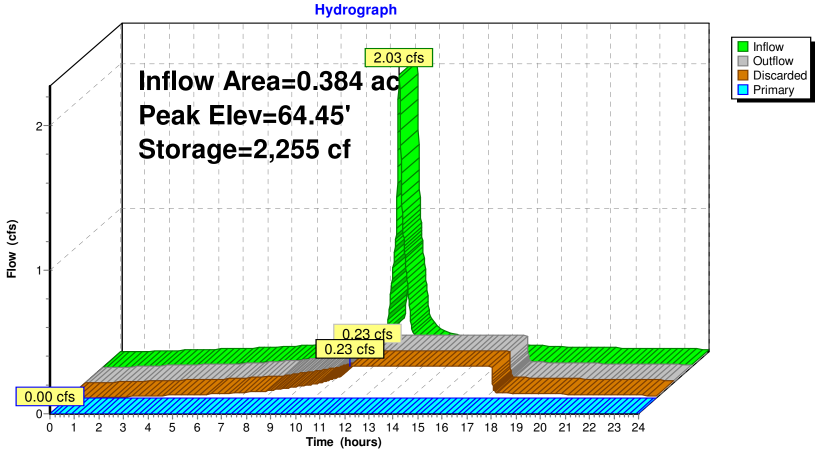
4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af
Overall Storage Efficiency = 60.2%
Overall System Size = 73.50' x 16.00' x 4.04'

30 Chambers
176.0 cy Field
116.8 cy Stone



Pond UIS-2: UIS at North of Site



Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.58' above defined flood level

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.44 cfs @ 12.09 hrs, Volume= 0.033 af, Atten= 1%, Lag= 0.6 min
Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
Primary = 0.43 cfs @ 12.09 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.79' @ 12.09 hrs Surf.Area= 103 sf Storage= 137 cf
Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 65.9 min calculated for 0.033 af (93% of inflow)
Center-of-Mass det. time= 26.7 min (772.9 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.40'	**6.0" Round Culvert** L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=71.72' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.43 cfs @ 12.09 hrs HW=73.79' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.43 cfs @ 2.65 fps)

Pond UIS-3: UIS-3 - 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 2 rows

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

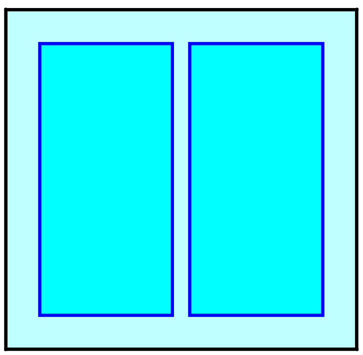
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

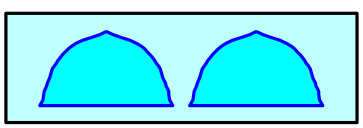
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

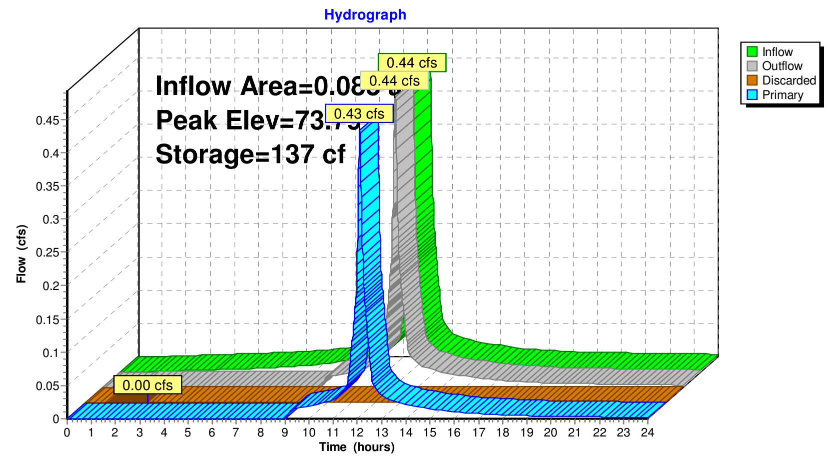
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-3: UIS-3



Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.53' above defined flood level

Inflow Area = 0.073 ac,100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.38 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 3%, Lag= 1.2 min
Discarded = 0.00 cfs @ 2.88 hrs, Volume= 0.004 af
Primary = 0.37 cfs @ 12.10 hrs, Volume= 0.024 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.73' @ 12.10 hrs Surf.Area= 103 sf Storage= 146 cf
Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 71.7 min calculated for 0.029 af (92% of inflow)
Center-of-Mass det. time= 28.8 min (775.0 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.20'	**6.0" Round Culvert** L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.88 hrs HW=72.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.37 cfs @ 12.10 hrs HW=74.73' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.37 cfs @ 1.90 fps)

Pond UIS-4: UIS-4 - 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 2 rows

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

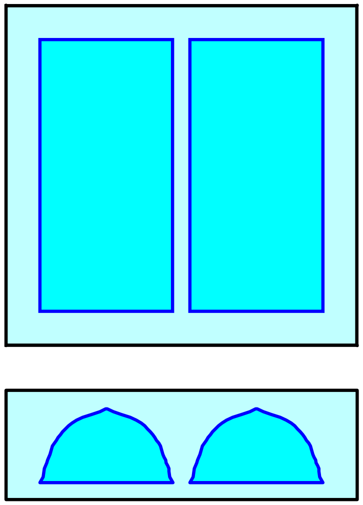
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

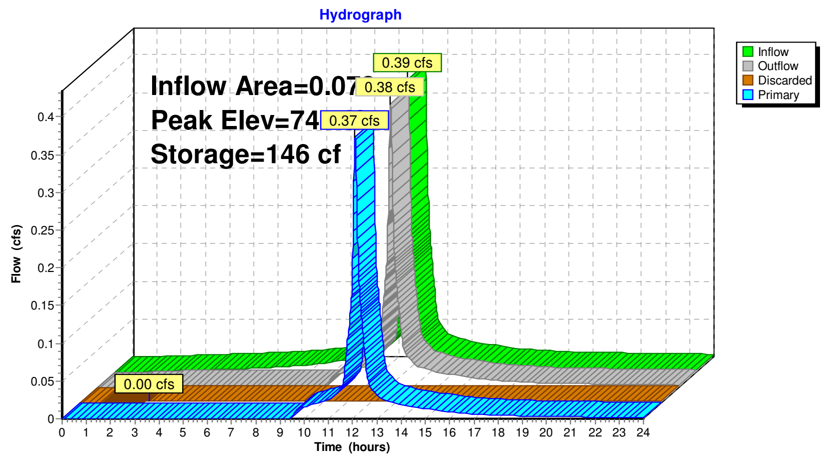
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-4: UIS-4



Summary for Pond UIS-5: UIS-5

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.033 af, Atten= 4%, Lag= 1.4 min
Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
Primary = 0.42 cfs @ 12.11 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 75.40' @ 12.11 hrs Surf.Area= 103 sf Storage= 151 cf

Plug-Flow detention time= 66.5 min calculated for 0.033 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (773.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.80'	**6.0" Round Culvert** L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=73.12' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.42 cfs @ 12.11 hrs HW=75.40' (Free Discharge)
2=Culvert (Inlet Controls 0.42 cfs @ 2.14 fps)

Pond UIS-5: UIS-5 - 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 2 rows

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

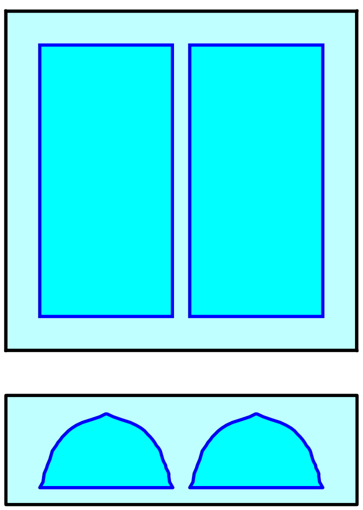
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

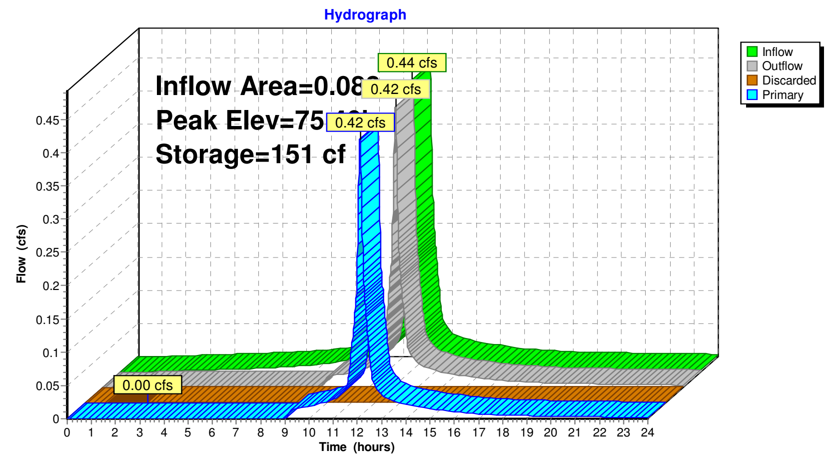
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-5: UIS-5



Summary for Pond UIS-6: UIS-6

Inflow Area =	0.089 ac,100.00% Impervious,	Inflow Depth > 5.16"	for 25-Year event
Inflow =	0.47 cfs @ 12.08 hrs, Volume=	0.038 af	
Outflow =	0.45 cfs @ 12.11 hrs, Volume=	0.036 af, Atten= 4%, Lag= 1.4 min	
Discarded =	0.00 cfs @ 2.48 hrs, Volume=	0.005 af	
Primary =	0.45 cfs @ 12.11 hrs, Volume=	0.031 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.65' @ 12.11 hrs Surf.Area= 103 sf Storage= 154 cf

Plug-Flow detention time= 63.7 min calculated for 0.036 af (93% of inflow)
Center-of-Mass det. time= 26.6 min (772.8 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.00'	**6.0" Round Culvert** L= 106.0' Ke= 1.000 Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.48 hrs HW=72.32' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.45 cfs @ 12.11 hrs HW=74.65' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.45 cfs @ 2.29 fps)

Pond UIS-6: UIS-6 - 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 2 rows

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

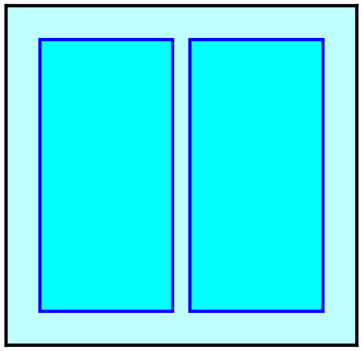
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

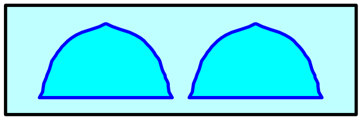
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

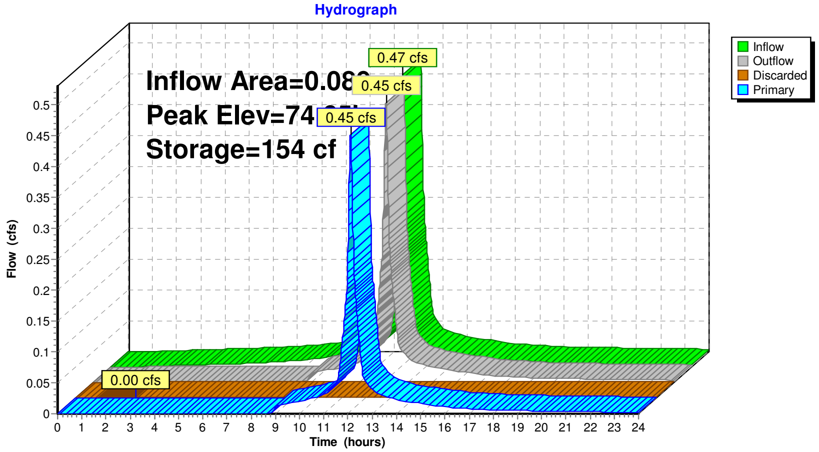
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-6: UIS-6



Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.033 af, Atten= 4%, Lag= 1.4 min
Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
Primary = 0.42 cfs @ 12.11 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.10' @ 12.11 hrs Surf.Area= 103 sf Storage= 151 cf

Plug-Flow detention time= 66.5 min calculated for 0.033 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (773.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.50'	**6.0" Round Culvert** L= 17.5' Ke= 1.000
			Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=71.82' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.42 cfs @ 12.11 hrs HW=74.10' (Free Discharge)
2=Culvert (Inlet Controls 0.42 cfs @ 2.14 fps)

Pond UIS-7: UIS-7 - 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 2 rows

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

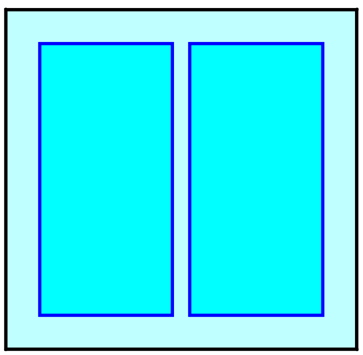
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

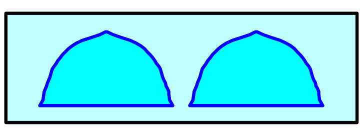
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

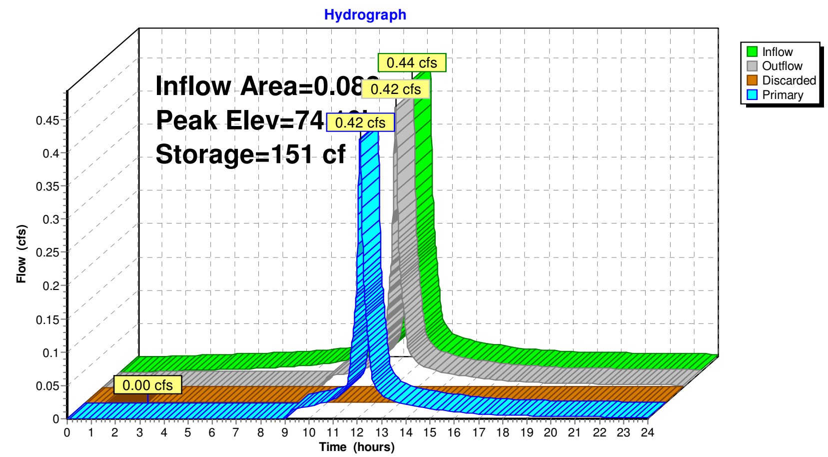
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-7: UIS-7



Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.033 af, Atten= 4%, Lag= 1.4 min
Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
Primary = 0.42 cfs @ 12.11 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.40' @ 12.11 hrs Surf.Area= 103 sf Storage= 151 cf

Plug-Flow detention time= 66.5 min calculated for 0.033 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (773.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.80'	**6.0" Round Culvert** L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=71.12' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.42 cfs @ 12.11 hrs HW=73.40' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.42 cfs @ 2.14 fps)

Pond UIS-8: UIS-8 - 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 2 rows

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

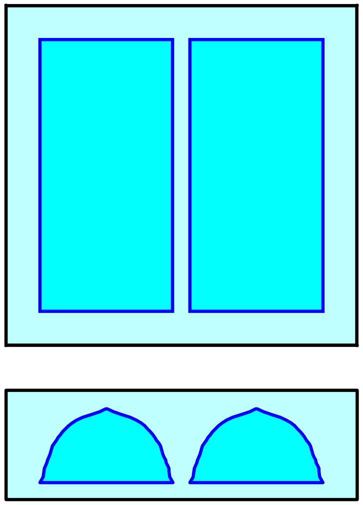
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

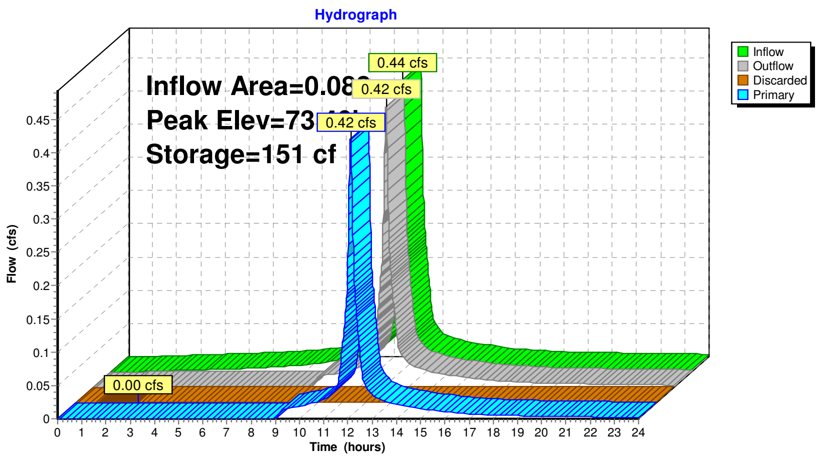
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-8: UIS-8



Summary for Pond UIS-9: UIS-9

Inflow Area = 0.089 ac,100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.037 af, Atten= 5%, Lag= 1.7 min
Discarded = 0.00 cfs @ 2.48 hrs, Volume= 0.005 af
Primary = 0.44 cfs @ 12.11 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 72.82' @ 12.11 hrs Surf.Area= 103 sf Storage= 99 cf

Plug-Flow detention time= 36.2 min calculated for 0.037 af (97% of inflow)
Center-of-Mass det. time= 16.4 min (762.7 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.18'	**6.0" Round Culvert** L= 79.0' Ke= 1.000
			Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.48 hrs HW=71.31' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.44 cfs @ 12.11 hrs HW=72.82' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.44 cfs @ 2.26 fps)

Pond UIS-9: UIS-9 - 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 2 rows

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

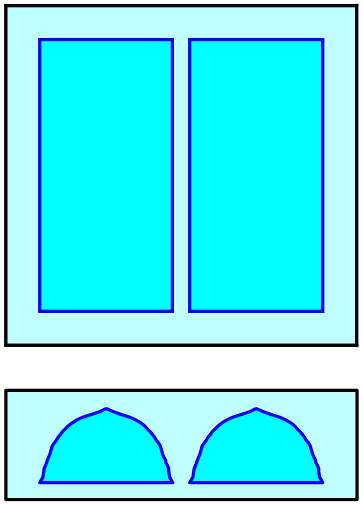
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

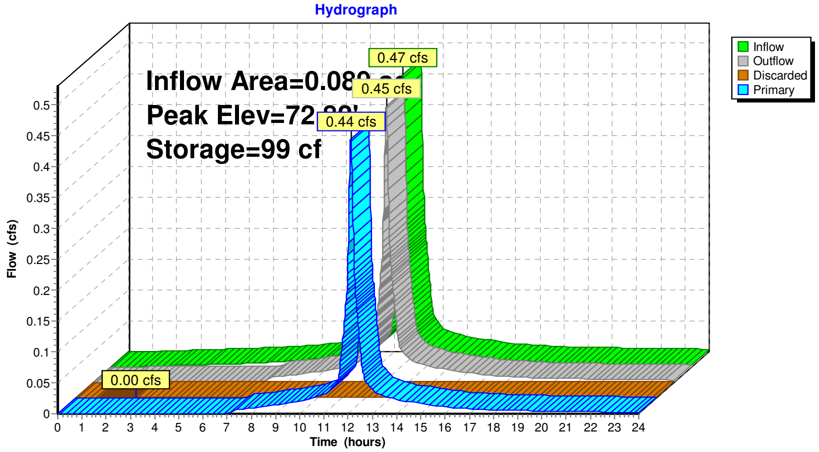
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-9: UIS-9



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Northern Grassed Area to Runoff Area=81,776 sf 1.57% Impervious Runoff Depth>0.79"
Tc=6.0 min UI Adjusted CN=42 Runoff=0.96 cfs 0.124 af

Subcatchment P-10: Area Around Isolated Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>3.71"
Tc=6.0 min UI Adjusted CN=75 Runoff=3.16 cfs 0.224 af

Subcatchment P-2: Existing Drive to Existing Runoff Area=22,978 sf 59.84% Impervious Runoff Depth>4.34"
Tc=6.0 min CN=81 Runoff=2.66 cfs 0.191 af

Subcatchment P-3: Area Around Isolated Runoff Area=27,549 sf 12.75% Impervious Runoff Depth>1.39"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.86 cfs 0.073 af

Subcatchment P-3A: Gravel Road to Detention Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>3.30"
Tc=6.0 min CN=71 Runoff=0.44 cfs 0.031 af

Subcatchment P-4: Sloped Entrance Drive - Runoff Area=21,239 sf 62.65% Impervious Runoff Depth>4.23"
Tc=6.0 min CN=80 Runoff=2.41 cfs 0.172 af

Subcatchment P-5: Driveway - Units 25-11 Runoff Area=39,272 sf 52.13% Impervious Runoff Depth>3.61"
Tc=6.0 min CN=74 Runoff=3.82 cfs 0.271 af

Subcatchment P-6: Pavement Units 12-19 Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>4.02"
Tc=6.0 min CN=78 Runoff=2.07 cfs 0.147 af

Subcatchment P-7: Driveway - Units 20-24 Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>3.30"
Tc=6.0 min CN=71 Runoff=1.39 cfs 0.099 af

Subcatchment P-8: Surface Infiltration Pond Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.86"
Tc=6.0 min CN=43 Runoff=0.21 cfs 0.025 af

Subcatchment P-9: Woods/Grass Northwest Runoff Area=102,567 sf 2.25% Impervious Runoff Depth>0.42"
Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.33 cfs 0.082 af

Subcatchment R-1: Roof - Units 1&2 (C&B) Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-10: Roof - Units 19&20 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af

Subcatchment R-11: Roof - Units 21&22 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment R-12: Roof - Units 23&24 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af

Subcatchment R-13: Roof - Units 25&26 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af

Subcatchment R-14: Roof Units 27&28 - A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment R-15: Roof Units 29&30 - (B & C Runoff Area=1,705 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment R-16: Front Units 29&30 Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af

Subcatchment R-17: Mailbox Structure Rood Runoff Area=120 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.02 cfs 0.001 af

Subcatchment R-2: Roof Units 3&4 - (B & C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-3: Roof Units 5&6 - A&B Units Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment R-4: Roof - Units 7&8 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment R-5: Roof - Units 9&10 - (B&C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-6: Roof - Units 11&12 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment R-7: Roof - Units 13&14 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af

Subcatchment R-8: Roof - Units 15&16 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment R-9: Roof - Units 17&18 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Reach SP-1: Wetlands South of Driveway Inflow=0.90 cfs 0.196 af
Outflow=0.90 cfs 0.196 af

Reach SP-2: Large Wetland Area East Inflow=1.85 cfs 0.418 af
Outflow=1.85 cfs 0.418 af

Reach SP-3: Large Wetland Area West Inflow=4.64 cfs 0.867 af
Outflow=4.64 cfs 0.867 af

Pond 3P: 12 Inch Culvert Peak Elev=57.10' Inflow=0.90 cfs 0.196 af
12.0" Round Culvert n=0.011 L=51.0' S=0.0025 '/' Outflow=0.90 cfs 0.196 af

Pond D-1: Surface Infiltration Pond Peak Elev=70.84' Storage=16,567 cf Inflow=10.97 cfs 0.799 af
Discarded=0.12 cfs 0.130 af Primary=2.94 cfs 0.367 af Outflow=3.06 cfs 0.497 af

Pond D-2: Existing Detention Basin Peak Elev=58.70' Storage=4,642 cf Inflow=2.66 cfs 0.191 af
Outflow=0.28 cfs 0.120 af

Pond D-3: Detention Pond by Access Road Peak Elev=64.06' Storage=478 cf Inflow=0.44 cfs 0.031 af
Discarded=0.04 cfs 0.029 af Primary=0.17 cfs 0.003 af Outflow=0.21 cfs 0.031 af

Pond UIS-1: UIS at Entrance Peak Elev=68.49' Storage=13,981 cf Inflow=7.26 cfs 0.535 af
Discarded=0.08 cfs 0.119 af Primary=0.71 cfs 0.096 af Outflow=0.80 cfs 0.214 af

Pond UIS-2: UIS at North of Site Peak Elev=68.45' Storage=2,860 cf Inflow=2.45 cfs 0.200 af
Discarded=0.23 cfs 0.198 af Primary=0.43 cfs 0.002 af Outflow=0.65 cfs 0.200 af

Pond UIS-3: UIS-3 Peak Elev=73.84' Storage=141 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.52 cfs 0.036 af Outflow=0.53 cfs 0.041 af

Pond UIS-4: UIS-4 Peak Elev=74.85' Storage=153 cf Inflow=0.47 cfs 0.038 af
Discarded=0.00 cfs 0.005 af Primary=0.45 cfs 0.031 af Outflow=0.45 cfs 0.036 af

Pond UIS-5: UIS-5 Peak Elev=75.56' Storage=159 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.50 cfs 0.036 af Outflow=0.51 cfs 0.041 af

Pond UIS-6: UIS-6 Peak Elev=74.83' Storage=163 cf Inflow=0.57 cfs 0.047 af
Discarded=0.00 cfs 0.005 af Primary=0.54 cfs 0.039 af Outflow=0.54 cfs 0.044 af

Pond UIS-7: UIS-7 Peak Elev=74.26' Storage=159 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.50 cfs 0.036 af Outflow=0.51 cfs 0.041 af

Pond UIS-8: UIS-8 Peak Elev=73.56' Storage=159 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.50 cfs 0.036 af Outflow=0.51 cfs 0.041 af

Pond UIS-9: UIS-9 Peak Elev=72.99' Storage=111 cf Inflow=0.57 cfs 0.047 af
Discarded=0.00 cfs 0.005 af Primary=0.53 cfs 0.041 af Outflow=0.53 cfs 0.045 af

Total Runoff Area = 10.007 ac Runoff Volume = 2.084 af Average Runoff Depth = 2.50"
69.75% Pervious = 6.980 ac 30.25% Impervious = 3.027 ac

Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

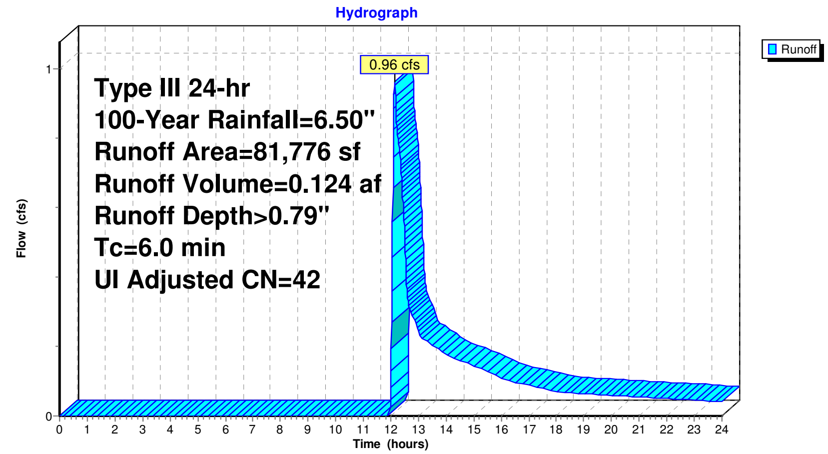
Runoff = 0.96 cfs @ 12.13 hrs, Volume= 0.124 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
36,287	30		Woods, Good, HSG A
10,782	70		Woods, Good, HSG C
9,419	55		Woods, Good, HSG B
22,149	39		>75% Grass cover, Good, HSG A
1,287	98		Unconnected pavement, HSG A
1,852	72		Dirt roads, HSG A
81,776	43	42	Weighted Average, UI Adjusted
80,489			98.43% Pervious Area
1,287			1.57% Impervious Area
1,287			100.00% Unconnected

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

Subcatchment P-1: Northern Grassed Area to Wetlands



Summary for Subcatchment P-10: Area Around Isolated Wetland

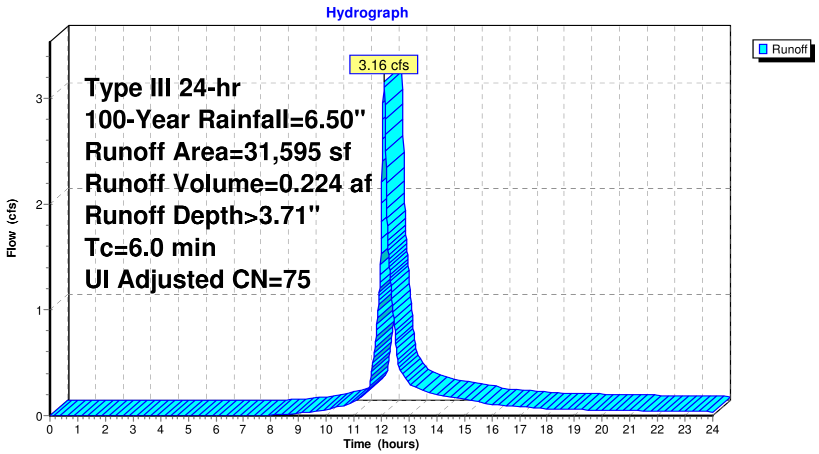
Runoff = 3.16 cfs @ 12.09 hrs, Volume= 0.224 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

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

Subcatchment P-10: Area Around Isolated Wetland



Summary for Subcatchment P-2: Existing Drive to Existing Basin

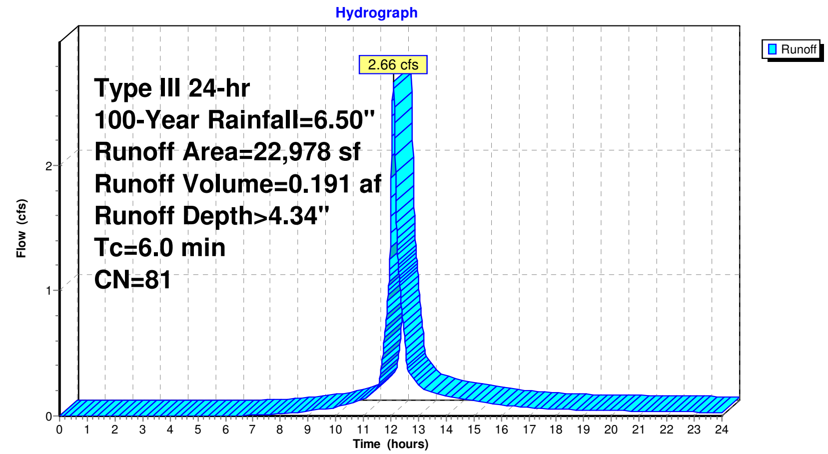
Runoff = 2.66 cfs @ 12.09 hrs, Volume= 0.191 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
6,902	98	Unconnected pavement, HSG A
1,353	76	Gravel roads, HSG A
4,824	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
3,632	98	Unconnected pavement, HSG B
3,217	98	Unconnected pavement, HSG C
22,978	81	Weighted Average
9,227		40.16% Pervious Area
13,751		59.84% Impervious Area
13,751		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6.0 TC**

Subcatchment P-2: Existing Drive to Existing Basin



Summary for Subcatchment P-3: Area Around Isolated Wetland

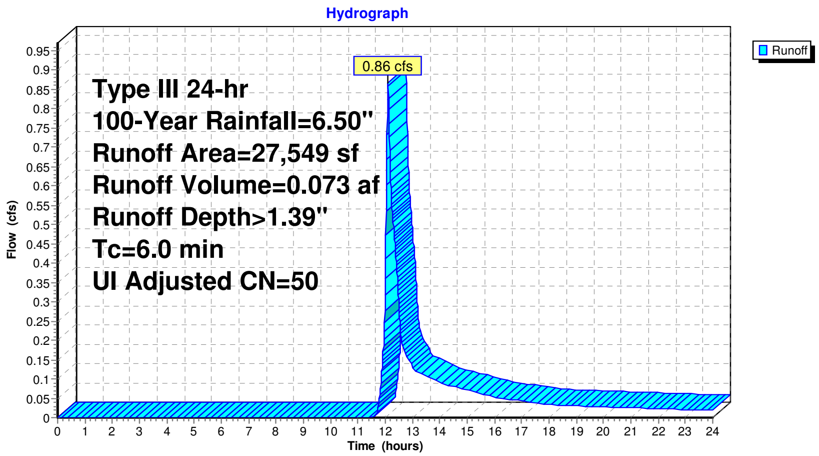
Runoff = 0.86 cfs @ 12.10 hrs, Volume= 0.073 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
3,512	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,549	53	50	Weighted Average, UI Adjusted
24,037			87.25% Pervious Area
3,512			12.75% Impervious Area
3,512			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

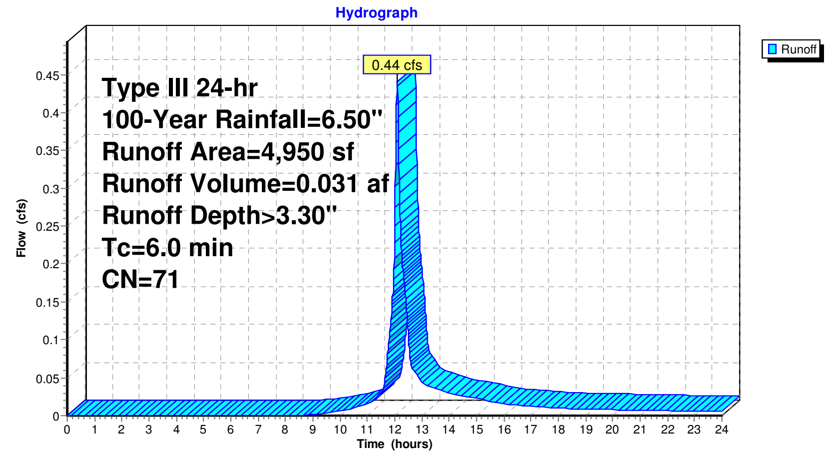
Runoff = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af, Depth> 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

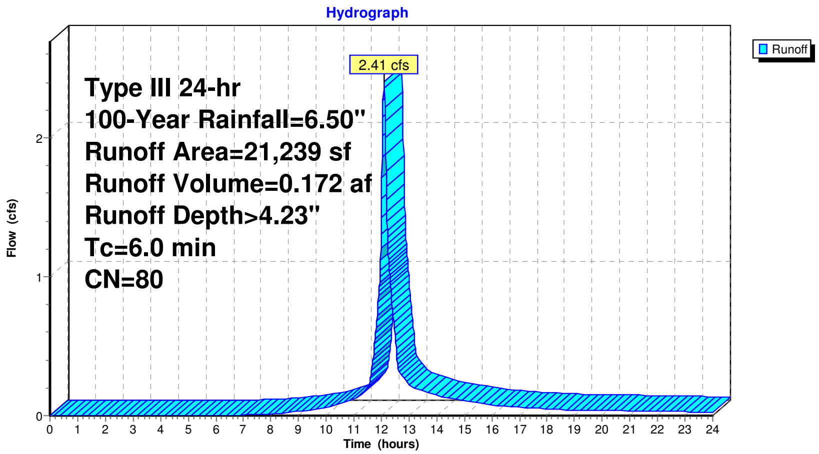
Runoff = 2.41 cfs @ 12.09 hrs, Volume= 0.172 af, Depth> 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
13,306	98	Paved parking, HSG A
5,234	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,239	80	Weighted Average
7,933		37.35% Pervious Area
13,306		62.65% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

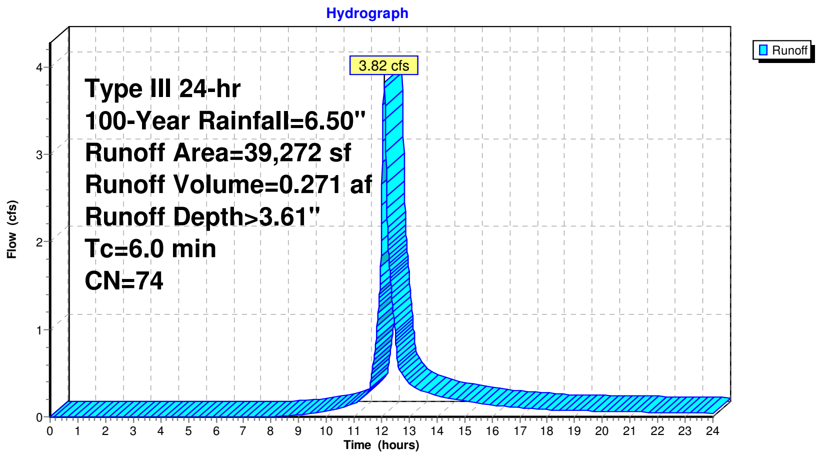
Runoff = 3.82 cfs @ 12.09 hrs, Volume= 0.271 af, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
19,875	98	Paved parking, HSG A
14,088	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
596	98	Unconnected pavement, HSG C
39,272	74	Weighted Average
18,801		47.87% Pervious Area
20,471		52.13% Impervious Area
596		2.91% Unconnected

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

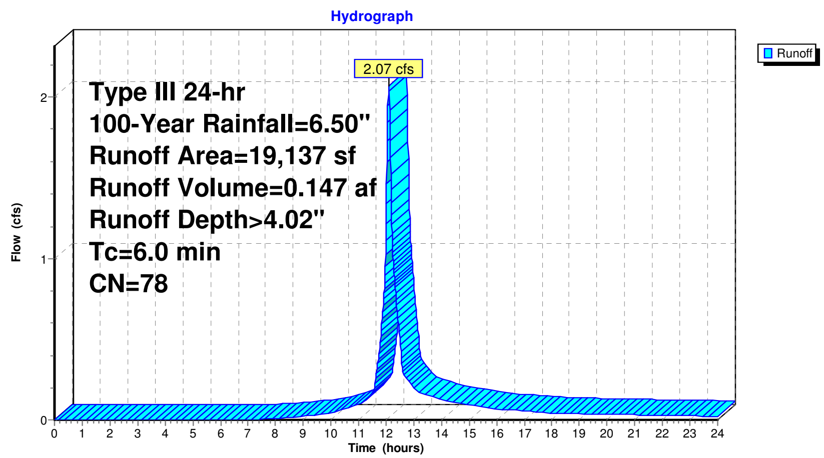
Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.147 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

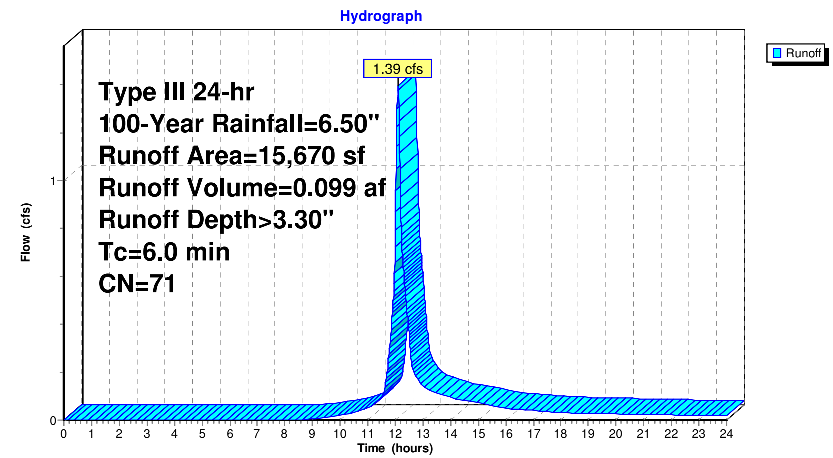
Runoff = 1.39 cfs @ 12.09 hrs, Volume= 0.099 af, Depth> 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Summary for Subcatchment P-8: Surface Infiltration Pond Area

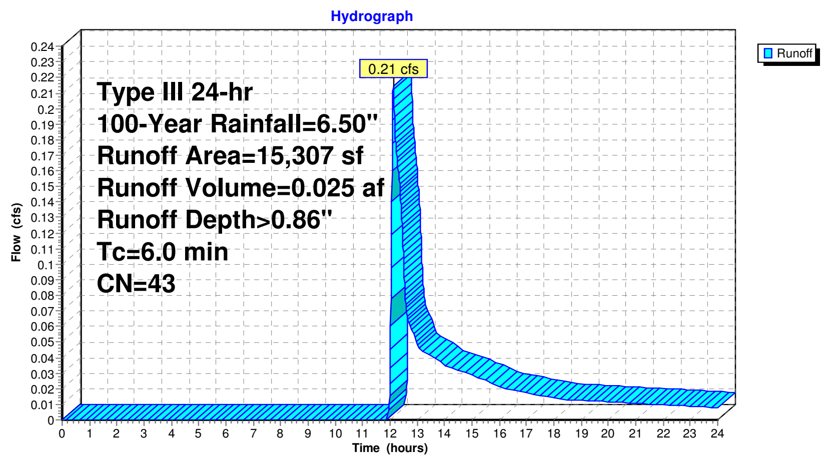
Runoff = 0.21 cfs @ 12.12 hrs, Volume= 0.025 af, Depth> 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

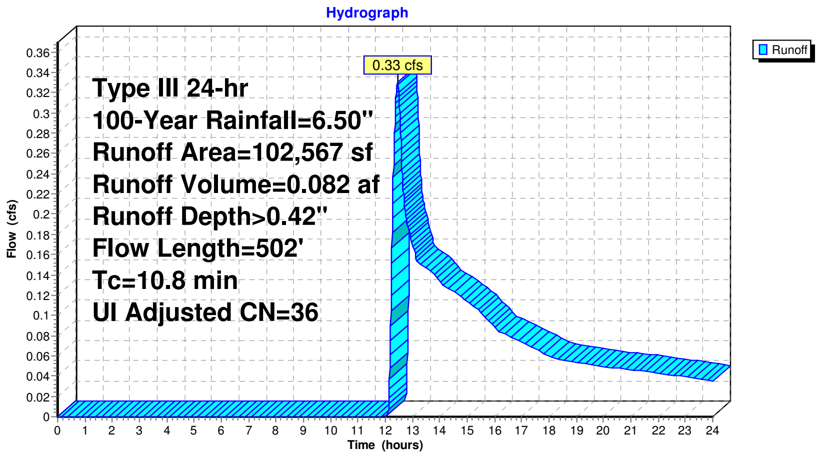
Runoff = 0.33 cfs @ 12.45 hrs, Volume= 0.082 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.8	502	Total			

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands



Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

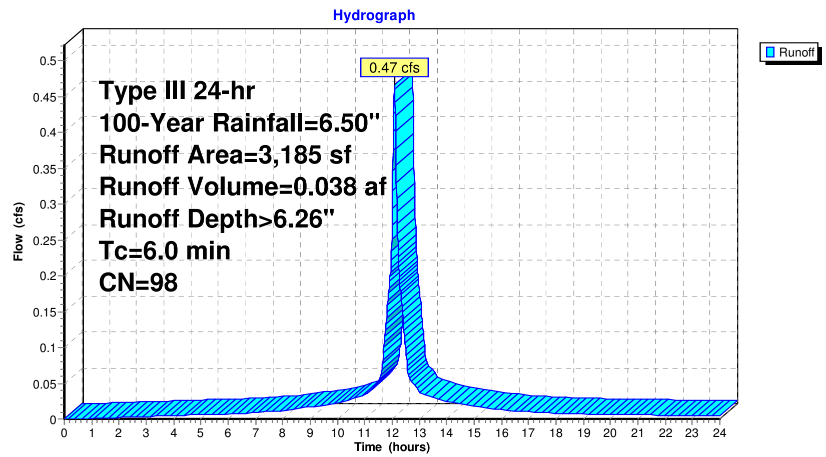
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

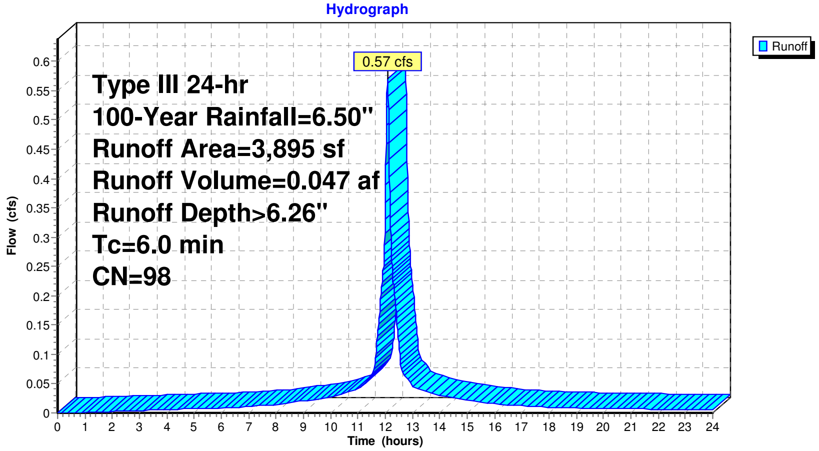
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

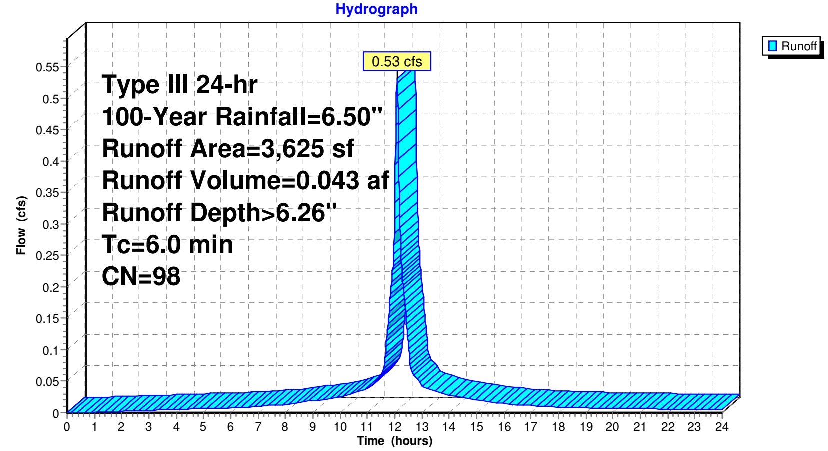
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

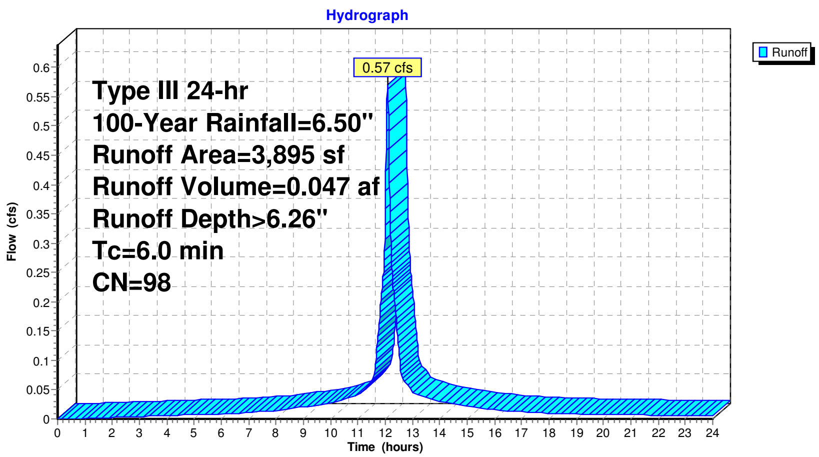
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)



Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

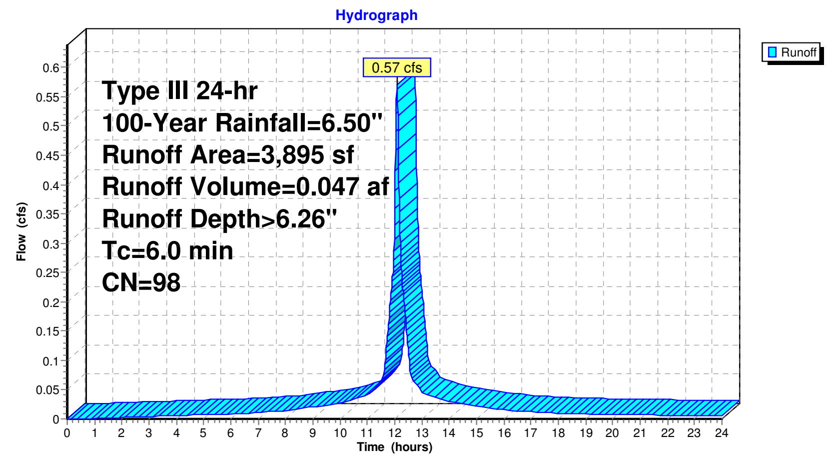
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

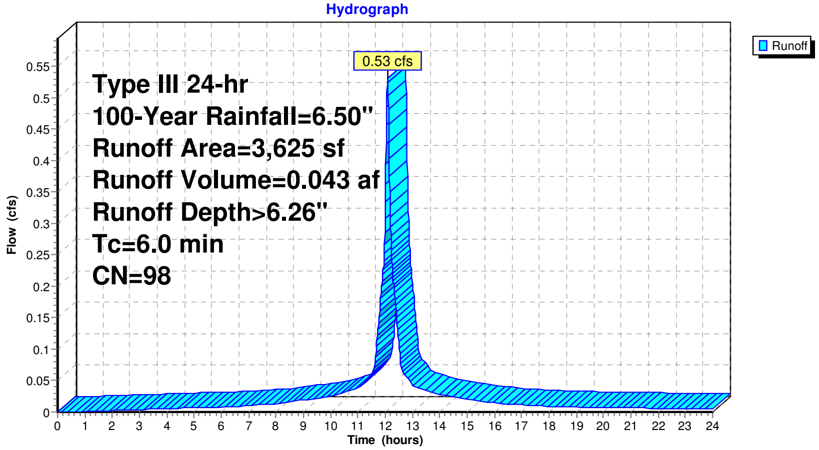
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

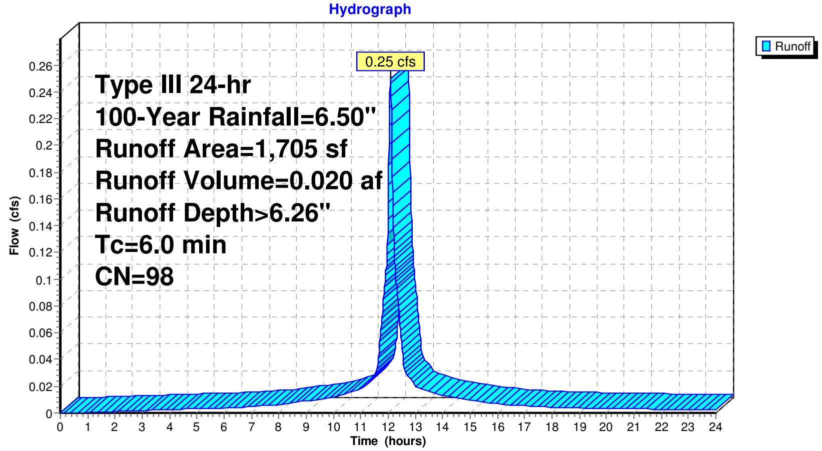
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,705	98	Unconnected roofs, HSG A
1,705		100.00% Impervious Area
1,705		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

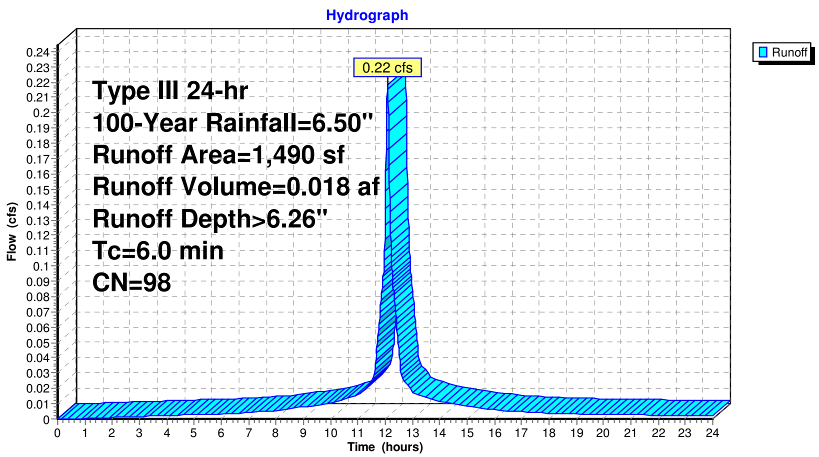
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

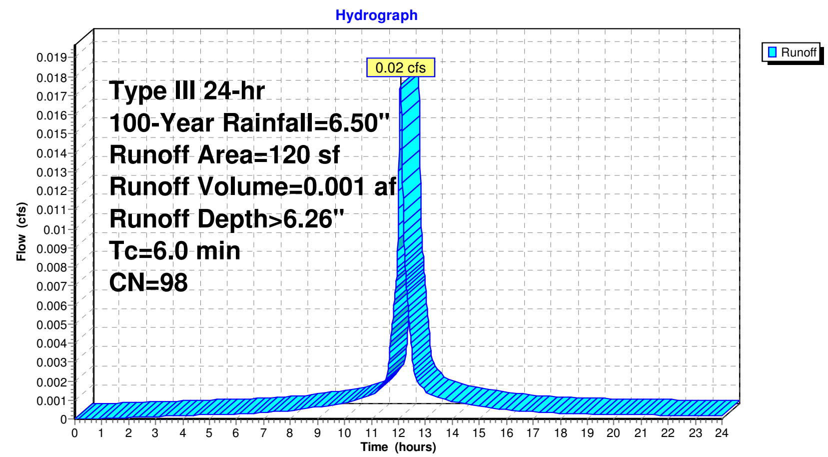
Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

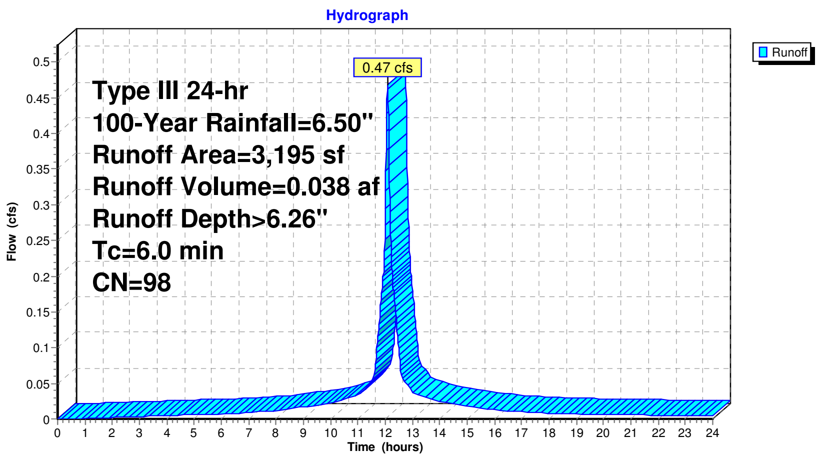
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

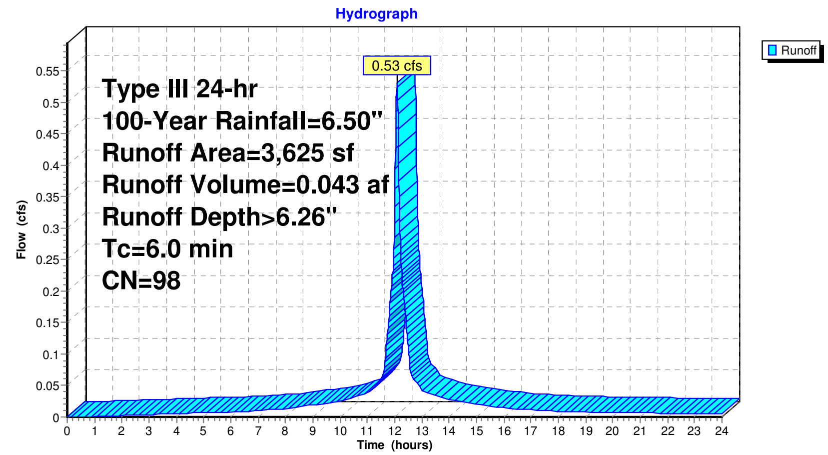
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

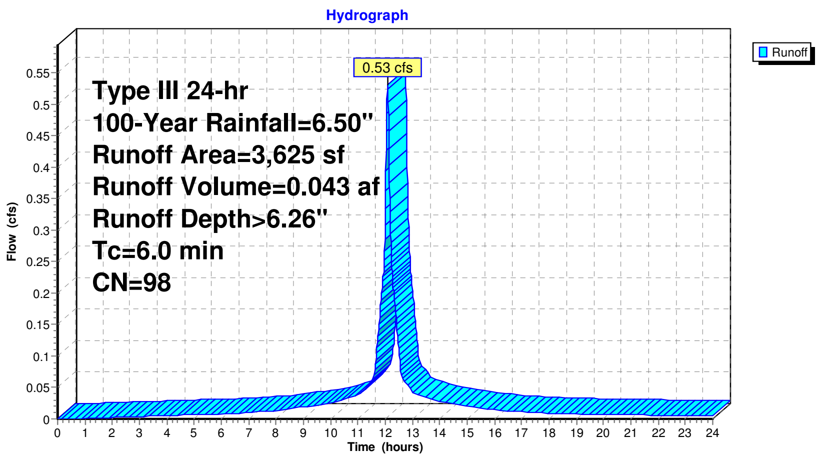
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

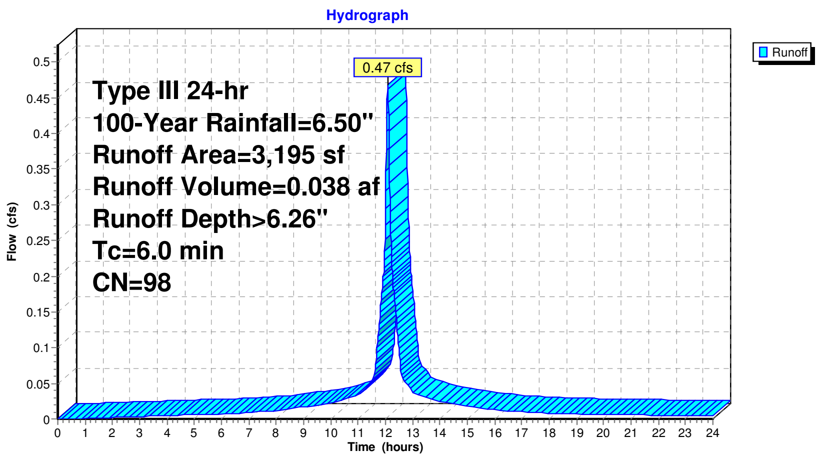
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

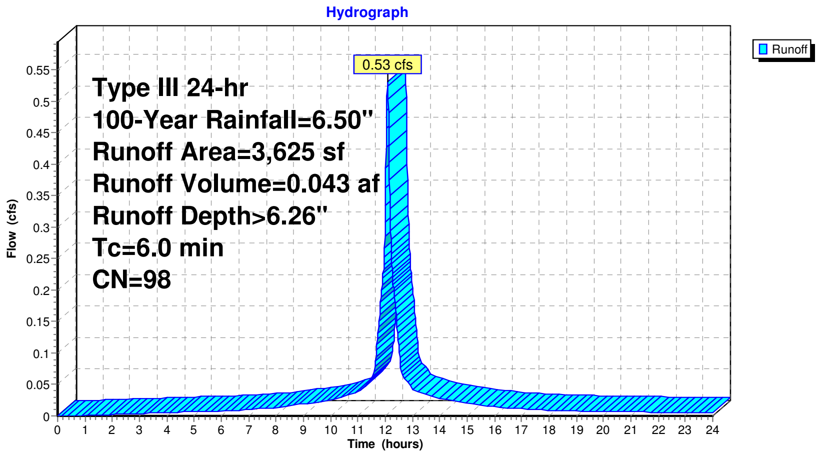
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

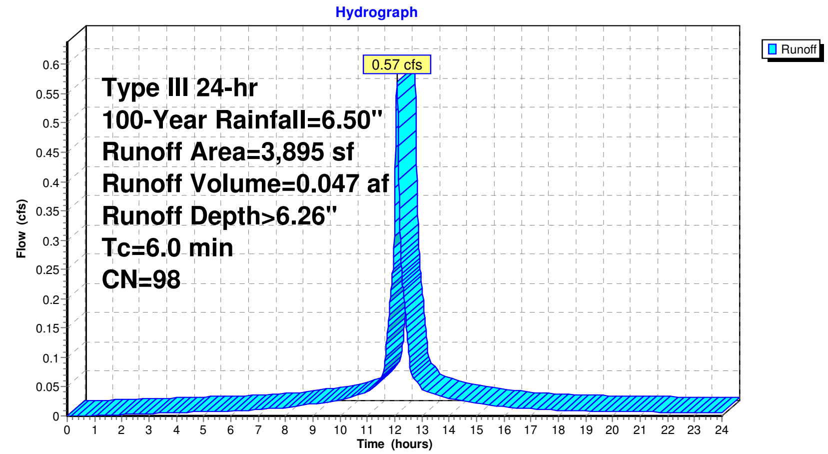
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

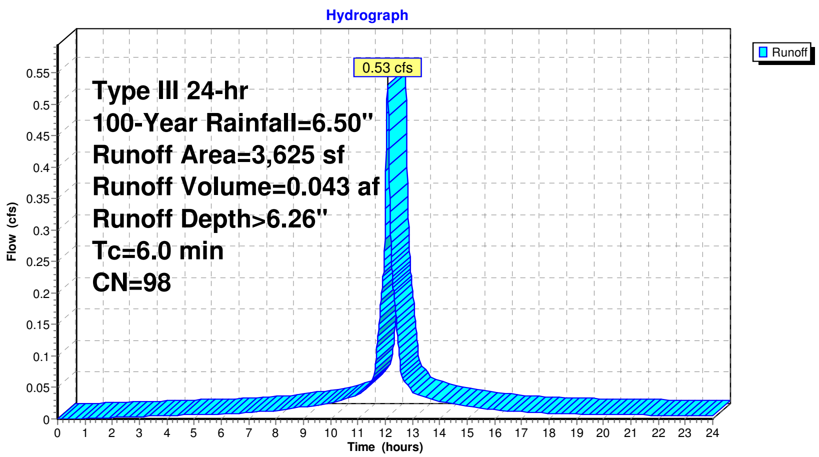
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

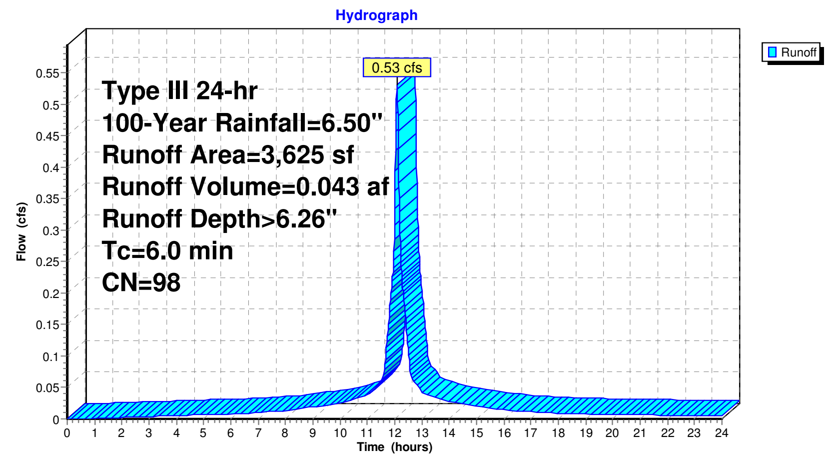
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)



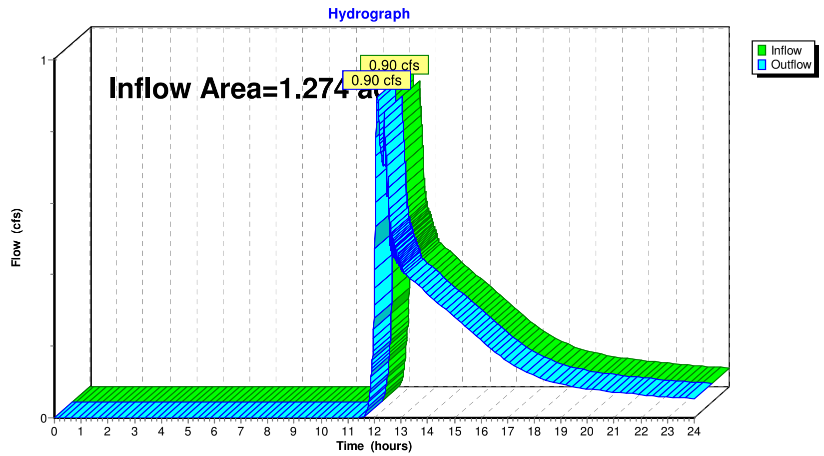
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 1.84" for 100-Year event
Inflow = 0.90 cfs @ 12.12 hrs, Volume= 0.196 af
Outflow = 0.90 cfs @ 12.12 hrs, Volume= 0.196 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-1: Wetlands South of Driveway



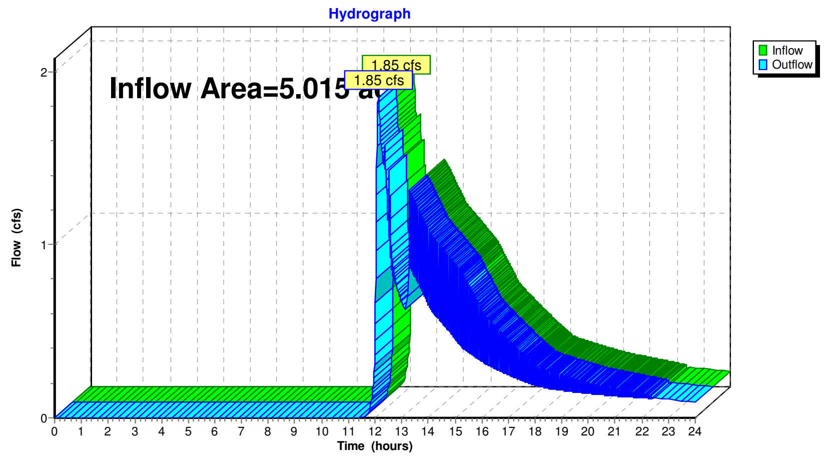
Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.015 ac, 29.33% Impervious, Inflow Depth > 1.00" for 100-Year event
Inflow = 1.85 cfs @ 12.13 hrs, Volume= 0.418 af
Outflow = 1.85 cfs @ 12.13 hrs, Volume= 0.418 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-2: Large Wetland Area East



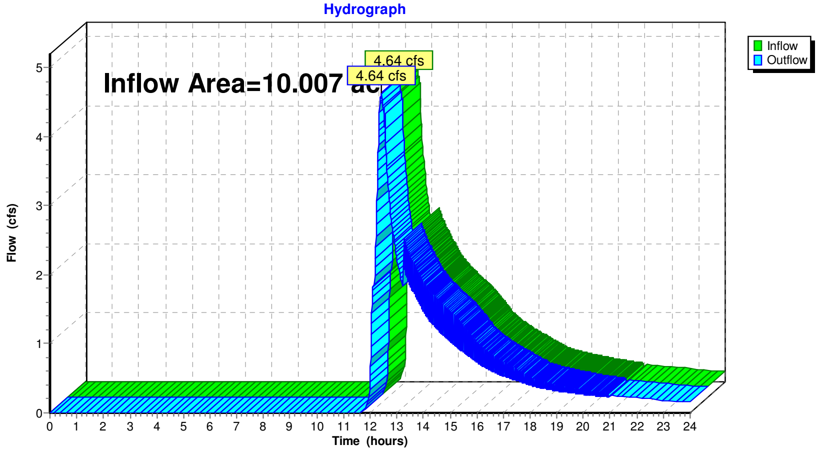
Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.007 ac, 30.25% Impervious, Inflow Depth > 1.04" for 100-Year event
Inflow = 4.64 cfs @ 12.42 hrs, Volume= 0.867 af
Outflow = 4.64 cfs @ 12.42 hrs, Volume= 0.867 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach SP-3: Large Wetland Area West



Summary for Pond 3P: 12 Inch Culvert

[57] Hint: Peaked at 57.10' (Flood elevation advised)

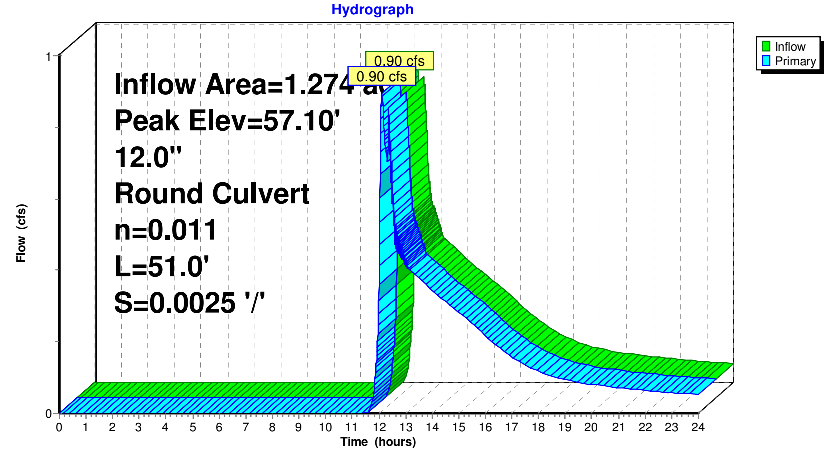
Inflow Area = 1.274 ac, 33.91% Impervious, Inflow Depth > 1.84" for 100-Year event
Inflow = 0.90 cfs @ 12.12 hrs, Volume= 0.196 af
Outflow = 0.90 cfs @ 12.12 hrs, Volume= 0.196 af, Atten= 0%, Lag= 0.0 min
Primary = 0.90 cfs @ 12.12 hrs, Volume= 0.196 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.10' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.51'	**12.0" Round RCP_Round 12"** L= 51.0' Ke= 0.200 Inlet / Outlet Invert= 56.51' / 56.38' S= 0.0025 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.90 cfs @ 12.12 hrs HW=57.10' (Free Discharge)
↑—1=RCP_Round 12" (Barrel Controls 0.90 cfs @ 2.68 fps)

Pond 3P: 12 Inch Culvert



Summary for Pond D-1: Surface Infiltration Pond

[58] Hint: Peaked 0.84' above defined flood level
[79] Warning: Submerged Pond UIS-3 Primary device # 2 OUTLET by 0.14'

Inflow Area = 2.637 ac, 56.99% Impervious, Inflow Depth > 3.63" for 100-Year event
Inflow = 10.97 cfs @ 12.09 hrs, Volume= 0.799 af
Outflow = 3.06 cfs @ 12.46 hrs, Volume= 0.497 af, Atten= 72%, Lag= 22.1 min
Discarded = 0.12 cfs @ 12.46 hrs, Volume= 0.130 af
Primary = 2.94 cfs @ 12.46 hrs, Volume= 0.367 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 70.84' @ 12.46 hrs Surf.Area= 5,273 sf Storage= 16,567 cf
Flood Elev= 70.00' Surf.Area= 4,583 sf Storage= 12,420 cf

Plug-Flow detention time= 194.0 min calculated for 0.497 af (62% of inflow)
Center-of-Mass det. time= 94.5 min (903.0 - 808.6)

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

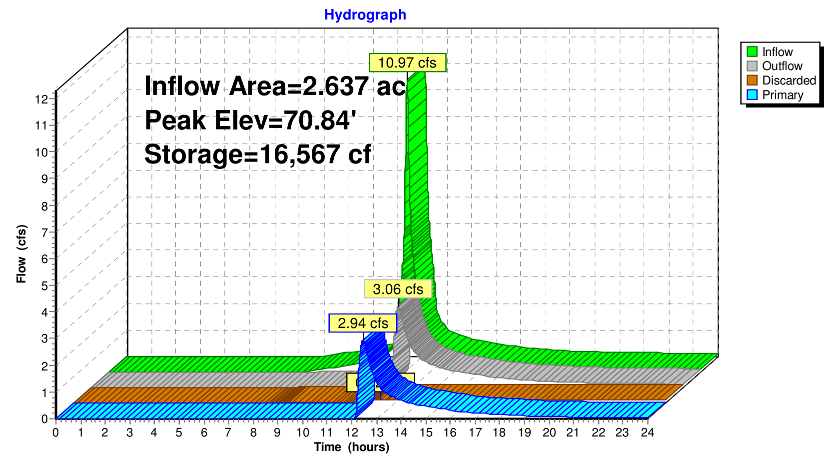
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	70.10'	**18.0" Round Culvert** L= 234.0' Ke= 0.200 Inlet / Outlet Invert= 70.10' / 67.00' S= 0.0132 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.12 cfs @ 12.46 hrs HW=70.84' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=2.93 cfs @ 12.46 hrs HW=70.84' (Free Discharge)
└**2=Culvert** (Barrel Controls 2.93 cfs @ 4.92 fps)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

[58] Hint: Peaked 0.62' above defined flood level

Inflow Area = 0.528 ac, 59.84% Impervious, Inflow Depth > 4.34" for 100-Year event
Inflow = 2.66 cfs @ 12.09 hrs, Volume= 0.191 af
Outflow = 0.28 cfs @ 12.87 hrs, Volume= 0.120 af, Atten= 89%, Lag= 46.8 min
Primary = 0.28 cfs @ 12.87 hrs, Volume= 0.120 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.70' @ 12.87 hrs Surf.Area= 3,090 sf Storage= 4,642 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

Plug-Flow detention time= 241.1 min calculated for 0.120 af (63% of inflow)
Center-of-Mass det. time= 139.9 min (947.6 - 807.7)

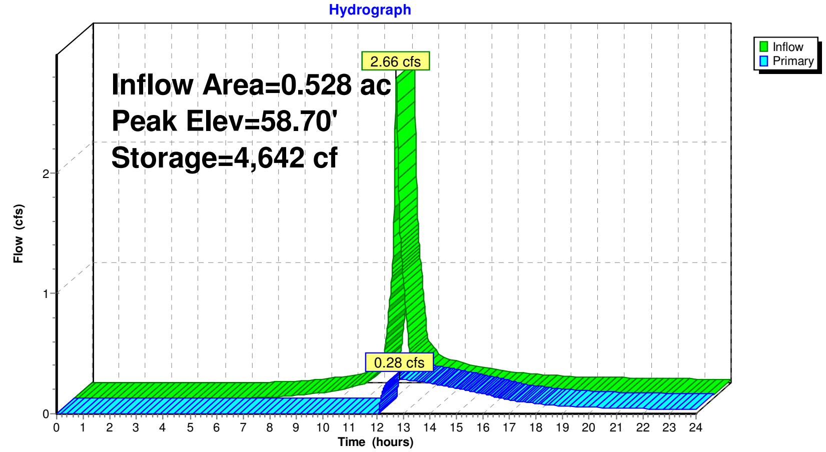
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	58.80'	**8.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.28 cfs @ 12.87 hrs HW=58.70' (Free Discharge)
—**1=Orifice/Grate** (Orifice Controls 0.28 cfs @ 3.25 fps)
—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

[93] Warning: Storage range exceeded by 0.06'
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=50)

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 3.30" for 100-Year event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af
Outflow = 0.21 cfs @ 12.36 hrs, Volume= 0.031 af, Atten= 53%, Lag= 16.2 min
Discarded = 0.04 cfs @ 12.35 hrs, Volume= 0.029 af
Primary = 0.17 cfs @ 12.36 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 64.06' @ 12.36 hrs Surf.Area= 650 sf Storage= 478 cf

Plug-Flow detention time= 130.5 min calculated for 0.031 af (100% of inflow)
Center-of-Mass det. time= 130.1 min (961.4 - 831.3)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

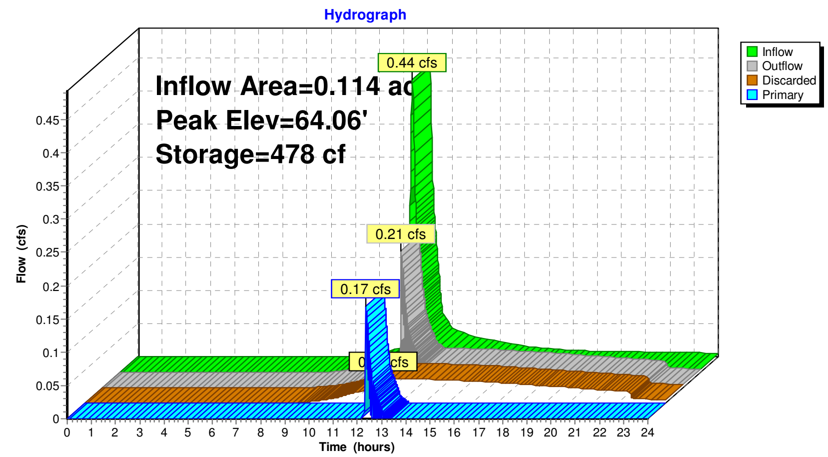
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	**2.410 in/hr Exfiltration over Horizontal area**

Discarded OutFlow Max=0.04 cfs @ 12.35 hrs HW=64.04' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.17 cfs @ 12.36 hrs HW=64.06' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.17 cfs @ 0.57 fps)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

[93] Warning: Storage range exceeded by 1.99'
[58] Hint: Peaked 0.09' above defined flood level
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=490)

Inflow Area = 1.480 ac, 42.24% Impervious, Inflow Depth > 4.34" for 100-Year event
Inflow = 7.26 cfs @ 12.09 hrs, Volume= 0.535 af
Outflow = 0.80 cfs @ 13.27 hrs, Volume= 0.214 af, Atten= 89%, Lag= 71.0 min
Discarded = 0.08 cfs @ 8.82 hrs, Volume= 0.119 af
Primary = 0.71 cfs @ 13.27 hrs, Volume= 0.096 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 68.49' @ 13.27 hrs Surf.Area= 3,486 sf Storage= 13,981 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,981 cf

Plug-Flow detention time= 251.3 min calculated for 0.214 af (40% of inflow)
Center-of-Mass det. time= 119.6 min (917.4 - 797.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,786 cf	**50.50'W x 69.03'L x 6.50'H Field A**
			22,660 cf Overall - 8,195 cf Embedded = 14,465 cf x 40.0% Voids
#2A	61.00'	8,195 cf	**Cultec R-902HD** x 126 Inside #1
			Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
			Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
			7 Rows of 18 Chambers
			Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
		13,981 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	68.40'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 8.82 hrs HW=60.08' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.70 cfs @ 13.27 hrs HW=68.49' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.70 cfs @ 0.98 fps)

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

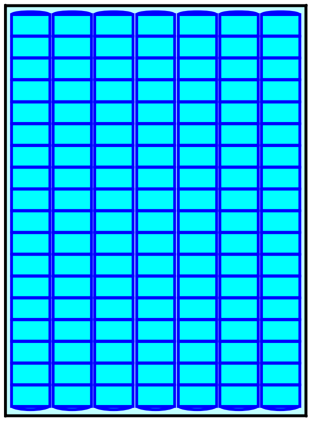
18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03' Base Length
7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width
12.0" Base + 48.0" Chamber Height + 18.0" Cover = 6.50' Field Height

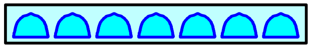
126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.3 cf Chamber Storage

22,660.2 cf Field - 8,195.3 cf Chambers = 14,464.9 cf Stone x 40.0% Voids = 5,786.0 cf Stone Storage

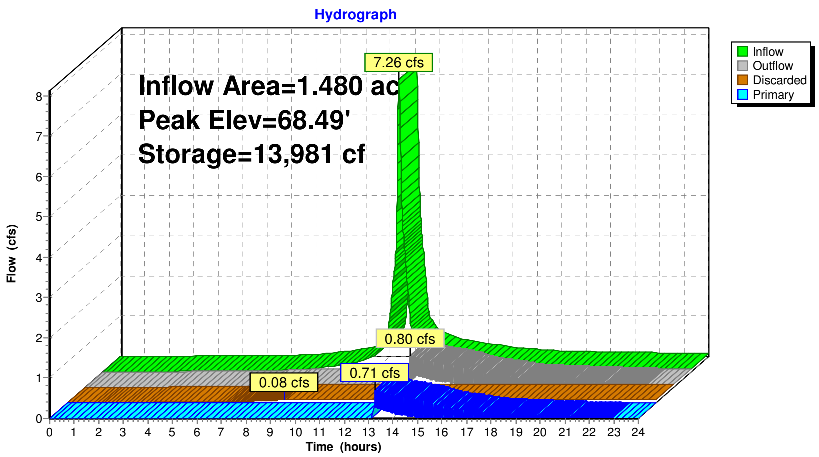
Chamber Storage + Stone Storage = 13,981.2 cf = 0.321 af
Overall Storage Efficiency = 61.7%
Overall System Size = 69.03' x 50.50' x 6.50'

126 Chambers
839.3 cy Field
535.7 cy Stone





Pond UIS-1: UIS at Entrance



Summary for Pond UIS-2: UIS at North of Site

[93] Warning: Storage range exceeded by 2.91'
[58] Hint: Peaked 0.20' above defined flood level
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=17)

Inflow Area = 0.384 ac,100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 2.45 cfs @ 12.08 hrs, Volume= 0.200 af
Outflow = 0.65 cfs @ 12.53 hrs, Volume= 0.200 af, Atten= 73%, Lag= 26.8 min
Discarded = 0.23 cfs @ 11.33 hrs, Volume= 0.198 af
Primary = 0.43 cfs @ 12.53 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 68.45' @ 12.53 hrs Surf.Area= 1,176 sf Storage= 2,860 cf
Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 84.5 min calculated for 0.200 af (100% of inflow)
Center-of-Mass det. time= 84.2 min (827.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	**16.00'W x 73.50'L x 4.04'H Field A**
			4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	**Cultec R-330XLHD** x 30 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	68.25'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.33 hrs HW=61.57' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.42 cfs @ 12.53 hrs HW=68.45' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.42 cfs @ 2.15 fps)

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

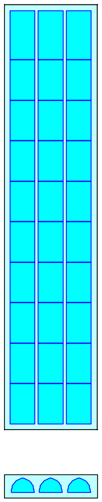
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

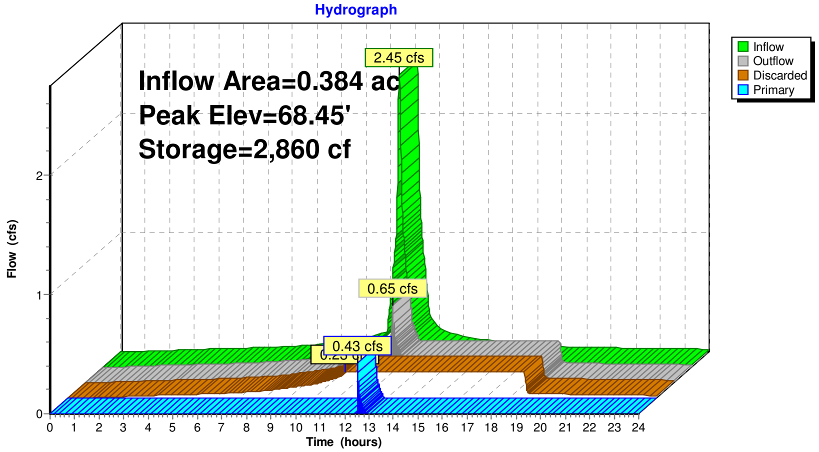
4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af
Overall Storage Efficiency = 60.2%
Overall System Size = 73.50' x 16.00' x 4.04'

30 Chambers
176.0 cy Field
116.8 cy Stone



Pond UIS-2: UIS at North of Site



Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.63' above defined flood level

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
Outflow = 0.53 cfs @ 12.09 hrs, Volume= 0.041 af, Atten= 1%, Lag= 0.7 min
Discarded = 0.00 cfs @ 1.97 hrs, Volume= 0.005 af
Primary = 0.52 cfs @ 12.09 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.84' @ 12.09 hrs Surf.Area= 103 sf Storage= 141 cf
Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 59.0 min calculated for 0.041 af (94% of inflow)
Center-of-Mass det. time= 25.2 min (768.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.40'	**6.0" Round Culvert** L= 30.0' Ke= 0.200
			Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=71.72' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.52 cfs @ 12.09 hrs HW=73.84' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.52 cfs @ 2.83 fps)

Pond UIS-3: UIS-3 - 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 2 rows

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

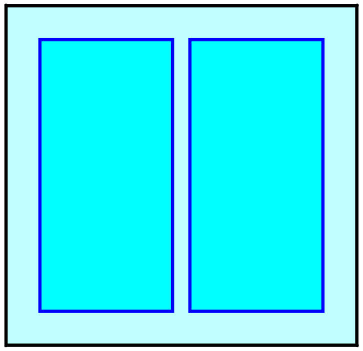
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

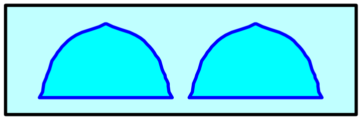
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

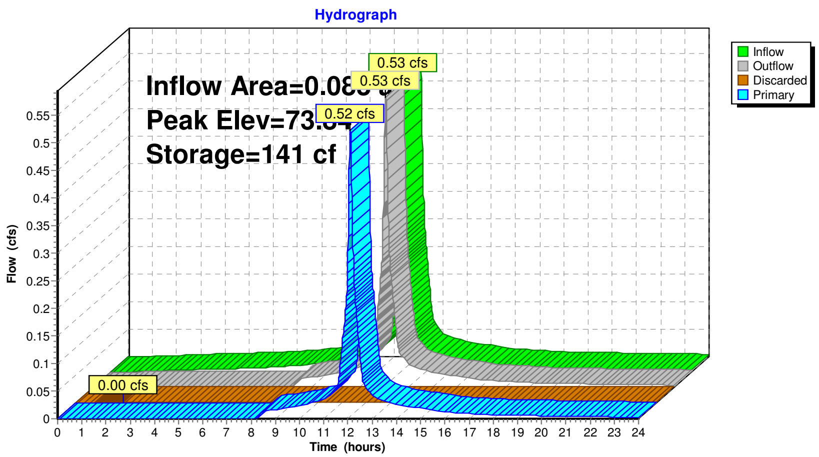
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-3: UIS-3



Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.65' above defined flood level

Inflow Area = 0.073 ac,100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.036 af, Atten= 4%, Lag= 1.4 min
Discarded = 0.00 cfs @ 2.21 hrs, Volume= 0.005 af
Primary = 0.45 cfs @ 12.11 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.85' @ 12.11 hrs Surf.Area= 103 sf Storage= 153 cf
Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 64.5 min calculated for 0.036 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (770.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.20'	**6.0" Round Culvert** L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.21 hrs HW=72.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.45 cfs @ 12.11 hrs HW=74.84' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.45 cfs @ 2.27 fps)

Pond UIS-4: UIS-4 - 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 2 rows

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

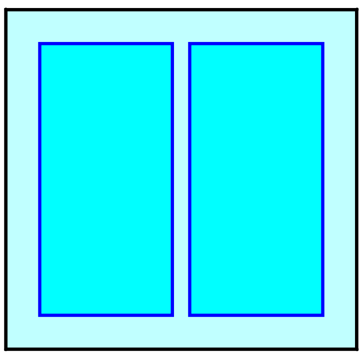
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

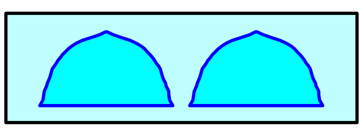
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

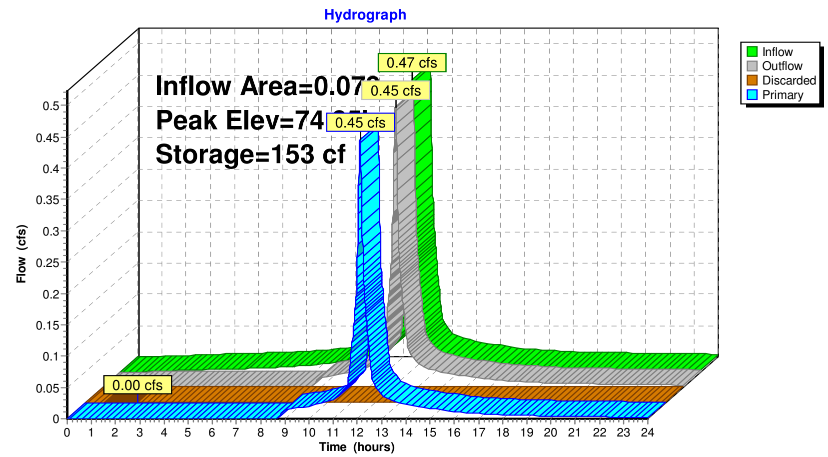
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-4: UIS-4



Summary for Pond UIS-5: UIS-5

Inflow Area =	0.083 ac,100.00% Impervious,	Inflow Depth > 6.26"	for 100-Year event
Inflow =	0.53 cfs @ 12.08 hrs,	Volume= 0.043 af	
Outflow =	0.51 cfs @ 12.11 hrs,	Volume= 0.041 af,	Atten= 5%, Lag= 1.5 min
Discarded =	0.00 cfs @ 1.97 hrs,	Volume= 0.005 af	
Primary =	0.50 cfs @ 12.11 hrs,	Volume= 0.036 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 75.56' @ 12.11 hrs Surf.Area= 103 sf Storage= 159 cf

Plug-Flow detention time= 59.8 min calculated for 0.041 af (94% of inflow)
Center-of-Mass det. time= 25.9 min (769.3 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.80'	**6.0" Round Culvert** L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=73.12' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.50 cfs @ 12.11 hrs HW=75.55' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.50 cfs @ 2.56 fps)

Pond UIS-5: UIS-5 - 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 2 rows

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

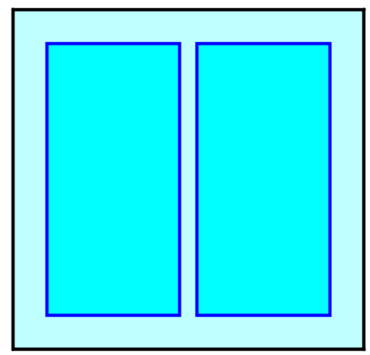
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

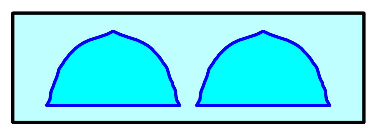
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

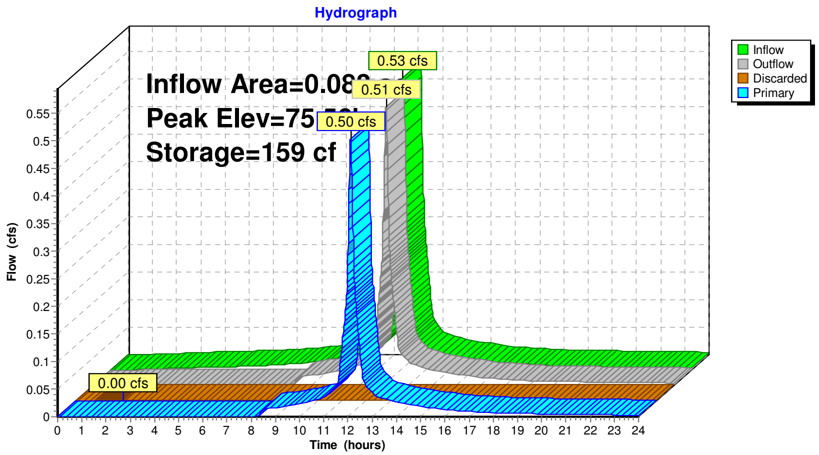
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-5: UIS-5



Summary for Pond UIS-6: UIS-6

```
Inflow Area =      0.089 ac,100.00% Impervious,  Inflow Depth >  6.26"   for  100-Year event
Inflow      =      0.57 cfs @  12.08 hrs,  Volume=        0.047 af
Outflow     =      0.54 cfs @  12.11 hrs,  Volume=        0.044 af,  Atten= 5%,  Lag= 1.5 min
Discarded   =      0.00 cfs @   1.86 hrs,  Volume=        0.005 af
Primary     =      0.54 cfs @  12.11 hrs,  Volume=        0.039 af
```

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.83' @ 12.11 hrs Surf.Area= 103 sf Storage= 163 cf

Plug-Flow detention time= 57.1 min calculated for 0.044 af (94% of inflow)
Center-of-Mass det. time= 25.0 min (768.4 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A**
			332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	**Cultec R-280HD** x 2 Inside #1
			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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	74.00'	**6.0" Round Culvert** L= 106.0' Ke= 1.000
			Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 '/' Cc= 0.900
			n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.86 hrs HW=72.32' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.54 cfs @ 12.11 hrs HW=74.83' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.54 cfs @ 2.75 fps)

Pond UIS-6: UIS-6 - 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 2 rows

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

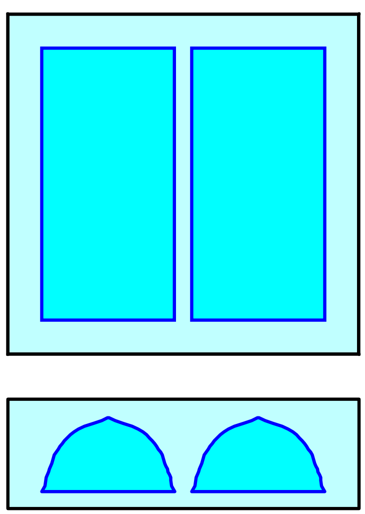
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

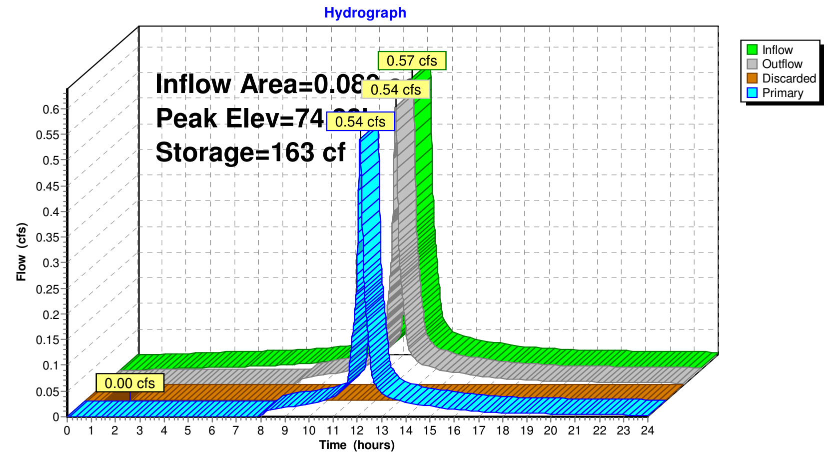
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-6: UIS-6



Summary for Pond UIS-7: UIS-7

Inflow Area =	0.083 ac,100.00% Impervious,	Inflow Depth > 6.26"	for 100-Year event
Inflow =	0.53 cfs @ 12.08 hrs,	Volume=	0.043 af
Outflow =	0.51 cfs @ 12.11 hrs,	Volume=	0.041 af, Atten= 5%, Lag= 1.5 min
Discarded =	0.00 cfs @ 1.97 hrs,	Volume=	0.005 af
Primary =	0.50 cfs @ 12.11 hrs,	Volume=	0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.26' @ 12.11 hrs Surf.Area= 103 sf Storage= 159 cf

Plug-Flow detention time= 59.8 min calculated for 0.041 af (94% of inflow)
Center-of-Mass det. time= 25.9 min (769.3 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	73.50'	**6.0" Round Culvert** L= 17.5' Ke= 1.000 Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=71.82' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.50 cfs @ 12.11 hrs HW=74.25' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.50 cfs @ 2.56 fps)

Pond UIS-7: UIS-7 - 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 2 rows

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

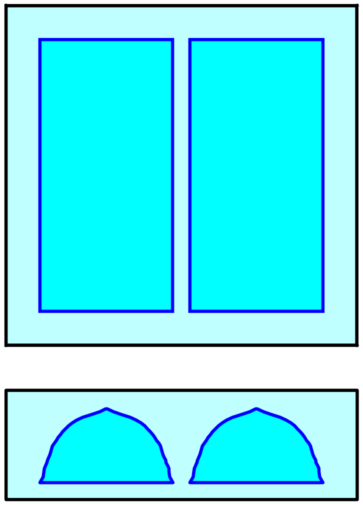
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

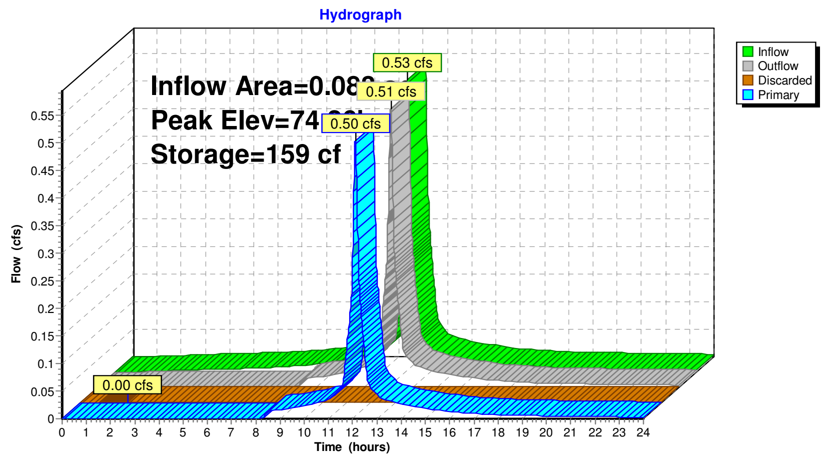
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-7: UIS-7



Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac,100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
Outflow = 0.51 cfs @ 12.11 hrs, Volume= 0.041 af, Atten= 5%, Lag= 1.5 min
Discarded = 0.00 cfs @ 1.97 hrs, Volume= 0.005 af
Primary = 0.50 cfs @ 12.11 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.56' @ 12.11 hrs Surf.Area= 103 sf Storage= 159 cf

Plug-Flow detention time= 59.8 min calculated for 0.041 af (94% of inflow)
Center-of-Mass det. time= 25.9 min (769.3 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.80'	**6.0" Round Culvert** L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=71.12' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.50 cfs @ 12.11 hrs HW=73.55' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.50 cfs @ 2.56 fps)

Pond UIS-8: UIS-8 - 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 2 rows

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

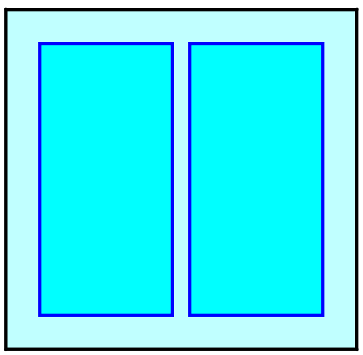
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

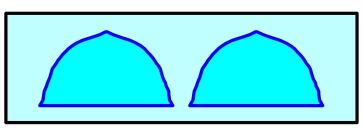
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

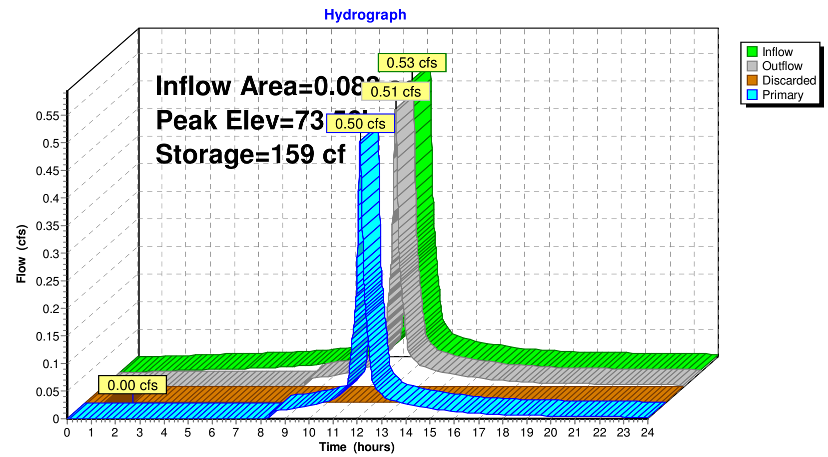
Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone





Pond UIS-8: UIS-8



Summary for Pond UIS-9: UIS-9

Inflow Area =	0.089 ac,100.00% Impervious,	Inflow Depth > 6.26"	for 100-Year event
Inflow =	0.57 cfs @ 12.08 hrs,	Volume=	0.047 af
Outflow =	0.53 cfs @ 12.11 hrs,	Volume=	0.045 af, Atten= 7%, Lag= 1.9 min
Discarded =	0.00 cfs @ 1.86 hrs,	Volume=	0.005 af
Primary =	0.53 cfs @ 12.11 hrs,	Volume=	0.041 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 72.99' @ 12.11 hrs Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 32.1 min calculated for 0.045 af (97% of inflow)
Center-of-Mass det. time= 15.2 min (758.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	**10.33'W x 10.00'L x 3.21'H Field A** 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	**Cultec R-280HD** x 2 Inside #1 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 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	72.18'	**6.0" Round Culvert** L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.86 hrs HW=71.31' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.53 cfs @ 12.11 hrs HW=72.99' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.53 cfs @ 2.69 fps)

Pond UIS-9: UIS-9 - 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 2 rows

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

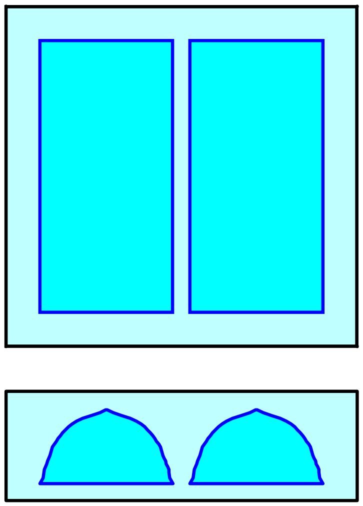
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

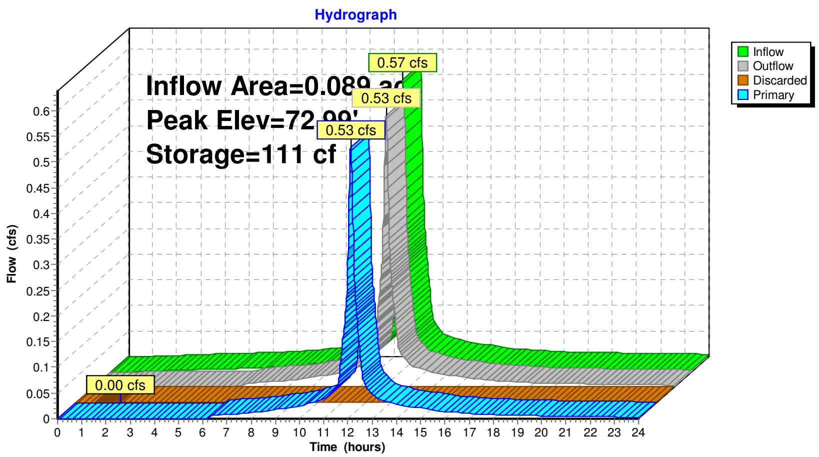
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

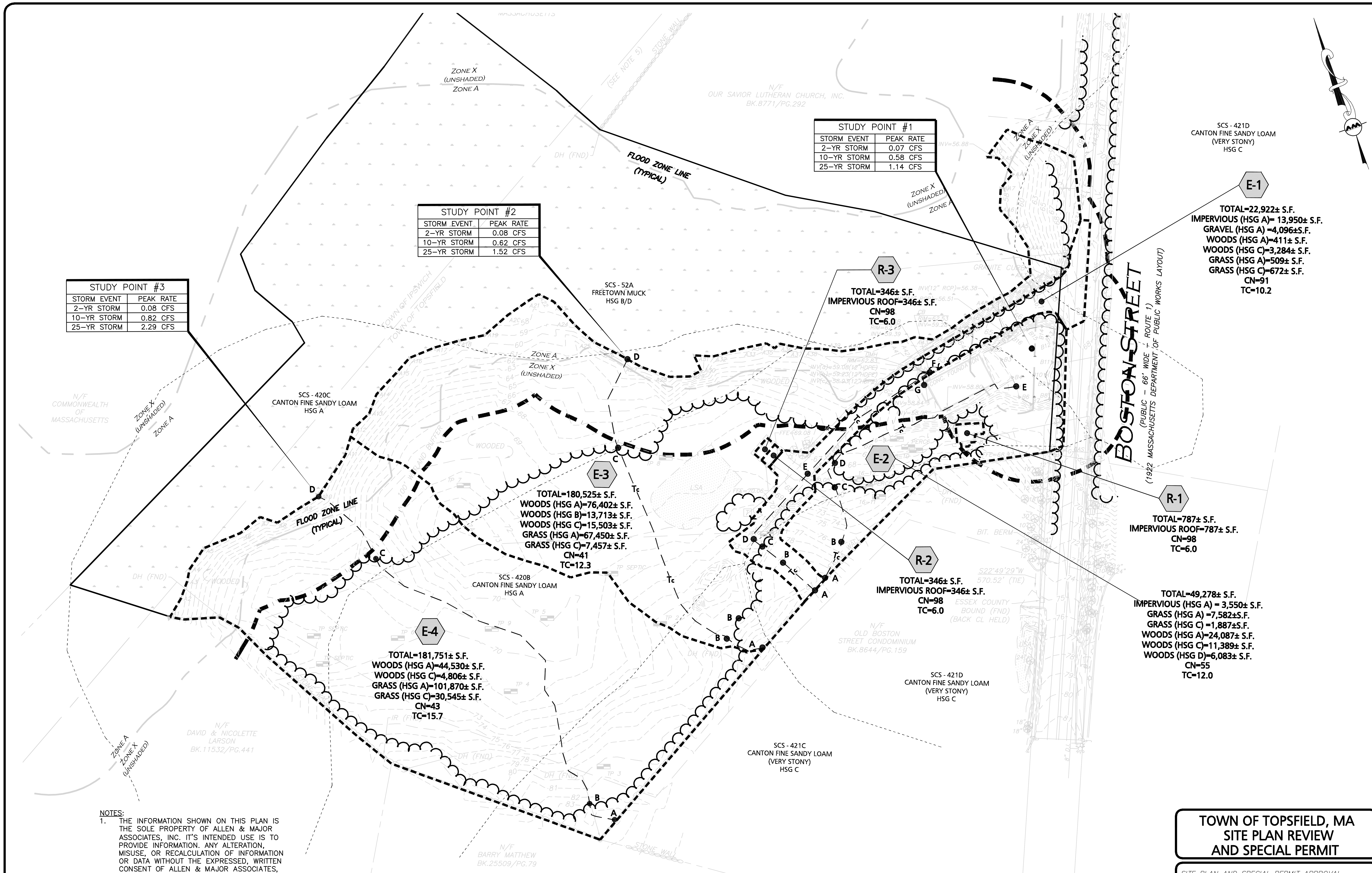
2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-9: UIS-9



Section 5.0 – Drainage Site Plans



STUDY POINT #1

STORM EVENT	PEAK RATE
2-YR STORM	0.07 CFS
10-YR STORM	0.58 CFS
25-YR STORM	1.14 CFS

STUDY POINT #2

STORM EVENT	PEAK RATE
2-YR STORM	0.08 CFS
10-YR STORM	0.62 CFS
25-YR STORM	1.52 CFS

STUDY POINT #3

STORM EVENT	PEAK RATE
2-YR STORM	0.08 CFS
10-YR STORM	0.82 CFS
25-YR STORM	2.29 CFS

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3. SITE IS LOCATED ENTIRELY WITHIN ELDERLY HOUSING DISTRICT (EHD) OVERLAY, KNOWN AS "ROLLING GREEN ELDERLY HOUSING DISTRICT," PER ARTICLE 33 OF ANNUAL AND SPECIAL TOWN MEETING WARRANT FOR FISCAL YEAR 2017, FROM MAY 3, 2016 TOWN MEETING.
4. SITE IS LOCATED WITHIN FEMA FLOODPLAIN ZONE A – AREAS SUBJECT TO INUNDATION BY THE 1-PERCENT-ANNUAL-CHANCE FLOOD EVENT AS SHOWN ON FEMA MAP 25009C0266F, EFFECTIVE DATE JULY 3, 2012.

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1-888-344-7233

LEGEND:

- EX. PROPERTY LINE
- PRE-DEV. WATERSHED AREA
- SCS SOILS BOUNDARY
- WATERSHED NO. (E1)
- EDGE OF WETLANDS
- TIME OF CONCENTRATION (Tc)

TOWN OF TOPSFIELD, MA
SITE PLAN REVIEW
AND SPECIAL PERMIT

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE DATE

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

N:\PROJECTS\2165-01A\CIVIL\DRAWINGS\CURRENT\C-2165-01A - PRE-DEVELOPMENT WATERSHED PLAN.DWG

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ISSUED FOR DRAINAGE REPORT
02-27-2017

PROFESSIONAL ENGINEER FOR ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
2	2-27-2017	REVISIONS PER TOWN COMMENTS
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT\OWNER:
SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=50'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:

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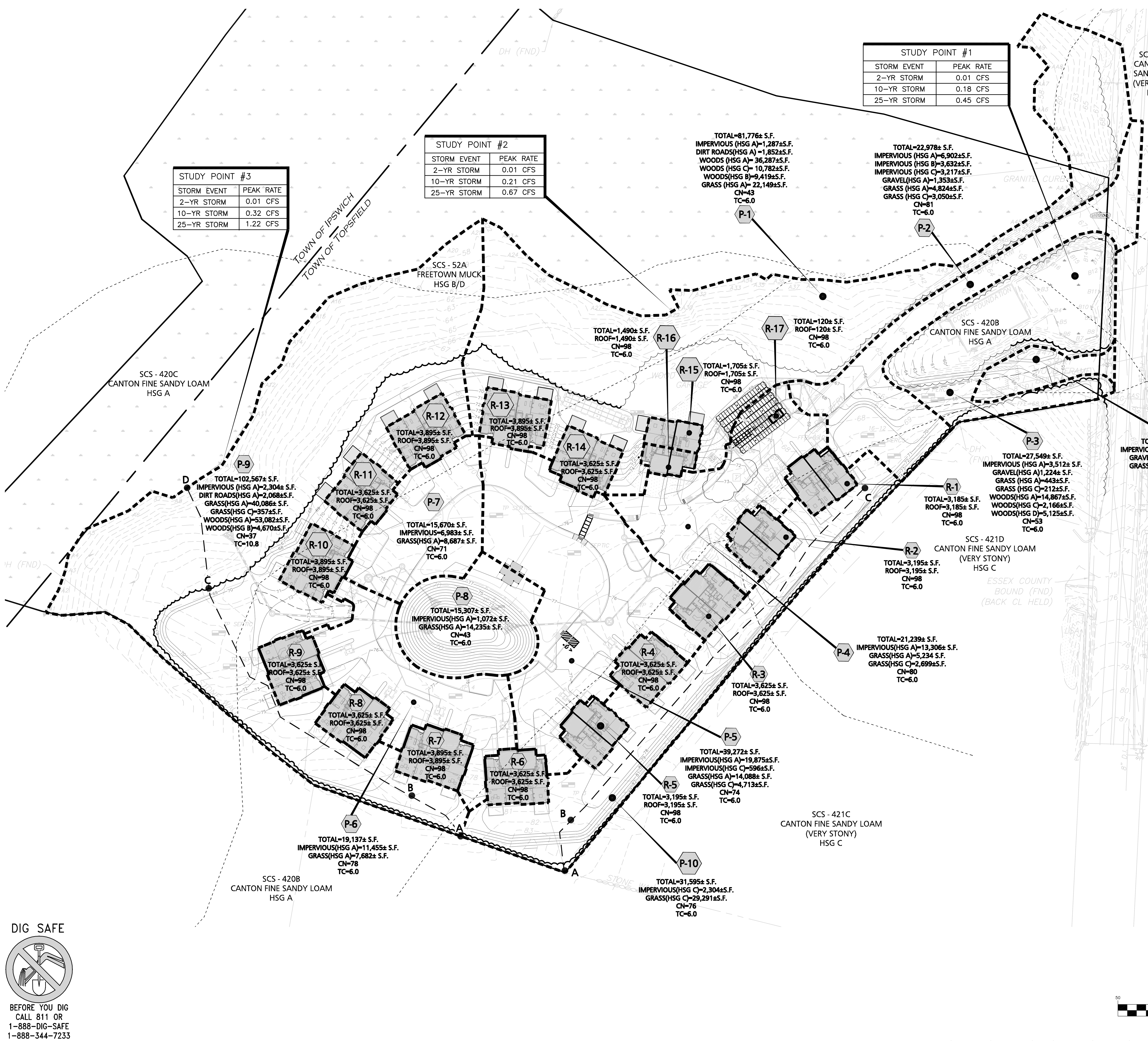
DRAWING TITLE: EXISTING WATERSHED PLAN

SHEET No. EWS



STUDY POINT #1

STORM EVENT	PEAK RATE
2-YR STORM	0.01 CFS
10-YR STORM	0.18 CFS
25-YR STORM	0.45 CFS

STUDY POINT #2

STORM EVENT	PEAK RATE
2-YR STORM	0.01 CFS
10-YR STORM	0.21 CFS
25-YR STORM	0.67 CFS

STUDY POINT #3

STORM EVENT	PEAK RATE
2-YR STORM	0.01 CFS
10-YR STORM	0.32 CFS
25-YR STORM	1.22 CFS

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1-888-344-7233

LEGEND:

- EX. PROPERTY LINE
- POST-DEV. WATERSHED AREA
- SCS SOILS BOUNDARY
- WATERSHED NO. (R-1)
- EDGE OF WETLANDS
- TIME OF CONCENTRATION (Tc)
- EXISTING TREELINE TO REMAIN
- PROPOSED TREELINE

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TOWN OF TOPSFIELD, MA
SITE PLAN REVIEW
AND SPECIAL PERMIT

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE DATE

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

N:\PROJECTS\2165-01A\CIVIL\DRAWINGS\CURRENT\C-2165-01A - POST-DEVELOPMENT WATERSHED PLAN.DWG

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ISSUED FOR DRAINAGE REPORT
02-27-2017

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
2	2-27-2017	REVISIONS PER TOWN COMMENTS
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT\OWNER:
SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=50'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:

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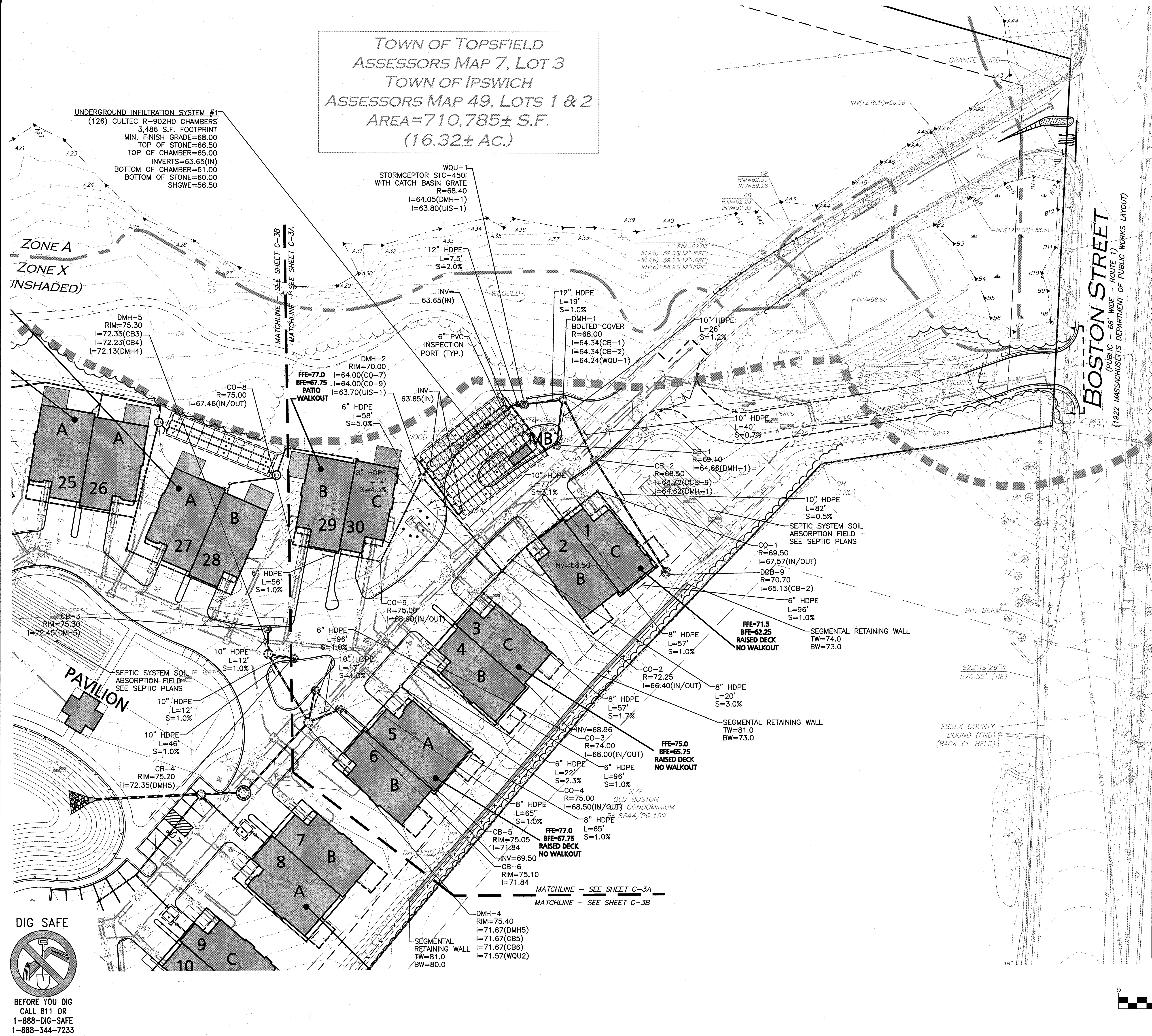
PROPOSED WATERSHED PLAN	PWS



LEGEND:

DRAIN MANHOLE	
CATCH BASIN	
CATCH BASIN - DOUBLE GRATE	
FLARED END SECTION	
DRAIN LINE	
RIPRAP OUTFALL	
OUTLET CONTROL STRUCT.	
5' CONTOUR	
1' CONTOUR	
SPOT GRADE	× 68.50
TOP OF BERM	
DETENTION BASIN	
SAW-CUT LINE	
INFILTRATION SYSTEM	

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**TOWN OF TOPSFIELD, MA
SITE PLAN REVIEW
AND SPECIAL PERMIT**

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE DATE

N:\PROJECTS\2165-01A\CIVIL\DRAWINGS\CURRENT\C-2165-01A - DRAINAGE PLAN.DWG

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TIMOTHY J. WILLIAMS CIVIL No.43119 REGISTERED PROFESSIONAL ENGINEER

2/27/17

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
2	2-27-2017	REVISIONS PER TOWN COMMENTS
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT\OWNER:
SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=30'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

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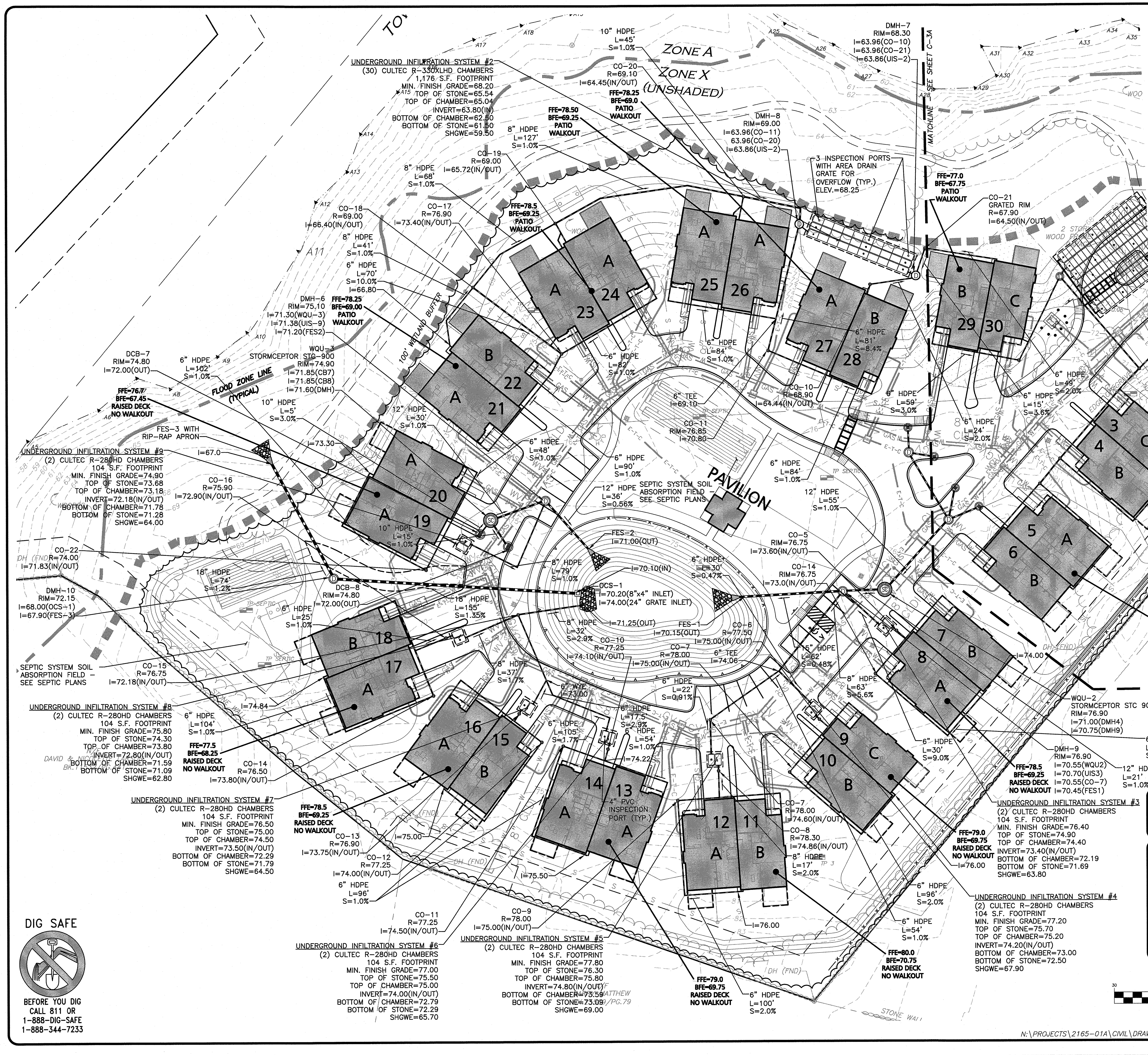
DRAWING TITLE:	SHEET No.
DRAINAGE PLAN	C-4A



LEGEND:

DRAIN MANHOLE	
CATCH BASIN	
CATCH BASIN - DOUBLE GRATE	
FLARED END SECTION	
DRAIN LINE	
RIPRAP OUTFALL	
OUTLET CONTROL STRUCT.	
5' CONTOUR	
1' CONTOUR	
SPOT GRADE	×68.50
TOP OF BERM	
DETENTION BASIN	
SAW-CUT LINE	
INFILTRATION SYSTEM	

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4. ALL ROOF LEADERS ARE TO BE 6" HDPE UNLESS OTHERWISE SPECIFIED.

TOWN OF TOPSFIELD, MA SITE PLAN REVIEW AND SPECIAL PERMIT

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE DATE

GRAPHIC SCALE

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COMMONWEALTH OF MASSACHUSETTS TIMOTHY J. WILLIAMS CIVIL No.43119 REGISTERED PROFESSIONAL ENGINEER

2/27/17

PROFESSIONAL ENGINEER FOR ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
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1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT\OWNER:

SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:

RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=30'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

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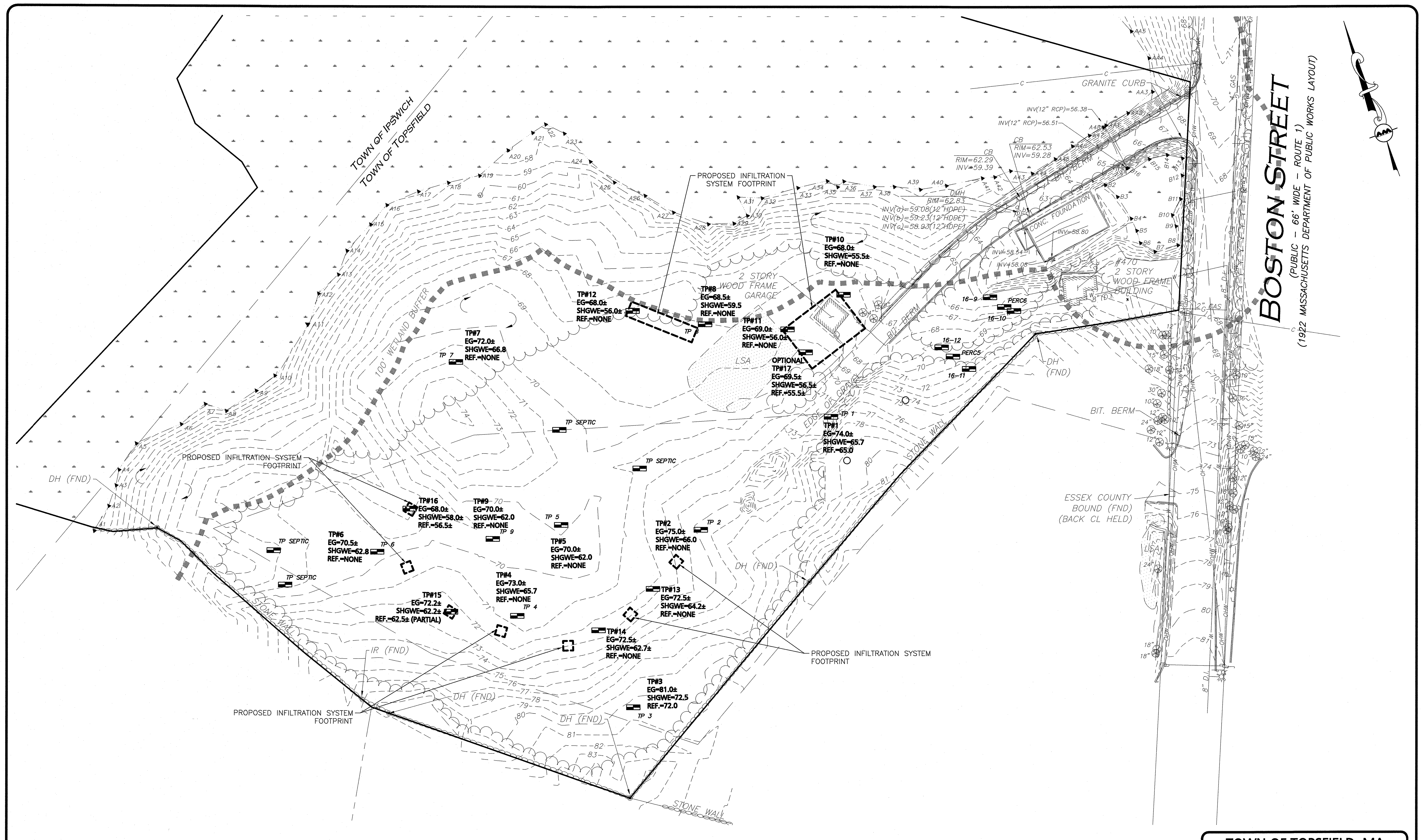
DRAWING TITLE:	SHEET No.
DRAINAGE PLAN	C-4B



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SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE DATE

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

N:\PROJECTS\2165-01A\CIVIL\DRAWINGS\CURRENT\C-2165-01A - TEST PIT LOCATIONS PLAN.DWG

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COMMONWEALTH OF MASSACHUSETTS
TIMOTHY J. WILLIAMS
CIVIL
No.43119
REGISTERED PROFESSIONAL ENGINEER

2/27/17

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
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1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT\OWNER:

SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:

RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=50'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:

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DRAWING TITLE:	SHEET No.
TEST PITS PLAN	TPP-1

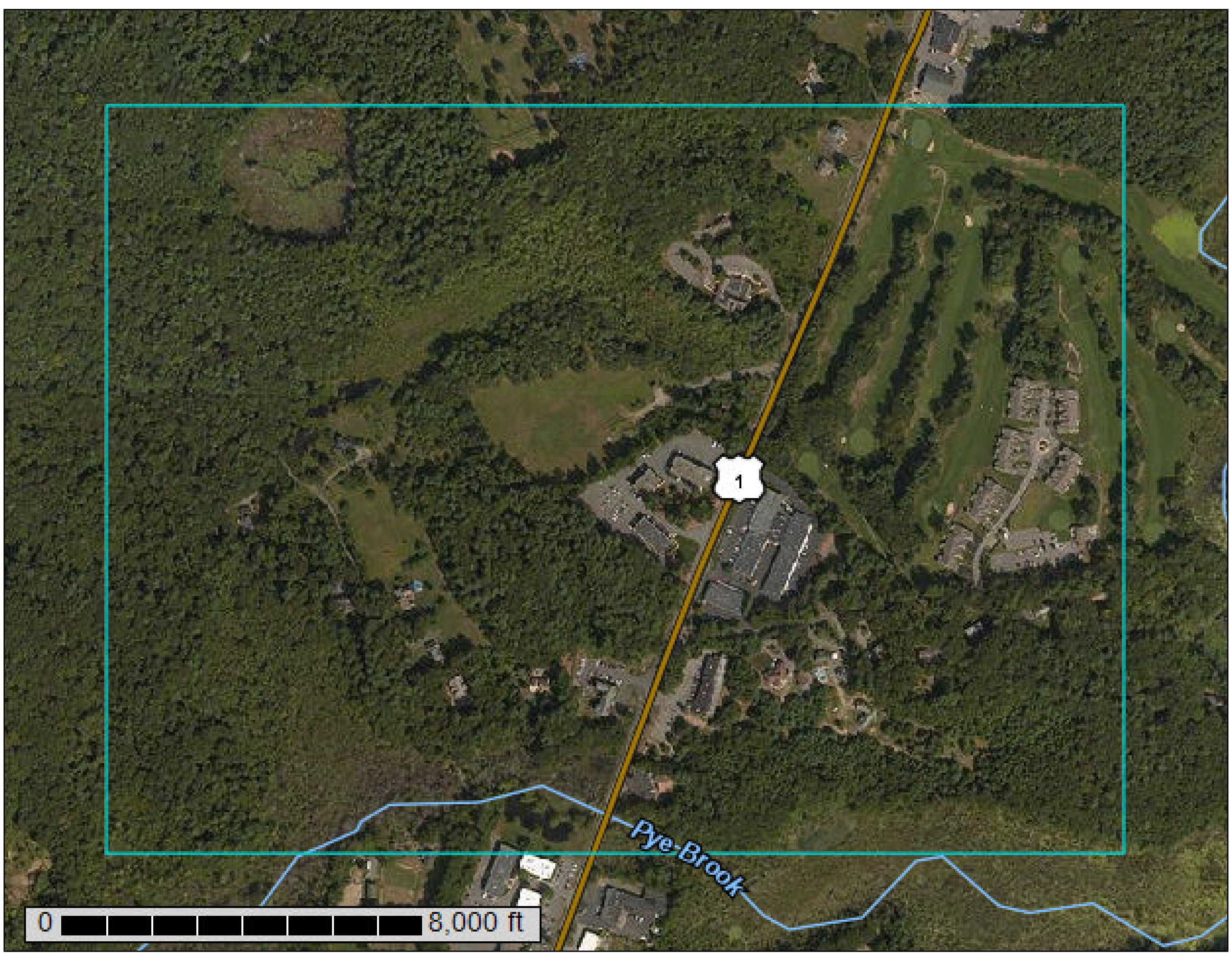
Section 6.0 - Appendix

USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part; and Essex County, Massachusetts, Southern Part



October 13, 2016

Soil Map

Map Scale: 1:6,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 300, 600, 1200, 1800

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

Map Unit Legend

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1	Water	1.2	0.6%
31A	Walpole sandy loam, 0 to 3 percent slopes	1.9	0.9%
32A	Wareham loamy sand, 0 to 3 percent slopes	0.5	0.2%
52A	Freetown muck, 0 to 1 percent slopes	31.2	14.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	16.9	7.7%
253C	Hinckley loamy sand, 8 to 15 percent slopes	4.8	2.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	5.7	2.6%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	14.5	6.7%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	17.5	8.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	6.1	2.8%
420C	Canton fine sandy loam, 8 to 15 percent slopes	9.8	4.5%
420D	Canton fine sandy loam, 15 to 25 percent slopes	0.1	0.0%
421B	Canton fine sandy loam, 3 to 8 percent slopes, very stony	10.2	4.7%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	21.1	9.7%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	17.6	8.1%
600	Pits, gravel	8.9	4.1%
651	Udorthents, smoothed	4.0	1.8%
717E	Rock outcrop-Charlton-Hollis complex, 15 to 35 percent slopes	1.2	0.6%
Subtotals for Soil Survey Area		**173.2**	**79.3%**
Totals for Area of Interest		**218.4**	**100.0%**

Essex County, Massachusetts, Southern Part (MA606)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
31B	Walpole fine sandy loam, 3 to 8 percent slopes	2.6	1.2%
52A	Freetown muck, 0 to 1 percent slopes	13.5	6.2%

Essex County, Massachusetts, Southern Part (MA606)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
242B	Hinckley gravelly fine sandy loam, 3 to 8 percent slopes	11.1	5.1%
242C	Hinckley loamy sand, 8 to 15 percent slopes	12.7	5.8%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	0.2	0.1%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	1.8	0.8%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	1.7	0.8%
392E	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	0.0	0.0%
420C	Canton fine sandy loam, 8 to 20 percent slopes	1.2	0.6%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	0.5	0.2%
Subtotals for Soil Survey Area		**45.2**	**20.7%**
Totals for Area of Interest		**218.4**	**100.0%**

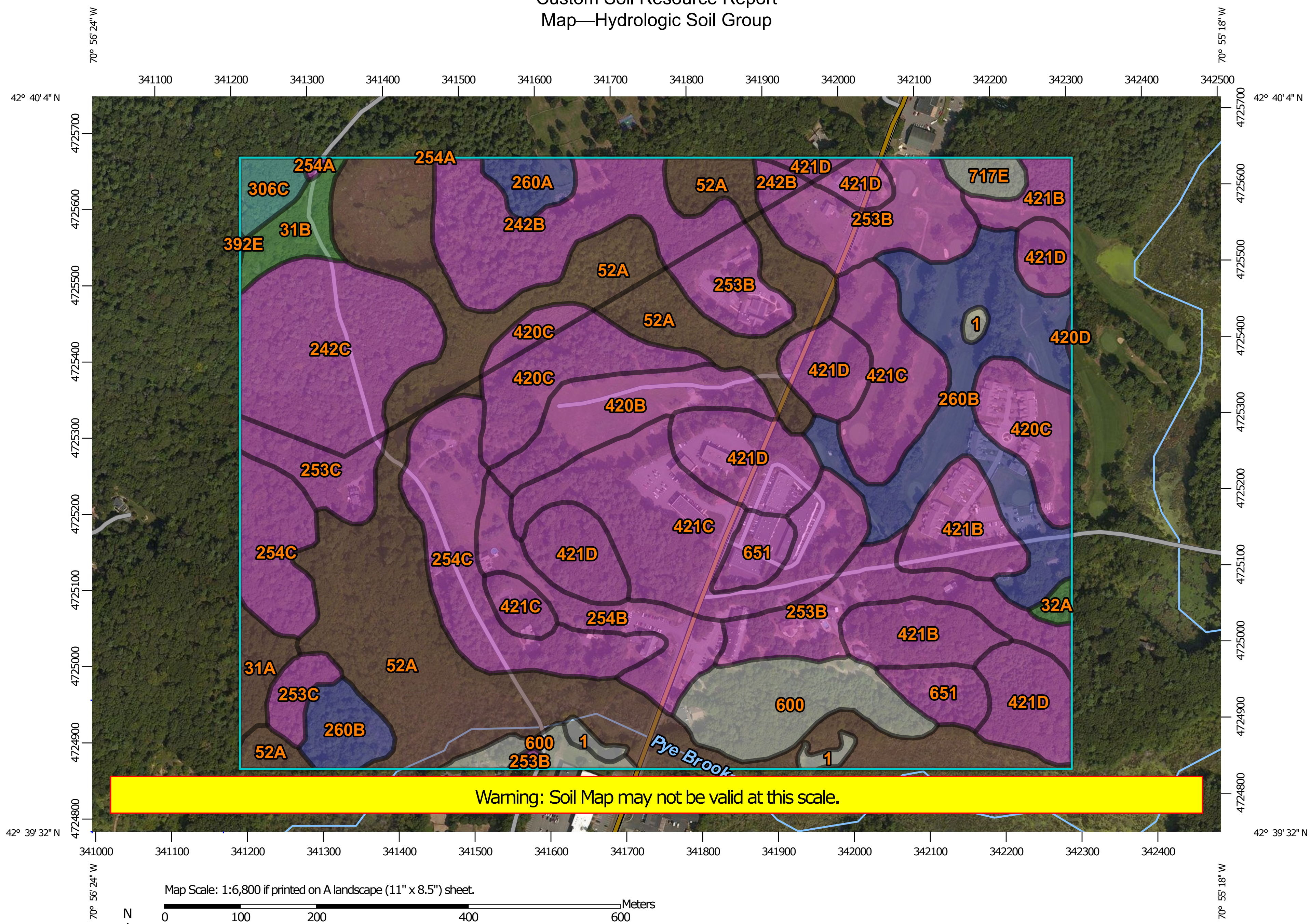
Map Unit Descriptions

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

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

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

Map—Hydrologic Soil Group



Map Scale: 1:6,800 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 300, 600, 1200, 1800

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: http://websoilsurvey.nrcs.usda.gov
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 11, Sep 28, 2015

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 12, Sep 28, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Essex County, Massachusetts, Northern Part (MA605)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1	Water		1.2	0.6%
31A	Walpole sandy loam, 0 to 3 percent slopes	B/D	1.9	0.9%
32A	Wareham loamy sand, 0 to 3 percent slopes	A/D	0.5	0.2%
52A	Freetown muck, 0 to 1 percent slopes	B/D	31.2	14.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	16.9	7.7%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	4.8	2.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	5.7	2.6%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	14.5	6.7%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	17.5	8.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	A	6.1	2.8%
420C	Canton fine sandy loam, 8 to 15 percent slopes	A	9.8	4.5%
420D	Canton fine sandy loam, 15 to 25 percent slopes	A	0.1	0.0%
421B	Canton fine sandy loam, 3 to 8 percent slopes, very stony	A	10.2	4.7%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	A	21.1	9.7%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	17.6	8.1%
600	Pits, gravel		8.9	4.1%
651	Udorthents, smoothed	A	4.0	1.8%
717E	Rock outcrop-Charlton-Hollis complex, 15 to 35 percent slopes		1.2	0.6%
Subtotals for Soil Survey Area			**173.2**	**79.3%**
Totals for Area of Interest			**218.4**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Essex County, Massachusetts, Southern Part (MA606)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
31B	Walpole fine sandy loam, 3 to 8 percent slopes	A/D	2.6	1.2%
52A	Freetown muck, 0 to 1 percent slopes	B/D	13.5	6.2%
242B	Hinckley gravelly fine sandy loam, 3 to 8 percent slopes	A	11.1	5.1%
242C	Hinckley loamy sand, 8 to 15 percent slopes	A	12.7	5.8%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	0.2	0.1%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	B	1.8	0.8%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	1.7	0.8%
392E	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	C	0.0	0.0%
420C	Canton fine sandy loam, 8 to 20 percent slopes	A	1.2	0.6%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	0.5	0.2%
Subtotals for Soil Survey Area			**45.2**	**20.7%**
Totals for Area of Interest			**218.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

Canton Fine Sandy Loam
Soil Name

Bedrock
Soil Limitations

Sandy till
Geologic/Parent Material

Morraine
Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? [x] Yes [ ] No
If Yes, continue to #5.

Within the 100-year flood boundary? [x] Yes [ ] No
FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 74.0 feet   Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Crushed stone drive near end of paved driveway

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)   Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A   Slope (%): 0-3%

Vegetation: Grass   Landform: Morraine   Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	200+ feet feet
Property Line	110' feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till   Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☒ Impervious Layer(s) ☒ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No   If yes: N/A Depth Weeping from Pit   N/A Depth Standing Water in Hole

Estimated Depth to High Groundwater: 100" inches   65.7 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
2-0	Crushed stone										
0-66	$2C_1$	5R3/6				SL	5%	10%			
66-108	$2C_2$	5R3/6	100	7.5YR6/8	2%	SL	5%	15%			

Additional Notes:

Fractured/weathered rock throughout. No water noted, no weeping.

ESHWT @ 100" (2% mottles - concentrations)

Refusal @ 108" (Ledge)

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ Date ________ Time ________ Weather ________

1. Location

Ground Elevation at Surface of Hole: ________ feet   Latitude/Longitude: ____/____

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.)   ________ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ________ Slope (%)

________ Vegetation   ________ Landform   ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet   Drainage Way ________ feet   Wetlands ________ feet

Property Line ________ feet   Drinking Water Well ________ feet   Other ________ feet

4. Parent Material: ________   Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ________ Depth Weeping from Pit   ________ Depth Standing Water in Hole

Estimated Depth to High Groundwater: ________ inches   ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-1	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	100" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ____________ Reading Date ____________

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 108 inches

c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

*Significant amounts fractured rock throughout

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson

Signature of Soil Evaluator

July 8, 2016

Date

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 1, 2018

Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

Canton Fine Sandy Loam
Soil Name

Bedrock
Soil Limitations

Sandy till
Geologic/Parent Material

Morraine
Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? [x] Yes [ ] No
If Yes, continue to #5.

Within the 100-year flood boundary? [x] Yes [ ] No
FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 75.0 feet

Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Slope along southern property line, 110' from PL

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A

Slope (%): 3-8%

Vegetation: Grass

Landform: Morraine

Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body: N/A feet

Drainage Way: N/A feet

Wetlands: 300+ feet feet

Property Line: 110' feet

Drinking Water Well: N/A feet

Other: N/A feet

4. Parent Material: Sandy till

Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☒ Impervious Layer(s) ☒ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: N/A Depth Weeping from Pit; N/A Depth Standing Water in Hole

Estimated Depth to High Groundwater: 108" inches; 66.0 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR5/6				FSL					
8-24	B	10YR4/6				SL	5%	15%			
24-150	C	10YR3/6	108	7.5YR6/8	2%	S&G	5%	15%			

Additional Notes:

Fractured/weathered rock 60"-150". No water noted, no weeping.

ESHWT @ 108" (2% mottles - concentrations)

No Refusal

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ ________ Date ________ Time ________ Weather

1. Location

Ground Elevation at Surface of Hole: ________ feet Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.) ________ Surface Stones (e.g., cobbles, stones, boulders, etc.) ________ Slope (%)

________ Vegetation ________ Landform ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet Drainage Way ________ feet Wetlands ________ feet

Property Line ________ feet Drinking Water Well ________ feet Other ________ feet

4. Parent Material: ________ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ________ Depth Weeping from Pit ________ Depth Standing Water in Hole

Estimated Depth to High Groundwater: ________ inches ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-2	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	108 inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number _______ Reading Date _______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 150 inches

c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

*Significant amounts fractured rock throughout

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: Sarkis Development Company

Street Address: 470 Boston Street

Map/Lot #: Map 2, Lot 5

City: Topsfield

State: MA

Zip Code: 01983

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No

   If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Soil Name: Canton Fine Sandy Loam

   Soil Limitations: Bedrock

   Geologic/Parent Material: Sandy till

   Landform: Morraine

3. Surficial Geological Report Available? [ ] Yes [x] No

   If yes: _____ _____ _____ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No

   MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year)

   Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 81.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southwestern corner

2. Land Use Open field (e.g., woodland, agricultural field, vacant lot, etc.) | N/A Surface Stones (e.g., cobbles, stones, boulders, etc.) | 0-3% Slope (%)

Grass Vegetation | Morraine Landform | N/A Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	500+ feet feet
Property Line	45' feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☒ Impervious Layer(s) ☒ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: N/A Depth Weeping from Pit | N/A Depth Standing Water in Hole

Estimated Depth to High Groundwater: 102" inches | 72.5 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR4/4				FSL					
8-32	B	10YR3/6				LS		10%			
32-108	C	10YR3/6	102	7.5YR6/8	2%	LS		10%			Ref.@108"

Additional Notes:

No water noted, no weeping. ESHWT @ 102"

Angular cobbles and fractured rock throughout B & C layers

Refusal @ 108" (Ledge)

C. On-Site Review (continued)

Deep Observation Hole Number: ______ Date ______ Time ______ Weather ______

1. Location

   Ground Elevation at Surface of Hole: ______ feet   Latitude/Longitude: ______ / ______

2. Land Use ______ (e.g., woodland, agricultural field, vacant lot, etc.)   ______ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ______ Slope (%)

   ______ Vegetation   ______ Landform   ______ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ______ feet   Drainage Way ______ feet   Wetlands ______ feet

   Property Line ______ feet   Drinking Water Well ______ feet   Other ______ feet

4. Parent Material: ______   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ______ Depth Weeping from Pit   ______ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ______ inches   ______ elevation

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-3	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	102" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 108 inches

c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

*Significant amounts fractured rock throughout

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness | Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location
   Ground Elevation at Surface of Hole: 73.0 feet
   Latitude/Longitude: 42.664163 / -70.930328
   Description of Location: Southwest corner of property

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)
   Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A
   Slope (%): 3-8%
   Vegetation: Grass
   Landform: Morraine
   Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:
   Open Water Body: N/A feet
   Drainage Way: N/A feet
   Wetlands: 500+ feet feet
   Property Line: 110' feet
   Drinking Water Well: N/A feet
   Other: N/A feet

4. Parent Material: Sandy till
   Unsuitable Materials Present: ☐ Yes ☒ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No
   If yes: N/A Depth Weeping from Pit; 144" Depth Standing Water in Hole
   Estimated Depth to High Groundwater: 88" inches; 65.7 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	A	10YR3/1				SL					
10-22	B	10YR3/2				SL					
22-80	B/C	10YR5/6				Sand					
80-144	C	10YR5/4	88	7.5YR5/8	5%	F. Sand					Moist

Additional Notes:
Standing water @ 144". ESHWT @ 88" (Some mottling in B/C transition layer - concentrations & depletions)

Concentrations - 5YR5/8, depletions - 10YR6/1

No Refusal.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ ________ Date ________ Time ________ Weather

1. Location

   Ground Elevation at Surface of Hole: ________ feet   Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.)   ________ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ________ Slope (%)

   ________ Vegetation   ________ Landform   ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet   Drainage Way ________ feet   Wetlands ________ feet

   Property Line ________ feet   Drinking Water Well ________ feet   Other ________ feet

4. Parent Material: ________   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ________ Depth Weeping from Pit   ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches   ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used: | Obs. Hole # TP-4 | Obs. Hole #

	Obs. Hole # TP-4	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	88" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 144 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: Sarkis Development Company

Street Address: 470 Boston Street

Map/Lot #: Map 2, Lot 5

City: Topsfield

State: MA

Zip Code: 01983

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Soil Name: Canton Fine Sandy Loam

   Soil Limitations: Bedrock

   Geologic/Parent Material: Sandy till

   Landform: Morraine

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No

   MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year)

   Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-5 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

   Ground Elevation at Surface of Hole: 70.0 feet   Latitude/Longitude: 42.664163 / -70.930328

   Description of Location: Crushed stone drive near end of paved driveway

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)   Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A   Slope (%): 0-3%

   Vegetation: Grass   Landform: Morraine   Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

   Open Water Body: N/A feet   Drainage Way: N/A feet   Wetlands: 375+ feet feet

   Property Line: 220' feet   Drinking Water Well: N/A feet   Other: N/A feet

4. Parent Material: Sandy till   Unsuitable Materials Present: ☐ Yes ☒ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No   If yes: N/A Depth Weeping from Pit   132" Depth Standing Water in Hole

   Estimated Depth to High Groundwater: 96" inches   62.0 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR3/2				SL					
8-34	B	10YR3/1				SL					
34-72	2C1	10YR5/8				M. sand					Moist
72-132	2C2	10YR5/4	96	7.5YR6/8	5%	Sand			Loose, SG		

Additional Notes:
ESHWT @ 96" (5% mottles - concentrations & depletions)

Standing water @ 132" (bottom)

No Refusal, coarse sand layer at 60-70".

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______ Date ______ Time ______ Weather ______

1. Location

Ground Elevation at Surface of Hole: ______ feet   Latitude/Longitude: ______ / ______

2. Land Use ______ (e.g., woodland, agricultural field, vacant lot, etc.)   ______ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ______ Slope (%)

______ Vegetation   ______ Landform   ______ Position on Landscape (SU, SH, BS, FS,

3. Distances from:

Open Water Body	______ feet	Drainage Way	______ feet	Wetlands	______ feet
Property Line	______ feet	Drinking Water Well	______ feet	Other	______ feet

4. Parent Material: ______   Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ______ Depth Weeping from Pit   ______ Depth Standing Water in Hole

Estimated Depth to High Groundwater: ______ inches   ______ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-5	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	96" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 132 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson

Signature of Soil Evaluator

July 8, 2016

Date

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 1, 2018

Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-6 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 70.5 feet

Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Crushed stone drive near end of paved driveway

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A

Slope (%): 0-3%

Vegetation: Grass

Landform: Morraine

Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	175+ feet
Property Line	115' feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: N/A Depth Weeping from Pit; N/A Depth Standing Water in Hole

Estimated Depth to High Groundwater: 92" inches; 62.8 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR4/3				FSL					
8-28	B	10YR6/6				FSL					
28-72	B/C	10YR3/3				FSL	5%	2%			
72-136	C	10YR3/3	92"	7.5YR6/8	2%	FSL	5%	2%			

Additional Notes:
ESHWT @ 92". No refusal, no weeping, no standing water.

Heavy manganese deposits throughout B/C and C layers, color 10R3/3

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______ ______ Date ______ Time ______ Weather

1. Location

   Ground Elevation at Surface of Hole: ______ feet   Latitude/Longitude: ______ / ______

2. Land Use ______ (e.g., woodland, agricultural field, vacant lot, etc.)   ______ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ______ Slope (%)

   ______ Vegetation   ______ Landform   ______ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ______ feet   Drainage Way ______ feet   Wetlands ______ feet

   Property Line ______ feet   Drinking Water Well ______ feet   Other ______ feet

4. Parent Material: ______   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ______ Depth Weeping from Pit   ______ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ______ inches   ______ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-6	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	92" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 136 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: Sarkis Development Company

Street Address: 470 Boston Street

Map/Lot #: Map 2, Lot 5

City: Topsfield

State: MA

Zip Code: 01983

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Soil Name: Canton Fine Sandy Loam

   Soil Limitations: Bedrock

   Geologic/Parent Material: Sandy till

   Landform: Morraine

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ (Map Unit)

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-7 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 72.0 feet

Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Woodland area by wetlands

2. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A

Slope (%): 0-3%

Vegetation: Grass

Landform: Morraine

Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	130+ feet feet
Property Line	250' feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No

If yes: N/A Depth Weeping from Pit; N/A Depth Standing Water in Hole

Estimated Depth to High Groundwater: 62" inches; 66.8 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR3/3				FSL					
8-28	B	10YR5/6				FSL	5%	10%			
28-76	B/C	10YR4/4	62	7.5YR6/8	2%	FSL	5%	15%	Massive, fri.		
76-144	C	10YR4/4				FSL			Massive, fri.		5% cobbles

Additional Notes:
No water noted, no weeping. No refusal.

ESHWT @ 62" (Significant mottling - concentrations, color 7.5YR6/8)

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ Date ________ Time ________ Weather ________

1. Location

   Ground Elevation at Surface of Hole: ________ feet   Latitude/Longitude: ____ / ____

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.)   ________ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ________ Slope (%)

   ________ Vegetation   ________ Landform   ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet   Drainage Way ________ feet   Wetlands ________ feet

   Property Line ________ feet   Drinking Water Well ________ feet   Other ________ feet

4. Parent Material: ________   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ________ Depth Weeping from Pit   ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches   ________ elevation

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-7	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	62" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 144 inches

c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ____ ____ ____ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-8 | 7/7/2016 (Date) | 8:00AM (Time) | Overcast, 65 degrees (Weather)

1. Location

   Ground Elevation at Surface of Hole: 68.5 Latitude/Longitude: 42.664163 / -70.930328

   Description of Location: Northern treeline, 50' back corner existing garage

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.) | N/A Surface Stones (e.g., cobbles, stones, boulders, etc.) | 0-3% Slope (%)

   Grass (Vegetation) | Morraine (Landform) | N/A Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 115+ feet feet

   Property Line 275' feet | Drinking Water Well N/A feet | Other N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: N/A Depth Weeping from Pit | 150" Depth Standing Water in Hole

   Estimated Depth to High Groundwater: 108" inches | 59.5 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-8

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR4/3				LS					
8-18	B	10YR56				LS	5%				
18-45	B/C	10YR5/8				LS	20%				
45-150	C	10YR5/6	108	7.5YR6/8	2%	Fine sand			Loose, SG		

Additional Notes:
ESHWT @ 108", some mottling, concentrations, color 7.5YR6/8

Standing water @ 150"

No Refusal. Well defined transition from LS to fine sand.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ Date ________ Time ________ Weather ________

1. Location

Ground Elevation at Surface of Hole: ________ feet

Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.)

________ Surface Stones (e.g., cobbles, stones, boulders, etc.)

________ Slope (%)

________ Vegetation

________ Landform

________ Position on Landscape (SU, SH, BS, FS,

3. Distances from:

Open Water Body ________ feet

Drainage Way ________ feet

Wetlands ________ feet

Property Line ________ feet

Drinking Water Well ________ feet

Other ________ feet

4. Parent Material: ________

Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes: ________ Depth Weeping from Pit ________ Depth Standing Water in Hole

Estimated Depth to High Groundwater: ________ inches ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-8	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	108" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 108 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

Canton Fine Sandy Loam
Soil Name

Bedrock
Soil Limitations

Sandy till
Geologic/Parent Material

Morraine
Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ________ ________ ________ Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? [x] Yes [ ] No
If Yes, continue to #5.

Within the 100-year flood boundary? [x] Yes [ ] No
FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): June, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-9 | Date: 7/7/2016 | Time: 8:00AM | Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 70.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Open field, proposed detention basin

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)
Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A
Slope (%): 0-3%
Vegetation: Grass
Landform: Morraine
Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	225+ feet feet
Property Line	175' feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: 120" Depth Weeping from Pit 138" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 96" inches 62.0 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-9

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR3/3				LS					
8-32	B	10YR5/4				LS					
32-72	$2C_1$	10YR6/6				Sand					
72-138	$2C_2$	10YR3/6	96	7.5YR6/8	2%	LS	10%				

Additional Notes:

Fractured/weathered rock throughout C layer. Standing water at 138", weeping at 120". ESHWT @ 96" (mottling)

No Refusal.

C. On-Site Review (continued)

Deep Observation Hole Number: ________ ________ Date ________ Time ________ Weather

1. Location

   Ground Elevation at Surface of Hole: ________ feet Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.) ________ Surface Stones (e.g., cobbles, stones, boulders, etc.) ________ Slope (%)

   ________ Vegetation ________ Landform ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet Drainage Way ________ feet Wetlands ________ feet

   Property Line ________ feet Drinking Water Well ________ feet Other ________ feet

4. Parent Material: ________ Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ________ Depth Weeping from Pit ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-9	Obs. Hole #
☐ Depth observed standing water in observation hole	inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	96" inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 138 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

*Significant amounts fractured rock throughout

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson
Signature of Soil Evaluator

July 8, 2016
Date

David M. Robinson, S.E. # 13799
Typed or Printed Name of Soil Evaluator / License #

July 1, 2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: Sarkis Development Company

Street Address: 470 Boston Street

Map/Lot #: Map 2, Lot 5

City: Topsfield

State: MA

Zip Code: 01983

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair
2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Soil Name: Canton Fine Sandy Loam

   Soil Limitations: Bedrock

   Geologic/Parent Material: Sandy till

   Landform: Morraine
3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit
4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No

   FEMA Zone A
5. Within a velocity zone? [ ] Yes [x] No
6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)
7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal
8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10 | Date: 12/9/2016 | Time: 7:30AM | Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 68.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Northeast corner existing garage

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)
Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A
Slope (%): 0-3%
Vegetation: Grass
Landform: Morraine
Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:
Open Water Body: N/A feet
Drainage Way: N/A feet
Wetlands: 120+/- feet feet
Property Line: 150'+/- feet
Drinking Water Well: N/A feet
Other: N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 150" Depth Weeping from Pit 154" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 150" inches 55.5 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-10

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-18	A	10YR2/3				SL					
18-28	B	10YR5/6				LS	10%				
28-60	1C	10YR5/6				SL		2%			
60-156	2C	10YR5/6				SL		2%			

Additional Notes:

Water noted at 154", weeping at 150. ESHWT @ 150"

Cobbles and stones throughout B & C layers, no refusal,

layer fine sand at 60-70", no mottling noted.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ Date ________ Time ________ Weather ________

1. Location

   Ground Elevation at Surface of Hole: ________ feet Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.) ________ Surface Stones (e.g., cobbles, stones, boulders, etc.) ________ Slope (%)

   ________ Vegetation ________ Landform ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet Drainage Way ________ feet Wetlands ________ feet

   Property Line ________ feet Drinking Water Well ________ feet Other ________ feet

4. Parent Material: ________ Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ________ Depth Weeping from Pit ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-10	Obs. Hole #
☐ Depth observed standing water in observation hole	154 inches	inches
☐ Depth weeping from side of observation hole	150 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 156 inches

c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

12/27/2016
Date

David M. Robinson, SE 13799
Typed or Printed Name of Soil Evaluator / License #

7/1/2018
Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: Sarkis Development Company

Street Address: 470 Boston Street

Map/Lot #: Map 2, Lot 5

City: Topsfield

State: MA

Zip Code: 01983

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Soil Name: Canton Fine Sandy Loam

   Soil Limitations: Bedrock

   Geologic/Parent Material: Sandy till

   Landform: Morraine

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ____ ____ ____ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-11 | Date: 12/9/2016 | Time: 8:00AM | Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 69.0   Latitude/Longitude: 42.664163 / -70.930328

Description of Location: SouthWest corner existing garage

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)   Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A   Slope (%): 0-3%

Vegetation: Grass   Landform: Morraine   Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	120+/- feet feet
Property Line	150'+/- feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till   Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No   If yes: 156" Depth Weeping from Pit   174" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 156" inches   56.0 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-11

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR2/3				SL					
12-36	B1	10YR5/4				LS					
36-66	B2	10YR5/6				Coarse sand	10-15%		Loose, SG		
66-120	1C	10YR5/8				Sand			Loose, SG		
120-180	2C	10YR5/8				LS					

Additional Notes:

Standing Water noted at 174", weeping at 156. ESHWT

@ 156", no refusal, no mottling noted.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ Date ________ Time ________ Weather ________

1. Location

   Ground Elevation at Surface of Hole: ________ feet Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.) ________ Surface Stones (e.g., cobbles, stones, boulders, etc.) ________ Slope (%)

   ________ Vegetation ________ Landform ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet Drainage Way ________ feet Wetlands ________ feet

   Property Line ________ feet Drinking Water Well ________ feet Other ________ feet

4. Parent Material: ________ Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ________ Depth Weeping from Pit ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-11	Obs. Hole #
☐ Depth observed standing water in observation hole	174 inches	inches
☐ Depth weeping from side of observation hole	156 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 180 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

[signature]	12/27/2016
Signature of Soil Evaluator	Date
David. M. Robinson, SE 13799	7/1/2018
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-12 | Date: 12/9/2016 | Time: 8:30AM | Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 68.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: North west corner proposed UIS-2, along treeline

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A

Slope (%): 0-3%

Vegetation: Grass

Landform: Morraine

Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body: N/A feet | Drainage Way: N/A feet | Wetlands: 100+/- feet feet

Property Line: 300'+/- feet | Drinking Water Well: N/A feet | Other: N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 144" Depth Weeping from Pit 158" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 144" inches 56.0 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-12

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	A	10YR2/3				SL					
6-26	Bw	10YR5/4				LS	5-7%				
26786	1C	10YR5/6				Med. sand			Loose, SG		Boulder, abrupt boundary
78-162	2C	10YR5/8				Sand					Angular cobbles

Additional Notes:

Standing Water noted at 158", weeping at 144.

ESHWT @ 144", no refusal, very little/no mottling

noted. Some fractured ledge at 160", easily broken up.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______ Date ______ Time ______ Weather ______

1. Location

   Ground Elevation at Surface of Hole: ______ feet   Latitude/Longitude: ______ / ______

2. Land Use ______ (e.g., woodland, agricultural field, vacant lot, etc.)   ______ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ______ Slope (%)

   ______ Vegetation   ______ Landform   ______ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ______ feet   Drainage Way ______ feet   Wetlands ______ feet

   Property Line ______ feet   Drinking Water Well ______ feet   Other ______ feet

4. Parent Material: ______   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ______ Depth Weeping from Pit   ______ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ______ inches   ______ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-12	Obs. Hole #
☐ Depth observed standing water in observation hole	158 inches	inches
☐ Depth weeping from side of observation hole	144 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

______ Index Well Number ______ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 162 inches

c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

David M. Robinson

Signature of Soil Evaluator

12/27/2016

Date

David. M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

7/1/2018

Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam (Soil Name) Bedrock (Soil Limitations)

   Sandy till (Geologic/Parent Material) Morraine (Landform)

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-13 | Date: 12/9/2016 | Time: 9:30AM | Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 72.5 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southeast corner (See Test Pits Plan, TPP-1)

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A

Slope (%): 3-8%

Vegetation: Grass

Landform: Morraine

Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	450+/- feet
Property Line	100'+/- feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 100" Depth Weeping from Pit; 122" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 122" inches; 62.3 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-13

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	A	10YR2/3				FSL					
10-40	Bw	10YR5/4				FSL					
40-132	C	10YR5/6				FSL		2%	Massive, friable		Some fractured ledge

Additional Notes:

Standing Water noted at 122", weeping at 100. ESHWT @ 100", no refusal, very little/no mottling noted. Some fractured ledge in C horizon, easily broken up.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______ Date ______ Time ______ Weather ______

1. Location

   Ground Elevation at Surface of Hole: ______ feet Latitude/Longitude: ______ / ______

2. Land Use ______ (e.g., woodland, agricultural field, vacant lot, etc.) ______ Surface Stones (e.g., cobbles, stones, boulders, etc.) ______ Slope (%)

   ______ Vegetation ______ Landform ______ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet

   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Parent Material: ______ Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ______ inches ______ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-13	Obs. Hole #
☐ Depth observed standing water in observation hole	122 inches	inches
☐ Depth weeping from side of observation hole	100 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ____________ Reading Date ____________

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 132 inches
   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	12/27/2016 Date
David. M. Robinson, SE 13799 Typed or Printed Name of Soil Evaluator / License #	7/1/2018 Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
   Wetland Type

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-14 | 12/9/2016 (Date) | 10:30AM (Time) | Overcast, 35 degrees (Weather)

1. Location

   Ground Elevation at Surface of Hole: 72.5 Latitude/Longitude: 42.664163 / -70.930328

   Description of Location: Southern corner (See Test Pits Plan, TPP-1)

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.) | N/A Surface Stones (e.g., cobbles, stones, boulders, etc.) | 3-8% Slope (%)

   Grass (Vegetation) | Morraine (Landform) | N/A Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 430+/- feet feet

   Property Line 125'+/- feet | Drinking Water Well N/A feet | Other N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 118" Depth Weeping from Pit | 122" Depth Standing Water in Hole

   Estimated Depth to High Groundwater: 122" inches | 62.7 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-14

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR2/3				LS					
12-36	Bw	10YR5/4				LS					
36-132	C	10YR5/6				FSL		2%	Massive, friable		

Additional Notes:

Standing Water noted at 122", weeping at 118. ESHWT @ 118",

no refusal, very little/no mottling noted.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______ Date ______ Time ______ Weather ______

1. Location

Ground Elevation at Surface of Hole: ______ feet

Latitude/Longitude: ______ / ______

2. Land Use ______ (e.g., woodland, agricultural field, vacant lot, etc.)

______ Surface Stones (e.g., cobbles, stones, boulders, etc.)

______ Slope (%)

______ Vegetation

______ Landform

______ Position on Landscape (SU, SH, BS, FS,

3. Distances from:

Open Water Body	______ feet	Drainage Way	______ feet	Wetlands	______ feet
Property Line	______ feet	Drinking Water Well	______ feet	Other	______ feet

4. Parent Material: ______ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Estimated Depth to High Groundwater: ______ inches ______ elevation

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-14	Obs. Hole #
☐ Depth observed standing water in observation hole	122 inches	inches
☐ Depth weeping from side of observation hole	118 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ______ Reading Date ______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 132 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	12/27/2016 Date
David M. Robinson, SE 13799 Typed or Printed Name of Soil Evaluator / License #	7/1/2018 Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: Sarkis Development Company

Street Address: 470 Boston Street

Map/Lot #: Map 2, Lot 5

City: Topsfield

State: MA

Zip Code: 01983

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Soil Name: Canton Fine Sandy Loam

   Soil Limitations: Bedrock

   Geologic/Parent Material: Sandy till

   Landform: Morraine

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No

   MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year)

   Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-15 | Date: 12/9/2016 | Time: 11:00AM | Weather: Overcast, 35 degrees

1. Location

   Ground Elevation at Surface of Hole: 72.2 Latitude/Longitude: 42.664163 / -70.930328

   Description of Location: Southern corner (See Test Pits Plan, TPP-1)

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A | Slope (%): 3-8%

   Vegetation: Grass | Landform: Morraine | Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from: Open Water Body: N/A feet | Drainage Way: N/A feet | Wetlands: 300+/- feet feet

   Property Line: 125'+/- feet | Drinking Water Well: N/A feet | Other: N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 120" Depth Weeping from Pit | 136" Depth Standing Water in Hole

   Estimated Depth to High Groundwater: 120 inches | 62.2 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-15

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR2/3				FSL					
12-40	Bw	10YR5/4				FSL					
40-140	C	10YR5/6				SL		5%	Massive, friable		Angular cobbles

Additional Notes:

Standing Water noted at 136", weeping at 120. ESHWT @ 120", partial refusal west side of pit @116", mottling noted below weep line. Some fine materials in C layer.

Some angular cobbles in C layer (~5%)

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ Date ________ Time ________ Weather ________

1. Location

   Ground Elevation at Surface of Hole: ________ feet

   Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.)

   ________ Surface Stones (e.g., cobbles, stones, boulders, etc.)

   ________ Slope (%)

   ________ Vegetation

   ________ Landform

   ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet Drainage Way ________ feet Wetlands ________ feet

   Property Line ________ feet Drinking Water Well ________ feet Other ________ feet

4. Parent Material: ________ Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ________ Depth Weeping from Pit ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches ________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used: Obs. Hole # TP-15 Obs. Hole # ______

	Obs. Hole # TP-15	Obs. Hole #
☐ Depth observed standing water in observation hole	136 inches	inches
☐ Depth weeping from side of observation hole	120 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

______ Index Well Number ______ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

Obs. Hole # ______ S_c ______ S_r ______ OW_c ______ OW_{max} ______ OW_r ______ S_h ______

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 140 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ______ inches Lower boundary: ______ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Date: 12/27/2016

Typed or Printed Name of Soil Evaluator / License #: David M. Robinson, SE 13799

Expiration Date of License: 7/1/2018

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ________ ________ ________ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No

   MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
   Wetland Type

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year)

   Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-16 | Date: 12/9/2016 | Time: 11:30AM | Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 68.0 | Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Center of site (See Test Pits Plan, TPP-1)

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A | Slope (%): 0-3%

Vegetation: Grass | Landform: Morraine | Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:
   - Open Water Body: N/A feet
   - Drainage Way: N/A feet
   - Wetlands: 200+/- feet
   - Property Line: 180'+/- feet
   - Drinking Water Well: N/A feet
   - Other: N/A feet

4. Parent Material: Sandy till | Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No | If yes: 120" Depth Weeping from Pit | 128" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 120 inches | 58.0 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-16

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-18	A	10YR2/3				FSL					
18-24	Bw	10YR5/4				FSL					
24-60	1C	10YR5/6				Sand					
60-138	2C	10YR5/6				SL		5%			Angular cobbles

Additional Notes:

Standing Water noted at 128", weeping at 120. ESHWT @ 120", refusal @ 138" (bedrock), Some angular cobbles in C layer (~5%)

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ________ ________ Date ________ Time ________ Weather

1. Location

   Ground Elevation at Surface of Hole: ________ feet   Latitude/Longitude: ________ / ________

2. Land Use ________ (e.g., woodland, agricultural field, vacant lot, etc.)   ________ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ________ Slope (%)

   ________ Vegetation   ________ Landform   ________ Position on Landscape (SU, SH, BS, FS,

3. Distances from:
   - Open Water Body ________ feet
   - Drainage Way ________ feet
   - Wetlands ________ feet
   - Property Line ________ feet
   - Drinking Water Well ________ feet
   - Other ________ feet

4. Parent Material: ________   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ________ Depth Weeping from Pit   ________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ________ inches   ________ elevation

C. On-Site Review (continued)

Deep Observation Hole Number: ____________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-16	Obs. Hole #
☐ Depth observed standing water in observation hole	128 inches	inches
☐ Depth weeping from side of observation hole	120 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number _______ Reading Date _______

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

Obs. Hole # ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 138 inches

c. If no, at what depth was impervious material observed? Upper boundary: ____ inches Lower boundary: ____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness	Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

[signature]	12/27/2016
Signature of Soil Evaluator	Date
David M. Robinson, SE 13799	7/1/2018
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company
Owner Name

470 Boston Street
Street Address

Map 2, Lot 5
Map/Lot #

Topsfield
City

MA
State

01983
Zip Code

B. Site Information

1. (Check one) [x] New Construction [ ] Upgrade [ ] Repair

2. Soil Survey Available? [x] Yes [ ] No If yes: UC Davis Web Soil Survey (Source) 420B, 421C (Soil Map Unit)

   Canton Fine Sandy Loam
   Soil Name

   Bedrock
   Soil Limitations

   Sandy till
   Geologic/Parent Material

   Morraine
   Landform

3. Surficial Geological Report Available? [ ] Yes [x] No If yes: ______ ______ ______ Map Unit

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? [x] Yes [ ] No
   If Yes, continue to #5.

   Within the 100-year flood boundary? [x] Yes [ ] No
   FEMA Zone A

5. Within a velocity zone? [ ] Yes [x] No

6. Within a Mapped Wetland Area? [x] Yes [ ] No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees (Wetland Type)

7. Current Water Resource Conditions (USGS): Dec, 2016 (Month/Year) Range: [ ] Above Normal [ ] Normal [x] Below Normal

8. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-17 | Date: 12/9/2016 | Time: 12:30AM | Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 69.5 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southern corner of existing garage (See Test Pits Plan, TPP-1)

2. Land Use: Open field (e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.): N/A

Slope (%): 0-3%

Vegetation: Grass

Landform: Morraine

Position on Landscape (SU, SH, BS, FS, TS): N/A

3. Distances from:

Open Water Body	N/A feet	Drainage Way	N/A feet	Wetlands	150+/- feet feet
Property Line	160'+/- feet	Drinking Water Well	N/A feet	Other	N/A feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 156" Depth Weeping from Pit 166" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 156 inches 56.5 elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-17

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-20	A	10YR2/1				LS					Heavily plowed
20-36	Bw	10YR5/8				SL					
36-60	1C	10YR5/6				Med. Sand		5%			Some coarse sand
60-168	2C	10YR5/6				SL					Angular cobbles
											manganese deposits

Additional Notes:

Standing Water noted at 166", weeping at 156. ESHWT @ 156", refusal
@ 168" (bedrock), Some angular cobbles in 1C layer (~5%)

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ____________ ____________ Date ____________ Time ____________ Weather

1. Location

   Ground Elevation at Surface of Hole: ____________ feet   Latitude/Longitude: ________ / ________

2. Land Use ____________ (e.g., woodland, agricultural field, vacant lot, etc.)   ____________ Surface Stones (e.g., cobbles, stones, boulders, etc.)   ____________ Slope (%)

   ____________ Vegetation   ____________ Landform   ____________ Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ________ feet   Drainage Way ________ feet   Wetlands ________ feet

   Property Line ________ feet   Drinking Water Well ________ feet   Other ________ feet

4. Parent Material: ____________   Unsuitable Materials Present: ☐ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No   If yes: ____________ Depth Weeping from Pit ____________ Depth Standing Water in Hole

   Estimated Depth to High Groundwater: ____________ inches ____________ elevation

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: ______________________

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

____

____

____

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used: Obs. Hole # TP-17 Obs. Hole # ____

	Obs. Hole # TP-17	Obs. Hole #
☐ Depth observed standing water in observation hole	166 inches	inches
☐ Depth weeping from side of observation hole	156 inches	inches
☐ Depth to soil redoximorphic features (mottles)	inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches

Index Well Number ____ Reading Date ____

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

Obs. Hole # ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 0 inches Lower boundary: 166 inches

   c. If no, at what depth was impervious material observed? Upper boundary: ____ inches Lower boundary: ____ inches

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Date: 12/27/2016

Typed or Printed Name of Soil Evaluator / License #: David M. Robinson, SE 13799

Expiration Date of License: 7/1/2018

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe	
Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic)	
Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgtn.)	
Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay	
Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
Open Channels	
Lined Channels	
Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged	
Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet)	
Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

Detailed Stormceptor Sizing Report – Rolling Green EHD - 470 Boston Street

Project Information & Location			
Project Name	470 Boston Street EHD	**Project Number**	2165-01A
City	Topsfield	**State/ Province**	Massachusetts
Country	United States of America	**Date**	9/26/2016
Designer Information		**EOR Information (optional)**	
Name	Dave Robinson	**Name**	
Company	Allen & Major Associates	**Company**	
Phone #	603-553-8151	**Phone #**	
Email	drobinson@allenmajor.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Rolling Green EHD - 470 Boston Street
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	86
PSD	Fine Distribution
Rainfall Station	ROCKPORT 1 ESE

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	79
STC 900	86
STC 1200	87
STC 1800	87
STC 2400	90
STC 3600	91
STC 4800	93
STC 6000	93
STC 7200	94
STC 11000	96
STC 13000	96
STC 16000	97
StormceptorMAX	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	Massachusetts	**Total Number of Rainfall Events**	5100
Rainfall Station Name	ROCKPORT 1 ESE	**Total Rainfall (in)**	1244.3
Station ID #	6977	**Average Annual Rainfall (in)**	34.6
Coordinates	42°39'0"N, 70°36'0"W	**Total Evaporation (in)**	81.7
Elevation (ft)	79	**Total Infiltration (in)**	307.2
Years of Rainfall Data	36	**Total Rainfall that is Runoff (in)**	855.4

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (acres)	1.0
Imperviousness %	75.0

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Design Details	
Stormceptor Inlet Invert Elev (ft)	63.80
Stormceptor Outlet Invert Elev (ft)	63.55
Stormceptor Rim Elev (ft)	68.00
Normal Water Level Elevation (ft)	
Pipe Diameter (in)	12
Pipe Material	HDPE - plastic
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	Rolling Green EHD - 470 Boston Street

Site Details

Drainage Area	
Total Area (acres)	1.0
Imperviousness %	75.0

Surface Characteristics	
Width (ft)	417.00
Slope %	2
Impervious Depression Storage (in)	0.02
Pervious Depression Storage (in)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (in/day)	0.1

Dry Weather Flow	
Dry Weather Flow (cfs)	0

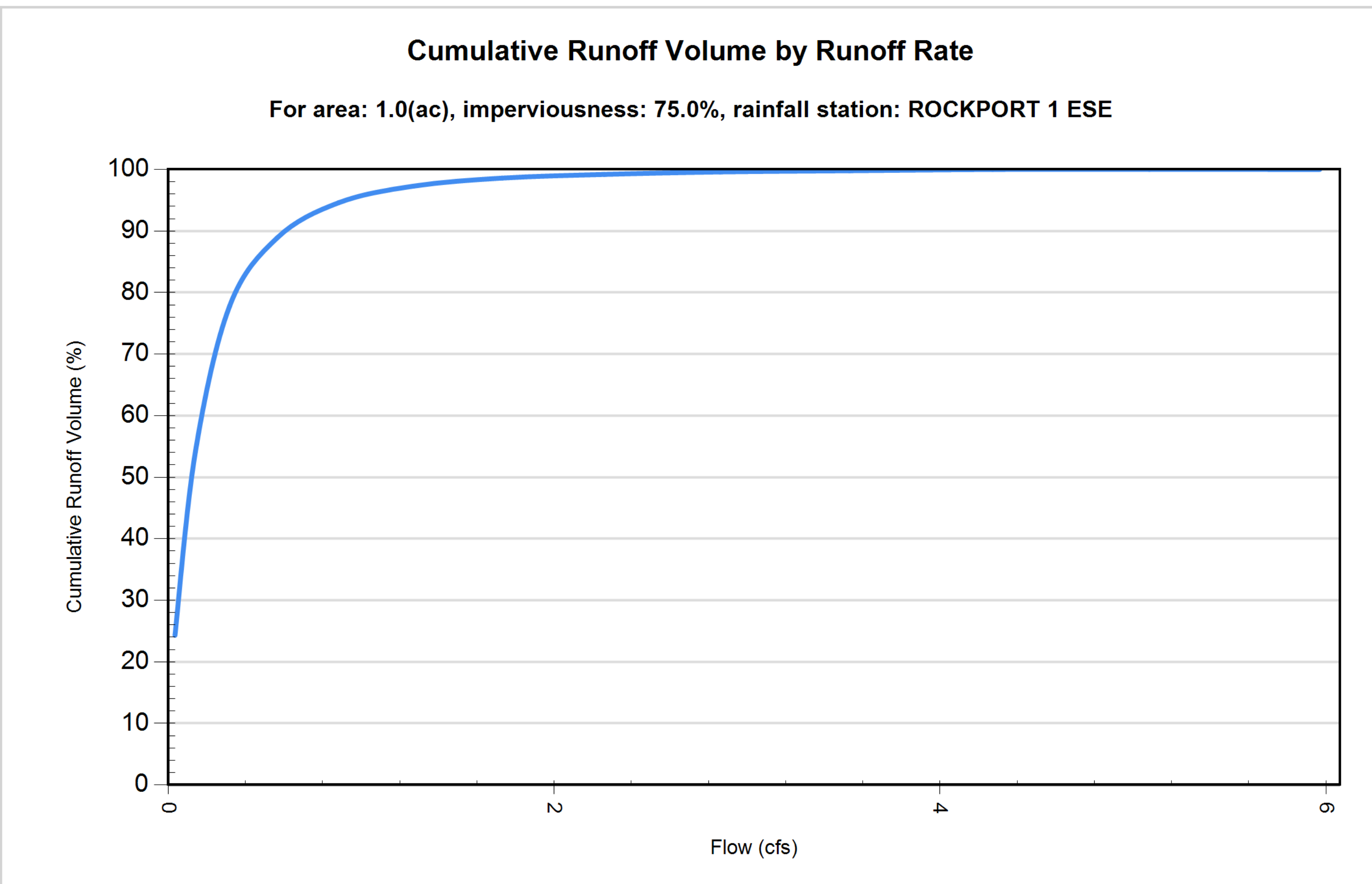
Winter Months	
Winter Infiltration	0

TSS Loading Parameters	
TSS Loading Function	

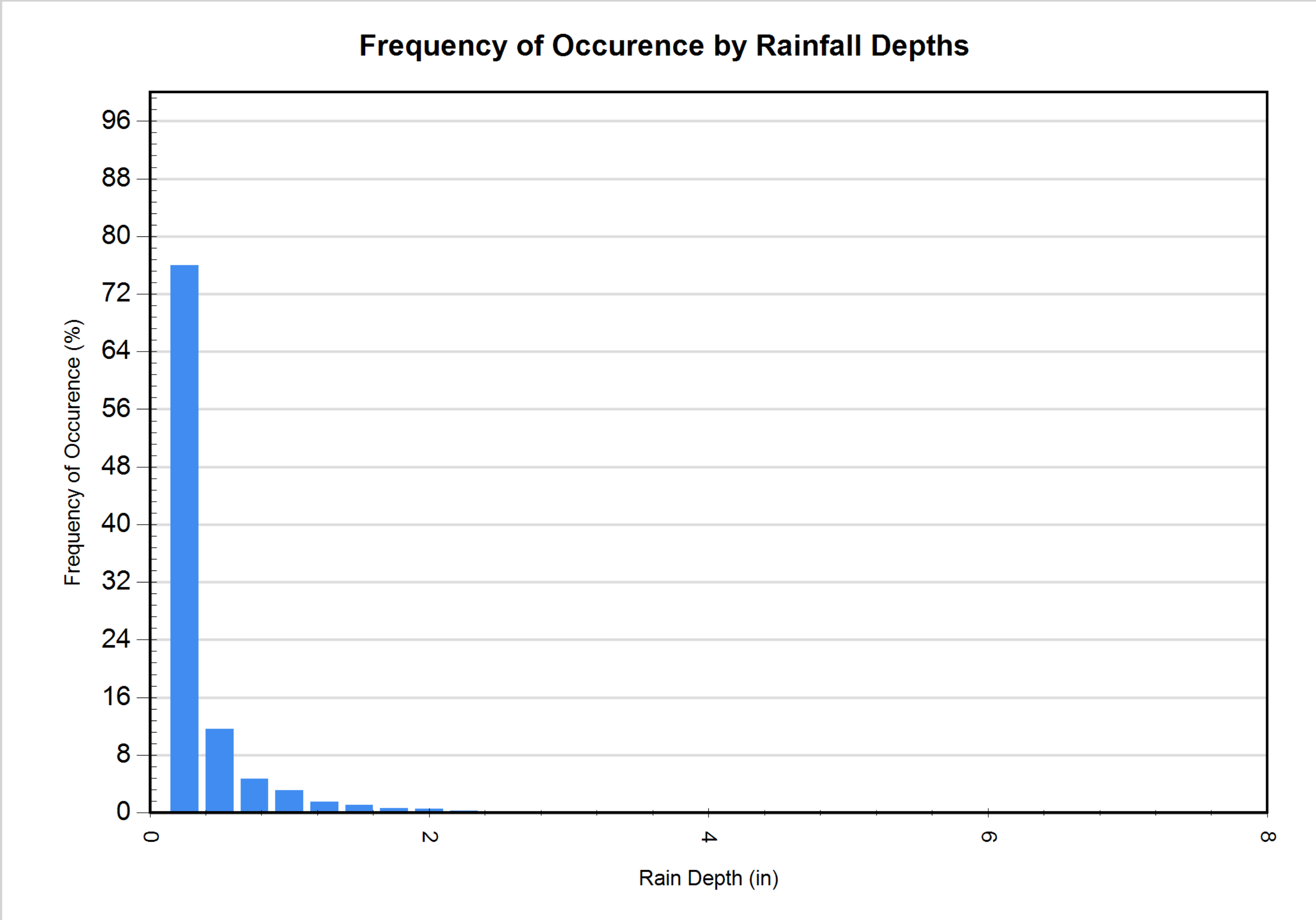
Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

TSS Availability Parameters	
Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	**Runoff Volume (ft³)**	**Volume Over (ft³)**	**Cumulative Runoff Volume (%)**
0.035	781308	2438162	24.3
0.141	1743789	1476073	54.2
0.318	2503688	716008	77.8
0.565	2862925	356485	88.9
0.883	3045655	173672	94.6
1.271	3132611	86643	97.3
1.730	3173051	46186	98.6
2.260	3194425	24795	99.2
2.860	3207086	12132	99.6
3.531	3214240	4973	99.8
4.273	3217757	1454	100.0
5.085	3218958	251	100.0
5.968	3219209	0	100.0



Rainfall Event Analysis				
Rainfall Depth (in)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (in)**	**Percentage of Annual Volume (%)**
0.25	3874	76.0	354	28.4
0.50	591	11.6	215	17.3
0.75	242	4.7	152	12.2
1.00	159	3.1	137	11.0
1.25	79	1.5	89	7.1
1.50	57	1.1	78	6.2
1.75	30	0.6	48	3.9
2.00	24	0.5	44	3.6
2.25	14	0.3	30	2.4
2.50	9	0.2	21	1.7
2.75	5	0.1	13	1.0
3.00	5	0.1	14	1.1
3.25	0	0.0	0	0.0
3.50	3	0.1	10	0.8
3.75	2	0.0	7	0.6
4.00	1	0.0	4	0.3
4.25	1	0.0	4	0.3
4.50	0	0.0	0	0.0
4.75	0	0.0	0	0.0
5.00	0	0.0	0	0.0
5.25	0	0.0	0	0.0
5.50	2	0.0	11	0.9
5.75	1	0.0	6	0.5
6.00	0	0.0	0	0.0
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	0	0.0	0	0.0
7.00	0	0.0	0	0.0
7.25	1	0.0	7	0.6
7.50	0	0.0	0	0.0
7.75	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Detailed Stormceptor Sizing Report – Topsfield Rolling Green EHD

Project Information & Location			
Project Name	470 Boston Street EHD	**Project Number**	2165-01A
City	Topsfield	**State/ Province**	Massachusetts
Country	United States of America	**Date**	9/26/2016
Designer Information		**EOR Information (optional)**	
Name	Dave Robinson	**Name**	
Company	Allen & Major Associates	**Company**	
Phone #	603-553-8151	**Phone #**	
Email	drobinson@allenmajor.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Topsfield Rolling Green EHD
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	83
PSD	Fine Distribution
Rainfall Station	ROCKPORT 1 ESE

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	77
STC 900	83
STC 1200	83
STC 1800	84
STC 2400	87
STC 3600	88
STC 4800	90
STC 6000	90
STC 7200	92
STC 11000	94
STC 13000	94
STC 16000	95
StormceptorMAX	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	Massachusetts	**Total Number of Rainfall Events**	5100
Rainfall Station Name	ROCKPORT 1 ESE	**Total Rainfall (in)**	1244.3
Station ID #	6977	**Average Annual Rainfall (in)**	34.6
Coordinates	42°39'0"N, 70°36'0"W	**Total Evaporation (in)**	80.0
Elevation (ft)	79	**Total Infiltration (in)**	319.5
Years of Rainfall Data	36	**Total Rainfall that is Runoff (in)**	844.8

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Stormceptor®

Rinker MATERIALS™

Drainage Area	
Total Area (acres)	0.90
Imperviousness %	74.0

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Design Details	
Stormceptor Inlet Invert Elev (ft)	71.00
Stormceptor Outlet Invert Elev (ft)	70.75
Stormceptor Rim Elev (ft)	76.90
Normal Water Level Elevation (ft)	
Pipe Diameter (in)	12
Pipe Material	HDPE - plastic
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Stormceptor®

Rinker MATERIALS™

Site Name	Topsfield Rolling Green EHD

Site Details

Drainage Area	
Total Area (acres)	0.90
Imperviousness %	74.0

Surface Characteristics	
Width (ft)	396.00
Slope %	2
Impervious Depression Storage (in)	0.02
Pervious Depression Storage (in)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (in/day)	0.1

Dry Weather Flow	
Dry Weather Flow (cfs)	0

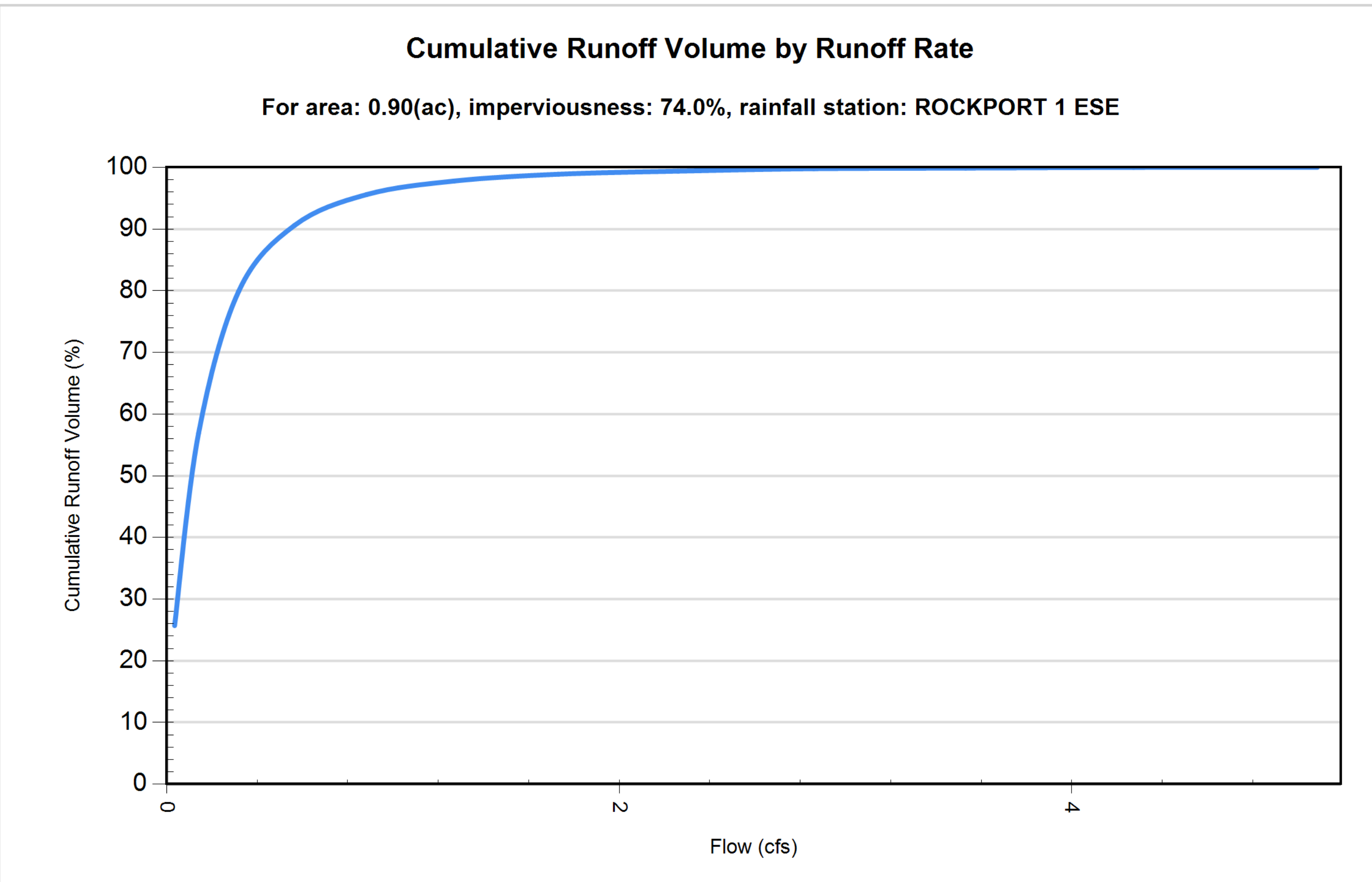
Winter Months	
Winter Infiltration	0

TSS Loading Parameters	
TSS Loading Function	

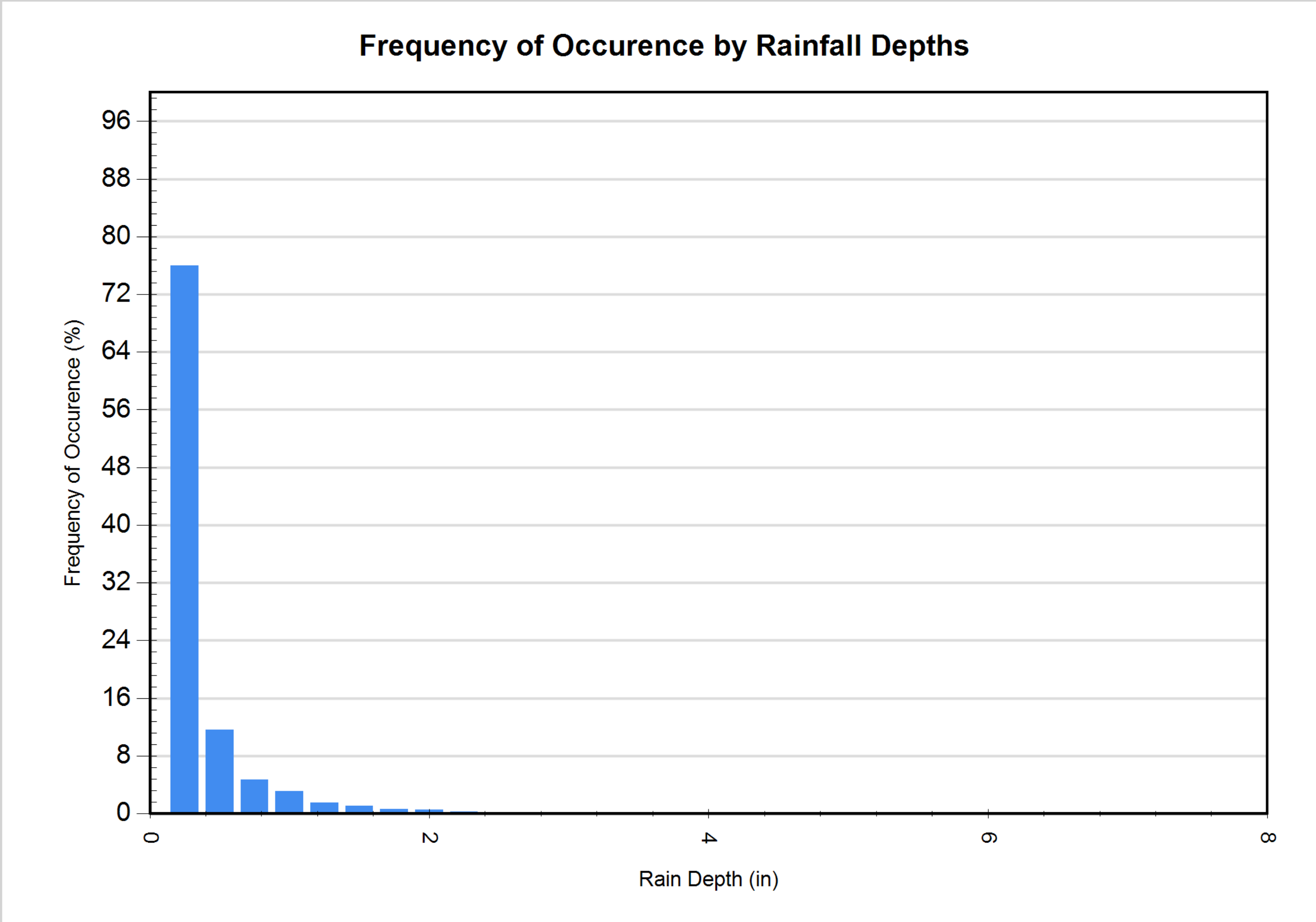
Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

TSS Availability Parameters	
Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	**Runoff Volume (ft³)**	**Volume Over (ft³)**	**Cumulative Runoff Volume (%)**
0.035	734475	2128825	25.7
0.141	1629599	1233729	56.9
0.318	2287293	576176	79.9
0.565	2595545	267910	90.6
0.883	2736282	127129	95.6
1.271	2801437	61948	97.8
1.730	2831045	32333	98.9
2.260	2846869	16501	99.4
2.860	2856266	7098	99.8
3.531	2860910	2453	99.9
4.273	2862855	508	100.0
5.085	2863364	0	100.0



Rainfall Event Analysis				
Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	3874	76.0	354	28.4
0.50	591	11.6	215	17.3
0.75	242	4.7	152	12.2
1.00	159	3.1	137	11.0
1.25	79	1.5	89	7.1
1.50	57	1.1	78	6.2
1.75	30	0.6	48	3.9
2.00	24	0.5	44	3.6
2.25	14	0.3	30	2.4
2.50	9	0.2	21	1.7
2.75	5	0.1	13	1.0
3.00	5	0.1	14	1.1
3.25	0	0.0	0	0.0
3.50	3	0.1	10	0.8
3.75	2	0.0	7	0.6
4.00	1	0.0	4	0.3
4.25	1	0.0	4	0.3
4.50	0	0.0	0	0.0
4.75	0	0.0	0	0.0
5.00	0	0.0	0	0.0
5.25	0	0.0	0	0.0
5.50	2	0.0	11	0.9
5.75	1	0.0	6	0.5
6.00	0	0.0	0	0.0
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	0	0.0	0	0.0
7.00	0	0.0	0	0.0
7.25	1	0.0	7	0.6
7.50	0	0.0	0	0.0
7.75	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Detailed Stormceptor Sizing Report – Topsfield EHD STC #3

Project Information & Location			
Project Name	470 Boston Street EHD	**Project Number**	2165-01A
City	Topsfield	**State/ Province**	Massachusetts
Country	United States of America	**Date**	9/26/2016
Designer Information		**EOR Information (optional)**	
Name	Dave Robinson	**Name**	
Company	Allen & Major Associates	**Company**	
Phone #	603-553-8151	**Phone #**	
Email	drobinson@allenmajor.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Topsfield EHD STC #3
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	84
PSD	Fine Distribution
Rainfall Station	ROCKPORT 1 ESE

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	78
STC 900	84
STC 1200	84
STC 1800	85
STC 2400	87
STC 3600	88
STC 4800	90
STC 6000	91
STC 7200	92
STC 11000	94
STC 13000	94
STC 16000	95
StormceptorMAX	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	Massachusetts	**Total Number of Rainfall Events**	5100
Rainfall Station Name	ROCKPORT 1 ESE	**Total Rainfall (in)**	1244.3
Station ID #	6977	**Average Annual Rainfall (in)**	34.6
Coordinates	42°39'0"N, 70°36'0"W	**Total Evaporation (in)**	80.9
Elevation (ft)	79	**Total Infiltration (in)**	307.0
Years of Rainfall Data	36	**Total Rainfall that is Runoff (in)**	856.4

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Stormceptor®

Rinker MATERIALS™

Drainage Area	
Total Area (acres)	0.8
Imperviousness %	75.0

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Design Details	
Stormceptor Inlet Invert Elev (ft)	71.85
Stormceptor Outlet Invert Elev (ft)	71.60
Stormceptor Rim Elev (ft)	74.90
Normal Water Level Elevation (ft)	
Pipe Diameter (in)	12
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	Topsfield EHD STC #3

Site Details

Drainage Area	
Total Area (acres)	0.8
Imperviousness %	75.0

Surface Characteristics	
Width (ft)	373.00
Slope %	2
Impervious Depression Storage (in)	0.02
Pervious Depression Storage (in)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (in/day)	0.1

Dry Weather Flow	
Dry Weather Flow (cfs)	0

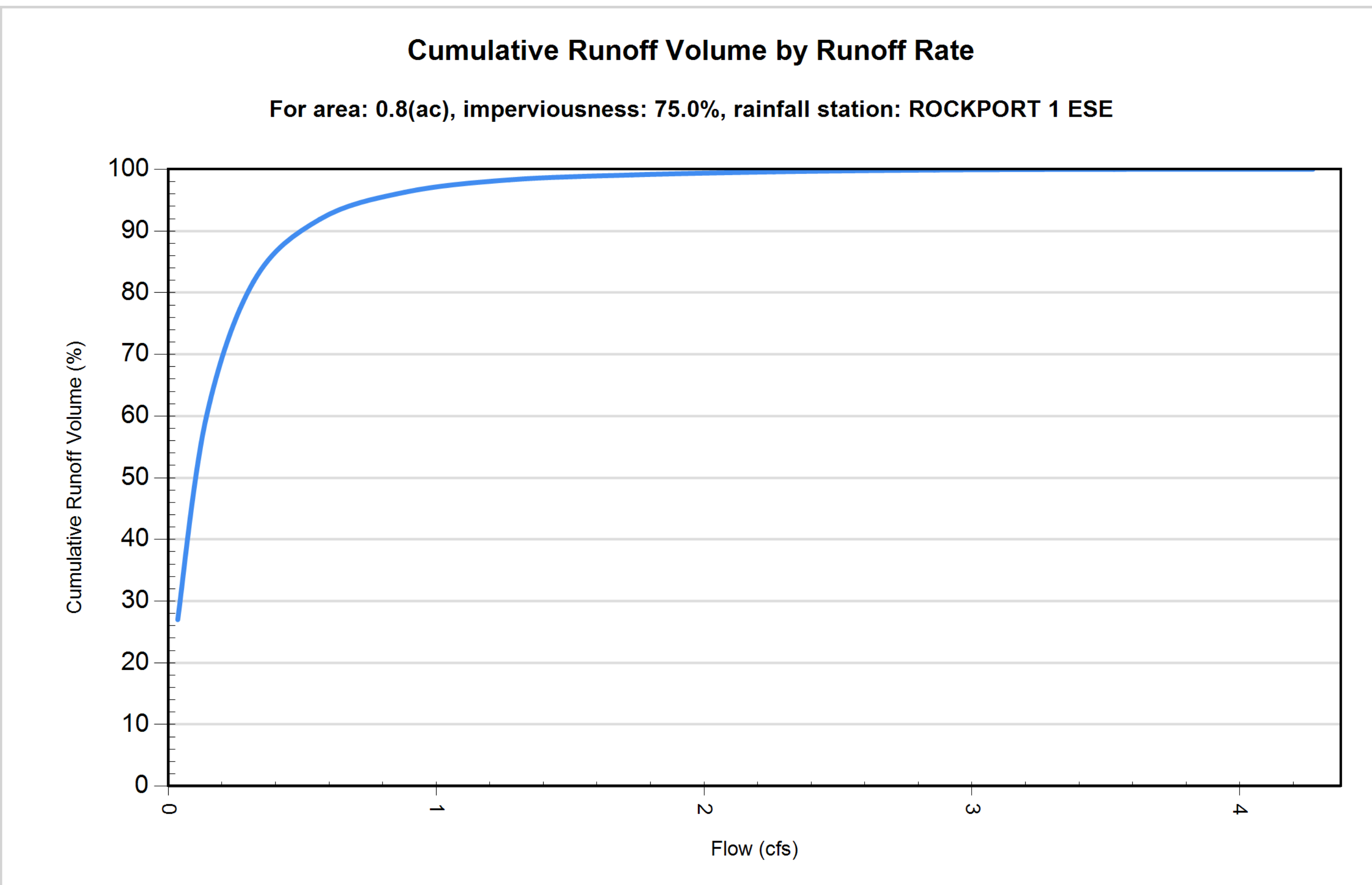
Winter Months	
Winter Infiltration	0

TSS Loading Parameters	
TSS Loading Function	

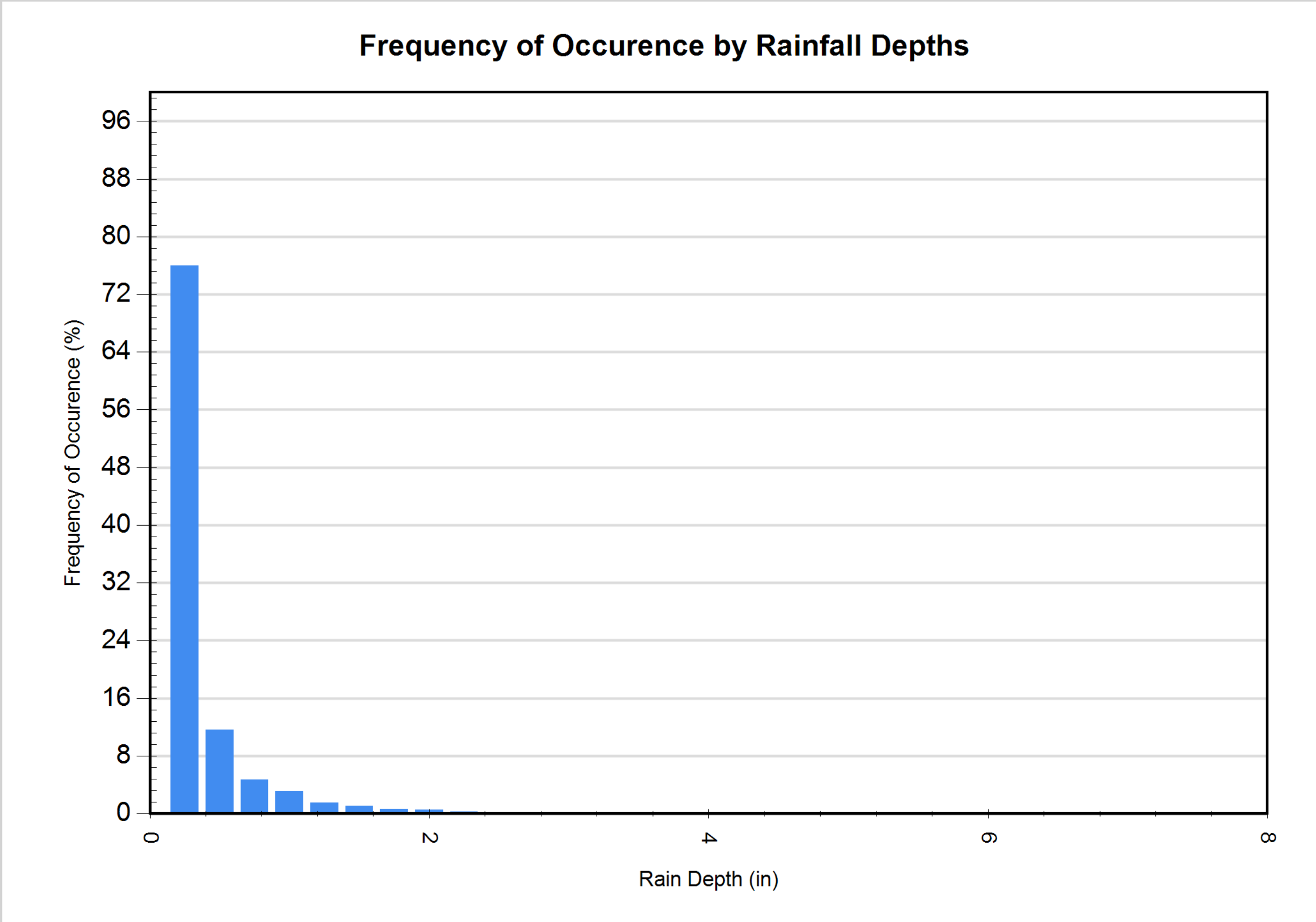
Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

TSS Availability Parameters	
Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	Runoff Volume (ft³)	Volume Over (ft³)	Cumulative Runoff Volume (%)
0.035	698053	1883179	27.0
0.141	1540137	1040872	59.7
0.318	2112665	468531	81.8
0.565	2372353	208893	91.9
0.883	2486945	94262	96.3
1.271	2536127	45060	98.3
1.730	2558575	22607	99.1
2.260	2570751	10430	99.6
2.860	2577312	3865	99.9
3.531	2580237	939	100.0
4.273	2581100	77	100.0



Rainfall Event Analysis				
Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	3874	76.0	354	28.4
0.50	591	11.6	215	17.3
0.75	242	4.7	152	12.2
1.00	159	3.1	137	11.0
1.25	79	1.5	89	7.1
1.50	57	1.1	78	6.2
1.75	30	0.6	48	3.9
2.00	24	0.5	44	3.6
2.25	14	0.3	30	2.4
2.50	9	0.2	21	1.7
2.75	5	0.1	13	1.0
3.00	5	0.1	14	1.1
3.25	0	0.0	0	0.0
3.50	3	0.1	10	0.8
3.75	2	0.0	7	0.6
4.00	1	0.0	4	0.3
4.25	1	0.0	4	0.3
4.50	0	0.0	0	0.0
4.75	0	0.0	0	0.0
5.00	0	0.0	0	0.0
5.25	0	0.0	0	0.0
5.50	2	0.0	11	0.9
5.75	1	0.0	6	0.5
6.00	0	0.0	0	0.0
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	0	0.0	0	0.0
7.00	0	0.0	0	0.0
7.25	1	0.0	7	0.6
7.50	0	0.0	0	0.0
7.75	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

TECHNICAL SHEET

Stormceptor has TARP covered

TARP Tier I Approval Verifies Stormceptor's Superior Performance

What is TARP?

TARP (Technology Acceptance and Reciprocity Partnership) was established in 2000 as a standardized method of evaluating the performance of stormwater treatment technologies.

The TARP program is a three-tiered process that includes rigorous laboratory testing, field tests and regulatory permits. TARP standards are currently recognized by eight participating states - New Jersey, California, Illinois, Maryland, Massachusetts, New York, Pennsylvania and Virginia.

What does TARP do?

TARP's certification program provides scientific data on stormwater technologies and related performance claims, which helps:

- Regulators and engineers make sound decisions when addressing stormwater treatment needs.
- Spread technology performance data quickly, giving jurisdictions an opportunity to better meet their water quality objectives.

How was Stormceptor recognized by TARP?

In February 2005, Stormceptor received TARP Tier I interim certification from the New Jersey Department of Environmental Protection (NJDEP), verifying Stormceptor's ability to perform beyond normal operational capacity during extreme rainfall.

What does TARP test for?

TARP Tier I focused on the removal of total suspended solids (TSS) and scour testing under various operating rates and sediment loadings. Seven stormwater treatment technologies were tested, including the Stormceptor System.

Particle Size Distribution (PSD) testing

Stormceptor was one of only two units tested to utilize the NJDEP PSD testing – treating a sample of particles between one and 1,000 microns. Instead of following TARP standards, the other technologies opted to test a preferred particle size range that best suited their unit's performance (see TARP Tier I – Hydrodynamic Comparison Results) – testing coarser, larger particles that are easier to remove.

Of the devices tested, Stormceptor removed the broadest range of pollutants.

Total Suspended Solids (TSS) removal efficiency

TARP protocol required testing at varying TSS concentrations – 100 mg/L, 200 mg/L, 300 mg/L, with the unit filled to 50% of the recommended capacity before maintenance.

How did Stormceptor perform?

Of all the technologies tested, Stormceptor recorded the highest TSS removal while removing a significant portion of clay and fine silts (NJDEP PSD).

Stormceptor:	75% TSS removal, tested with NJDEP fine PSD
High Efficiency CDS:	73.7%, tested with a much coarser PSD than NJDEP PSD
Downstream Defender:	70%, tested with sand particles
VortSentry:	69%, tested with sand particles
Vortechs:	64%, tested with a much coarser PSD than NJDEP PSD
Aquaswirl:	60%, tested with sand particles
BaySaver:	51%, tested with NJDEP fine PSD

Not only did Stormceptor record the highest TSS removal, it did so removing NJDEP's specified PSD, meaning it removed both a higher percentage as well as a broader range of particles than the other technologies.

Scour test results

Stormceptor was one of only two technologies that completed the scour test as mandated by NJDEP. **Tests demonstrated Stormceptor did not scour with the unit loaded to design capacity.**

The calm *during* the storm

Stormceptor removes more pollutants from stormwater than any other separator. Stormceptor does not scour as the flow rate increases, maintaining a continuous positive treatment of suspended solids. Stormceptor is designed to remove a wide range of particles, as well as free oils, heavy metals and nutrients that attach to fine sediment. Units can also be designed to remove a specific particle size distribution.

With over 18,000 units operating worldwide, Stormceptor protects waterways every day in every storm.

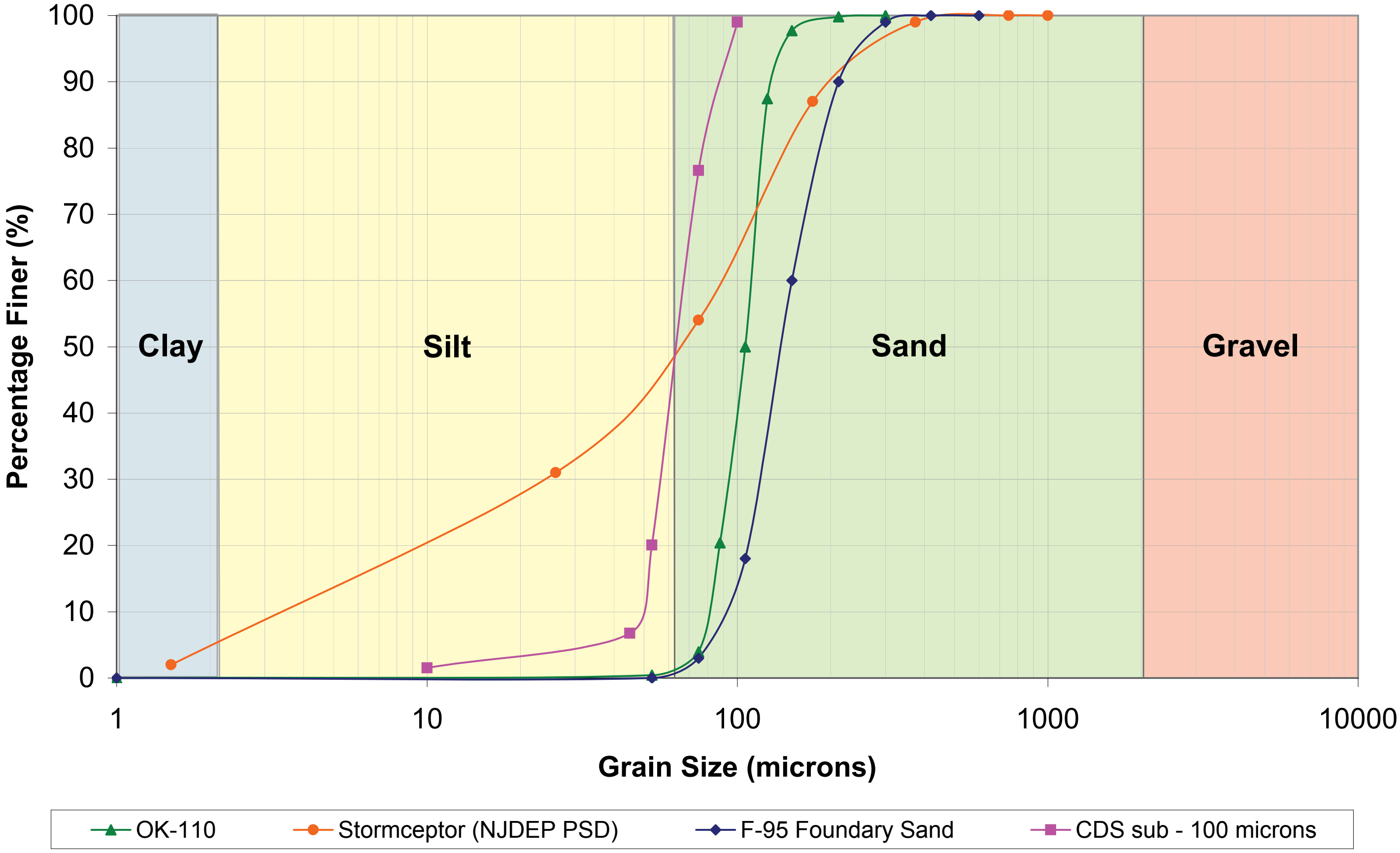
TARP TIER I - Hydrodynamic Comparison Results[1]

DESCRIPTION			HYDRODYNAMIC DEVICES						
			Stormceptor	**High Efficiency CDS**	**Downstream Defender**	**VortSentry**	**Vortechs**	**Aquaswirl**	**Baysaver System**
MODEL TESTED		Model ID	**STC 900**	New Design: PMSU20_20_6 (tank diameter incr. by 1 foot, diff. baffle arrangement)	4-FT	VS40	Model 2000	AS-3	1K
MODEL TESTED		Treatment Chamber Diameter (ID)	**6 ft**	6 ft	4 ft	4 ft	4 ft	2.5 ft	2 ft
MODEL TESTED		Marketed Water Quality Peak Flow Treatment Capacity	**n/a** [2]	1.1 cfs (31.1 L/s)	3.0 cfs (85 L/s)	1.1 cfs (31.1 L/s)	2.8 cfs (79.3 L/s)	1.8 cfs (51 L/s)	2.4 cfs (68 L/s)
MODEL TESTED		100% Operating Rate Tested	**0.64 cfs (18 L/s)**	1.1 cfs (31.1 L/s)	1.1 cfs (31.1 L/s)	1.1 cfs (31.1 L/s)	1.12 cfs (32 L/s) **(40 % of Original)**	0.9 cfs (30.6 L/s) **(60 % of Original)**	1.1 cfs (31 L/s) **(46 % of Original)**
MODEL TESTED		Original Physical Design Tested	**YES**	**NO** (New Design: Increased Tank Volume & Changed Baffle Arrangement)	YES	YES	YES	YES	YES
NJCAT VERIFICATION	**PARTICLE SIZE USED**	Used NJCAT Specified PSD	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	YES
NJCAT VERIFICATION	**PARTICLE SIZE USED**	PSD Range	**NJCAT PSD Tested**	10-100 µm (i.e. fines washed out of sediment samples used via plankton nets)	53 - 300 µm	53 - 300 µm	38 - 75 µm	50 - 150 µm	NJCAT PSD Tested
NJCAT VERIFICATION	**PARTICLE SIZE USED**	**PSD Name**		**sub-100 PSD**	**F-95 Sand**	**F-95 Sand**		**OK-110**	
NJCAT VERIFICATION	**PARTICLE SIZE USED**		**Refer to Particle Size Distribution (PSD) Chart for details & differences between the distributions used**						
NJCAT VERIFICATION	**TSS REMOVAL RESULTS**	100% Operating Rate Tested	**YES**	YES	YES	YES	**NO** (Up to **40%** of operating rate tested)	**NO** (Up to **60%** of operating rate tested)	**NO** (Up to **46%** of operating rate tested)
NJCAT VERIFICATION	**TSS REMOVAL RESULTS**	125% Operating Rate Tested	**YES**	**NO**	YES	YES	**NO**	**NO**	**NO**
NJCAT VERIFICATION	**TSS REMOVAL RESULTS**	Pre-loaded unit at 50% Sediment Capacity prior to evaluating performance	**YES**	**NO**	**NO**	YES	**NO**	**NO**	YES
NJCAT VERIFICATION	**TSS REMOVAL RESULTS**	**NJCAT Verification For TSS Removal**	**75 % TSS** (up to 125% of operating rate)	**73.7 % TSS** (up to 100% of operating rate)	**70 % TSS** (up to 125% of operating rate)	**69 % TSS** (up to 125% of operating rate)	**64 % TSS** (up to **40%** of operating rate)	**60 % TSS** (up to **60%** of operating rate)	**51 % TSS** (up to **46%** of operating rate)
NJCAT VERIFICATION	**SCOUR TEST RESULTS**	Scour Test Performed	**YES**	**NO**	**NO**	YES	**NO**	**NO**	Yes - in second chamber only
NJCAT VERIFICATION	**SCOUR TEST RESULTS**	50% Sediment Loading Capacity at 125% Operating Rate	**NO SCOUR** **0 ppm**	**Not Tested**	**Not Tested**	NO SCOUR 0 ppm	**Not Tested**	**Not Tested**	SCOUR 11 ppm
NJCAT VERIFICATION	**SCOUR TEST RESULTS**	100% Sediment Loading Capacity at 125% Operating Rate (Level were maintenance is recommended)	**NO SCOUR** [3] **3 ppm**	**Not Tested**	**Not Tested**	SCOUR 8 ppm	**Not Tested**	**Not Tested**	SCOUR 16 ppm
TARP TIER I NJDEP INTERIM APPROVAL		NJDEP Accepted NJCAT Verified Value for TSS Removal	**Interim Approval set at 50% TSS**	Interim Approval set at 50% TSS	Interim Approval set at 50% TSS	Interim Approval set at 50% TSS	Interim Approval set at 50% TSS	Interim Approval set at 50% TSS	Interim Approval set at 50% TSS
TARP TIER I NJDEP INTERIM APPROVAL		Original Design Approved by NJDEP	**YES**	**NO** Only the "new" high efficiency design can be used. Original CDS design not approved.	YES	YES	**NO** Must reduce original flow capacity marketed in literature by 60%.	**NO** Must reduce original flow capacity marketed in literature by 50%.	**NO** Must reduce original flow capacity marketed in literature by 54%; Must increase tank surface area by 44% to 79% for design safety.

1. The Technology Acceptance and Reciprocity Partnership (TARP) is a workgroup of the Environmental Council of States (ECOS) that was originally made up of California, Illinois, Maryland, Massachusetts, New Jersey, New York, Pennsylvania and Virginia. Source of all NJDEP & TARP documented information: www.state.nj.us/dep/dsr/bscit/CertifiedMain.htm.
2. Stormceptor is marketed and designed to achieve water quality objectives, rather than sizing primarily for flow-based criteria.
3. Indicated in the NJDEP interim-certification letter (Feb. 15, 2005) which can be obtained from the below web link. Stormceptor did not scour at a 125% operating rate and 100% unit sediment loading. 3 ppm is considered to be within the tolerance of the testing error.

For NJDEP Interim Certified Stormwater Technologies go to: **http://www.state.nj.us/dep/dsr/bscit/CertifiedMain.htm**

Comparison of Particle Size Distributions (PSD) used in TARP Tier I Testing



TIER I - Lab Testing Protocol

1. Measure TSS Removal Efficiency

- Influent concentrations: 100, 200, 300 mg/L
- Five operating rates (25, 50, 75, 100, 125%)
- 50% pre-loaded with sediment

2. Measure Scouring / Re-suspension

- 50% and 100% pre-loaded at 125% operating rate

3. Utilize Pre-defined NJDEP Particle Size Distribution

- 5% clay / 40% silt / 55% sand

Source of all NJDEP and TARP documented information, go to: http://www.state.nj.us/dep/dsr/bscit/CertifiedMain.htm

Title	***MA DEP Standard Calculations***	By	DMR
Project	*Rolling Green Elderly Housing Development, Topsfield, MA*	Chk'd	SRC
Date	October 13, 2016	Apprv'd	SRC
Revised	February 27, 2017		

Stormwater Recharge/Water Quality Volume Table

Required Recharge Equation: Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in* ft^3*, cubic yards or acre-feet*
F *= Target Depth Factor associated with each Hydraulic Soil Group*
Impervious Area *= pavement & rooftop area on site*

Required Water Quality Treatment Volume Equation: $V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP} * 43{,}560 \text{ square feet/acre})$

V_{WQ} *= Required Water Quality Treatment Volume, expressed in* ft^3
D_{WQ} *= Water Quality Depth*
A_{IMP} *= Impervious Area (excluding non-metal roofs)*

							Recharge Required			*Water Quality Volume Required*	
			Impervious Area (Feet)								
W'SHED	Area (Feet)	Pervious	HSG A (F=0.6)*	HSG B (F=0.35)*	HSG C (F=0.25)*	HSG D (F=0.1)*	*F Avg. (Inches)*	*Impervious Area (Feet)*	*Rv* (ft^3)	D_{WQ} *(Inch)*	V_{WQ}
P-1	81,776	78,637	3,139	0	0	0	0.000	3,139	0	0.5	131
P-2	22,978	9,227	6,902	3,632	3,217	0	0.452	13,751	518	0.5	573
P-3	27,549	24,037	3,512	0	0	0	0.600	3,512	176	0.5	146
P-3A	4,950	1,557	3,393	0	0	0	0.600	3,393	170	0.5	141
P-4	21,239	7,933	13,306	0	0	0	0.600	13,306	665	0.5	554
P-5	39,272	18,801	19,875	0	596	0	0.590	20,471	1,006	0.5	853
P-6	19,137	7,682	11,455	0	0	0	0.600	11,455	573	0.5	477
P-7	15,670	8,687	6,983	0	0	0	0.600	6,983	349	0.5	291
P-8	15,307	14,235	1,072	0	0	0	0.600	1,072	54	0.5	45
P-9	102,567	98,195	4,372	0	0	0	0.600	4,372	219	0.5	182
P-10	31,595	29,291	0	0	2,304	0	0.250	2,304	48	0.5	96
R-1	3,185	0	850	0	2,335	0	0.343	3,185	91	0.5	133
R-2	3,195	0	0	0	3,195	0	0.250	3,195	67	0.5	133
R-3	3,625	0	0	0	3,625	0	0.250	3,625	76	0.5	151
R-4	3,625	0	0	0	3,625	0	0.250	3,625	76	0.5	151
R-5	3,195	0	0	0	3,195	0	0.250	3,195	67	0.5	133
R-6	3,625	0	630	0	2,995	0	0.311	3,625	94	0.5	151
R-7	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-8	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-9	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-10	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-11	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-12	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-13	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-14	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-15	1,705	0	1,705	0	0	0	0.600	1,705	85	0.5	71
R-16	1,490	0	1,490	0	0	0	0.600	1,490	75	0.5	62
R-17	120	0	120	0	0	0	0.600	120	6	0.5	5
Total	435,885	0			0	0			**5,910**		**5,728**

Stormwater Recharge Summary

Title	***MA DEP Standard Calculations***	By	DMR
Project	*Rolling Green Elderly Housing Development, Topsfield, MA*	Chk'd	SRC
Date	October 13, 2016	Apprv'd	SRC
Revised	February 27, 2017		

Equations provided above

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in* ft^3*, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

A_{WQ} *= Required Water Quality Treatment Volume, expressed in* ft^3

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

	Required (cf)	Provided (cf)			
A_{WQ} =	*5,910*	*34,716*			***Underground Infiltration System #1 - #9 and Surface Detention Basins #1-3***
A_{WQ} =	*5,910*	*34,716*			***Total***

Water Quality Volume

A_{WQ} *= Required Water Quality Treatment Volume, expressed in* ft^3

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

	Required (cf)	Provided (cf)			
A_{WQ} =	*5,728*	*34,716*			***Underground Infiltration System #1 - #9 and Surface Detention Basins #1-3***
A_{WQ} =	*5,728*	*34,716*			***Total***

Draindown Within 72 Hours

$\textbf{Time}_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Underground Infiltration System #1 (Assumed Sand)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	3,396
Infiltration Volume (ft^3) =	1,027
$\textbf{Time}_{drawdown}$ **(Hours)=**	3.56

Underground Infiltration System #2 (Sand)	
Infiltration Rate (in/Hr)=	8.27
Bottom Area (ft^2) =	1,176
Infiltration Volume (ft^3) =	837
$\textbf{Time}_{drawdown}$ **(Hours)=**	1.03

Underground Infiltration Systems #3-9 (Sandy Loam)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	104
Infiltration Volume (ft^3) =	195
$\textbf{Time}_{drawdown}$ **(Hours)=**	22.03

Surface Infiltration System (Sandy Loam & Sand)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	1,817
Infiltration Volume (ft^3) =	2,970
$\textbf{Time}_{drawdown}$ **(Hours)=**	19.23

Title	***MA DEP Standard Calculations***		By	DMR
Project	*Rolling Green Elderly Housing Development, Topsfield, MA*		Chk'd	SRC
Date	October 13, 2016		Apprv'd	SRC
Revised	February 27, 2017			

TSS Removal Worksheet

TSS Removal Calculation Worksheet - UIS#1

A	B BMP'	C TSS Removal Rate'			D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)	
	Deep Sump and Hooded Catch Basin	0.25			1.00	0.25	0.75	(25% has been removed prior to infiltration)
	Proprietary Treatment Practice WQU-1	0.77			0.75	0.58	0.17	
	Subsurface Infiltration Basin #1 with Filter Fabric	0.80			0.17	0.14	0.03	

Total TSS Removal = 97%

TSS Removal Calculation Worksheet - UIS #2

A	B BMP'	C TSS Removal Rate'			D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)	
	Deep Sump Catch Basins	0.25			1.00	0.25	0.75	(25% has been removed prior to infiltration)
	Subsurface Infiltration Basin #1	0.80			0.75	0.60	0.15	

Total TSS Removal = 85%

Title	***MA DEP Standard Calculations***		By	DMR
Project	*Rolling Green Elderly Housing Development, Topsfield, MA*		Chk'd	SRC
Date	October 13, 2016		Apprv'd	SRC
Revised	February 27, 2017			

TSS Removal Calculation Worksheet - WQU #2 & 3

A	B BMP[1]	C TSS Removal Rate[1]			D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)	
	Deep Sump Catch Basins	**0.25**			**1.00**	**0.25**	**0.75**	(25% has been removed prior to infiltration)
	Proprietary Treatment Practice	**0.80**			**0.75**	**0.60**	**0.15**	
	Infiltration Basin	**0.80**			**0.15**	**0.12**	**0.03**	

Total TSS Removal = **97%**

Mounding Analysis

Infiltration System	*Water Table*			*System Bottom*	*Vertical Separation*	*Attenuated System*	*Mounding Analysis Required*
1	56.50			60.00	3.5	YES	YES
2	59.50			61.50	2.0	YES	YES

Allen & Major Associates, Inc.	Computation Sheet

Title	***Pipe Sizing Table***	Minimum Slope:	0.0047	By	DMR
Project	Topsfield Elderly Housing Development	Minimum Pipe Size:	6	Chk'd	SRC
Date	October 13, 2016	Rainfall Intensity (in/hr):	5.40 (25 year storm)	Apprv'd	TJW
Revised	February 27, 2017	Manning's n:	0.011 HDPE/PVC		
A&M Project Number:	2165-01A	Manning's n:	0.013 RCP		
		Minimum Pipe Cover:	1.84'		

Elderly Housing Development - Topsfield, MA

Line						Req'd. Capac.	Pipe Size	Slope	Design Capacity		Drop	Invert Elevation		Rim Elev.	
From	To	Length	Area	wgt. *C*	*C*A	*Qd*	*D*	*s*	Q_{full}	V_{full}		Upper	Lower	Upper	Cover
Upper	Lower	(feet)	(acres)			(cfs)	(in)	(%)	(cfs)	(fps)	(feet)	(ft)	(ft)	(ft)	(ft)
CB1	DMH-1	32	0.402	0.57	0.228	1.23	10	1.00%	2.6	4.75	0.32	64.66	64.34	69.10	3.48
CB2	DMH-1	40	0.060	0.91	0.054	0.29	10	0.70%	2.2	3.97	0.28	64.62	64.34	68.50	2.92
DMH-1	WQU-1	19				1.52	12	1.53%	5.2	6.62	0.29	64.34	64.05	68.00	2.54
REAR OF UNITS	CLEANOUT	100	0.046	0.95	0.044	0.24	6	1.00%	0.7	3.38	1.00	100.00	99.00	102.00	VARIES
LARGEST UNIT (AA)	CLEANOUT	100	0.087	0.95	0.083	0.45	6	1.00%	0.7	3.38	1.00	100.00	99.00	102.00	VARIES
WQU1	UIS1	7.5	1.047	0.69	0.719	2.21	12	2.00%	6.0	7.58	0.15	63.80	63.65	68.40	3.48
CB3	DMH5	12	0.130	0.79	0.103	0.55	10	1.00%	2.6	4.75	0.12	72.45	72.33	75.30	1.89
CB4	DMH5	12	0.130	0.79	0.103	0.55	10	1.00%	2.6	4.75	0.12	72.35	72.23	75.20	1.89
CB5	DMH4	17	0.207	0.75	0.155	0.84	10	1.00%	2.6	4.75	0.17	71.84	71.67	75.05	2.25
CB6	DMH4	17	0.207	0.75	0.155	0.84	10	1.00%	2.6	4.75	0.17	71.84	71.67	75.10	2.30
WQU2	DMH9	21	0.673	3.08	0.515	2.78	12	0.95%	4.1	5.23	0.20	70.75	70.55	76.90	5.03
UIS 3	DMH9	30	0.083	0.95	0.079	0.43	6	9.00%	2.0	10.13	2.70	73.40	70.70	76.75	2.72
UIS 4	6" TEE	30	0.073	0.95	0.070	0.38	6	0.47%	0.5	2.31	0.14	74.20	74.06	77.50	2.68
UIS 5	CO-7	22	0.083	0.95	0.079	0.43	6	0.91%	0.6	3.22	0.20	74.80	74.60	78.30	2.88
CO-7	6" TEE	54	0.083	0.95	0.079	0.43	6	1.00%	0.7	3.38	0.54	74.60	74.06	78.00	2.78
6" TEE	DMH 9	63	0.083	0.95	0.079	0.43	8	5.57%	3.4	9.66	3.51	74.06	70.55	78.00	3.15
DMH9	FES1	62				3.58	15	0.48%	5.3	4.33	0.30	70.45	70.15	76.90	5.08
DMH5	DMH4	46	0.402	0.57	0.228	1.23	10	1.00%	2.6	4.75	0.46	72.13	71.67	75.30	2.21
CB7	WQU3	5	0.281	0.80	0.226	1.22	10	3.00%	4.5	8.22	0.15	72.00	71.85	74.80	1.84
CB8	WQU3	15	0.281	0.80	0.226	1.22	10	1.00%	2.6	4.75	0.15	72.00	71.85	74.80	1.84
WQU3	DMH6	31	0.562	1.61	0.452	2.44	12	0.97%	4.2	5.27	0.30	71.60	71.30	74.90	2.18
DMH-6	FES-2	36	0.888	0.70	0.619	6.11	12	0.56%	3.1	4.00	0.20	71.20	71.00	75.10	2.77
OCS-1	DMH-10	155				9.69	18	1.35%	14.5	8.18	2.10	70.10	68.00	74.00	2.28
DMH-10	FES-3	74				9.69	18	1.22%	13.7	7.75	0.90	67.90	67.00	72.15	2.63
DCB-9	CB-2	82	0.725	0.39	0.286	1.54	10	0.50%	1.8	3.36	0.41	65.13	64.72	70.70	4.61

ROLLING GREEN ELDERLY HOUSING DEVELOPMENT, TOPSFIELD, MA

Allen & Major Associates, Inc.

Computation Sheet

By	DMR
Chk'd	SRC
Apprv'd	TJW

Title: ***RipRap Sizing Spreadsheet***
Project: Rolling Green EHD, 470 Boston Street, Topsfield MA
Date: Feb. 27, 2017
A&M Project Number: 2165-01A

OUTLET	Do (ft.)	Q10 (cfs)	Tw (ft.)	La (ft.)	Wup (ft.)	Wdn (ft.)	d50 (ft.)*
FES-1	1.25	2.06	0.5	11.4	3.8	15.2	0.08
FES-2	1.00	0.72	0.5	8.3	3.0	11.3	0.03
FES-3	1.25	0.14	0.5	8.9	3.8	12.7	0.00

Notes:

Assume 6" Tw at Outfall
Use MHD M2.02.2 Stone
Depth of Stone to be 6" or 1.5 times d50 - which ever is larger
* 6" Stone Minimum
**Apron width shall meet defined channel downstream

When Tw < 0.5Do at pipe outlet:

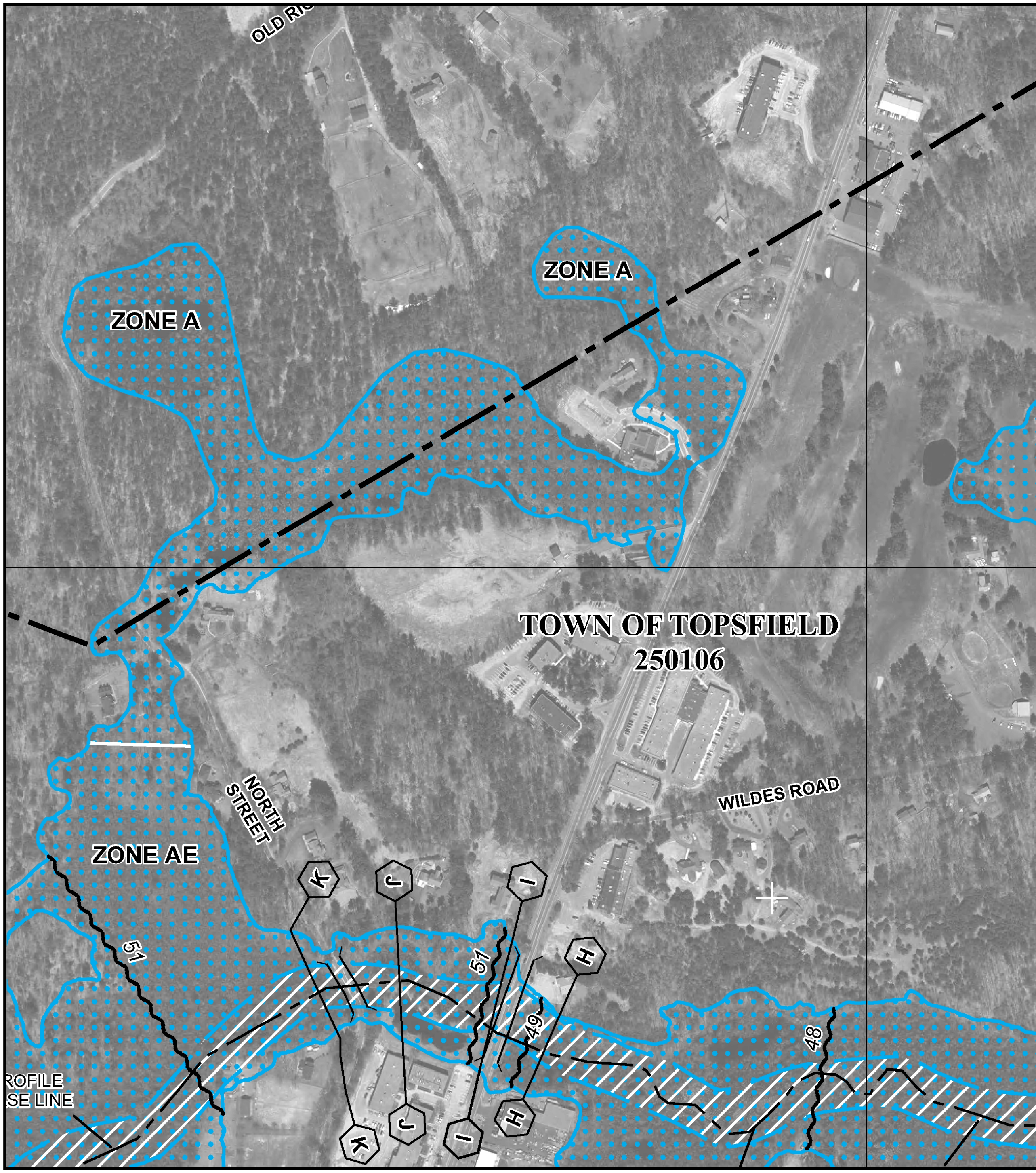
La = 1.8Q/Do^1.5 + 7Do
Wup = 3Do
Wdn = 3Do + La
d50 = (0.02Q^1.3)/(TwDo)

When Tw > or = 0.5Do at pipe outlet:

La = 3Q/Do^1.5 + 7Do
Wup = 3Do
Wdn = 3Do + 0.4La
d50 = (0.02Q^1.3)/(TwDo)

Where:

Tw = the tailwater depth at the outlet of the pipe or channel
Do = the diameter of the pipe or the width of channel
Q = the discharge from the pipe of channel (10 year Storm)
La = the length of apron
Wup = the upstream width of apron
Wdn = the downstream width of apron
d50 = the median stone diameter



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0266F

FIRM

FLOOD INSURANCE RATE MAP

ESSEX COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 266 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
IPSWICH, TOWN OF	250086	0266	F
ROWLEY, TOWN OF	250101	0266	F
TOPSFIELD, TOWN OF	250106	0266	F

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

MAP NUMBER
25009C0266F

EFFECTIVE DATE
JULY 3, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: Sarkis Development Company

ADDRESS: 2 Elm Square

Andover, MA 01810

TEL. NUMBER: (978) 475-4055

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.