
DRAINAGE REPORT

Stardust LLC

20 Tariffville Road

Simsbury, CT

Revised July 12, 2021

Prepared for:

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Project No. 2021-011

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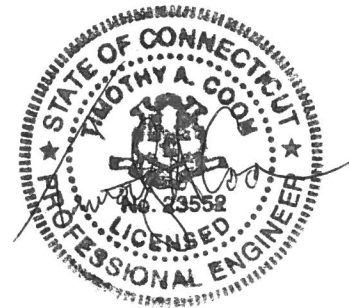


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I. INTRODUCTION

A. Project Description

Stardust LLC is proposing a self-storage facility comprised of ten one-story buildings totaling 47,889 square feet at 20 Tariffville Road in Simsbury. The development will result in an increase in impervious area of approximately 2.0 acres. Runoff from the new impervious area will be directed to a new infiltration basin designed to provide treatment and ground water recharge in accordance with the Connecticut Stormwater Quality Manual and Town of Simsbury Stormwater Articles. In addition, runoff from the existing parking lot at the site will be collected and diverted through a new hydrodynamic separator to provide treatment of the stormwater prior to discharge where no treatment was previously provided.

B. Existing Conditions

The subject parcel consists of 10.2 acres at 20 Tariffville Road in Simsbury. The parcel fronts Tariffville Road to the south, St. John's Place to the west, and the Farmington River to the east. The western portion of the site is currently developed with the Old Well Tavern restaurant, a residential structure, and a 148 space parking lot. A second residential building and garage are located on the northern end of the site and accessed by two gravel driveways, one off of the northern corner of the parking lot and a second one that comes off of Tariffville Road. The second driveway runs just west of the top of the bank that leads down into the floodplain of the Farmington River. The central portion of the parcel between the parking lot and the gravel drive at the top of the slope is maintained as lawn. The eastern portion of the parcel is located within the floodplain and consists of a combination of woods and open field. The proposed development area is limited to the undeveloped central portion of the site and the very eastern edge of the existing parking lot.

The project parcel does not contain a formal drainage system. The majority of the runoff from area to the north and east of the restaurant building and parking lot are directed to an existing 15" culvert at the southeast corner of the parking lot which travels under the gravel driveway and discharges at the edge of the floodplain in the southeast corner of the parcel. Runoff from the northern and central portions of the parcel sheet flow easterly toward the Farmington River. The areas to the west and south of the restaurant building sheet flow into the surrounding streets.

C. Soils Investigations

Based on a review of the USDA Soil Survey of Connecticut, the soils in the area to be developed consist of several soils; including Urban Land, Merrimac fine sandy loam, Agawam fine sandy loam, and Enfield silt loam (see Soils Map in Appendix 2). The USDA Soil Survey defines groups of soils into Hydrologic Soil Groups (HSG) according to their runoff-producing characteristics. Soils are assigned to four groups (A, B, C, and D Groups). In group A, are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They typically are deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a hardpan or clay

layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other nearly impervious material. The classification of the Merrimac fine sandy loam is HSG A and the others are HSG B.

On March 8, 2021, a series of 8 test pits were performed in the area of the proposed development to confirm the existing soil conditions. Test pits were excavated to depths ranging from 76-90 inches. Soils encountered include 10-24 inches of topsoil over sandy loam subsoils to a depth of 24-44 inches, overlying fine to coarse sand and gravel. Soil mottling indicative of the seasonal high water table was encountered in test pits TP4 and TP6 at depths of 80 and 86 inches, respectively. No evidence of the water table was encountered in the other test pits. Test pit logs are provided in Appendix 3.

Soil samples were collected from test pits 1 through 4 at depths ranging from 24 to 36 inches. These samples were submitted to New England Materials Testing Lab, LLC for permeability testing by ASTM D2434. Calculated permeabilities ranged from 0.522 in/hr for the sample collected in TP4 to 12.35 in/hr for the sample collected in TP2. Permeability test results are also provided in Appendix 3.

II. SYSTEM DESIGN

A. Proposed System

The proposed project will result in the addition of approximately 2 acres of new impervious area at the site. In order to mitigate the increase in runoff resulting from the additional impervious area a new infiltration basin will be constructed along the eastern side of the development to provide retention and treatment prior to discharge. In addition, runoff from the existing parking lot will be collected in a series of new inlets and diverted through a new stormwater treatment unit. Discharge from the infiltration basin and stormwater treatment unit will be conveyed to a new manhole that will discharge to a new riprap outfall to replace the existing culvert outfall at the edge of the floodplain in the southeast corner of the site.

As discussed above, several test pits were completed at the site to verify soil conditions. Test pits TP1, TP2 and TP3 were all located within the limits of the proposed infiltration basin. Samples collected from these test pits at depths consistent with the proposed bottom of the basin were subsequently tested for permeability. The resulting permeabilities were 2.34 in/hr (TP1), 12.35 in/hr (TP2) and 8.5 in/hr (TP3). As a conservative measure, the slowest permeability rate of 2.34 in/hr was used as the basis for the design infiltration rate. This rate was further reduced by 50% to account for potential clogging resulting in a final design infiltration rate for the basin of 1.17 inches/hour.

The infiltration basin has been designed in accordance with the Connecticut Stormwater Quality Manual. Pretreatment will be provided by a level stone spreader at the edge of the pavement and a 25-foot wide vegetated filter strip leading to the basin. The bottom of the basin will be set at elevation 152 which is in excess of the required 3 feet of separation to the seasonal high water table that was encountered in the test pits completed in the vicinity of the basin. The Water Quality Volume (WQV) for the area contributing to the infiltration basin was calculated to be

8,414 cubic feet (see Appendix 6). The proposed basin storage capacity below the outlet is approximately 14,003 cubic feet which exceeds the required WQV (see basin characteristics in Appendix 5). Flows from larger storm events in excess of the storage and infiltration capacity of the basin will discharge via a 15" culvert that will connect to the manhole which ultimately discharges to the edge of the floodplain. Based on the storage volume, bottom area and design infiltration rate, the time to drain the proposed basin was calculated to be 26.2 hours (see Appendix 6), which is less than the required maximum allowable of 72 hours.

B. Peak Discharge Attenuation

1. Methodology

Peak runoff flow rates were determined for pre- and post-development conditions using Applied Microcomputer System's HydroCAD™ Stormwater Modeling System. This computer software employs the SCS Technical Release 55 and 20 (TR-55 & TR-20) methodology. The potential stormwater impacts downstream were evaluated for the 2-yr, 10-yr, 25-yr, and 100-yr; 24-hour storm events. The rainfall for these storm events was taken from NOAA Atlas 14 provided in Appendix 1. Based on the present drainage patterns, all runoff from the proposed development area flows easterly into the Farmington River. As a result, the edge of the floodplain to the Farmington River was selected as the design point.

The analyses area was limited to approximately 7.1 acres which contribute runoff across the development area as shown on the Drainage Area Maps in Appendix 4. Portions of the site to remain unchanged and that do not contribute runoff across the development area (i.e. the areas to the south and west of the restaurant) were excluded from the analyses.

2. Pre-Development Hydrology

The pre-development site was divided into two subcatchments. Subcatchment E1 includes the area that discharges directly to the edge of the design point. Subcatchment E2 includes the remaining portion of the analyses area that drains through the culvert under the gravel driveway at the southeast corner of the site. The pre-development drainage area map is provided in Appendix 4. The pre-development runoff characteristics of the contributing areas are provided on the HydroCAD data sheets in Appendix 5. The calculated peak discharge rates and volumes for the design storms are summarized in Table 1 and 2 below.

3. Post-Development Hydrology

The same design point for the pre-development analysis was used for the post development analysis. The post development site was divided into five subcatchments. Subcatchment S1 includes the area that will continue to drain overland directly to the

design point (i.e. floodplain). Subcatchments S2a, S2b, and S2c include the areas that will discharge to the yard drain, catch basin and treatment structure, respectively, at the south end of the existing parking lot. Subcatchment S3 includes the remainder of the analyses area that will drain to the infiltration basin. Subcatchment areas are shown on the post development drainage area map in Appendix 4. The post development runoff characteristics of the subcatchments are provided on the HydroCAD data sheets in Appendix 5.

Using the characteristics for the subcatchments and infiltration basin described above, the Post Development peak flow rates and volumes for the site were calculated for the design storms. These are summarized in Tables 1 and 2 below. As shown in Table 1, the post-development peak flows at design point are less than the pre-development peak flows for all design storms. Similarly, Table 2 demonstrates that the proposed stormwater management system will result in a decrease in the overall runoff volume discharged from the site for all of the design storms. In addition, the calculations indicate that all runoff from the new development area intercepted by the infiltration basin will be completely recharged with no discharge from the basin for storms up to and including the 2-year design storm.

TABLE 1 – COMPARISON OF PRE- & POST-DEVELOPMENT DISCHARGE RATES (CFS) TO DESIGN POINT

| | 2-year | 10-year | 25-year | 100-year |
|------------------|--------|---------|---------|----------|
| Pre-Development | 4.1 | 9.5 | 13.5 | 21.3 |
| Post Development | 1.8 | 7.0 | 11.7 | 18.2 |

TABLE 2 – COMPARISON OF PRE- & POST-DEVELOPMENT DISCHARGE VOLUME (AC-FT) TO DESIGN POINT

| | 2-year | 10-year | 25-year | 100-year |
|------------------|--------|---------|---------|----------|
| Pre-Development | 0.483 | 1.193 | 1.714 | 2.600 |
| Post Development | 0.276 | 1.006 | 1.562 | 2.484 |

C. Stormwater Treatment

As discussed above, runoff from the development area will sheet flow from the edge of the parking lot across a 25-foot wide vegetated filter strip and into the infiltration basin. The filter strip will provide pre-treatment and the infiltration basin is considered by the DEEP as a primary treatment practice for providing water quality renovation prior to discharge.

In addition, runoff from the existing parking lot, which previously was discharged to the floodplain of the Farmington River untreated, will be collected and diverted through a new water quality unit (CDS Model 2015-4-C). This treatment unit was sized by the manufacturer to provide the required Water Quality Flow rate, as well as provide a net annual removal of total suspended solids (TSS) in excess of 80%. Sizing calculations for the unit are provided in

Appendix 5.

D. Groundwater Recharge

The infiltration basin was also designed to provide the required groundwater recharge by infiltrating stormwater back into the ground. For the purpose of determining the Groundwater Recharge Volume (GRV), the Hydraulic Soil Group underlying the development area was conservatively assumed to be all HSG A. Using this category, the GRV is calculated as follows:

$$\text{GRV} = (D)(I)/12 \quad \text{where} \quad \begin{array}{l} \text{GRV} = \text{Groundwater Recharge Volume (acre-ft)} \\ D = \text{depth of runoff to be recharged} = 0.6 \text{ inches} \\ I = \text{new impervious area} = 2.00 \text{ acres} \end{array}$$

$$\begin{aligned} \text{GRV} &= (0.6)(2.00)/12 \\ &= 0.100 \text{ ac-ft} = 4,356 \text{ cf} \end{aligned}$$

As discussed above, the storage capacity of the infiltration basin below the outlet invert is 14,003 cubic feet, which exceeds the GRV requirement.

E. Pipe Sizing

The piping proposed at the site consists of smooth bore high density polyethylene corrugated plastic pipe (HDPE). The roughness coefficient used for this pipe type is 0.012. The analysis provided in Appendix 5 indicates headwater elevation in the structure at each pipe inlet (YD, CB, CDS and DMH) for the design storms and compares it to the flood elevation, which corresponds to the top of frame of the structure. The calculations indicate that all proposed pipes will have sufficient capacity to convey the 25-year storm event without surcharging out of the top of the structures. Similarly, the calculations indicate that the pipe from the drain manhole to the outlet is sufficient to convey flows from the 100-year design storm, which is necessary for the infiltration basin outlet to function as designed.

F. Inlet Capacity Analysis

The three proposed stormwater inlets (YD, CB1 and the CDS unit) are located in depressions or sags. An analysis of the inlet capacity of each of the inlets during the 25-year storm event was performed and is provided in Appendix 5. The analysis indicates that some runoff will bypass the yard drain (YD). However, the bypass will flow directly to CB1 along the edge of the pavement. Both CB1 and the CDS unit have sufficient inlet capacity for all flow to them during the 25-year storm. The results indicate that the inlets have sufficient capacity to prevent any significant impacts.

F. Pipe Outfall Protection

Outfall protection for the pipe discharge at the edge of the floodplain will consist of a modified riprap apron. The apron was designed for the 100-year design storm in accordance with the

requirements of the Table 8.6.1 of the CT DOT Drainage Manual. Calculations are provided in Appendix 6.

III. SUMMARY AND CONCLUSIONS

The proposed stormwater management system for the new development includes sheet flow from the edge of the pavement across a grass filter strip to an infiltration basin. The discussion above indicates that the basin will recharge in excess of the required WQV and GRV and result in a decrease in both peak discharge rate and volume from the site. In addition, runoff from the existing parking lot, which was previously discharged untreated, will be collected and diverted through a new stormwater treatment unit. In conclusion, the results of this report indicate that the proposed development will result in a positive impact to downstream properties.

Appendix 1:
RAINFALL DATA



NOAA Atlas 14, Volume 10, Version 3
Location name: Simsbury, Connecticut, USA*
Latitude: 41.8949°, Longitude: -72.7808°
Elevation: 149.24 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹ | | | | | | | | | | |
|--|-------------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|
| Duration | Average recurrence interval (years) | | | | | | | | | |
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.348 (0.267-0.450) | 0.416 (0.319-0.539) | 0.528 (0.404-0.686) | 0.621 (0.473-0.812) | 0.749 (0.553-1.02) | 0.845 (0.613-1.18) | 0.946 (0.667-1.37) | 1.06 (0.710-1.58) | 1.22 (0.788-1.88) | 1.35 (0.853-2.13) |
| 10-min | 0.493 (0.379-0.637) | 0.590 (0.453-0.763) | 0.749 (0.572-0.973) | 0.880 (0.670-1.15) | 1.06 (0.784-1.45) | 1.20 (0.868-1.68) | 1.34 (0.945-1.95) | 1.50 (1.01-2.24) | 1.73 (1.12-2.67) | 1.91 (1.21-3.02) |
| 15-min | 0.580 (0.445-0.749) | 0.694 (0.532-0.898) | 0.880 (0.674-1.14) | 1.03 (0.788-1.35) | 1.25 (0.922-1.71) | 1.41 (1.02-1.97) | 1.58 (1.11-2.29) | 1.76 (1.18-2.63) | 2.03 (1.31-3.14) | 2.25 (1.42-3.55) |
| 30-min | 0.782 (0.601-1.01) | 0.939 (0.721-1.22) | 1.20 (0.916-1.55) | 1.41 (1.07-1.84) | 1.71 (1.26-2.33) | 1.93 (1.40-2.70) | 2.16 (1.52-3.14) | 2.42 (1.62-3.60) | 2.78 (1.80-4.30) | 3.08 (1.95-4.87) |
| 60-min | 0.984 (0.756-1.27) | 1.19 (0.910-1.53) | 1.51 (1.16-1.97) | 1.79 (1.36-2.33) | 2.16 (1.60-2.96) | 2.45 (1.77-3.42) | 2.74 (1.93-3.98) | 3.07 (2.06-4.58) | 3.53 (2.29-5.47) | 3.91 (2.48-6.18) |
| 2-hr | 1.27 (0.980-1.63) | 1.52 (1.18-1.96) | 1.94 (1.49-2.50) | 2.28 (1.75-2.96) | 2.75 (2.05-3.75) | 3.11 (2.27-4.34) | 3.48 (2.48-5.07) | 3.92 (2.64-5.82) | 4.57 (2.97-7.04) | 5.12 (3.25-8.05) |
| 3-hr | 1.46 (1.13-1.87) | 1.75 (1.36-2.25) | 2.23 (1.73-2.87) | 2.63 (2.02-3.40) | 3.18 (2.38-4.33) | 3.59 (2.64-5.00) | 4.03 (2.89-5.86) | 4.55 (3.07-6.74) | 5.35 (3.48-8.22) | 6.03 (3.84-9.45) |
| 6-hr | 1.83 (1.43-2.33) | 2.22 (1.73-2.82) | 2.86 (2.22-3.65) | 3.38 (2.62-4.35) | 4.11 (3.09-5.57) | 4.64 (3.44-6.46) | 5.23 (3.78-7.61) | 5.95 (4.03-8.76) | 7.07 (4.61-10.8) | 8.05 (5.14-12.6) |
| 12-hr | 2.24 (1.77-2.83) | 2.76 (2.17-3.49) | 3.62 (2.83-4.59) | 4.32 (3.36-5.51) | 5.29 (4.01-7.14) | 6.00 (4.48-8.33) | 6.79 (4.96-9.88) | 7.78 (5.28-11.4) | 9.34 (6.11-14.2) | 10.7 (6.85-16.6) |
| 24-hr | 2.61 (2.07-3.28) | 3.28 (2.60-4.12) | 4.37 (3.45-5.51) | 5.28 (4.14-6.69) | 6.52 (4.99-8.78) | 7.43 (5.59-10.3) | 8.45 (6.23-12.3) | 9.76 (6.65-14.2) | 11.9 (7.80-18.0) | 13.8 (8.84-21.3) |
| 2-day | 2.92 (2.33-3.64) | 3.73 (2.97-4.65) | 5.06 (4.01-6.33) | 6.15 (4.85-7.75) | 7.66 (5.90-10.3) | 8.76 (6.64-12.1) | 9.99 (7.46-14.6) | 11.7 (7.97-16.9) | 14.4 (9.49-21.7) | 16.9 (10.9-26.0) |
| 3-day | 3.19 (2.55-3.95) | 4.08 (3.26-5.06) | 5.54 (4.41-6.90) | 6.74 (5.34-8.46) | 8.41 (6.50-11.3) | 9.61 (7.32-13.3) | 11.0 (8.23-16.0) | 12.8 (8.79-18.6) | 16.0 (10.5-24.0) | 18.8 (12.1-28.7) |
| 4-day | 3.43 (2.76-4.25) | 4.39 (3.52-5.43) | 5.95 (4.75-7.39) | 7.24 (5.75-9.06) | 9.02 (6.99-12.0) | 10.3 (7.87-14.2) | 11.8 (8.83-17.1) | 13.8 (9.44-19.9) | 17.1 (11.3-25.6) | 20.1 (13.0-30.7) |
| 7-day | 4.12 (3.32-5.06) | 5.20 (4.19-6.40) | 6.96 (5.59-8.61) | 8.43 (6.73-10.5) | 10.4 (8.13-13.9) | 11.9 (9.12-16.3) | 13.6 (10.2-19.6) | 15.8 (10.9-22.7) | 19.5 (12.9-29.1) | 22.8 (14.8-34.7) |
| 10-day | 4.80 (3.89-5.88) | 5.94 (4.81-7.29) | 7.81 (6.29-9.62) | 9.36 (7.50-11.6) | 11.5 (8.97-15.2) | 13.0 (10.0-17.7) | 14.8 (11.1-21.2) | 17.1 (11.8-24.5) | 20.9 (13.9-31.1) | 24.3 (15.8-36.9) |
| 20-day | 6.93 (5.65-8.43) | 8.12 (6.61-9.90) | 10.1 (8.17-12.3) | 11.7 (9.43-14.4) | 13.9 (10.9-18.1) | 15.6 (11.9-20.8) | 17.4 (13.0-24.4) | 19.7 (13.7-27.9) | 23.3 (15.5-34.4) | 26.5 (17.2-40.0) |
| 30-day | 8.72 (7.14-10.6) | 9.94 (8.13-12.1) | 11.9 (9.71-14.5) | 13.6 (11.0-16.6) | 15.8 (12.4-20.4) | 17.5 (13.4-23.2) | 19.3 (14.4-26.7) | 21.5 (15.0-30.4) | 24.8 (16.6-36.5) | 27.6 (18.0-41.5) |
| 45-day | 11.0 (9.02-13.2) | 12.2 (10.0-14.8) | 14.3 (11.7-17.3) | 16.0 (13.0-19.5) | 18.3 (14.3-23.3) | 20.1 (15.4-26.2) | 21.9 (16.2-29.8) | 23.9 (16.7-33.6) | 26.7 (17.9-39.0) | 28.9 (18.9-43.4) |
| 60-day | 12.8 (10.6-15.5) | 14.1 (11.6-17.0) | 16.3 (13.3-19.7) | 18.0 (14.7-22.0) | 20.5 (16.1-25.9) | 22.3 (17.1-29.0) | 24.2 (17.8-32.5) | 26.0 (18.3-36.5) | 28.4 (19.1-41.4) | 30.1 (19.7-45.1) |

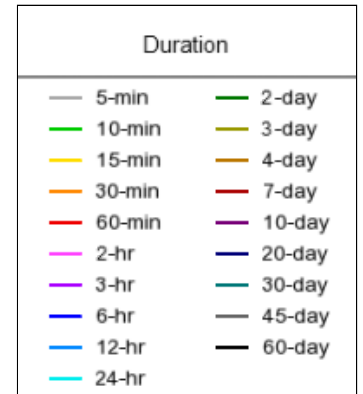
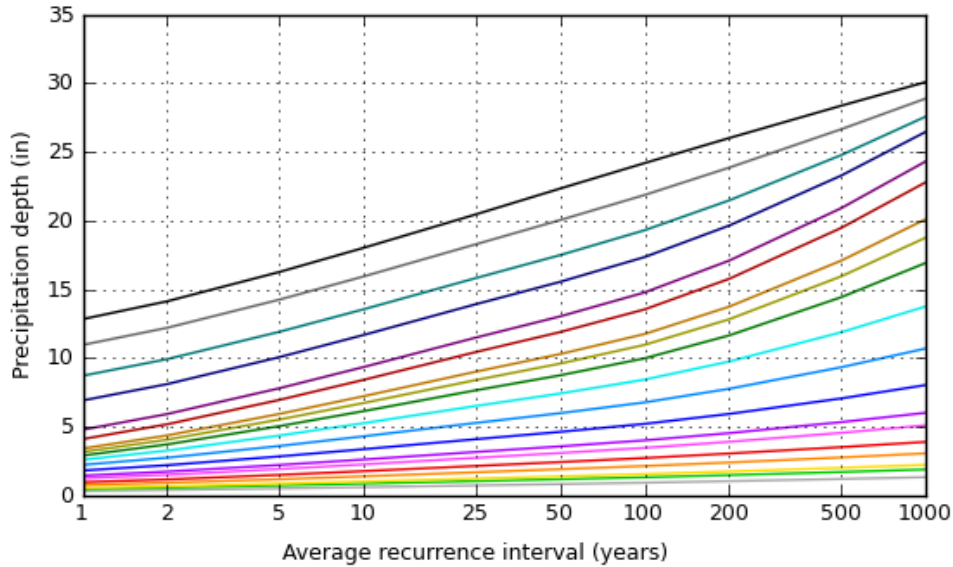
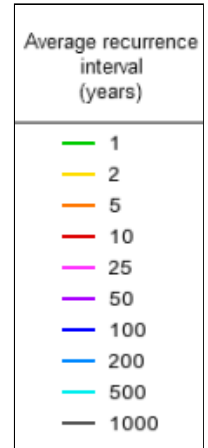
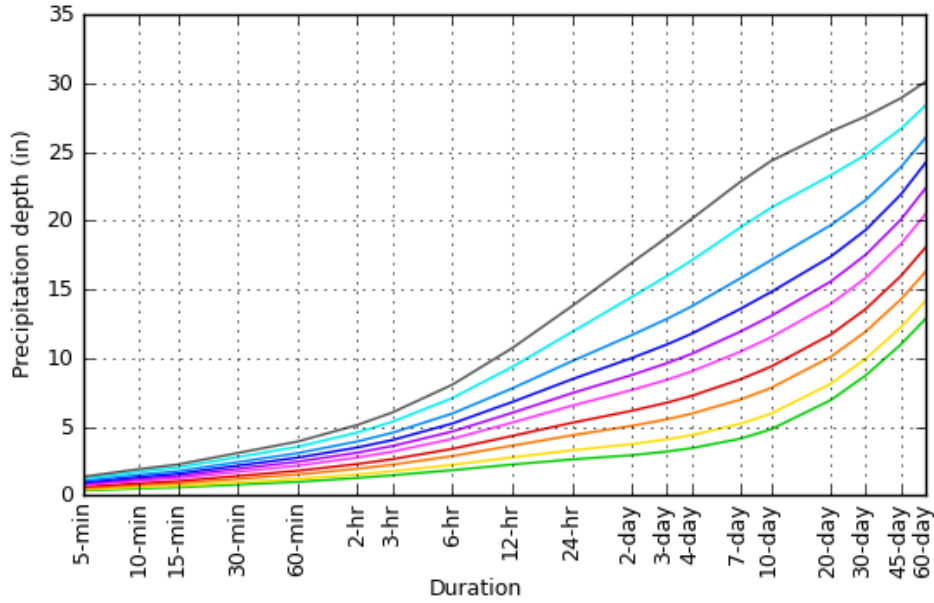
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

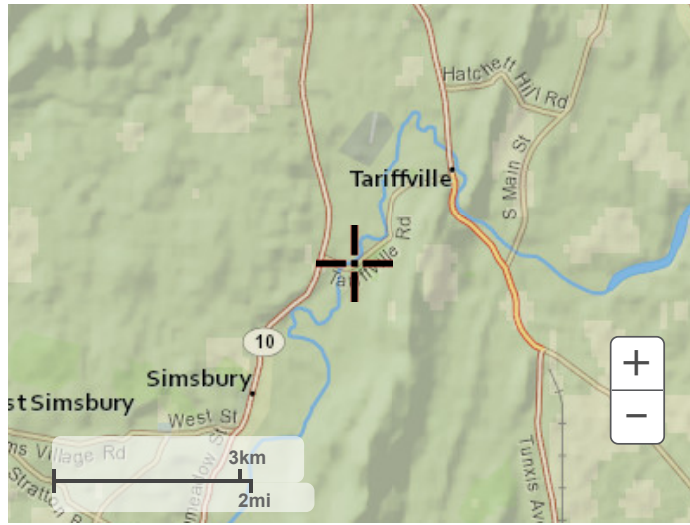
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Maps & aerials

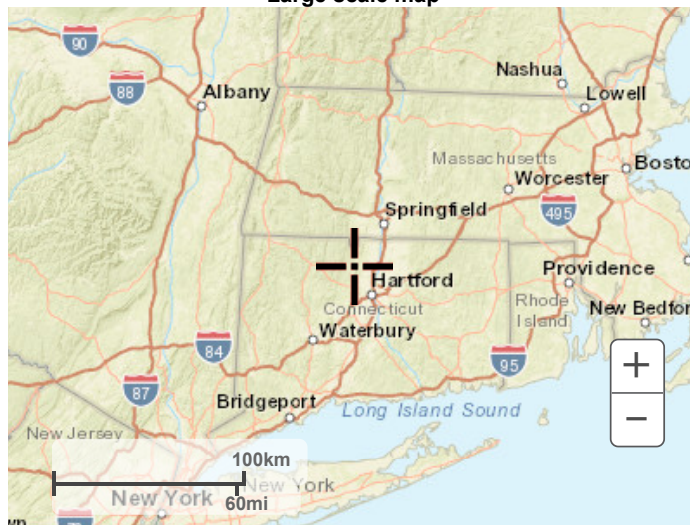
Small scale terrain



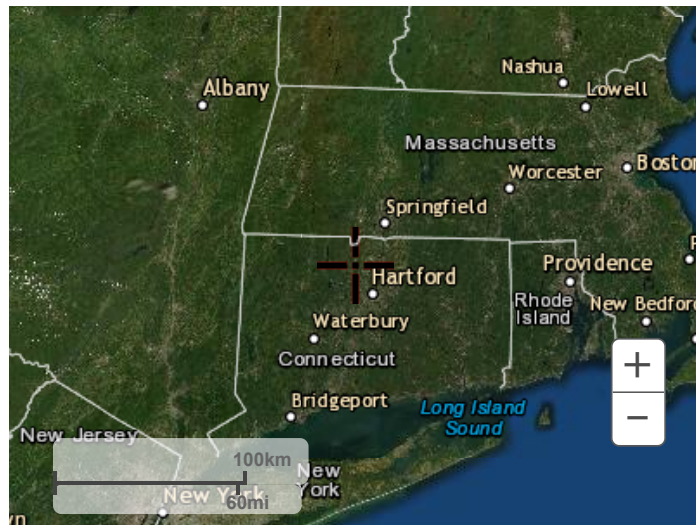
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
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Questions?: HDSC.Questions@noaa.gov

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Appendix 2:

NRCS SOILS INFORMATION



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 State of Connecticut



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

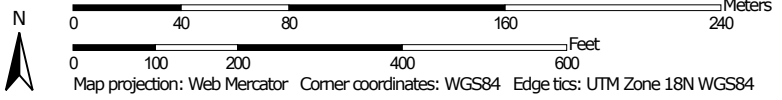
The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.


Map Scale: 1:2,800 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)




















Soils







 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: State of Connecticut
 Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 24, 2019—Oct 24, 2019

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

Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|------------------------------------|---|--------------|----------------|
| 29A | Agawam fine sandy loam, 0 to 3 percent slopes | 3.9 | 17.4% |
| 34A | Merrimac fine sandy loam, 0 to 3 percent slopes | 3.2 | 14.3% |
| 100 | Suncook loamy fine sand | 1.1 | 4.8% |
| 101 | Occum fine sandy loam | 3.6 | 16.0% |
| 102 | Pootatuck fine sandy loam | 0.0 | 0.2% |
| 108 | Saco silt loam | 2.4 | 10.6% |
| 306 | Udorthents-Urban land complex | 0.2 | 0.7% |
| 307 | Urban land | 2.8 | 12.4% |
| 704A | Enfield silt loam, 0 to 3 percent slopes | 2.5 | 10.9% |
| W | Water | 2.8 | 12.7% |
| Totals for Area of Interest | | 22.4 | 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

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descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

State of Connecticut

29A—Agawam fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqw
Elevation: 0 to 1,040 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Agawam

Setting

Landform: Outwash plains, kame terraces, kames, moraines, outwash terraces
Landform position (two-dimensional): Backslope, shoulder, footslope, summit
Landform position (three-dimensional): Side slope, crest, tread, riser, rise, dip
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 11 inches: fine sandy loam
Bw1 - 11 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C1 - 26 to 39 inches: loamy fine sand
2C2 - 39 to 55 inches: loamy fine sand
2C3 - 55 to 65 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F145XY008MA - Dry Outwash

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Hydric soil rating: No

Minor Components

Ninigret

Percent of map unit: 5 percent

Landform: Terraces

Down-slope shape: Linear

Across-slope shape: Concave

Hydric soil rating: No

Windsor

Percent of map unit: 4 percent

Landform: Outwash plains, outwash terraces, deltas, dunes

Landform position (three-dimensional): Tread, riser

Down-slope shape: Linear, convex

Across-slope shape: Linear, convex

Hydric soil rating: No

Walpole

Percent of map unit: 3 percent

Landform: Outwash plains, depressions, outwash terraces, depressions, deltas

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Tread, dip, tal

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Hinckley

Percent of map unit: 3 percent

Landform: Outwash plains, eskers, kames, deltas

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise

Down-slope shape: Convex

Across-slope shape: Linear, convex

Hydric soil rating: No

34A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr

Elevation: 0 to 1,100 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent

Minor components: 15 percent

Custom Soil Resource Report

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Kames, eskers, moraines, outwash terraces, outwash plains

Landform position (two-dimensional): Backslope, footslope, shoulder, summit

Landform position (three-dimensional): Side slope, crest, riser, tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam

Bw1 - 10 to 22 inches: fine sandy loam

Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand

2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 2 percent

Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)

Sodium adsorption ratio, maximum: 1.0

Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A

Ecological site: F145XY008MA - Dry Outwash

Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent

Landform: Outwash plains, terraces, deltas

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread, dip

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent

Landform: Kames, deltas, outwash plains, eskers

Landform position (two-dimensional): Summit, shoulder, backslope

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Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Moraines, outwash plains, outwash terraces, stream terraces, kames, eskers
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Deltas, dunes, outwash plains, outwash terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

100—Suncook loamy fine sand

Map Unit Setting

National map unit symbol: 9lj
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Suncook

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy alluvium

Typical profile

Ap - 0 to 7 inches: loamy fine sand
C1 - 7 to 15 inches: stratified coarse sand to loamy fine sand
C2 - 15 to 22 inches: stratified coarse sand to loamy fine sand

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C3 - 22 to 32 inches: stratified coarse sand to loamy fine sand

C4 - 32 to 42 inches: stratified coarse sand to loamy fine sand

C5 - 42 to 65 inches: stratified gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.62 in/hr)

Depth to water table: About 60 to 72 inches

Frequency of flooding: Rare

Frequency of ponding: None

Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A

Ecological site: F144AY006CT - High Floodplain Levee

Hydric soil rating: No

Minor Components

Occum

Percent of map unit: 5 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Pootatuck

Percent of map unit: 5 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Concave

Hydric soil rating: No

Unnamed, no flooding

Percent of map unit: 4 percent

Hydric soil rating: No

Rippowam

Percent of map unit: 3 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Concave

Hydric soil rating: Yes

Saco

Percent of map unit: 3 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

101—Occum fine sandy loam

Map Unit Setting

National map unit symbol: 9ljm
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Occum

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: sandy loam
C1 - 28 to 32 inches: stratified very gravelly coarse sand to loamy fine sand
C2 - 32 to 42 inches: stratified very gravelly coarse sand to loamy fine sand
C3 - 42 to 65 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 5.95 in/hr)
Depth to water table: About 60 to 72 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F144AY010NH - Sandy High Floodplain
Hydric soil rating: No

Minor Components

Suncook

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Pootatuck

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Rippowam

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Agawam

Percent of map unit: 5 percent
Landform: Outwash plains, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

102—Pootatuck fine sandy loam

Map Unit Setting

National map unit symbol: 9ljn
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Pootatuck

Setting

Landform: Flood plains
Down-slope shape: Linear

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Across-slope shape: Concave
Parent material: Coarse-loamy alluvium

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 16 inches: fine sandy loam
Bw2 - 16 to 21 inches: fine sandy loam
Bw3 - 21 to 29 inches: sandy loam
C1 - 29 to 35 inches: stratified very gravelly coarse sand to loamy fine sand
C2 - 35 to 40 inches: stratified very gravelly coarse sand to loamy fine sand
C3 - 40 to 65 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 5.95 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F144AY012CT - Sandy Low Floodplain
Hydric soil rating: No

Minor Components

Suncook

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Occum

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Lim

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rippowam

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear

Custom Soil Resource Report

Across-slope shape: Concave
Hydric soil rating: Yes

Limerick

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Saco

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

108—Saco silt loam

Map Unit Setting

National map unit symbol: 9ljv
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Saco

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-silty alluvium

Typical profile

A - 0 to 12 inches: silt loam
Cg1 - 12 to 32 inches: silt loam
Cg2 - 32 to 48 inches: silt loam
2Cg3 - 48 to 60 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: FrequentNone

Frequency of ponding: Frequent

Available water capacity: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Hydrologic Soil Group: B/D

Ecological site: F144AY016MA - Very Wet Low Floodplain

Hydric soil rating: Yes

Minor Components

Lim

Percent of map unit: 5 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Limerick

Percent of map unit: 5 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Winooski

Percent of map unit: 3 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Rippowam

Percent of map unit: 3 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Concave

Hydric soil rating: Yes

Hadley

Percent of map unit: 2 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Bash

Percent of map unit: 2 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

306—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 9lmg
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 50 percent
Urban land: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Drift

Typical profile

A - 0 to 5 inches: loam
C1 - 5 to 21 inches: gravelly loam
C2 - 21 to 80 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: About 54 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Custom Soil Resource Report

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Unnamed, undisturbed soils

Percent of map unit: 8 percent
Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Hydric soil rating: No

307—Urban land

Map Unit Setting

National map unit symbol: 9lmh
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Unnamed, undisturbed soils

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

Udorthents, wet substratum

Percent of map unit: 10 percent
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

704A—Enfield silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2y07p
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Enfield

Setting

Landform: Outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-silty eolian deposits over sandy and gravelly glaciofluvial deposits derived from granite, schist, and/or gneiss

Typical profile

Ap - 0 to 7 inches: silt loam
Bw1 - 7 to 15 inches: silt loam
Bw2 - 15 to 25 inches: silt loam
2C - 25 to 60 inches: stratified very gravelly coarse sand to loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 16 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 1

Hydrologic Soil Group: B

Ecological site: F145XY009CT - Well Drained Outwash

Hydric soil rating: No

Minor Components

Haven

Percent of map unit: 5 percent

Landform: Outwash terraces, outwash plains

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Linear

Hydric soil rating: No

Tisbury

Percent of map unit: 5 percent

Landform: Valley trains, outwash terraces, outwash plains, deltas

Landform position (three-dimensional): Tread

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: No

Agawam

Percent of map unit: 3 percent

Landform: Kames, moraines, outwash terraces, outwash plains, kame terraces

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Side slope, crest, tread

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Raypol

Percent of map unit: 2 percent

Landform: Depressions, drainageways

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

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Appendix 3:

**TEST PIT LOGS &
PERMEABILITY TEST RESULTS**

Test Pit Logs
20 Tariffville Road, Simsbury, CT
3/28/2021

| | |
|--|---|
| <p>TP#1 0" – 10" Sandy Loam Topsoil 10" – 38" Brown Loamy Sand 38" – 58" Medium to Coarse Sand & Gravel 58" – 76" Tan Fine Sand No Mottling No Water No Ledge Permeability Sample Depth = 24"-30" Permeability Rate = 2.34 in/hr</p> | <p>TP5 0" – 20" Sandy Loam Topsoil 20" – 40" Red/Brown Sandy Loam 40" – 58" Tan Fine to Coarse Sand 58" – 84" Fine to Coarse Sand & Gravel No Mottling No Water No Ledge Permeability Sample Depth = 24"-36" Permeability Rate = 5.03 in/hr</p> |
| <p>TP2 0" – 10" Sandy Loam Topsoil 10" – 24" Brown Loamy Sand 24" – 51" Fine to Medium Tan Sand 51" – 70" Medium to Coarse Sand & Gravel 70" – 84" Tan Fine Sand No Mottling No Water No Ledge Permeability Sample Depth = 30"-36" Permeability Rate = 12.35 in/hr</p> | <p>TP6 0" – 10" Sandy Loam Topsoil 10" – 40" Red/Brown Sandy Loam 40" – 68" Tan Fine to Medium Sand 68" – 96" Fine to Coarse Sand & Gravel Mottles @ 86" Water @ 92" No Ledge</p> |
| <p>TP3 0" – 10" Sandy Loam Topsoil 10" – 24" Brown Loamy Sand 24" – 58" Fine to Medium Tan Sand 58" – 84" Medium to Coarse Sand & Gravel No Mottling No Water No Ledge Permeability Sample Depth = 24"-30" Permeability Rate = 8.5 in/hr</p> | <p>TP7 0" – 24" Sandy Loam Topsoil 24" – 44" Red/Brown Sandy Loam 44" – 80" Tan Fine to Coarse Sand 80" – 96" Fine to Coarse Sand & Gravel No Mottling No Water No Ledge</p> |
| <p>TP4 0" – 6" Sand & Gravel Fill 6" – 18" Buried Sandy Loam Topsoil 18" – 40" Red/Brown Sandy Loam 40" – 90" Stratified Sand grading to Fine to Coarse Sand & Gravel Mottles @ 80" Water @ 84" No Ledge Permeability Sample Depth = 24"-30" Permeability Rate = 0.522 in/hr</p> | <p>TP8 0" – 12" Sandy Loam Topsoil 12" – 30" Red/Brown Loamy Sand 38" – 90" Tan Fine to Coarse Sand grading to Coarse Sand & Gravel No Mottling No Water No Ledge</p> |



NEW ENGLAND MATERIALS TESTING LAB, LLC.
NEW ENGLAND REGIONAL OFFICE

72 Bissell Street Manchester, CT 06040 • Tel: 860-783-5830 • Fax: 860-783-5832

Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 001

Lab ID: 075-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-1

Technician: Z. A

Date: 06/29/2020

LAB PERMEABILITY TEST

Sample description: Light brown sand and some fines.

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 24" to 30"

Method: Permeability by ASTM D2434 (Constant Head Method)

$$k = QL/Ath$$

Where k = coefficient of permeability,

| | |
|--|---------------------------|
| Q = quantity of water discharged, | Q = 1000 cm ³ |
| L = length of sample in centimeters | L = 15.24 cm |
| A = cross sectional area of specimen, | A = 43.10 cm ² |
| t = total time for discharge, in seconds | t = 3480 sec |
| h = difference in head manometers, | h = 61.5 cm |

$$k = 0.00165216 \text{ cm/sec.}$$

$$k = 2.34 \text{ inch/hour}$$

Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

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Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 002

Lab ID: 076-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-2

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Light brown fine sand

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 30” to 36”

Method: Permeability by ASTM D2434 (Constant Head Method)

$$k = QL/Ath$$

Where k = coefficient of permeability,

| | | |
|--|-----|-----------------------|
| Q = quantity of water discharged, | Q = | 1000 cm ³ |
| L = length of sample in centimeters | L = | 15.24 cm |
| A = cross sectional area of specimen, | A = | 43.10 cm ² |
| t = total time for discharge, in seconds | t = | 660 sec |
| h = difference in head manometers, | h = | 61.5 cm |

$$k = 0.00871141 \text{ cm/sec.}$$

$$k = 12.35 \text{ inch/hour}$$

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Submitted By: New England Materials Testing Lab, LLC.

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Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 003

Lab ID: 077-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-3

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Light brown sand, little fines

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 24” to 30”

Method: Permeability by ASTM D2434 (Constant Head Method)

$$k = QL/Ath$$

Where k = coefficient of permeability,

| | | |
|--|-----|-----------------------|
| Q = quantity of water discharged, | Q = | 1000 cm ³ |
| L = length of sample in centimeters | L = | 15.24 cm |
| A = cross sectional area of specimen, | A = | 43.10 cm ² |
| t = total time for discharge, in seconds | t = | 960 sec |
| h = difference in head manometers, | h = | 61.5 cm |

$$k = 0.0059891 \text{ cm/sec.}$$

$$k = 8.5 \text{ inch/hour}$$

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Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 004

Lab ID: 078-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-4

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Brown silty clayey sandy material

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 24" to 30"

Method: Permeability by ASTM D2434 (Constant Head Method)

$$k = QL/Ath$$

Where k = coefficient of permeability,

| | |
|--|---------------------------|
| Q = quantity of water discharged, | Q = 500 cm ³ |
| L = length of sample in centimeters | L = 15.24 cm |
| A = cross sectional area of specimen, | A = 43.10 cm ² |
| t = total time for discharge, in seconds | t = 7800 sec |
| h = difference in head manometers, | h = 61.5 cm |

$$k = 0.00036856 \text{ cm/sec.}$$

$$k = 0.522 \text{ inch/hour}$$

Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

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Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 005

Lab ID: 079-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-5

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Gray sand, little bank run gravel, little fines.

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 36" to 42"

Method: Permeability by ASTM D2434 (Constant Head Method)

$$k = QL/Ath$$

Where k = coefficient of permeability,

| | |
|--|---------------------------|
| Q = quantity of water discharged, | Q = 1000 cm ³ |
| L = length of sample in centimeters | L = 15.24 cm |
| A = cross sectional area of specimen, | A = 43.10 cm ² |
| t = total time for discharge, in seconds | t = 1620 sec |
| h = difference in head manometers, | h = 61.5 cm |

$$k = 0.00354909 \text{ cm/sec.}$$

$$k = 5.03 \text{ inch/hour}$$

Reported To: JR Russo Surveyors Engineers

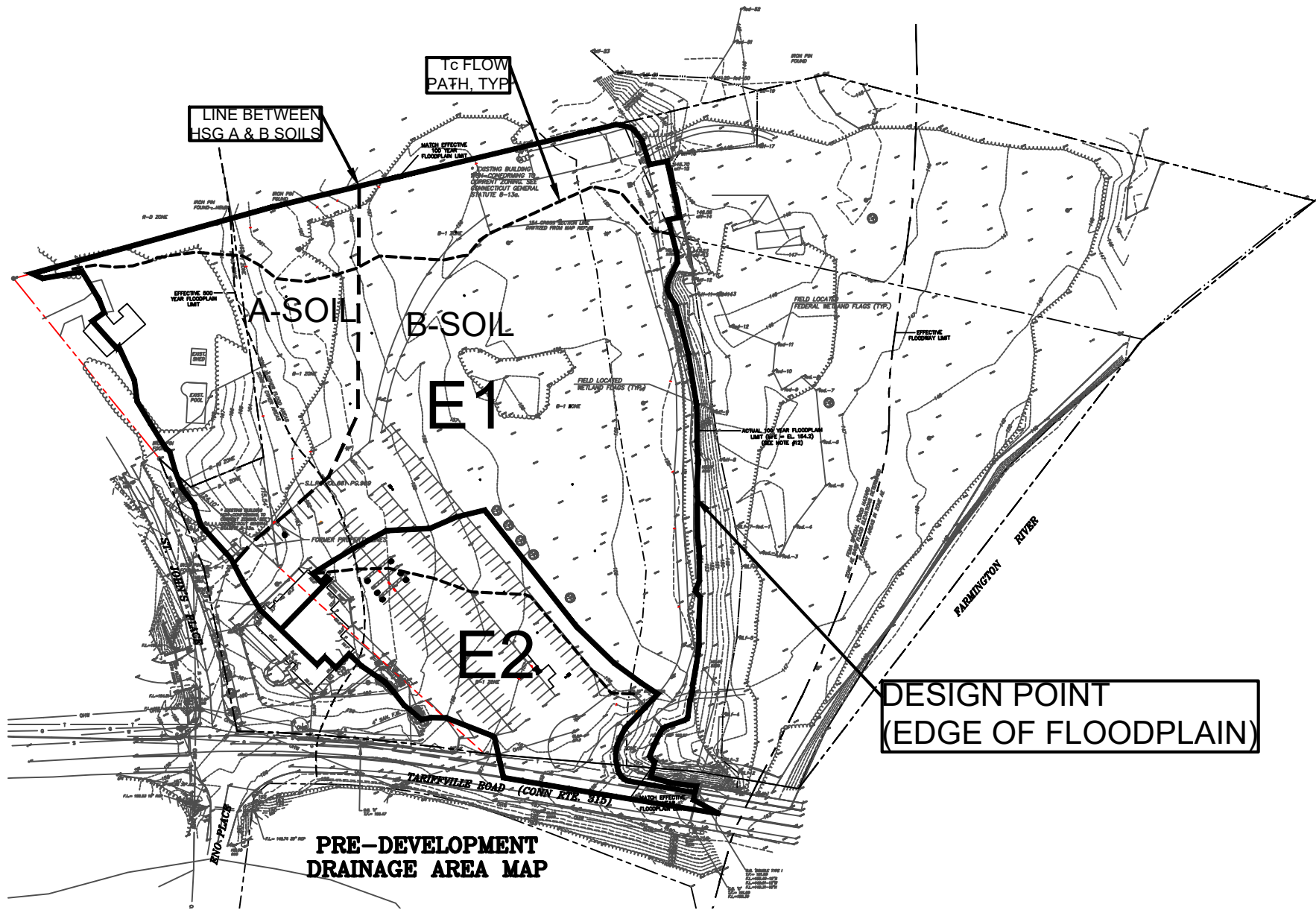
Submitted By: New England Materials Testing Lab, LLC.

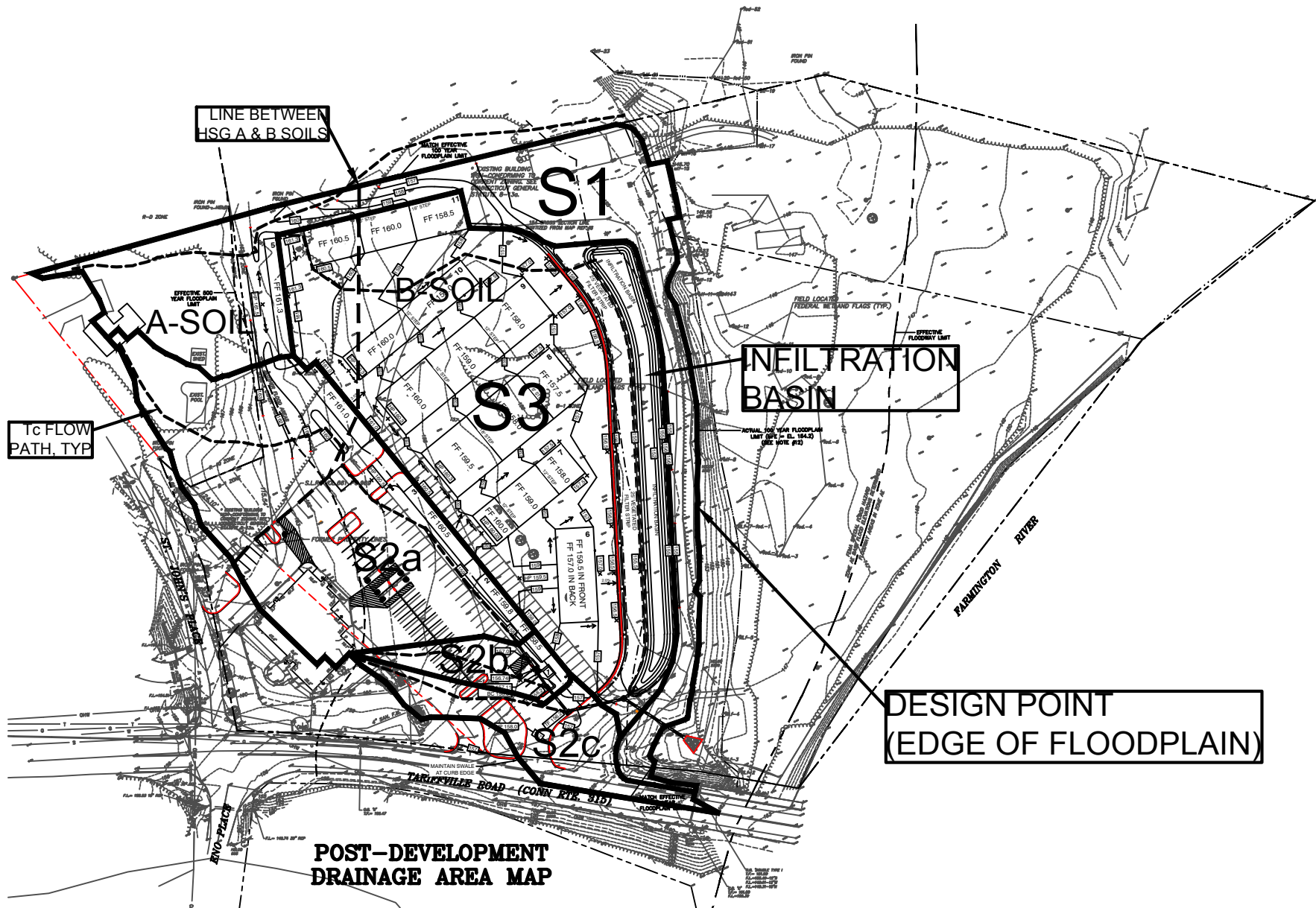
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Appendix 4:
DRAINAGE AREA MAPS





LINE BETWEEN
HSG A & B SOILS

S1

B-SOIL

INfiltration
BASIN

TC FLOW
PATH, TYP

A-SOIL

S3

DESIGN POINT
(EDGE OF FLOODPLAIN)

POST-DEVELOPMENT
DRAINAGE AREA MAP

FARMINGTON
RIVER

TARIFFVILLE ROAD (CONN. RTE. 915)

AVO-PLANT

R-0 20%

FF 160.5

FF 160.0

FF 158.5

FF 160.0

FF 159.0

FF 160.0

FF 160.0

FF 160.0

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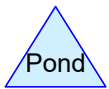
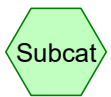
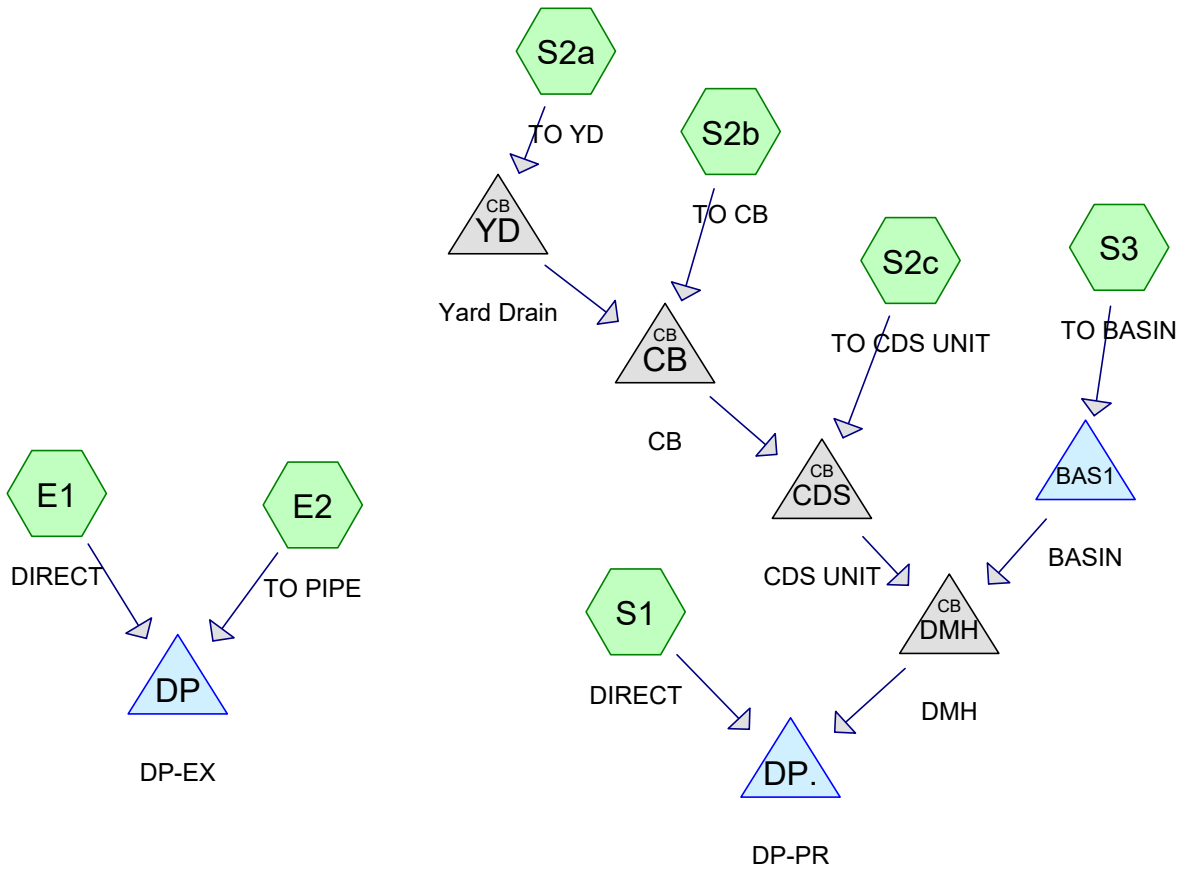
FF 160.0

FF 160.0

FF 160.0

FF 160.0

Appendix 5:
HYDROCAD ANALYSES



Routing Diagram for 2021-011 LADA Simsbury Rev 7-8-21
 Prepared by {enter your company name here}, Printed 7/13/2021
 HydroCAD® 10.00-25 s/n 02386 © 2019 HydroCAD Software Solutions LLC

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

| | |
|-------------------------------------|---|
| SubcatchmentE1: DIRECT | Runoff Area=245,855 sf 19.29% Impervious Runoff Depth=0.44" Flow Length=684' Tc=18.8 min CN=60 Runoff=1.28 cfs 0.207 af |
| SubcatchmentE2: TO PIPE | Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=2.33" Flow Length=389' Tc=4.5 min CN=91 Runoff=4.02 cfs 0.276 af |
| SubcatchmentS1: DIRECT | Runoff Area=71,749 sf 30.94% Impervious Runoff Depth=0.56" Flow Length=635' Tc=20.2 min CN=63 Runoff=0.53 cfs 0.076 af |
| SubcatchmentS2a: TO YD | Runoff Area=73,505 sf 45.64% Impervious Runoff Depth=0.73" Flow Length=602' Tc=22.2 min CN=67 Runoff=0.79 cfs 0.103 af |
| SubcatchmentS2b: TO CB | Runoff Area=8,477 sf 78.41% Impervious Runoff Depth=2.24" Flow Length=188' Slope=0.0255 '/' Tc=1.7 min CN=90 Runoff=0.59 cfs 0.036 af |
| SubcatchmentS2c: TO CDS UNIT | Runoff Area=17,487 sf 65.61% Impervious Runoff Depth=1.83" Flow Length=228' Slope=0.0255 '/' Tc=1.9 min CN=85 Runoff=1.00 cfs 0.061 af |
| SubcatchmentS3: TO BASIN | Runoff Area=136,043 sf 76.91% Impervious Runoff Depth=2.15" Flow Length=382' Tc=3.8 min CN=89 Runoff=8.48 cfs 0.561 af |
| Pond BAS1: BASIN | Peak Elev=153.68' Storage=13,298 cf Inflow=8.48 cfs 0.561 af Discarded=0.39 cfs 0.570 af Primary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.570 af |
| Pond CB: CB | Peak Elev=152.83' Inflow=0.94 cfs 0.139 af 15.0" Round Culvert n=0.012 L=31.0' S=0.0065 '/' Outflow=0.94 cfs 0.139 af |
| Pond CDS: CDS UNIT | Peak Elev=152.73' Inflow=1.70 cfs 0.200 af 15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=1.70 cfs 0.200 af |
| Pond DMH: DMH | Peak Elev=151.95' Inflow=1.70 cfs 0.200 af 24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=1.70 cfs 0.200 af |
| Pond DP: DP-EX | Inflow=4.12 cfs 0.483 af Primary=4.12 cfs 0.483 af |
| Pond DP.: DP-PR | Inflow=1.77 cfs 0.276 af Primary=1.77 cfs 0.276 af |
| Pond YD: Yard Drain | Peak Elev=153.62' Inflow=0.79 cfs 0.103 af 15.0" Round Culvert n=0.012 L=56.0' S=0.0179 '/' Outflow=0.79 cfs 0.103 af |

Summary for Subcatchment E1: DIRECT

Runoff = 1.28 cfs @ 12.39 hrs, Volume= 0.207 af, Depth= 0.44"

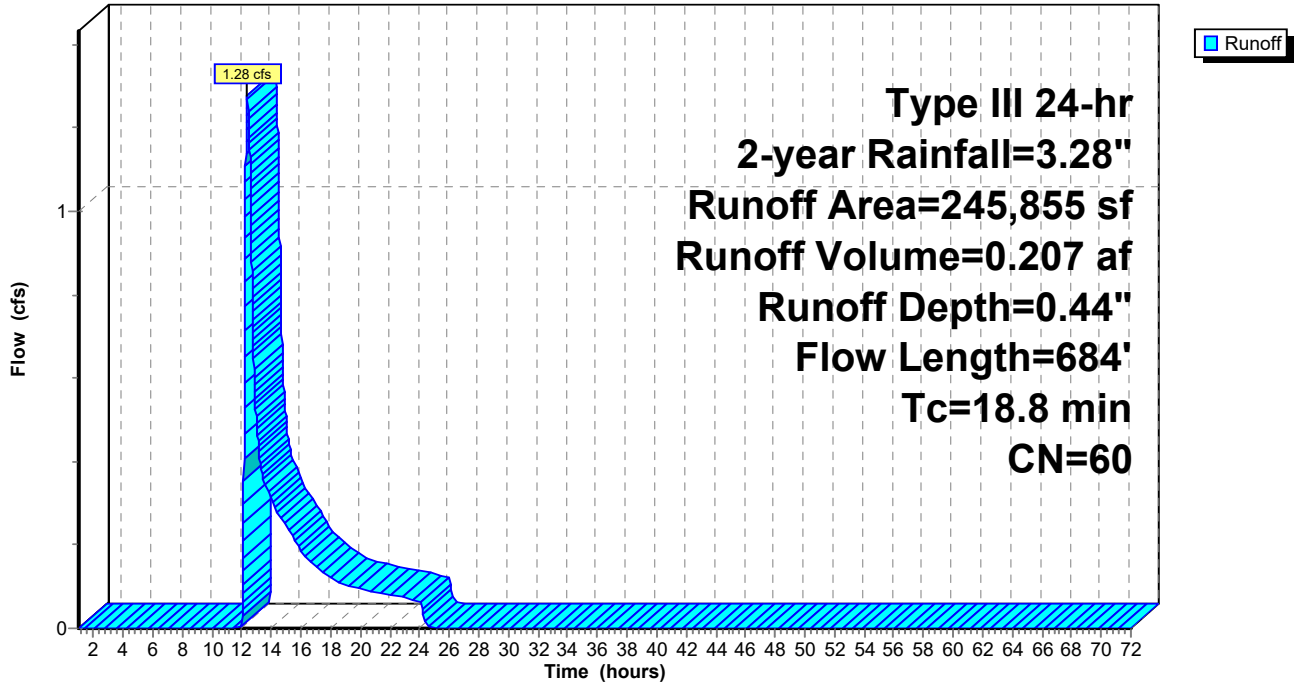
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 118,874 | 61 | >75% Grass cover, Good, HSG B |
| 9,139 | 55 | Woods, Good, HSG B |
| 44,246 | 98 | Paved parking, HSG B |
| 31,283 | 39 | >75% Grass cover, Good, HSG A |
| 39,145 | 30 | Woods, Good, HSG A |
| 3,168 | 98 | Paved parking, HSG A |
| 245,855 | 60 | Weighted Average |
| 198,441 | | 80.71% Pervious Area |
| 47,414 | | 19.29% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 2.6 | 135 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 1.6 | 114 | 0.0281 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.2 | 265 | 0.0045 | 1.36 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.2 | 20 | 0.0400 | 1.40 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 18.8 | 684 | Total | | | |

Subcatchment E1: DIRECT

Hydrograph



Summary for Subcatchment E2: TO PIPE

Runoff = 4.02 cfs @ 12.07 hrs, Volume= 0.276 af, Depth= 2.33"

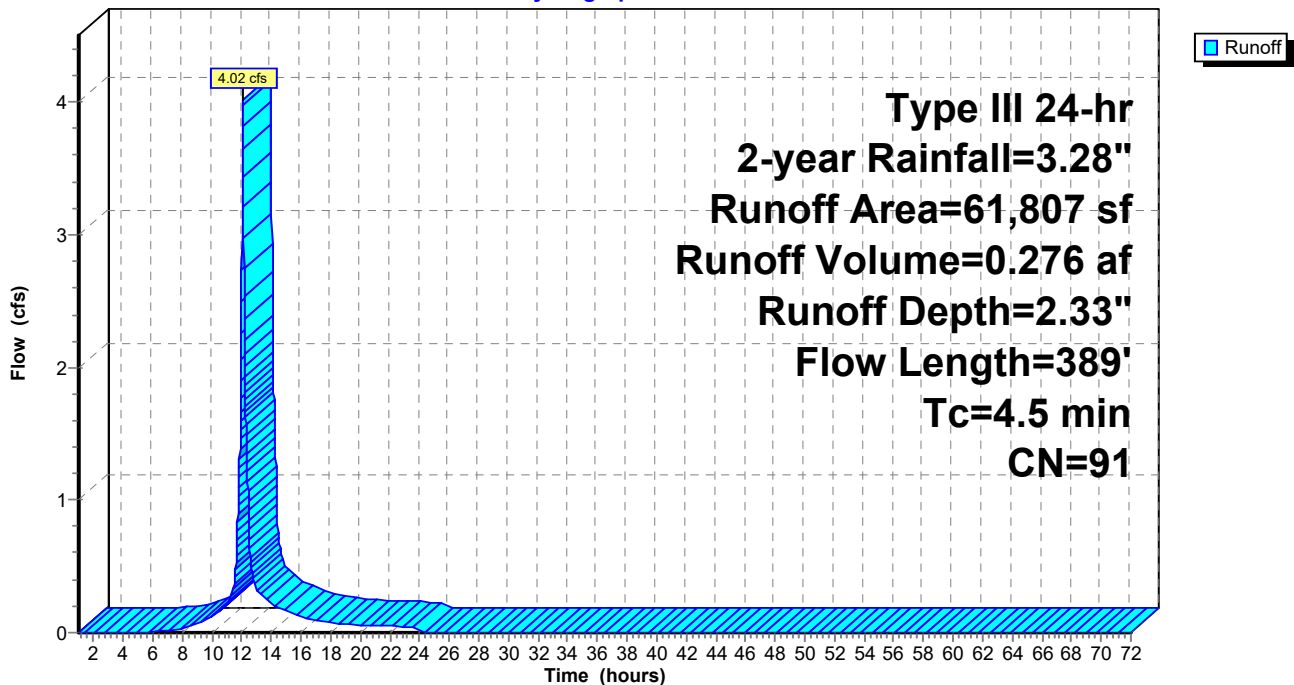
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 11,246 | 61 | >75% Grass cover, Good, HSG B |
| 50,561 | 98 | Paved parking, HSG B |
| 61,807 | 91 | Weighted Average |
| 11,246 | | 18.20% Pervious Area |
| 50,561 | | 81.80% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.2 | 10 | 0.0348 | 0.13 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 1.4 | 140 | 0.0296 | 1.72 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.6 | 215 | 0.0122 | 2.24 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 24 | 0.0279 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 4.5 | 389 | Total | | | |

Subcatchment E2: TO PIPE

Hydrograph



Summary for Subcatchment S1: DIRECT

Runoff = 0.53 cfs @ 12.37 hrs, Volume= 0.076 af, Depth= 0.56"

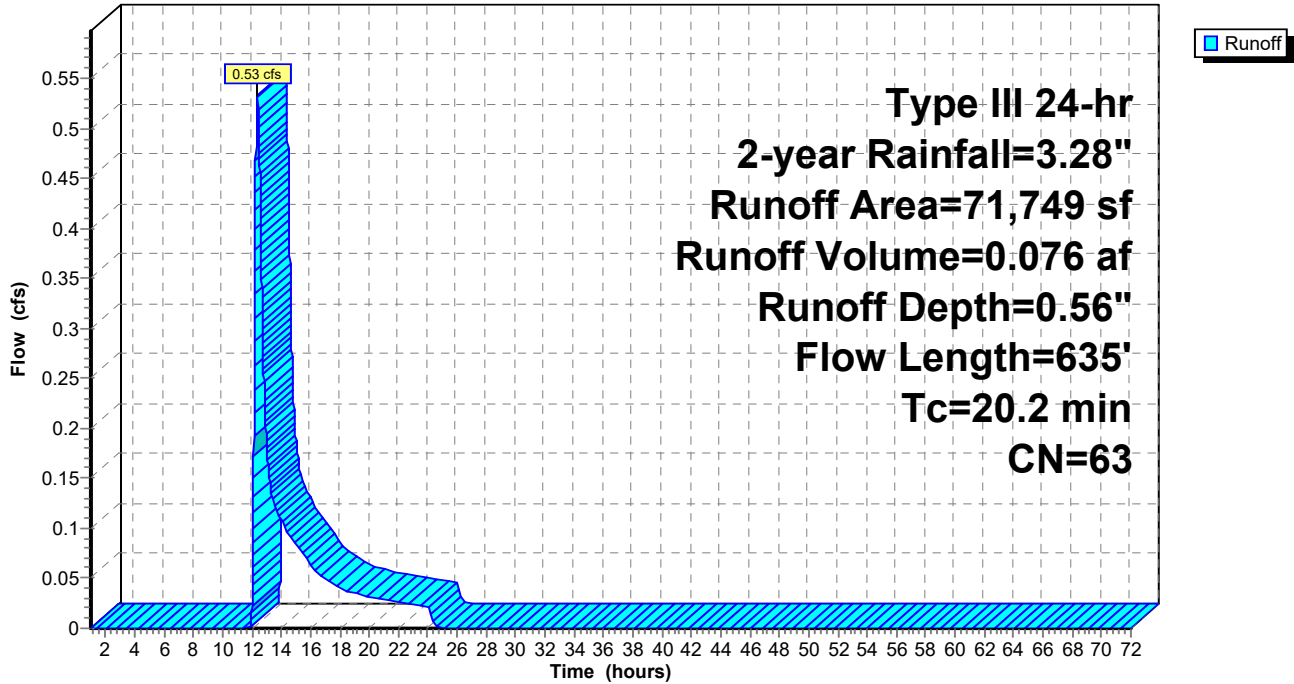
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 19,240 | 61 | >75% Grass cover, Good, HSG B |
| 4,239 | 55 | Woods, Good, HSG B |
| * 22,200 | 98 | Paved parking |
| 21,008 | 39 | >75% Grass cover, Good, HSG A |
| 5,062 | 30 | Woods, Good, HSG A |
| 71,749 | 63 | Weighted Average |
| 49,549 | | 69.06% Pervious Area |
| 22,200 | | 30.94% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.8 | 40 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 8.2 | 445 | 0.0169 | 0.91 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 20.2 | 635 | Total | | | |

Subcatchment S1: DIRECT

Hydrograph



Summary for Subcatchment S2a: TO YD

Runoff = 0.79 cfs @ 12.36 hrs, Volume= 0.103 af, Depth= 0.73"

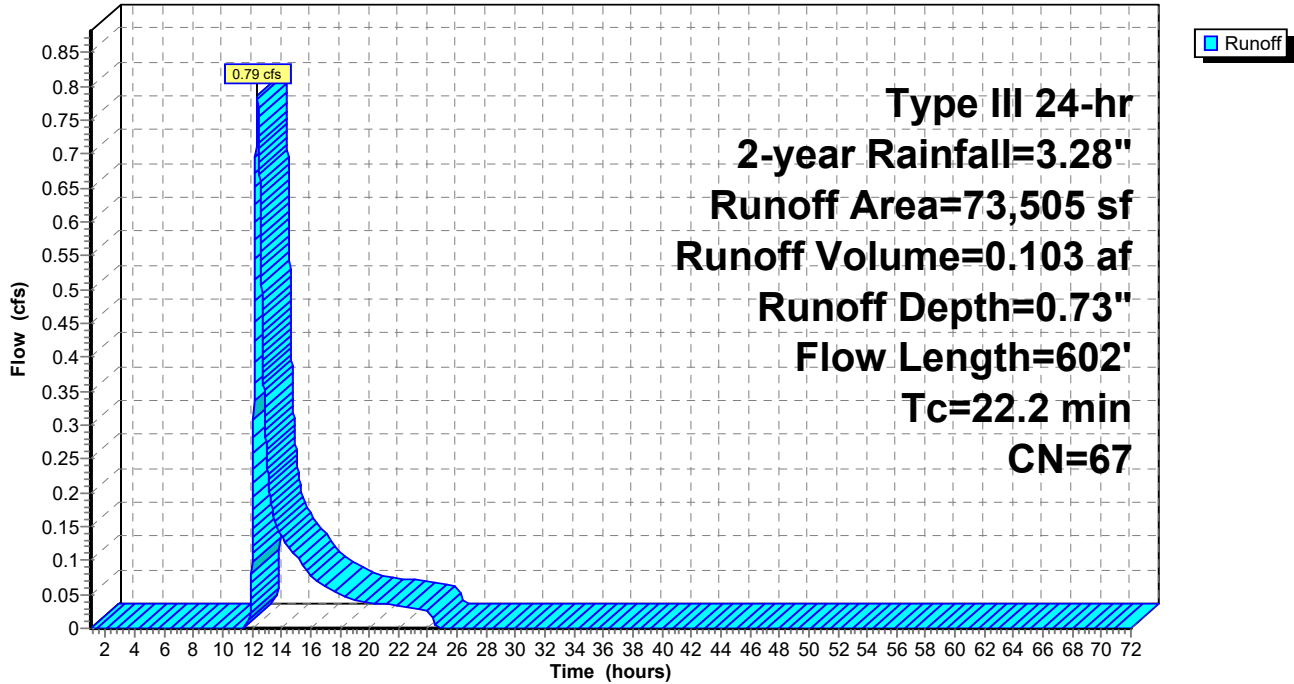
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 10,567 | 61 | >75% Grass cover, Good, HSG B |
| 30,587 | 98 | Paved parking, HSG B |
| 12,582 | 39 | >75% Grass cover, Good, HSG A |
| 16,809 | 30 | Woods, Good, HSG A |
| 2,960 | 98 | Paved parking, HSG A |
| 73,505 | 67 | Weighted Average |
| 39,958 | | 54.36% Pervious Area |
| 33,547 | | 45.64% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 9.2 | 121 | 0.0347 | 0.22 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 5.3 | 29 | 0.0552 | 0.09 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.3 | 96 | 0.0573 | 1.20 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 2.2 | 92 | 0.0100 | 0.70 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 0.5 | 74 | 0.0176 | 2.69 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 3.7 | 190 | 0.0150 | 0.86 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 22.2 | 602 | Total | | | |

Subcatchment S2a: TO YD

Hydrograph



Summary for Subcatchment S2b: TO CB

Runoff = 0.59 cfs @ 12.03 hrs, Volume= 0.036 af, Depth= 2.24"

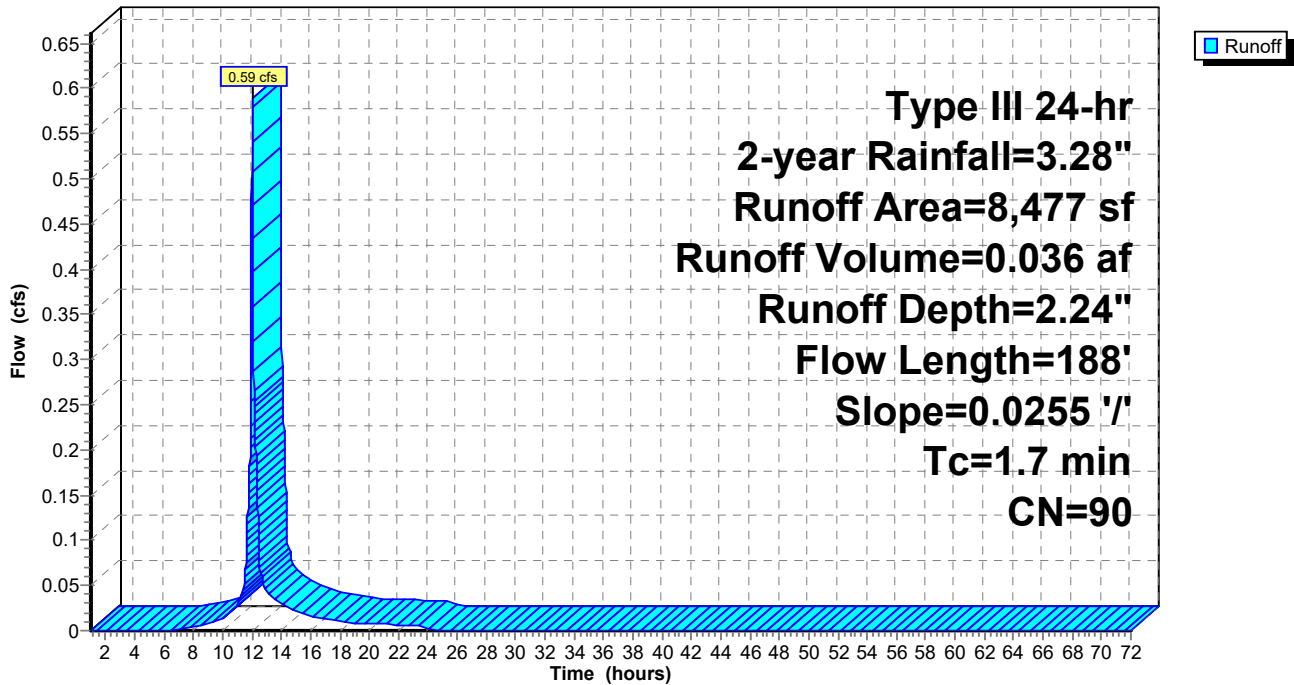
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 1,830 | 61 | >75% Grass cover, Good, HSG B |
| 6,647 | 98 | Paved parking, HSG B |
| 8,477 | 90 | Weighted Average |
| 1,830 | | 21.59% Pervious Area |
| 6,647 | | 78.41% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, GR Smooth surfaces n= 0.011 P2= 3.20" |
| 0.2 | 38 | 0.0255 | 3.24 | | Shallow Concentrated Flow, WOODS Paved Kv= 20.3 fps |
| 1.7 | 188 | Total | | | |

Subcatchment S2b: TO CB

Hydrograph



Summary for Subcatchment S2c: TO CDS UNIT

Runoff = 1.00 cfs @ 12.03 hrs, Volume= 0.061 af, Depth= 1.83"

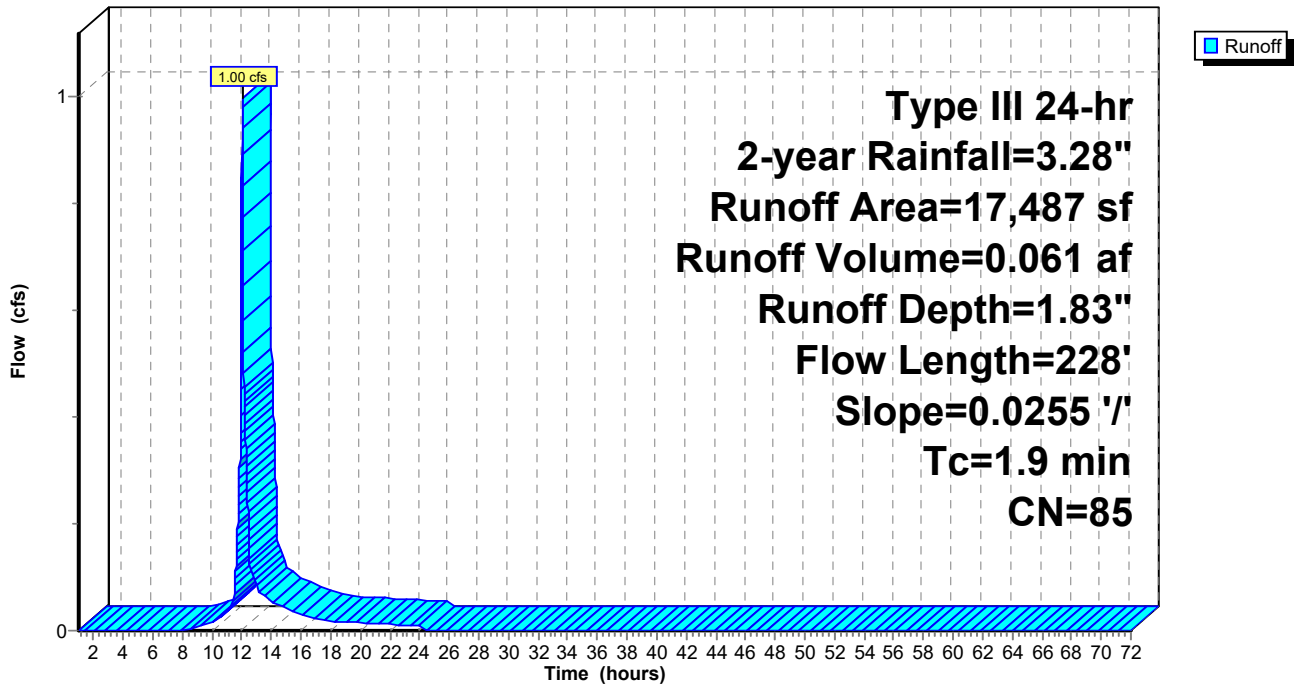
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 6,013 | 61 | >75% Grass cover, Good, HSG B |
| 11,474 | 98 | Paved parking, HSG B |
| 17,487 | 85 | Weighted Average |
| 6,013 | | 34.39% Pervious Area |
| 11,474 | | 65.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20" |
| 0.4 | 78 | 0.0255 | 3.24 | | Shallow Concentrated Flow, Paved Kv= 20.3 fps |
| 1.9 | 228 | Total | | | |

Subcatchment S2c: TO CDS UNIT

Hydrograph



Summary for Subcatchment S3: TO BASIN

Runoff = 8.48 cfs @ 12.06 hrs, Volume= 0.561 af, Depth= 2.15"

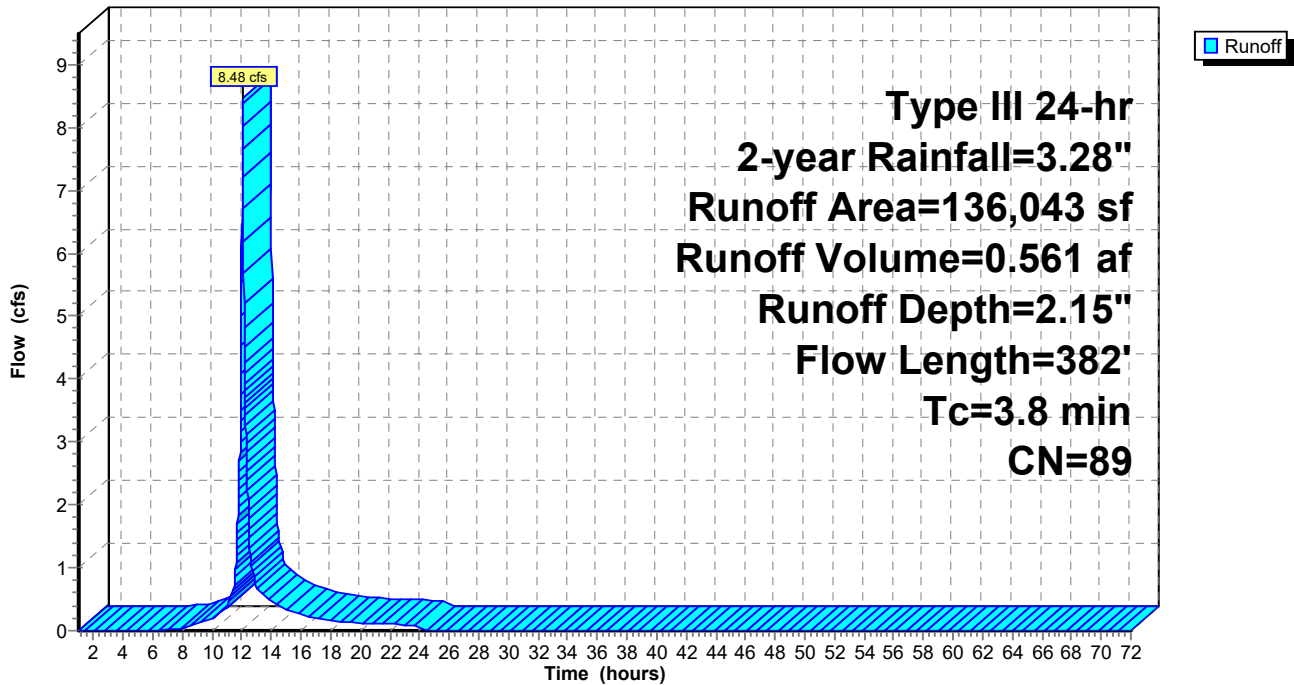
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 31,417 | 61 | >75% Grass cover, Good, HSG B |
| * 104,626 | 98 | Paved parking |
| 136,043 | 89 | Weighted Average |
| 31,417 | | 23.09% Pervious Area |
| 104,626 | | 76.91% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 2.1 | 150 | 0.0118 | 1.21 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.4 | 204 | 0.0134 | 2.35 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 28 | 0.0530 | 1.61 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 382 | Total | | | |

Subcatchment S3: TO BASIN

Hydrograph



Summary for Pond BAS1: BASIN

Inflow Area = 3.123 ac, 76.91% Impervious, Inflow Depth = 2.15" for 2-year event
 Inflow = 8.48 cfs @ 12.06 hrs, Volume= 0.561 af
 Outflow = 0.39 cfs @ 14.59 hrs, Volume= 0.570 af, Atten= 95%, Lag= 152.0 min
 Discarded = 0.39 cfs @ 14.59 hrs, Volume= 0.570 af
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.68' @ 14.59 hrs Surf.Area= 10,385 sf Storage= 13,298 cf
 Flood Elev= 155.50' Surf.Area= 15,913 sf Storage= 37,171 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 382.4 min (1,190.5 - 808.1)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 152.00' | 47,572 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 152.00 | 5,458 | 0 | 0 |
| 153.00 | 8,348 | 6,903 | 6,903 |
| 153.75 | 10,586 | 7,100 | 14,003 |
| 154.00 | 11,338 | 2,741 | 16,744 |
| 155.00 | 14,373 | 12,856 | 29,599 |
| 155.50 | 15,913 | 7,572 | 37,171 |
| 156.00 | 25,691 | 10,401 | 47,572 |

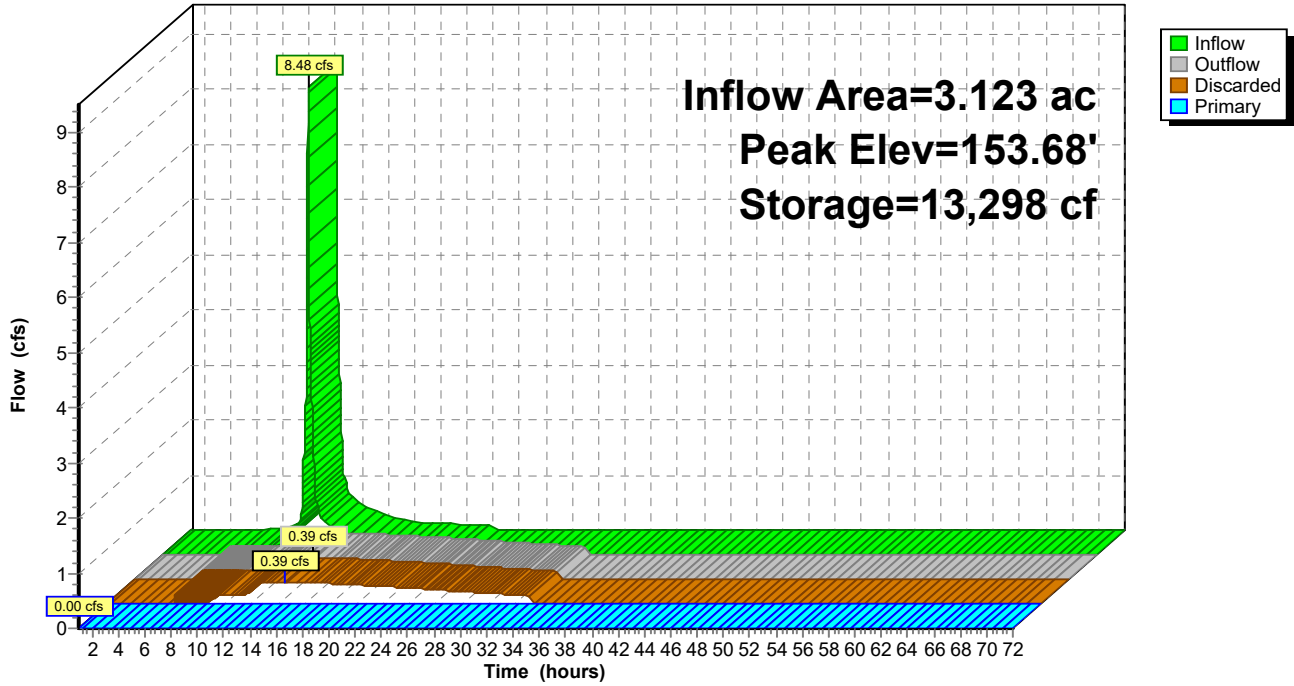
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 152.00' | 1.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 149.00' |
| #2 | Primary | 153.75' | 15.0" Round Culvert L= 14.0' Ke= 0.500 Inlet / Outlet Invert= 153.75' / 153.00' S= 0.0536 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |
| #3 | Primary | 155.50' | 40.0' long x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

Discarded OutFlow Max=0.39 cfs @ 14.59 hrs HW=153.68' (Free Discharge)
 ↑1=Exfiltration (Controls 0.39 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=152.00' TW=151.35' (Dynamic Tailwater)
 ↑2=Culvert (Controls 0.00 cfs)
 ↑3=Broad-Crested Rectangular Weir(Controls 0.00 cfs)

Pond BAS1: BASIN

Hydrograph



Summary for Pond CB: CB

Inflow Area = 1.882 ac, 49.03% Impervious, Inflow Depth = 0.89" for 2-year event
 Inflow = 0.94 cfs @ 12.34 hrs, Volume= 0.139 af
 Outflow = 0.94 cfs @ 12.35 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.6 min
 Primary = 0.94 cfs @ 12.35 hrs, Volume= 0.139 af

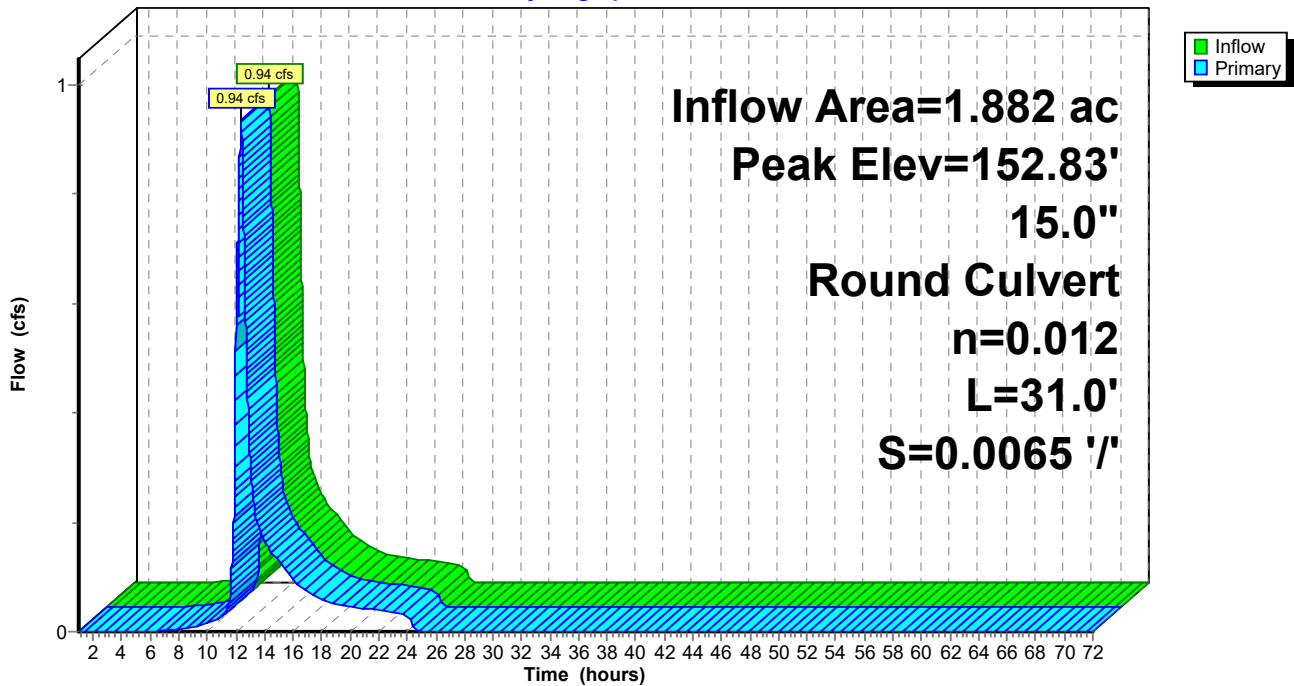
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 152.83' @ 12.05 hrs
 Flood Elev= 156.20'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 152.20' | 15.0" Round Culvert L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 152.20' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=0.94 cfs @ 12.35 hrs HW=152.80' TW=152.60' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 0.94 cfs @ 2.35 fps)

Pond CB: CB

Hydrograph



Summary for Pond CDS: CDS UNIT

Inflow Area = 2.283 ac, 51.94% Impervious, Inflow Depth = 1.05" for 2-year event
 Inflow = 1.70 cfs @ 12.03 hrs, Volume= 0.200 af
 Outflow = 1.70 cfs @ 12.04 hrs, Volume= 0.200 af, Atten= 0%, Lag= 0.6 min
 Primary = 1.70 cfs @ 12.04 hrs, Volume= 0.200 af

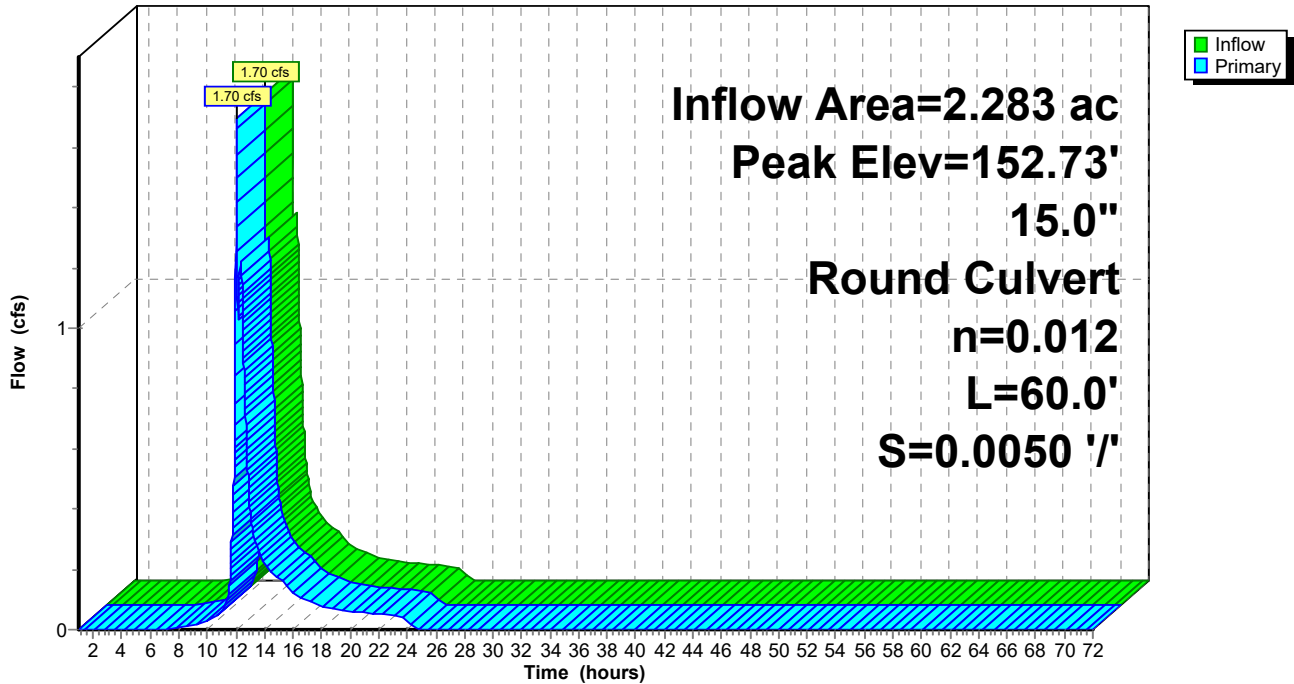
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 152.73' @ 12.04 hrs
 Flood Elev= 156.20'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 152.00' | 15.0" Round Culvert L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 152.00' / 151.70' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=1.69 cfs @ 12.04 hrs HW=152.73' TW=151.95' (Dynamic Tailwater)
 ←1=Culvert (Barrel Controls 1.69 cfs @ 3.30 fps)

Pond CDS: CDS UNIT

Hydrograph



Summary for Pond DMH: DMH

Inflow Area = 5.407 ac, 66.36% Impervious, Inflow Depth = 0.44" for 2-year event
 Inflow = 1.70 cfs @ 12.04 hrs, Volume= 0.200 af
 Outflow = 1.70 cfs @ 12.05 hrs, Volume= 0.200 af, Atten= 0%, Lag= 0.6 min
 Primary = 1.70 cfs @ 12.05 hrs, Volume= 0.200 af

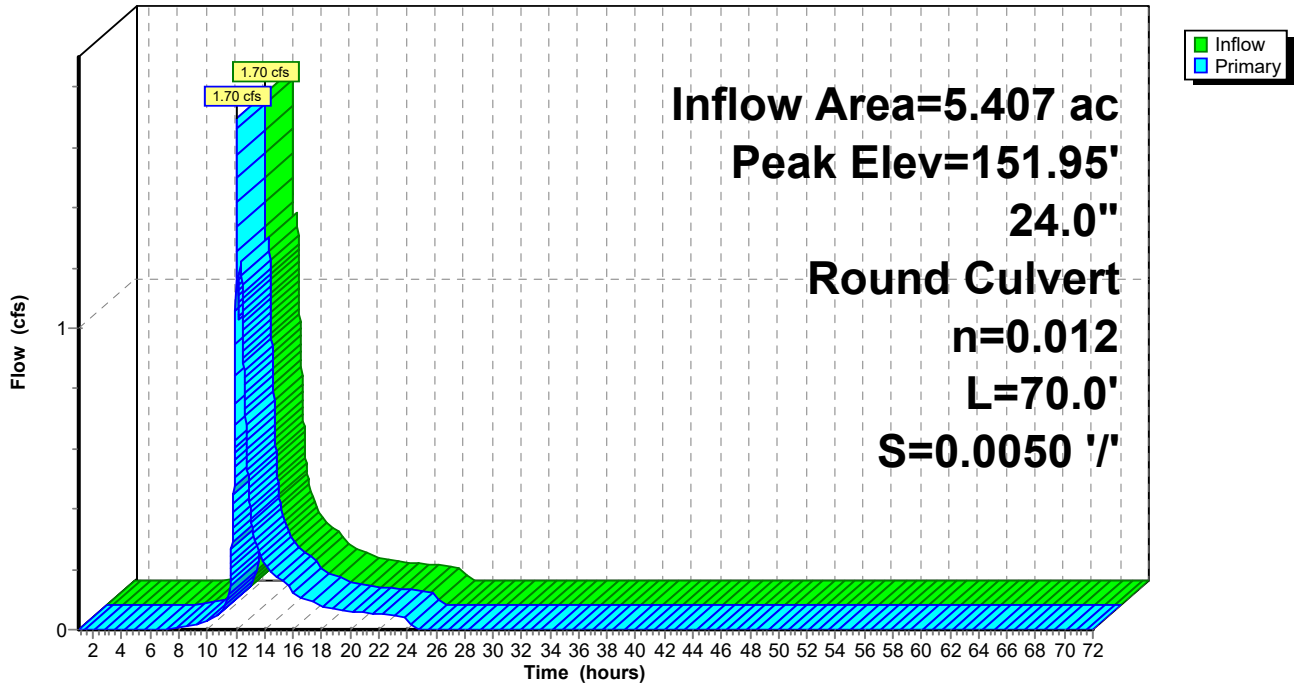
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 151.95' @ 12.05 hrs
 Flood Elev= 157.50'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|--|
| #1 | Primary | 151.35' | 24.0" Round Culvert L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf |

Primary OutFlow Max=1.69 cfs @ 12.05 hrs HW=151.95' TW=0.00' (Dynamic Tailwater)
 ←1=Culvert (Barrel Controls 1.69 cfs @ 3.18 fps)

Pond DMH: DMH

Hydrograph



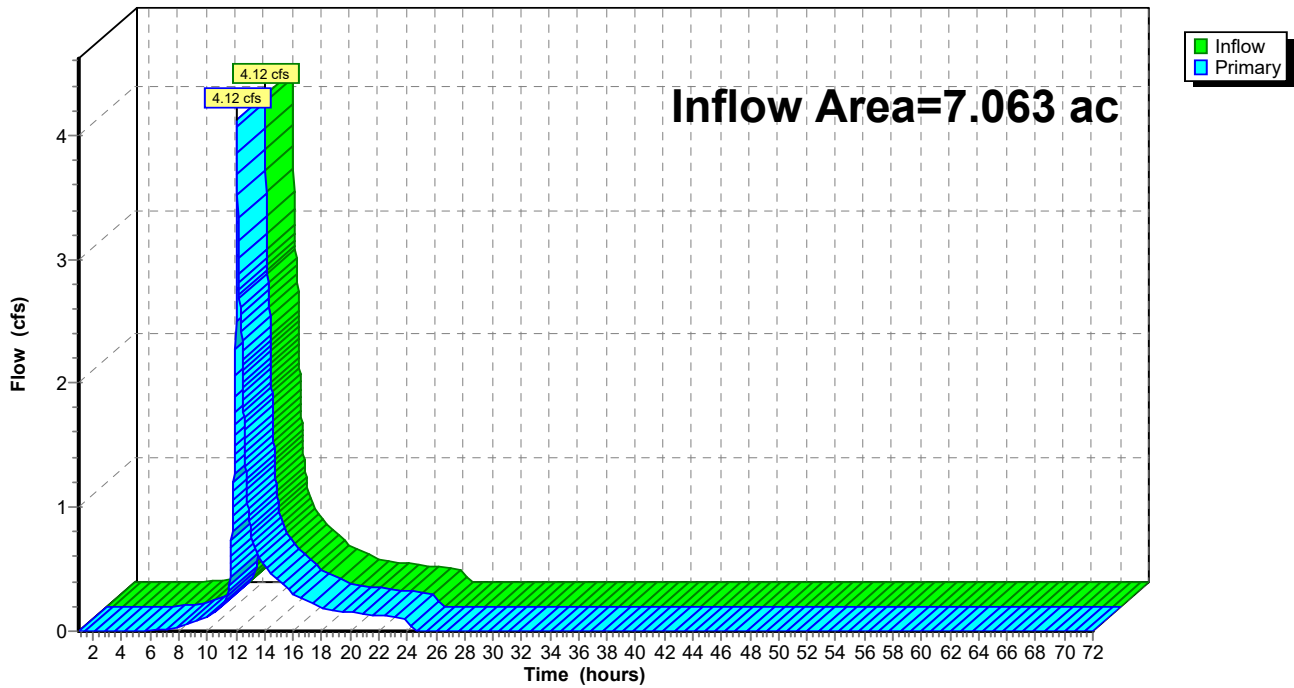
Summary for Pond DP: DP-EX

Inflow Area = 7.063 ac, 31.85% Impervious, Inflow Depth = 0.82" for 2-year event
Inflow = 4.12 cfs @ 12.07 hrs, Volume= 0.483 af
Primary = 4.12 cfs @ 12.08 hrs, Volume= 0.483 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP: DP-EX

Hydrograph



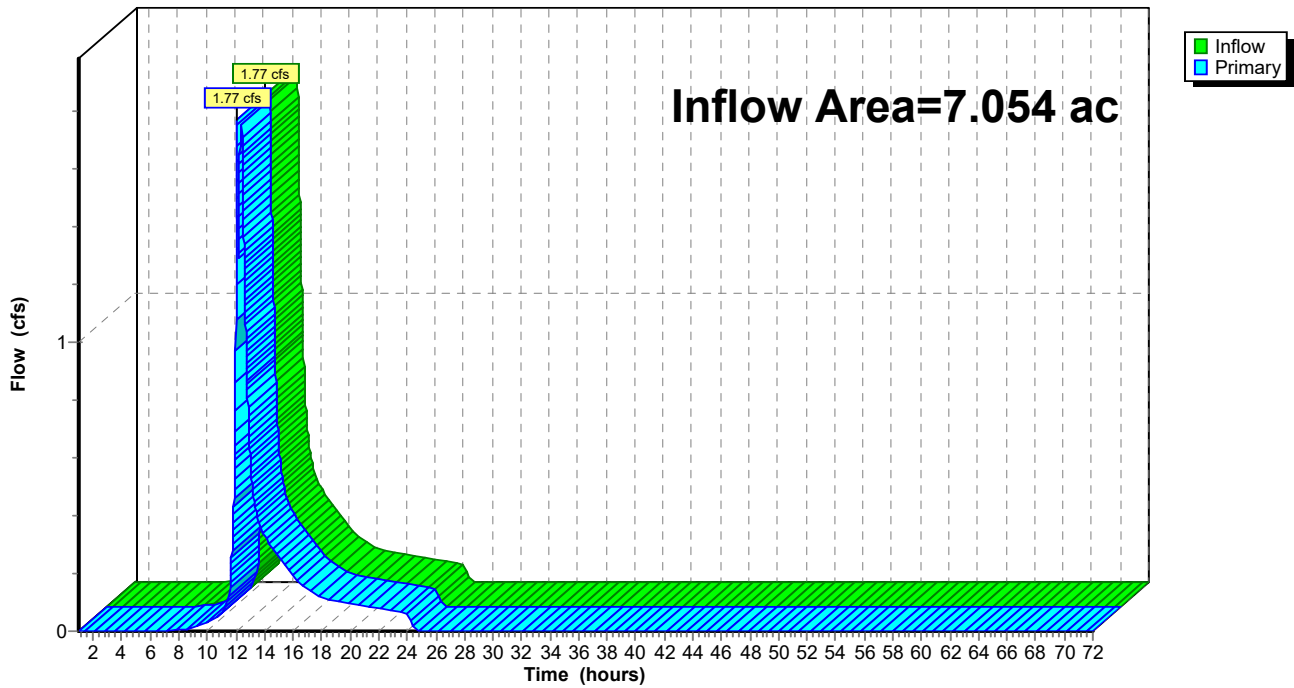
Summary for Pond DP.: DP-PR

Inflow Area = 7.054 ac, 58.09% Impervious, Inflow Depth = 0.47" for 2-year event
Inflow = 1.77 cfs @ 12.06 hrs, Volume= 0.276 af
Primary = 1.77 cfs @ 12.07 hrs, Volume= 0.276 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP.: DP-PR

Hydrograph



Summary for Pond YD: Yard Drain

Inflow Area = 1.687 ac, 45.64% Impervious, Inflow Depth = 0.73" for 2-year event
 Inflow = 0.79 cfs @ 12.36 hrs, Volume= 0.103 af
 Outflow = 0.79 cfs @ 12.37 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.6 min
 Primary = 0.79 cfs @ 12.37 hrs, Volume= 0.103 af

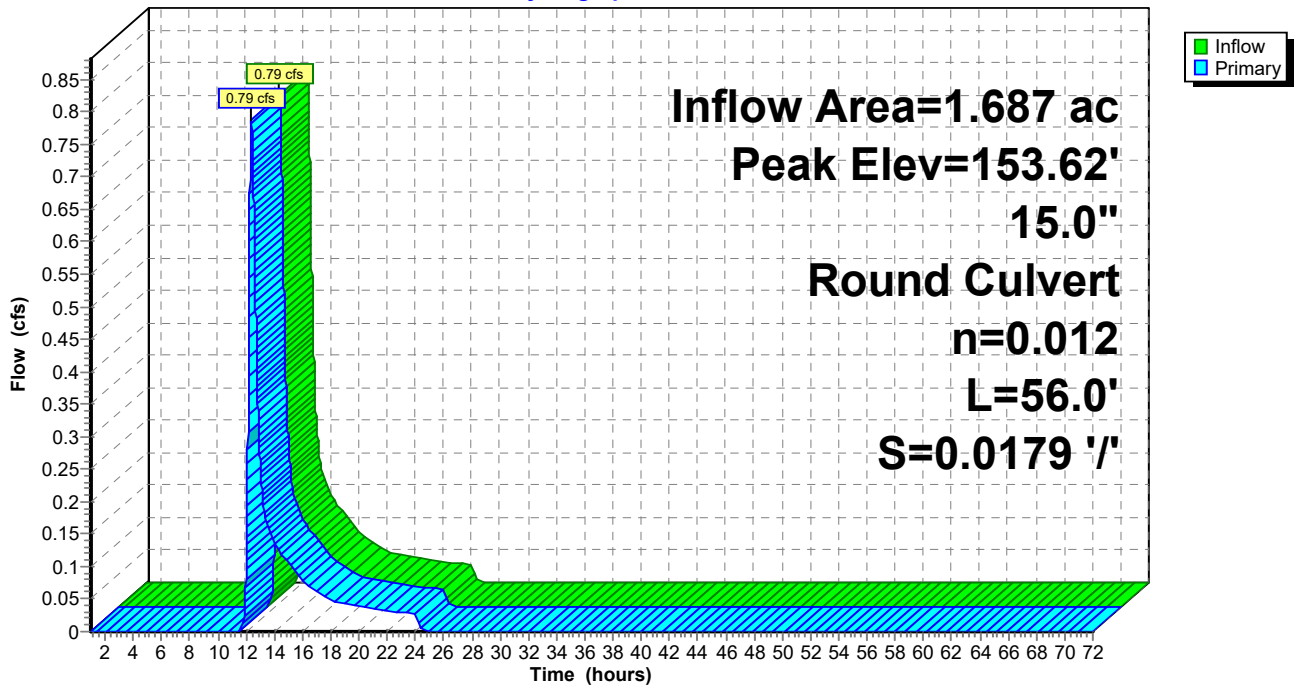
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.62' @ 12.37 hrs
 Flood Elev= 156.90'

| Device # | Routing | Invert | Outlet Devices |
|----------|---------|---------|---|
| #1 | Primary | 153.20' | 15.0" Round Culvert L= 56.0' Ke= 0.500 Inlet / Outlet Invert= 153.20' / 152.20' S= 0.0179 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=0.79 cfs @ 12.37 hrs HW=153.62' TW=152.80' (Dynamic Tailwater)
 ←1=Culvert (Inlet Controls 0.79 cfs @ 2.20 fps)

Pond YD: Yard Drain

Hydrograph



Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentE1: DIRECT Runoff Area=245,855 sf 19.29% Impervious Runoff Depth=1.47"
Flow Length=684' Tc=18.8 min CN=60 Runoff=6.08 cfs 0.690 af

SubcatchmentE2: TO PIPE Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=4.25"
Flow Length=389' Tc=4.5 min CN=91 Runoff=7.12 cfs 0.503 af

SubcatchmentS1: DIRECT Runoff Area=71,749 sf 30.94% Impervious Runoff Depth=1.69"
Flow Length=635' Tc=20.2 min CN=63 Runoff=2.05 cfs 0.232 af

SubcatchmentS2a: TO YD Runoff Area=73,505 sf 45.64% Impervious Runoff Depth=2.00"
Flow Length=602' Tc=22.2 min CN=67 Runoff=2.47 cfs 0.281 af

SubcatchmentS2b: TO CB Runoff Area=8,477 sf 78.41% Impervious Runoff Depth=4.15"
Flow Length=188' Slope=0.0255 '/' Tc=1.7 min CN=90 Runoff=1.06 cfs 0.067 af

SubcatchmentS2c: TO CDS UNIT Runoff Area=17,487 sf 65.61% Impervious Runoff Depth=3.63"
Flow Length=228' Slope=0.0255 '/' Tc=1.9 min CN=85 Runoff=1.95 cfs 0.121 af

SubcatchmentS3: TO BASIN Runoff Area=136,043 sf 76.91% Impervious Runoff Depth=4.04"
Flow Length=382' Tc=3.8 min CN=89 Runoff=15.49 cfs 1.052 af

Pond BAS1: BASIN Peak Elev=154.44' Storage=22,019 cf Inflow=15.49 cfs 1.052 af
Discarded=0.53 cfs 0.756 af Primary=1.96 cfs 0.304 af Outflow=2.49 cfs 1.060 af

Pond CB: CB Peak Elev=153.38' Inflow=2.76 cfs 0.349 af
15.0" Round Culvert n=0.012 L=31.0' S=0.0065 '/' Outflow=2.76 cfs 0.349 af

Pond CDS: CDS UNIT Peak Elev=153.20' Inflow=3.74 cfs 0.470 af
15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=3.74 cfs 0.470 af

Pond DMH: DMH Peak Elev=152.44' Inflow=4.98 cfs 0.774 af
24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=4.98 cfs 0.774 af

Pond DP: DP-EX Inflow=9.53 cfs 1.193 af
Primary=9.53 cfs 1.193 af

Pond DP.: DP-PR Inflow=6.96 cfs 1.006 af
Primary=6.96 cfs 1.006 af

Pond YD: Yard Drain Peak Elev=154.03' Inflow=2.47 cfs 0.281 af
15.0" Round Culvert n=0.012 L=56.0' S=0.0179 '/' Outflow=2.47 cfs 0.281 af

Summary for Subcatchment E1: DIRECT

Runoff = 6.08 cfs @ 12.29 hrs, Volume= 0.690 af, Depth= 1.47"

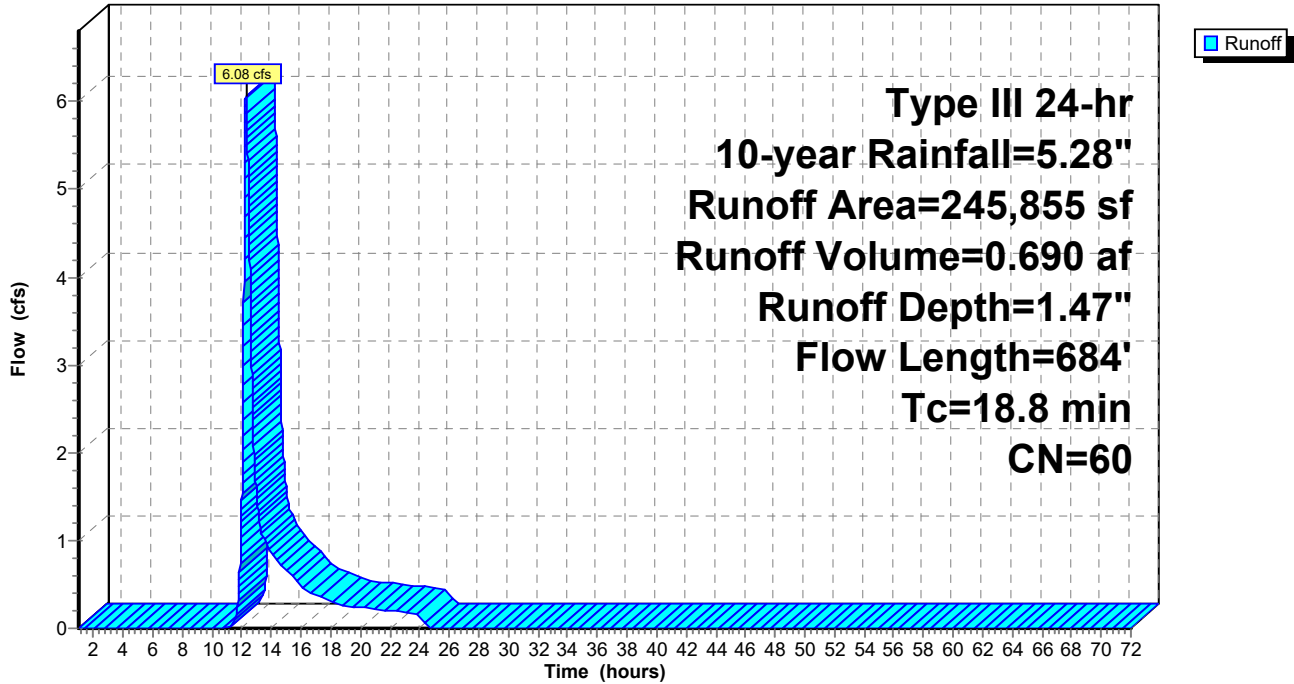
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 118,874 | 61 | >75% Grass cover, Good, HSG B |
| 9,139 | 55 | Woods, Good, HSG B |
| 44,246 | 98 | Paved parking, HSG B |
| 31,283 | 39 | >75% Grass cover, Good, HSG A |
| 39,145 | 30 | Woods, Good, HSG A |
| 3,168 | 98 | Paved parking, HSG A |
| 245,855 | 60 | Weighted Average |
| 198,441 | | 80.71% Pervious Area |
| 47,414 | | 19.29% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 2.6 | 135 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 1.6 | 114 | 0.0281 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.2 | 265 | 0.0045 | 1.36 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.2 | 20 | 0.0400 | 1.40 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 18.8 | 684 | Total | | | |

Subcatchment E1: DIRECT

Hydrograph



Summary for Subcatchment E2: TO PIPE

Runoff = 7.12 cfs @ 12.06 hrs, Volume= 0.503 af, Depth= 4.25"

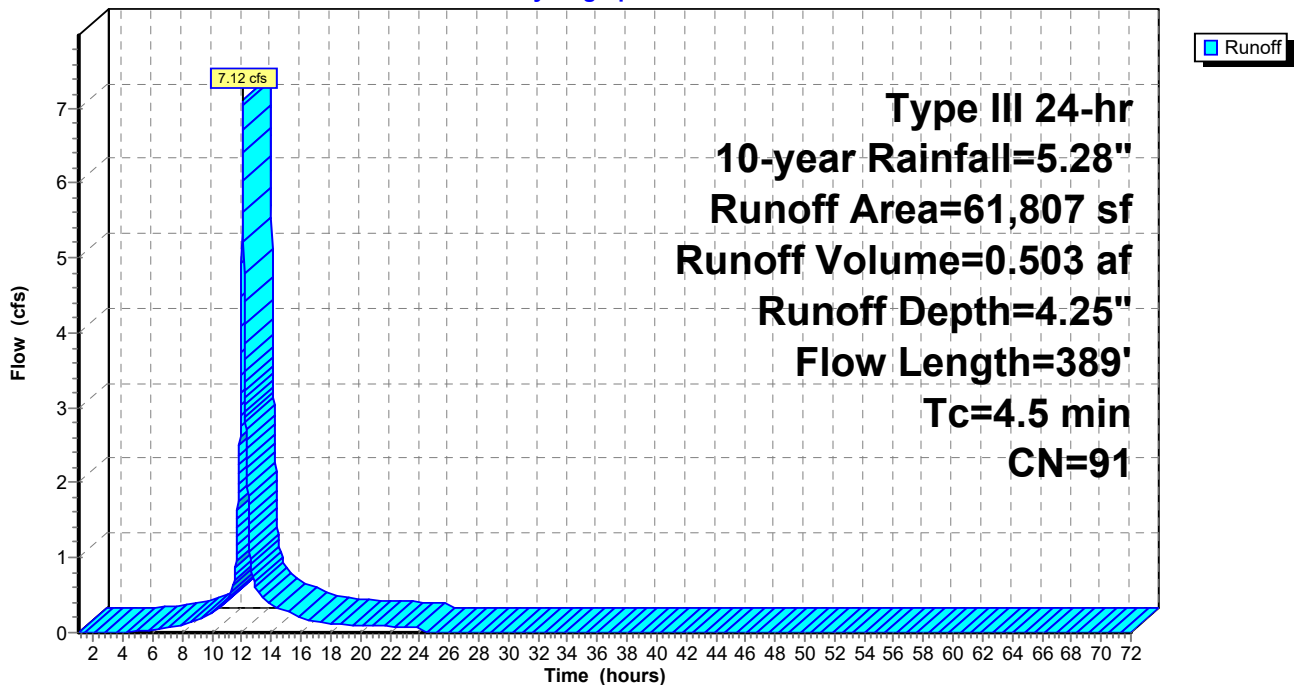
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 11,246 | 61 | >75% Grass cover, Good, HSG B |
| 50,561 | 98 | Paved parking, HSG B |
| 61,807 | 91 | Weighted Average |
| 11,246 | | 18.20% Pervious Area |
| 50,561 | | 81.80% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.2 | 10 | 0.0348 | 0.13 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 1.4 | 140 | 0.0296 | 1.72 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.6 | 215 | 0.0122 | 2.24 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 24 | 0.0279 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 4.5 | 389 | Total | | | |

Subcatchment E2: TO PIPE

Hydrograph



Summary for Subcatchment S1: DIRECT

Runoff = 2.05 cfs @ 12.30 hrs, Volume= 0.232 af, Depth= 1.69"

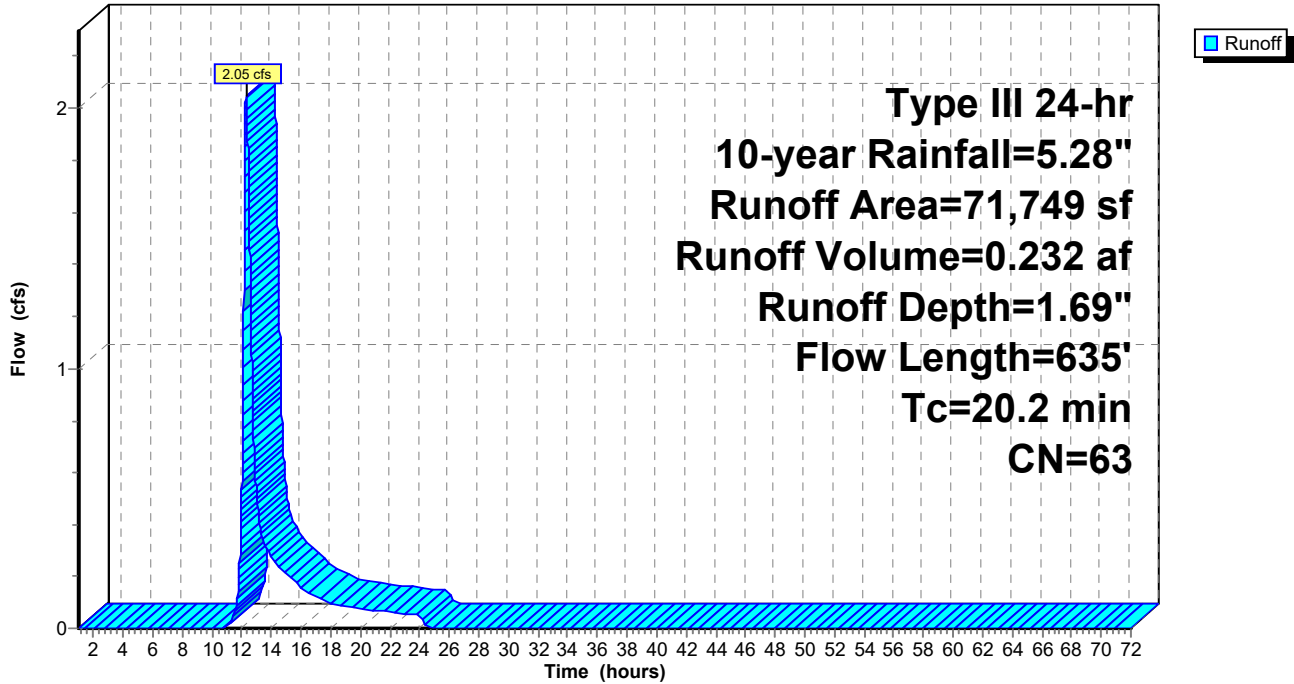
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 19,240 | 61 | >75% Grass cover, Good, HSG B |
| 4,239 | 55 | Woods, Good, HSG B |
| * 22,200 | 98 | Paved parking |
| 21,008 | 39 | >75% Grass cover, Good, HSG A |
| 5,062 | 30 | Woods, Good, HSG A |
| 71,749 | 63 | Weighted Average |
| 49,549 | | 69.06% Pervious Area |
| 22,200 | | 30.94% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.8 | 40 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 8.2 | 445 | 0.0169 | 0.91 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 20.2 | 635 | Total | | | |

Subcatchment S1: DIRECT

Hydrograph



Summary for Subcatchment S2a: TO YD

Runoff = 2.47 cfs @ 12.32 hrs, Volume= 0.281 af, Depth= 2.00"

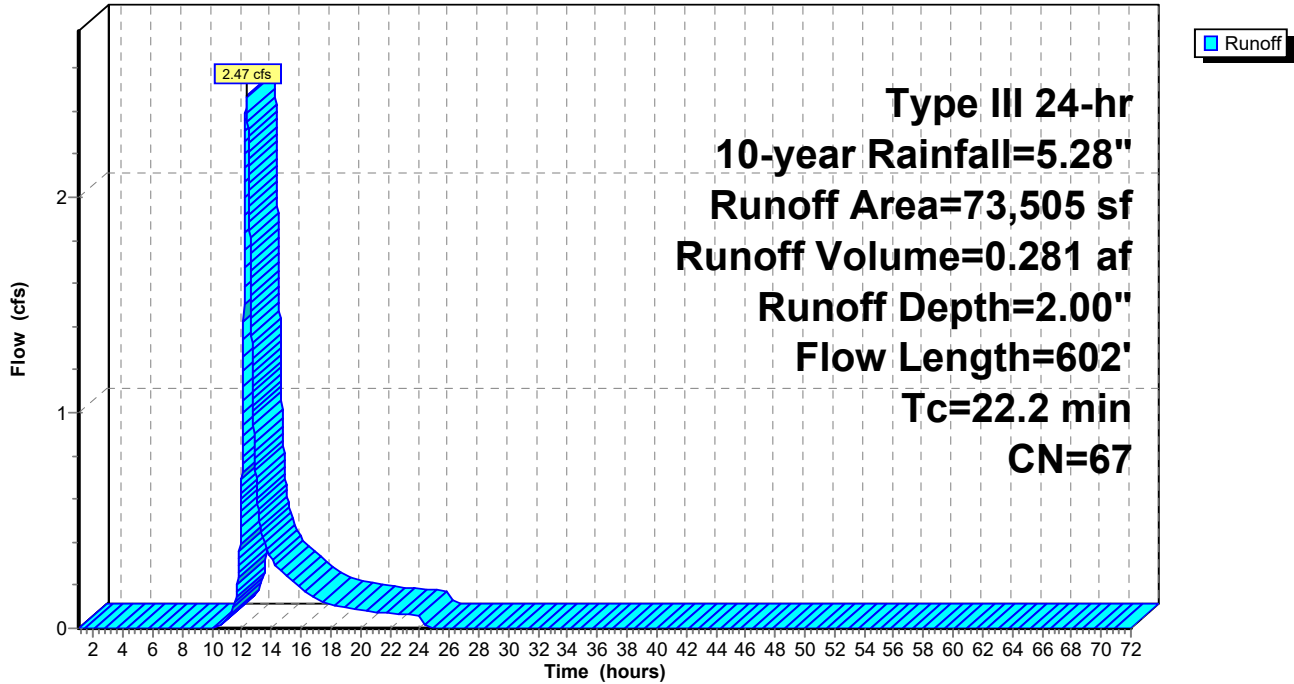
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 10,567 | 61 | >75% Grass cover, Good, HSG B |
| 30,587 | 98 | Paved parking, HSG B |
| 12,582 | 39 | >75% Grass cover, Good, HSG A |
| 16,809 | 30 | Woods, Good, HSG A |
| 2,960 | 98 | Paved parking, HSG A |
| 73,505 | 67 | Weighted Average |
| 39,958 | | 54.36% Pervious Area |
| 33,547 | | 45.64% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 9.2 | 121 | 0.0347 | 0.22 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 5.3 | 29 | 0.0552 | 0.09 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.3 | 96 | 0.0573 | 1.20 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 2.2 | 92 | 0.0100 | 0.70 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 0.5 | 74 | 0.0176 | 2.69 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 3.7 | 190 | 0.0150 | 0.86 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 22.2 | 602 | Total | | | |

Subcatchment S2a: TO YD

Hydrograph



Summary for Subcatchment S2b: TO CB

Runoff = 1.06 cfs @ 12.03 hrs, Volume= 0.067 af, Depth= 4.15"

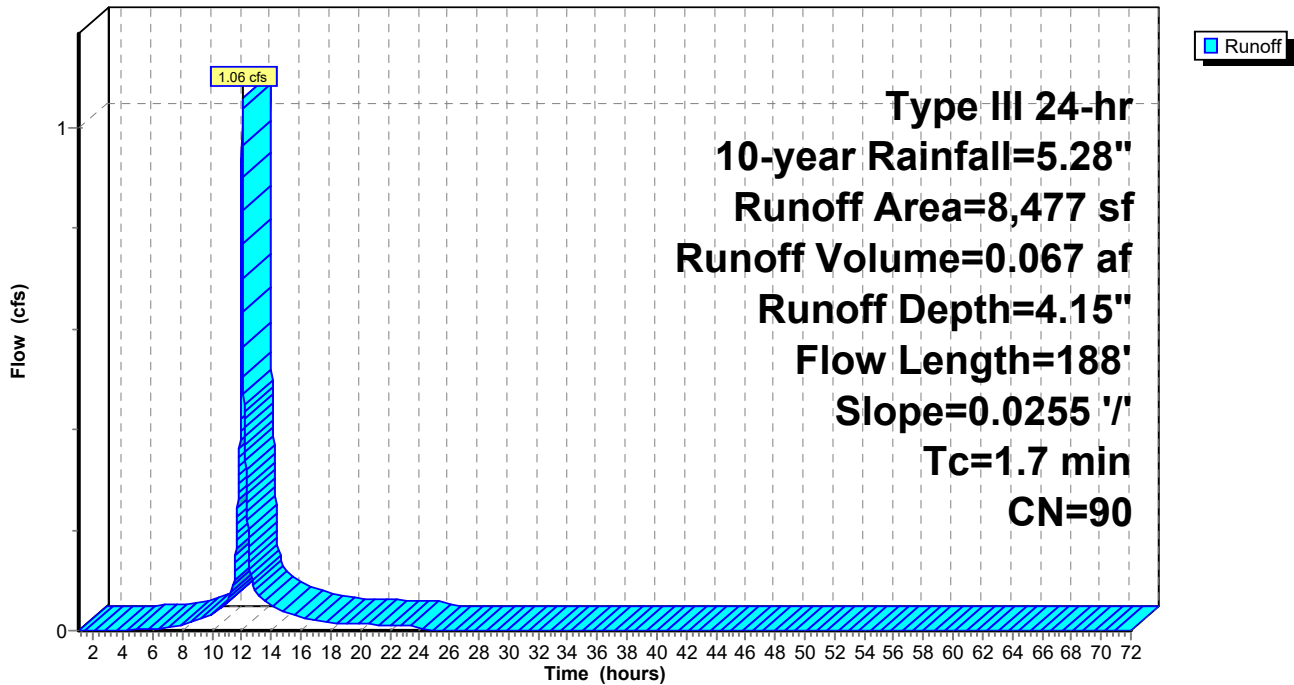
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 1,830 | 61 | >75% Grass cover, Good, HSG B |
| 6,647 | 98 | Paved parking, HSG B |
| 8,477 | 90 | Weighted Average |
| 1,830 | | 21.59% Pervious Area |
| 6,647 | | 78.41% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, GR Smooth surfaces n= 0.011 P2= 3.20" |
| 0.2 | 38 | 0.0255 | 3.24 | | Shallow Concentrated Flow, WOODS Paved Kv= 20.3 fps |
| 1.7 | 188 | Total | | | |

Subcatchment S2b: TO CB

Hydrograph



Summary for Subcatchment S2c: TO CDS UNIT

Runoff = 1.95 cfs @ 12.03 hrs, Volume= 0.121 af, Depth= 3.63"

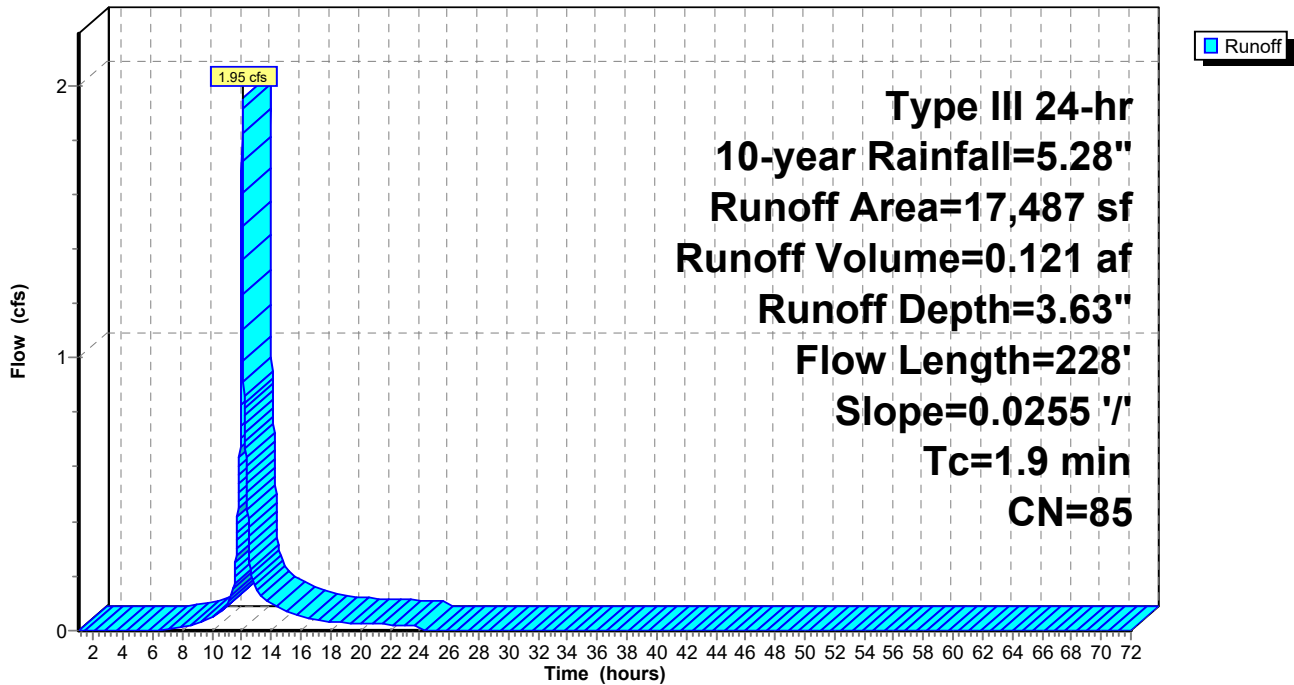
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 6,013 | 61 | >75% Grass cover, Good, HSG B |
| 11,474 | 98 | Paved parking, HSG B |
| 17,487 | 85 | Weighted Average |
| 6,013 | | 34.39% Pervious Area |
| 11,474 | | 65.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20" |
| 0.4 | 78 | 0.0255 | 3.24 | | Shallow Concentrated Flow, Paved Kv= 20.3 fps |
| 1.9 | 228 | Total | | | |

Subcatchment S2c: TO CDS UNIT

Hydrograph



Summary for Subcatchment S3: TO BASIN

Runoff = 15.49 cfs @ 12.06 hrs, Volume= 1.052 af, Depth= 4.04"

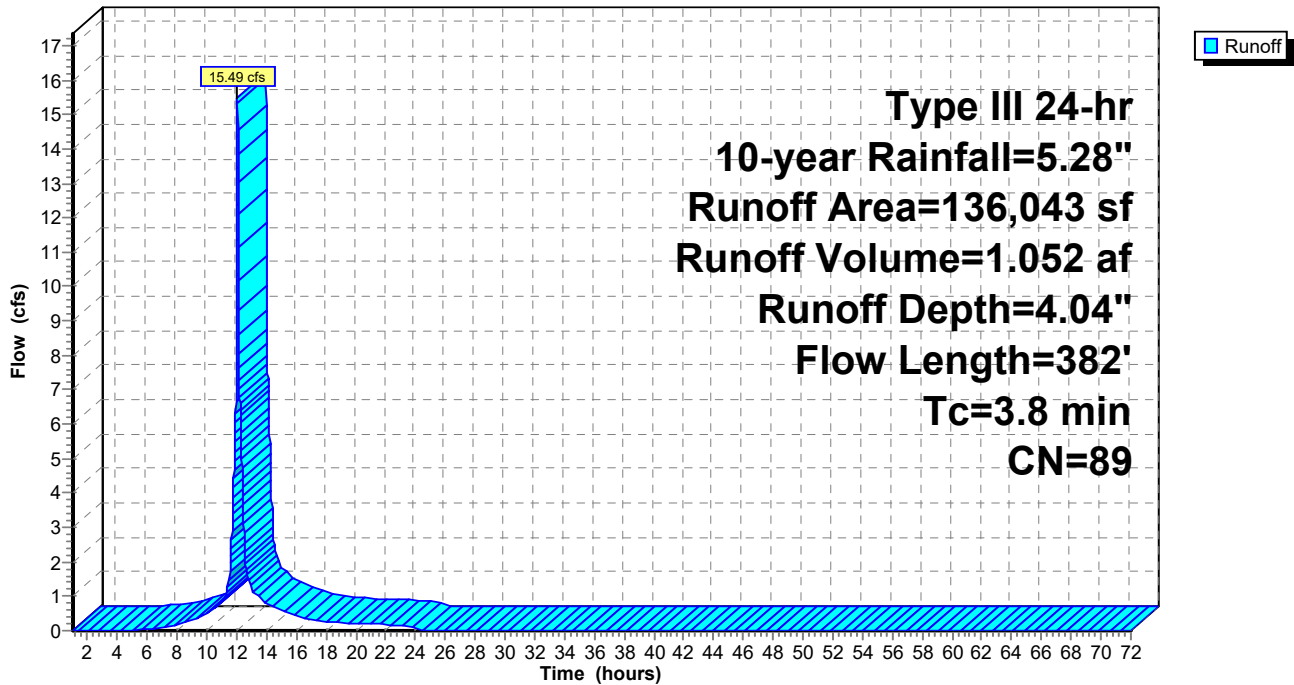
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.28"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 31,417 | 61 | >75% Grass cover, Good, HSG B |
| * 104,626 | 98 | Paved parking |
| 136,043 | 89 | Weighted Average |
| 31,417 | | 23.09% Pervious Area |
| 104,626 | | 76.91% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 2.1 | 150 | 0.0118 | 1.21 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.4 | 204 | 0.0134 | 2.35 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 28 | 0.0530 | 1.61 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 382 | Total | | | |

Subcatchment S3: TO BASIN

Hydrograph



Summary for Pond BAS1: BASIN

Inflow Area = 3.123 ac, 76.91% Impervious, Inflow Depth = 4.04" for 10-year event
 Inflow = 15.49 cfs @ 12.06 hrs, Volume= 1.052 af
 Outflow = 2.49 cfs @ 12.52 hrs, Volume= 1.060 af, Atten= 84%, Lag= 27.7 min
 Discarded = 0.53 cfs @ 12.52 hrs, Volume= 0.756 af
 Primary = 1.96 cfs @ 12.52 hrs, Volume= 0.304 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 154.44' @ 12.52 hrs Surf.Area= 12,672 sf Storage= 22,019 cf
 Flood Elev= 155.50' Surf.Area= 15,913 sf Storage= 37,171 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 317.1 min (1,107.6 - 790.5)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 152.00' | 47,572 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 152.00 | 5,458 | 0 | 0 |
| 153.00 | 8,348 | 6,903 | 6,903 |
| 153.75 | 10,586 | 7,100 | 14,003 |
| 154.00 | 11,338 | 2,741 | 16,744 |
| 155.00 | 14,373 | 12,856 | 29,599 |
| 155.50 | 15,913 | 7,572 | 37,171 |
| 156.00 | 25,691 | 10,401 | 47,572 |

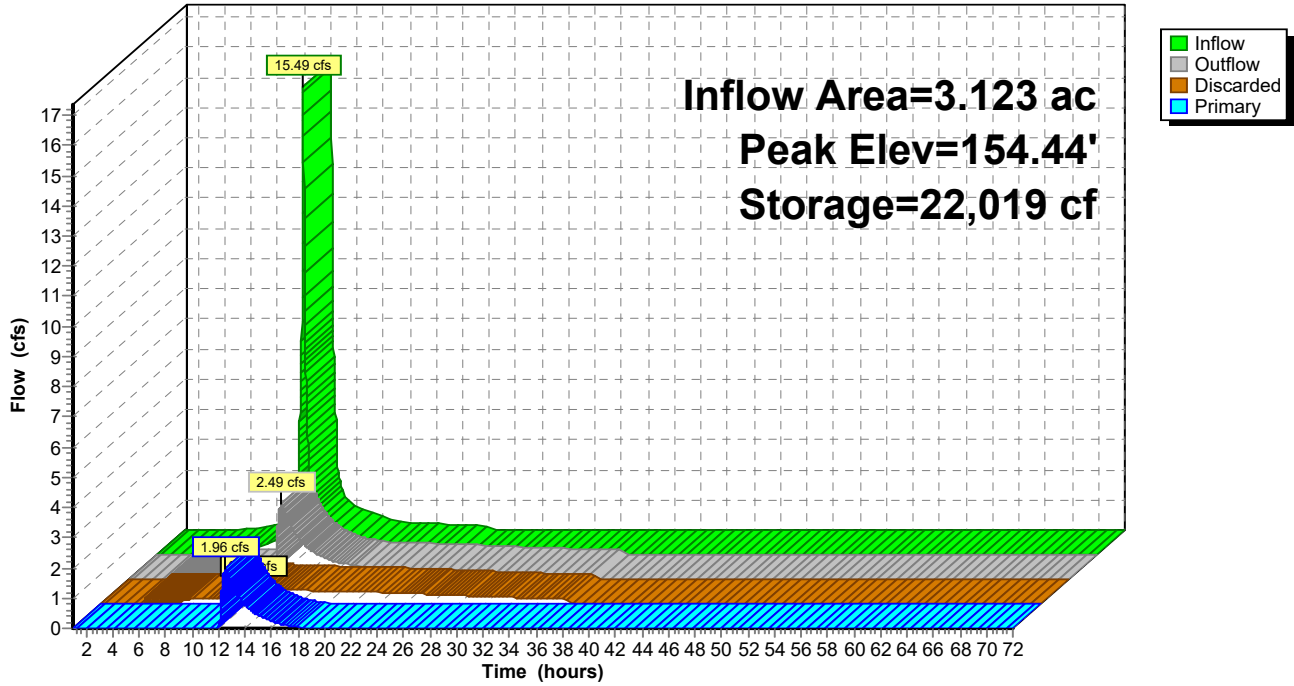
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 152.00' | 1.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 149.00' |
| #2 | Primary | 153.75' | 15.0" Round Culvert L= 14.0' Ke= 0.500 Inlet / Outlet Invert= 153.75' / 153.00' S= 0.0536 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |
| #3 | Primary | 155.50' | 40.0' long x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

Discarded OutFlow Max=0.53 cfs @ 12.52 hrs HW=154.44' (Free Discharge)
 ↑1=Exfiltration (Controls 0.53 cfs)

Primary OutFlow Max=1.96 cfs @ 12.52 hrs HW=154.44' TW=152.38' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 1.96 cfs @ 2.83 fps)
 ↑3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond BAS1: BASIN

Hydrograph



Summary for Pond CB: CB

Inflow Area = 1.882 ac, 49.03% Impervious, Inflow Depth = 2.22" for 10-year event
 Inflow = 2.76 cfs @ 12.32 hrs, Volume= 0.349 af
 Outflow = 2.76 cfs @ 12.33 hrs, Volume= 0.349 af, Atten= 0%, Lag= 0.6 min
 Primary = 2.76 cfs @ 12.33 hrs, Volume= 0.349 af

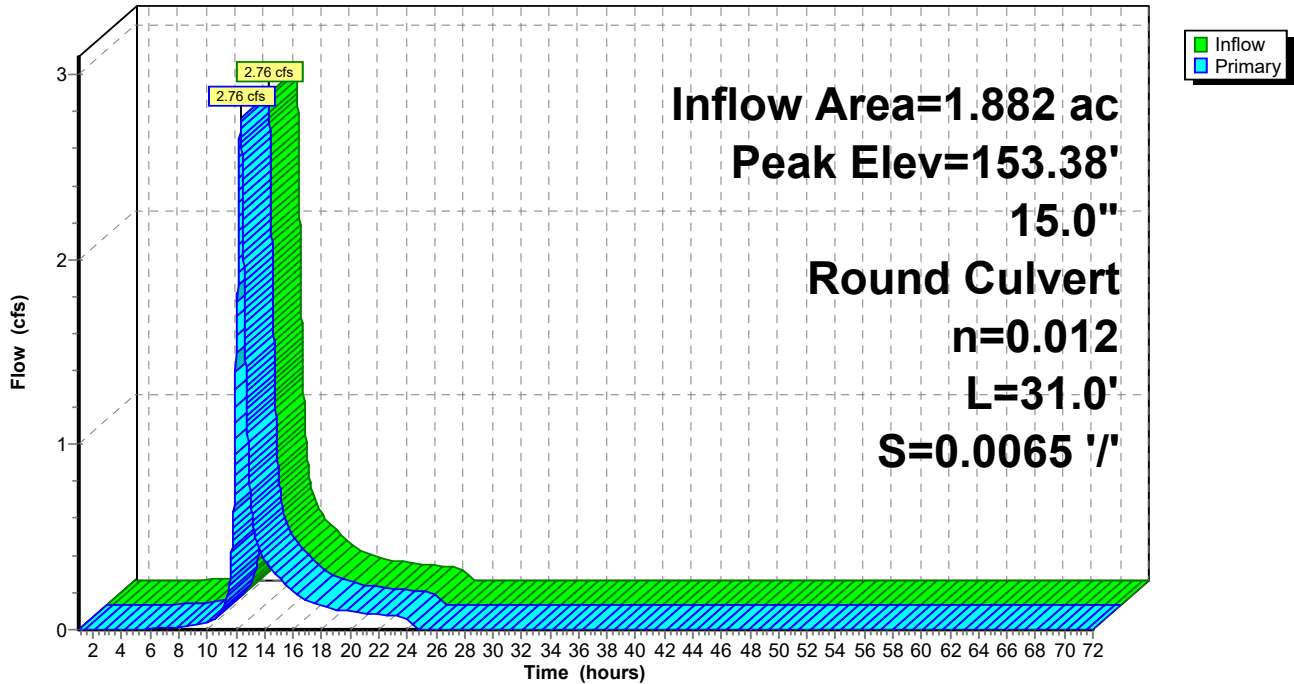
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.38' @ 12.33 hrs
 Flood Elev= 156.20'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 152.20' | 15.0" Round Culvert L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 152.20' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=2.77 cfs @ 12.33 hrs HW=153.38' TW=153.10' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 2.77 cfs @ 2.99 fps)

Pond CB: CB

Hydrograph



Summary for Pond CDS: CDS UNIT

Inflow Area = 2.283 ac, 51.94% Impervious, Inflow Depth = 2.47" for 10-year event
 Inflow = 3.74 cfs @ 12.03 hrs, Volume= 0.470 af
 Outflow = 3.74 cfs @ 12.04 hrs, Volume= 0.470 af, Atten= 0%, Lag= 0.6 min
 Primary = 3.74 cfs @ 12.04 hrs, Volume= 0.470 af

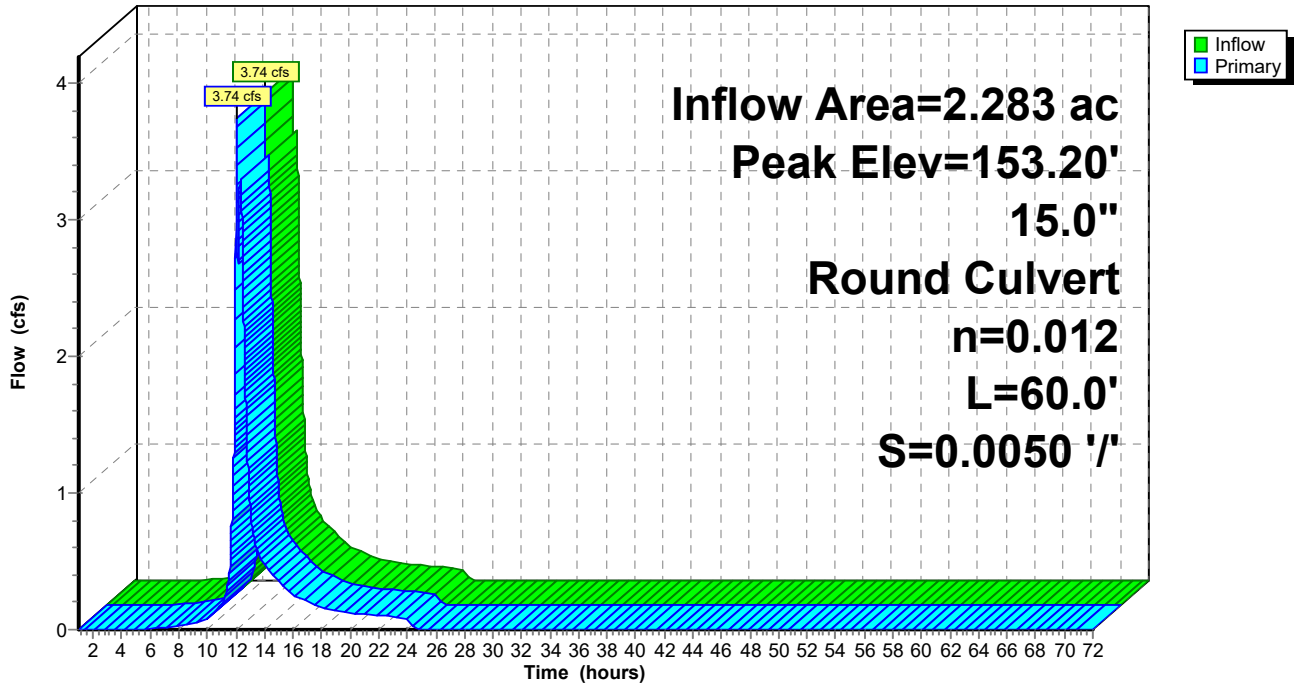
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.20' @ 12.04 hrs
 Flood Elev= 156.20'

| Device # | Routing | Invert | Outlet Devices |
|----------|---------|---------|--|
| #1 | Primary | 152.00' | 15.0" Round Culvert L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 152.00' / 151.70' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=3.73 cfs @ 12.04 hrs HW=153.19' TW=152.27' (Dynamic Tailwater)
 ←1=Culvert (Barrel Controls 3.73 cfs @ 3.97 fps)

Pond CDS: CDS UNIT

Hydrograph



Summary for Pond DMH: DMH

Inflow Area = 5.407 ac, 66.36% Impervious, Inflow Depth = 1.72" for 10-year event
 Inflow = 4.98 cfs @ 12.37 hrs, Volume= 0.774 af
 Outflow = 4.98 cfs @ 12.38 hrs, Volume= 0.774 af, Atten= 0%, Lag= 0.6 min
 Primary = 4.98 cfs @ 12.38 hrs, Volume= 0.774 af

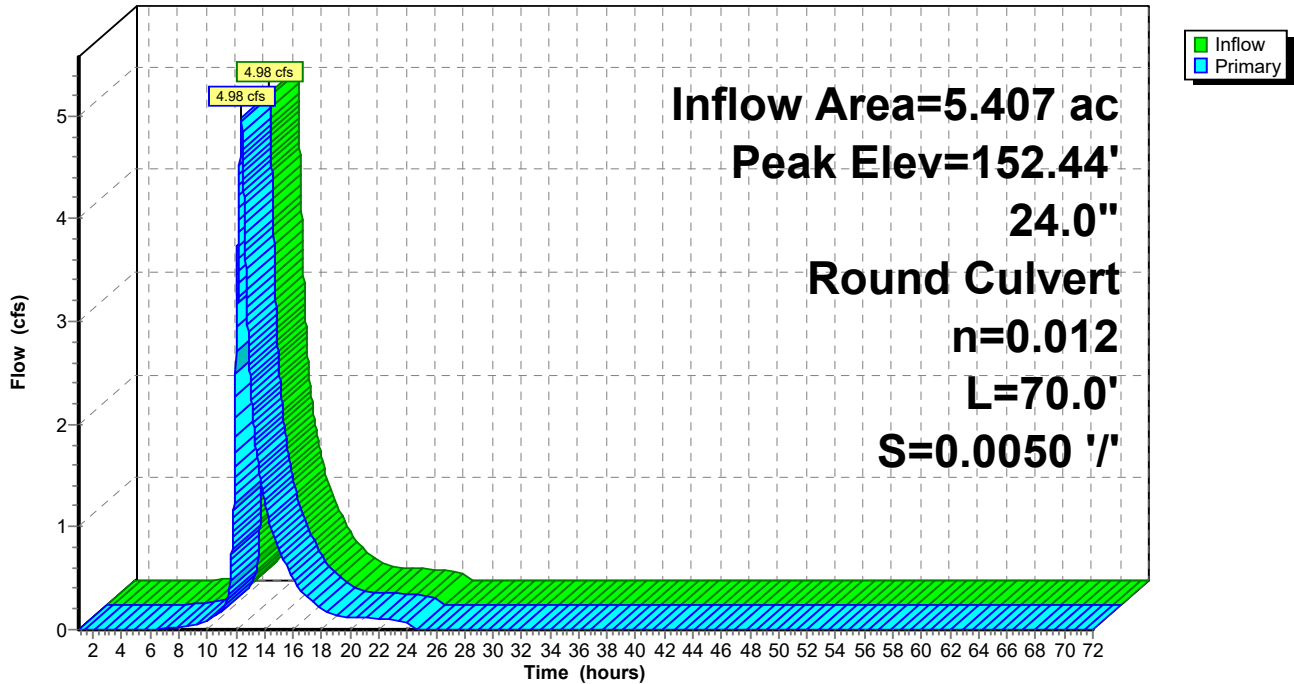
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 152.44' @ 12.38 hrs
 Flood Elev= 157.50'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|--|
| #1 | Primary | 151.35' | 24.0" Round Culvert L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf |

Primary OutFlow Max=4.98 cfs @ 12.38 hrs HW=152.44' TW=0.00' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 4.98 cfs @ 4.10 fps)

Pond DMH: DMH

Hydrograph



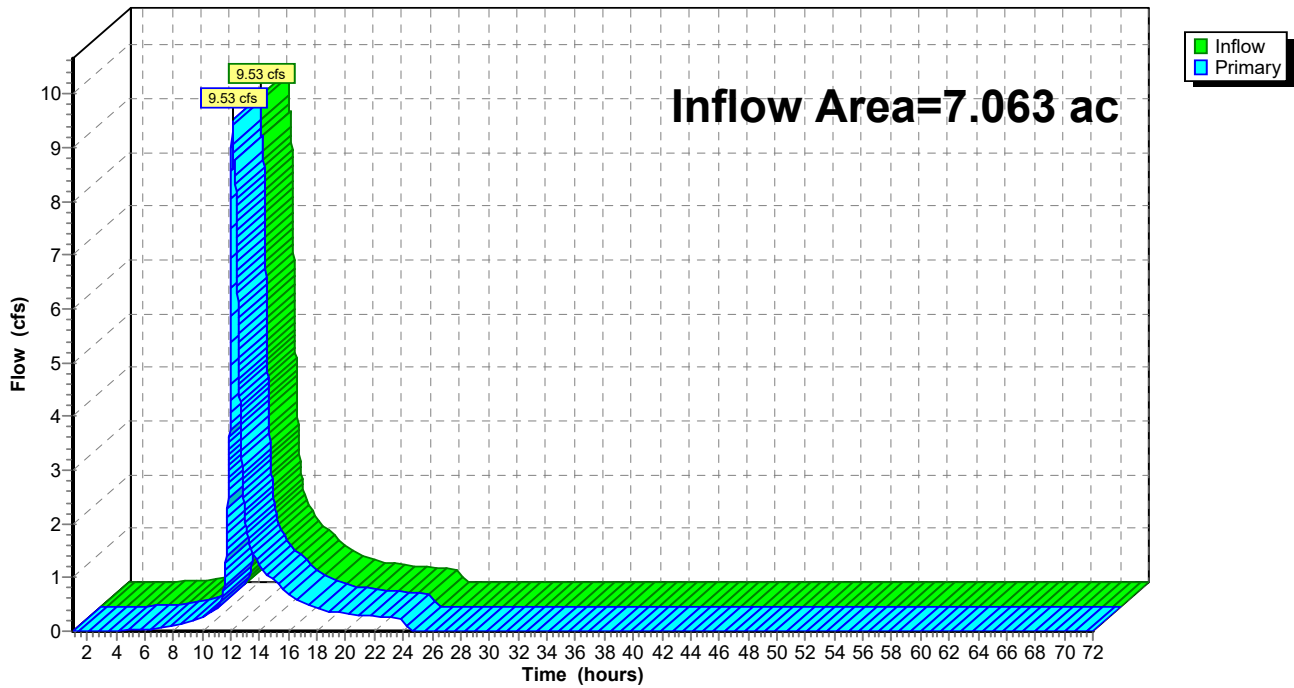
Summary for Pond DP: DP-EX

Inflow Area = 7.063 ac, 31.85% Impervious, Inflow Depth = 2.03" for 10-year event
Inflow = 9.53 cfs @ 12.08 hrs, Volume= 1.193 af
Primary = 9.53 cfs @ 12.09 hrs, Volume= 1.193 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP: DP-EX

Hydrograph



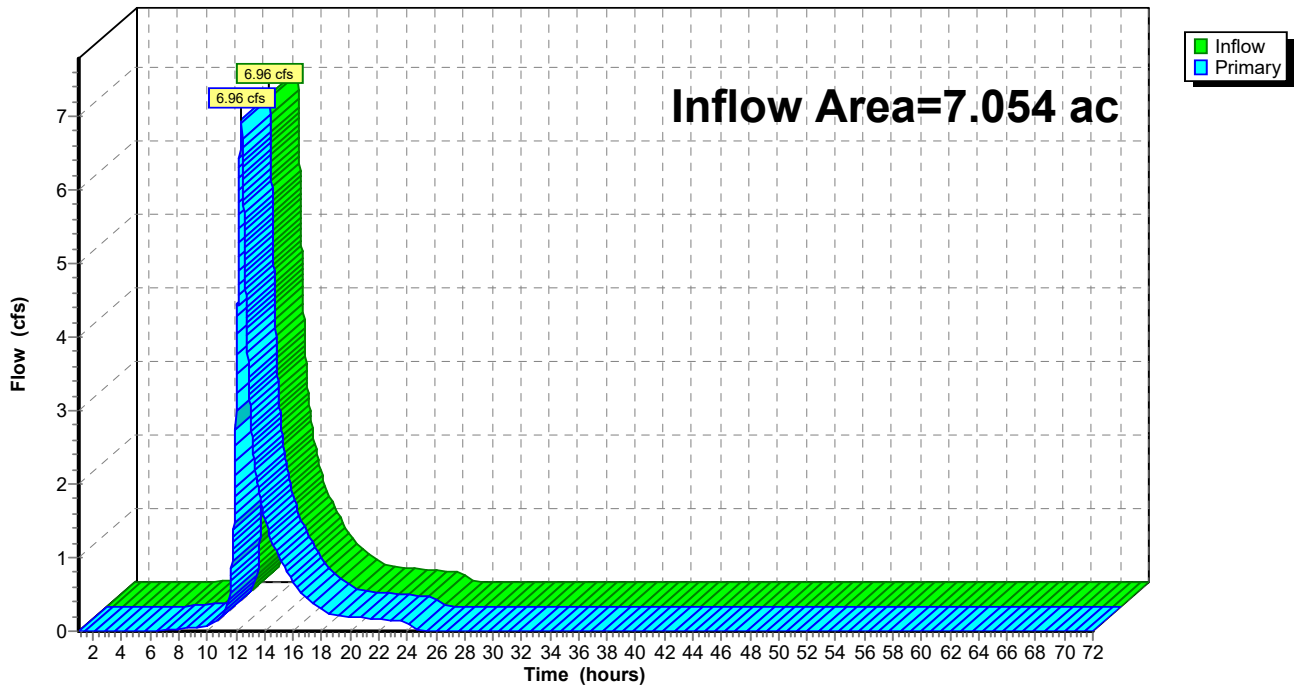
Summary for Pond DP.: DP-PR

Inflow Area = 7.054 ac, 58.09% Impervious, Inflow Depth = 1.71" for 10-year event
Inflow = 6.96 cfs @ 12.35 hrs, Volume= 1.006 af
Primary = 6.96 cfs @ 12.36 hrs, Volume= 1.006 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP.: DP-PR

Hydrograph



Summary for Pond YD: Yard Drain

Inflow Area = 1.687 ac, 45.64% Impervious, Inflow Depth = 2.00" for 10-year event
 Inflow = 2.47 cfs @ 12.32 hrs, Volume= 0.281 af
 Outflow = 2.47 cfs @ 12.33 hrs, Volume= 0.281 af, Atten= 0%, Lag= 0.6 min
 Primary = 2.47 cfs @ 12.33 hrs, Volume= 0.281 af

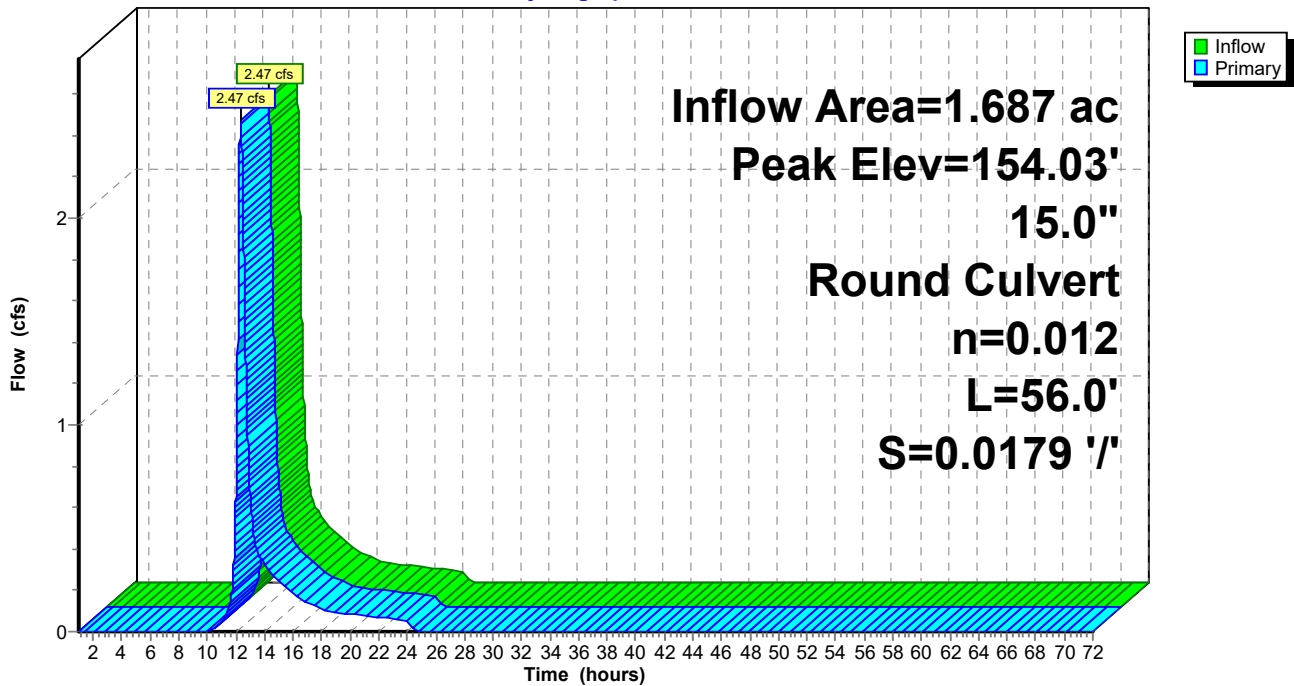
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 154.03' @ 12.34 hrs
 Flood Elev= 156.90'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 153.20' | 15.0" Round Culvert L= 56.0' Ke= 0.500 Inlet / Outlet Invert= 153.20' / 152.20' S= 0.0179 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=2.47 cfs @ 12.33 hrs HW=154.03' TW=153.38' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 2.47 cfs @ 4.03 fps)

Pond YD: Yard Drain

Hydrograph



Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

| | |
|-------------------------------------|--|
| SubcatchmentE1: DIRECT | Runoff Area=245,855 sf 19.29% Impervious Runoff Depth=2.27" Flow Length=684' Tc=18.8 min CN=60 Runoff=9.90 cfs 1.067 af |
| SubcatchmentE2: TO PIPE | Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=5.47" Flow Length=389' Tc=4.5 min CN=91 Runoff=9.02 cfs 0.646 af |
| SubcatchmentS1: DIRECT | Runoff Area=71,749 sf 30.94% Impervious Runoff Depth=2.55" Flow Length=635' Tc=20.2 min CN=63 Runoff=3.21 cfs 0.350 af |
| SubcatchmentS2a: TO YD | Runoff Area=73,505 sf 45.64% Impervious Runoff Depth=2.93" Flow Length=602' Tc=22.2 min CN=67 Runoff=3.70 cfs 0.412 af |
| SubcatchmentS2b: TO CB | Runoff Area=8,477 sf 78.41% Impervious Runoff Depth=5.35" Flow Length=188' Slope=0.0255 '/' Tc=1.7 min CN=90 Runoff=1.35 cfs 0.087 af |
| SubcatchmentS2c: TO CDS UNIT | Runoff Area=17,487 sf 65.61% Impervious Runoff Depth=4.79" Flow Length=228' Slope=0.0255 '/' Tc=1.9 min CN=85 Runoff=2.55 cfs 0.160 af |
| SubcatchmentS3: TO BASIN | Runoff Area=136,043 sf 76.91% Impervious Runoff Depth=5.24" Flow Length=382' Tc=3.8 min CN=89 Runoff=19.82 cfs 1.364 af |
| Pond BAS1: BASIN | Peak Elev=154.81' Storage=26,968 cf Inflow=19.82 cfs 1.364 af Discarded=0.59 cfs 0.818 af Primary=3.91 cfs 0.553 af Outflow=4.50 cfs 1.371 af |
| Pond CB: CB | Peak Elev=153.99' Inflow=4.07 cfs 0.499 af 15.0" Round Culvert n=0.012 L=31.0' S=0.0065 '/' Outflow=4.07 cfs 0.499 af |
| Pond CDS: CDS UNIT | Peak Elev=153.59' Inflow=5.11 cfs 0.659 af 15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=5.11 cfs 0.659 af |
| Pond DMH: DMH | Peak Elev=152.87' Inflow=8.57 cfs 1.212 af 24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=8.57 cfs 1.212 af |
| Pond DP: DP-EX | Inflow=13.54 cfs 1.714 af Primary=13.54 cfs 1.714 af |
| Pond DP.: DP-PR | Inflow=11.70 cfs 1.561 af Primary=11.70 cfs 1.561 af |
| Pond YD: Yard Drain | Peak Elev=154.48' Inflow=3.70 cfs 0.412 af 15.0" Round Culvert n=0.012 L=56.0' S=0.0179 '/' Outflow=3.70 cfs 0.412 af |

Summary for Subcatchment E1: DIRECT

Runoff = 9.90 cfs @ 12.27 hrs, Volume= 1.067 af, Depth= 2.27"

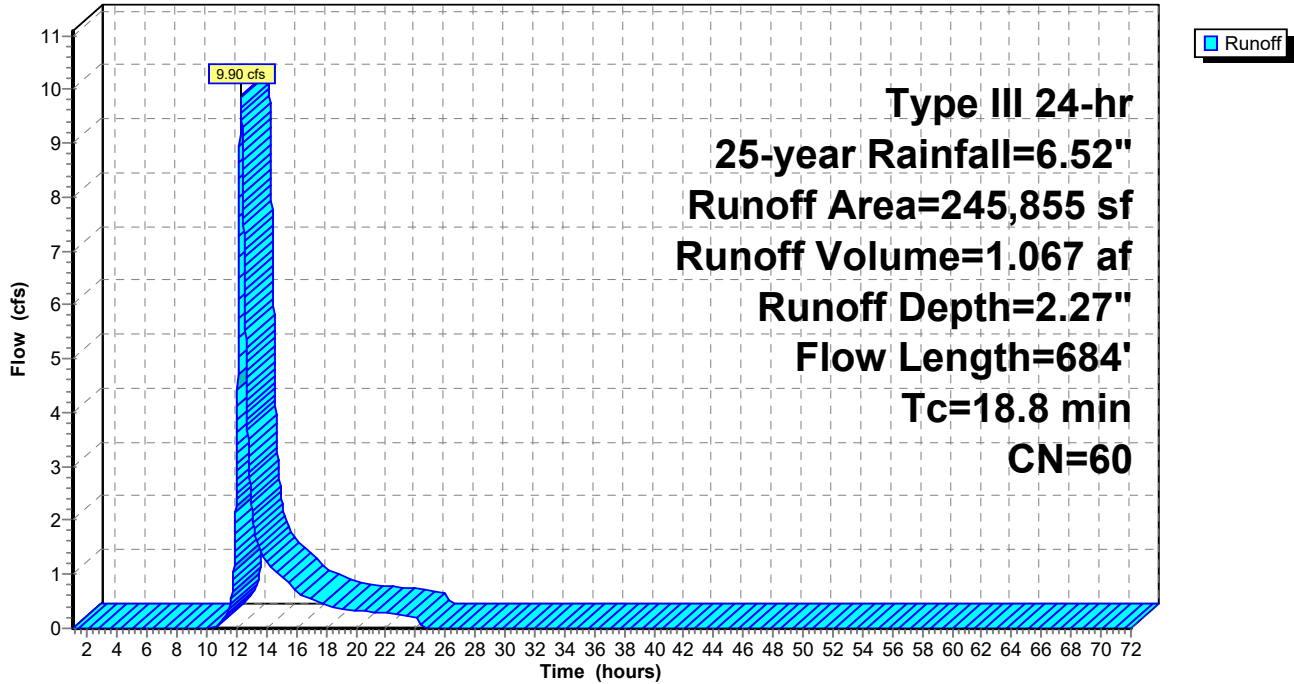
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 118,874 | 61 | >75% Grass cover, Good, HSG B |
| 9,139 | 55 | Woods, Good, HSG B |
| 44,246 | 98 | Paved parking, HSG B |
| 31,283 | 39 | >75% Grass cover, Good, HSG A |
| 39,145 | 30 | Woods, Good, HSG A |
| 3,168 | 98 | Paved parking, HSG A |
| 245,855 | 60 | Weighted Average |
| 198,441 | | 80.71% Pervious Area |
| 47,414 | | 19.29% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 2.6 | 135 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 1.6 | 114 | 0.0281 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.2 | 265 | 0.0045 | 1.36 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.2 | 20 | 0.0400 | 1.40 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 18.8 | 684 | Total | | | |

Subcatchment E1: DIRECT

Hydrograph



Summary for Subcatchment E2: TO PIPE

Runoff = 9.02 cfs @ 12.06 hrs, Volume= 0.646 af, Depth= 5.47"

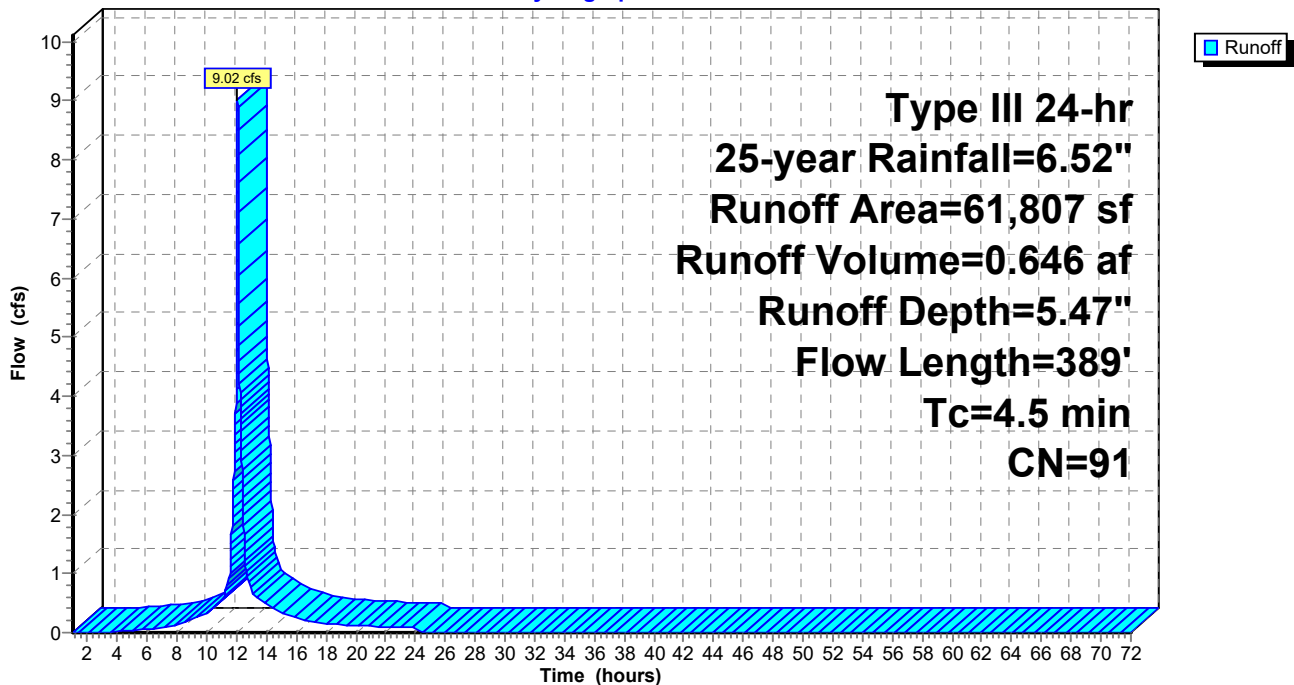
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 11,246 | 61 | >75% Grass cover, Good, HSG B |
| 50,561 | 98 | Paved parking, HSG B |
| 61,807 | 91 | Weighted Average |
| 11,246 | | 18.20% Pervious Area |
| 50,561 | | 81.80% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.2 | 10 | 0.0348 | 0.13 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 1.4 | 140 | 0.0296 | 1.72 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.6 | 215 | 0.0122 | 2.24 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 24 | 0.0279 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 4.5 | 389 | Total | | | |

Subcatchment E2: TO PIPE

Hydrograph



Summary for Subcatchment S1: DIRECT

Runoff = 3.21 cfs @ 12.29 hrs, Volume= 0.350 af, Depth= 2.55"

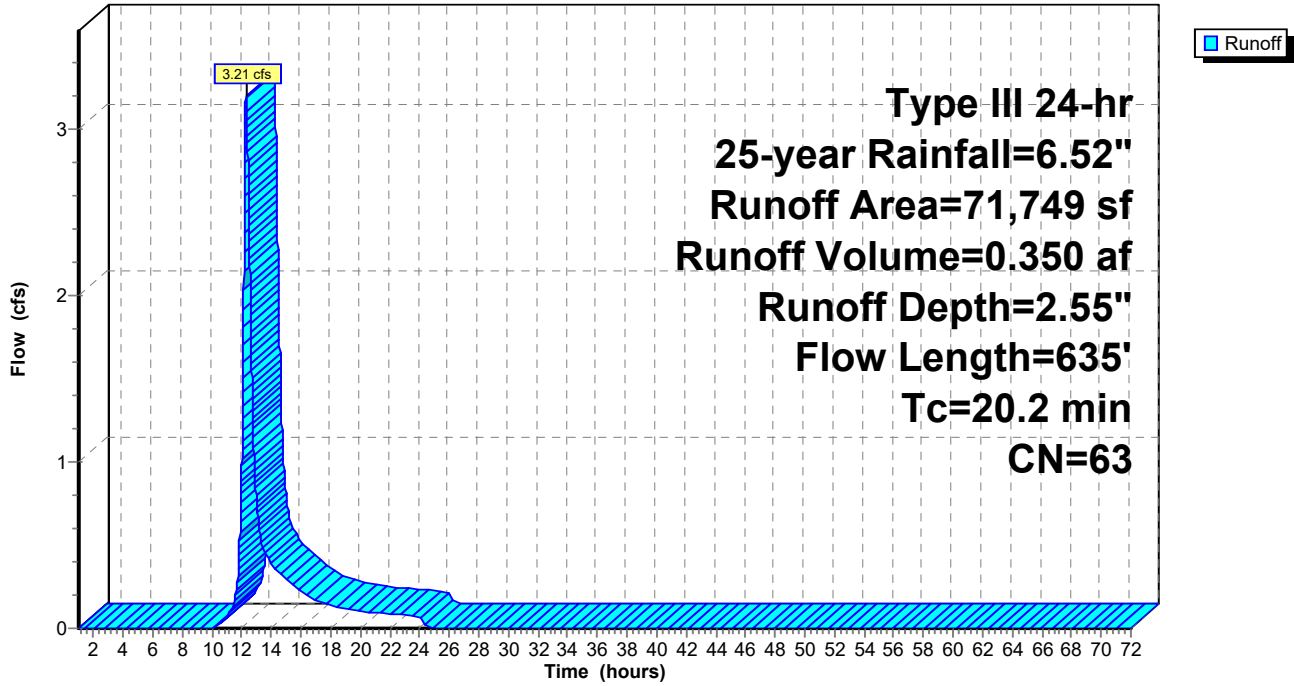
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 19,240 | 61 | >75% Grass cover, Good, HSG B |
| 4,239 | 55 | Woods, Good, HSG B |
| * 22,200 | 98 | Paved parking |
| 21,008 | 39 | >75% Grass cover, Good, HSG A |
| 5,062 | 30 | Woods, Good, HSG A |
| 71,749 | 63 | Weighted Average |
| 49,549 | | 69.06% Pervious Area |
| 22,200 | | 30.94% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.8 | 40 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 8.2 | 445 | 0.0169 | 0.91 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 20.2 | 635 | Total | | | |

Subcatchment S1: DIRECT

Hydrograph



Summary for Subcatchment S2a: TO YD

Runoff = 3.70 cfs @ 12.31 hrs, Volume= 0.412 af, Depth= 2.93"

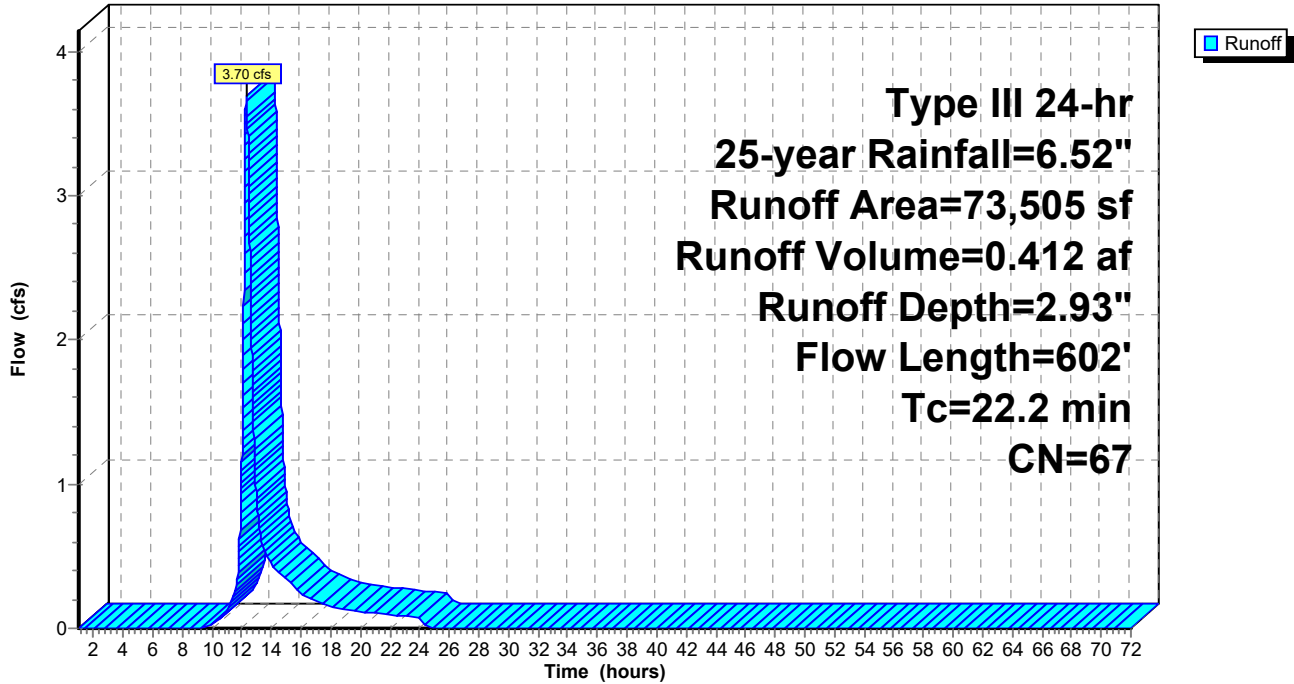
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 10,567 | 61 | >75% Grass cover, Good, HSG B |
| 30,587 | 98 | Paved parking, HSG B |
| 12,582 | 39 | >75% Grass cover, Good, HSG A |
| 16,809 | 30 | Woods, Good, HSG A |
| 2,960 | 98 | Paved parking, HSG A |
| 73,505 | 67 | Weighted Average |
| 39,958 | | 54.36% Pervious Area |
| 33,547 | | 45.64% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 9.2 | 121 | 0.0347 | 0.22 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 5.3 | 29 | 0.0552 | 0.09 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.3 | 96 | 0.0573 | 1.20 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 2.2 | 92 | 0.0100 | 0.70 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 0.5 | 74 | 0.0176 | 2.69 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 3.7 | 190 | 0.0150 | 0.86 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 22.2 | 602 | Total | | | |

Subcatchment S2a: TO YD

Hydrograph



Summary for Subcatchment S2b: TO CB

Runoff = 1.35 cfs @ 12.02 hrs, Volume= 0.087 af, Depth= 5.35"

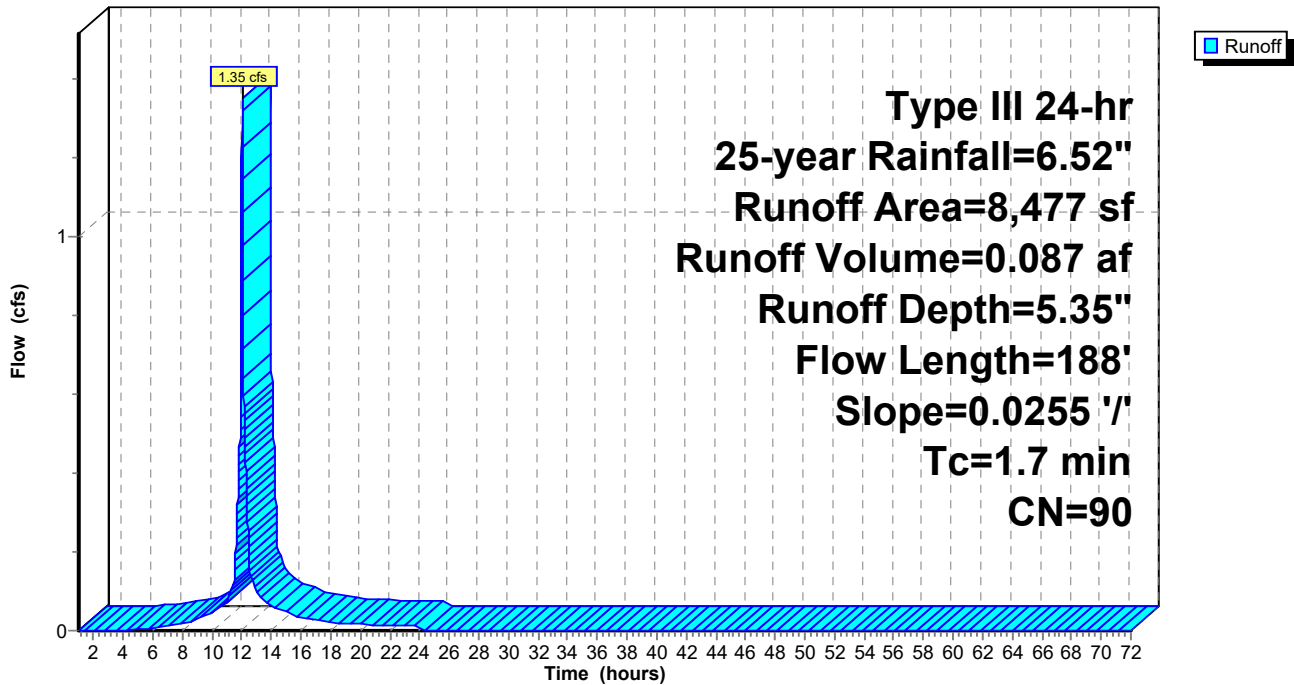
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 1,830 | 61 | >75% Grass cover, Good, HSG B |
| 6,647 | 98 | Paved parking, HSG B |
| 8,477 | 90 | Weighted Average |
| 1,830 | | 21.59% Pervious Area |
| 6,647 | | 78.41% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, GR Smooth surfaces n= 0.011 P2= 3.20" |
| 0.2 | 38 | 0.0255 | 3.24 | | Shallow Concentrated Flow, WOODS Paved Kv= 20.3 fps |
| 1.7 | 188 | Total | | | |

Subcatchment S2b: TO CB

Hydrograph



Summary for Subcatchment S2c: TO CDS UNIT

Runoff = 2.55 cfs @ 12.03 hrs, Volume= 0.160 af, Depth= 4.79"

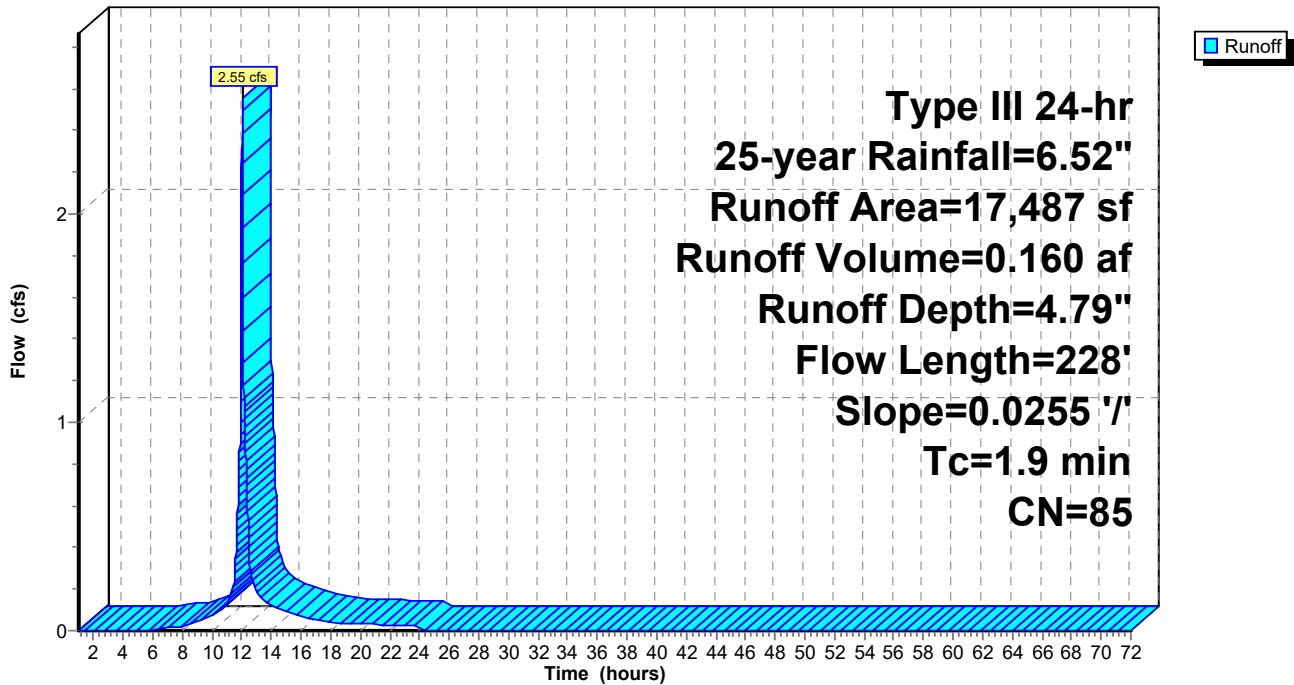
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 6,013 | 61 | >75% Grass cover, Good, HSG B |
| 11,474 | 98 | Paved parking, HSG B |
| 17,487 | 85 | Weighted Average |
| 6,013 | | 34.39% Pervious Area |
| 11,474 | | 65.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20" |
| 0.4 | 78 | 0.0255 | 3.24 | | Shallow Concentrated Flow, Paved Kv= 20.3 fps |
| 1.9 | 228 | Total | | | |

Subcatchment S2c: TO CDS UNIT

Hydrograph



Summary for Subcatchment S3: TO BASIN

Runoff = 19.82 cfs @ 12.05 hrs, Volume= 1.364 af, Depth= 5.24"

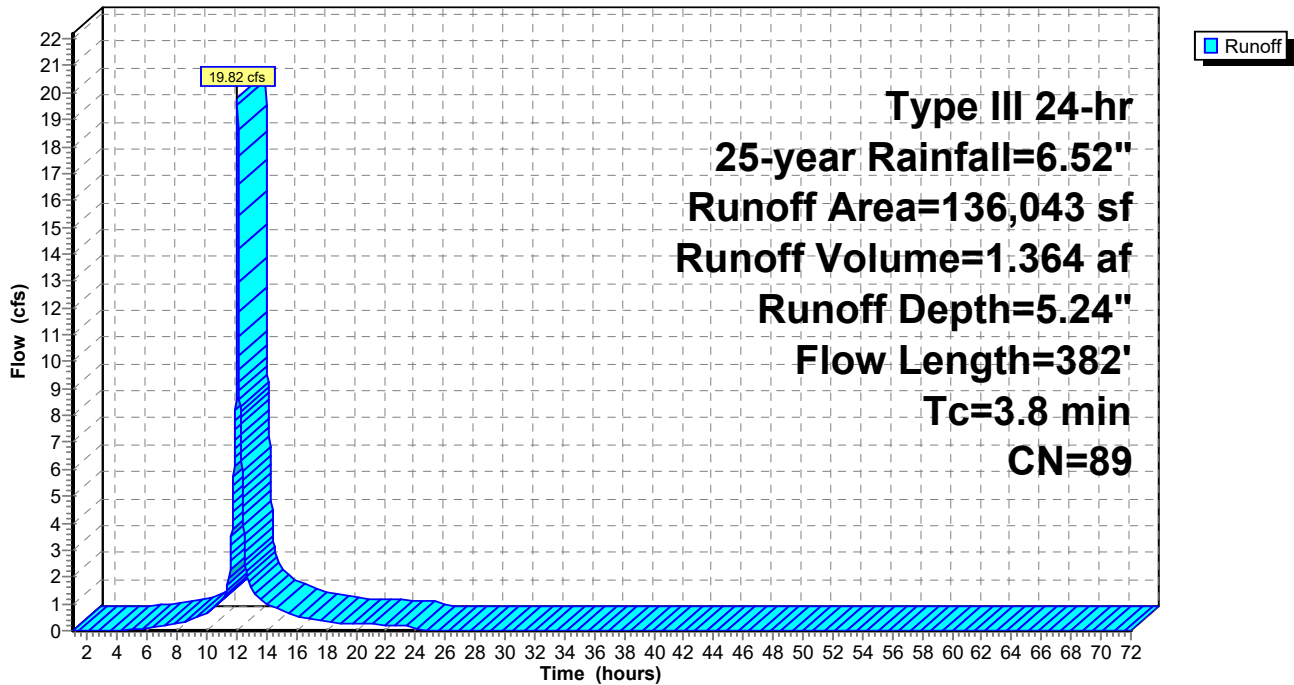
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.52"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 31,417 | 61 | >75% Grass cover, Good, HSG B |
| * 104,626 | 98 | Paved parking |
| 136,043 | 89 | Weighted Average |
| 31,417 | | 23.09% Pervious Area |
| 104,626 | | 76.91% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 2.1 | 150 | 0.0118 | 1.21 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.4 | 204 | 0.0134 | 2.35 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 28 | 0.0530 | 1.61 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 382 | Total | | | |

Subcatchment S3: TO BASIN

Hydrograph



Summary for Pond BAS1: BASIN

Inflow Area = 3.123 ac, 76.91% Impervious, Inflow Depth = 5.24" for 25-year event
 Inflow = 19.82 cfs @ 12.05 hrs, Volume= 1.364 af
 Outflow = 4.50 cfs @ 12.44 hrs, Volume= 1.371 af, Atten= 77%, Lag= 22.9 min
 Discarded = 0.59 cfs @ 12.44 hrs, Volume= 0.818 af
 Primary = 3.91 cfs @ 12.44 hrs, Volume= 0.553 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 154.81' @ 12.44 hrs Surf.Area= 13,806 sf Storage= 26,968 cf
 Flood Elev= 155.50' Surf.Area= 15,913 sf Storage= 37,171 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 275.0 min (1,058.4 - 783.4)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 152.00' | 47,572 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 152.00 | 5,458 | 0 | 0 |
| 153.00 | 8,348 | 6,903 | 6,903 |
| 153.75 | 10,586 | 7,100 | 14,003 |
| 154.00 | 11,338 | 2,741 | 16,744 |
| 155.00 | 14,373 | 12,856 | 29,599 |
| 155.50 | 15,913 | 7,572 | 37,171 |
| 156.00 | 25,691 | 10,401 | 47,572 |

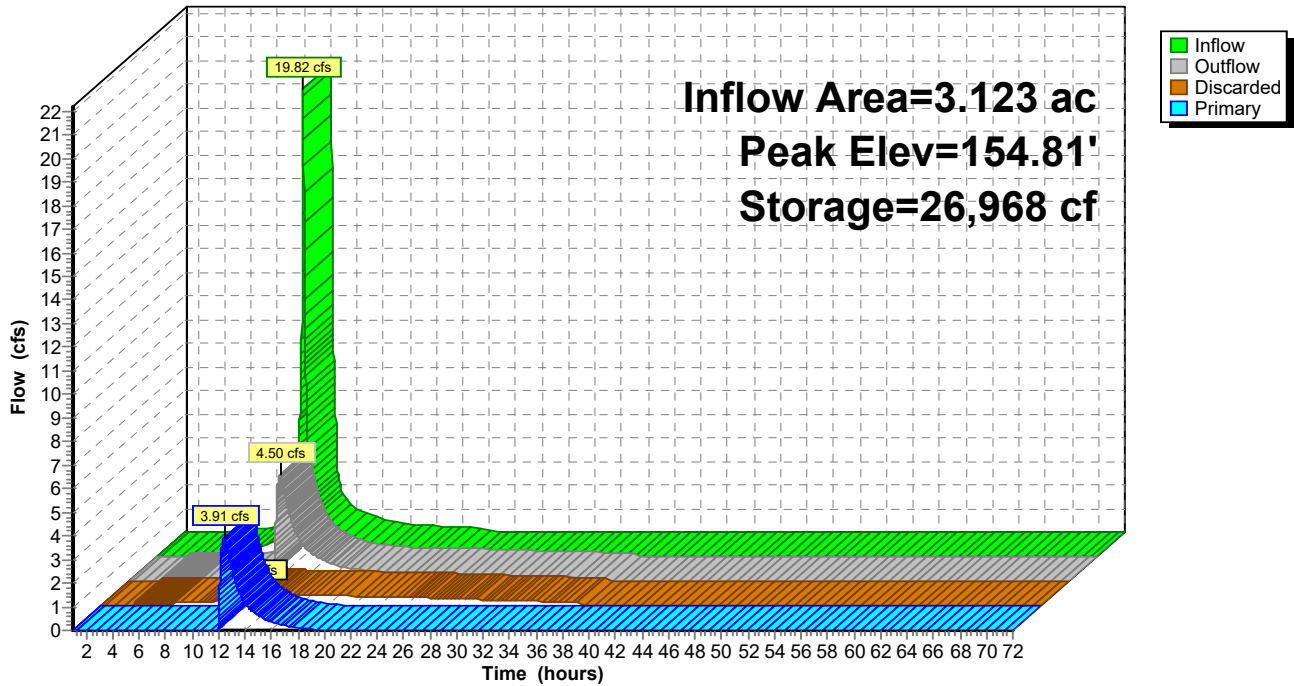
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 152.00' | 1.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 149.00' |
| #2 | Primary | 153.75' | 15.0" Round Culvert L= 14.0' Ke= 0.500 Inlet / Outlet Invert= 153.75' / 153.00' S= 0.0536 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |
| #3 | Primary | 155.50' | 40.0' long x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

Discarded OutFlow Max=0.59 cfs @ 12.44 hrs HW=154.81' (Free Discharge)
 ↑1=Exfiltration (Controls 0.59 cfs)

Primary OutFlow Max=3.91 cfs @ 12.44 hrs HW=154.81' TW=152.82' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 3.91 cfs @ 3.51 fps)
 ↑3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond BAS1: BASIN

Hydrograph



Summary for Pond CB: CB

Inflow Area = 1.882 ac, 49.03% Impervious, Inflow Depth = 3.18" for 25-year event
 Inflow = 4.07 cfs @ 12.32 hrs, Volume= 0.499 af
 Outflow = 4.07 cfs @ 12.33 hrs, Volume= 0.499 af, Atten= 0%, Lag= 0.6 min
 Primary = 4.07 cfs @ 12.33 hrs, Volume= 0.499 af

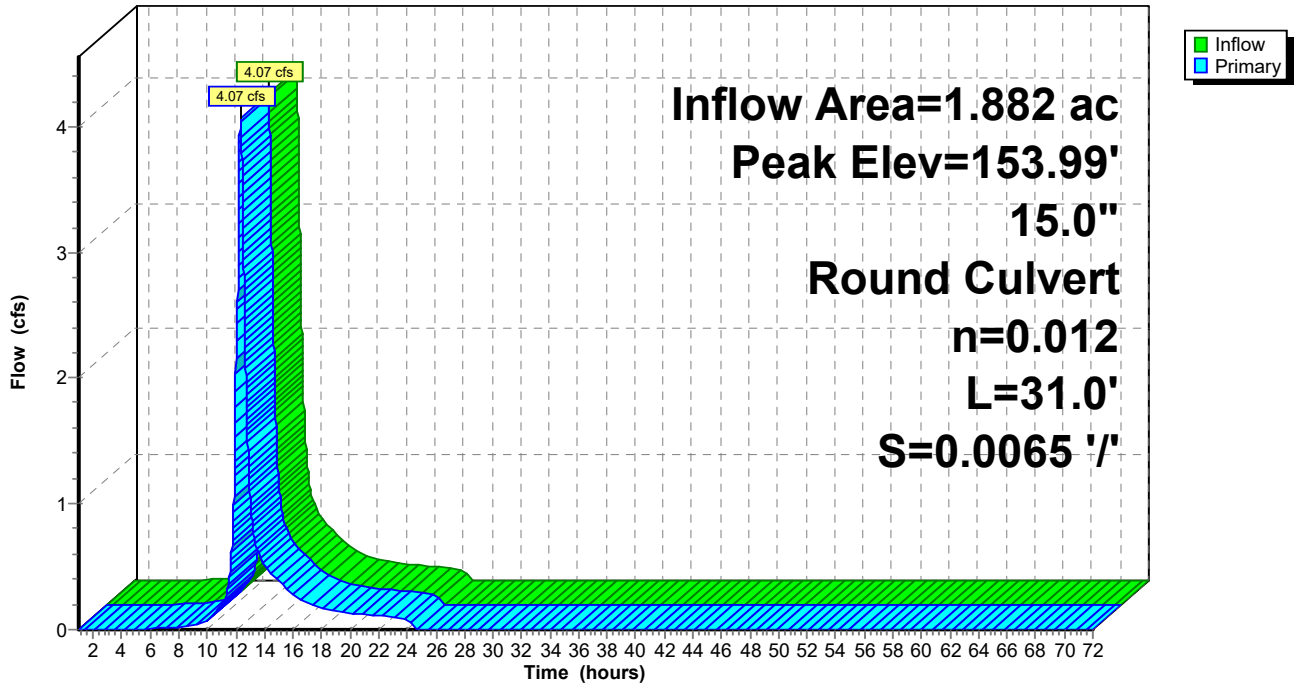
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.99' @ 12.33 hrs
 Flood Elev= 156.20'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 152.20' | 15.0" Round Culvert L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 152.20' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=4.06 cfs @ 12.33 hrs HW=153.99' TW=153.51' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 4.06 cfs @ 3.31 fps)

Pond CB: CB

Hydrograph



Summary for Pond CDS: CDS UNIT

Inflow Area = 2.283 ac, 51.94% Impervious, Inflow Depth = 3.46" for 25-year event
 Inflow = 5.11 cfs @ 12.03 hrs, Volume= 0.659 af
 Outflow = 5.11 cfs @ 12.04 hrs, Volume= 0.659 af, Atten= 0%, Lag= 0.6 min
 Primary = 5.11 cfs @ 12.04 hrs, Volume= 0.659 af

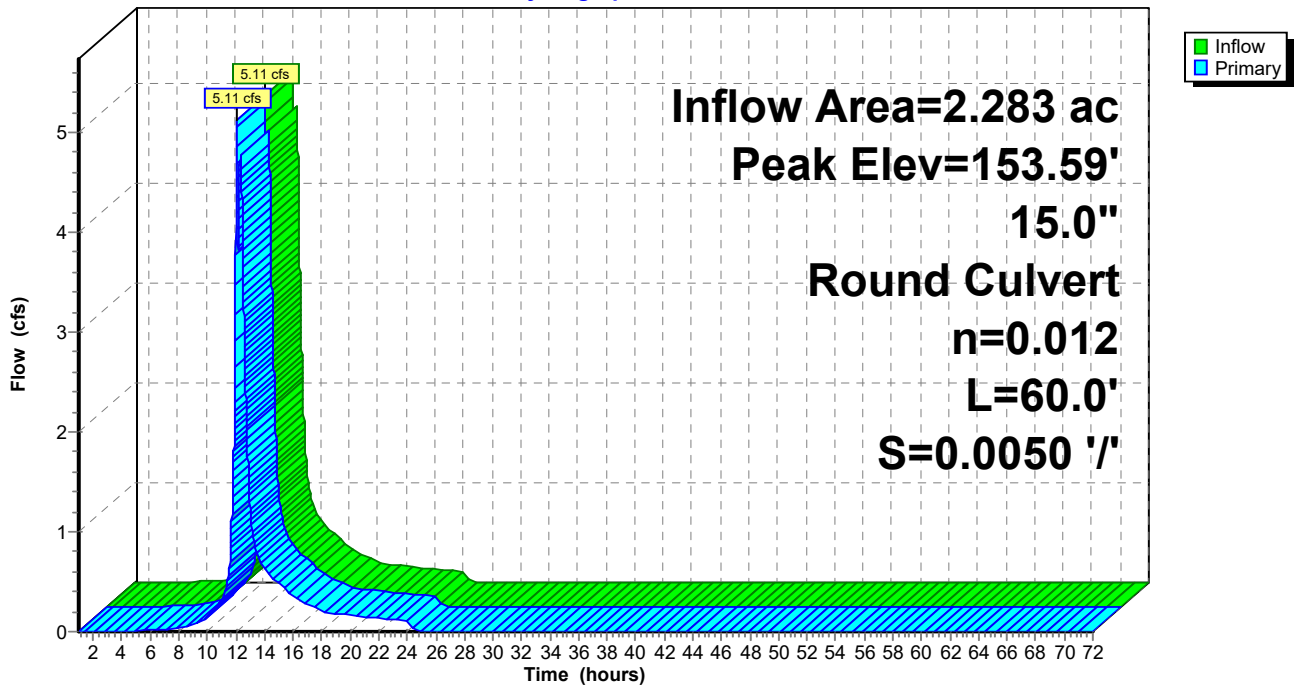
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.59' @ 12.04 hrs
 Flood Elev= 156.20'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 152.00' | 15.0" Round Culvert L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 152.00' / 151.70' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=5.09 cfs @ 12.04 hrs HW=153.58' TW=152.52' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 5.09 cfs @ 4.24 fps)

Pond CDS: CDS UNIT

Hydrograph



Summary for Pond DMH: DMH

Inflow Area = 5.407 ac, 66.36% Impervious, Inflow Depth = 2.69" for 25-year event
 Inflow = 8.57 cfs @ 12.34 hrs, Volume= 1.212 af
 Outflow = 8.57 cfs @ 12.35 hrs, Volume= 1.212 af, Atten= 0%, Lag= 0.6 min
 Primary = 8.57 cfs @ 12.35 hrs, Volume= 1.212 af

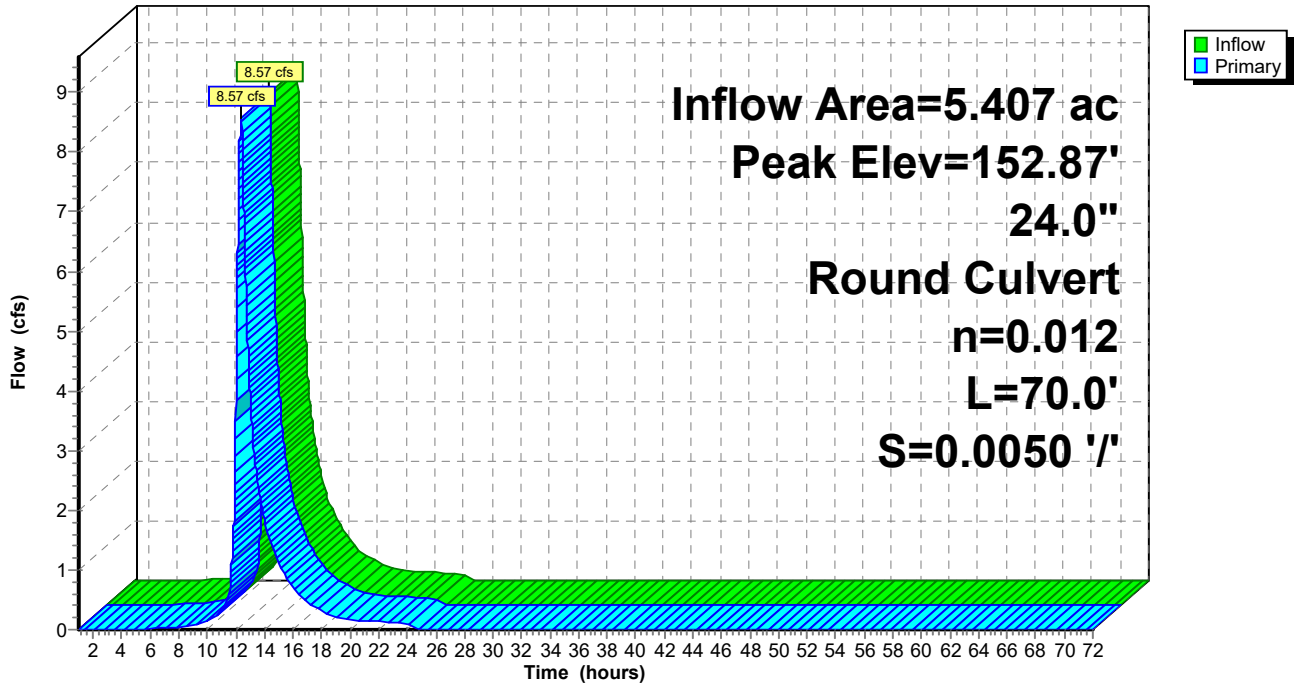
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 152.87' @ 12.35 hrs
 Flood Elev= 157.50'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|--|
| #1 | Primary | 151.35' | 24.0" Round Culvert L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf |

Primary OutFlow Max=8.57 cfs @ 12.35 hrs HW=152.87' TW=0.00' (Dynamic Tailwater)
 ←1=Culvert (Barrel Controls 8.57 cfs @ 4.65 fps)

Pond DMH: DMH

Hydrograph



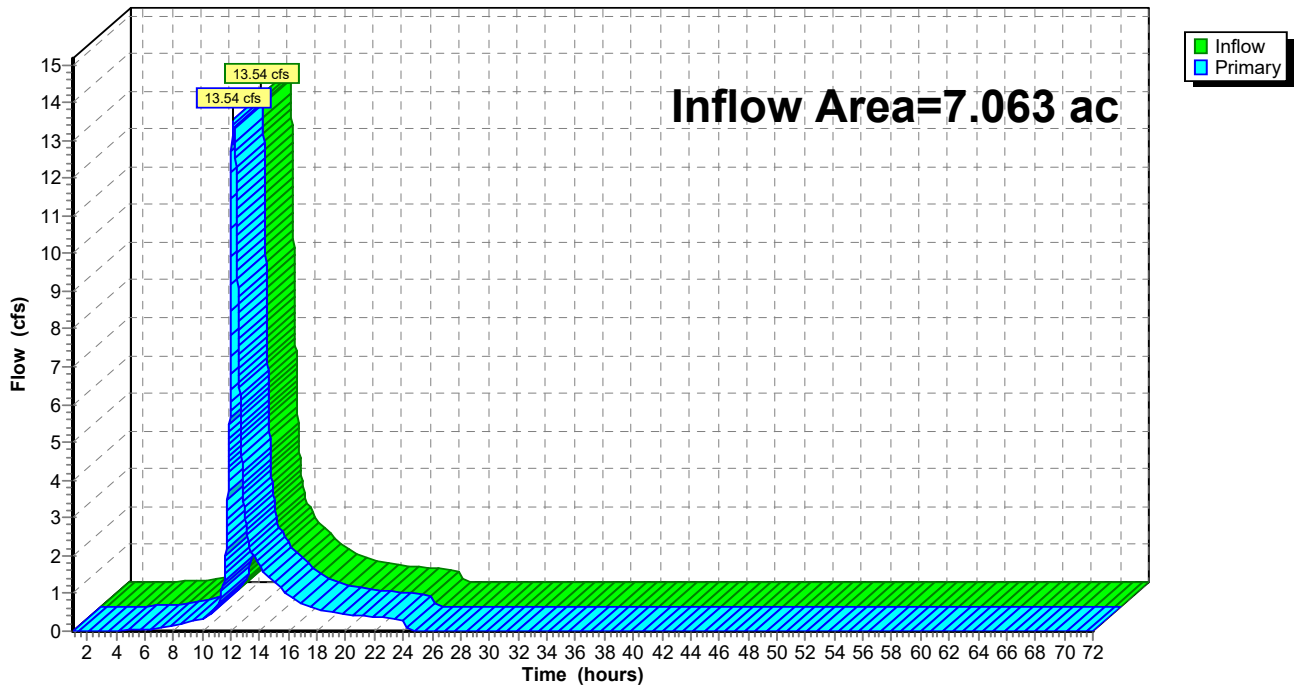
Summary for Pond DP: DP-EX

Inflow Area = 7.063 ac, 31.85% Impervious, Inflow Depth = 2.91" for 25-year event
Inflow = 13.54 cfs @ 12.09 hrs, Volume= 1.714 af
Primary = 13.54 cfs @ 12.10 hrs, Volume= 1.714 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP: DP-EX

Hydrograph



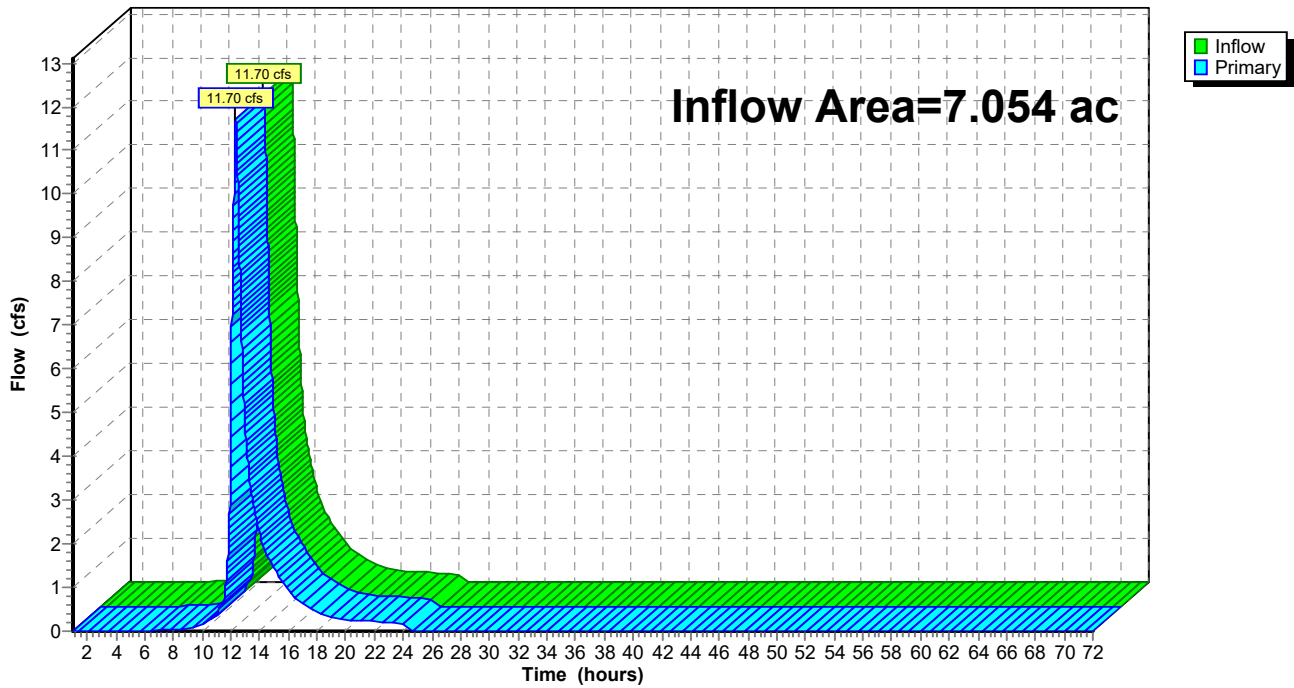
Summary for Pond DP.: DP-PR

Inflow Area = 7.054 ac, 58.09% Impervious, Inflow Depth = 2.66" for 25-year event
Inflow = 11.70 cfs @ 12.33 hrs, Volume= 1.561 af
Primary = 11.70 cfs @ 12.34 hrs, Volume= 1.561 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP.: DP-PR

Hydrograph



Summary for Pond YD: Yard Drain

Inflow Area = 1.687 ac, 45.64% Impervious, Inflow Depth = 2.93" for 25-year event
 Inflow = 3.70 cfs @ 12.31 hrs, Volume= 0.412 af
 Outflow = 3.70 cfs @ 12.32 hrs, Volume= 0.412 af, Atten= 0%, Lag= 0.6 min
 Primary = 3.70 cfs @ 12.32 hrs, Volume= 0.412 af

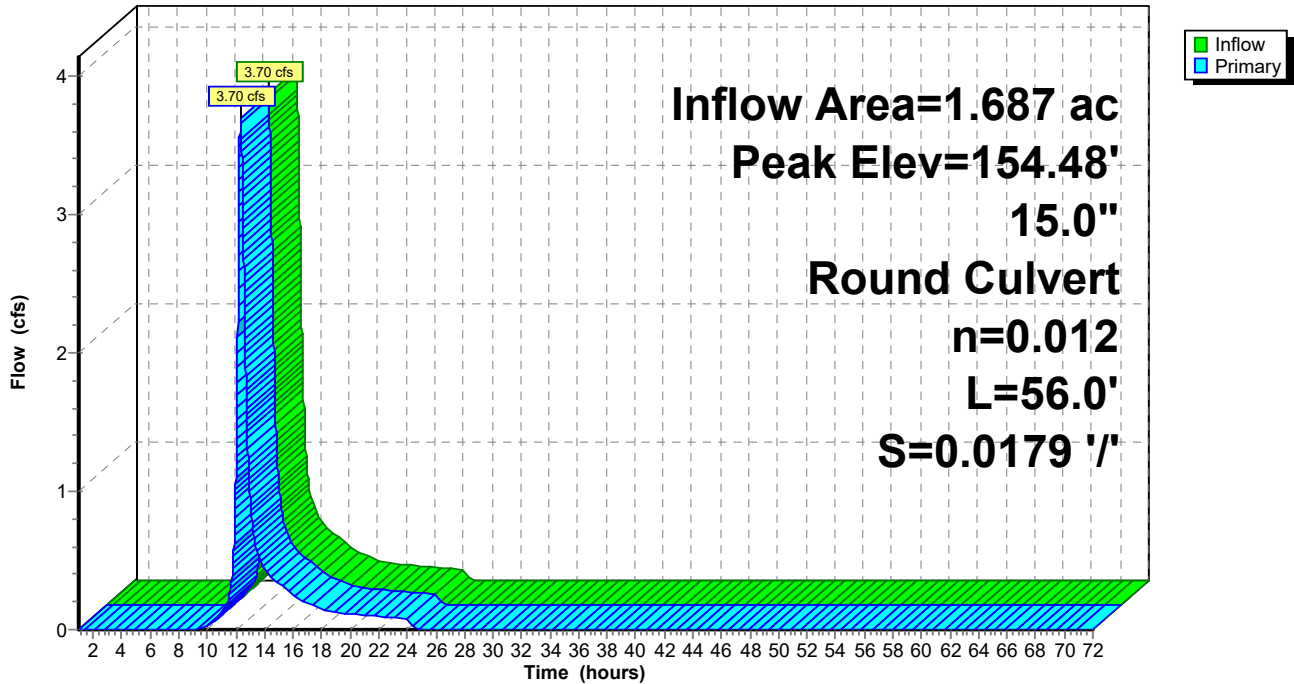
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 154.48' @ 12.34 hrs
 Flood Elev= 156.90'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 153.20' | 15.0" Round Culvert L= 56.0' Ke= 0.500 Inlet / Outlet Invert= 153.20' / 152.20' S= 0.0179 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=3.66 cfs @ 12.32 hrs HW=154.47' TW=153.98' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 3.66 cfs @ 3.64 fps)

Pond YD: Yard Drain

Hydrograph



Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

| | |
|-------------------------------------|--|
| SubcatchmentE1: DIRECT | Runoff Area=245,855 sf 19.29% Impervious Runoff Depth=3.67" Flow Length=684' Tc=18.8 min CN=60 Runoff=16.58 cfs 1.728 af |
| SubcatchmentE2: TO PIPE | Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=7.37" Flow Length=389' Tc=4.5 min CN=91 Runoff=11.95 cfs 0.871 af |
| SubcatchmentS1: DIRECT | Runoff Area=71,749 sf 30.94% Impervious Runoff Depth=4.03" Flow Length=635' Tc=20.2 min CN=63 Runoff=5.19 cfs 0.553 af |
| SubcatchmentS2a: TO YD | Runoff Area=73,505 sf 45.64% Impervious Runoff Depth=4.50" Flow Length=602' Tc=22.2 min CN=67 Runoff=5.75 cfs 0.632 af |
| SubcatchmentS2b: TO CB | Runoff Area=8,477 sf 78.41% Impervious Runoff Depth=7.25" Flow Length=188' Slope=0.0255 '/' Tc=1.7 min CN=90 Runoff=1.80 cfs 0.118 af |
| SubcatchmentS2c: TO CDS UNIT | Runoff Area=17,487 sf 65.61% Impervious Runoff Depth=6.65" Flow Length=228' Slope=0.0255 '/' Tc=1.9 min CN=85 Runoff=3.48 cfs 0.222 af |
| SubcatchmentS3: TO BASIN | Runoff Area=136,043 sf 76.91% Impervious Runoff Depth=7.13" Flow Length=382' Tc=3.8 min CN=89 Runoff=26.50 cfs 1.855 af |
| Pond BAS1: BASIN | Peak Elev=155.39' Storage=35,382 cf Inflow=26.50 cfs 1.855 af Discarded=0.70 cfs 0.902 af Primary=5.94 cfs 0.959 af Outflow=6.64 cfs 1.861 af |
| Pond CB: CB | Peak Elev=155.97' Inflow=6.23 cfs 0.750 af 15.0" Round Culvert n=0.012 L=31.0' S=0.0065 '/' Outflow=6.23 cfs 0.750 af |
| Pond CDS: CDS UNIT | Peak Elev=154.86' Inflow=7.33 cfs 0.972 af 15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=7.33 cfs 0.972 af |
| Pond DMH: DMH | Peak Elev=153.37' Inflow=13.10 cfs 1.931 af 24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=13.10 cfs 1.931 af |
| Pond DP: DP-EX | Inflow=21.25 cfs 2.600 af Primary=21.25 cfs 2.600 af |
| Pond DP.: DP-PR | Inflow=18.22 cfs 2.484 af Primary=18.22 cfs 2.484 af |
| Pond YD: Yard Drain | Peak Elev=156.91' Inflow=5.75 cfs 0.632 af 15.0" Round Culvert n=0.012 L=56.0' S=0.0179 '/' Outflow=5.75 cfs 0.632 af |

Summary for Subcatchment E1: DIRECT

Runoff = 16.58 cfs @ 12.26 hrs, Volume= 1.728 af, Depth= 3.67"

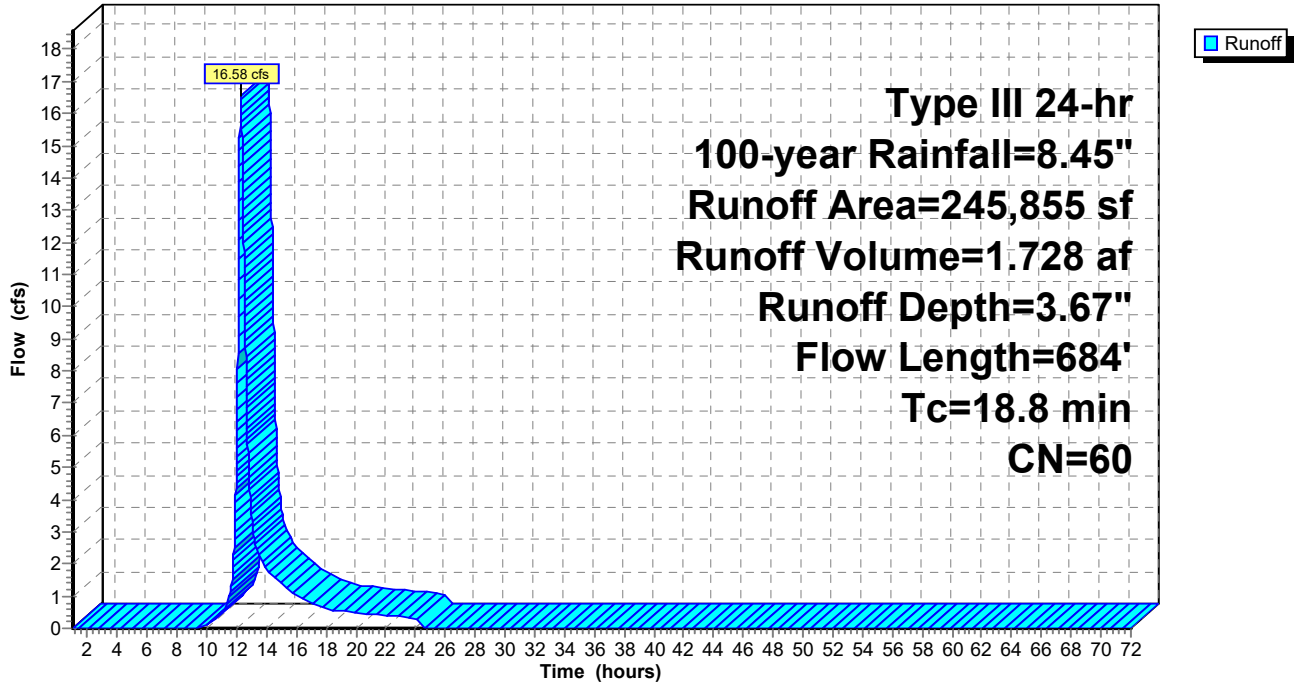
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 118,874 | 61 | >75% Grass cover, Good, HSG B |
| 9,139 | 55 | Woods, Good, HSG B |
| 44,246 | 98 | Paved parking, HSG B |
| 31,283 | 39 | >75% Grass cover, Good, HSG A |
| 39,145 | 30 | Woods, Good, HSG A |
| 3,168 | 98 | Paved parking, HSG A |
| 245,855 | 60 | Weighted Average |
| 198,441 | | 80.71% Pervious Area |
| 47,414 | | 19.29% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 2.6 | 135 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 1.6 | 114 | 0.0281 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.2 | 265 | 0.0045 | 1.36 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.2 | 20 | 0.0400 | 1.40 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 18.8 | 684 | Total | | | |

Subcatchment E1: DIRECT

Hydrograph



Summary for Subcatchment E2: TO PIPE

Runoff = 11.95 cfs @ 12.06 hrs, Volume= 0.871 af, Depth= 7.37"

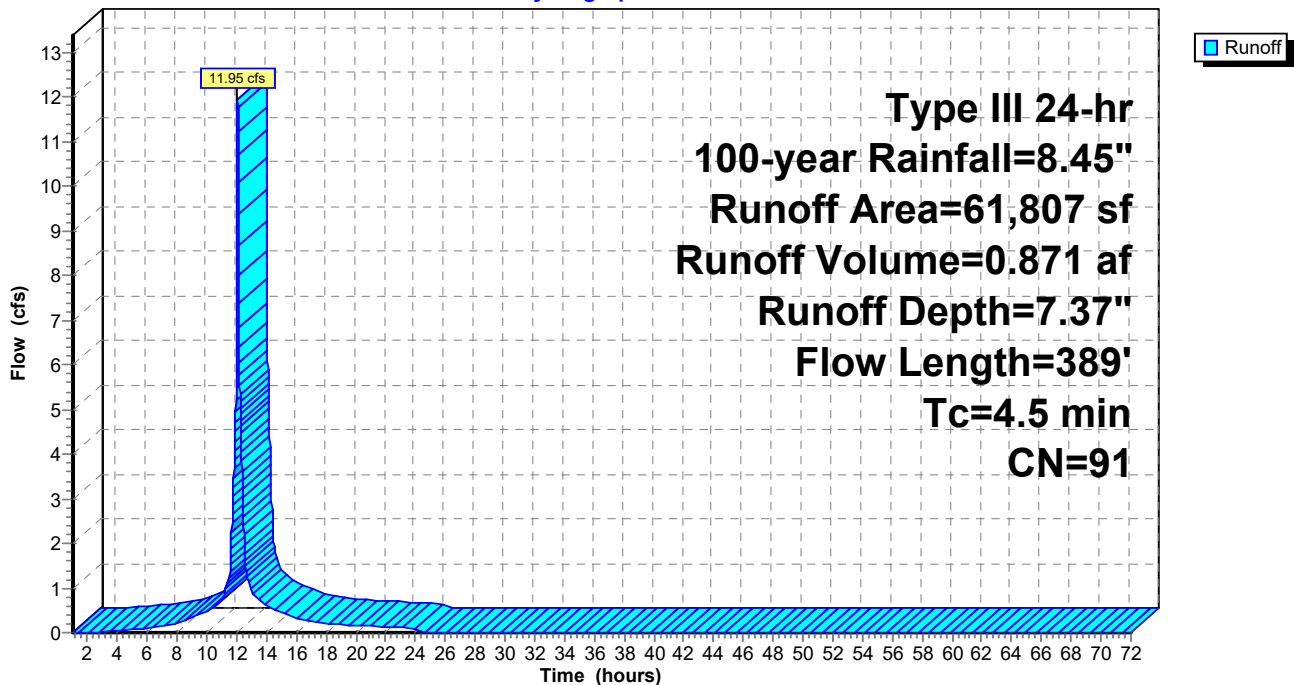
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 11,246 | 61 | >75% Grass cover, Good, HSG B |
| 50,561 | 98 | Paved parking, HSG B |
| 61,807 | 91 | Weighted Average |
| 11,246 | | 18.20% Pervious Area |
| 50,561 | | 81.80% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.2 | 10 | 0.0348 | 0.13 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 1.4 | 140 | 0.0296 | 1.72 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.6 | 215 | 0.0122 | 2.24 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 24 | 0.0279 | 1.17 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 4.5 | 389 | Total | | | |

Subcatchment E2: TO PIPE

Hydrograph



Summary for Subcatchment S1: DIRECT

Runoff = 5.19 cfs @ 12.28 hrs, Volume= 0.553 af, Depth= 4.03"

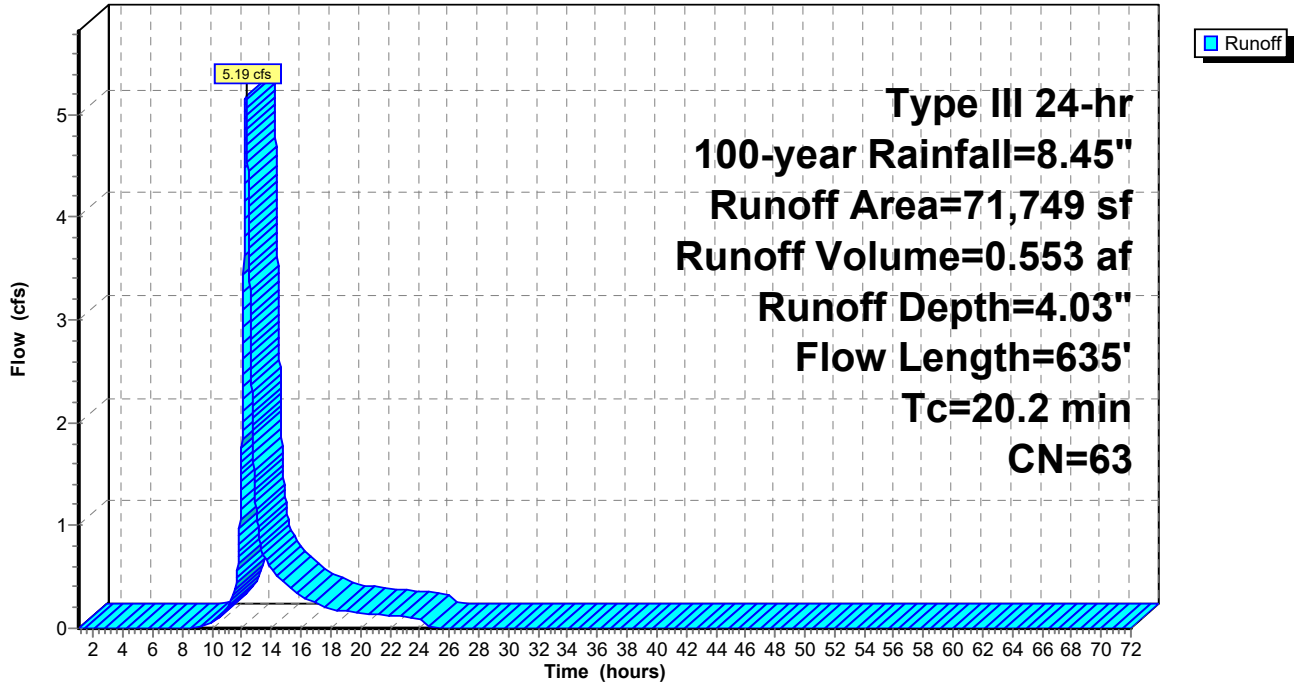
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 19,240 | 61 | >75% Grass cover, Good, HSG B |
| 4,239 | 55 | Woods, Good, HSG B |
| * 22,200 | 98 | Paved parking |
| 21,008 | 39 | >75% Grass cover, Good, HSG A |
| 5,062 | 30 | Woods, Good, HSG A |
| 71,749 | 63 | Weighted Average |
| 49,549 | | 69.06% Pervious Area |
| 22,200 | | 30.94% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.4 | 5 | 0.0433 | 0.06 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 7.4 | 135 | 0.0741 | 0.30 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 2.4 | 10 | 0.0455 | 0.07 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.8 | 40 | 0.0311 | 0.88 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 8.2 | 445 | 0.0169 | 0.91 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 20.2 | 635 | Total | | | |

Subcatchment S1: DIRECT

Hydrograph



Summary for Subcatchment S2a: TO YD

Runoff = 5.75 cfs @ 12.31 hrs, Volume= 0.632 af, Depth= 4.50"

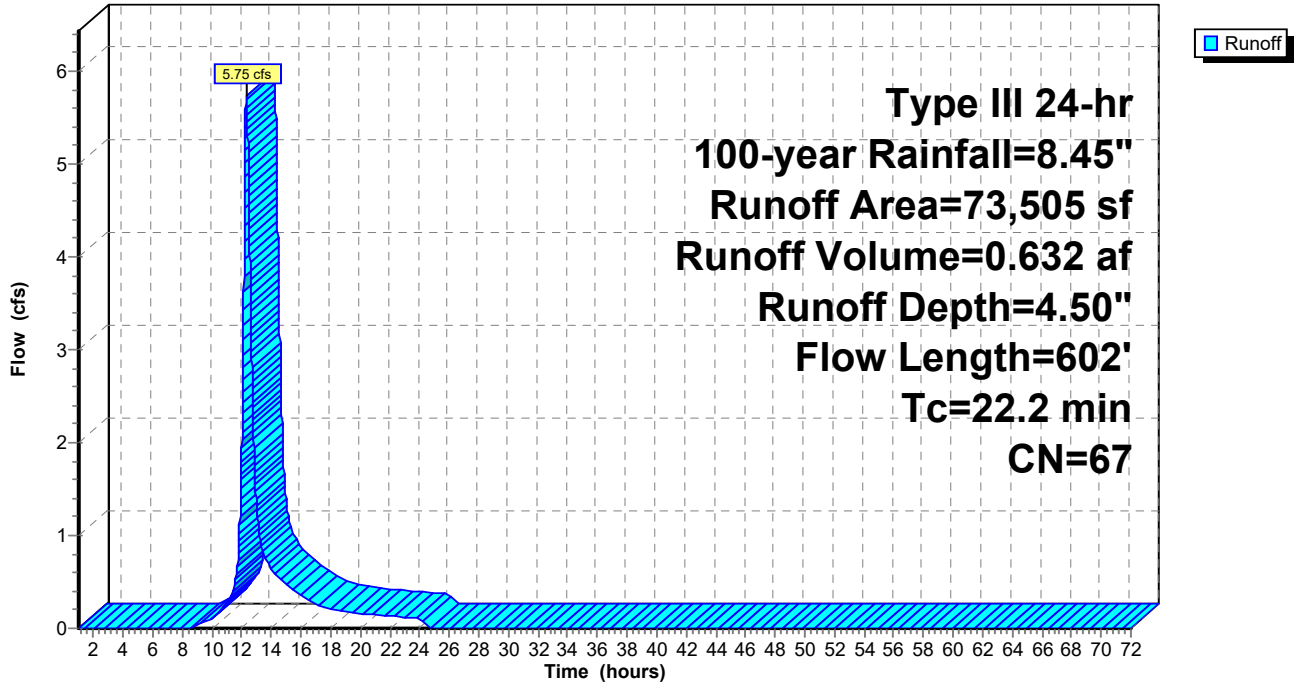
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 10,567 | 61 | >75% Grass cover, Good, HSG B |
| 30,587 | 98 | Paved parking, HSG B |
| 12,582 | 39 | >75% Grass cover, Good, HSG A |
| 16,809 | 30 | Woods, Good, HSG A |
| 2,960 | 98 | Paved parking, HSG A |
| 73,505 | 67 | Weighted Average |
| 39,958 | | 54.36% Pervious Area |
| 33,547 | | 45.64% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 9.2 | 121 | 0.0347 | 0.22 | | Sheet Flow, GR Grass: Short n= 0.150 P2= 3.20" |
| 5.3 | 29 | 0.0552 | 0.09 | | Sheet Flow, WOODS Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.3 | 96 | 0.0573 | 1.20 | | Shallow Concentrated Flow, WOODS Woodland Kv= 5.0 fps |
| 2.2 | 92 | 0.0100 | 0.70 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 0.5 | 74 | 0.0176 | 2.69 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 3.7 | 190 | 0.0150 | 0.86 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 22.2 | 602 | Total | | | |

Subcatchment S2a: TO YD

Hydrograph



Summary for Subcatchment S2b: TO CB

Runoff = 1.80 cfs @ 12.02 hrs, Volume= 0.118 af, Depth= 7.25"

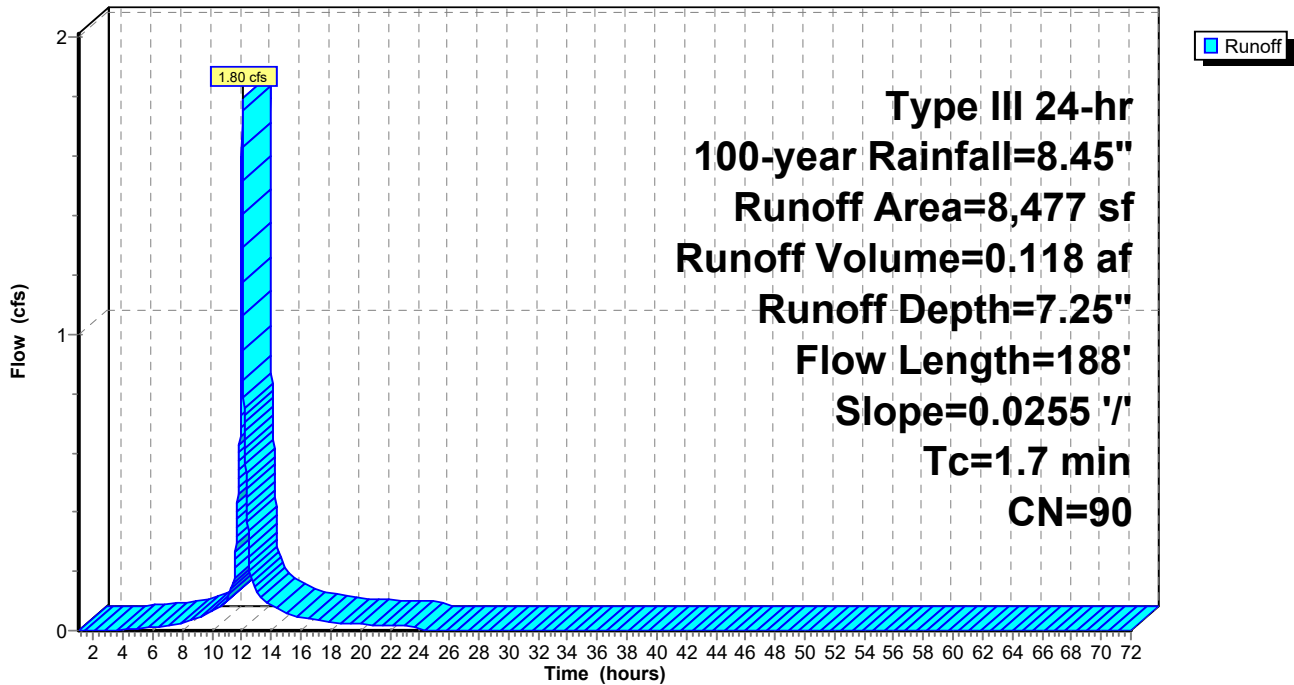
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 1,830 | 61 | >75% Grass cover, Good, HSG B |
| 6,647 | 98 | Paved parking, HSG B |
| 8,477 | 90 | Weighted Average |
| 1,830 | | 21.59% Pervious Area |
| 6,647 | | 78.41% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, GR Smooth surfaces n= 0.011 P2= 3.20" |
| 0.2 | 38 | 0.0255 | 3.24 | | Shallow Concentrated Flow, WOODS Paved Kv= 20.3 fps |
| 1.7 | 188 | Total | | | |

Subcatchment S2b: TO CB

Hydrograph



Summary for Subcatchment S2c: TO CDS UNIT

Runoff = 3.48 cfs @ 12.03 hrs, Volume= 0.222 af, Depth= 6.65"

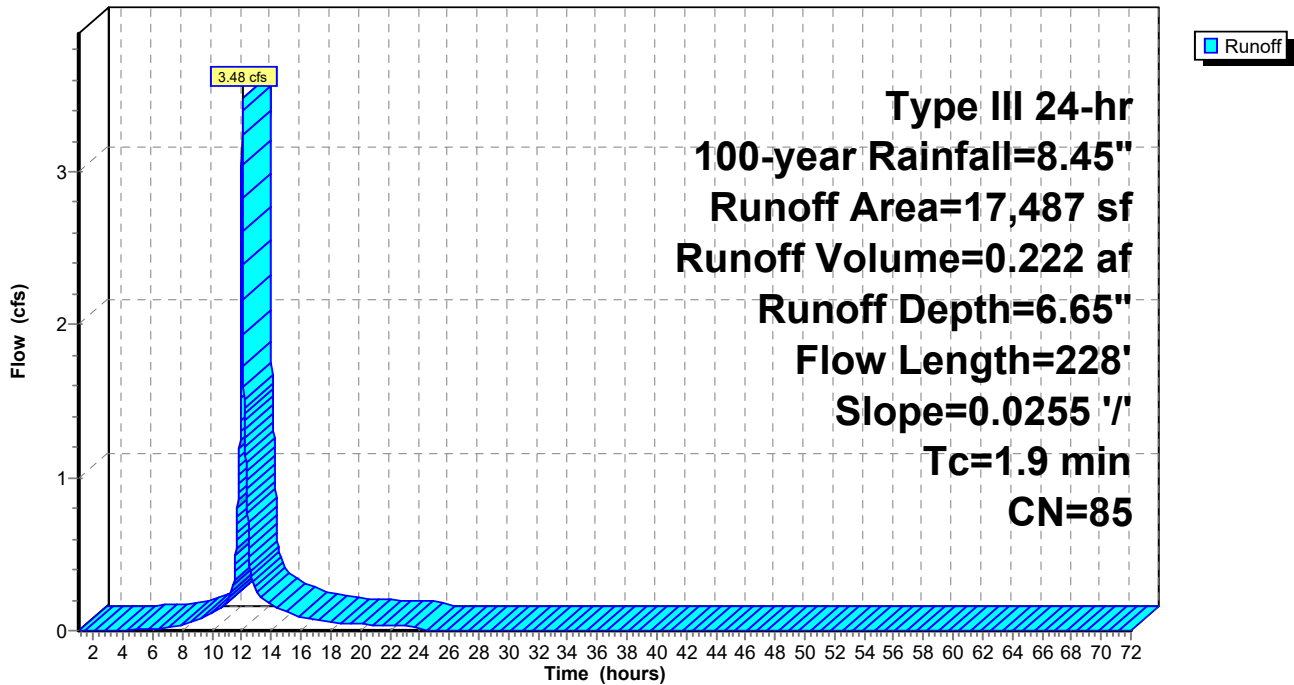
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 6,013 | 61 | >75% Grass cover, Good, HSG B |
| 11,474 | 98 | Paved parking, HSG B |
| 17,487 | 85 | Weighted Average |
| 6,013 | | 34.39% Pervious Area |
| 11,474 | | 65.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 1.5 | 150 | 0.0255 | 1.64 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20" |
| 0.4 | 78 | 0.0255 | 3.24 | | Shallow Concentrated Flow, Paved Kv= 20.3 fps |
| 1.9 | 228 | Total | | | |

Subcatchment S2c: TO CDS UNIT

Hydrograph



Summary for Subcatchment S3: TO BASIN

Runoff = 26.50 cfs @ 12.05 hrs, Volume= 1.855 af, Depth= 7.13"

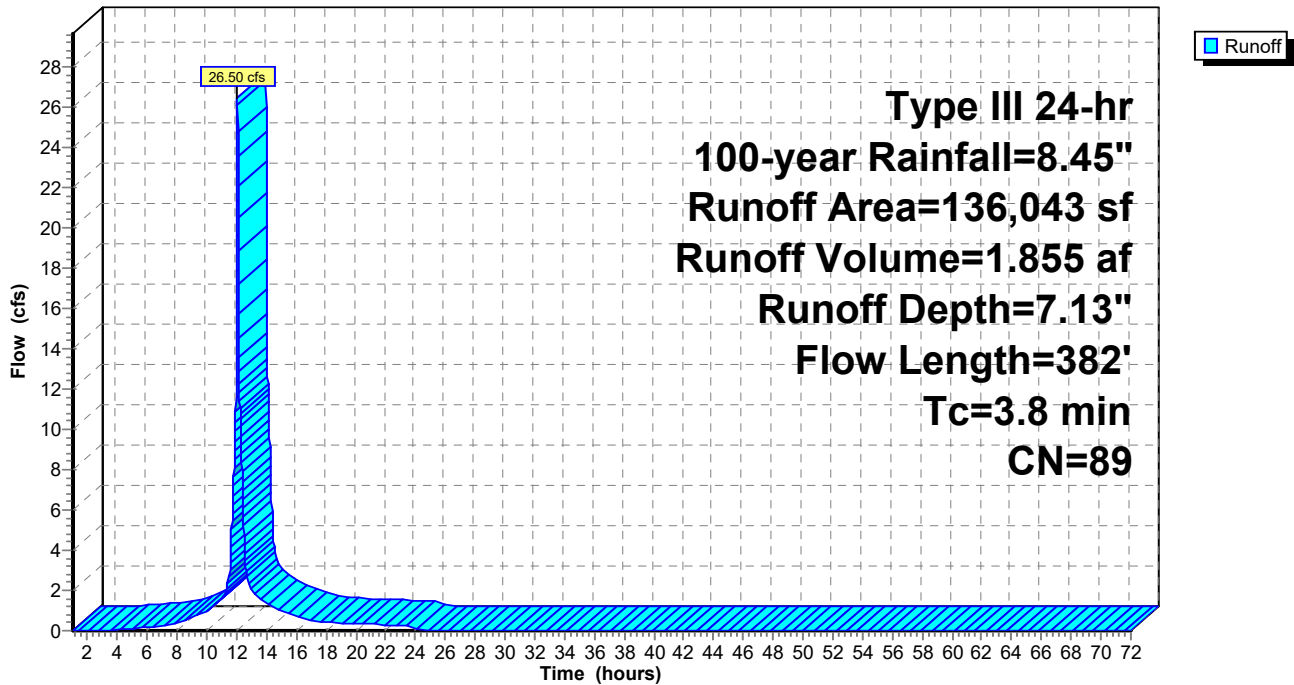
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.45"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 31,417 | 61 | >75% Grass cover, Good, HSG B |
| * 104,626 | 98 | Paved parking |
| 136,043 | 89 | Weighted Average |
| 31,417 | | 23.09% Pervious Area |
| 104,626 | | 76.91% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 2.1 | 150 | 0.0118 | 1.21 | | Sheet Flow, IM Smooth surfaces n= 0.011 P2= 3.20" |
| 1.4 | 204 | 0.0134 | 2.35 | | Shallow Concentrated Flow, IM Paved Kv= 20.3 fps |
| 0.3 | 28 | 0.0530 | 1.61 | | Shallow Concentrated Flow, GR Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 382 | Total | | | |

Subcatchment S3: TO BASIN

Hydrograph



Summary for Pond BAS1: BASIN

Inflow Area = 3.123 ac, 76.91% Impervious, Inflow Depth = 7.13" for 100-year event
 Inflow = 26.50 cfs @ 12.05 hrs, Volume= 1.855 af
 Outflow = 6.64 cfs @ 12.41 hrs, Volume= 1.861 af, Atten= 75%, Lag= 21.0 min
 Discarded = 0.70 cfs @ 12.41 hrs, Volume= 0.902 af
 Primary = 5.94 cfs @ 12.41 hrs, Volume= 0.959 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 155.39' @ 12.41 hrs Surf.Area= 15,563 sf Storage= 35,382 cf
 Flood Elev= 155.50' Surf.Area= 15,913 sf Storage= 37,171 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 235.1 min (1,010.5 - 775.4)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 152.00' | 47,572 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 152.00 | 5,458 | 0 | 0 |
| 153.00 | 8,348 | 6,903 | 6,903 |
| 153.75 | 10,586 | 7,100 | 14,003 |
| 154.00 | 11,338 | 2,741 | 16,744 |
| 155.00 | 14,373 | 12,856 | 29,599 |
| 155.50 | 15,913 | 7,572 | 37,171 |
| 156.00 | 25,691 | 10,401 | 47,572 |

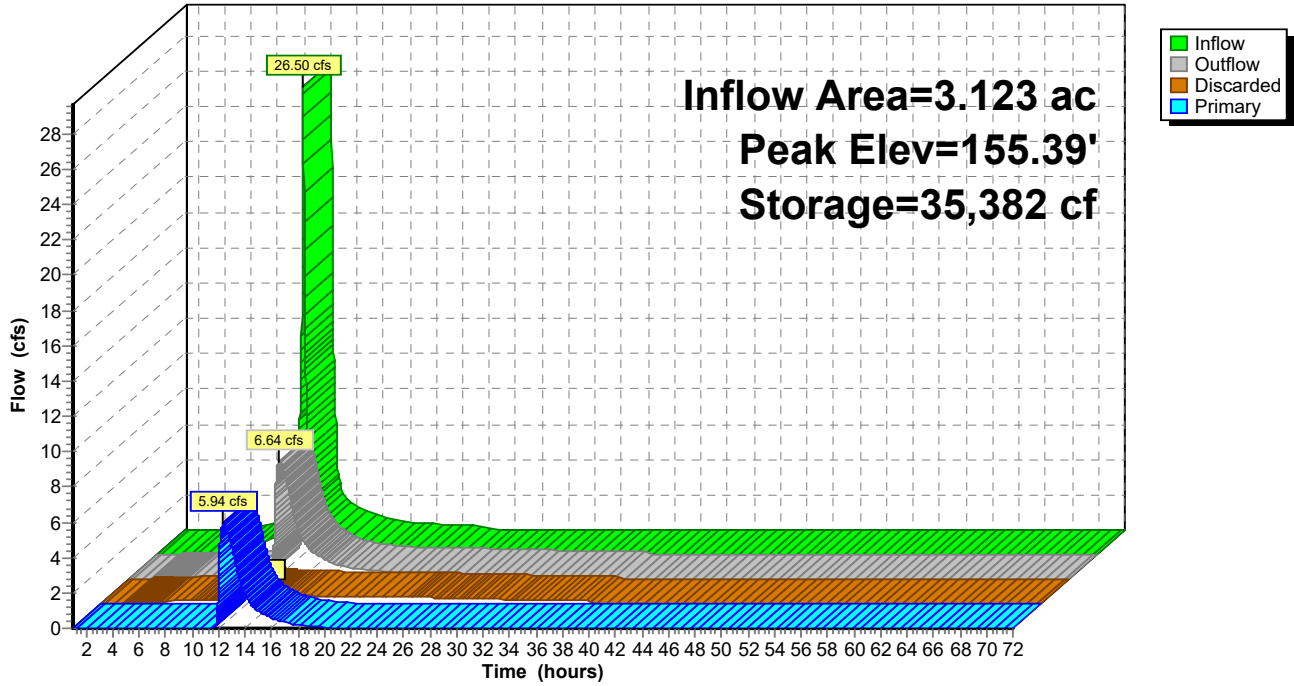
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 152.00' | 1.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 149.00' |
| #2 | Primary | 153.75' | 15.0" Round Culvert L= 14.0' Ke= 0.500 Inlet / Outlet Invert= 153.75' / 153.00' S= 0.0536 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |
| #3 | Primary | 155.50' | 40.0' long x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

Discarded OutFlow Max=0.70 cfs @ 12.41 hrs HW=155.39' (Free Discharge)
 ↑1=Exfiltration (Controls 0.70 cfs)

Primary OutFlow Max=5.94 cfs @ 12.41 hrs HW=155.39' TW=153.32' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 5.94 cfs @ 4.84 fps)
 ↑3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond BAS1: BASIN

Hydrograph



Summary for Pond CB: CB

Inflow Area = 1.882 ac, 49.03% Impervious, Inflow Depth = 4.78" for 100-year event
 Inflow = 6.23 cfs @ 12.32 hrs, Volume= 0.750 af
 Outflow = 6.23 cfs @ 12.33 hrs, Volume= 0.750 af, Atten= 0%, Lag= 0.6 min
 Primary = 6.23 cfs @ 12.33 hrs, Volume= 0.750 af

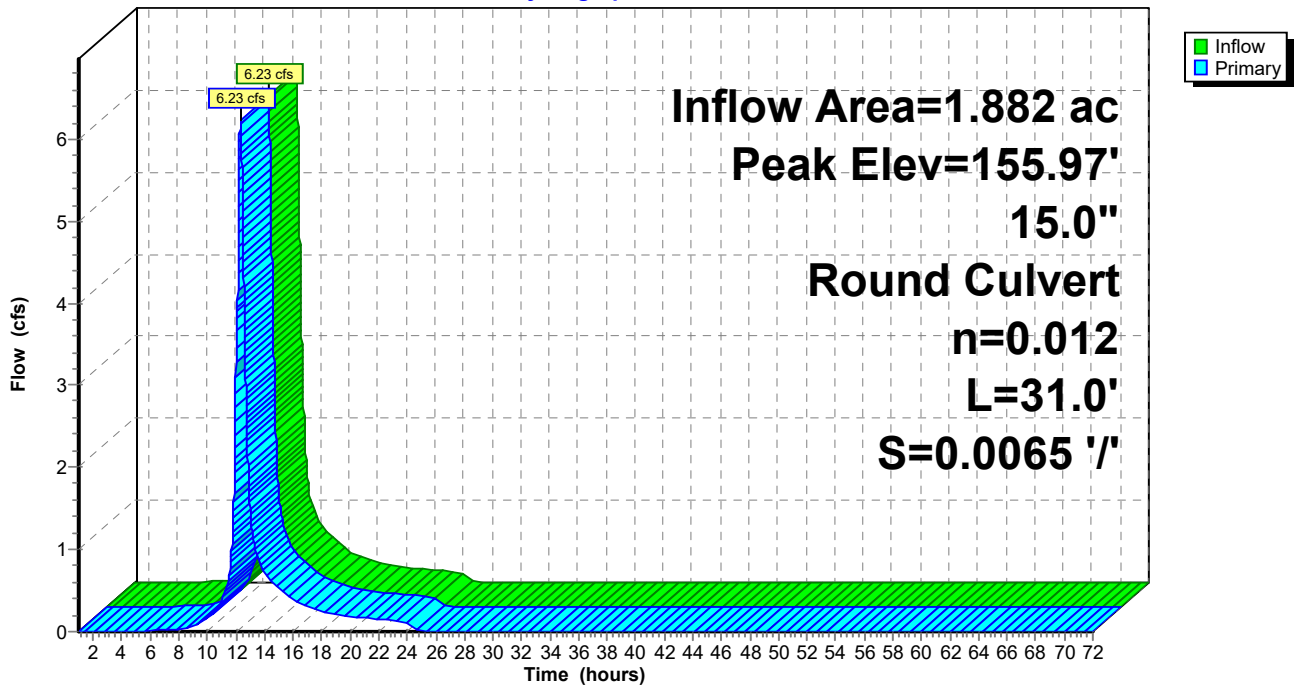
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 155.97' @ 12.32 hrs
 Flood Elev= 156.20'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 152.20' | 15.0" Round Culvert L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 152.20' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=6.24 cfs @ 12.33 hrs HW=155.97' TW=154.85' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 6.24 cfs @ 5.08 fps)

Pond CB: CB

Hydrograph



Summary for Pond CDS: CDS UNIT

Inflow Area = 2.283 ac, 51.94% Impervious, Inflow Depth = 5.11" for 100-year event
 Inflow = 7.33 cfs @ 12.03 hrs, Volume= 0.972 af
 Outflow = 7.33 cfs @ 12.04 hrs, Volume= 0.972 af, Atten= 0%, Lag= 0.6 min
 Primary = 7.33 cfs @ 12.04 hrs, Volume= 0.972 af

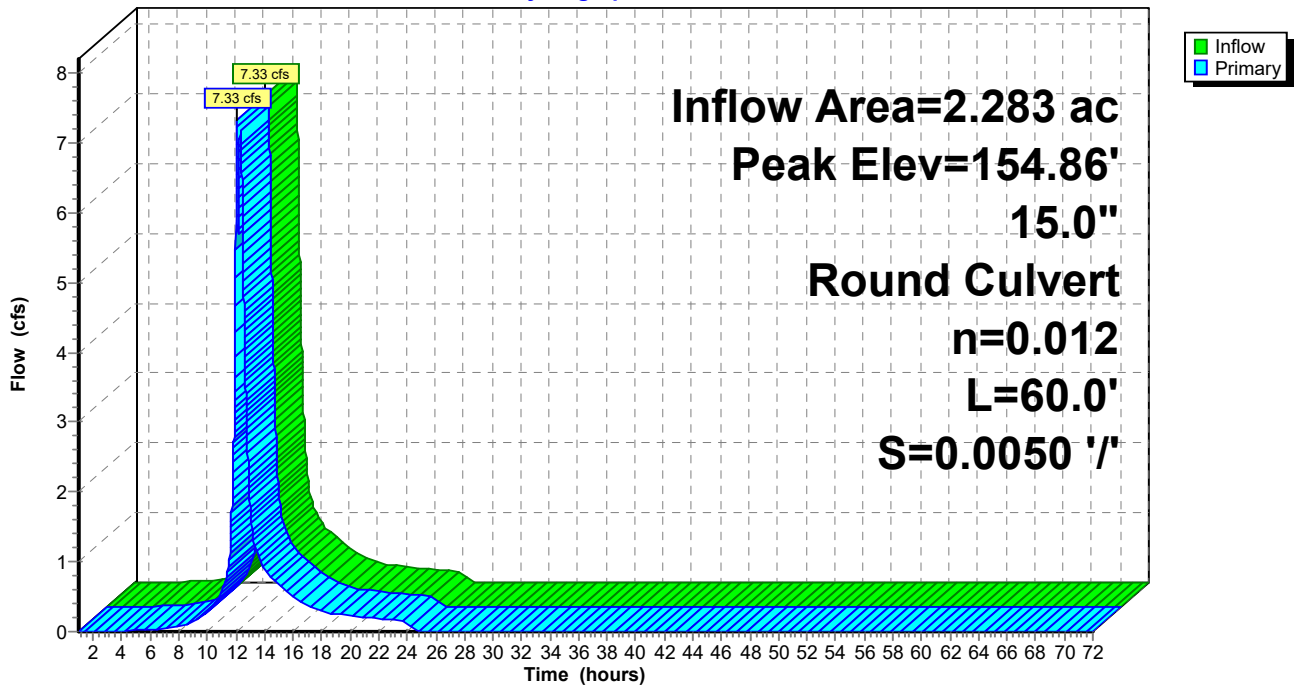
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 154.86' @ 12.31 hrs
 Flood Elev= 156.20'

| Device #1 | Routing | Invert | Outlet Devices |
|-----------|---------|---------|--|
| | Primary | 152.00' | 15.0" Round Culvert L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 152.00' / 151.70' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=7.15 cfs @ 12.04 hrs HW=154.53' TW=153.06' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 7.15 cfs @ 5.82 fps)

Pond CDS: CDS UNIT

Hydrograph



Summary for Pond DMH: DMH

Inflow Area = 5.407 ac, 66.36% Impervious, Inflow Depth = 4.29" for 100-year event
 Inflow = 13.10 cfs @ 12.32 hrs, Volume= 1.931 af
 Outflow = 13.10 cfs @ 12.33 hrs, Volume= 1.931 af, Atten= 0%, Lag= 0.6 min
 Primary = 13.10 cfs @ 12.33 hrs, Volume= 1.931 af

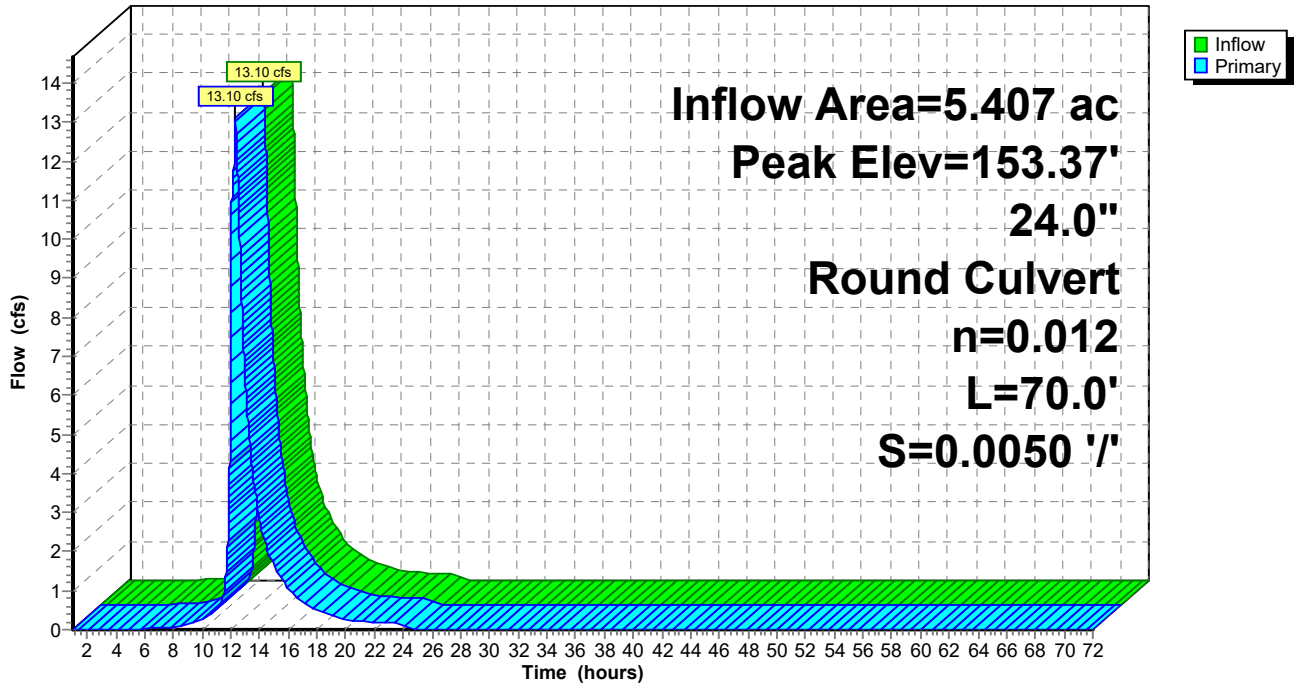
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.37' @ 12.33 hrs
 Flood Elev= 157.50'

| Device # | Routing | Invert | Outlet Devices |
|----------|---------|---------|--|
| #1 | Primary | 151.35' | 24.0" Round Culvert L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf |

Primary OutFlow Max=13.10 cfs @ 12.33 hrs HW=153.37' TW=0.00' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 13.10 cfs @ 5.14 fps)

Pond DMH: DMH

Hydrograph



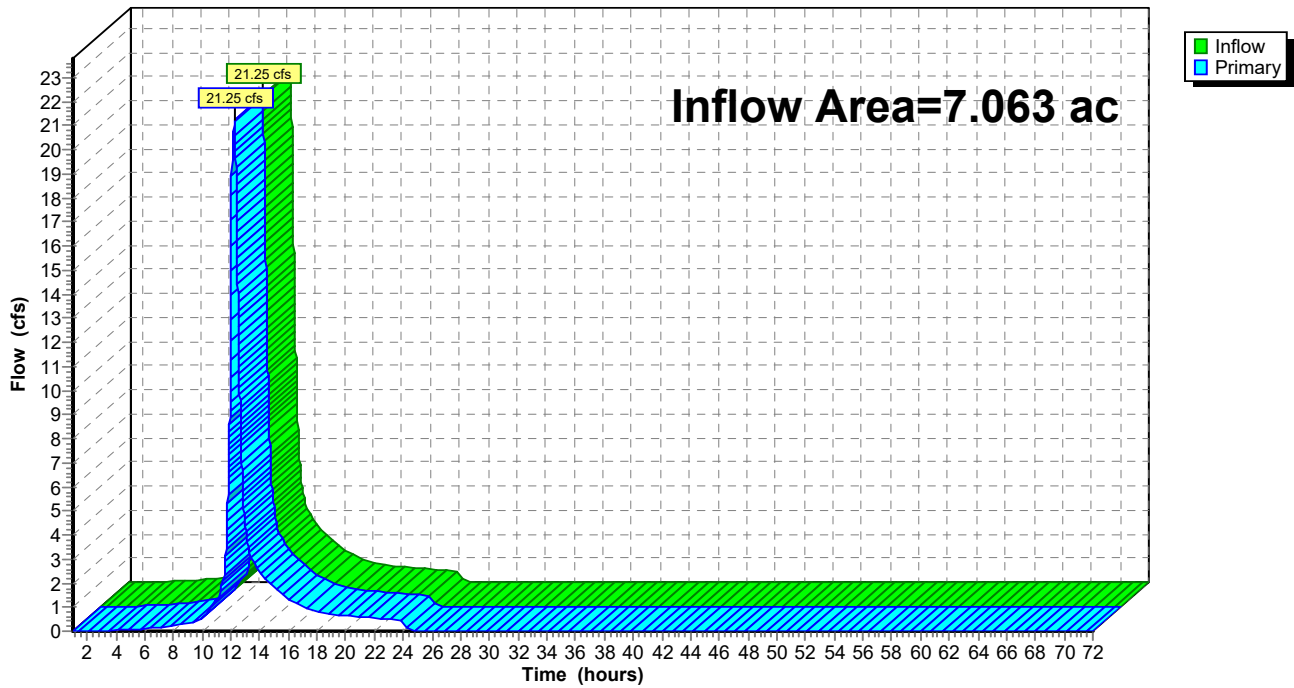
Summary for Pond DP: DP-EX

Inflow Area = 7.063 ac, 31.85% Impervious, Inflow Depth = 4.42" for 100-year event
Inflow = 21.25 cfs @ 12.24 hrs, Volume= 2.600 af
Primary = 21.25 cfs @ 12.25 hrs, Volume= 2.600 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP: DP-EX

Hydrograph



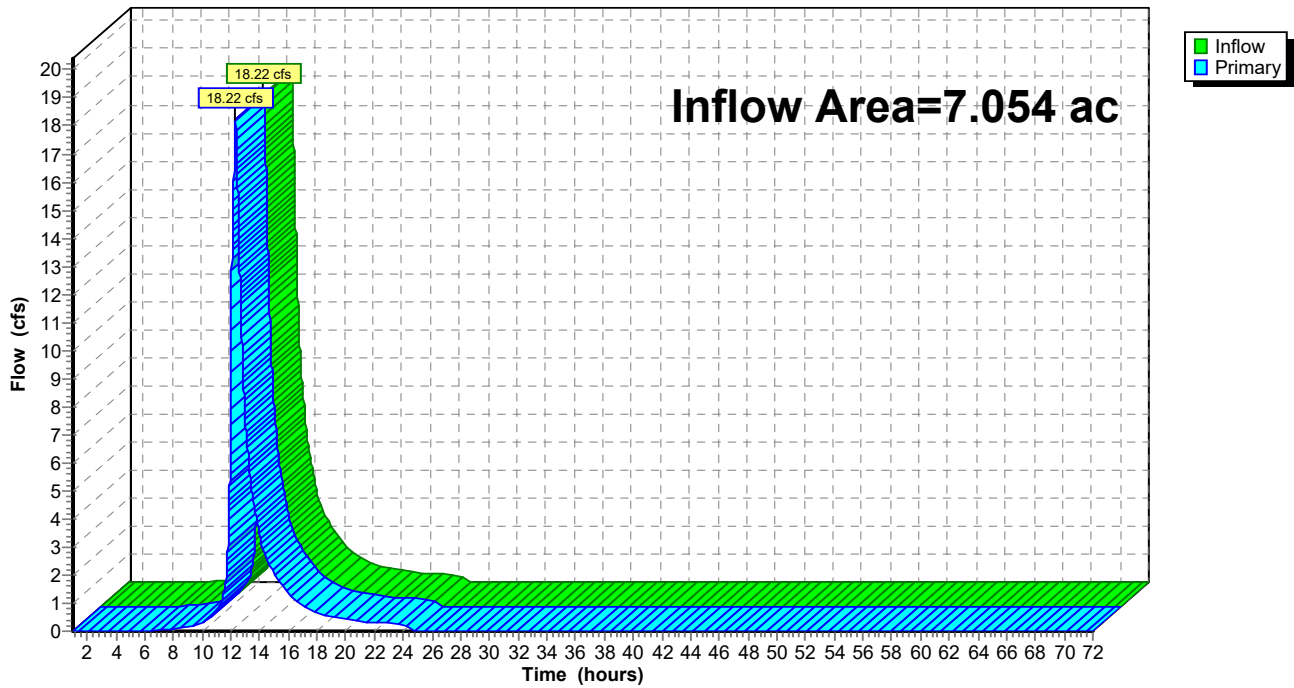
Summary for Pond DP.: DP-PR

Inflow Area = 7.054 ac, 58.09% Impervious, Inflow Depth = 4.23" for 100-year event
Inflow = 18.22 cfs @ 12.31 hrs, Volume= 2.484 af
Primary = 18.22 cfs @ 12.32 hrs, Volume= 2.484 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Pond DP.: DP-PR

Hydrograph



Summary for Pond YD: Yard Drain

Inflow Area = 1.687 ac, 45.64% Impervious, Inflow Depth = 4.50" for 100-year event
 Inflow = 5.75 cfs @ 12.31 hrs, Volume= 0.632 af
 Outflow = 5.75 cfs @ 12.32 hrs, Volume= 0.632 af, Atten= 0%, Lag= 0.6 min
 Primary = 5.75 cfs @ 12.32 hrs, Volume= 0.632 af

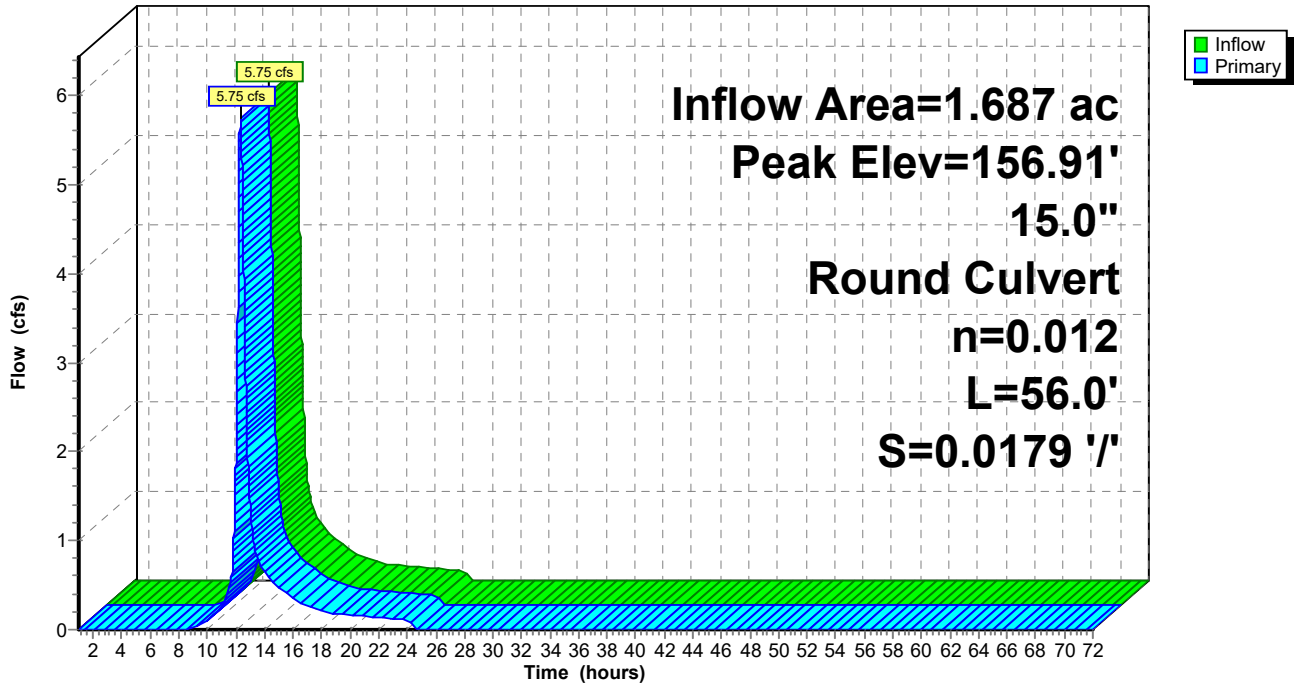
Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 156.91' @ 12.33 hrs
 Flood Elev= 156.90'

| Device # | Routing | Invert | Outlet Devices |
|----------|---------|---------|---|
| #1 | Primary | 153.20' | 15.0" Round Culvert L= 56.0' Ke= 0.500 Inlet / Outlet Invert= 153.20' / 152.20' S= 0.0179 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=5.70 cfs @ 12.32 hrs HW=156.90' TW=155.97' (Dynamic Tailwater)
 1=Culvert (Inlet Controls 5.70 cfs @ 4.65 fps)

Pond YD: Yard Drain

Hydrograph



Appendix 6:

MISCELLANEOUS CALCULATIONS



Infiltration Basin Sizing

① Water Quality Volume (WQV)

$$WQV = (1") (R) (A) / 12 \text{ and } R = 0.05 + 0.009(I)$$

where WQV = water quality volume (cf)

R = runoff coefficient

A = contributing area (sf) = 136,043 s.f.

I = percent impervious coverage = 76.91%

$$R = 0.05 + 0.009(76.91) \\ = 0.742$$

$$WQV = (1") (0.742) (136,043) / 12 \\ = 8414 \text{ cf}$$

② Time to Drain

Design infiltration rate = 1.17 in/hr = 0.0976 ft/hr

Storage capacity below outlet = 14,003 cf

Basin Bottom Area (Elev. 152) = 5,458 sf

$$\text{Drawdown Time} = \frac{\text{Volume}}{(\text{Area})(\text{Rate})} \\ = \frac{14,003 \text{ CF}}{(5458)(0.0976)} \\ = 26.2 \text{ hrs}$$

Max. Drawdown Time = 72 hours

Project: Stardust Self Storage
Location: Simsbury, CT
Prepared For: JR Russo

Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 1" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

| Structure Name | A (acres) | A (miles ²) | Runoff Coefficient | Percent Imp. (%)* | t _c (min) | t _c (hr) |
|----------------|-----------|-------------------------|--------------------|-------------------|----------------------|---------------------|
| WQU | 2.40 | 0.00375 | 0.63 | 55.15 | 22.0 | 0.367 |

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure: The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method.

1. Compute WQV in watershed inches using the following equation:

$$WQV = P * R$$

where: WQV = water quality volume (watershed inches)
P = design precipitation (inches) = (1" for water quality storm)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

| Structure Name | Percent Imp. (%) | R | P (in) | WQV (in) | WQV (ac-ft) |
|----------------|------------------|-------|--------|----------|-------------|
| WQU | 55.15 | 0.546 | 1.0 | 0.546 | 0.1093 |

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$CN = 1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25QP)^{1/2}]$$

where: CN = Runoff Curve Number
P = design precipitation (inches) = (1" for water quality storm)
Q = runoff depth (watershed inches)

| Structure Name | Q (in) | CN |
|----------------|--------|-------|
| WQU | 0.546 | 94.73 |

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P, interpolating when appropriate.

| Structure Name | I _a (in) | I _a /P |
|----------------|---------------------|-------------------|
| WQU | 0.111 | 0.111 |

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles.

| Structure Name | t_c (hr) | A (miles ²) |
|----------------|------------|-------------------------|
| WQU | 0.367 | 0.00375 |

5. Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 for appropriate t_c for type III rainfall distribution.

| Structure Name | t_c (hr) | I_a/P | q_u (csm/in) |
|----------------|------------|-------------|----------------|
| WQU | 0.367 | 0.111351144 | 475 |

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$$WQF = (q_u) \cdot (A) \cdot (Q)$$

where: WQF = water quality flow (cfs)
 q_u = unit peak discharge (cfs/mi²/inch)
 A = drainage area (mi²)
 Q = runoff depth (watershed inches)

| Structure Name | q_u (csm/in) | A (miles ²) | Q (in) | WQF (cfs) |
|----------------|----------------|-------------------------|--------|-----------|
| WQU | 475 | 0.00375 | 0.546 | 0.97 |

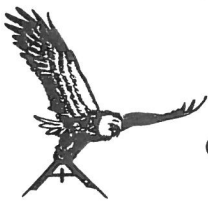
**CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD**

**STARDUST SELF STORAGE
SIMSBURY, CT**

| | | | |
|----------------|---------|------------------------|---------|
| Area | 2.40 ac | Unit Site Designation | WQU |
| Weighted C | 0.63 | Rainfall Station # | 34 |
| t _c | 22 min | | |
| CDS Model | 2015-4 | CDS Treatment Capacity | 1.4 cfs |

| <u>Rainfall Intensity¹</u> (in/hr) | <u>Percent Rainfall Volume¹</u> | <u>Cumulative Rainfall Volume</u> | <u>Total Flowrate (cfs)</u> | <u>Treated Flowrate (cfs)</u> | <u>Incremental Removal (%)</u> |
|--|--|-----------------------------------|-----------------------------|-------------------------------|---|
| 0.02 | 9.7% | 9.7% | 0.03 | 0.03 | 9.7 |
| 0.04 | 9.7% | 19.4% | 0.06 | 0.06 | 9.6 |
| 0.06 | 9.8% | 29.2% | 0.09 | 0.09 | 9.6 |
| 0.08 | 7.7% | 36.9% | 0.12 | 0.12 | 7.5 |
| 0.10 | 8.0% | 44.9% | 0.15 | 0.15 | 7.7 |
| 0.12 | 5.4% | 50.3% | 0.18 | 0.18 | 5.2 |
| 0.14 | 4.7% | 55.0% | 0.21 | 0.21 | 4.4 |
| 0.16 | 5.5% | 60.5% | 0.24 | 0.24 | 5.1 |
| 0.18 | 3.5% | 63.9% | 0.27 | 0.27 | 3.2 |
| 0.20 | 4.1% | 68.0% | 0.30 | 0.30 | 3.7 |
| 0.25 | 6.5% | 74.5% | 0.38 | 0.38 | 5.8 |
| 0.30 | 5.5% | 80.0% | 0.45 | 0.45 | 4.7 |
| 0.35 | 4.0% | 84.0% | 0.53 | 0.53 | 3.4 |
| 0.40 | 2.0% | 86.0% | 0.61 | 0.61 | 1.6 |
| 0.45 | 2.1% | 88.1% | 0.68 | 0.68 | 1.7 |
| 0.50 | 2.0% | 90.2% | 0.76 | 0.76 | 1.5 |
| 0.75 | 5.1% | 95.3% | 1.14 | 1.14 | 3.2 |
| 1.00 | 2.5% | 97.8% | 1.51 | 1.40 | 1.2 |
| 1.50 | 1.8% | 99.5% | 2.27 | 1.40 | 0.6 |
| 2.00 | 0.5% | 100.0% | 3.03 | 1.40 | 0.1 |
| | | | | | 89.5 |
| | | | | | Removal Efficiency Adjustment ² = 6.5% |
| | | | | | Predicted % Annual Rainfall Treated = 92.4% |
| | | | | | Predicted Net Annual Load Removal Efficiency = 83.1% |

1 - Based on 10 years of hourly precipitation data from NCDC station 806, Bridgeport WSO ARPT, Fairfield County, CT
 2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



INLET CAPACITY ANALYSIS

All inlets are located in depressions or sags.

Capacity of the grate inlet in a sag is calculated by:

$$Q_i = CA(2gh)^{1/2}$$

where Q_i = inlet flow rate (cfs)

C = orifice coefficient = 0.6

A = clear open area in the grate (ft^2)

g = 32.2 ft/s^2

h = height of water over grate (ft)

Yard Drain:

$A = 1.12 \text{ ft}^2$ for 24" dia grate (from Nyoplast)
 $h = 0.3 \text{ ft}$ (height in depression before bypass)

$$Q_i = 0.6(1.12 \text{ ft}^2)[(2)(32.2 \text{ ft}/\text{s}^2)(0.3 \text{ ft})]^{1/2}$$
$$= 2.95 \text{ cfs}$$

25-year Peak Flow to YD = 4.0 cfs (from HydroCAD)

$$Q_{\text{bypass}} = 4.0 \text{ cfs} - 2.95 \text{ cfs} = 1.05 \text{ cfs}$$

CB:

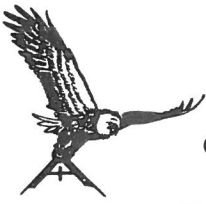
$A = 3.5 \text{ ft}^2$ (standard DOT grate)

$h = 0.2 \text{ ft}$ (height in depression before bypass)

$$Q_i = 0.6(3.5 \text{ ft}^2)[(2)(32.2 \text{ ft}/\text{s}^2)(0.2 \text{ ft})]^{1/2}$$
$$= 7.54 \text{ cfs}$$

25-year Peak Flow to CB = 1.17 cfs (HydroCAD) + 1.05 cfs (bypass from AD)
= 2.22 cfs

$Q_c = 7.54 \text{ cfs} > 2.22 \text{ cfs} \Rightarrow$ Adequate Capacity.
without including throat of
Type C catch basin.



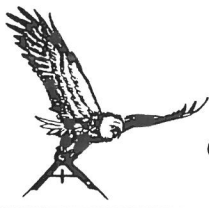
CDS Unit:

$$A = 2.45 \text{ ft}^2 \text{ (24" x 24" grate)}$$
$$h = 0.5' \text{ (height before spill over curb)}$$

$$Q_i = 0.6(2.45 \text{ ft}^2) [(2)(32.2 \text{ ft/s}^2)(0.5 \text{ ft})]^{1/2}$$
$$= 8.34 \text{ cfs}$$

25-year peak flow = 3.17 cfs (from HydroCAD)

$$Q_c = 8.34 \text{ cfs} > 3.17 \text{ cfs} \Rightarrow \text{Adequate Capacity}$$



Outfall Sizing

Design Storm = 100-YR

Peak Discharge = 13.10 cfs

Exit Velocity = 5.14 fps

Pipe Size = 24"

Riprap Size: Use modified riprap per Table 8.5 (attached)

Apron Length = 16' per Table 8-6.1 (attached)

Apron width @ pipe (w_1) = $3 \times \text{Dia.} = 3 \times 2' = 6'$

Apron width @ end (w_2) = $(3 \times \text{Dia.}) + (0.7L)$
= $(3 \times 2') + (0.7 \times 16')$
= $6 + 11.2$
= $17.2'$

Summary for Pond DMH: DMH

Inflow Area = 5.407 ac, 66.36% Impervious, Inflow Depth = 4.29" for 100-year event
 Inflow = 13.10 cfs @ 12.32 hrs, Volume= 1.931 af
 Outflow = 13.10 cfs @ 12.33 hrs, Volume= 1.931 af, Atten= 0%, Lag= 0.6 min
 Primary = 13.10 cfs @ 12.33 hrs, Volume= 1.931 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 153.37' @ 12.33 hrs
 Flood Elev= 157.50'

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 151.35' | 24.0" Round Culvert L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf |

Primary OutFlow Max=13.10 cfs @ 12.33 hrs HW=153.37' TW=0.00' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 13.10 cfs @ 5.14 fps)

8.7.3 Design Criteria

The design of riprap outlet protection applies to the immediate area or reach downstream of the pipe outlet and does not apply to continuous rock linings of channels or streams. For pipe outlets at the top of exit slopes or on slopes greater than 10%, the designer should assure that suitable safeguards are provided beyond the limits of the localized outlet protection to counter the highly erosive velocities caused by the reconcentration of flow beyond the initial riprap apron. Outlet protection shall be designed according to the following criteria:

- Riprap outlet protection shall be used at all outlets not flowing over exposed rock or into deep watercourses and ponds.
- In situations not covered by the above noted criteria and where the exit velocity is ≤ 4.27 mps (14 fps), a riprap apron shall also be used. For Type A and B riprap aprons, the type of riprap specified is dependent on the outlet velocity (see Section 8.6.6) and can be determined from Table 8.5. For Type C aprons, the type of riprap specified is determined by the procedures in HEC-15 and HEC-11 depending on the design discharge. See Chapter 7, Channels.
- The type of riprap apron and dimensions are determined by the guidelines outlined in Sections 8.7.2 and 8.7.5, respectively.
- When the outlet velocity is > 4.27 mps (14 fps), the designer should first investigate methods to reduce the outlet velocity. This may be accomplished by any one or combination of the following: increasing the pipe roughness, increasing the pipe size and/or decreasing the culvert slope. When this is not possible or economical, a number of outlet protection or energy dissipation design options are available. These are presented in detail in HEC-14. In most instances, however, a preformed scour hole design should be used, as it generally can provide the necessary degree of protection at an economical cost. The design of a preformed scour hole is presented in Section 8.7.6.

The design criteria of this section should be applicable to most outlet situations. However, recognizing that design and site conditions can vary significantly depending on the project or location on a particular project, it is the responsibility of the designer to ensure that the criteria is suitable to the site or to provide an alternate design which will adequately protect the outlet area from scour and erosion. These situations should be documented in the drainage design report.

Table 8.5 Allowable Outlet Velocities for Type A and B Riprap Aprons

| Outlet Velocity - mps (fps) | Riprap Specification |
|-----------------------------|----------------------|
| 0-2.44 (0-8) | Modified |
| 2.44-3.05 (8-10) | Intermediate |
| 3.05-4.27 (10-14) | Standard |

8.7.4 Tailwater Depth

The depth of tailwater immediately at the pipe outlet is required for the design of outlet protection and must be determined for the design flow rate. Manning's equation may be used to determine tailwater depth. See Sections 8.3.5 and 8.3.6 for additional information on how to determine the tailwater depth.

OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

| DISCHARGE (cfs) | OUTLET PIPE DIAMETER OR SPAN (in) | | | | | | | | | | |
|--------------------|-----------------------------------|------------|------------------|------------|--------------|----------------|-------------|---------------|-----------------|-----------|--|
| | 12 | 15 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | |
| 0-5 | 10 | 10 | | <i>USE</i> | | | | | | | |
| 6 | 12 | 11 | | | | | | | | | |
| 7 | | 13 | 12 | | | | | | | | |
| 8 | | 14 | 13 | 12 | | <i>MINIMUM</i> | | | | | |
| 9 | | | 14 | 13 | | | | | | | |
| 10 | | | 15 | 13 | | | | | | | |
| 11 | | | 16 | 14 | | | | <i>LENGTH</i> | | | |
| 12 | | | | 14 | | | | | | | |
| 14 | | | | 16 | 14 | | | | | | |
| 16 | | | | 17 | 15 | 14 | | | <i>OUTLINED</i> | | |
| 18 | | | | 18 | 16 | 15 | | | | | |
| 20 | | | | | 17 | 15 | 14 | | | | |
| 22 | | <i>USE</i> | | | 18 | 16 | 15 | | | | |
| 24 | | | | | | 17 | 15 | 14 | | | |
| 26 | | | | | | 17 | 16 | 15 | | | |
| 28 | | | | | | 18 | 16 | 15 | | | |
| 30 | | | | | | 19 | 17 | 16 | | | |
| 35 | | | | | | 20 | 18 | 17 | 16 | | |
| 40 | | | <i>PREFORMED</i> | | | | 20 | 18 | 17 | 16 | |
| 45 | | | | | | | 21 | 19 | 18 | 16 | |
| 50 | | | | | | | 22 | 20 | 18 | 17 | |
| 55 | | | | | | | | 21 | 19 | 18 | |
| 60 | | | | | | | | 22 | 20 | 19 | |
| 65 | | | | | | | | 24 | 21 | 20 | |
| 70 | | | | | <i>SCOUR</i> | | | 25 | 22 | 20 | |
| 75 | | | | | | | | 26 | 23 | 21 | |
| 80 | | | | | | | | | 24 | 22 | |
| 90 | | | | | | | | | 26 | 24 | |
| 100 | | | | | | | | | 28 | 25 | |
| 110 | | | | | | | | | | 27 | |
| 125 | | | | | | | <i>HOLE</i> | | | 29 | |
| 130 | | | | | | | | | | 30 | |

Table 8-6.1 - Length - L_a (feet)

Type A Riprap Apron

- Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.