# STORMWATER MANAGEMENT REPORT

PROPOSED

KILLINGLY HIGH SCHOOL

SOLAR PROJECT

226 PUTNAM PIKE
KILLINGLY, CONNECTICUT
WINDHAM COUNTY

**Prepared for:**

**Greenskies Clean Energy, LLC**
**127 Washington Avenue**
**West Building, Garden Level**
**Middletown, CT 06457**

**Prepared by:**

**All-Points Technology Corporation, P.C.**
**567 Vauxhall Street Extension, Suite 311**
**Waterford, CT 06385**

**June 2021**

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## Introduction

At the request of Greenskies Clean Energy, LLC, All-Points Technology Corporation, P.C. ("APT") has prepared the following analysis of and design to address stormwater impacts resulting from the development of a proposed 1.068 MW direct current ("DC") (0.809 MW alternating current ("AC")) solar electric generating facility herein referred to as Killingly HS Solar (the "Project") located at 226 Putnam Pike, in Killingly, Connecticut (the "Site").

The purpose of this report is to provide a description and analysis of the potential stormwater drainage impacts associated with the Project, as well as a description of the design to mitigate such potential stormwater drainage impacts. The design is intended to be in full compliance with the State and Town regulations while taking prevailing site conditions and practical factors into account.

## Existing Site Conditions

The Site consists of an irregularly shaped 141.59± acres parcel, with the Project area specifically located in an existing wooded area to the south of the High School. The central portion of the Site consists of the high school buildings and associated parking and athletic fields. The remainder of the site is primarily undeveloped wooded land with a small portion of cleared field, used by the school, in the south east. The parcel is zoned "Rural Development" per the Town of Killingly zoning regulation. Access to the Site is from a paved driveway off of Putnam Pike/Route 12.

The Project's area, consisting of the proposed solar facility and appurtenances, existing topography generally slopes downward from the south to the north. Within the specific Project area, the topography includes slopes that are less than 15 percent. Elevations within the Project area range from approximately 467 feet AMSL to the south to approximately 400 feet AMSL to the north along the driveway.

## Developed Site Conditions

The Project will be constructed south of the high school and east of the existing cleared field. Access to the Project area will be provided via an existing gravel access road off the main high school driveway. The Project includes the installation of (1,050) 360W solar panel modules, (1,536) 450W solar panel modules, and associated fencing, access road, utilities, and stormwater management features, within approximately 6.44± acres of the Site. Of the 6.44± acres of disturbance, 4.67± acres will require clearing and grubbing for the installation of the fenced solar facility and associated stormwater management and erosion and sediment control features. The remaining 1.77± acres is anticipated to require tree cutting only for shading purposes.

The proposed solar panels will be installed on a post driven ground mounted racking system, with minimal changes to the existing grades. As a result, the post-development site conditions will mimic the pre-developed site conditions. Areas of clearing and grubbing and any existing ground cover that is disturbed during construction will be reseeded with a low growth seed mix.

In order to account for the change in ground cover and time of concentration, grass-lined stormwater management basins are proposed to the north of the fenced facility.

**Stormwater Management**

*Analysis Methodology*

The hydrologic analysis was performed using the HydroCAD stormwater modeling system computer program developed by HydroCAD Software Solutions, LLC.

Hydrographs for each watershed were developed using the SCS Synthetic Unit Hydrograph Method with a Type III rainfall distribution. Hydrographs were developed for the NOAA Atlas 14, Volume 10, Version 3 Precipitation 2-, 25-, 50-, and 100-year storm event with rainfall depths of 3.40, 6.21, 7.01, and 7.87 inches respectively.

The existing and proposed drainage areas used in the calculations are illustrated on the Existing and Proposed Drainage Area Plans (EDA-1 & PDA-1). These maps and the corresponding HydroCAD output are attached.

The Water Quality Volume ("WQV") for the site will be calculated assuming that the roadways, gravel surfaces, and transformer pads are effectively impervious cover. The panels are not considered impervious cover for purposes of the WQV calculations.

The Project area soils identified by the United States Department of Agriculture (USDA) Natural Resources Conservation Service consist primarily of a HSG rating of "B", with portions with a HSG rating of "C" and "D". The specific Map Unit Symbol soils include 62C, 86C, and 47C. Specific details for each soil Map Unit Symbol are provided in Appendix A.

*Existing Drainage Patterns*

The Project area drains from the south to the north, with a portion of off-site watershed draining onto the Site from the south. The Site is modeled at two (2) Analysis Points ("AP-1" and "AP-2"). AP-1 is the existing 24" culvert that runs under the existing driveway. AP-2 is the existing 15" culvert that runs under the existing driveway. Peak discharges have been computed at the points of study for the 2-, 25-, 50-, and 100-year storm events.

The pre-developed peak discharges at each analysis point are tabulated in Table 1.

**Table 1**

| ***Analysis Point*** | **Pre-developed Peak Storm Runoff (Q), cubic feet per second (cfs)** | | | |
|---|---|---|---|---|
| | **2-year** | **25-year** | **50-year** | **100-year** |
| AP-1 | 2.04 | 10.91 | 14.00 | 17.49 |
| AP-2 | 0.58 | 4.09 | 5.37 | 6.85 |

*Proposed Drainage Patterns*

The Project will require clearing and grubbing in the immediate area for the proposed solar installation, including the necessary utilities, access road, and stormwater management features, resulting in approximately 6.44± acres of disturbance.

To manage the increase in post-development runoff due to the change in cover type associated with converting woods to meadow within the proposed limit of disturbance, one (1) grass-lined stormwater management basin with a forebay is proposed to the north of the project area. The basin is designed with two (2) low flow culverts that are intended to direct clean runoff to maintain existing hydrologic conditions to the two delineated wetlands to the north and west. Additionally, a swale along the northern fence line and an earthen berm along the northwestern fence line are proposed to direct water to the basin. A forebay has been designed to provide the WQV. See attached calculations. Additional flow and volume control out of the basin is provided via rip-rap lined overflow weirs and plunge pool level spreaders at the end of each low flow culvert.

Since the proposed development mimics the existing conditions, the post-development condition was modeled using the same Analysis Point. Peak discharges have been computed at the point of study for the 2-year, 25-year, 50-year, and 100-year storm events. The post-development discharges at each point of study are tabulated in Table 1.

**Table 2**

| ***Analysis Point*** | **Post-developed Peak Storm Runoff (Q), cubic feet per second (cfs)** | | | |
|---|---|---|---|---|
| | **2-year** | **25-year** | **50-year** | **100-year** |
| AP-1 | 0.64 | 3.61 | 9.07 | 15.08 |
| AP-2 | 0.53 | 3.46 | 4.48 | 5.58 |

The reduction in runoff achieved by the post-development discharges in comparison with the pre-development discharges are tabulated in Table 3.

**Table 3**

| ***Analysis Point*** | **Peak Storm Runoff (Q) Comparison Pre- and Post-, Percent (%) Decrease** | | | |
|---|---|---|---|---|
| | **2-year** | **25-year** | **50-year** | **100-year** |
| AP-1 | 69% | 67% | 35% | 14% |
| AP-2 | 9% | 15% | 17% | 19% |

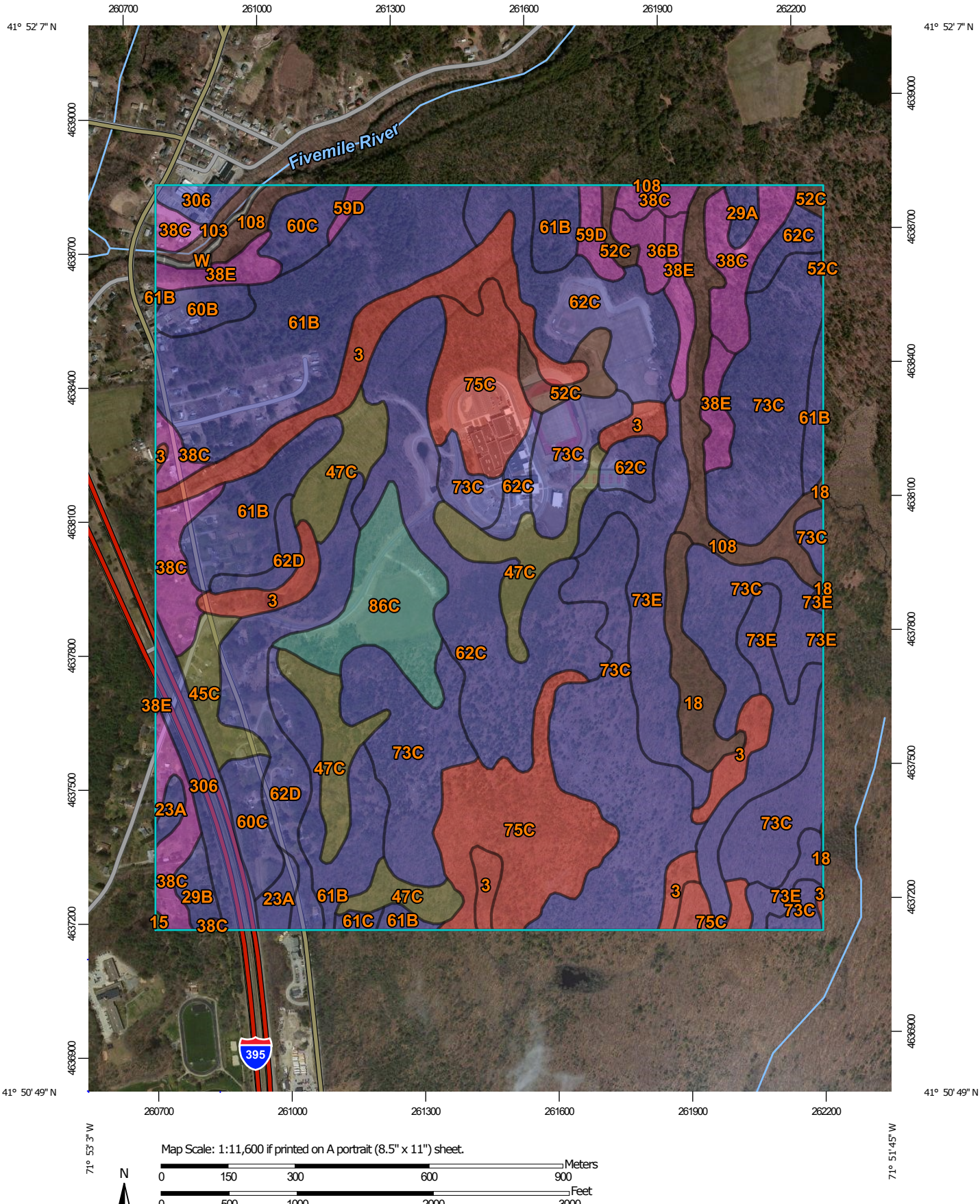
**Conclusion**

The stormwater management for the proposed Project has been designed such that the post-development peak discharges to the waters of the State of Connecticut for the 2-, 25-, 50-, and 100- year storm events are less than the pre-development peak discharges, as seen in Table 4, Overall Pre-Development verse Post-Development Peak Discharge Summary, below. As a result, the proposed solar array will not result in any adverse conditions to the surrounding areas and properties.

**Table 4**

| **Overall Pre- and Post-Development Peak Storm Runoff (Q) Comparison, cubic feet per second (CFS)** | | | | |
|---|---|---|---|---|
| **AP-1** | **2-year** | **25-year** | **50-year** | **100-year** |
| Existing (AP-1) | 2.04 | 10.91 | 14.00 | 17.49 |
| Proposed (AP-1) | 0.64 | 3.61 | 9.07 | 15.08 |
| % Difference | 69% | 67% | 35% | 14% |
| | | | | |
| **AP-2** | **2-year** | **25-year** | **50-year** | **100-year** |
| Existing (AP-2) | 0.58 | 4.09 | 5.37 | 6.85 |
| Proposed (AP-2) | 0.53 | 3.46 | 4.48 | 5.58 |
| % Difference | 9% | 15% | 17% | 19% |

# APPENDIX A: NRCS SOIL SURVEY


71° 53' 3" W
71° 51' 45" W
41° 52' 7" N
41° 50' 49" N
260700
261000
261300
261600
261900
262200
4639000
4638700
4638400
4638100
4637800
4637500
4637200
4636900
Fivemile River
306
59D
108
38C
29A
52C
38C
103
108
60C
61B
59D
62C
W
38E
52C
36B
38C
52C
38E
61B
60B
62C
61B
3
75C
52C
38E
73C
61B
3
3
38C
73C
47C
62C
73C
62C
18
61B
108
73C
38C
62D
47C
73C
18
3
86C
73E
73E
73E
62C
73C
45C
38E
18
73C
3
47C
306
62D
23A
60C
75C
73C
18
38C
29B
23A
61B
47C
3
3
73E
3
73C
15
38C
61C
61B
75C
395
Map Scale: 1:11,600 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
150
300
600
900
Feet
0
500
1000
2000
3000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Lines**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Points**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

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

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: Mar 30, 2011—May 1, 2011

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.

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 3 | Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony | D | 33.7 | 5.4% |
| 15 | Scarboro muck, 0 to 3 percent slopes | A/D | 0.1 | 0.0% |
| 18 | Catden and Freetown soils, 0 to 2 percent slopes | B/D | 9.6 | 1.5% |
| 23A | Sudbury sandy loam, 0 to 5 percent slopes | B | 4.0 | 0.7% |
| 29A | Agawam fine sandy loam, 0 to 3 percent slopes | B | 2.0 | 0.3% |
| 29B | Agawam fine sandy loam, 3 to 8 percent slopes | B | 3.0 | 0.5% |
| 36B | Windsor loamy sand, 3 to 8 percent slopes | A | 3.6 | 0.6% |
| 38C | Hinckley loamy sand, 3 to 15 percent slopes | A | 29.2 | 4.7% |
| 38E | Hinckley loamy sand, 15 to 45 percent slopes | A | 11.8 | 1.9% |
| 45C | Woodbridge fine sandy loam, 8 to 15 percent slopes | C/D | 6.6 | 1.1% |
| 47C | Woodbridge fine sandy loam, 3 to 15 percent slopes, extremely stony | C/D | 31.2 | 5.0% |
| 52C | Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony | B/D | 7.3 | 1.2% |
| 59D | Gloucester gravelly sandy loam, 15 to 35 percent slopes, extremely stony | A | 4.1 | 0.7% |
| 60B | Canton and Charlton fine sandy loams, 3 to 8 percent slopes | B | 4.8 | 0.8% |
| 60C | Canton and Charlton fine sandy loams, 8 to 15 percent slopes | B | 12.0 | 1.9% |

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 61B | Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony | B | 84.0 | 13.5% |
| 61C | Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony | B | 1.0 | 0.2% |
| 62C | Canton and Charlton fine sandy loams, 3 to 15 percent slopes, extremely stony | B | 76.4 | 12.3% |
| 62D | Canton and Charlton fine sandy loams, 15 to 35 percent slopes, extremely stony | B | 24.4 | 3.9% |
| 73C | Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky | B | 131.7 | 21.2% |
| 73E | Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky | B | 38.0 | 6.1% |
| 75C | Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes | D | 48.0 | 7.7% |
| 86C | Paxton and Montauk fine sandy loams, 3 to 15 percent slopes, extremely stony | C | 19.1 | 3.1% |
| 103 | Rippowam fine sandy loam | B/D | 1.9 | 0.3% |
| 108 | Saco silt loam | B/D | 17.0 | 2.7% |
| 306 | Udorthents-Urban land complex | B | 14.9 | 2.4% |
| W | Water | | 1.2 | 0.2% |
| **Totals for Area of Interest** | | | **620.7** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

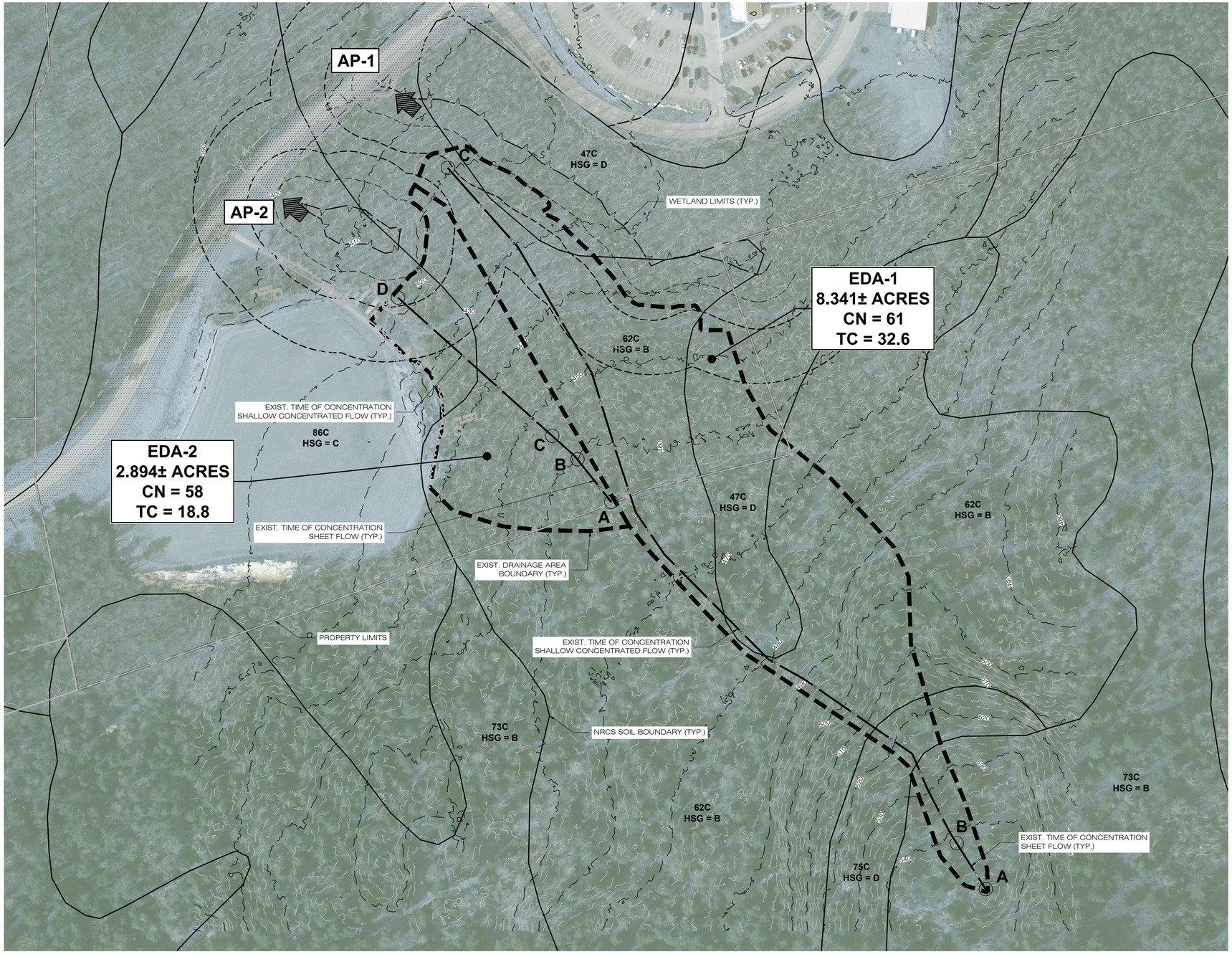
# APPENDIX B: EXISTING DRAINAGE AREA MAP (EDA-1) & HYDROLOGIC COMPUTATION (HYDROCAD)

## EXISTING DRAINAGE AREAS

| | TOTAL AREA (ACRES) | COMPOSITE CN | TC (MINS.) |
|---|---|---|---|
| EDA-1 | 8.341 | 61 | 32.6 |
| EDA-2 | 2.894 | 58 | 18.8 |

## EXISTING CONDITION PEAK FLOWS

| ANALYSIS POINT | 2-YEAR (CFS) | 25-YEAR (CFS) | 50-YEAR (CFS) | 100-YEAR (CFS) |
|---|---|---|---|---|
| AP-1 | 2.04 | 10.91 | 14.00 | 17.49 |
| AP-2 | 0.58 | 4.09 | 5.37 | 6.85 |




1 EDA-1 **EXISTING DRAINAGE AREA MAP**
SCALE : 1" = 100'-0"

100 0 50 100 200
( IN FEET ) 1 inch = 100 ft.


Greenskies
a Clean Focus company
127 WASHINGTON AVENUE
WEST BUILDING, GARDEN LEVEL
NORTH HAVEN, CT 06473

ALL-POINTS TECHNOLOGY CORPORATION
567 VAUXHAUL STREET EXTENSION - SUITE 311
WATERFORD, CT 06385 PHONE: (860)-663-1697
WWW.ALLPOINTSTECH.COM FAX: (860)-663-0935


**PERMIT SET**

| NO | DATE | REVISION |
|---|---|---|
| 0 | 06/01/21 | FOR REVIEW: KAM |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

**DESIGN PROFESSIONAL OF RECORD**

PROF: KEVIN A. MCCAFFERY P.E.
COMP: ALL-POINTS TECHNOLOGY CORPORATION
ADD: 567 VAUXHAUL STREET EXTENSION - SUITE 311 WATERFORD, CT 06385

OWNER: TOWN OF KILLINGLY BOARD OF EDUCATION
ADDRESS: 79 WESTFIELD AVE KILLINGLY, CT 06239

**KILLINGLY HS SOLAR**

SITE ADDRESS: 226 PUTNAM PIKE KILLINGLY, CT 06241

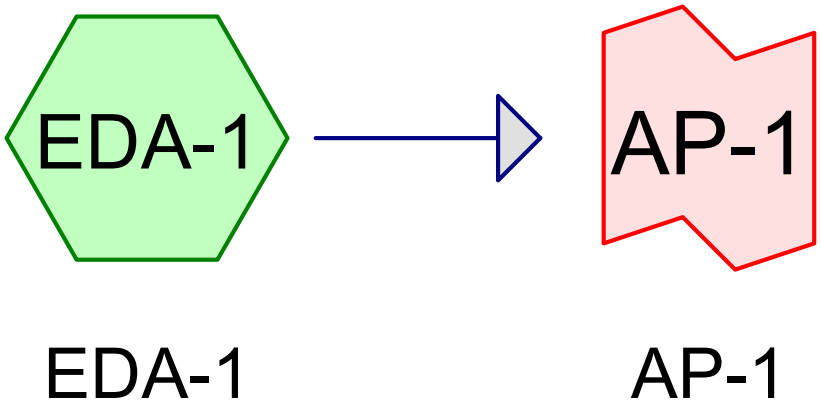
APT FILING NUMBER: CT599140

DRAWN BY: JT

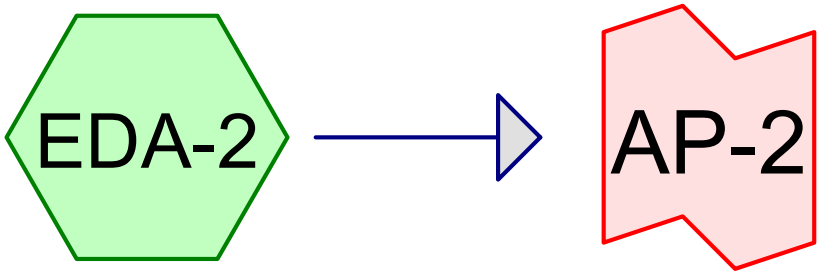
DATE: 06/01/21 CHECKED BY: KAM

SHEET TITLE:
**EXISTING DRAINAGE AREA MAP**

SHEET NUMBER:
**EDA-1**




EDA-1 AP-1




EDA-2 AP-2

Subcat Reach Pond Link

**Routing Diagram for CT599140_KillinglyHS - EX - Rev0**
Prepared by Microsoft, Printed 6/1/2021

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 8.457 | 55 | Woods, Good, HSG B (EDA-1, EDA-2) |
| 0.631 | 70 | Woods, Good, HSG C (EDA-2) |
| 2.147 | 77 | Woods, Good, HSG D (EDA-1) |
| **11.235** | **60** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 8.457 | HSG B | EDA-1, EDA-2 |
| 0.631 | HSG C | EDA-2 |
| 2.147 | HSG D | EDA-1 |
| 0.000 | Other | |
| **11.235** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|---|---|---|---|---|---|---|---|
| 0.000 | 8.457 | 0.631 | 2.147 | 0.000 | 11.235 | Woods, Good | EDA-1, EDA-2 |
| **0.000** | **8.457** | **0.631** | **2.147** | **0.000** | **11.235** | **TOTAL AREA** | |

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment EDA-1: EDA-1** Runoff Area=8.341 ac 0.00% Impervious Runoff Depth=0.53"
Flow Length=1,700' Tc=32.6 min CN=61 Runoff=2.04 cfs 0.367 af

**Subcatchment EDA-2: EDA-2** Runoff Area=2.894 ac 0.00% Impervious Runoff Depth=0.41"
Flow Length=544' Tc=18.8 min CN=58 Runoff=0.58 cfs 0.100 af

**Link AP-1: AP-1** Inflow=2.04 cfs 0.367 af
Primary=2.04 cfs 0.367 af

**Link AP-2: AP-2** Inflow=0.58 cfs 0.100 af
Primary=0.58 cfs 0.100 af

**Total Runoff Area = 11.235 ac Runoff Volume = 0.467 af Average Runoff Depth = 0.50"**
**100.00% Pervious = 11.235 ac 0.00% Impervious = 0.000 ac**

## Summary for Subcatchment EDA-1: EDA-1

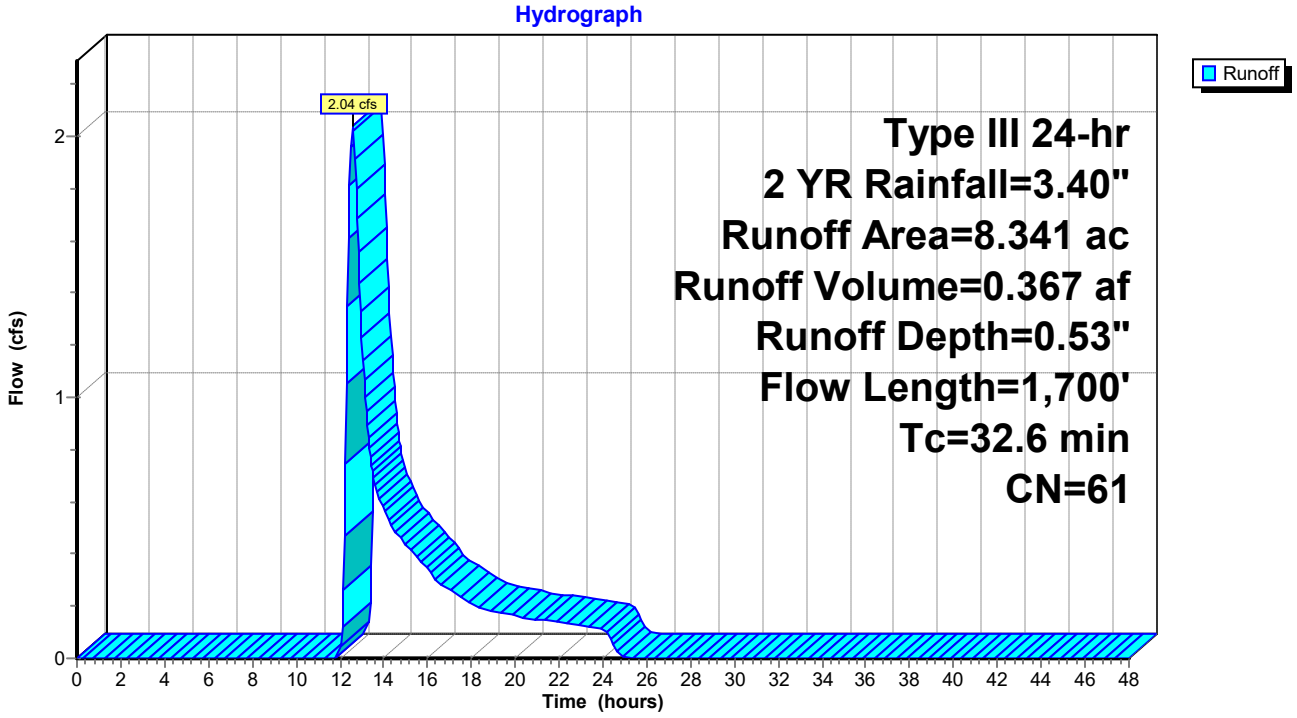
Runoff = 2.04 cfs @ 12.58 hrs, Volume= 0.367 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.40"

| Area (ac) | CN | Description |
|---|---|---|
| 6.194 | 55 | Woods, Good, HSG B |
| 2.147 | 77 | Woods, Good, HSG D |
| 8.341 | 61 | Weighted Average |
| 8.341 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 19.3 | 1,600 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 32.6 | 1,700 | Total | | | |

## Subcatchment EDA-1: EDA-1



## Summary for Subcatchment EDA-2: EDA-2

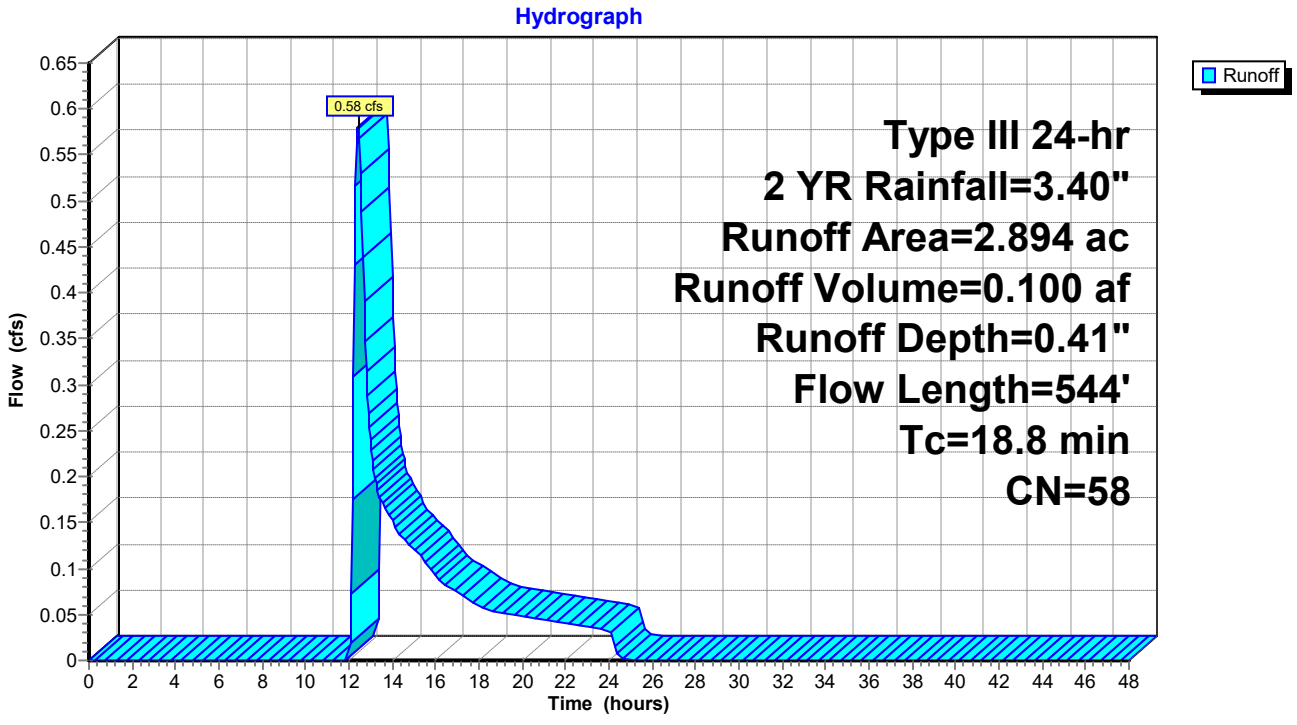
Runoff = 0.58 cfs @ 12.42 hrs, Volume= 0.100 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.40"

| Area (ac) | CN | Description |
|---|---|---|
| 2.263 | 55 | Woods, Good, HSG B |
| 0.631 | 70 | Woods, Good, HSG C |
| 2.894 | 58 | Weighted Average |
| 2.894 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 4.1 | 381 | 0.0979 | 1.56 | | **Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps |
| 18.8 | 544 | Total | | | |

## Subcatchment EDA-2: EDA-2

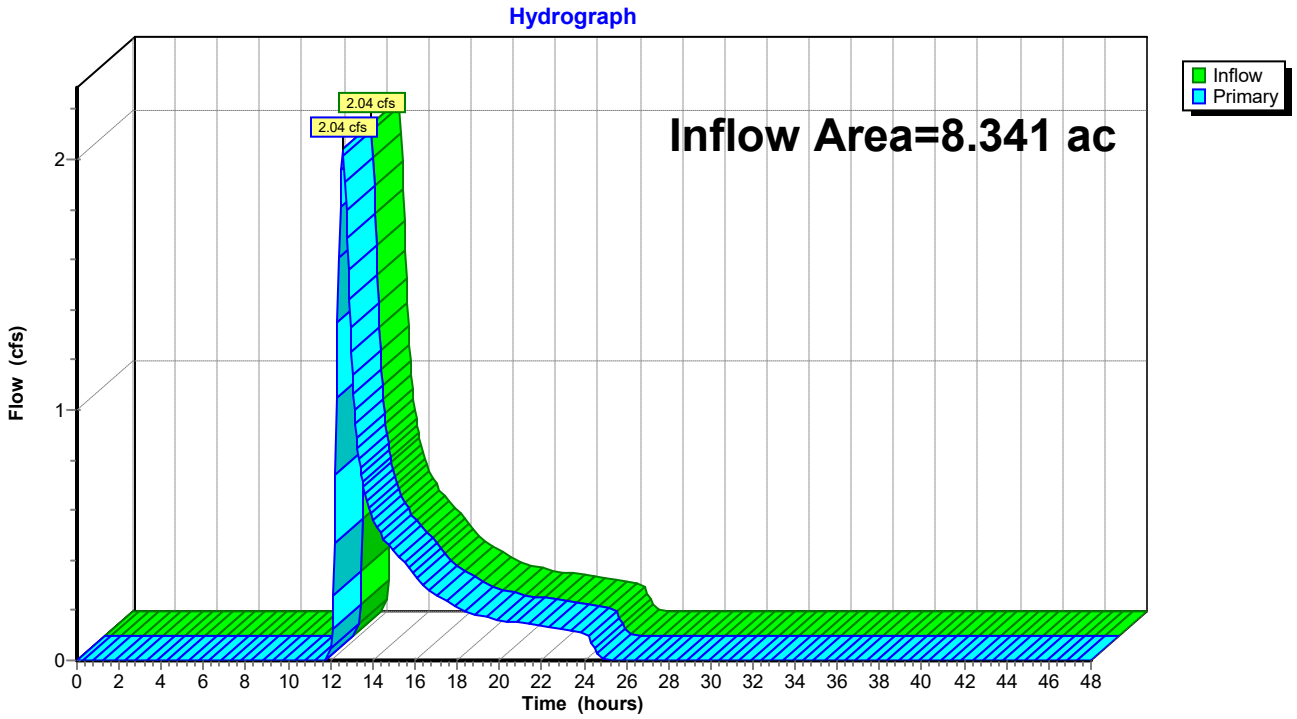


## Summary for Link AP-1: AP-1

Inflow Area = 8.341 ac, 0.00% Impervious, Inflow Depth = 0.53" for 2 YR event
Inflow = 2.04 cfs @ 12.58 hrs, Volume= 0.367 af
Primary = 2.04 cfs @ 12.58 hrs, Volume= 0.367 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

### Link AP-1: AP-1

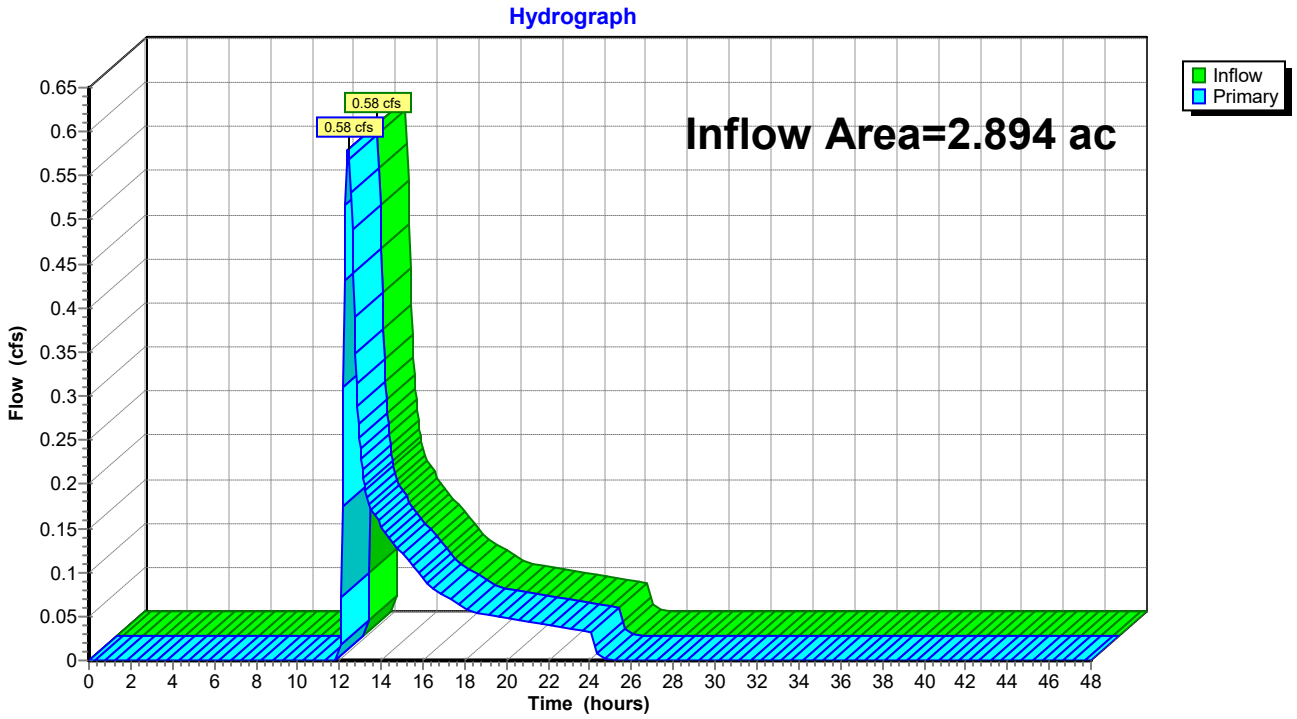


## Summary for Link AP-2: AP-2

Inflow Area = 2.894 ac, 0.00% Impervious, Inflow Depth = 0.41" for 2 YR event
Inflow = 0.58 cfs @ 12.42 hrs, Volume= 0.100 af
Primary = 0.58 cfs @ 12.42 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment EDA-1: EDA-1** Runoff Area=8.341 ac 0.00% Impervious Runoff Depth=2.15"
Flow Length=1,700' Tc=32.6 min CN=61 Runoff=10.91 cfs 1.493 af

**Subcatchment EDA-2: EDA-2** Runoff Area=2.894 ac 0.00% Impervious Runoff Depth=1.89"
Flow Length=544' Tc=18.8 min CN=58 Runoff=4.09 cfs 0.456 af

**Link AP-1: AP-1** Inflow=10.91 cfs 1.493 af
Primary=10.91 cfs 1.493 af

**Link AP-2: AP-2** Inflow=4.09 cfs 0.456 af
Primary=4.09 cfs 0.456 af

**Total Runoff Area = 11.235 ac Runoff Volume = 1.948 af Average Runoff Depth = 2.08"**
**100.00% Pervious = 11.235 ac 0.00% Impervious = 0.000 ac**

## Summary for Subcatchment EDA-1: EDA-1

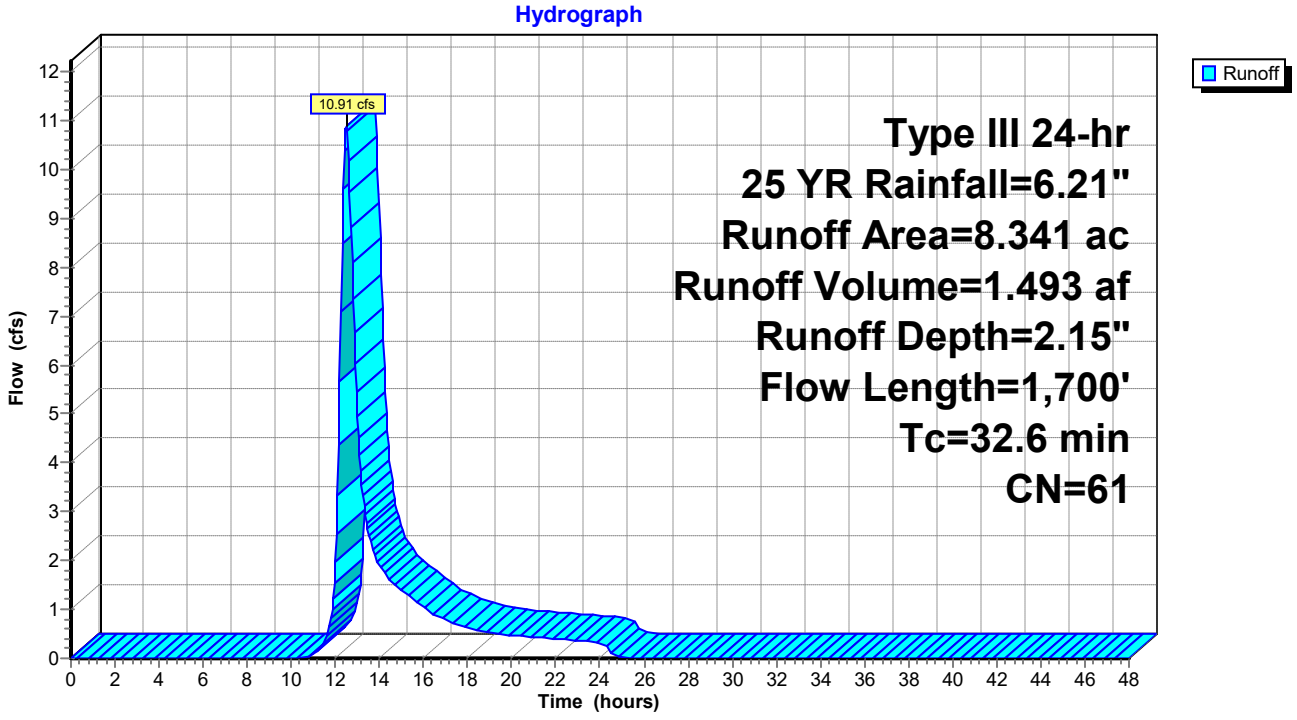
Runoff = 10.91 cfs @ 12.49 hrs, Volume= 1.493 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YR Rainfall=6.21"

| Area (ac) | CN | Description |
|---|---|---|
| 6.194 | 55 | Woods, Good, HSG B |
| 2.147 | 77 | Woods, Good, HSG D |
| 8.341 | 61 | Weighted Average |
| 8.341 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 19.3 | 1,600 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 32.6 | 1,700 | Total | | | |

## Subcatchment EDA-1: EDA-1



## Summary for Subcatchment EDA-2: EDA-2

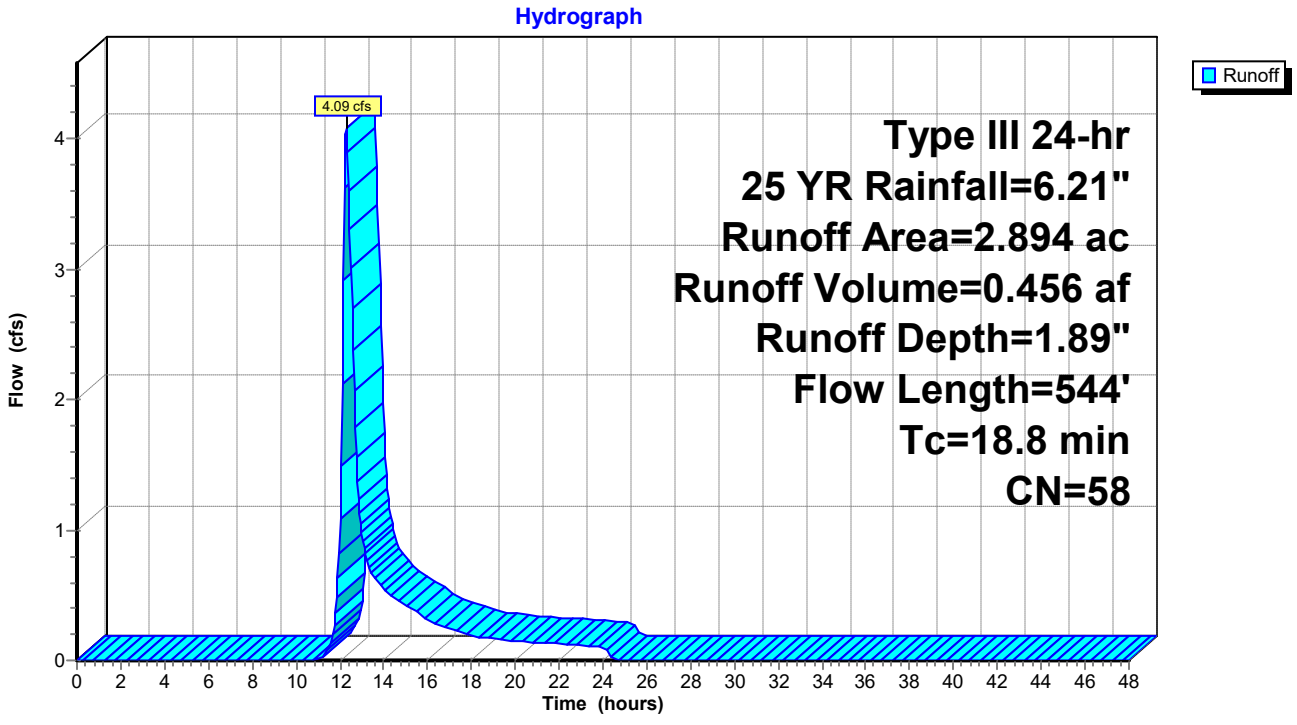
Runoff = 4.09 cfs @ 12.29 hrs, Volume= 0.456 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YR Rainfall=6.21"

| Area (ac) | CN | Description |
|---|---|---|
| 2.263 | 55 | Woods, Good, HSG B |
| 0.631 | 70 | Woods, Good, HSG C |
| 2.894 | 58 | Weighted Average |
| 2.894 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 4.1 | 381 | 0.0979 | 1.56 | | **Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps |
| 18.8 | 544 | Total | | | |

## Subcatchment EDA-2: EDA-2

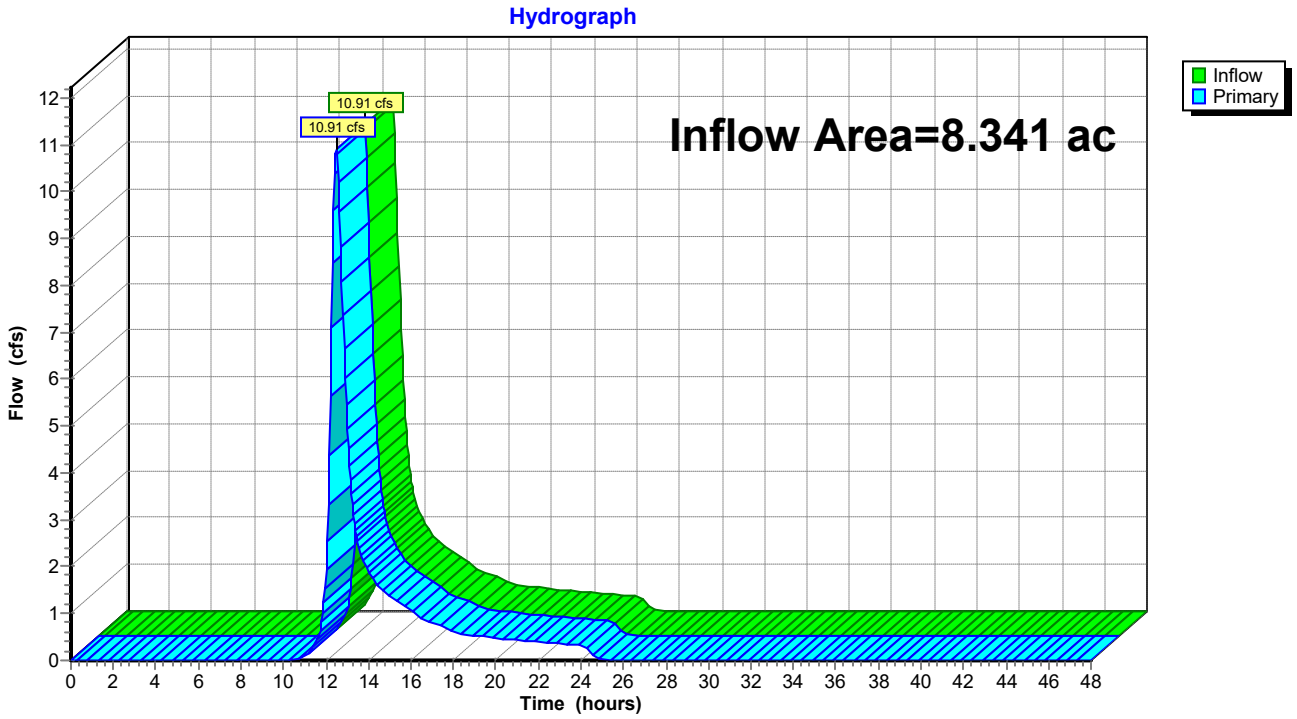


## Summary for Link AP-1: AP-1

Inflow Area = 8.341 ac, 0.00% Impervious, Inflow Depth = 2.15" for 25 YR event
Inflow = 10.91 cfs @ 12.49 hrs, Volume= 1.493 af
Primary = 10.91 cfs @ 12.49 hrs, Volume= 1.493 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-1: AP-1

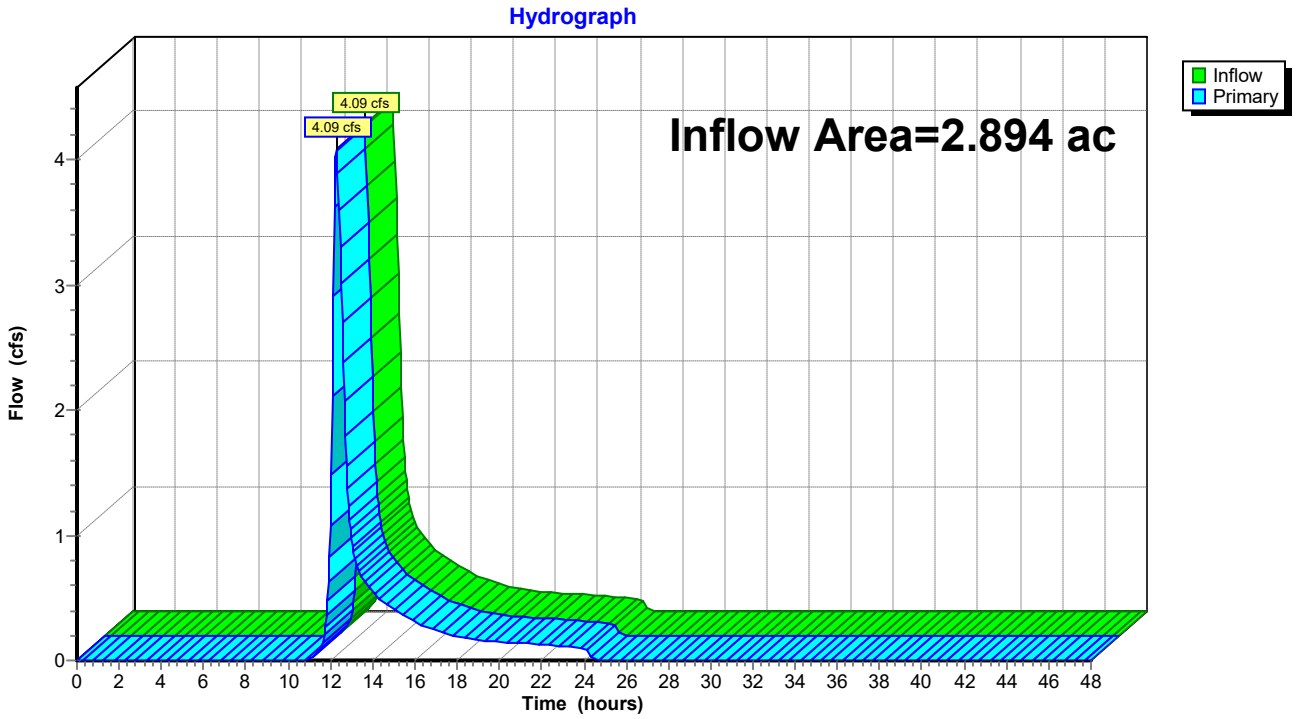


## Summary for Link AP-2: AP-2

Inflow Area = 2.894 ac, 0.00% Impervious, Inflow Depth = 1.89" for 25 YR event
Inflow = 4.09 cfs @ 12.29 hrs, Volume= 0.456 af
Primary = 4.09 cfs @ 12.29 hrs, Volume= 0.456 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment EDA-1: EDA-1** Runoff Area=8.341 ac 0.00% Impervious Runoff Depth=2.71"
Flow Length=1,700' Tc=32.6 min CN=61 Runoff=14.00 cfs 1.883 af

**Subcatchment EDA-2: EDA-2** Runoff Area=2.894 ac 0.00% Impervious Runoff Depth=2.42"
Flow Length=544' Tc=18.8 min CN=58 Runoff=5.37 cfs 0.583 af

**Link AP-1: AP-1** Inflow=14.00 cfs 1.883 af
Primary=14.00 cfs 1.883 af

**Link AP-2: AP-2** Inflow=5.37 cfs 0.583 af
Primary=5.37 cfs 0.583 af

**Total Runoff Area = 11.235 ac Runoff Volume = 2.466 af Average Runoff Depth = 2.63"**
**100.00% Pervious = 11.235 ac 0.00% Impervious = 0.000 ac**

## Summary for Subcatchment EDA-1: EDA-1

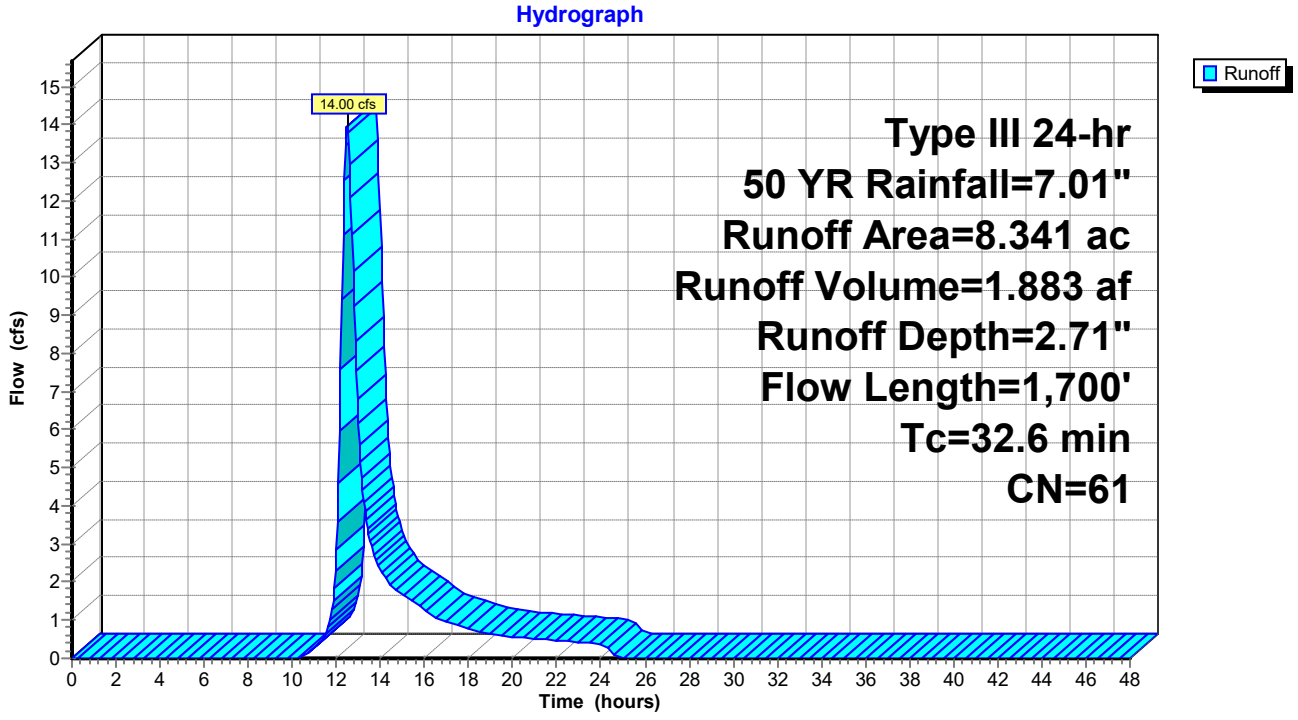
Runoff = 14.00 cfs @ 12.48 hrs, Volume= 1.883 af, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 YR Rainfall=7.01"

| Area (ac) | CN | Description |
|---|---|---|
| 6.194 | 55 | Woods, Good, HSG B |
| 2.147 | 77 | Woods, Good, HSG D |
| 8.341 | 61 | Weighted Average |
| 8.341 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 19.3 | 1,600 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 32.6 | 1,700 | Total | | | |

## Subcatchment EDA-1: EDA-1



## Summary for Subcatchment EDA-2: EDA-2

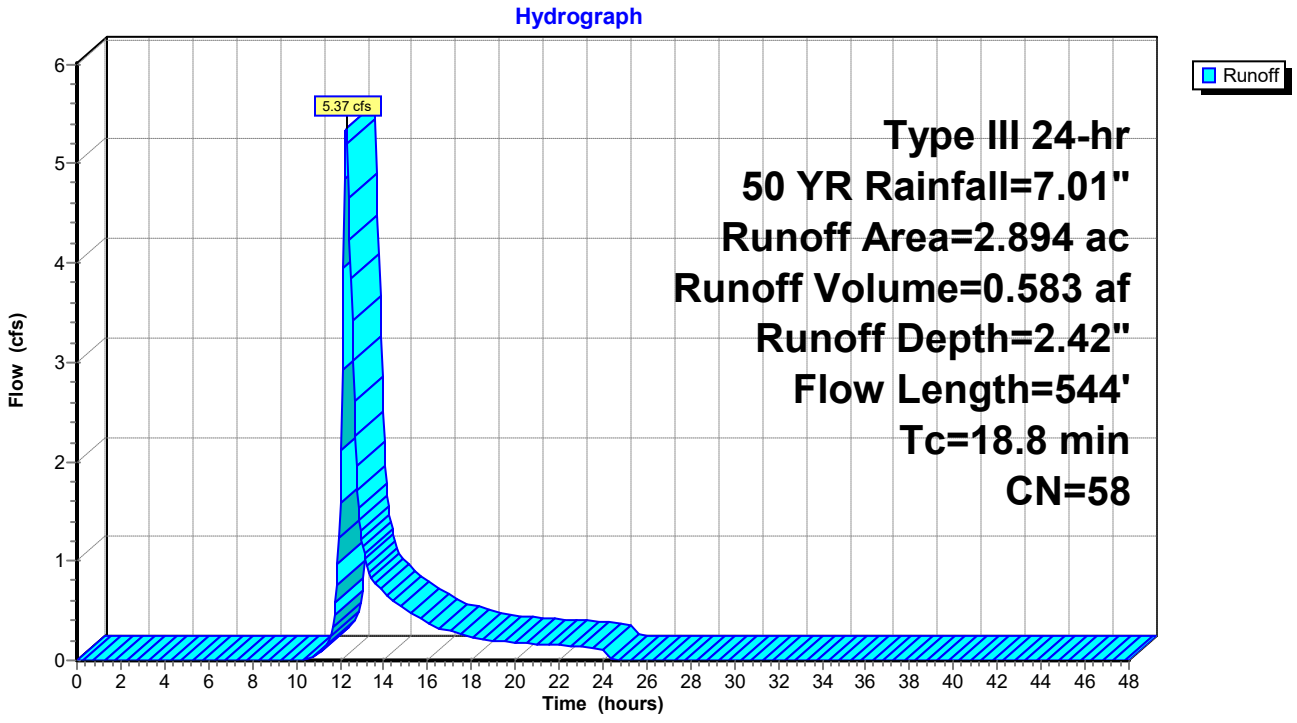
Runoff = 5.37 cfs @ 12.28 hrs, Volume= 0.583 af, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 YR Rainfall=7.01"

| Area (ac) | CN | Description |
|---|---|---|
| 2.263 | 55 | Woods, Good, HSG B |
| 0.631 | 70 | Woods, Good, HSG C |
| 2.894 | 58 | Weighted Average |
| 2.894 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 4.1 | 381 | 0.0979 | 1.56 | | **Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps |
| 18.8 | 544 | Total | | | |

## Subcatchment EDA-2: EDA-2

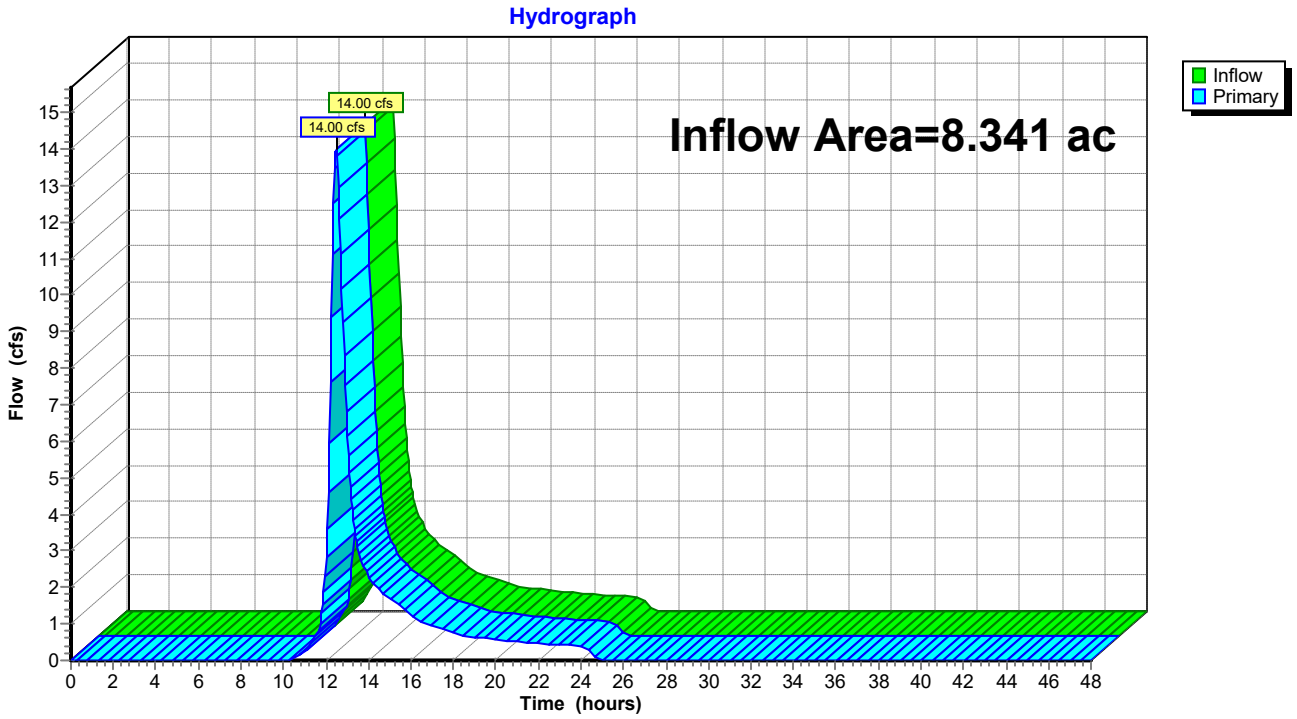


## Summary for Link AP-1: AP-1

Inflow Area = 8.341 ac, 0.00% Impervious, Inflow Depth = 2.71" for 50 YR event
Inflow = 14.00 cfs @ 12.48 hrs, Volume= 1.883 af
Primary = 14.00 cfs @ 12.48 hrs, Volume= 1.883 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-1: AP-1

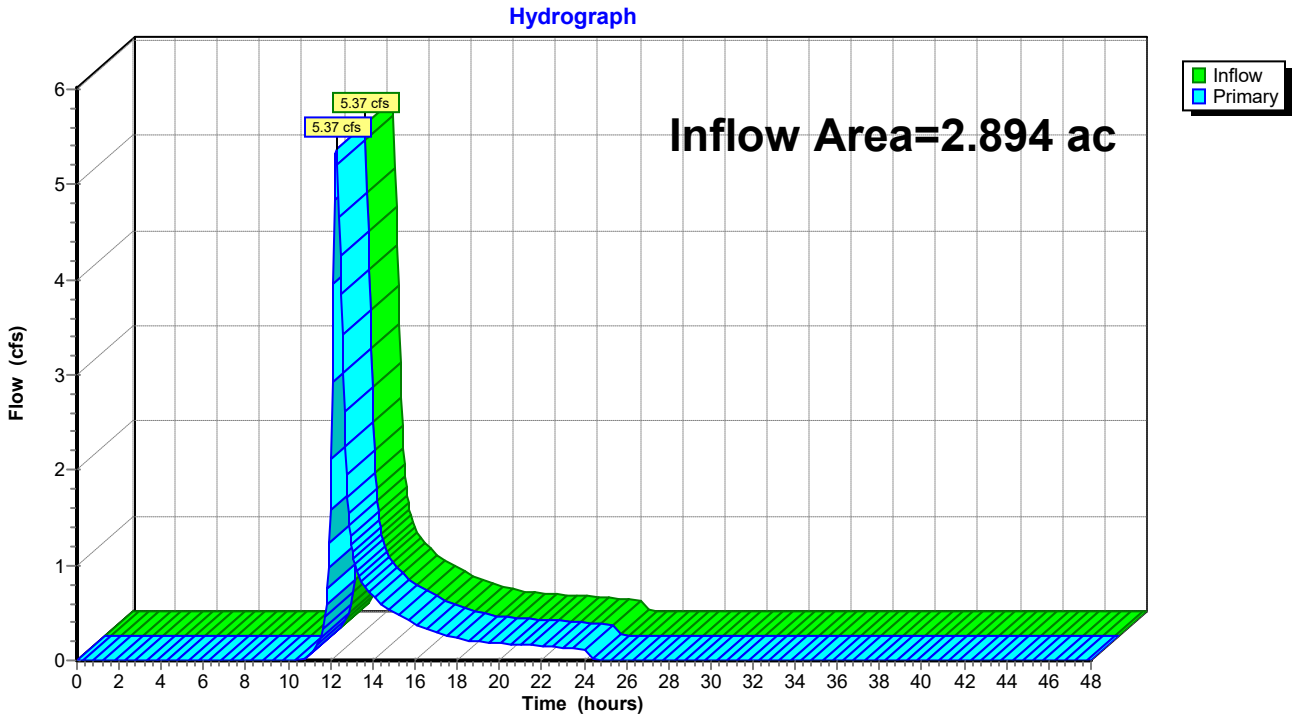


## Summary for Link AP-2: AP-2

Inflow Area = 2.894 ac, 0.00% Impervious, Inflow Depth = 2.42" for 50 YR event
Inflow = 5.37 cfs @ 12.28 hrs, Volume= 0.583 af
Primary = 5.37 cfs @ 12.28 hrs, Volume= 0.583 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment EDA-1: EDA-1** Runoff Area=8.341 ac 0.00% Impervious Runoff Depth=3.35"
Flow Length=1,700' Tc=32.6 min CN=61 Runoff=17.49 cfs 2.326 af

**Subcatchment EDA-2: EDA-2** Runoff Area=2.894 ac 0.00% Impervious Runoff Depth=3.02"
Flow Length=544' Tc=18.8 min CN=58 Runoff=6.85 cfs 0.728 af

**Link AP-1: AP-1** Inflow=17.49 cfs 2.326 af
Primary=17.49 cfs 2.326 af

**Link AP-2: AP-2** Inflow=6.85 cfs 0.728 af
Primary=6.85 cfs 0.728 af

**Total Runoff Area = 11.235 ac Runoff Volume = 3.054 af Average Runoff Depth = 3.26"**
**100.00% Pervious = 11.235 ac 0.00% Impervious = 0.000 ac**

## Summary for Subcatchment EDA-1: EDA-1

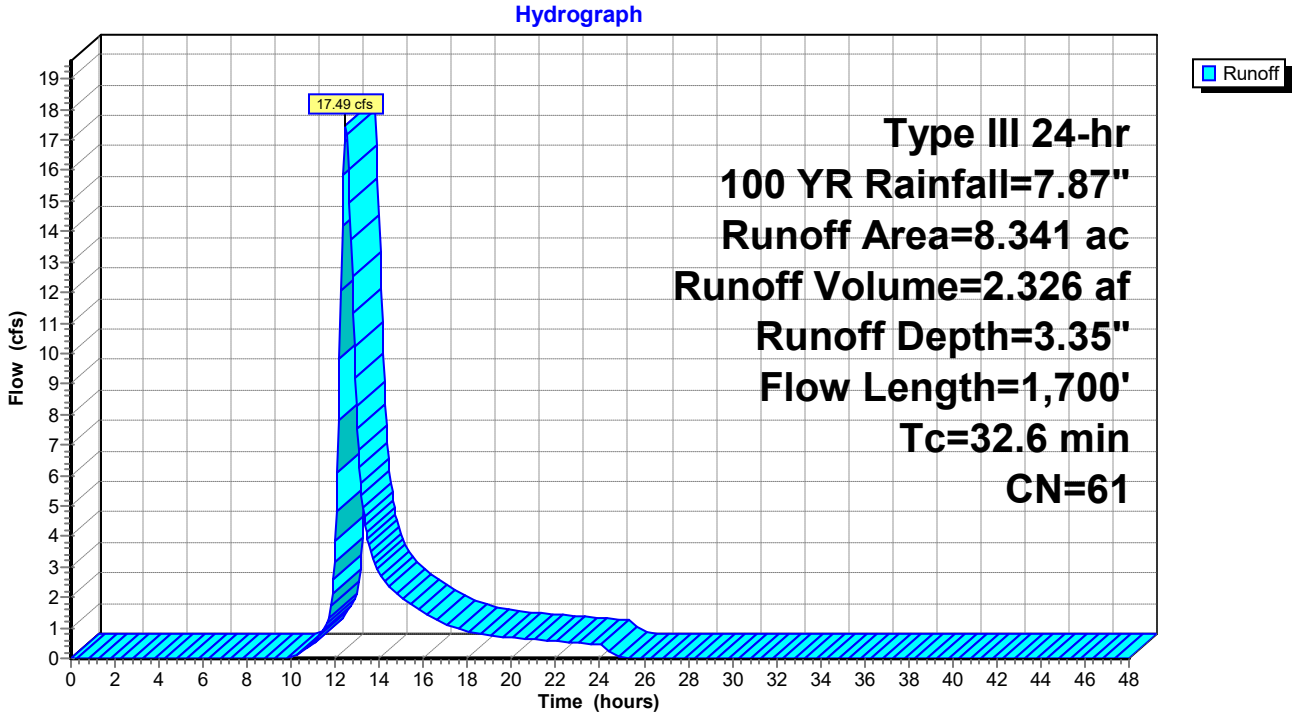
Runoff = 17.49 cfs @ 12.47 hrs, Volume= 2.326 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.87"

| Area (ac) | CN | Description |
|---|---|---|
| 6.194 | 55 | Woods, Good, HSG B |
| 2.147 | 77 | Woods, Good, HSG D |
| 8.341 | 61 | Weighted Average |
| 8.341 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 19.3 | 1,600 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 32.6 | 1,700 | Total | | | |

## Subcatchment EDA-1: EDA-1



## Summary for Subcatchment EDA-2: EDA-2

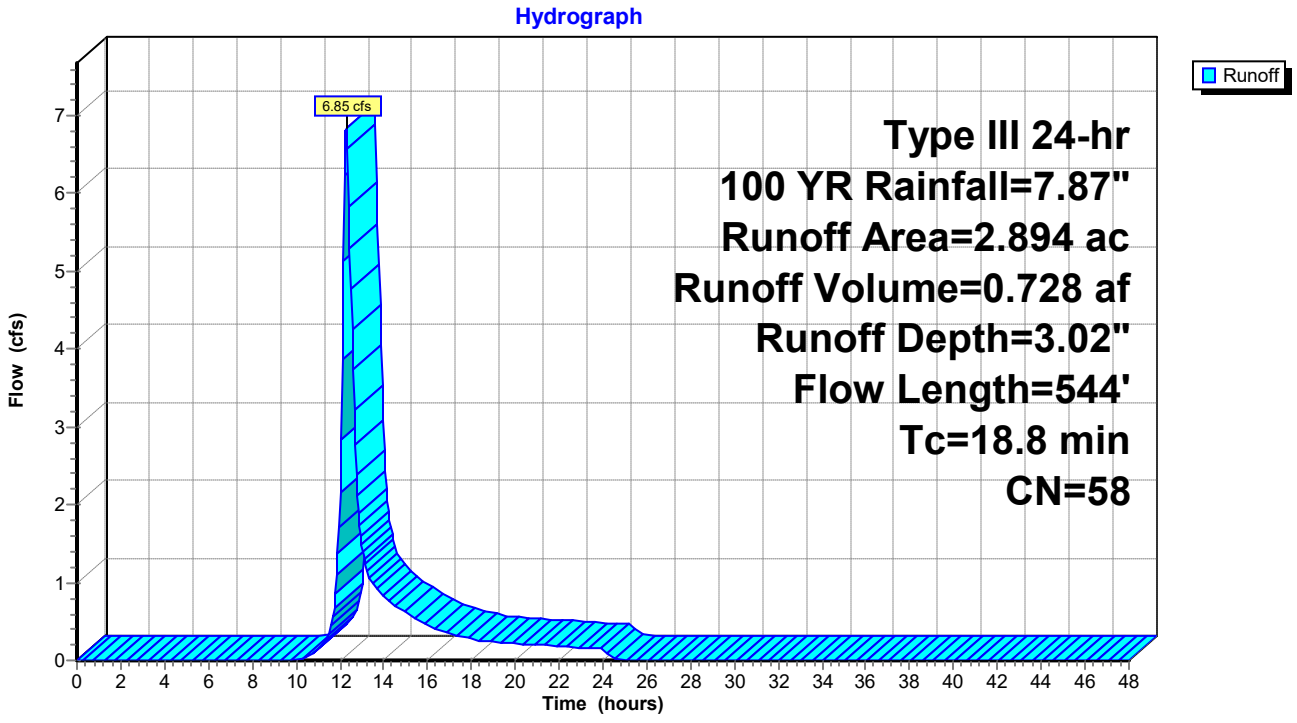
Runoff = 6.85 cfs @ 12.27 hrs, Volume= 0.728 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.87"

| Area (ac) | CN | Description |
|---|---|---|
| 2.263 | 55 | Woods, Good, HSG B |
| 0.631 | 70 | Woods, Good, HSG C |
| 2.894 | 58 | Weighted Average |
| 2.894 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 4.1 | 381 | 0.0979 | 1.56 | | **Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps |
| 18.8 | 544 | Total | | | |

## Subcatchment EDA-2: EDA-2

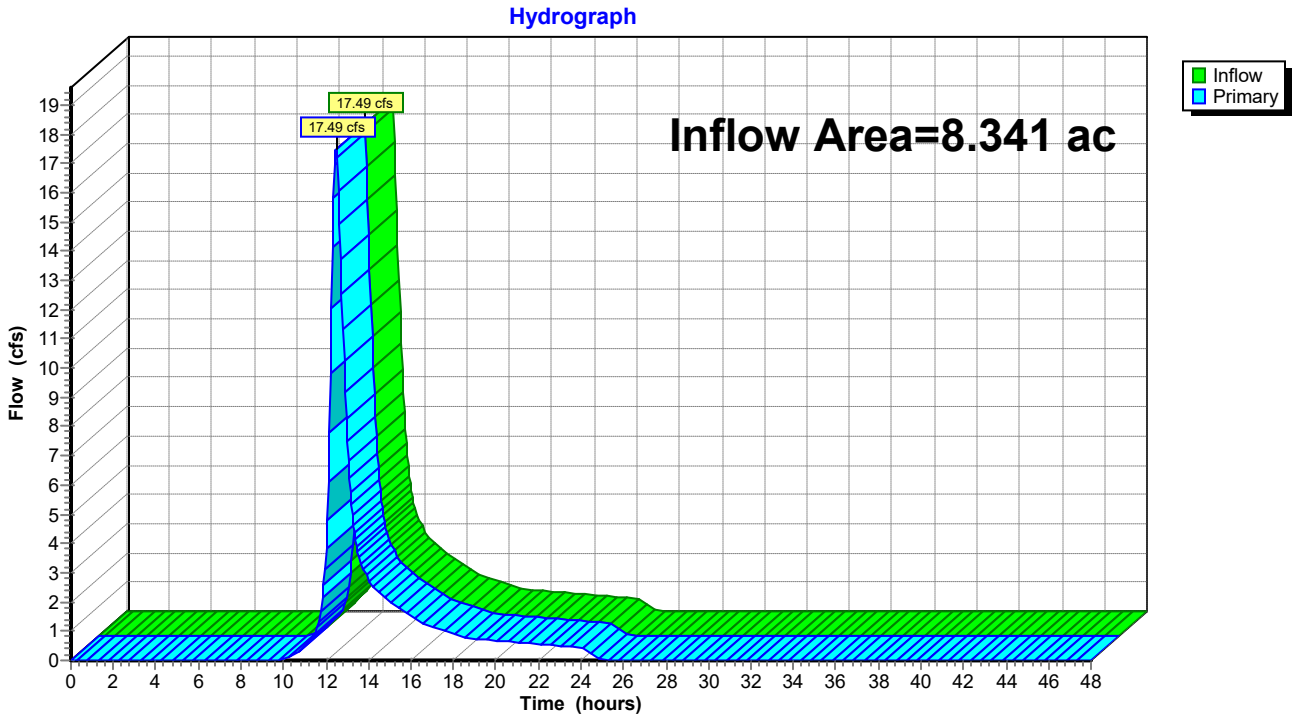


## Summary for Link AP-1: AP-1

Inflow Area = 8.341 ac, 0.00% Impervious, Inflow Depth = 3.35" for 100 YR event
Inflow = 17.49 cfs @ 12.47 hrs, Volume= 2.326 af
Primary = 17.49 cfs @ 12.47 hrs, Volume= 2.326 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-1: AP-1

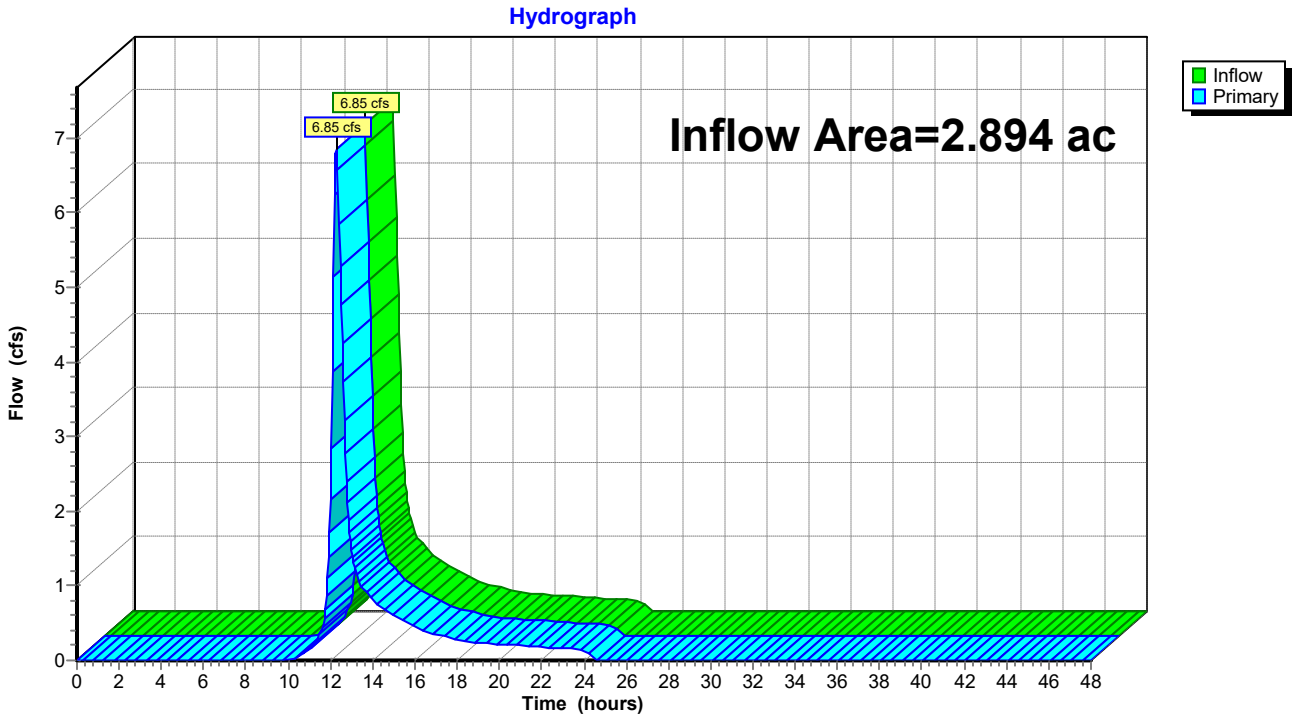


## Summary for Link AP-2: AP-2

Inflow Area = 2.894 ac, 0.00% Impervious, Inflow Depth = 3.02" for 100 YR event
Inflow = 6.85 cfs @ 12.27 hrs, Volume= 0.728 af
Primary = 6.85 cfs @ 12.27 hrs, Volume= 0.728 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



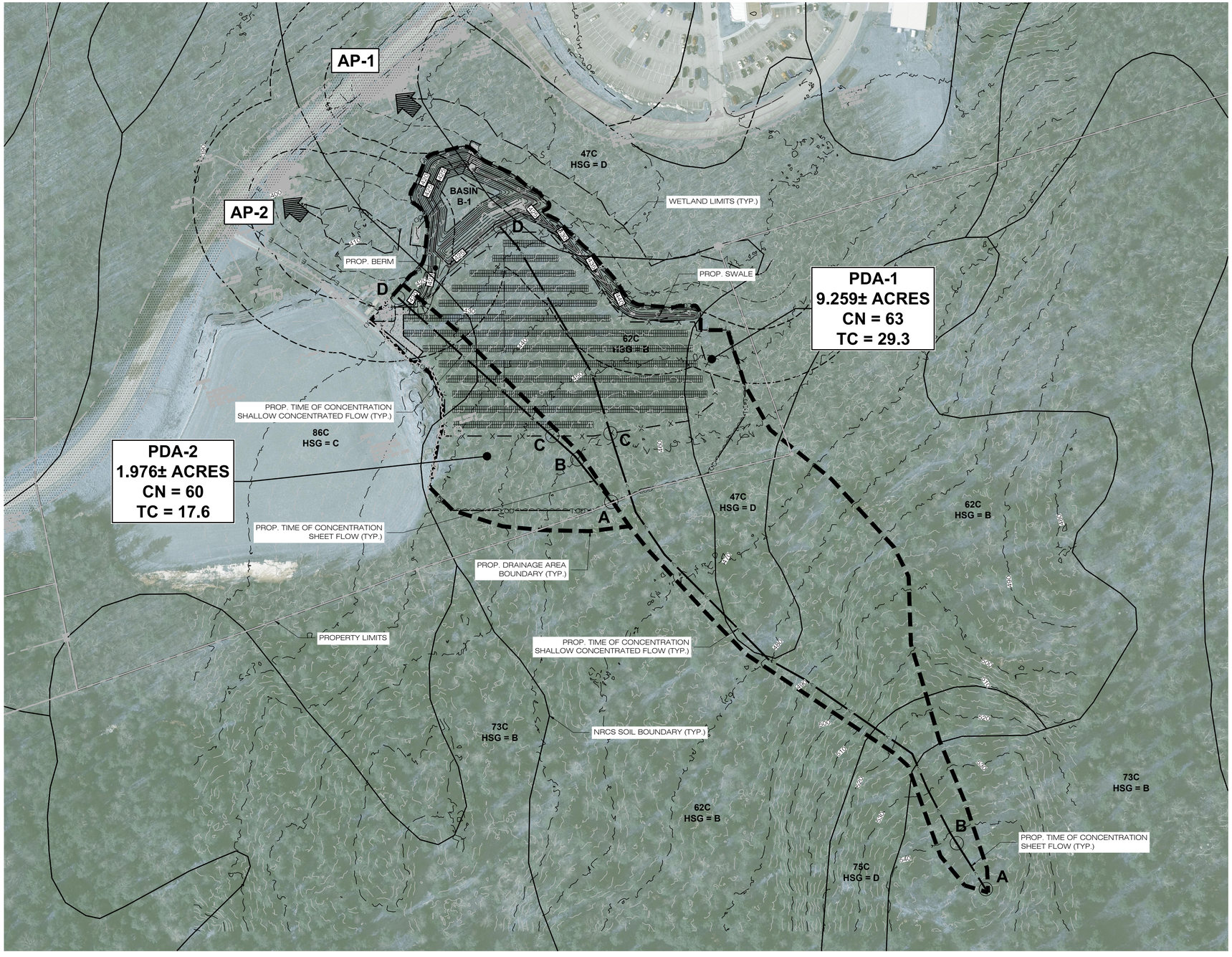
# APPENDIX C: PROPOSED DRAINAGE AREA MAP (PDA-1) & HYDROLOGIC COMPUTATION (HYDROCAD)

## PROPOSED DRAINAGE AREAS

| | TOTAL AREA (ACRES) | COMPOSITE CN | TC (MINS.) |
|---|---|---|---|
| PDA-1 | 9.259 | 63 | 29.3 |
| PDA-2 | 1.976 | 60 | 17.6 |

## PROPOSED CONDITION PEAK FLOWS

| ANALYSIS POINT | 2-YEAR (CFS) | 25-YEAR (CFS) | 50-YEAR (CFS) | 100-YEAR (CFS) |
|---|---|---|---|---|
| AP-1 | 0.64 | 3.61 | 9.07 | 15.08 |
| AP-2 | 0.53 | 3.46 | 4.48 | 5.58 |




1 PDA-1 **PROPOSED DRAINAGE AREA MAP**

SCALE : 1" = 100'-0"

100 0 50 100 200

( IN FEET ) 1 inch = 100 ft.


Greenskies
a Clean Focus company

127 WASHINGTON AVENUE
WEST BUILDING, GARDEN LEVEL
NORTH HAVEN, CT 06473

ALL-POINTS TECHNOLOGY CORPORATION

567 VAUXHAUL STREET EXTENSION - SUITE 311
WATERFORD, CT 06385 PHONE: (860)-663-1697
WWW.ALLPOINTSTECH.COM FAX: (860)-663-0935


**PERMIT SET**

| NO | DATE | REVISION |
|---|---|---|
| 0 | 06/01/21 | FOR REVIEW: KAM |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

**DESIGN PROFESSIONAL OF RECORD**

PROF: KEVIN A. MCCAFFERY P.E.
COMP: ALL-POINTS TECHNOLOGY CORPORATION
ADD: 567 VAUXHAUL STREET EXTENSION - SUITE 311 WATERFORD, CT 06385

OWNER: TOWN OF KILLINGLY BOARD OF EDUCATION
ADDRESS: 79 WESTFIELD AVE KILLINGLY, CT 06239

**KILLINGLY HS SOLAR**

SITE ADDRESS: 226 PUTNAM PIKE KILLINGLY, CT 06241

APT FILING NUMBER: CT599140

DRAWN BY: JT

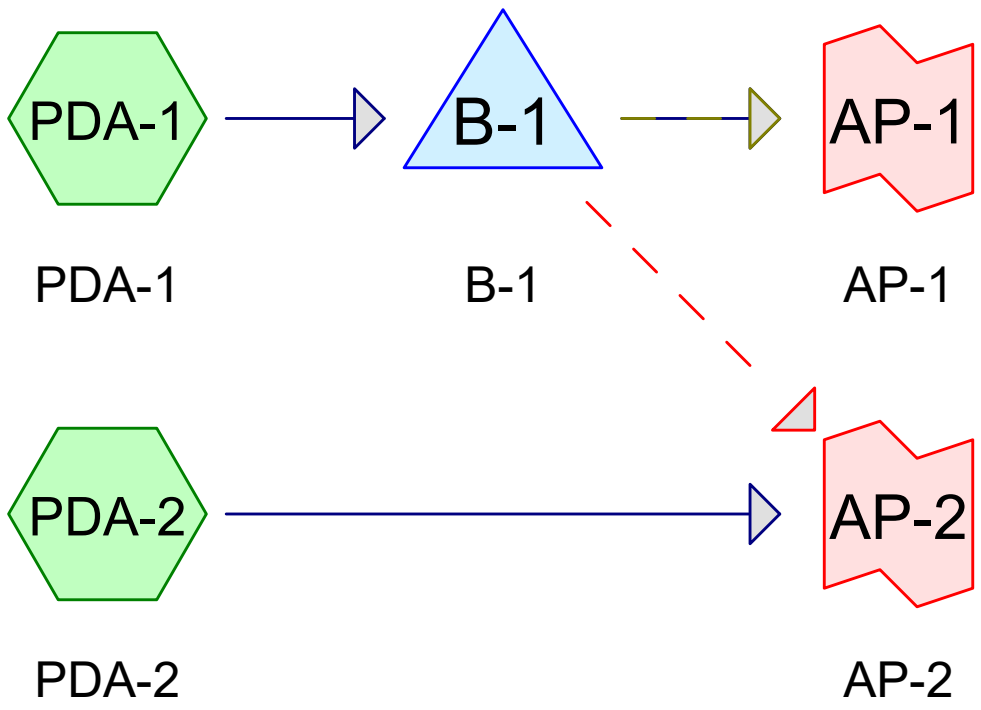
DATE: 06/01/21 CHECKED BY: KAM

SHEET TITLE:

**PROPOSED DRAINAGE AREA MAP**

SHEET NUMBER:

**PDA-1**




Subcat Reach Pond Link

**Routing Diagram for CT599140_KillinglyHS - PR - Rev0**
Prepared by Microsoft, Printed 6/1/2021

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 3.177 | 58 | Meadow, non-grazed, HSG B (PDA-1, PDA-2) |
| 0.202 | 71 | Meadow, non-grazed, HSG C (PDA-1, PDA-2) |
| 0.344 | 75 | Meadow, non-grazed, HSG C (PDA-2) |
| 0.350 | 78 | Meadow, non-grazed, HSG D (PDA-1) |
| 0.005 | 98 | Unconnected pavement, HSG C (PDA-2) |
| 0.366 | 98 | Water Surface, HSG B (PDA-1) |
| 0.102 | 98 | Water Surface, HSG D (PDA-1) |
| 4.914 | 55 | Woods, Good, HSG B (PDA-1, PDA-2) |
| 0.080 | 70 | Woods, Good, HSG C (PDA-2) |
| 1.695 | 77 | Woods, Good, HSG D (PDA-1) |
| **11.235** | **63** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 8.457 | HSG B | PDA-1, PDA-2 |
| 0.631 | HSG C | PDA-1, PDA-2 |
| 2.147 | HSG D | PDA-1 |
| 0.000 | Other | |
| **11.235** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|---|---|---|---|---|---|---|---|
| 0.000 | 3.177 | 0.546 | 0.350 | 0.000 | 4.073 | Meadow, non-grazed | PDA-1, PDA-2 |
| 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.005 | Unconnected pavement | PDA-2 |
| 0.000 | 0.366 | 0.000 | 0.102 | 0.000 | 0.468 | Water Surface | PDA-1 |
| 0.000 | 4.914 | 0.080 | 1.695 | 0.000 | 6.689 | Woods, Good | PDA-1, PDA-2 |
| **0.000** | **8.457** | **0.631** | **2.147** | **0.000** | **11.235** | **TOTAL AREA** | |

## Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | B-1 | 420.50 | 419.00 | 42.0 | 0.0357 | 0.013 | 6.0 | 0.0 | 0.0 |
| 2 | B-1 | 421.00 | 419.00 | 68.0 | 0.0294 | 0.013 | 4.0 | 0.0 | 0.0 |

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment PDA-1: PDA-1** Runoff Area=9.259 ac 5.05% Impervious Runoff Depth=0.61"
Flow Length=1,555' Tc=29.3 min CN=63 Runoff=2.96 cfs 0.472 af

**Subcatchment PDA-2: PDA-2** Runoff Area=1.976 ac 0.25% Impervious Runoff Depth=0.49"
Flow Length=544' Tc=17.6 min CN=60 Runoff=0.53 cfs 0.081 af

**Pond B-1: B-1** Peak Elev=421.49' Storage=6,166 cf Inflow=2.96 cfs 0.472 af
Primary=0.64 cfs 0.418 af Secondary=0.19 cfs 0.050 af Tertiary=0.00 cfs 0.000 af Outflow=0.83 cfs 0.469 af

**Link AP-1: AP-1** Inflow=0.64 cfs 0.418 af
Primary=0.64 cfs 0.418 af

**Link AP-2: AP-2** Inflow=0.53 cfs 0.131 af
Primary=0.53 cfs 0.131 af

**Total Runoff Area = 11.235 ac Runoff Volume = 0.552 af Average Runoff Depth = 0.59"**
**95.79% Pervious = 10.762 ac 4.21% Impervious = 0.473 ac**

## Summary for Subcatchment PDA-1: PDA-1

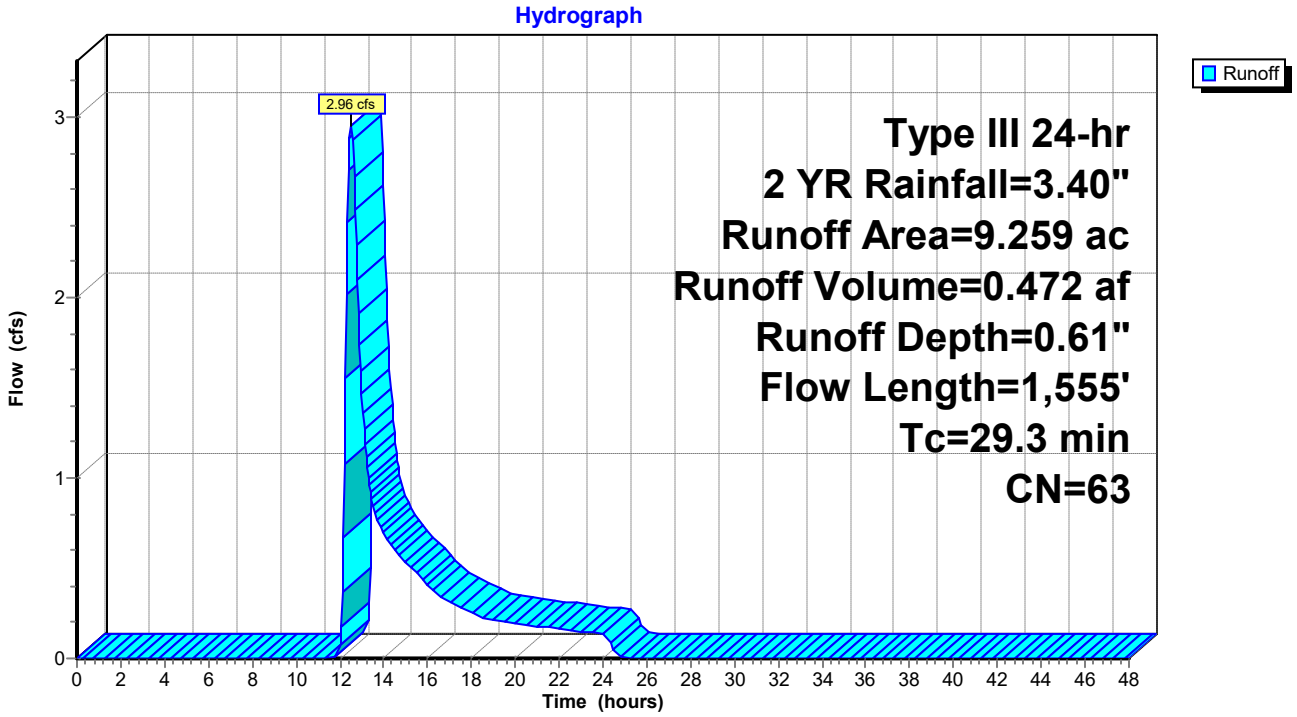
Runoff = 2.96 cfs @ 12.51 hrs, Volume= 0.472 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 3.793 | 55 | Woods, Good, HSG B |
| | 2.806 | 58 | Meadow, non-grazed, HSG B |
| * | 0.366 | 98 | Water Surface, HSG B |
| | 0.147 | 71 | Meadow, non-grazed, HSG C |
| | 1.695 | 77 | Woods, Good, HSG D |
| | 0.350 | 78 | Meadow, non-grazed, HSG D |
| | 0.102 | 98 | Water Surface, HSG D |
| | 9.259 | 63 | Weighted Average |
| | 8.791 | | 94.95% Pervious Area |
| | 0.468 | | 5.05% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B**<br>Woods: Light underbrush n= 0.400 P2= 3.18" |
| 12.3 | 1,020 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C**<br>Woodland Kv= 5.0 fps |
| 3.7 | 435 | 0.0764 | 1.93 | | **Shallow Concentrated Flow, C-D**<br>Short Grass Pasture Kv= 7.0 fps |
| 29.3 | 1,555 | Total | | | |

## Subcatchment PDA-1: PDA-1



## Summary for Subcatchment PDA-2: PDA-2

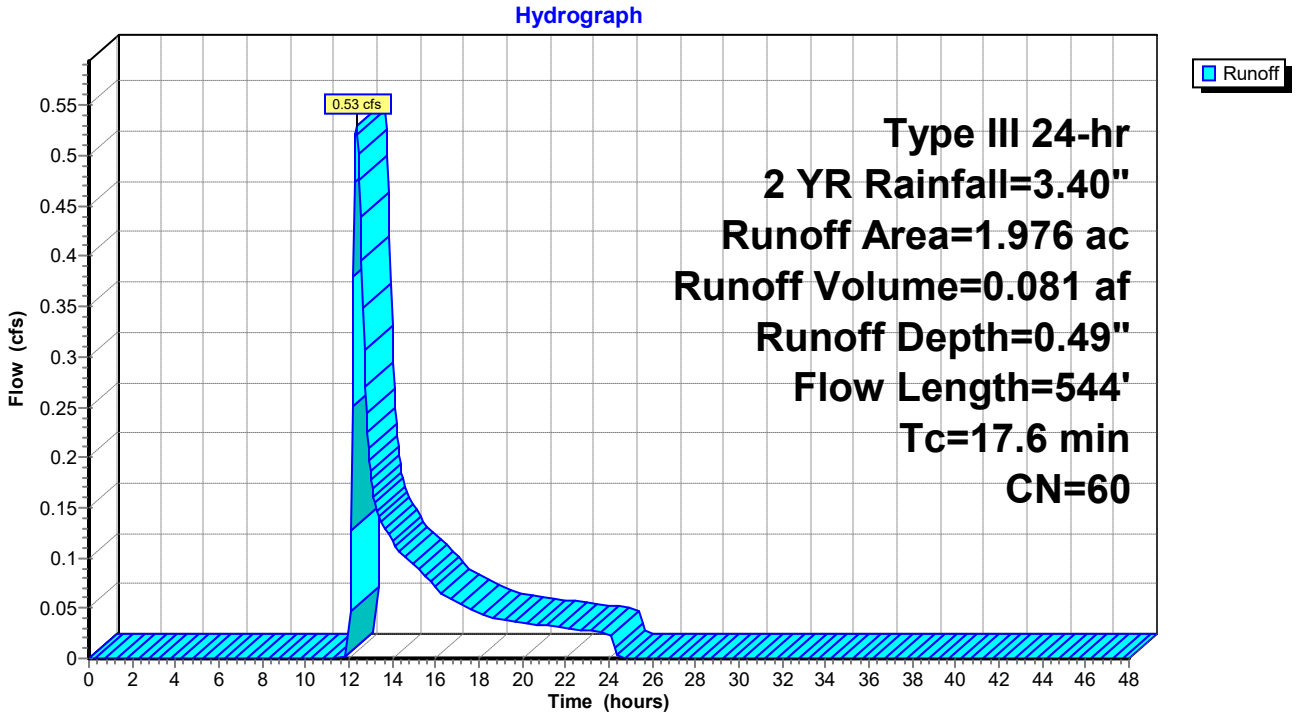
Runoff = 0.53 cfs @ 12.35 hrs, Volume= 0.081 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 1.121 | 55 | Woods, Good, HSG B |
| | 0.371 | 58 | Meadow, non-grazed, HSG B |
| | 0.080 | 70 | Woods, Good, HSG C |
| * | 0.344 | 75 | Meadow, non-grazed, HSG C |
| | 0.055 | 71 | Meadow, non-grazed, HSG C |
| * | 0.005 | 98 | Unconnected pavement, HSG C |
| | 1.976 | 60 | Weighted Average |
| | 1.971 | | 99.75% Pervious Area |
| | 0.005 | | 0.25% Impervious Area |
| | 0.005 | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 2.9 | 381 | 0.0979 | 2.19 | | **Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps |
| 17.6 | 544 | Total | | | |

## Subcatchment PDA-2: PDA-2



## Summary for Pond B-1: B-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth = 0.61" for 2 YR event
Inflow = 2.96 cfs @ 12.51 hrs, Volume= 0.472 af
Outflow = 0.83 cfs @ 13.56 hrs, Volume= 0.469 af, Atten= 72%, Lag= 62.8 min
Primary = 0.64 cfs @ 13.56 hrs, Volume= 0.418 af
Secondary = 0.19 cfs @ 13.56 hrs, Volume= 0.050 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 421.49' @ 13.56 hrs Surf.Area= 6,788 sf Storage= 6,166 cf

Plug-Flow detention time= 137.7 min calculated for 0.468 af (99% of inflow)
Center-of-Mass det. time= 135.1 min ( 1,054.7 - 919.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 420.50' | 56,868 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 420.50 | 5,695 | 337.7 | 0 | 0 | 5,695 |
| 424.00 | 9,995 | 453.8 | 27,107 | 27,107 | 13,138 |
| 426.00 | 20,376 | 613.0 | 29,761 | 56,868 | 26,695 |

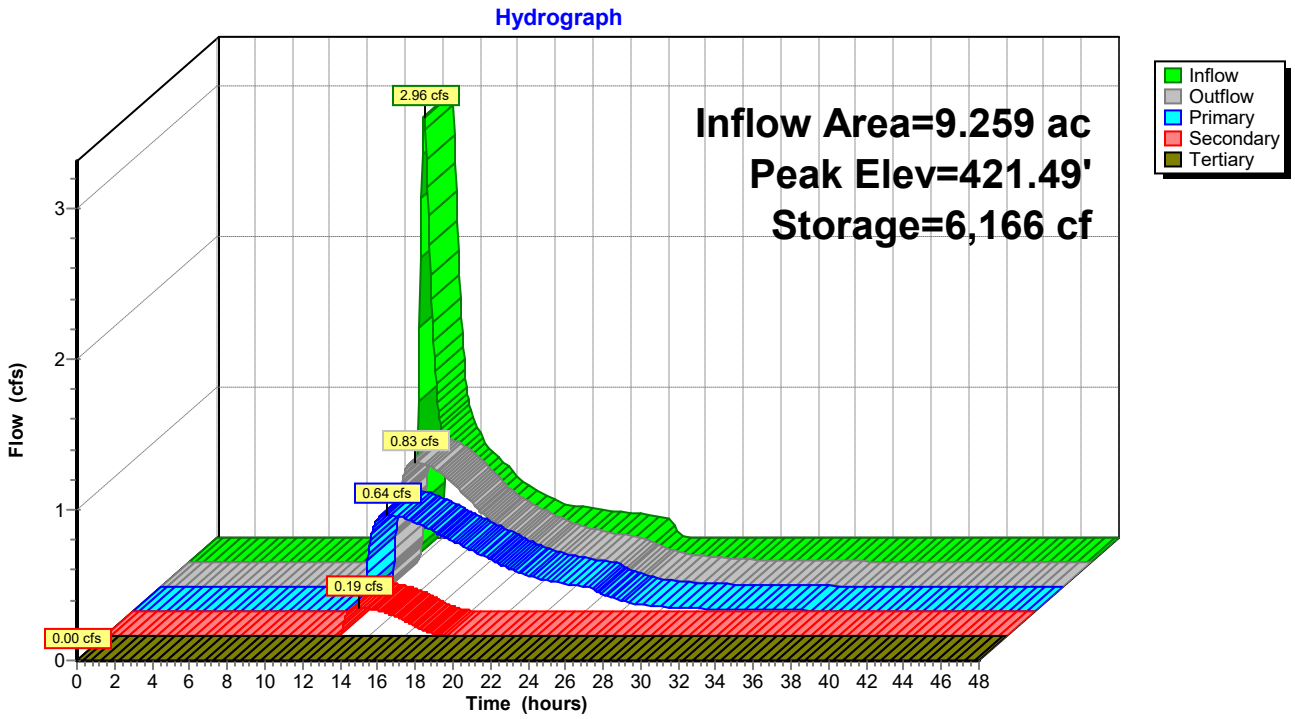
| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 420.50' | **6.0" Round Culvert**<br>L= 42.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 420.50' / 419.00' S= 0.0357 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf |
| #2 | Secondary | 421.00' | **4.0" Round Culvert**<br>L= 68.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 421.00' / 419.00' S= 0.0294 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf |
| #3 | Tertiary | 424.30' | **15.0' long x 14.2' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.65 2.68 2.70 2.65 2.64 2.65 2.64 2.63 |

**Primary OutFlow** Max=0.64 cfs @ 13.56 hrs HW=421.49' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.64 cfs @ 3.27 fps)

**Secondary OutFlow** Max=0.19 cfs @ 13.56 hrs HW=421.49' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Inlet Controls 0.19 cfs @ 2.16 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=420.50' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond B-1: B-1

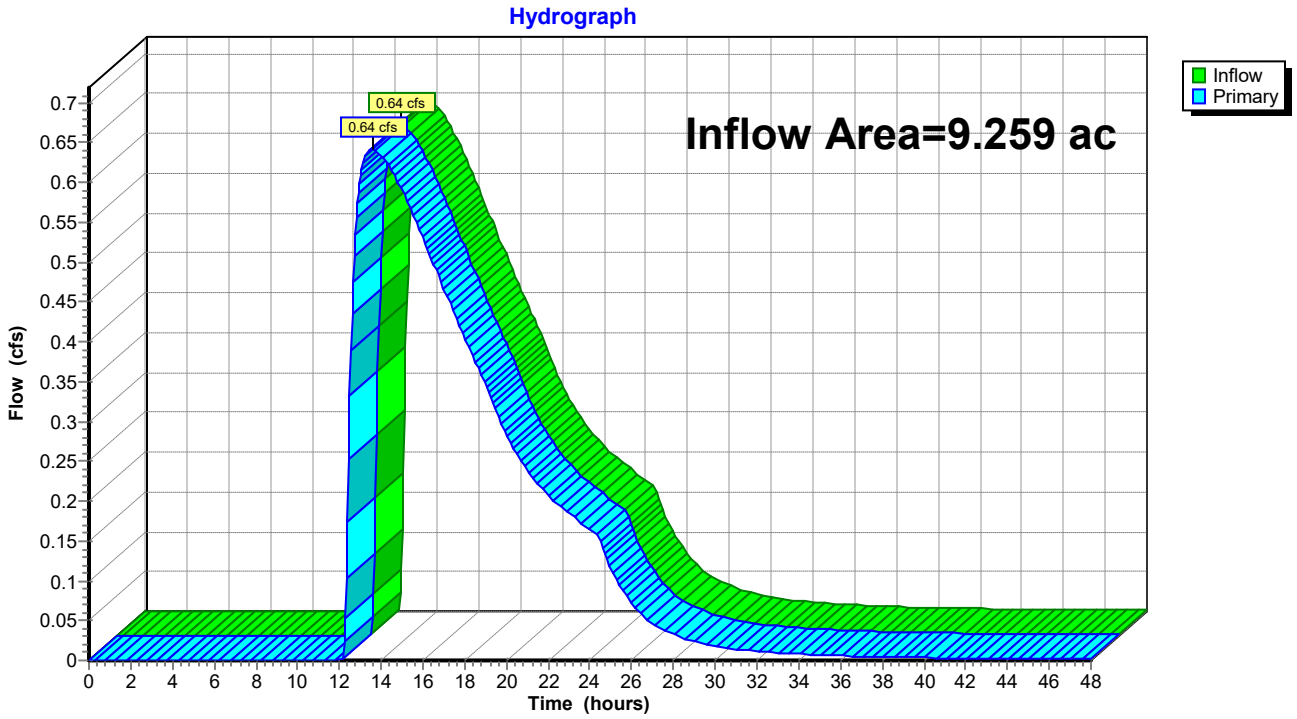

Hydrograph
Inflow Area=9.259 ac
Peak Elev=421.49'
Storage=6,166 cf
Inflow
Outflow
Primary
Secondary
Tertiary
2.96 cfs
0.83 cfs
0.64 cfs
0.19 cfs
0.00 cfs
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
0 1 2 3

## Summary for Link AP-1: AP-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth > 0.54" for 2 YR event
Inflow = 0.64 cfs @ 13.56 hrs, Volume= 0.418 af
Primary = 0.64 cfs @ 13.56 hrs, Volume= 0.418 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

### Link AP-1: AP-1

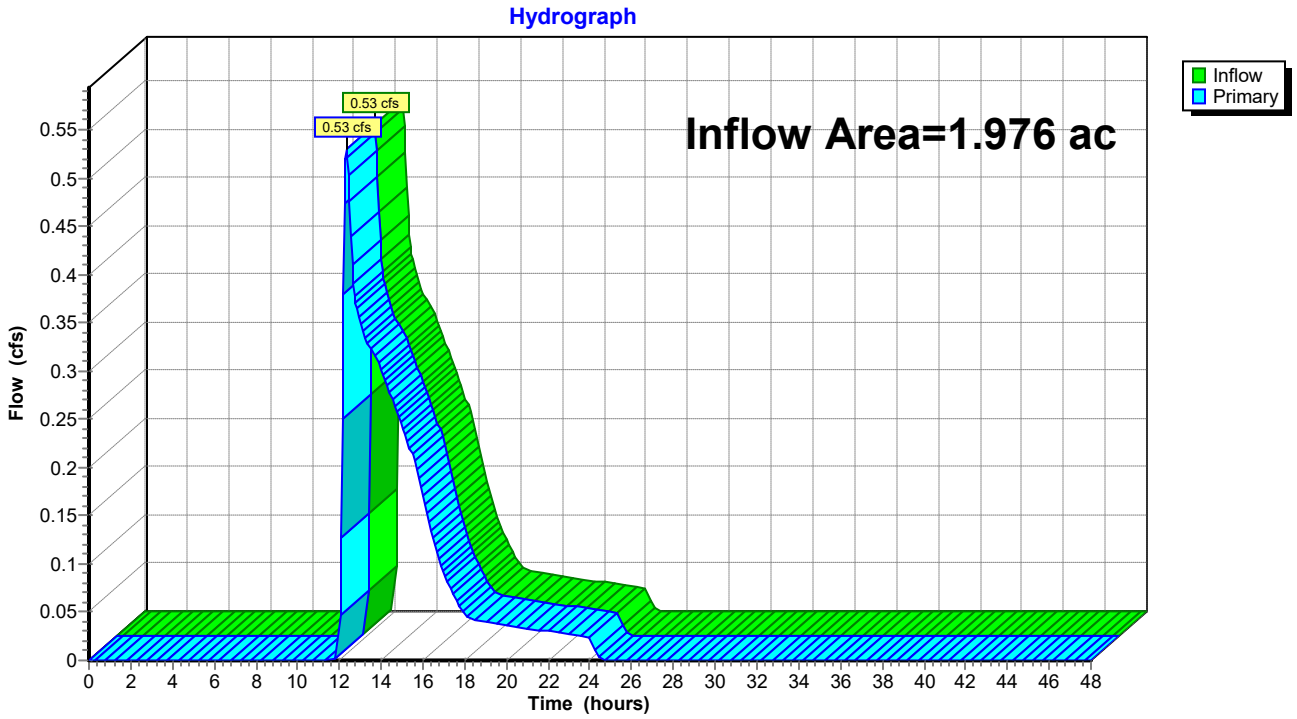


## Summary for Link AP-2: AP-2

Inflow Area = 1.976 ac, 0.25% Impervious, Inflow Depth = 0.79" for 2 YR event
Inflow = 0.53 cfs @ 12.35 hrs, Volume= 0.131 af
Primary = 0.53 cfs @ 12.35 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment PDA-1: PDA-1** Runoff Area=9.259 ac 5.05% Impervious Runoff Depth=2.32"
Flow Length=1,555' Tc=29.3 min CN=63 Runoff=13.94 cfs 1.793 af

**Subcatchment PDA-2: PDA-2** Runoff Area=1.976 ac 0.25% Impervious Runoff Depth=2.06"
Flow Length=544' Tc=17.6 min CN=60 Runoff=3.19 cfs 0.339 af

**Pond B-1: B-1** Peak Elev=424.44' Storage=31,981 cf Inflow=13.94 cfs 1.793 af
Primary=1.43 cfs 1.263 af Secondary=0.47 cfs 0.395 af Tertiary=2.18 cfs 0.131 af Outflow=4.08 cfs 1.790 af

**Link AP-1: AP-1** Inflow=3.61 cfs 1.394 af
Primary=3.61 cfs 1.394 af

**Link AP-2: AP-2** Inflow=3.46 cfs 0.735 af
Primary=3.46 cfs 0.735 af

**Total Runoff Area = 11.235 ac Runoff Volume = 2.133 af Average Runoff Depth = 2.28"**
**95.79% Pervious = 10.762 ac 4.21% Impervious = 0.473 ac**

## Summary for Subcatchment PDA-1: PDA-1

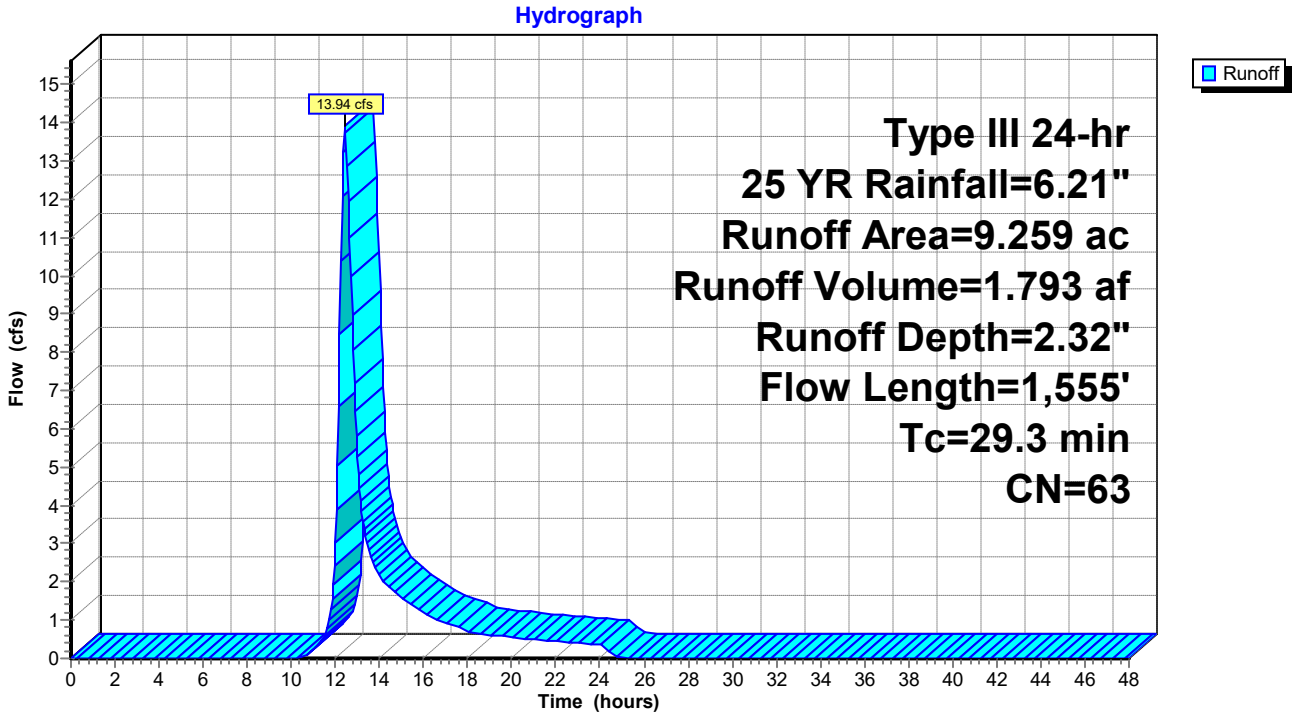
Runoff = 13.94 cfs @ 12.43 hrs, Volume= 1.793 af, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YR Rainfall=6.21"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 3.793 | 55 | Woods, Good, HSG B |
| | 2.806 | 58 | Meadow, non-grazed, HSG B |
| * | 0.366 | 98 | Water Surface, HSG B |
| | 0.147 | 71 | Meadow, non-grazed, HSG C |
| | 1.695 | 77 | Woods, Good, HSG D |
| | 0.350 | 78 | Meadow, non-grazed, HSG D |
| | 0.102 | 98 | Water Surface, HSG D |
| | 9.259 | 63 | Weighted Average |
| | 8.791 | | 94.95% Pervious Area |
| | 0.468 | | 5.05% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B**<br>Woods: Light underbrush n= 0.400 P2= 3.18" |
| 12.3 | 1,020 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C**<br>Woodland Kv= 5.0 fps |
| 3.7 | 435 | 0.0764 | 1.93 | | **Shallow Concentrated Flow, C-D**<br>Short Grass Pasture Kv= 7.0 fps |
| 29.3 | 1,555 | Total | | | |

## Subcatchment PDA-1: PDA-1



## Summary for Subcatchment PDA-2: PDA-2

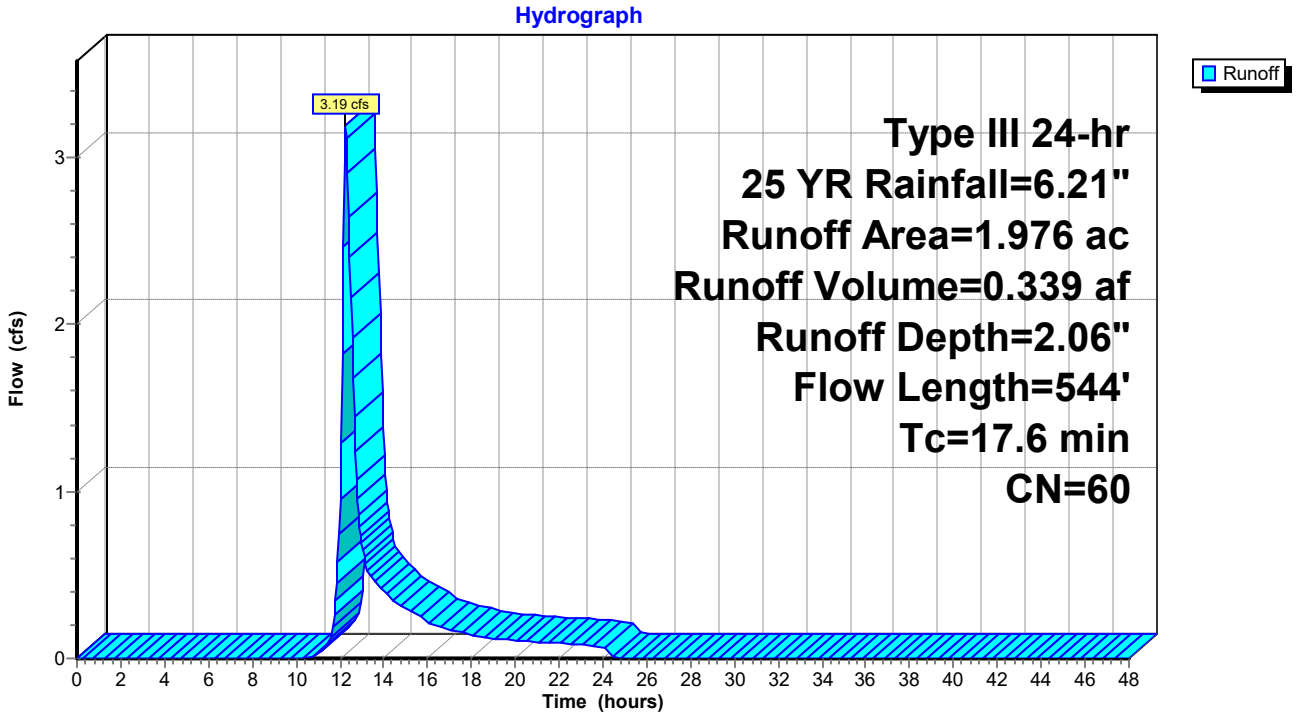
Runoff = 3.19 cfs @ 12.26 hrs, Volume= 0.339 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YR Rainfall=6.21"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 1.121 | 55 | Woods, Good, HSG B |
| | 0.371 | 58 | Meadow, non-grazed, HSG B |
| | 0.080 | 70 | Woods, Good, HSG C |
| * | 0.344 | 75 | Meadow, non-grazed, HSG C |
| | 0.055 | 71 | Meadow, non-grazed, HSG C |
| * | 0.005 | 98 | Unconnected pavement, HSG C |
| | 1.976 | 60 | Weighted Average |
| | 1.971 | | 99.75% Pervious Area |
| | 0.005 | | 0.25% Impervious Area |
| | 0.005 | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 2.9 | 381 | 0.0979 | 2.19 | | **Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps |
| 17.6 | 544 | Total | | | |

## Subcatchment PDA-2: PDA-2



## Summary for Pond B-1: B-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth = 2.32" for 25 YR event
Inflow = 13.94 cfs @ 12.43 hrs, Volume= 1.793 af
Outflow = 4.08 cfs @ 13.16 hrs, Volume= 1.790 af, Atten= 71%, Lag= 43.6 min
Primary = 1.43 cfs @ 13.16 hrs, Volume= 1.263 af
Secondary = 0.47 cfs @ 13.16 hrs, Volume= 0.395 af
Tertiary = 2.18 cfs @ 13.16 hrs, Volume= 0.131 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 424.44' @ 13.16 hrs Surf.Area= 11,984 sf Storage= 31,981 cf

Plug-Flow detention time= 197.4 min calculated for 1.790 af (100% of inflow)
Center-of-Mass det. time= 196.1 min ( 1,070.9 - 874.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 420.50' | 56,868 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 420.50 | 5,695 | 337.7 | 0 | 0 | 5,695 |
| 424.00 | 9,995 | 453.8 | 27,107 | 27,107 | 13,138 |
| 426.00 | 20,376 | 613.0 | 29,761 | 56,868 | 26,695 |

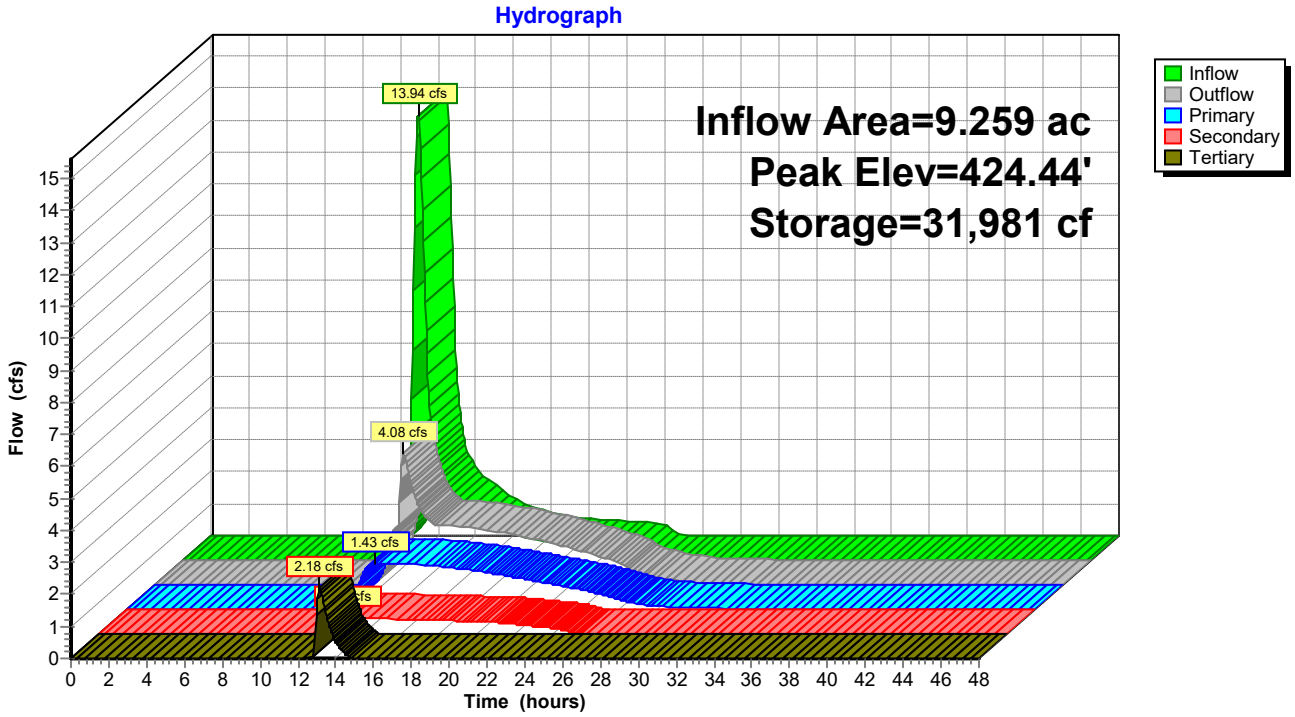
| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 420.50' | **6.0" Round Culvert**<br>L= 42.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 420.50' / 419.00' S= 0.0357 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf |
| #2 | Secondary | 421.00' | **4.0" Round Culvert**<br>L= 68.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 421.00' / 419.00' S= 0.0294 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf |
| #3 | Tertiary | 424.30' | **15.0' long x 14.2' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.65 2.68 2.70 2.65 2.64 2.65 2.64 2.63 |

**Primary OutFlow** Max=1.43 cfs @ 13.16 hrs HW=424.44' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.43 cfs @ 7.31 fps)

**Secondary OutFlow** Max=0.47 cfs @ 13.16 hrs HW=424.44' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Barrel Controls 0.47 cfs @ 5.44 fps)

**Tertiary OutFlow** Max=2.17 cfs @ 13.16 hrs HW=424.44' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 2.17 cfs @ 1.00 fps)

## Pond B-1: B-1

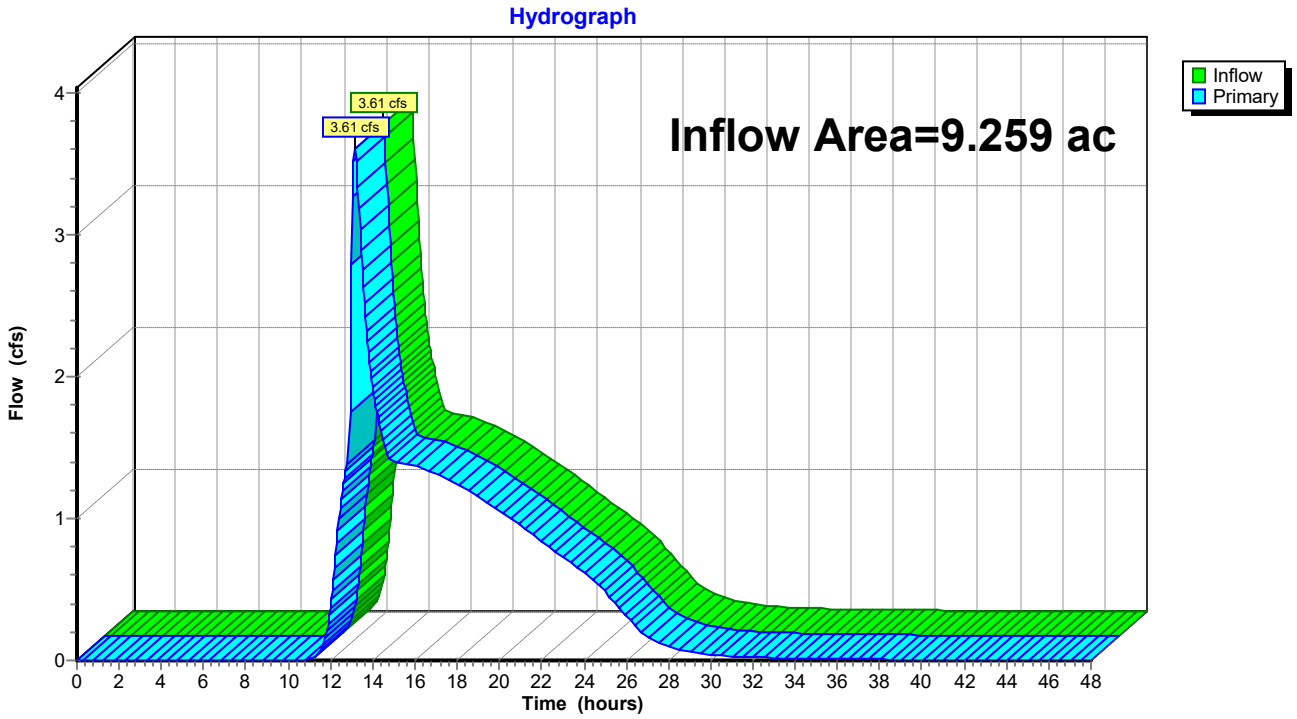

Hydrograph
Inflow Area=9.259 ac
Peak Elev=424.44'
Storage=31,981 cf
13.94 cfs
4.08 cfs
1.43 cfs
2.18 cfs
Inflow
Outflow
Primary
Secondary
Tertiary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

## Summary for Link AP-1: AP-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth > 1.81" for 25 YR event
Inflow = 3.61 cfs @ 13.16 hrs, Volume= 1.394 af
Primary = 3.61 cfs @ 13.16 hrs, Volume= 1.394 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-1: AP-1

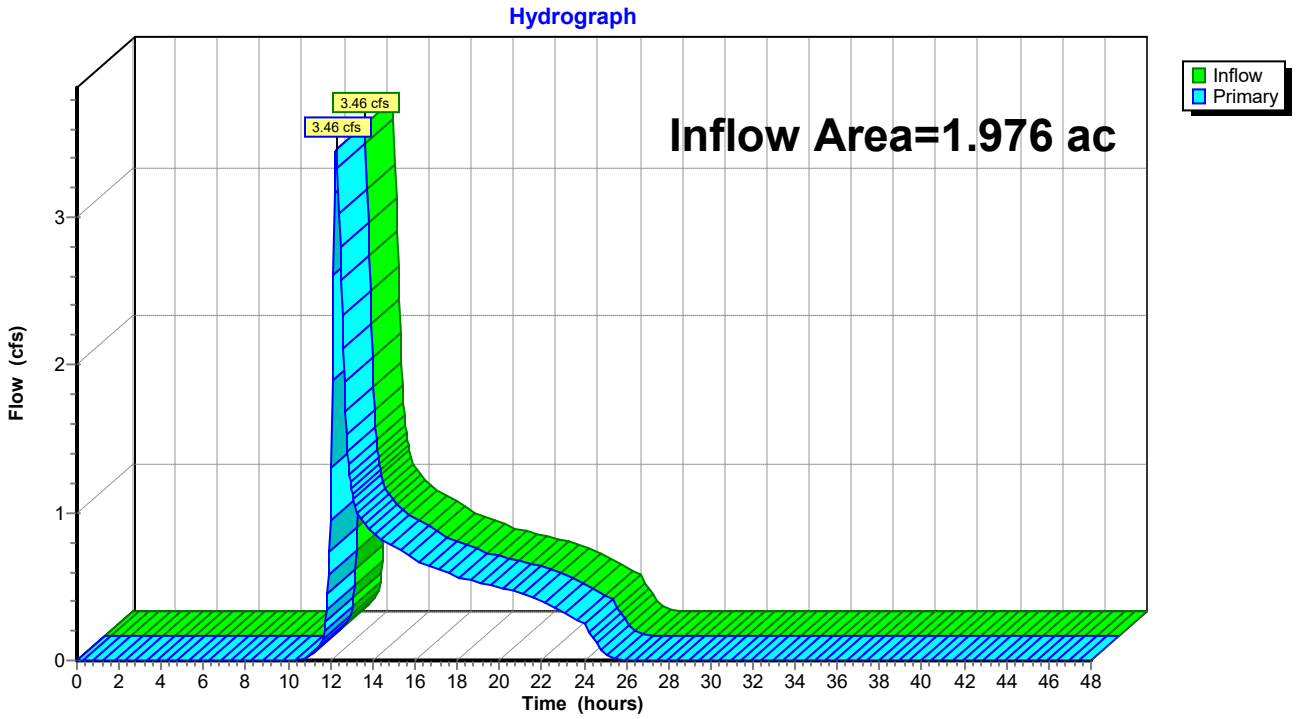


## Summary for Link AP-2: AP-2

Inflow Area = 1.976 ac, 0.25% Impervious, Inflow Depth = 4.46" for 25 YR event
Inflow = 3.46 cfs @ 12.27 hrs, Volume= 0.735 af
Primary = 3.46 cfs @ 12.27 hrs, Volume= 0.735 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment PDA-1: PDA-1** Runoff Area=9.259 ac 5.05% Impervious Runoff Depth=2.91"
Flow Length=1,555' Tc=29.3 min CN=63 Runoff=17.68 cfs 2.244 af

**Subcatchment PDA-2: PDA-2** Runoff Area=1.976 ac 0.25% Impervious Runoff Depth=2.61"
Flow Length=544' Tc=17.6 min CN=60 Runoff=4.13 cfs 0.430 af

**Pond B-1: B-1** Peak Elev=424.63' Storage=34,296 cf Inflow=17.68 cfs 2.244 af
Primary=1.47 cfs 1.368 af Secondary=0.48 cfs 0.430 af Tertiary=7.60 cfs 0.442 af Outflow=9.56 cfs 2.240 af

**Link AP-1: AP-1** Inflow=9.07 cfs 1.810 af
Primary=9.07 cfs 1.810 af

**Link AP-2: AP-2** Inflow=4.48 cfs 0.860 af
Primary=4.48 cfs 0.860 af

**Total Runoff Area = 11.235 ac Runoff Volume = 2.674 af Average Runoff Depth = 2.86"**
**95.79% Pervious = 10.762 ac 4.21% Impervious = 0.473 ac**

## Summary for Subcatchment PDA-1: PDA-1

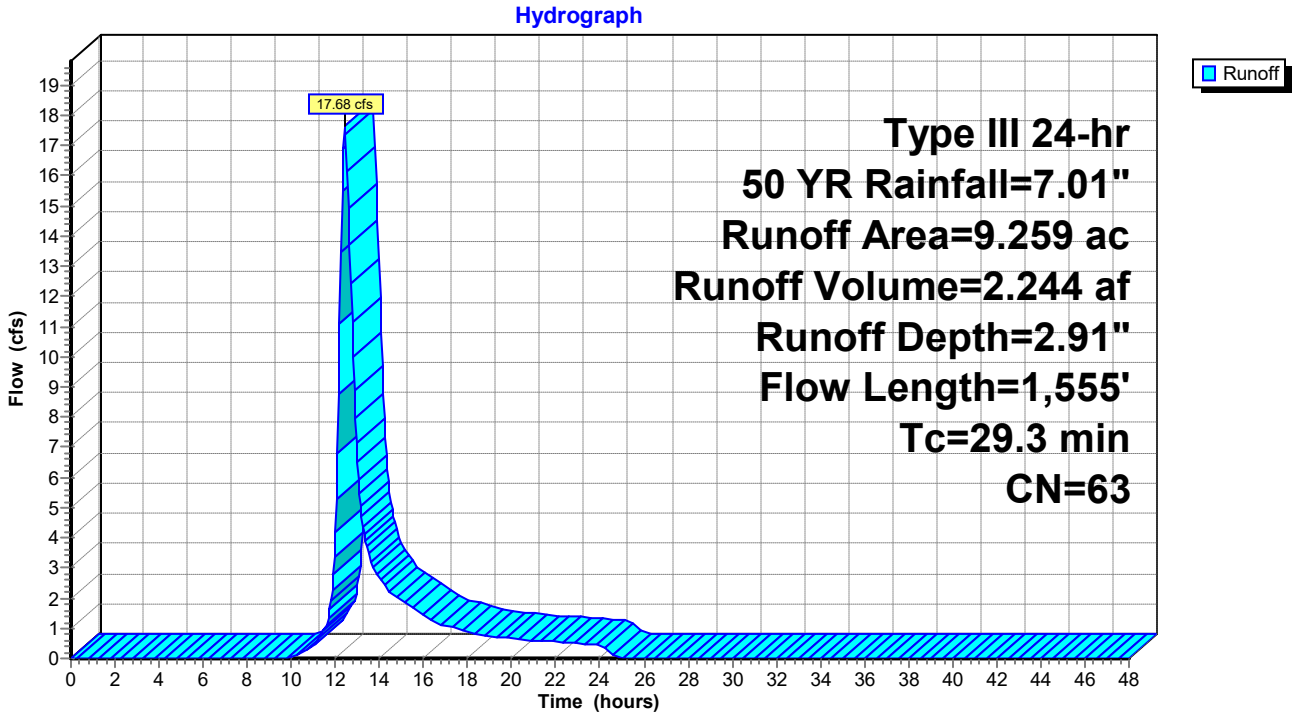
Runoff = 17.68 cfs @ 12.43 hrs, Volume= 2.244 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 YR Rainfall=7.01"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 3.793 | 55 | Woods, Good, HSG B |
| | 2.806 | 58 | Meadow, non-grazed, HSG B |
| * | 0.366 | 98 | Water Surface, HSG B |
| | 0.147 | 71 | Meadow, non-grazed, HSG C |
| | 1.695 | 77 | Woods, Good, HSG D |
| | 0.350 | 78 | Meadow, non-grazed, HSG D |
| | 0.102 | 98 | Water Surface, HSG D |
| | 9.259 | 63 | Weighted Average |
| | 8.791 | | 94.95% Pervious Area |
| | 0.468 | | 5.05% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B**<br>Woods: Light underbrush n= 0.400 P2= 3.18" |
| 12.3 | 1,020 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C**<br>Woodland Kv= 5.0 fps |
| 3.7 | 435 | 0.0764 | 1.93 | | **Shallow Concentrated Flow, C-D**<br>Short Grass Pasture Kv= 7.0 fps |
| 29.3 | 1,555 | Total | | | |

## Subcatchment PDA-1: PDA-1



## Summary for Subcatchment PDA-2: PDA-2

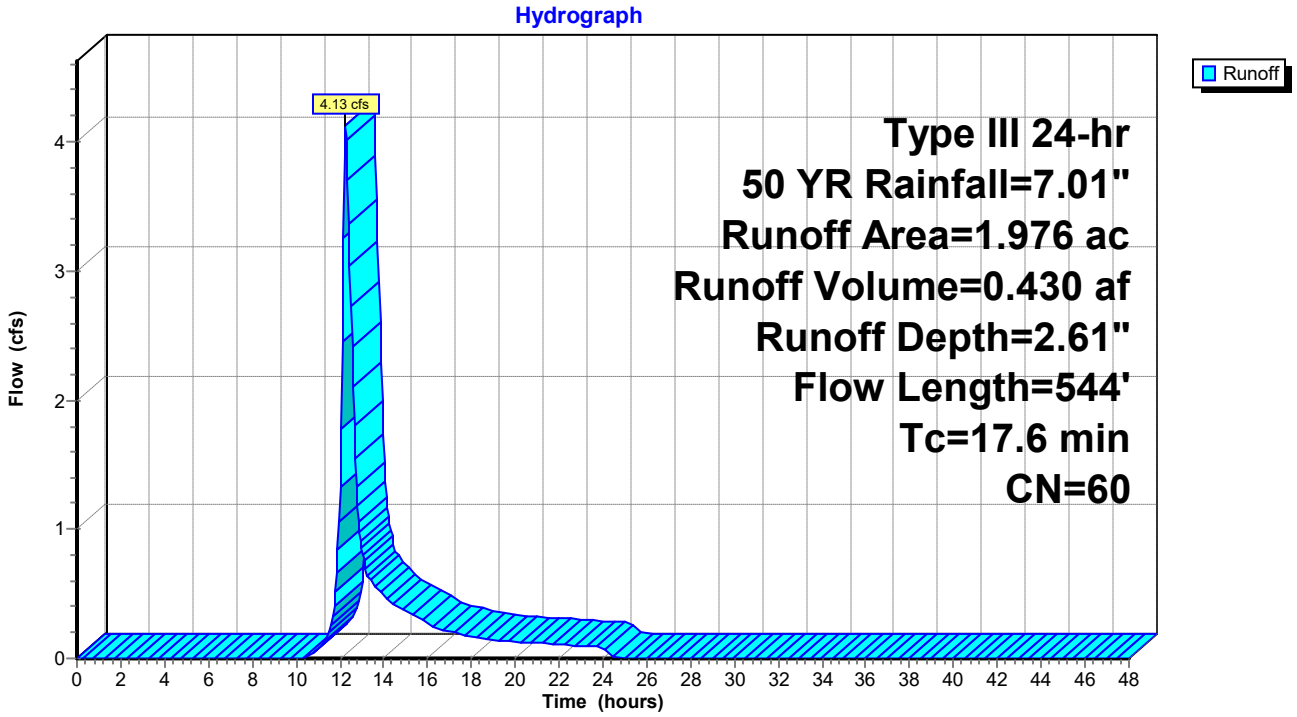
Runoff = 4.13 cfs @ 12.26 hrs, Volume= 0.430 af, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 YR Rainfall=7.01"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 1.121 | 55 | Woods, Good, HSG B |
| | 0.371 | 58 | Meadow, non-grazed, HSG B |
| | 0.080 | 70 | Woods, Good, HSG C |
| * | 0.344 | 75 | Meadow, non-grazed, HSG C |
| | 0.055 | 71 | Meadow, non-grazed, HSG C |
| * | 0.005 | 98 | Unconnected pavement, HSG C |
| | 1.976 | 60 | Weighted Average |
| | 1.971 | | 99.75% Pervious Area |
| | 0.005 | | 0.25% Impervious Area |
| | 0.005 | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 2.9 | 381 | 0.0979 | 2.19 | | **Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps |
| 17.6 | 544 | Total | | | |

## Subcatchment PDA-2: PDA-2



## Summary for Pond B-1: B-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth = 2.91" for 50 YR event
Inflow = 17.68 cfs @ 12.43 hrs, Volume= 2.244 af
Outflow = 9.56 cfs @ 12.82 hrs, Volume= 2.240 af, Atten= 46%, Lag= 23.8 min
Primary = 1.47 cfs @ 12.82 hrs, Volume= 1.368 af
Secondary = 0.48 cfs @ 12.82 hrs, Volume= 0.430 af
Tertiary = 7.60 cfs @ 12.82 hrs, Volume= 0.442 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 424.63' @ 12.82 hrs Surf.Area= 12,872 sf Storage= 34,296 cf

Plug-Flow detention time= 174.6 min calculated for 2.238 af (100% of inflow)
Center-of-Mass det. time= 174.5 min ( 1,042.6 - 868.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 420.50' | 56,868 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 420.50 | 5,695 | 337.7 | 0 | 0 | 5,695 |
| 424.00 | 9,995 | 453.8 | 27,107 | 27,107 | 13,138 |
| 426.00 | 20,376 | 613.0 | 29,761 | 56,868 | 26,695 |

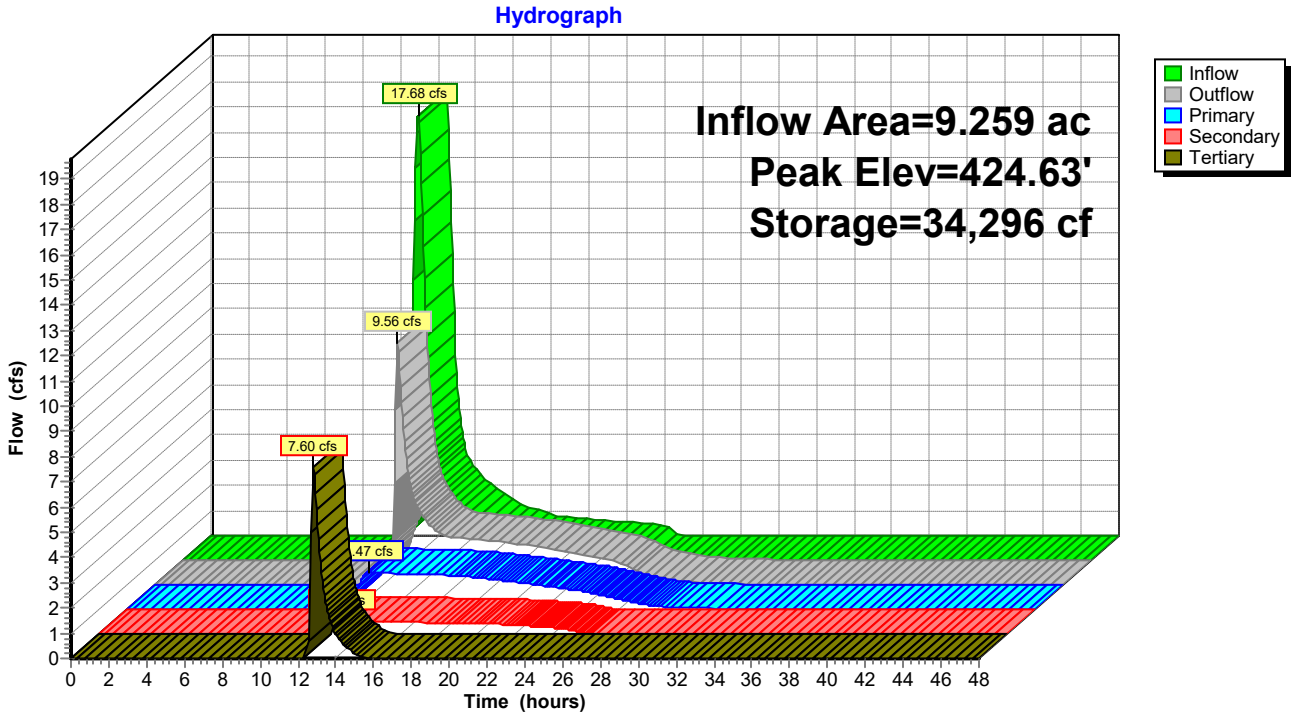
| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 420.50' | **6.0" Round Culvert**<br>L= 42.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 420.50' / 419.00' S= 0.0357 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf |
| #2 | Secondary | 421.00' | **4.0" Round Culvert**<br>L= 68.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 421.00' / 419.00' S= 0.0294 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf |
| #3 | Tertiary | 424.30' | **15.0' long x 14.2' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.65 2.68 2.70 2.65 2.64 2.65 2.64 2.63 |

**Primary OutFlow** Max=1.47 cfs @ 12.82 hrs HW=424.63' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.47 cfs @ 7.49 fps)

**Secondary OutFlow** Max=0.48 cfs @ 12.82 hrs HW=424.63' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Barrel Controls 0.48 cfs @ 5.53 fps)

**Tertiary OutFlow** Max=7.51 cfs @ 12.82 hrs HW=424.63' TW=0.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Weir Controls 7.51 cfs @ 1.53 fps)

## Pond B-1: B-1

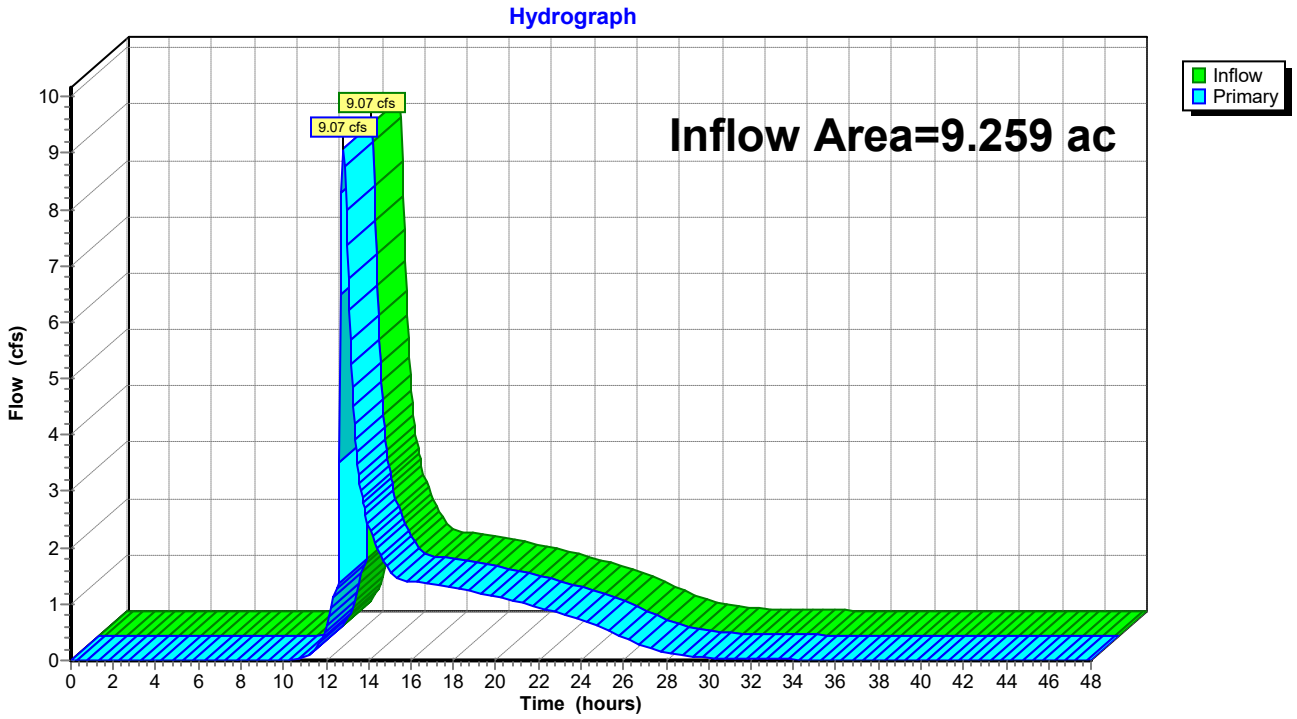

Hydrograph
Inflow Area=9.259 ac
Peak Elev=424.63'
Storage=34,296 cf
17.68 cfs
9.56 cfs
7.60 cfs
Inflow
Outflow
Primary
Secondary
Tertiary
Flow (cfs)
Time (hours)

## Summary for Link AP-1: AP-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth > 2.35" for 50 YR event
Inflow = 9.07 cfs @ 12.82 hrs, Volume= 1.810 af
Primary = 9.07 cfs @ 12.82 hrs, Volume= 1.810 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-1: AP-1

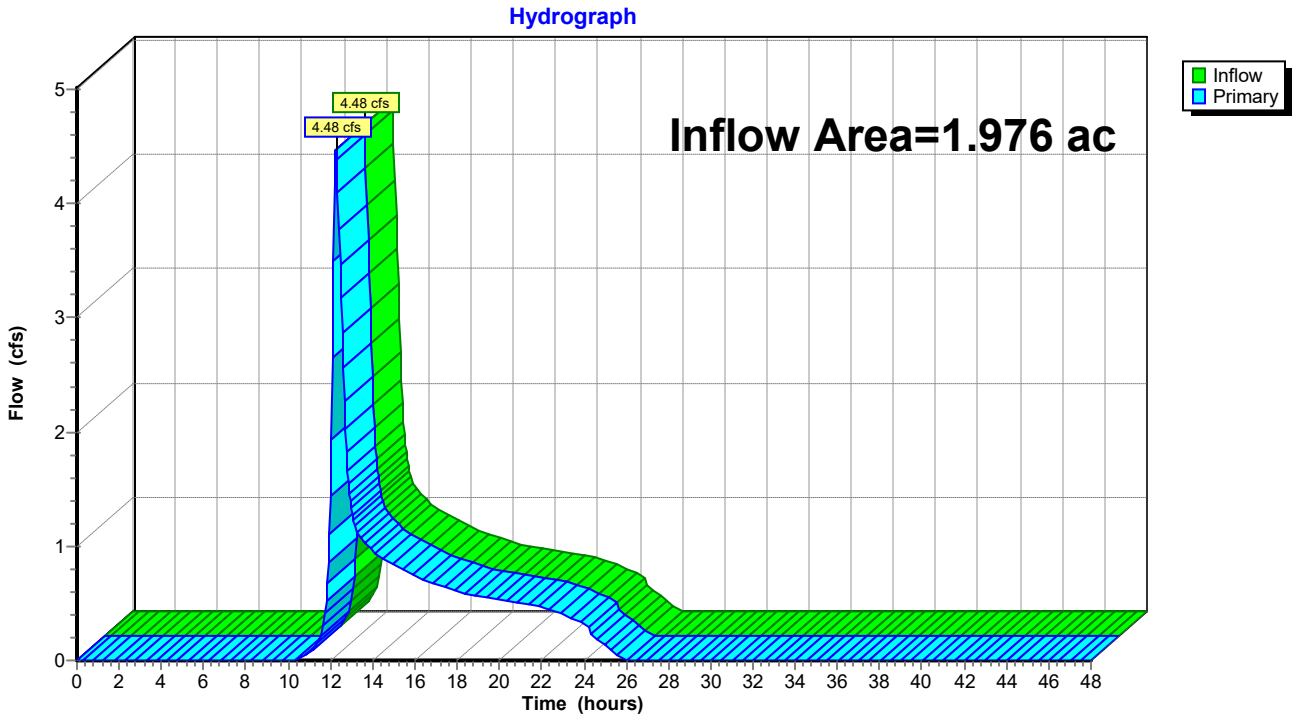


## Summary for Link AP-2: AP-2

Inflow Area = 1.976 ac, 0.25% Impervious, Inflow Depth = 5.22" for 50 YR event
Inflow = 4.48 cfs @ 12.26 hrs, Volume= 0.860 af
Primary = 4.48 cfs @ 12.26 hrs, Volume= 0.860 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment PDA-1: PDA-1** Runoff Area=9.259 ac 5.05% Impervious Runoff Depth=3.57"
Flow Length=1,555' Tc=29.3 min CN=63 Runoff=21.89 cfs 2.752 af

**Subcatchment PDA-2: PDA-2** Runoff Area=1.976 ac 0.25% Impervious Runoff Depth=3.24"
Flow Length=544' Tc=17.6 min CN=60 Runoff=5.19 cfs 0.533 af

**Pond B-1: B-1** Peak Elev=424.78' Storage=36,331 cf Inflow=21.89 cfs 2.752 af
Primary=1.50 cfs 1.469 af Secondary=0.49 cfs 0.462 af Tertiary=13.58 cfs 0.817 af Outflow=15.57 cfs 2.748 af

**Link AP-1: AP-1** Inflow=15.08 cfs 2.286 af
Primary=15.08 cfs 2.286 af

**Link AP-2: AP-2** Inflow=5.58 cfs 0.995 af
Primary=5.58 cfs 0.995 af

**Total Runoff Area = 11.235 ac Runoff Volume = 3.285 af Average Runoff Depth = 3.51"**
**95.79% Pervious = 10.762 ac 4.21% Impervious = 0.473 ac**

## Summary for Subcatchment PDA-1: PDA-1

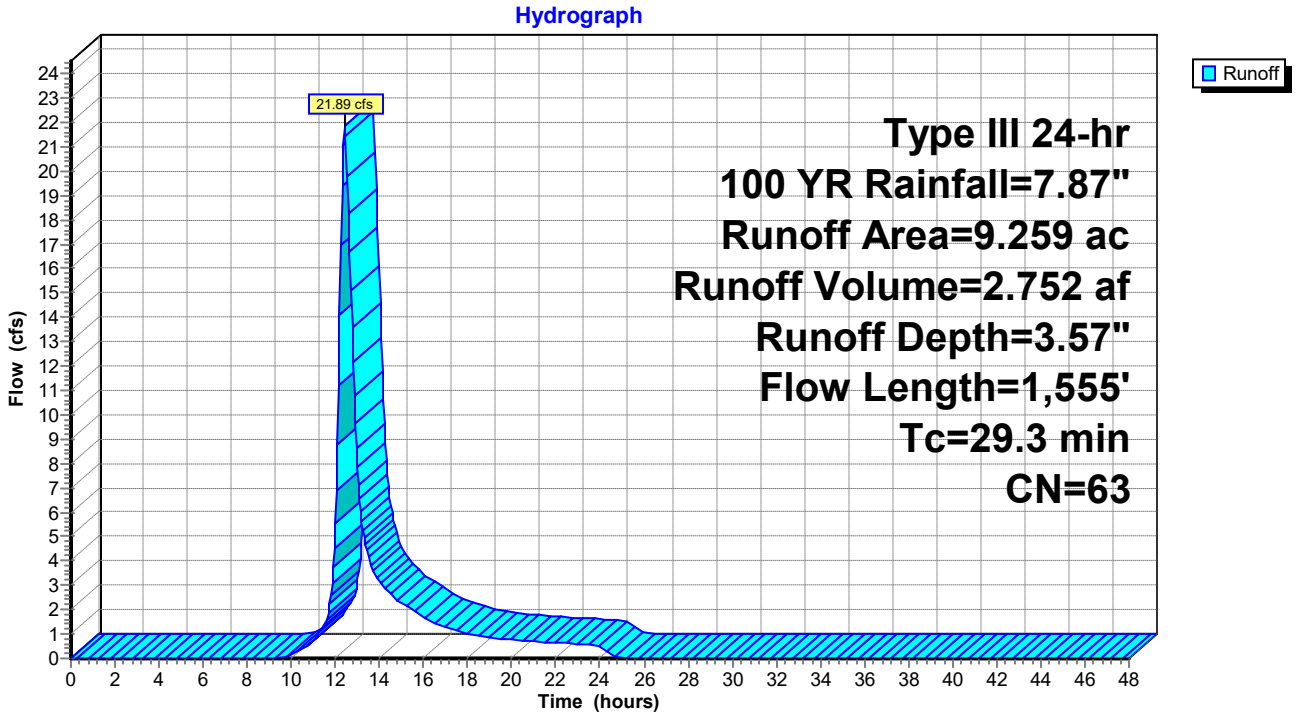
Runoff = 21.89 cfs @ 12.42 hrs, Volume= 2.752 af, Depth= 3.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.87"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 3.793 | 55 | Woods, Good, HSG B |
| | 2.806 | 58 | Meadow, non-grazed, HSG B |
| * | 0.366 | 98 | Water Surface, HSG B |
| | 0.147 | 71 | Meadow, non-grazed, HSG C |
| | 1.695 | 77 | Woods, Good, HSG D |
| | 0.350 | 78 | Meadow, non-grazed, HSG D |
| | 0.102 | 98 | Water Surface, HSG D |
| | 9.259 | 63 | Weighted Average |
| | 8.791 | | 94.95% Pervious Area |
| | 0.468 | | 5.05% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.3 | 100 | 0.0663 | 0.12 | | **Sheet Flow, A-B**<br>Woods: Light underbrush n= 0.400 P2= 3.18" |
| 12.3 | 1,020 | 0.0764 | 1.38 | | **Shallow Concentrated Flow, B-C**<br>Woodland Kv= 5.0 fps |
| 3.7 | 435 | 0.0764 | 1.93 | | **Shallow Concentrated Flow, C-D**<br>Short Grass Pasture Kv= 7.0 fps |
| 29.3 | 1,555 | Total | | | |

## Subcatchment PDA-1: PDA-1



## Summary for Subcatchment PDA-2: PDA-2

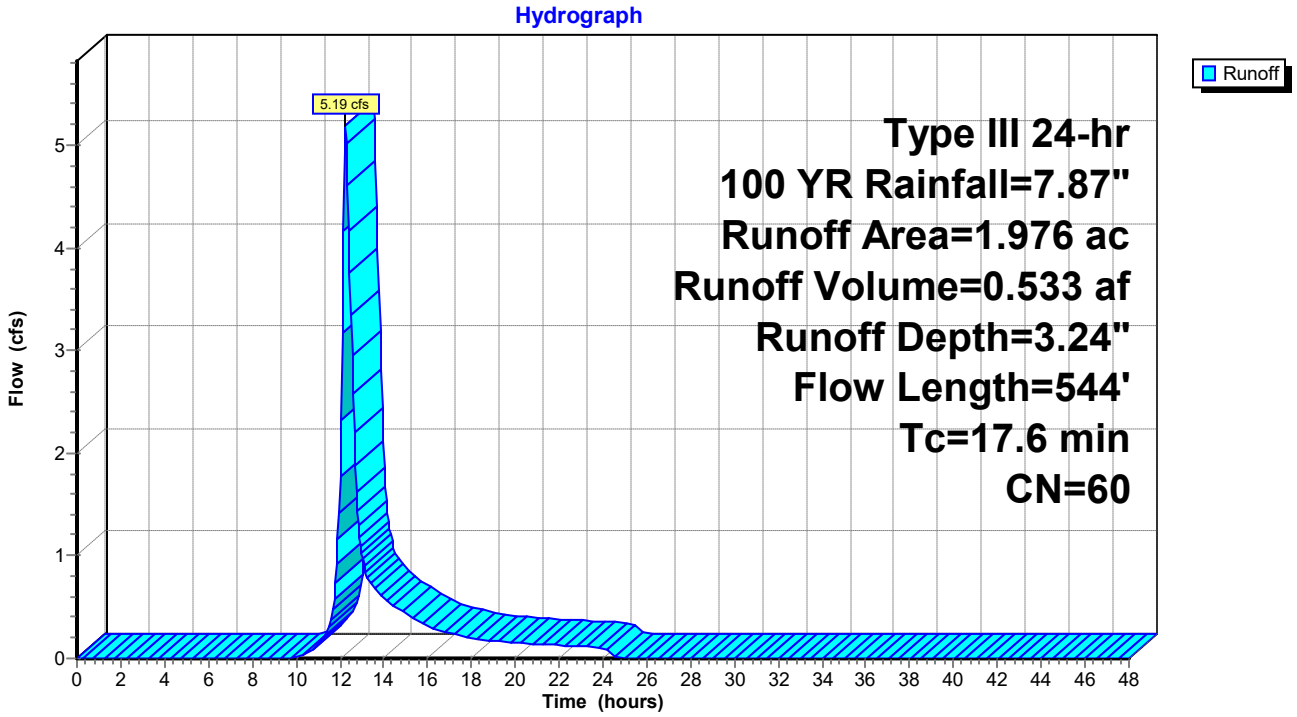
Runoff = 5.19 cfs @ 12.26 hrs, Volume= 0.533 af, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.87"

| | Area (ac) | CN | Description |
|---|---|---|---|
| | 1.121 | 55 | Woods, Good, HSG B |
| | 0.371 | 58 | Meadow, non-grazed, HSG B |
| | 0.080 | 70 | Woods, Good, HSG C |
| * | 0.344 | 75 | Meadow, non-grazed, HSG C |
| | 0.055 | 71 | Meadow, non-grazed, HSG C |
| * | 0.005 | 98 | Unconnected pavement, HSG C |
| | 1.976 | 60 | Weighted Average |
| | 1.971 | | 99.75% Pervious Area |
| | 0.005 | | 0.25% Impervious Area |
| | 0.005 | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.0 | 100 | 0.0588 | 0.12 | | **Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.18" |
| 0.7 | 63 | 0.0903 | 1.50 | | **Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps |
| 2.9 | 381 | 0.0979 | 2.19 | | **Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps |
| 17.6 | 544 | Total | | | |

## Subcatchment PDA-2: PDA-2



## Summary for Pond B-1: B-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth = 3.57" for 100 YR event
Inflow = 21.89 cfs @ 12.42 hrs, Volume= 2.752 af
Outflow = 15.57 cfs @ 12.69 hrs, Volume= 2.748 af, Atten= 29%, Lag= 16.2 min
Primary = 1.50 cfs @ 12.69 hrs, Volume= 1.469 af
Secondary = 0.49 cfs @ 12.69 hrs, Volume= 0.462 af
Tertiary = 13.58 cfs @ 12.69 hrs, Volume= 0.817 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 424.78' @ 12.69 hrs Surf.Area= 13,628 sf Storage= 36,331 cf

Plug-Flow detention time= 156.8 min calculated for 2.748 af (100% of inflow)
Center-of-Mass det. time= 155.9 min ( 1,017.9 - 862.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 420.50' | 56,868 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 420.50 | 5,695 | 337.7 | 0 | 0 | 5,695 |
| 424.00 | 9,995 | 453.8 | 27,107 | 27,107 | 13,138 |
| 426.00 | 20,376 | 613.0 | 29,761 | 56,868 | 26,695 |

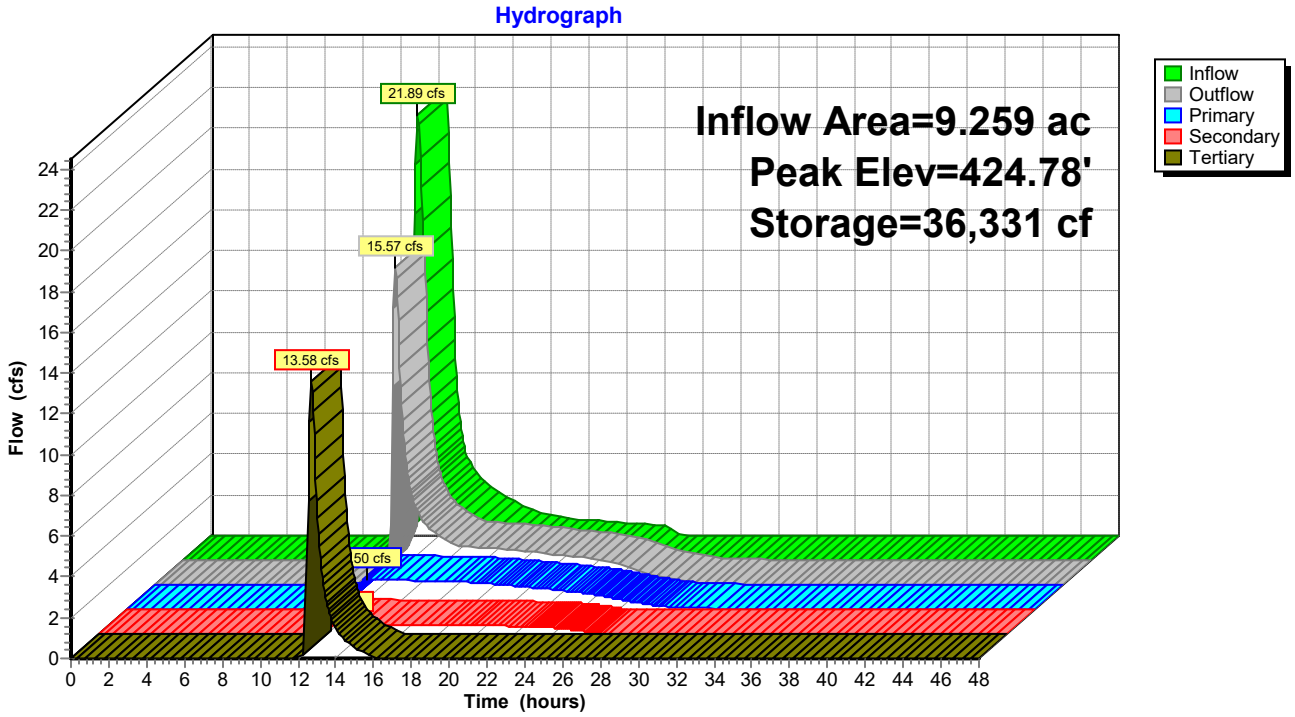
| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 420.50' | **6.0" Round Culvert**<br>L= 42.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 420.50' / 419.00' S= 0.0357 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf |
| #2 | Secondary | 421.00' | **4.0" Round Culvert**<br>L= 68.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 421.00' / 419.00' S= 0.0294 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf |
| #3 | Tertiary | 424.30' | **15.0' long x 14.2' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.65 2.68 2.70 2.65 2.64 2.65 2.64 2.63 |

**Primary OutFlow** Max=1.50 cfs @ 12.69 hrs HW=424.78' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.50 cfs @ 7.63 fps)

**Secondary OutFlow** Max=0.49 cfs @ 12.69 hrs HW=424.78' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Barrel Controls 0.49 cfs @ 5.61 fps)

**Tertiary OutFlow** Max=13.52 cfs @ 12.69 hrs HW=424.78' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 13.52 cfs @ 1.87 fps)

## Pond B-1: B-1

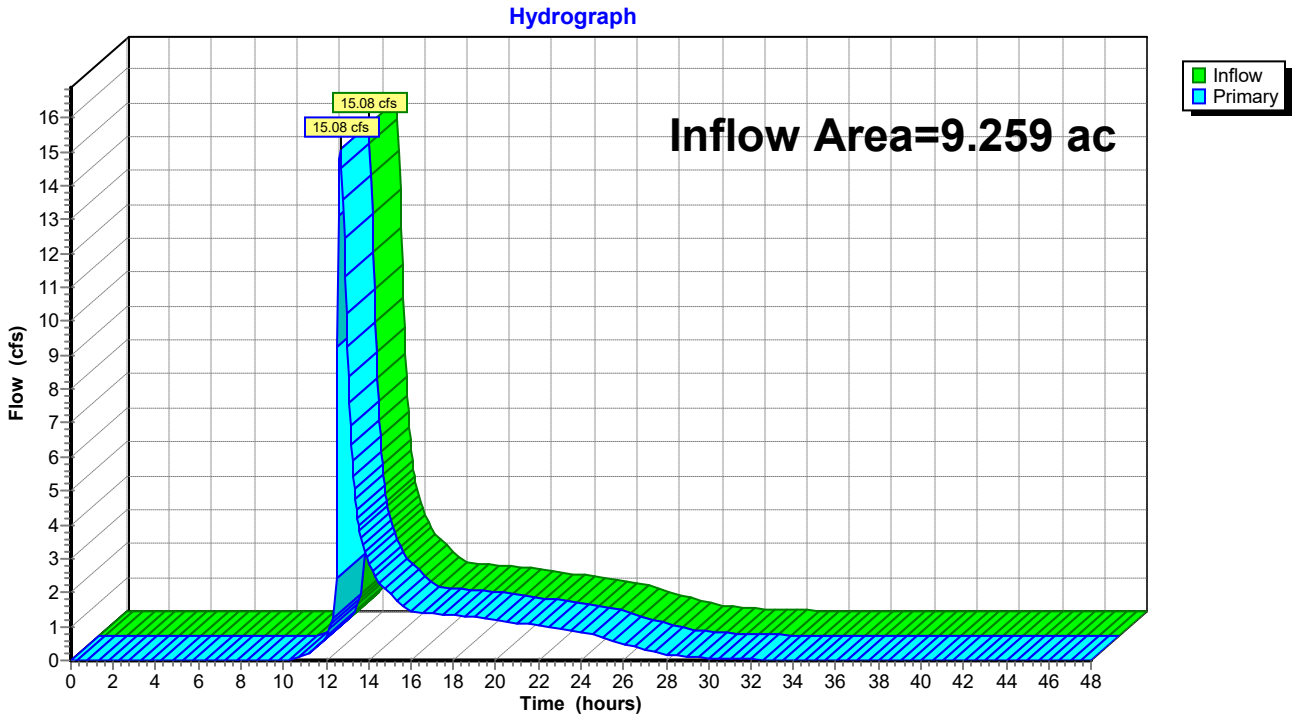

Hydrograph
Inflow Area=9.259 ac
Peak Elev=424.78'
Storage=36,331 cf
21.89 cfs
15.57 cfs
13.58 cfs
50 cfs
Inflow
Outflow
Primary
Secondary
Tertiary
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

## Summary for Link AP-1: AP-1

Inflow Area = 9.259 ac, 5.05% Impervious, Inflow Depth > 2.96" for 100 YR event
Inflow = 15.08 cfs @ 12.69 hrs, Volume= 2.286 af
Primary = 15.08 cfs @ 12.69 hrs, Volume= 2.286 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-1: AP-1

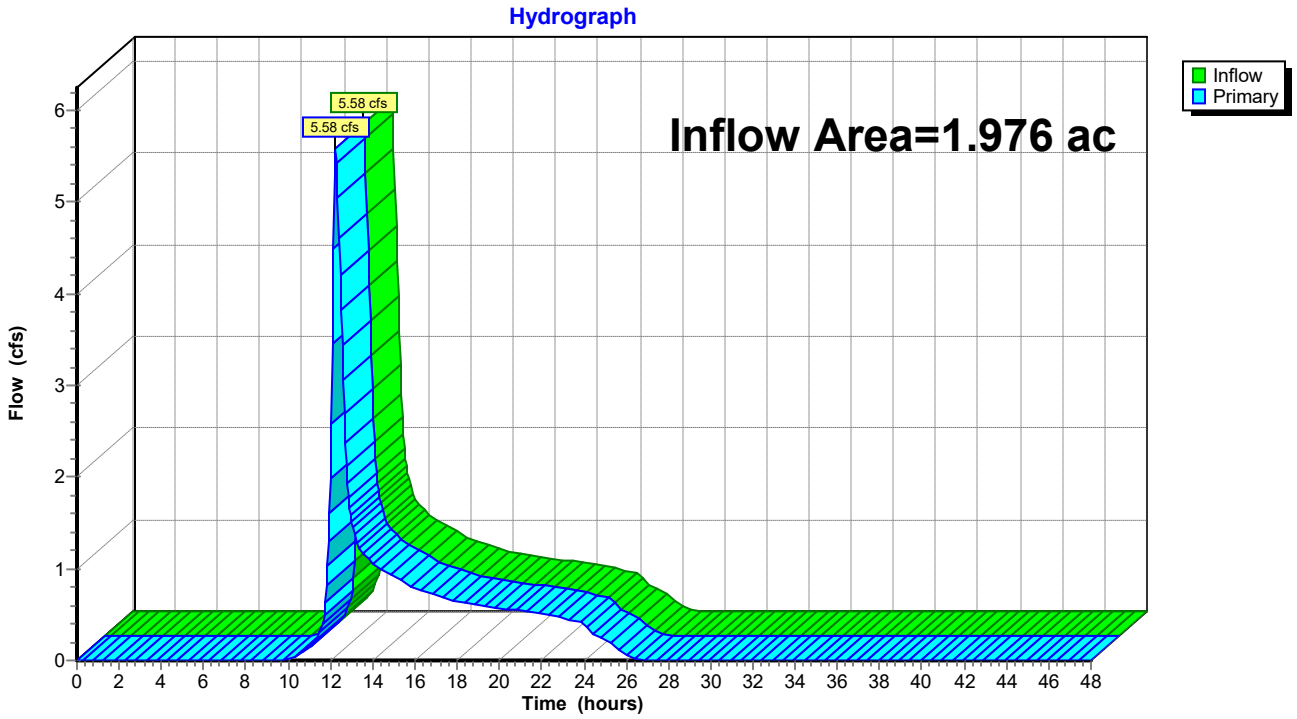


## Summary for Link AP-2: AP-2

Inflow Area = 1.976 ac, 0.25% Impervious, Inflow Depth = 6.04" for 100 YR event
Inflow = 5.58 cfs @ 12.26 hrs, Volume= 0.995 af
Primary = 5.58 cfs @ 12.26 hrs, Volume= 0.995 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

## Link AP-2: AP-2



# APPENDIX D: NOAA ATLAS 14 PRECIPITATION FREQUENCY TABLE

**NOAA Atlas 14, Volume 10, Version 3**
**Location name: Dayville, Connecticut, USA***
**Latitude: 41.8578°, Longitude: -71.8745°**
**Elevation: 422.17 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_&_aerials

## 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 | **0.332** (0.258-0.424) | **0.396** (0.307-0.505) | **0.500** (0.386-0.640) | **0.585** (0.450-0.753) | **0.703** (0.524-0.941) | **0.793** (0.578-1.08) | **0.886** (0.626-1.25) | **0.987** (0.664-1.43) | **1.13** (0.730-1.68) | **1.24** (0.784-1.89) |
| 10-min | **0.471** (0.366-0.600) | **0.561** (0.435-0.715) | **0.708** (0.548-0.906) | **0.830** (0.638-1.07) | **0.997** (0.742-1.33) | **1.12** (0.819-1.53) | **1.25** (0.887-1.77) | **1.40** (0.941-2.02) | **1.60** (1.03-2.38) | **1.75** (1.11-2.67) |
| 15-min | **0.554** (0.430-0.706) | **0.660** (0.512-0.841) | **0.833** (0.644-1.07) | **0.975** (0.750-1.25) | **1.17** (0.873-1.57) | **1.32** (0.963-1.80) | **1.48** (1.04-2.08) | **1.64** (1.11-2.37) | **1.88** (1.22-2.80) | **2.06** (1.31-3.14) |
| 30-min | **0.775** (0.602-0.988) | **0.922** (0.716-1.18) | **1.16** (0.900-1.49) | **1.36** (1.05-1.75) | **1.64** (1.22-2.19) | **1.85** (1.35-2.52) | **2.06** (1.46-2.90) | **2.29** (1.55-3.31) | **2.62** (1.70-3.91) | **2.88** (1.82-4.38) |
| 60-min | **0.996** (0.774-1.27) | **1.19** (0.920-1.51) | **1.49** (1.16-1.91) | **1.75** (1.35-2.25) | **2.10** (1.57-2.81) | **2.37** (1.73-3.23) | **2.65** (1.87-3.73) | **2.95** (1.98-4.26) | **3.36** (2.18-5.02) | **3.69** (2.34-5.62) |
| 2-hr | **1.27** (0.995-1.61) | **1.51** (1.18-1.92) | **1.90** (1.48-2.41) | **2.22** (1.72-2.84) | **2.66** (1.99-3.55) | **2.99** (2.20-4.07) | **3.34** (2.39-4.72) | **3.75** (2.53-5.38) | **4.34** (2.82-6.44) | **4.84** (3.07-7.32) |
| 3-hr | **1.47** (1.15-1.85) | **1.74** (1.36-2.20) | **2.18** (1.70-2.77) | **2.55** (1.98-3.25) | **3.06** (2.30-4.07) | **3.44** (2.54-4.68) | **3.84** (2.76-5.43) | **4.32** (2.93-6.19) | **5.05** (3.29-7.46) | **5.66** (3.60-8.52) |
| 6-hr | **1.88** (1.48-2.35) | **2.23** (1.75-2.80) | **2.80** (2.20-3.53) | **3.28** (2.56-4.15) | **3.93** (2.98-5.21) | **4.42** (3.28-5.99) | **4.95** (3.58-6.96) | **5.58** (3.79-7.94) | **6.55** (4.27-9.62) | **7.37** (4.70-11.0) |
| 12-hr | **2.37** (1.88-2.95) | **2.83** (2.24-3.53) | **3.58** (2.82-4.48) | **4.20** (3.30-5.29) | **5.06** (3.85-6.66) | **5.70** (4.25-7.66) | **6.38** (4.64-8.92) | **7.20** (4.91-10.2) | **8.43** (5.53-12.3) | **9.48** (6.07-14.1) |
| 24-hr | **2.82** (2.25-3.50) | **3.40** (2.71-4.22) | **4.35** (3.45-5.42) | **5.13** (4.05-6.42) | **6.21** (4.75-8.13) | **7.01** (5.25-9.37) | **7.87** (5.74-10.9) | **8.90** (6.09-12.5) | **10.4** (6.86-15.1) | **11.7** (7.53-17.3) |
| 2-day | **3.18** (2.55-3.92) | **3.87** (3.10-4.77) | **4.99** (3.98-6.18) | **5.92** (4.70-7.37) | **7.21** (5.54-9.38) | **8.16** (6.15-10.9) | **9.19** (6.74-12.7) | **10.4** (7.15-14.5) | **12.3** (8.10-17.7) | **13.9** (8.93-20.3) |
| 3-day | **3.44** (2.77-4.23) | **4.19** (3.37-5.16) | **5.41** (4.33-6.68) | **6.43** (5.11-7.97) | **7.82** (6.03-10.1) | **8.85** (6.69-11.7) | **9.97** (7.34-13.7) | **11.3** (7.79-15.7) | **13.4** (8.83-19.2) | **15.1** (9.74-22.1) |
| 4-day | **3.69** (2.97-4.52) | **4.48** (3.61-5.50) | **5.77** (4.64-7.11) | **6.85** (5.46-8.48) | **8.33** (6.44-10.8) | **9.42** (7.14-12.5) | **10.6** (7.82-14.6) | **12.0** (8.29-16.7) | **14.2** (9.41-20.3) | **16.1** (10.4-23.4) |
| 7-day | **4.37** (3.54-5.33) | **5.26** (4.26-6.43) | **6.71** (5.41-8.23) | **7.92** (6.35-9.75) | **9.58** (7.43-12.3) | **10.8** (8.22-14.2) | **12.1** (8.98-16.6) | **13.7** (9.50-19.0) | **16.2** (10.7-23.0) | **18.3** (11.8-26.5) |
| 10-day | **5.06** (4.12-6.16) | **6.01** (4.88-7.32) | **7.55** (6.11-9.22) | **8.83** (7.10-10.8) | **10.6** (8.24-13.6) | **11.9** (9.06-15.6) | **13.3** (9.84-18.1) | **15.0** (10.4-20.6) | **17.5** (11.6-24.8) | **19.6** (12.7-28.3) |
| 20-day | **7.26** (5.93-8.78) | **8.27** (6.75-10.0) | **9.92** (8.07-12.0) | **11.3** (9.12-13.8) | **13.2** (10.3-16.7) | **14.6** (11.1-18.8) | **16.1** (11.8-21.4) | **17.7** (12.3-24.1) | **19.9** (13.3-28.0) | **21.7** (14.1-31.0) |
| 30-day | **9.10** (7.47-11.0) | **10.1** (8.31-12.2) | **11.8** (9.65-14.3) | **13.2** (10.7-16.1) | **15.2** (11.8-19.0) | **16.7** (12.7-21.3) | **18.1** (13.3-23.8) | **19.6** (13.7-26.6) | **21.5** (14.4-30.1) | **22.9** (14.9-32.8) |
| 45-day | **11.4** (9.37-13.7) | **12.4** (10.2-15.0) | **14.2** (11.6-17.1) | **15.6** (12.7-18.9) | **17.6** (13.8-21.9) | **19.2** (14.6-24.3) | **20.7** (15.1-26.8) | **22.0** (15.5-29.7) | **23.6** (15.9-32.9) | **24.7** (16.1-35.1) |
| 60-day | **13.3** (11.0-15.9) | **14.4** (11.8-17.2) | **16.1** (13.3-19.4) | **17.6** (14.4-21.3) | **19.7** (15.4-24.4) | **21.3** (16.2-26.8) | **22.8** (16.6-29.4) | **24.1** (16.9-32.3) | **25.5** (17.2-35.4) | **26.4** (17.3-37.5) |

[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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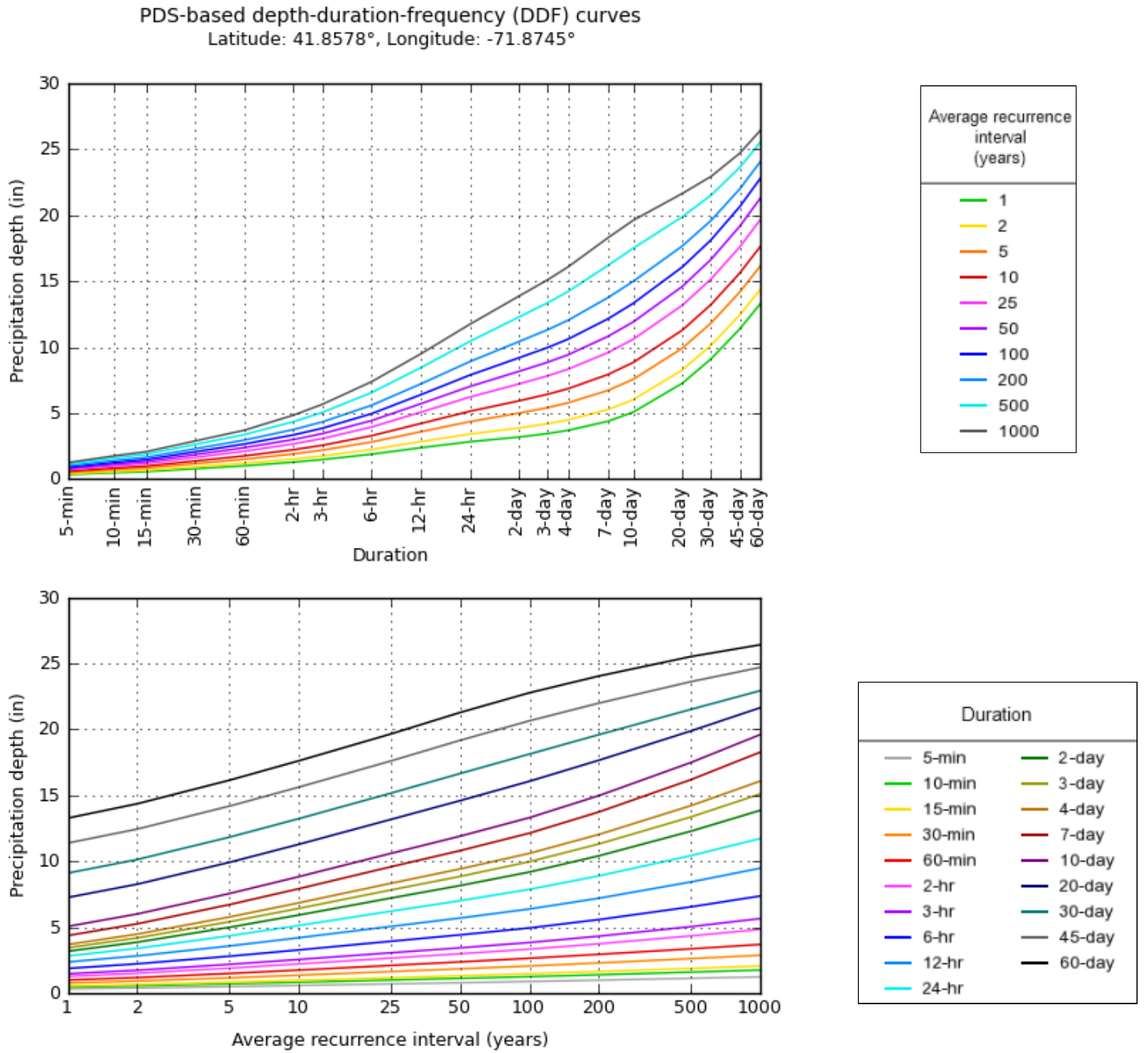
## PF graphical




NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Tue May 25 22:11:18 2021

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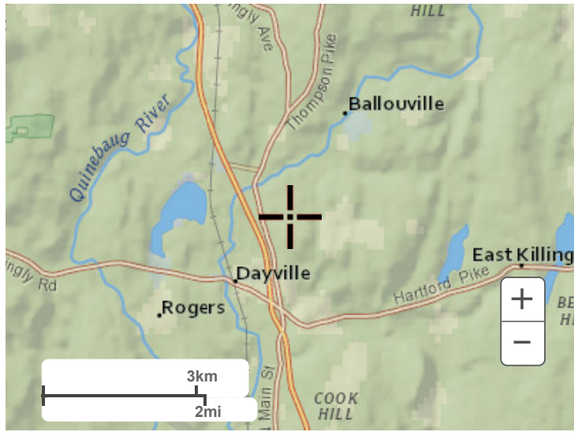
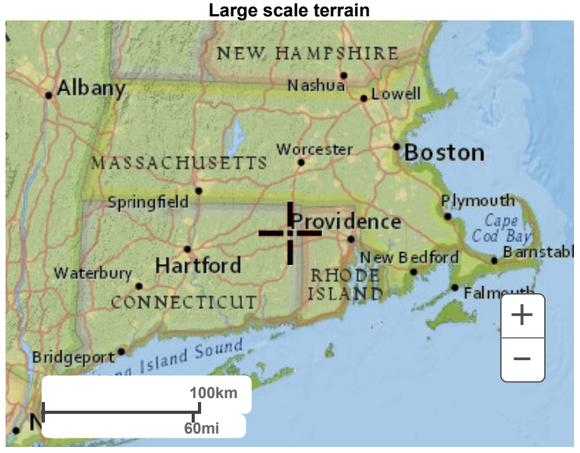
## Maps & aerials

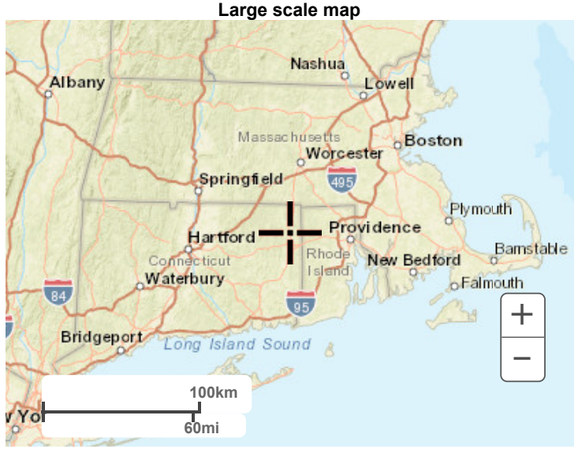
**Small scale terrain**



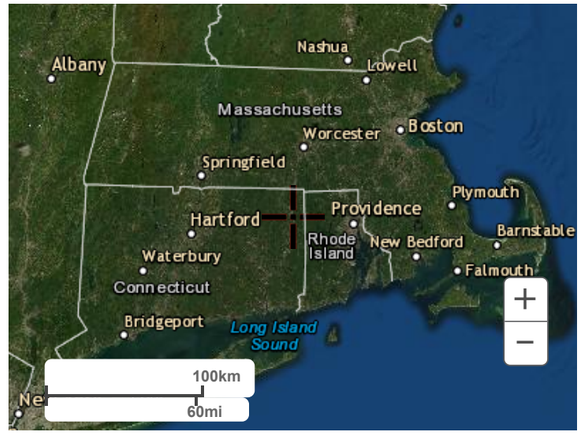

Large scale terrain




Large scale map




Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

# APPENDIX E: ADDITIONAL CALCULATIONS

SEDIMENT BASIN SIZING
FOR
KILLINGLY HS SOLAR
226 PUTNAM PIKE, KILLINGLY, CT

| | TSB-1 |
|---|---|
| Total Drainage Area (acre) | 9.26 |
| Total Drainge Area (square miles) | 0.0145 |
| Disturbed Area (acre)(DA*) | 3.77 |
| Remaining Existing Drainage Area (acre)(DA^) | 5.49 |
| A* (Disturbed Area)(ton/acre/yr) | 50.0 |
| A^ (Existing Drainage Area)(ton/ac/yr) | 0.2 |
| DR | 34% |
| TE | 0.8 |
| γ (sandy loam) (lbs/cf) | 85 |
| | |
| Sediment Volume Calcs: | |
| Req. Volume Dry (acre-ft/yr) | 0.03 |
| Req. Volume Dry (cf) | 1,214 |
| Req. Volume Wet (Dry x 2) (cf) | 2,428 |
| | |
| Residence Volume Calcs: | |
| SCS Runoff Volume (in), Vr (from HydroCAD) | 1.61 |
| Q10 (cfs) (from HydroCAD) | 9.18 |
| Q10/DA | 0.99 |
| Qo/Qi (Figure SB-13) | 0.100 |
| Qo (max over spillway) | 0.92 |
| Release Rate (csm) | 63.45 |
| V5 (in) (Figure DB-6) | 0.80 |
| Vs (acre-ft) | 0.62 |
| Vs (cf) | 26,888 |
| | |
| Volumes Required: | |
| Sediment Wet Volume (cf) | 2,428 |
| Residence Volume (10 YR Storm) (cf) | 26,888 |
| Total Volume Required (cf) | 29,316 |
| | |
| Volumes Provided: | |
| Total Volume Provided (cf) | 30,302 |

WATER QUALITY VOLUME CALCULATIONS
FOR
KILLINGLY HS SOLAR
226 PUTNAM PIKE, KILLINGLY, CT

$$WQV = \frac{(1")(R)(A)}{12}$$

where:
$WQV$ = water quality volume (ac-ft)
$R$ = volumetric runoff coefficien = 0.05+0.009(I)
$I$ = percent impervious cover
$A$ = site area in acres

$V = WQV + ((P)(A_b)/12)$

V=required basin storage volume (ac-ft)
WQV=Water Quality Volume (ac-ft)
P= design water quality precipitation (in)
$A_b$=basin surface area (ac)

| Area (ac) | Pervious (ac) | Imperv. (ac) | I | R | WQV (ac-ft) | P (in) | Ab (ac) | V (ac-ft) | Total V Req. (cf) | V Provided (cf) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11.23 | 11.18 | 0.06 | 1% | 0.05 | 0.05 | n/a | n/a | n/a | 2,232.24 | - |
| 9.26 | 9.26 | - | 0% | 0.05 | 0.04 | 1 | 0.266531 | 0.06 | 2,648.02 | 4,007.00 |

## Stage-Area-Storage for Pond FB-1: FB-1

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---|---|---|
| 421.00 | 832 | 0 |
| 421.05 | 876 | 43 |
| 421.10 | 921 | 88 |
| 421.15 | 967 | 135 |
| 421.20 | 1,015 | 184 |
| 421.25 | 1,063 | 236 |
| 421.30 | 1,113 | 291 |
| 421.35 | 1,164 | 348 |
| 421.40 | 1,216 | 407 |
| 421.45 | 1,269 | 469 |
| 421.50 | 1,323 | 534 |
| 421.55 | 1,379 | 602 |
| 421.60 | 1,435 | 672 |
| 421.65 | 1,493 | 745 |
| 421.70 | 1,551 | 821 |
| 421.75 | 1,611 | 900 |
| 421.80 | 1,672 | 982 |
| 421.85 | 1,735 | 1,068 |
| 421.90 | 1,798 | 1,156 |
| 421.95 | 1,862 | 1,247 |
| 422.00 | 1,928 | 1,342 |
| 422.05 | 1,995 | 1,440 |
| 422.10 | 2,062 | 1,542 |
| 422.15 | 2,131 | 1,646 |
| 422.20 | 2,202 | 1,755 |
| 422.25 | 2,273 | 1,867 |
| 422.30 | 2,345 | 1,982 |
| 422.35 | 2,419 | 2,101 |
| 422.40 | 2,493 | 2,224 |
| 422.45 | 2,569 | 2,350 |
| 422.50 | 2,646 | 2,481 |
| 422.55 | 2,724 | 2,615 |
| 422.60 | 2,803 | 2,753 |
| 422.65 | 2,884 | 2,895 |
| 422.70 | 2,965 | 3,042 |
| 422.75 | 3,048 | 3,192 |
| 422.80 | 3,131 | 3,346 |
| 422.85 | 3,216 | 3,505 |
| 422.90 | 3,302 | 3,668 |
| 422.95 | 3,389 | 3,835 |
| 423.00 | 3,478 | 4,007 |
| 423.05 | 3,567 | 4,183 |
| 423.10 | 3,657 | 4,364 |
| 423.15 | 3,749 | 4,549 |
| 423.20 | 3,842 | 4,739 |
| 423.25 | 3,936 | 4,933 |
| 423.30 | 4,031 | 5,132 |
| 423.35 | 4,127 | 5,336 |
| 423.40 | 4,224 | 5,545 |
| 423.45 | 4,323 | 5,759 |
| 423.50 | 4,423 | 5,977 |
| 423.55 | 4,523 | 6,201 |
| 423.60 | 4,625 | 6,430 |
| 423.65 | 4,728 | 6,663 |
| 423.70 | 4,832 | 6,902 |
| 423.75 | 4,938 | 7,147 |
| 423.80 | 5,044 | 7,396 |
| 423.85 | 5,152 | 7,651 |
| 423.90 | 5,260 | 7,911 |
| 423.95 | 5,370 | 8,177 |
| 424.00 | **5,481** | **8,448** |

FOREBAY WEIR @ 423.00'
STORAGE = 4,007 CF

PIPE CALCS
FOR
KILLINGLY HS SOLAR
226 PUTNAM PIKE, KILLINGLY, CT

| PIPE | PIPE DIAMETER (IN) | LENGTH (FT) | INV. IN (FT) | INV. OUT (FT) | SLOPE (FT/FT) | N VALUE | MAX VELOCITY (FT/SEC) |
|---|---|---|---|---|---|---|---|
| B-1A | 6 | 42 | 420.50 | 419.00 | 0.0357 | 0.0130 | 5.36 |
| B-1B | 4 | 68 | 421.00 | 419.00 | 0.0294 | 0.0130 | 3.71 |

| APRON SIZING | | | MIN. LENGTH (FT) | | | MIN. W2 (FT) | |
|---|---|---|---|---|---|---|---|
| PIPE | Sp (FT) | Q (CFS FOR 25YR STORM) | TYPE A | TYPE B | MIN. W1 (FT) | TYPE A | TYPE B |
| B-1A | 0.50 | 1.43 | 14.93 | 22.87 | 1.50 | 11.95 | 10.65 |
| B-1B | 0.33 | 0.47 | 8.61 | 12.32 | 1.00 | 7.02 | 5.93 |

# APPENDIX F: GEOTECHNICAL REPORT

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

# GEOTECHNICAL ENGINEERING REPORT
# PROPOSED SOLAR ARRAY
# KILLINGLY HIGH SCHOOL
# 226 PUTNAM PIKE
# DAYVILLE, CONNECTICUT

**Prepared for:**

All-Points Technology Corporation, P.C.
3 Saddlebrook Drive
Killingworth, Connecticut 06419

**Prepared by:**

Down To Earth Consulting, LLC
122 Church Street
Naugatuck, Connecticut 06770

File No. 0032-026.00
December 2019

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

December 28, 2019
File No. 0032-026.00

Mr. Bradley J. Parsons, PE
All-Points Technology Corporation
3 Saddlebrook Drive
Killingworth, Connecticut 06419

Via email: bparsons@allpointstech.com

Re: Geotechnical Engineering Report
Proposed Killingly High School Solar Array
226 Putnam Pike, Dayville, Connecticut

Down To Earth Consulting, LLC (DTE) is pleased to submit this preliminary geotechnical engineering report for the proposed solar array that will be located on 226 Putnam Pike in Dayville, Connecticut (Site) for All-Points Technology Corporation (Client). We appreciate this opportunity to work with you. Please call if you have any questions.

Sincerely,

Down To Earth Consulting, LLC

Raymond P. Janeiro, P.E.
Principal

Daniel F. LaMesa, P.E.
Principal/Reviewer

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## APPENDICES

## 1.0 INTRODUCTION

Down To Earth Consulting, LLC, completed a subsurface exploration program and geotechnical engineering evaluation for the proposed solar array foundations. Our geotechnical engineering services included: reviewing project plans, completing test borings, infiltration tests, and soil laboratory testing, characterizing subsurface conditions within the solar array limits, performing geotechnical engineering analyses, and providing geotechnical design and construction recommendations for the project. Refer to Figures 1 and 2 (in Appendix 1) for an area plan and site plan, respectively. Our services were performed in accordance with our November 8, 2019 proposal, which was based in part on a project Site Plan, prepared by Greenskies, dated July 15, 2019.

## 2.0 BACKGROUND

The proposed ground-mounted solar array will be located at the Killingly High School. The solar array will consist of about 3,400 modules and will generally be located in an undeveloped area south of the existing school building. Nominal cuts/fills on the order of 2-feet or less are anticipated to achieve design grades, as the solar array structures will generally conform to the existing Site topography. Refer to Figure 2 (Appendix 1) for existing site features and proposed solar array location. Foundation reaction loads were not available at the time of this writing.

## 3.0 SUBSURFACE DATA

### 3.1 GENERAL SITE GEOLOGY

Published surficial and bedrock geological map data (*1:125,000 scale, Surficial Materials Map of Connecticut, Janet Radway Stone, 1992 and 1:125,000 scale, Bedrock Geological Map of Connecticut, John Rodgers, 1985*) was reviewed. The Site surficial material is mapped as glacial till and the underlying bedrock is classified as granitic gneiss. Bedrock outcrops are mapped at the Site just north and south of the proposed array area.

### 3.2 TEST BORINGS

We completed five test borings (B-1 through B-5) drilled by our subcontractor General Borings, Inc. on November 27, 2019. Boring locations are depicted on Figure 2 (Appendix 1) and the logs are included in Appendix 2. Borings were located in the field by taping/pacing from existing site features and should be considered approximate.

The borings were drilled to explore the soil, bedrock (if encountered), and groundwater conditions in the proposed solar array area. Hollow-stem auger drilling methods were used to advance borings to depths ranging from approximately 8.5 to 22 feet below existing grades. Borings were terminated in natural soil deposits and in most instances (except for B-4 and B-5) refused on boulders and/or inferred bedrock.

Representative soil samples were obtained in the borings for soil classification and laboratory testing by split barrel sampling procedures in general accordance with ASTM D-1586. The split-spoon sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of

blows required to advance the sampler the middle 12-inches of a normal 24-inch penetration is recorded as the Standard Penetration Resistance Value (N). The blows (i.e., "N-Value") are indicated on the boring logs at their depth of occurrence and provide an indication of the relative consistency of the material.

Groundwater levels were measured using a weighted tape in open drill holes and/or inferred from wet soil samples during drilling.

### 3.3 LABORATORY TESTING

Soil samples were collected from 0 to 4 feet below grade at Boring B-1 and B-4 to evaluate the corrosivity potential of sampled soils. Samples were analyzed for pH (ASTM D4972), Sulfates (ASTM D4327), Chlorides (ASTM D4327), and Resistivity (ASTM G57). The results of the laboratory testing are included in Appendix 3. Based on the laboratory test results, the soil samples are not considered to be corrosive.

### 3.4 INFILTRATION TESTING

We performed two falling head permeability tests to estimate the vertical hydraulic conductivity of the upper site soils. Tests were performed in 3-inch diameter PVC pipe at depths of 3 and 5 feet below existing grades. Test locations are depicted on Figure 2 (Appendix 1) and the field logs are included in Appendix 4.

Measured permeability values averaged about $2x10^{-4}$ inches per minute for both tests. Hydraulic conductivities will vary between test locations.

## 4.0 SUBSURFACE CONDITIONS

### 4.1 SUBSURFACE PROFILE

The generalized subsurface profile, as inferred from the subsurface data, consists of natural Subsoil and Glacial Till Deposits. Fill was also encountered at B-3 and B-5 above the natural soil deposits. An approximate 6- to 8-inch layer of Topsoil/Forest Debris was encountered at the surface of the explorations. The following is a more detailed description of the subsurface materials encountered:

#### 4.1.1 Fill

Fill was encountered directly below the Topsoil/Forest Debris at Boring B-3 and B-5. This stratum was about 2 feet thick and typically consisted of loose, brown, fine to coarse sand with some (20 to 35%) to and (35 to 50%) amounts of silt and trace (1% to 10%) amounts of fine gravel. The encountered Fill appeared to consist of reworked native materials. The thickness, character, and consistency of the Fill will vary between exploration locations.

#### 4.1.2 Subsoil

Subsoil was encountered at each of the boring locations where Fill wasn't encountered (i.e., B-1, B-2, and B-4) directly below the Topsoil/Forest Debris. This stratum ranged in thickness from

about 0 to 3 feet and generally consisted of loose, orange-brown, silt with varying amounts of sand (about 20 to 60%) and trace amounts of gravel. The subsoil did not have an organic odor, but trace (0 to 10%) amounts of organic material (e.g., rootlets) was observed in many samples.

#### 4.1.3 Glacial Till

Natural Glacial Till was observed below the Fill or Subsoil in each of the borings. This material generally consisted of medium dense to very dense, brown/gray, fine to coarse sand with varying amounts of gravel (20 to 50%) and silt (10 to 40%). Decomposed rock fragments were observed in the Glacial Till near boring termination depths. Sporadic cobbles and boulders were inferred in this stratum based on "drill rig chatter". Borings B-1, B-2 and B-3 were terminated on inferred bedrock (or possible boulders) based on drilling refusal. Based on our field observations, bedrock may be very shallow (and possibly outcrop) in the area west of Boring B-2.

### 4.2 GROUNDWATER

Groundwater was measured in the boreholes during drilling and was encountered at about 4 to 10 feet below grade. Groundwater levels measured in the boreholes may not have had sufficient time to stabilize and should be considered approximate. Groundwater levels will vary depending on factors such as temperature, season, precipitation, construction activity, and other conditions, which may be different from those at the time of these measurements.

## 5.0 ENGINEERING IMPLICATIONS OF SUBSURFACE CONDITIONS

The proposed ground mount solar panels can be supported on driven steel pile foundations. The piles will need to be designed to resist compression, tension, and lateral loads. The pile design capacities will need to be determined based on the results of pile load testing completed at the Site. Obstructions (e.g., boulders and shallow bedrock) may require predrilling of pilot holes to accommodate pile driving, which may impact the capacity of the piles. If piles cannot penetrate the soils sufficiently, drilling of oversized holes backfilled with grout may be required.

## 6.0 PRELIMINARY GEOTECHNICAL ENGINEERING RECOMMENDATIONS

We offer the following preliminary geotechnical design recommendations based on the subsurface conditions encountered at the Site, available project information, and the proposed construction.

### 6.1 RACKING SYSTEM FOUNDATIONS

The proposed photovoltaic modules can be supported on driven steel piles end bearing in natural Sand Deposits. The steel piles should conform to ASTM A 572, Grade 50 and have hardened pile tips (e.g., pile driving shoes) to minimize pile damage on potential obstructions (e.g. boulders) and when bedrock is encountered. A minimum steel section corrosion loss of 1/16-inch all around the piles should be used. DTE recommends the following preliminary static design parameters for a driven pile foundation alternative:

| DESCRIPTION | VALUE |
|---|---|
| **Maximum Net Allowable Bearing Capacity**[1]<br>Glacial Till | 5 kips per square foot (ksf) |
| **Ultimate Skin Friction Value**[2]<br>Glacial Till (>3.5 fbg) | 450 pounds per square foot (psf) |
| **Modulus of Lateral Subgrade Reaction**[3]<br>Glacial Till (>3.5 fbg) | 100 pci |
| **Angle of Internal Friction**<br>Glacial Till (>3.5 fbg) | 36 |
| **Total Soil Unit Weight**<br>Glacial Till | 135 pounds per cubic foot (pcf) |

1. End-bearing should be neglected for uplift calculations. Provided value assumes a factor of safety of 3.
2. Contribution to pile capacity within the frost depth (i.e., above depths of 3.5 feet) should be ignored. The uplift capacity should be based on the dead weight of the pile and side resistance provided by the subsurface soils (i.e., end bearing should be neglected).
3. To analyze foundation under lateral loading (e.g., Ensoft LPILE).
4. All values provided in this table are preliminary and must be verified in the field by load testing.

Center-to-center pile spacing should not be less than 30 inches or 3 pile diameters. Final pile order lengths should be established based on the results of pile testing and the contractor should be prepared to increase anticipated pile lengths as conditions are exposed in the field.

Piles should be installed to a minimum ultimate geotechnical axial capacity of the structural load multiplied by 2 (assuming load testing is performed). Based on the recommended pile type, bearing material, and anticipated loads, we estimate negligible pile settlements.

The lateral capacity of the upper 30 inches of soil should be neglected due to loss of strength from frost action and the presence of loose surficial soils. Appropriate lateral capacity reductions associated with group effects should be used for piles having a center-to-center spacing of less than 5 times their largest cross-sectional dimension.

#### 6.1.1 Load Testing and Drivability

Tension and lateral load tests should be performed on test piles to finalize foundation design for uplift and lateral load capacity. Compression load tests should also be completed if end bearing capacity of piles is used. Load tests should be completed near the boring explorations in order to corroborate the load test and subsurface exploration data and develop final design recommendations. The testing results should be provided to DTE to reevaluate the above design parameters.

We recommend that a drivability analysis (i.e., Wave Equation Analysis for Piles (WEAP)) be performed for the site-specific conditions and selected pile driving hammer to evaluate the proposed pile driving equipment and development of stresses in the piles. The maximum

allowable driving stress in both tension and compression should not exceed 45 ksi, which is based on applying a reduction factor of 0.9 to the yield strength of Grade 50 Steel.

### 6.2 EQUIPMENT FOUNDATIONS

The proposed accessory structures may be designed as slabs-on-grade bearing on a base course of at least 12-inches of CGF or Crushed Stone overlying proof-rolled Glacial Till Deposits. Crushed Stone, if used, should be separated from soil subgrades, excavation sidewalls and backfill using a geotextile separation fabric.

DTE recommends a maximum net allowable bearing pressure of 2 kips per square foot (ksf) for slab design. Frost walls should be embedded a minimum of 42 inches below final grades for frost protection. Alternatively, dense insulation boards could be used under lightly loaded slabs-on-grade to reduce frost penetration.

The total settlement is expected to be less than 1 inch and differential settlement to be less than 0.5 inches. We recommend an ultimate coefficient of sliding friction of 0.4 (except if insulation boards are used to minimize frost penetration). A factor of safety of at least 1.5 should be applied to calculated sliding resistance.

The design subgrade modulus for the recommended subgrade and base course is 200 pounds per cubic inch.

## 7.0 MATERIALS RECOMMENDATIONS

### 7.1 COMPACTED GRANULAR FILL

Compacted Granular Fill (CGF) for use as structural fill shall consist of inorganic soil free of clay, loam, ice and snow, tree stumps, roots, and other organic matter; graded within the following limits:

| Sieve Size | Percent finer by weight |
|---|---|
| 4-inches | 100% |
| No. 10 | 30 - 100 |
| No. 40 | 10 - 90 |
| No. 200 | 0 - 12* |

* To be considered non-frost susceptible, granular fill should have a maximum of 3 percent of particles by weight smaller than 0.02mm in effective diameter.

### 7.2 CRUSHED STONE

Crushed Stone for use below foundations shall consist of sound, tough, durable, rock that is graded within the following:

| Sieve Size | Percent finer by weight |
|---|---|
| 5/8-inches | 100% |
| 1/2-inch | 85 - 100 |
| 3/8 inch | 15 - 45 |

| | |
|---|---|
| No. 4 | 0 - 15 |
| No. 8 | 0 - 5 |

7.3 COMPACTION REQUIRMENTS

CGF should be placed in loose lifts not exceeding 8-inches in depth and compacted to at least 95 percent of its maximum dry density, and within 2% of optimum moisture content, as determined by ASTM D1557, Method C (Modified Proctor).

Crushed Stone is considered to be "self-compacting" and would negate the need to run laboratory proctor testing and have field density testing of in-place lifts. The crushed stone should be plate compacted to "chink up" the working surface in lifts. We recommend placing Crushed Stone in maximum 12-inch lifts and compacting the lifts with a minimum of four passes with a vibratory plate compactor weighing a minimum of 1,000 pounds and with a minimum centrifugal force of 10,000 pounds.

## 8.0 CONSTRUCTION RECOMMENDATIONS

8.1 DEEP FOUNDATIONS – RACKING SYSTEMS

Technical specifications should be prepared by the design team that require detailed material and construction submittals and proof of experience in pile installation. The installation method or combination of methods selected by the contractor should be submitted for review by the design team, prior to mobilization of equipment. Specifications should include provisions for removing encountered cobbles, boulders, and other obstructions as a contingency. Any pile driving refusal remedies (pre-drilling, etc.) that are adopted by the Contractor during construction will require that those piles be load tested.

8.2 SHALLOW FOUNDATIONS – EQUIPMENT PADS

The proposed equipment areas should be cleared of existing vegetation and topsoil. Cobbles, boulders, and any identifiable compressible or deleterious materials should be removed. Existing fill (including re-worked parent materials), and other unsuitable materials, must be removed from beneath bearing zones of influence to the top of firm, natural Glacial Till Deposits prior to construction. Over-excavation below bearing areas should include the zone of influence, defined as the area beneath 1 horizontal to 1 vertical (1H:1V) lines extending downward and outward from pad areas. Equipment pads shall bear on a prepared subgrade of firm natural Glacial Till Deposits, or CGF or Crushed Stone (over firm natural soils). Refer to Section 7.0 for material and placement recommendations.

Earthwork should be performed in dry conditions so that disturbance to foundation subgrades is limited. During earthwork, the Contractor should be responsible for protecting subgrades from the elements and maintaining the soils in a suitable state until completion of the project. Backfill should not be placed over a subgrade with standing water or that is frozen. Standing water, if present, should be removed and any soft and yielding soil should be removed prior to backfill placement. Excavations to subgrade levels should be performed using a smooth-edged bucket to minimize possible disturbance to the in-place subgrade soils.

Soil subgrades should be proof-rolled under the observation of a qualified Geotechnical Engineer with at least four (4) passes of a smooth-drum vibratory roller (minimum 8,000 pounds, minimum centrifugal force of 12,500 pounds) or, where approved by the geotechnical engineer, a vibratory plate compactor with a minimum of 2,500 pounds of centrifugal force. Any soft or loose zones identified during proof-rolling should be excavated and replaced with CGF, as necessary, and as required by the Geotechnical Engineer.

### 8.3 TEMPORARY EXCAVATIONS

The site soils are classified as OSHA Class "C" soil and can be cut at a maximum one vertical to one and a half horizontal (1V:1.5H) slope up to a maximum excavation depth of 20 feet. These maximum slope and excavation depths assume no surcharge load (i.e., stockpiles, construction equipment, etc.) at the top of the excavations or groundwater seepage.

### 8.4 TEMPORARY GROUNDWATER CONTROL

Based on information obtained from the subsurface exploration program, groundwater may be encountered during construction. We anticipate that water (stormwater, perched water, etc.) can be managed with conventional sump pumps and trenches in the excavations. Stormwater runoff should not be permitted to accumulate on/within exposed subgrades and the runoff should be directed away from the exposed subgrade areas.

## 9.0 REVIEW OF FINAL DESIGN, PLANS, AND SPECIFICATIONS

When project plans are finalized, and specifications are available, they should be provided to DTE for review of conformance with our preliminary geotechnical recommendations. If any changes are made to the proposed structure locations or bearing levels, the recommendations provided in this report will need to be verified by DTE for applicability.

## 10.0 CONSTRUCTION QUALITY CONTROL

We further recommend that DTE be retained during earthwork construction to observe excavation to subgrade, fill placement and compaction, subgrade preparation, and deep foundation installation. The geotechnical engineer in the field should observe the work for compliance with the recommendations in this report, identify changes in subsurface conditions from those observed in the explorations should they become apparent, and assist in the development of design changes should subsurface conditions differ from those anticipated prior to the start of construction.

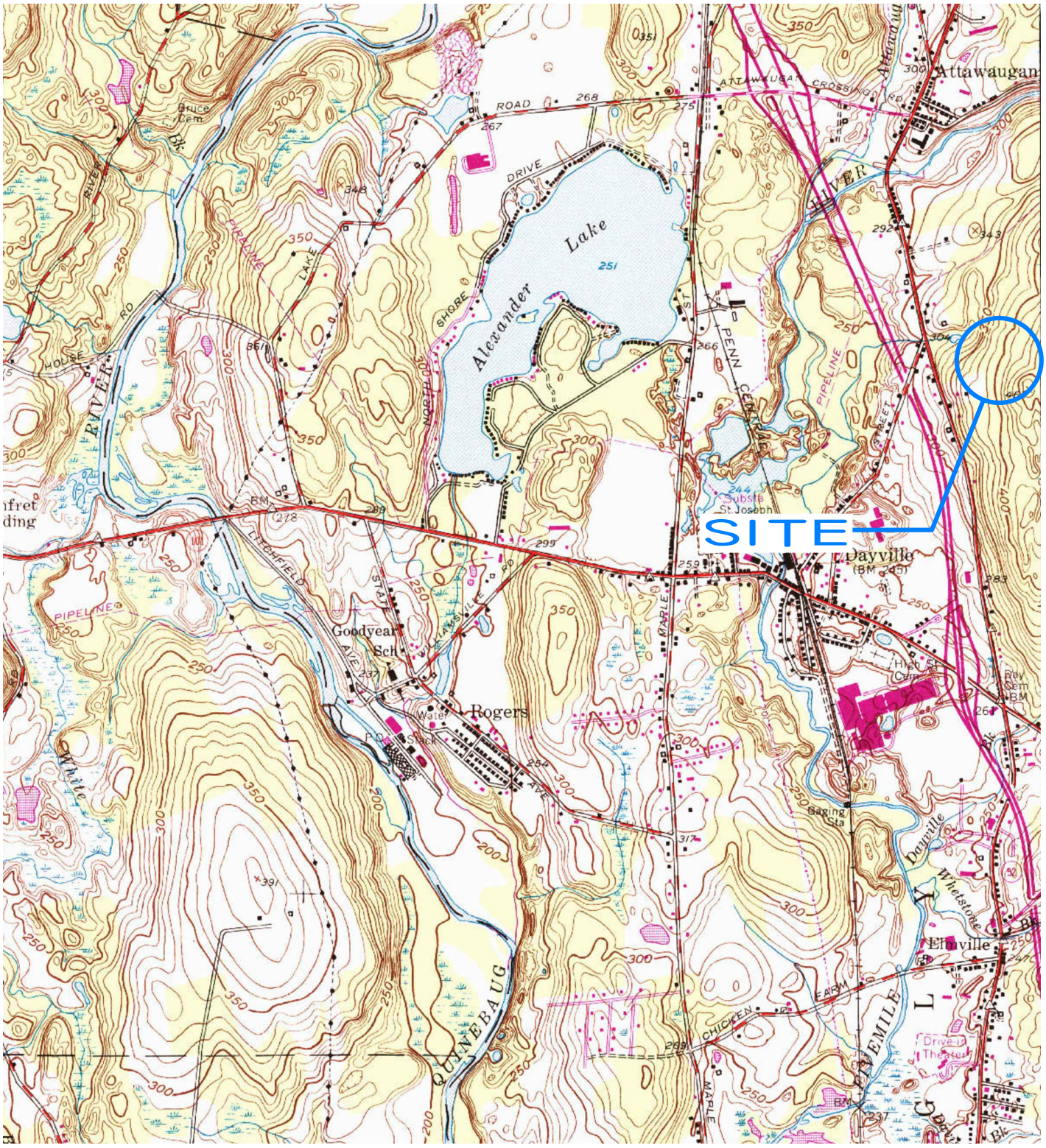
## 11.0 CLOSURE

We trust the information presented herein is sufficient for your use to progress design of the proposed solar array. We have enjoyed working with you on this project and look forward to our continued involvement. Please do not hesitate to call us if you have any questions.

This report is subject to the limitations included in Appendix 5.

# APPENDIX 1 -

# FIGURES

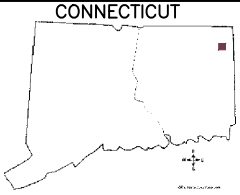



G:\My Drive\DTE Root Drive\Client Folders (new)\0032 - All-Points Technology\026 - Killingly HS Solar, Dayville, CT\CADD\0032-026.00 AREA AND SITE PLAN.dwg


**DOWN TO EARTH CONSULTING, LLC**
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

122 CHURCH STREET
NAUGATUCK, CONNECTICUT 06770


CONNECTICUT



QUADRANGLE LOCATION

# AREA PLAN
# KILLINGLY HIGH SCHOOL SOLAR ARRAY
# 226 PUTNAM PIKE
# DAYVILLE, CONNECTICUT

REFERENCE:
USGS TOPOGRAPHIC QUADRANGLE: DANIELSON, CT

SCALE 1"= 2,000'

2,000' 1,000' 0 2,000'

| | |
|---|---|
| DRAWN BY: ARB | REVIEWED BY: RPJ |

| | |
|---|---|
| PROJECT NO. | 0032-026.00 |
| DATE: | 12/12/19 |
| FIGURE NO. | 1 |


## LEGEND

B-1 — TEST BORING NO. AND LOCATION

I-1 — INFILTRATION TEST NO. AND LOCATION

NOTES:
1) BASE MAP DEVELOPED FROM AN ELECTRONIC FILE PREPARED BY GREENSKIES, ENTITLED "PROPOSED SITE PLAN, KILLINGLY HIGH SCHOOL, PV SOLAR ARRAY, 226 PUTNAM PIKE, DAYVILLE CT 06241", DATED 6/27/2019. ORIGINAL SCALE 1"=200'.
2) BORINGS WERE COMPLETED BY GENERAL BORINGS COMPANY, INC. AND OBSERVED BY DOWN TO EARTH CONSULTING, LLC.
3) THE LOCATIONS OF THE EXPLORATIONS WERE DETERMINED BY TAPING AND VISUAL ESTIMATES FROM EXISTING SITE FEATURES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DESIGNED BY OTHERS | | | | | | | |
| DRAWN BY ARB | | | | | | | |
| CHECKED BY RPJ | | | | | | | |
| | NO. | DATE | | DRWN. | CHKD | APPVD | |
| APPROVED BY RPJ | REVISIONS | | | | | | |

SCALE 1"= 100'

100' 50' 0 100'

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING
122 CHURCH STREET
NAUGATUCK, CONNECTICUT 06770

PROJECT
KILLINGLY HIGH SCHOOL SOLAR ARRAY
226 PUTNAM PIKE
DAYVILLE, CONNECTICUT

DWG. TITLE.
SITE AND EXPLORATION LOCATION PLAN

FILE NO. 0032-026.00

SCALE AS NOTED DATE 12/6/19

FIGURE NO. 2

G:\My Drive\DTE Root Drive\Client Folders (new)\0032 - All-Points Technology\026 - Killingly HS Solar, Dayville, CT\CADD\0032-026.00 AREA AND SITE PLAN.dwg Ray 12/23/2019 1:37 PM ----

# APPENDIX 2 -

# TEST BORING LOGS

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**PROJECT**
KILLINGLY HIGH SCHOOL SOLAR ARRAY
226 PUTNAM PIKE
DAYVILLE, CONNECTICUT

BORING NO. B-1
SHEET 1 of 1
FILE NO. 0032-026.00
CHKD. BY RPJ

| | | | | | |
|---|---|---|---|---|---|
| Boring Co. | General Borings, Inc. | Boring Location | See Boring Location Plan | | |
| Driller | John Wyatt | Ground Surface El. | Not Available | Datum | Not Available |
| Logged By | Mateusz Fekieta | Date Start | 11/27/2019 | Date End | 11/27/2019 |

| | |
|---|---|
| Hammer Type: | Auto Hammer |
| Sampler Size: | 1-3/8" I.D. Split Spoon |
| Type Drill Rig: | D-50 ATV Rig |
| Drilling Method: | 3.25 Inch I.D. Hollow Stem Augers |

**Groundwater Readings (from ground surface)**

| Date | Time | Depth (ft) | Elev. | Stabilization Time |
|---|---|---|---|---|
| 11/27/19 | - | 5.5 | - | 30 minutes |
| 11/27/19 | - | 4 | - | 2 hours |

| DEPTH | Casing Blows (ft) | SAMPLE INFORMATION Type & No. | REC/PEN (inches) | DEPTH (feet) | BLOWS PER 6 INCHES | Core Time (min./ft) | SAMPLE DESCRIPTION | STRATA DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 8"+/- Topsoil/ Forest Debris |
| 2 | | S-1 | 24/6 | 1 to 3 | 3-5-2-3 | | Loose, orange-brown SILT and fine to coarse SAND, trace fine Gravel, trace Roots | |
| 3 | | | | | | | | SUBSOIL |
| 4 | | S-2 | 24/9 | 3 to 5 | 3-6-10-16 | | Medium dense, gray/light brown, fine to coarse SAND and SILT, little fine Gravel | |
| 5 | | | | | | | | |
| 6 | | S-3 | 24/20 | 5 to 7 | 16-12-15-13 | | Medium dense, gray SILT and fine to coarse SAND, little fine to coarse Gravel | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | TILL |
| 11 | | S-4 | 24/18 | 10 to 12 | 14-27-35-23 | | Very dense, gray fine to coarse SAND, some Silt, little fine Gravel | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | S-5 | 22/15 | 15 to 16.9 | 14-22-32-50/2" | | Very dense, gray fine to coarse SAND and SILT, little fine Gravel, with decomposed Rock fragments, wet | |
| 17 | | | | | | | | |
| 18 | | | | | | | END OF EXPLORATION (REFUSAL) AT 16.9 FEET BELOW GRADE | |
| 19 | | | | | | | | |
| 20 | | | | | | | | |
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| 40 | | | | | | | | |

| SPT N-Values | SPT N-Values | Proportions | SYMBOL KEY | |
|---|---|---|---|---|
| 0 to 4 - Very Loose | 0 to 2 - Very Soft | Trace = 1 to 10% | 1. S denotes split-barrel sampler. | 7. WH denotes weight of hammer |
| 5 to 10 - Loose | 3 to 4 - Soft | Little = 10 to 20% | 2. ST denotes 3-inch O.D. undisturbed sample. | 8. WR denotes weight of rods |
| 11 to 30 - Medium Dense | 5 to 8 - Medium Stiff | Some = 20 to 35% | 3. UO denotes 3-inch Osterberg undisturbed sample. | 9. PP denotes Pocket Penetrometer. |
| 31 to 50 - Dense | 9 to 15 - Stiff | And = 35 to 50% | 4. PEN denotes penetration length of sampler. | 10. FVST denotes field vane shear test. |
| Over 50 - Very Dense | 16 to 30 - Very Stiff | | 5. REC denotes recovered length of sample. | 11. RQD denotes Rock Quality Designation. |
| | Over 30 - Hard | | 6. SPT denotes Standard Penetration Test. | 12. C denotes core run number. |

FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.
3) Cobbles and/or boulders were inferred based on auger chatter at 4 feet and from about 5 to 10 feet, 12 to 13 feet, 14 to 16 feet below grade.
4) Sampler refusal at about 16.9 feet on inferred boulder or bedrock.

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**PROJECT**
KILLINGLY HIGH SCHOOL SOLAR ARRAY
226 PUTNAM PIKE
DAYVILLE, CONNECTICUT

BORING NO. B-2
SHEET 1 of 1
FILE NO. 0032-026.00
CHKD. BY RPJ

| | | | | | |
|---|---|---|---|---|---|
| Boring Co. | General Borings, Inc. | Boring Location | See Boring Location Plan | | |
| Driller | John Wyatt | Ground Surface El. | Not Available | Datum | Not Available |
| Logged By | Mateusz Fekieta | Date Start | 11/27/2019 | Date End | 11/27/2019 |

| | |
|---|---|
| Hammer Type: | Auto Hammer |
| Sampler Size: | 1-3/8" I.D. Split Spoon |
| Type Drill Rig: | D-50 ATV Rig |
| Drilling Method: | 3.25 Inch I.D. Hollow Stem Augers |

**Groundwater Readings (from ground surface)**

| Date | Time | Depth (ft) | Elev. | Stabilization Time |
|---|---|---|---|---|
| 11/27/19 | - | 6 | - | wet sample |
| 11/27/19 | - | 4.5 | - | 1.5 hours |

| DEPTH | Casing Blows (ft) | SAMPLE INFORMATION Type & No. | REC/PEN (inches) | DEPTH (feet) | BLOWS PER 6 INCHES | Core Time (min./ft) | SAMPLE DESCRIPTION | STRATA DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 6"+/- Topsoil/ Forest Debris |
| 2 | | S-1 | 24/2 | 1 to 3 | 3-4-4-7 | | Loose, orange-brown SILT, some fine to coarse Sand, trace Roots | |
| 3 | | | | | | | | SUBSOIL |
| 4 | | S-2 | 24/20 | 3 to 5 | 11-12-19-20 | | Dense, gray, fine to coarse GRAVEL and SAND, some Silt, little fine to coarse Gravel | |
| 5 | | | | | | | | |
| 6 | | S-3 | 24/9 | 5 to 7 | 17-22-26-35 | | Dense, gray, fine to coarse GRAVEL and SAND, little Silt, with decomposed Rock fragments, wet | TILL |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | END OF EXPLORATION (REFUSAL) AT 8.5 FEET BELOW GRADE | |
| 10 | | | | | | | | |
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| SPT N-Values | SPT N-Values | Proportions | SYMBOL KEY | |
|---|---|---|---|---|
| 0 to 4 - Very Loose | 0 to 2 - Very Soft | Trace = 1 to 10% | 1. S denotes split-barrel sampler. | 7. WH denotes weight of hammer |
| 5 to 10 - Loose | 3 to 4 - Soft | Little = 10 to 20% | 2. ST denotes 3-inch O.D. undisturbed sample. | 8. WR denotes weight of rods |
| 11 to 30 - Medium Dense | 5 to 8 - Medium Stiff | Some = 20 to 35% | 3. UO denotes 3-inch Osterberg undisturbed sample. | 9. PP denotes Pocket Penetrometer. |
| 31 to 50 - Dense | 9 to 15 - Stiff | And = 35 to 50% | 4. PEN denotes penetration length of sampler. | 10. FVST denotes field vane shear test. |
| Over 50 - Very Dense | 16 to 30 - Very Stiff | | 5. REC denotes recovered length of sample. | 11. RQD denotes Rock Quality Designation. |
| | Over 30 - Hard | | 6. SPT denotes Standard Penetration Test. | 12. C denotes core run number. |

FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.
3) Cobbles and/or boulders were inferred based on auger chatter from about 6 to 7 feet and 8 to 8.5 feet below grade.
4) Auger refusal at 8.5 feet below grade on inferred boulder or bedrock.

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**PROJECT**
KILLINGLY HIGH SCHOOL SOLAR ARRAY
226 PUTNAM PIKE
DAYVILLE, CONNECTICUT

BORING NO. B-3
SHEET 1 of 1
FILE NO. 0032-026.00
CHKD. BY RPJ

| | | | | | |
|---|---|---|---|---|---|
| Boring Co. | General Borings, Inc. | Boring Location | See Boring Location Plan | | |
| Driller | John Wyatt | Ground Surface El. | Not Available | Datum | Not Available |
| Logged By | Mateusz Fekieta | Date Start | 11/27/2019 | Date End | 11/27/2019 |

| | |
|---|---|
| Hammer Type: | Auto Hammer |
| Sampler Size: | 1-3/8" I.D. Split Spoon |
| Type Drill Rig: | D-50 ATV Rig |
| Drilling Method: | 3.25 Inch I.D. Hollow Stem Augers |

**Groundwater Readings (from ground surface)**

| Date | Time | Depth (ft) | Elev. | Stabilization Time |
|---|---|---|---|---|
| 11/27/19 | - | 10 | - | wet sample |

| DEPTH | Casing Blows (ft) | SAMPLE INFORMATION Type & No. | REC/PEN (inches) | DEPTH (feet) | BLOWS PER 6 INCHES | Core Time (min./ft) | SAMPLE DESCRIPTION | STRATA DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 3"+/- Topsoil |
| 2 | | S-1 | 24/16 | 1 to 3 | 1-1-2-10 | | Top 5": Loose, brown fine to coarse SAND and SILT | FILL |
| 3 | | | | | | | Bottom 11": Loose, gray fine to coarse SAND and SILT, trace fine Gravel | |
| 4 | | S-2 | 24/20 | 3 to 5 | 10-19-22-20 | | Dense, gray fine to coarse SAND and GRAVEL, some Silt | |
| 5 | | | | | | | | |
| 6 | | S-3 | 24/22 | 5 to 7 | 10-16-11-10 | | Medium dense, gray fine to coarse SAND and GRAVEL, some Silt | |
| 7 | | | | | | | | |
| 8 | | | | | | | | TILL |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | S-4 | 24/2 | 10 to 12 | 31-10-17-14 | | Medium dense, gray fine to coarse GRAVEL, some fine to coarse Sand, little Silt, with decomposed Rock fragments at sample tip, wet | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | END OF EXPLORATION (REFUSAL) AT 13.5 FEET BELOW GRADE | |
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| SPT N-Values | SPT N-Values | Proportions | SYMBOL KEY | |
|---|---|---|---|---|
| 0 to 4 - Very Loose | 0 to 2 - Very Soft | Trace = 1 to 10% | 1. S denotes split-barrel sampler. | 7. WH denotes weight of hammer |
| 5 to 10 - Loose | 3 to 4 - Soft | Little = 10 to 20% | 2. ST denotes 3-inch O.D. undisturbed sample. | 8. WR denotes weight of rods |
| 11 to 30 - Medium Dense | 5 to 8 - Medium Stiff | Some = 20 to 35% | 3. UO denotes 3-inch Osterberg undisturbed sample. | 9. PP denotes Pocket Penetrometer. |
| 31 to 50 - Dense | 9 to 15 - Stiff | And = 35 to 50% | 4. PEN denotes penetration length of sampler. | 10. FVST denotes field vane shear test. |
| Over 50 - Very Dense | 16 to 30 - Very Stiff | | 5. REC denotes recovered length of sample. | 11. RQD denotes Rock Quality Designation. |
| | Over 30 - Hard | | 6. SPT denotes Standard Penetration Test. | 12. C denotes core run number. |

FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.
3) Cobbles and/or boulders were inferred based on auger chatter from about 9 to 13.5 feet below grade.
4) Auger refusal at about 13.5 feet below grade on inferred boulder or bedrock.

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**PROJECT**
KILLINGLY HIGH SCHOOL SOLAR ARRAY
226 PUTNAM PIKE
DAYVILLE, CONNECTICUT

BORING NO. B-4
SHEET 1 of 1
FILE NO. 0032-026.00
CHKD. BY RPJ

| | | | | | |
|---|---|---|---|---|---|
| Boring Co. | General Borings, Inc. | Boring Location | See Boring Location Plan | | |
| Driller | John Wyatt | Ground Surface El. | Not Available | Datum | Not Available |
| Logged By | Mateusz Fekieta | Date Start | 11/27/2019 | Date End | 11/27/2019 |

| | |
|---|---|
| Hammer Type: | Auto Hammer |
| Sampler Size: | 1-3/8" I.D. Split Spoon |
| Type Drill Rig: | D-50 ATV Rig |
| Drilling Method: | 3.25 Inch I.D. Hollow Stem Augers |

**Groundwater Readings (from ground surface)**

| Date | Time | Depth (ft) | Elev. | Stabilization Time |
|---|---|---|---|---|
| 11/27/19 | - | 15 | - | wet sample |
| 11/27/19 | - | 5.5 | - | 3.5 hours |

| DEPTH | Casing Blows (ft) | SAMPLE INFORMATION Type & No. | REC/PEN (inches) | DEPTH (feet) | BLOWS PER 6 INCHES | Core Time (min./ft) | SAMPLE DESCRIPTION | STRATA DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 6"+/- Topsoil/ Forest Debris |
| 2 | | S-1 | 24/8 | 1 to 3 | 1-2-4-10 | | Loose, gray/light brown, fine to coarse SAND and SILT, trace fine Gravel, trace Roots | |
| 3 | | | | | | | | SUBSOIL |
| 4 | | S-2 | 24/20 | 3 to 5 | 10-12-17-20 | | Dense, gray fine to coarse SAND, some fine Gravel, little Silt | |
| 5 | | | | | | | | |
| 6 | | S-3 | 24/9 | 5 to 7 | 15-17-20-20 | | Dense, gray fine to coarse SAND, some Silt, some fine to coarse Gravel | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | S-4 | 24/5 | 10 to 12 | 17-26-23-17 | | Dense, gray fine to coarse SAND, some Silt, little fine Gravel, moist | |
| 12 | | | | | | | | |
| 13 | | | | | | | | TILL |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | S-5 | 24/6 | 15 to 16.9 | 9-18-19-23 | | Dense, gray fine to coarse SAND and fine to coarse GRAVEL, some Silt, wet | |
| 17 | | | | | | | | |
| 18 | | | | | | | | |
| 19 | | | | | | | | |
| 20 | | | | | | | | |
| 21 | | S-6 | 24/19 | 20 to 22 | 20-32-41-54 | | Very dense, gray fine to coarse SAND and SILT, some fine to coarse Gravel | |
| 22 | | | | | | | | |
| 23 | | | | | | | END OF EXPLORATION AT 22 FEET BELOW GRADE | |
| 24 | | | | | | | | |
| 25 | | | | | | | | |
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| 36 | | | | | | | | |
| 37 | | | | | | | | |
| 38 | | | | | | | | |
| 39 | | | | | | | | |
| 40 | | | | | | | | |

| SPT N-Values | SPT N-Values | Proportions | SYMBOL KEY | |
|---|---|---|---|---|
| 0 to 4 - Very Loose | 0 to 2 - Very Soft | Trace = 1 to 10% | 1. S denotes split-barrel sampler. | 7. WH denotes weight of hammer |
| 5 to 10 - Loose | 3 to 4 - Soft | Little = 10 to 20% | 2. ST denotes 3-inch O.D. undisturbed sample. | 8. WR denotes weight of rods |
| 11 to 30 - Medium Dense | 5 to 8 - Medium Stiff | Some = 20 to 35% | 3. UO denotes 3-inch Osterberg undisturbed sample. | 9. PP denotes Pocket Penetrometer. |
| 31 to 50 - Dense | 9 to 15 - Stiff | And = 35 to 50% | 4. PEN denotes penetration length of sampler. | 10. FVST denotes field vane shear test. |
| Over 50 - Very Dense | 16 to 30 - Very Stiff | | 5. REC denotes recovered length of sample. | 11. RQD denotes Rock Quality Designation. |
| | Over 30 - Hard | | 6. SPT denotes Standard Penetration Test. | 12. C denotes core run number. |

FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.
3) Cobbles and/or boulders were inferred based on auger chatter from about 9 to 12 feet and 13 to 20 feet below grade.

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**PROJECT**
KILLINGLY HIGH SCHOOL SOLAR ARRAY
226 PUTNAM PIKE
DAYVILLE, CONNECTICUT

BORING NO. B-5
SHEET 1 of 1
FILE NO. 0032-026.00
CHKD. BY RPJ

| | | | | | |
|---|---|---|---|---|---|
| Boring Co. | General Borings, Inc. | Boring Location | See Boring Location Plan | | |
| Driller | John Wyatt | Ground Surface El. | Not Available | Datum | Not Available |
| Logged By | Mateusz Fekieta | Date Start | 11/27/2019 | Date End | 11/27/2019 |

| | |
|---|---|
| Hammer Type: | Auto Hammer |
| Sampler Size: | 1-3/8" I.D. Split Spoon |
| Type Drill Rig: | D-50 ATV Rig |
| Drilling Method: | 3.25 Inch I.D. Hollow Stem Augers |

**Groundwater Readings (from ground surface)**

| Date | Time | Depth (ft) | Elev. | Stabilization Time |
|---|---|---|---|---|
| 11/27/19 | - | 5 | - | wet sample |
| 11/27/19 | - | 2.5 | | 1 hour |

| DEPTH | Casing Blows (ft) | SAMPLE INFORMATION Type & No. | REC/PEN (inches) | DEPTH (feet) | BLOWS PER 6 INCHES | Core Time (min./ft) | SAMPLE DESCRIPTION | STRATA DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 3"+/- Topsoil/ Forest Debris |
| 2 | | S-1 | 24/9 | 1 to 3 | 3-3-7-7 | | Medium dense, brown fine to coarse SAND and GRAVEL, some Silt | FILL |
| 3 | | | | | | | | |
| 4 | | S-2 | 24/21 | 3 to 5 | 10-15-17-32 | | Dense, gray fine to coarse SAND and SILT, some fine Gravel | |
| 5 | | | | | | | | |
| 6 | | S-3 | 24/20 | 5 to 7 | 9-19-22-29 | | Dense, gray fine to coarse SAND and GRAVEL, little Silt, wet | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | TILL |
| 11 | | S-4 | 24/9 | 10 to 12 | 38-19-13-10 | | Dense, gray fine to coarse SAND and SILT, little fine Gravel | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | S-5 | 24/18 | 15 to 17 | 6-7-8-7 | | Medium dense, gray fine to coarse SAND and Silt, trace fine Gravel | |
| 17 | | | | | | | | |
| 18 | | | | | | | END OF EXPLORATION AT 17 FEET BELOW GRADE | |
| 19 | | | | | | | | |
| 20 | | | | | | | | |
| 21 | | | | | | | | |
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| 40 | | | | | | | | |

| SPT N-Values | SPT N-Values | Proportions | SYMBOL KEY | |
|---|---|---|---|---|
| 0 to 4 - Very Loose | 0 to 2 - Very Soft | Trace = 1 to 10% | 1. S denotes split-barrel sampler. | 7. WH denotes weight of hammer |
| 5 to 10 - Loose | 3 to 4 - Soft | Little = 10 to 20% | 2. ST denotes 3-inch O.D. undisturbed sample. | 8. WR denotes weight of rods |
| 11 to 30 - Medium Dense | 5 to 8 - Medium Stiff | Some = 20 to 35% | 3. UO denotes 3-inch Osterberg undisturbed sample. | 9. PP denotes Pocket Penetrometer. |
| 31 to 50 - Dense | 9 to 15 - Stiff | And = 35 to 50% | 4. PEN denotes penetration length of sampler. | 10. FVST denotes field vane shear test. |
| Over 50 - Very Dense | 16 to 30 - Very Stiff | | 5. REC denotes recovered length of sample. | 11. RQD denotes Rock Quality Designation. |
| | Over 30 - Hard | | 6. SPT denotes Standard Penetration Test. | 12. C denotes core run number. |

FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.
3) Cobbles and/or boulders were inferred based on auger chatter at 5 feet, 7 to 10 feet, and 14 to 15 feet below grade.

# APPENDIX 3 -

# LABORATORY TEST RESULTS

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
*Let's Build a Solid Foundation*

Client Information:
Down to Earth Conslting, LLC
Naugatuck, CT
PM: Ray Janeiro
Assigned By: Ray Janeiro
Collected By: Client

Project Information:
**Killingly High School Solar Array**
**Dayville, CT**
DTE Project Number: 0032-026.00
Summary Page: 1 of 1
Report Date: 12.16.19

# LABORATORY TESTING DATA SHEET, Report No.: 7419-M-118

| Boring ID | Sample No. | Depth (ft) | Laboratory No. | Identification Tests | | | | | | Corrosivity Tests | | | | | | | | Laboratory Log and Soil Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | As Received Water Content % | LL % | PL % | Gravel % | Sand % | Fines % | Resitivity (Mohms-cm) | Sulfate (mg/kg) | Chloride (mg/kg) | Sulfide (mg/kg) | Redox Potential (mv) | pH | Electrical Resist. As Received Ohm-cm @ 60°F | Electrial Resist. Saturated Ohm-cm @ 60°F | |
| | | | | D2216 | D4318 | | D6913 | | | EPA | | | | | | G57 | | |
| B-1 | Grab | 0-4 | 19-S-2854 | 14.3 | | | | | | | 34 | ND | | | 5.69 | 40800 | 25800 | Corrosivity Only |
| B-4 | Grab | 0-4 | 19-S-2855 | 5.1 | | | | | | | 34 | ND | | | 5.68 | 112000 | 92400 | Corrosivity Only |
| | | | | | | | | | | | | | | | | | | |
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Electrical Resistivity and pH testing was completed on 12.12.19 by MN.

Date Received: *12.09.19*

Reviewed By:

Date Reviewed: *12.16.19*

*CERTIFICATE OF ANALYSIS*

Steve Accetta
Thielsch Engineering, Inc.
195 Frances Avenue
Cranston, RI 02910

**RE: Killingly High School Solar Array-Down to Earth (0032-026.00)**
**ESS Laboratory Work Order Number: 19L0241**

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

**REVIEWED**
**By ESS Laboratory at 3:27 pm, Dec 16, 2019**

**Analytical Summary**
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth ESS Laboratory Work Order: 19L0241

## SAMPLE RECEIPT

The following samples were received on December 09, 2019 for the analyses specified on the enclosed Chain of Custody Record.

**The client did not deliver the samples in a cooler.**

| Lab Number | Sample Name | Matrix | Analysis |
|---|---|---|---|
| 19L0241-01 | B-1 S-2854 | Soil | D4327 |
| 19L0241-02 | B-4 S-2855 | Soil | D4327 |

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth ESS Laboratory Work Order: 19L0241

## PROJECT NARRATIVE

**No unusual observations noted.**

**End of Project Narrative.**

## DATA USABILITY LINKS

***To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.***

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth ESS Laboratory Work Order: 19L0241

## CURRENT SW-846 METHODOLOGY VERSIONS

### Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

### Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth
Client Sample ID: B-1 S-2854
Date Sampled: 12/09/19 14:30
Percent Solids: 87

ESS Laboratory Work Order: 19L0241
ESS Laboratory Sample ID: 19L0241-01
Sample Matrix: Soil

## Classical Chemistry

| Analyte | Results (MRL) | MDL | Method | Limit | DF | Analyst | Analyzed | Units | Batch |
|---|---|---|---|---|---|---|---|---|---|
| Chloride | **WL** ND (6) | | D4327 | | 1 | JLK | 12/10/19 23:42 | mg/kg dry | CL91042 |
| **Sulfate** | **WL 34** (11) | | D4327 | | 1 | JLK | 12/10/19 23:42 | mg/kg dry | CL91042 |

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth
Client Sample ID: B-4 S-2855
Date Sampled: 12/09/19 14:30
Percent Solids: 90

ESS Laboratory Work Order: 19L0241
ESS Laboratory Sample ID: 19L0241-02
Sample Matrix: Soil

## Classical Chemistry

| Analyte | Results (MRL) | MDL | Method | Limit | DF | Analyst | Analyzed | Units | Batch |
|---|---|---|---|---|---|---|---|---|---|
| Chloride | **WL** ND (6) | | D4327 | | 1 | JLK | 12/11/19 0:15 | mg/kg dry | CL91042 |
| **Sulfate** | **WL 34** (11) | | D4327 | | 1 | JLK | 12/11/19 0:15 | mg/kg dry | CL91042 |

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth ESS Laboratory Work Order: 19L0241

## Quality Control Data

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Classical Chemistry** | | | | | | | | | | |
| **Batch CL91042 - General Preparation** | | | | | | | | | | |
| **Blank** | | | | | | | | | | |
| Chloride | ND | 0.5 | mg/kg wet | | | | | | | |
| Sulfate | ND | 1 | mg/kg wet | | | | | | | |
| **LCS** | | | | | | | | | | |
| Chloride | 2 | | mg/L | 2.500 | | 93 | 85-115 | | | |
| Sulfate | 5 | | mg/L | 4.994 | | 97 | 80-120 | | | |

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth ESS Laboratory Work Order: 19L0241

**Notes and Definitions**

| | |
|---|---|
| WL | Results obtained from a deionized water leach of the sample. |
| U | Analyte included in the analysis, but not detected |
| ND | Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| MDL | Method Detection Limit |
| MRL | Method Reporting Limit |
| LOD | Limit of Detection |
| LOQ | Limit of Quantitation |
| DL | Detection Limit |
| I/V | Initial Volume |
| F/V | Final Volume |
| § | Subcontracted analysis; see attached report |
| 1 | Range result excludes concentrations of surrogates and/or internal standards eluting in that range. |
| 2 | Range result excludes concentrations of target analytes eluting in that range. |
| 3 | Range result excludes the concentration of the C9-C10 aromatic range. |
| Avg | Results reported as a mathematical average. |
| NR | No Recovery |
| [CALC] | Calculated Analyte |
| SUB | Subcontracted analysis; see attached report |
| RL | Reporting Limit |
| EDL | Estimated Detection Limit |
| MF | Membrane Filtration |
| MPN | Most Probably Number |
| TNTC | Too numerous to Count |
| CFU | Colony Forming Units |

*CERTIFICATE OF ANALYSIS*

Client Name: Thielsch Engineering, Inc.
Client Project ID: Killingly High School Solar Array-Down to Earth ESS Laboratory Work Order: 19L0241

**ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS**

**ENVIRONMENTAL**

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

# ESS Laboratory

*Division of Thielsch Engineering, Inc.*
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

# CHAIN OF CUSTODY

ESS LAB PROJECT ID: 19L0241

Turn Time Standard __X__ Rush____ Approved By: _____

Reporting Limits -

State where samples were collected: **CT**

Is this project for any of the following: (please circle)
**MA-MCP CT-RCP RGP DOD** Other_____

Electonic Deliverable Yes_X__ No____
Format: Excel___ Access___ PDF_X_ Other_____

Project Manager: Steve Accetta
Company: Thielsch Engineering
Address: 195 Frances Ave
Cranston, RI 02910

**Project # 0032-026.00**

Project Name/Client Name: Killingly High School Solar Array / Down to Earth Consulting

Contract Pricing __x___
Special Pricing WO#: _____

| ESS Lab Sample ID | Date | Collection Time | Grab -G Composite-C | Matrix | Sample Identification | # of Container | Analysis: Sulfate (D4327) | Analysis: Chloride (D4327) | | | | | | | | | Comment # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.09.19 | 14:30 | G | S | B-1 S-2854 | 1 | X | X | | | | | | | | | |
| 2 | 12.09.19 | 14:30 | G | S | B-4 S-2855 | 1 | X | X | | | | | | | | | |
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Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_$CH_3OH$____ — 1 1

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA — AG AG

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present _____Yes ___/___No

Seals Intact _____ Yes _____No NA: _____

Cooler Temperature: 20.9 no ice

Sampled by :Client / J. McDaniel

Comments: Please send report to: Rroth@thielsch.com, Saccetta@thielsch.com, mcolman@thielsch.com

| Relinquished by: (Signature) | Date/Time | Received by: (Signature) | Relinquished by: (Signature) | Date/Time | Received by: (Signature) |
|---|---|---|---|---|---|
| [signature] | 12.09.19 15:00 | [signature] 12/9/19 | | | |
| Relinquished by: (Signature) | Date/Time | Received by: (Signature) | Relinquished by: (Signature) | Date/Time | Received by: (Signature) |
| | | | | | |

**Please E-mail all changes to Chain of Custody in writing.**

Page ____ of ____

# APPENDIX 4 -

# INFILTRATION TEST LOGS

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**Falling Head Test**
**Killingly High School Solar Array**
**225 Putnam Pike**
**Dayville, CT**
**File No. 0032-026.00**

**Test Location:** I-1
**Test Type:** Falling Head
**Date:** 11/27/2019

**Contractor:** General Borings, Inc.
**Engineer:** RPJ
**Weather:** 30's/40's, Cloudy

Ground surface El.: 0 - Unknown (ft.)
Top of Casing El.: 0.0 (ft.)
Bottom of Casing El.: -5.0 (ft.)

Depth to Bottom of Casing: 5 (ft.)

Inside Casing Diameter: 3.0 (in.)

Hydraulic Conductivity (Kv) = π [D {Ln (h1/h2) } ] / 11 (t2-t1)

| Elapsed Time (min.) | t2 - t1 (min.) | DTW (in.) | h1 (in.) | h2 (in.) | ln(h1/h2) | Kv (in/min) | Kv (cm/sec) | Kv (in/hr) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.03 | 60.0 | 60.0 | 0.0005 | 4.5E-04 | 1.9E-05 | 2.7E-02 |
| 2 | 1 | 0.06 | 60.0 | 59.9 | 0.0005 | 4.5E-04 | 1.9E-05 | 2.7E-02 |
| 3 | 1 | 0.09 | 59.9 | 59.9 | 0.0005 | 4.5E-04 | 1.9E-05 | 2.7E-02 |
| 4 | 1 | 0.13 | 59.9 | 59.9 | 0.0005 | 4.5E-04 | 1.9E-05 | 2.7E-02 |
| 5 | 1 | 0.16 | 59.9 | 59.8 | 0.0005 | 4.5E-04 | 1.9E-05 | 2.7E-02 |
| 7.5 | 2.5 | 0.19 | 59.8 | 59.8 | 0.0005 | 1.8E-04 | 7.6E-06 | 1.1E-02 |
| 10 | 2.5 | 0.21 | 59.8 | 59.8 | 0.0004 | 1.3E-04 | 5.5E-06 | 7.7E-03 |
| 15 | 5 | 0.23 | 59.8 | 59.8 | 0.0003 | 5.7E-05 | 2.4E-06 | 3.4E-03 |
| 20 | 5 | 0.25 | 59.8 | 59.8 | 0.0003 | 5.7E-05 | 2.4E-06 | 3.4E-03 |
| 30 | 10 | 0.29 | 59.8 | 59.7 | 0.0006 | 5.0E-05 | 2.1E-06 | 3.0E-03 |
| 40 | 10 | 0.32 | 59.7 | 59.7 | 0.0006 | 5.0E-05 | 2.1E-06 | 3.0E-03 |
| 50 | 10 | 0.35 | 59.7 | 59.7 | 0.0005 | 4.3E-05 | 1.8E-06 | 2.6E-03 |
| 60 | 10 | 0.38 | 59.7 | 59.6 | 0.0005 | 4.3E-05 | 1.8E-06 | 2.6E-03 |
| 80 | 20 | 0.44 | 59.6 | 59.6 | 0.0010 | 4.1E-05 | 1.7E-06 | 2.5E-03 |
| 100 | 20 | 0.50 | 59.6 | 59.5 | 0.0010 | 4.5E-05 | 1.9E-06 | 2.7E-03 |
| 120 | 20 | 0.56 | 59.5 | 59.4 | 0.0011 | 4.5E-05 | 1.9E-06 | 2.7E-03 |

DOWN TO EARTH CONSULTING, LLC
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**Falling Head Test**
**Killingly High School Solar Array**
**225 Putnam Pike**
**Dayville, CT**
**File No. 0032-026.00**

**Test Location:** I-2
**Test Type:** Falling Head
**Date:** 11/27/2019

**Contractor:** General Borings, Inc.
**Engineer:** RPJ
**Weather:** 30's/40's, Cloudy

Ground surface El.: 0 - Unknown (ft.)
Top of Casing El.: 0.5 (ft.)
Bottom of Casing El.: -3.0 (ft.)

Depth to Bottom of Casing: 3 (ft.)

Inside Casing Diameter: 3.0 (in.)

Hydraulic Conductivity (Kv) = π [D {Ln (h1/h2) } ] / 11 (t2-t1)

| Elapsed Time (min.) | t2 - t1 (min.) | DTW (in.) | h1 (in.) | h2 (in.) | ln(h1/h2) | Kv (in/min) | Kv (cm/sec) | Kv (in/hr) |
|---|---|---|---|---|---|---|---|---|
| 5 | 5 | 0.06 | 42.0 | 41.9 | 0.0015 | 2.6E-04 | 1.1E-05 | 1.5E-02 |
| 10 | 5 | 0.13 | 41.9 | 41.9 | 0.0015 | 2.6E-04 | 1.1E-05 | 1.5E-02 |
| 20 | 10 | 0.22 | 41.9 | 41.8 | 0.0022 | 1.9E-04 | 8.1E-06 | 1.2E-02 |
| 30 | 10 | 0.30 | 41.8 | 41.7 | 0.0019 | 1.6E-04 | 6.8E-06 | 9.6E-03 |
| 40 | 10 | 0.38 | 41.7 | 41.6 | 0.0019 | 1.6E-04 | 6.8E-06 | 9.6E-03 |
| 60 | 20 | 0.53 | 41.6 | 41.5 | 0.0038 | 1.6E-04 | 6.8E-06 | 9.7E-03 |
| 80 | 20 | 0.66 | 41.5 | 41.3 | 0.0030 | 1.3E-04 | 5.5E-06 | 7.8E-03 |
| 110 | 30 | 0.84 | 41.3 | 41.2 | 0.0045 | 1.3E-04 | 5.5E-06 | 7.8E-03 |
| 140 | 30 | 1.03 | 41.2 | 41.0 | 0.0046 | 1.3E-04 | 5.5E-06 | 7.8E-03 |

# APPENDIX 5 -

# LIMITATIONS

# LIMITATIONS

Explorations

1. The analyses and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations by Down To Earth Consulting, LLC (DTE). The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tidal, temperature, and other factors occurring since the time measurements were made.

Review

4. In the event that any changes in the nature, design or location of the proposed solar arrays are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by DTE. It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Construction

5. It is recommended that this firm be retained to provide soil engineering services during construction of the earthworks and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Use of Report

6. This report has been prepared for the exclusive use of All-Points Technology Corporation, PC for specific application to the project noted in this geotechnical report in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

7. This soil and foundation engineering report has been prepared for this project by DTE. This report is for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.

8. This report may contain comparative cost estimates for the purpose of evaluating alternative foundation schemes. These estimates may also involve approximate quantity evaluations. It should be noted that quantity estimates may not be accurate enough for construction bids. Since DTE has no control over labor and materials cost and design, the estimates of construction costs have been made on the basis of experience. DTE does not guarantee the accuracy of cost estimates as compared to contractor's bids for construction costs.