



Runoff and Peak Rate Analysis

S Barnes Solar Storm Water

April 2024

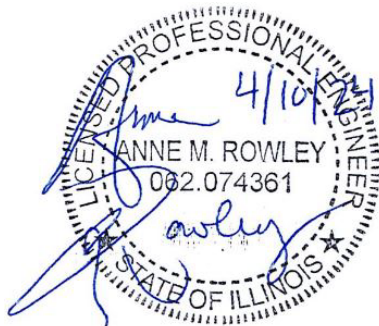
S Barnes Solar

Prepared For:

RPIL Solar 10, LLC
C/O Renewable Properties, LLC
44 Montgomery Street, Suite 3150
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Prepared By:

TRC
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PROJECT/PROPOSAL NAME RPIL – S Barnes Solar	PREPARED		CHECKED		PROJECT/PROPOSAL NO. 567363.0000.0003
	By: N. Schultz	Date: 2/1/2024 Updated: 2/7/2024 2/16/2024	By: A. Rowley	Date: 2/5/2024 2/15/2024 2/16/2024	

Purpose:

To estimate the change in storm water runoff volume and the peak discharge rate during the 2-year and 100-year, 24-hour storms resulting from a solar development located west of Barnes Road and north of Atchison Top in Sugar Grove Township, Kane County, Illinois (the Site). This change in storm water runoff volume and the peak discharge rate will dictate which storm water controls, if any, will be required.

Methodologies:

- Analysis of storm water runoff for the post condition was completed using HydroCAD®, Version 10, storm water modeling software (HydroCAD). HydroCAD is largely based on the United States Department of Agriculture (USDA) Soil Conservation Service’s (SCS), (also known as the Natural Resources Conservation Service [NRCS]) Technical Release 55 (TR-55) and TR-20 hydrology methods. HydroCAD also incorporates capabilities such as outlet hydraulics, exfiltration calculations, and a range of other features that are not applicable to the TR-55 and TR-20 methods. Additionally, it can do different distributions such as the Huff distribution.
- Drainage areas (subcatchments) and time of concentration lines for both the pre- and post-development conditions were delineated using Autodesk AutoCAD® Civil 3D design software (refer to Figures 1 and 2). These subcatchments and the corresponding time of concentration lines were then entered into HydroCAD. Surface runoff characteristics were determined based on the existing soils and topography at the Site, as well as planned final conditions. Rainfall quantities and storm distributions were determined based on the updated Bulletin 70 (see Attachment 1). HydroCAD was used to generate hydrographs from which the volume and peak discharge of storm water runoff were obtained.
- Both the pre- and post-development conditions were modeled based on topographic survey data performed by Farnsworth Group on October 16, 2023.

Assumptions:

- The following assumptions and input parameters were used when modeling the storm water runoff (refer to the attached HydroCAD outputs and references of this section):
 - Proposed grading is minimal and is not anticipated to affect Site flow. Therefore, the flow of storm water will be dependent primarily on the existing topography.
 - Storm water runoff for the existing conditions is modeled as agricultural with overland flow.
 - Storm water runoff for the developed conditions is modeled as meadow with overland flow.

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- The length of sheet flow is 100 feet for the modeled subcatchment.
- Calculations in this report are based on a 12-foot-wide gravel access road into the Site.
- Fence posts and pilings for the solar panels were not accounted for, as the total area was insignificant (less than 60 SF) and impact to storm water is anticipated to be minimal.
- The proposed vegetative screening was modeled the same as the solar seed mix to be used within the proposed fence line due to the delay of reaching mature growth. Areas shown as Solar Seed Mix Boundary that exist outside of the proposed fence were modeled as meadow.

Runoff and Routing Methods

- The Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) was utilized to determine existing soil groups for the Site. Group C and D hydrologic soil groups (HSG) are present.
- Runoff curve numbers were assumed as described below using land type and hydrologic soil group:

Land Description	Area	Curve Number (HSG C)	Curve Number (HSG D)	Reference
Row crops, SR + CR, Good	1	82	85	TR-55
>75% Grass Cover, Good	1	74	80	TR-55
Woods, Fair	1	73	79	TR-55
Meadow, Non-grazed	1	71	78	TR-55
Unconnected Pavement, Concrete Pads	1	98	98	TR-55
Paved Roads w/ Open Ditches	1	98	98	TR-55
Gravel Roads	1	89	91	TR-55
Pasture/Grassland/Range, Poor	1	NA	89	TR-55

Storm Events

- The values are based on the Kane County Ordinance for standard precipitation estimates. Kane County Ordinances base their estimates upon Illinois State Water Survey (ISWS) Updated Bulletin 70 for standard precipitation estimates (see Attachment 1).
- A 3rd Quartile Huff rainfall distribution was utilized when producing runoff hydrographs.
- A 2-year, 24-hour storm event in the vicinity of the Site produces 3.34 inches of rain.
- A 100-year, 24-hour storm event in the vicinity of the Site produces 8.57 inches of rain.

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Storm Water Runoff Results:

The results of the storm water runoff calculations are summarized in the tables below. The 2-year, 24-hour storm and 100-year, 24-hour storm have the peak runoff rate and total runoff volume summarized in Tables 1 and 2. Refer to the attached HydroCAD outputs in Attachments 2 and 3 for more details.

Table 1: Pre-Development Storm Water Runoff Summary

Watershed ID	Area (acres)	Time of Concentration (minutes)	2-Year, 24-Hour Storm		100-Year, 24-Hour Storm	
			Peak Runoff Rate (cfs)	Peak Runoff Volume (acre-ft)	Peak Runoff Rate (cfs)	Peak Runoff Volume (acre-ft)
S-1	40.0	30.7	9.48	5.75	31.42	21.74
Total Site	40.0	-	-	5.75	-	21.74

Table 2: Post-Development Storm Water Runoff Summary

Watershed ID	Area (acres)	Time of Concentration (minutes)	2-Year, 24-Hour Storm		100-Year, 24-Hour Storm	
			Peak Runoff Rate (cfs)	Peak Runoff Volume (acre-ft)	Peak Runoff Rate (cfs)	Peak Runoff Volume (acre-ft)
S-1	40.00	43.9	7.15	3.97	28.37	18.53
Total Site	40.00	-	-	3.97	-	18.53

Table 3: Difference in Storm Water Runoff Summary

Watershed ID	2-Year, 24-Hour Storm	100-Year, 24-Hour Storm
	Percent Volume Reduction (%)	Percent Volume Reduction (%)
S-1	31.0	14.8
Total Site	31.0	14.8

The results indicate a decrease in storm water runoff from subcatchment S-1. With these results, it is anticipated that no detention storage or other storm water runoff controls will be required for the Site to maintain equal to or better than previous outflow.

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Proposed Best Management Practices:

The proposed development adds approximately 15,332 square feet of impervious area to the Site. In accordance with the Kane County Stormwater Management Ordinance, Category I Best Management Practices (BMPs) are required to be incorporated into the Project. The proposed BMPs will provide runoff volume reduction and water quality treatment for one inch of rainfall over the added impervious area. The volume of water reduction and treatment required is approximately 1,278 cubic feet. Permanent Vegetation is proposed to meet the Category I BMP requirements. A native seeding mix that is suitable for Site conditions will be selected in accordance with the Practice Standards of the Illinois Urban Manual. Permanent Vegetation (Code 880) will establish a permanent cover to stabilize soils and enhance permeability while reducing runoff and erosion. The solar farm seed mix will be planted across the Site as shown in the landscaping details. This seed mix will be implemented and maintained to meet Permanent Vegetation BMP requirements in two strips within subcatchment S-1, as shown in Figure 2.

BMP Sizing

As discussed in earlier sections, ground cover improvements are proposed for the entire fenced area of the Site, however, to be flexible with seeding options, the minimum area of permanent vegetation to meet the BMP requirements was calculated. Calculations in Attachment 4 show that 23,000 square feet, or approximately 0.53 acres, of permanent vegetation must be implemented to meet the BMP volume reduction requirements.

Implementation and Maintenance

Permanent Vegetation will be implemented and maintained in accordance with Illinois Urban Manual practice standards. The landscaping details (Sheets L100 – L102) in the RPIL Solar 10 Civil Plan Set show proposed seed mixes, and planting locations. It is expected that this seed mix meets the requirements of practice standard 808a which lists acceptable plant species. Low-maintenance plants are prioritized in the landscaping plan. Prescribed burns and frequent mowing will not be implemented. Native grasses, forbs, and nurse crops are proposed.

References:

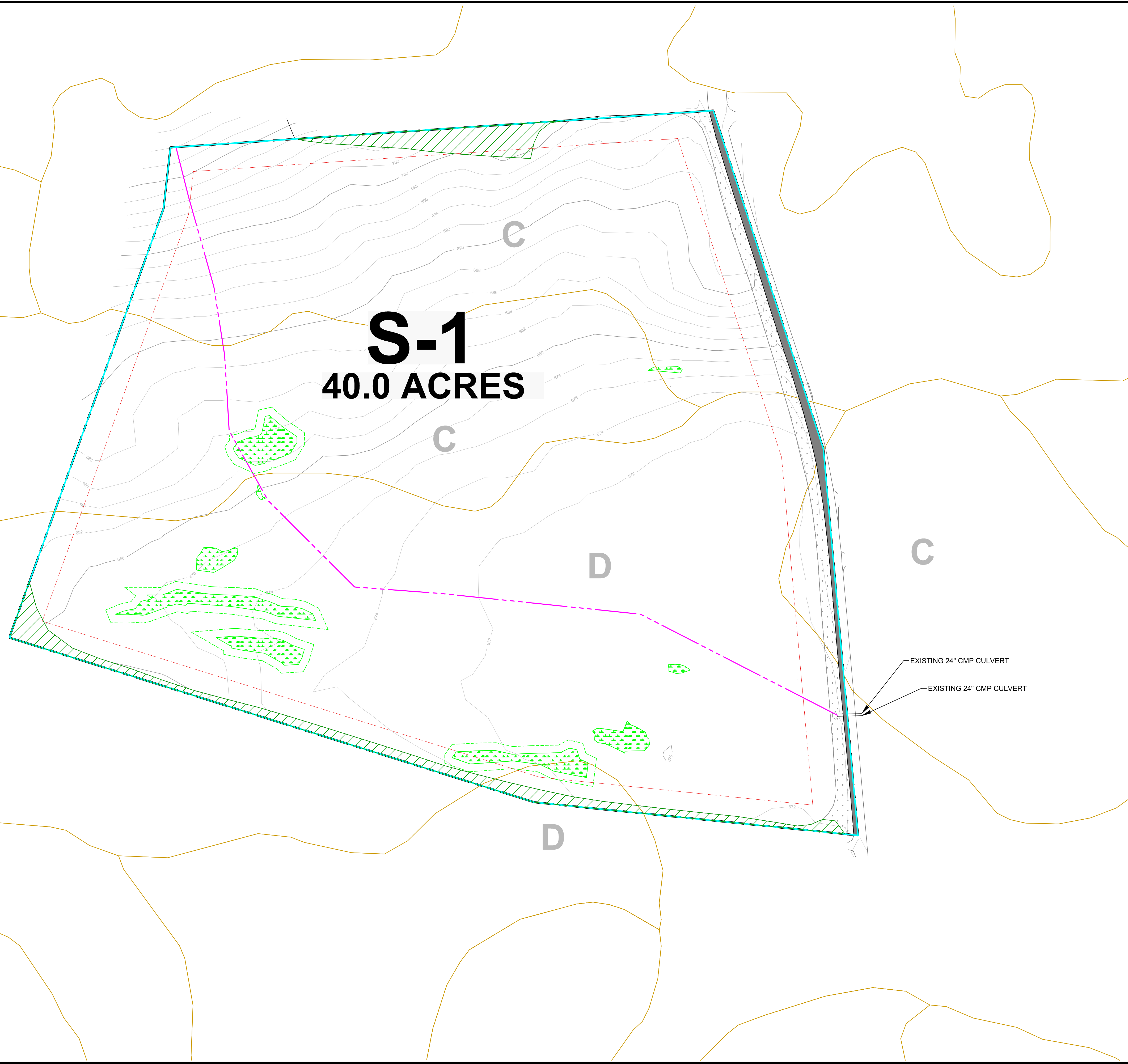
HydroCAD® Software Solutions LLC (HydroCAD). 2013. HydroCAD Storm Water Modeling System. Version 10.00.

US Department of Agriculture, Soil Conservation Service (SCS). Urban Hydrology for Small Watersheds. Technical Release No. 55 (TR-55). 2nd Edition. June 1986.

TRC Environmental Corp. RPIL Solar 10 Permit Level Plan Set. February 2024.

Figures

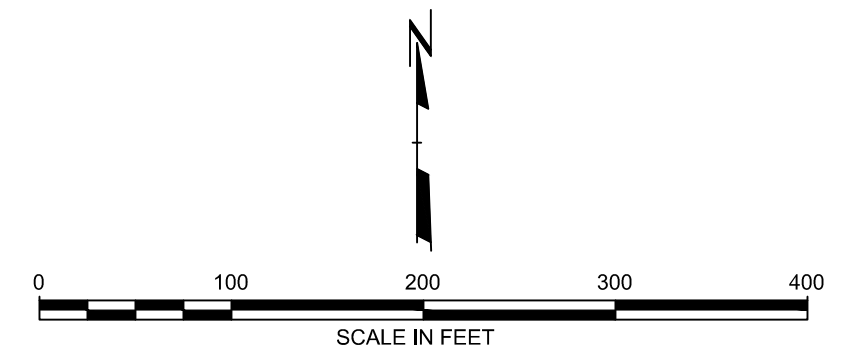
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LEGEND	
	PROPERTY LINE
	SUBCATCHMENT BOUNDARY
	SETBACK LINE
	TIME OF CONCENTRATION LINE
	EXISTING CONTOUR
	SOIL GROUP BOUNDARY
S-1	SUBCATCHMENT LABEL
D	SOIL GROUP LABEL
	EXISTING WETLAND
	WETLAND SETBACK
	TREES AND BRUSH
	GRASS AND WEEDS
	EXISTING ASPHALT ROADWAY

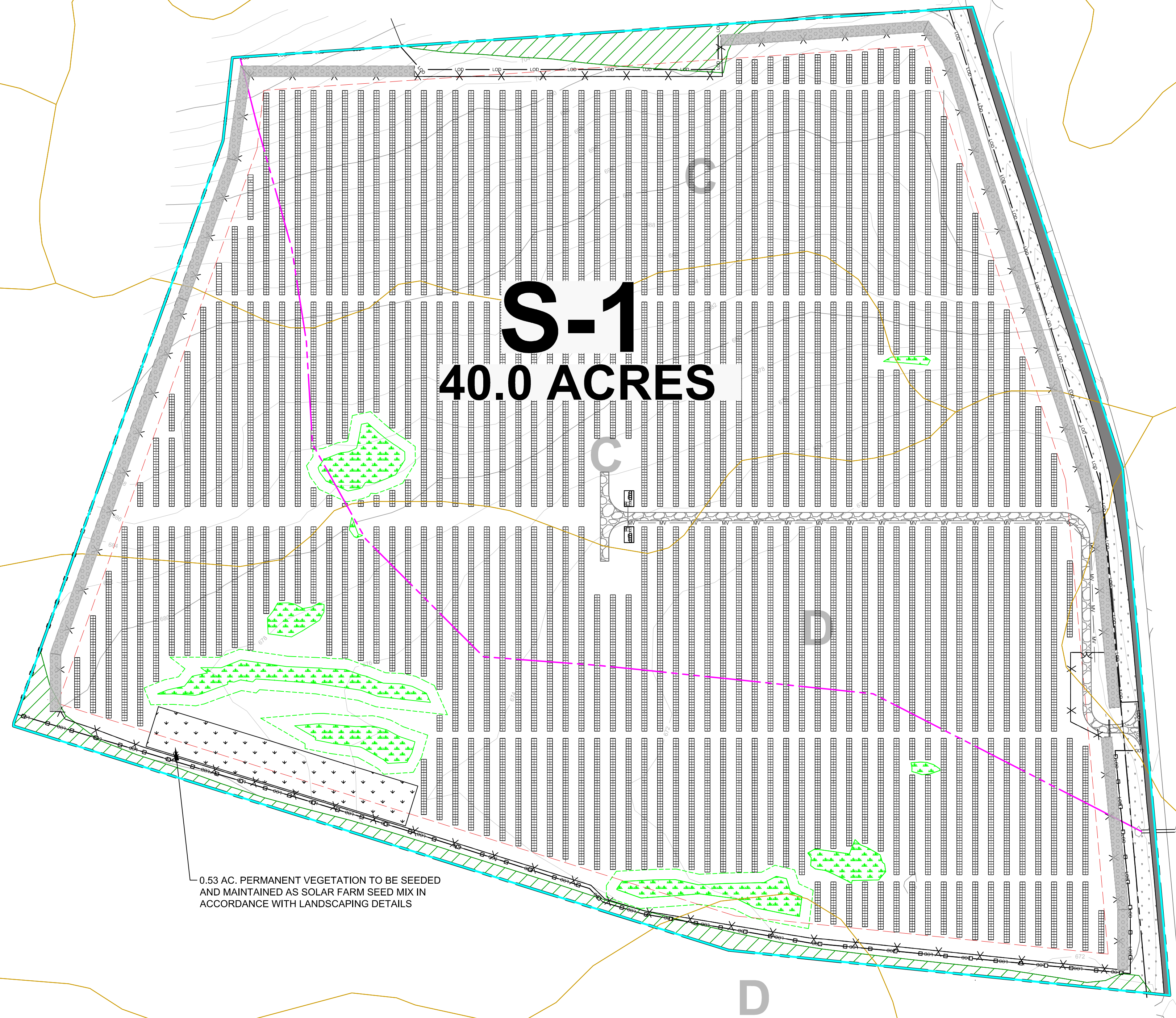
- NOTES**
- GROUP A. SOILS HAVING A HIGH INFILTRATION RATE (LOW RUNOFF POTENTIAL) WHEN THOROUGHLY WET. THESE CONSIST MAINLY OF DEEP, WELL DRAINED TO EXCESSIVELY DRAINED SANDS OR GRAVELLY SANDS. THESE SOILS HAVE A HIGH RATE OF WATER TRANSMISSION.
 - GROUP B. SOILS HAVING A MODERATE INFILTRATION RATE WHEN 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.

EXISTING 24" CMP CULVERT
EXISTING 24" CMP CULVERT



PROJECT:		RPIL SOLAR 10, LLC S BARNES ROAD SOLAR KANE COUNTY, IL	
TITLE: PRE-DEVELOPMENT STORMWATER CATCHMENTS			
DRAWN BY:	N. EDWIN	PROJ. NO.:	567363.0003.0000
CHECKED BY:	N. SCHULTZ	FIGURE 1	
APPROVED BY:	A. ROWLEY		
DATE:	FEBRUARY 2024		
		230 West Monroe St. Suite 1840 Chicago, IL 60606 Phone: 312.578.0870	
FILE NO.:	567363.0003.0000 - S Barnes Road Solar - SW_PRE.dwg		

2024 -- USER: nshulz -- ATTACHED XREFS: PR - SITE FEATURES; PR - LAND -- ATTACHED IMAGES: DRAWING NAME: C:\users\nshulz\project\swpost\567363.0003.dwg -- PLOT DATE: February 16, 2024 - 9:27AM -- LAYOUT: SW_POST



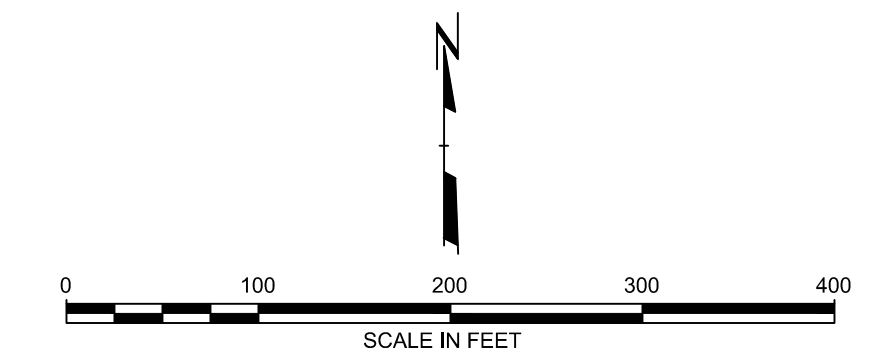
LEGEND

	PROPERTY LINE
	SUBCATCHMENT BOUNDARY
	SETBACK LINE
	TIME OF CONCENTRATION LINE
	EXISTING CONTOUR
	SOIL GROUP BOUNDARY
S-1	SUBCATCHMENT LABEL
D	SOIL GROUP LABEL
	EXISTING WETLAND
	WETLAND SETBACK
	TREES AND BRUSH
	GRASS AND WEEDS
	SOLAR SEED MIX
	12-FOOT-WIDE ACCESS ROAD
	SOLAR MODULES
	ELECTRICAL INVERTER
	SILT FENCE
	LIMITS OF DISTURBANCE
	PROPOSED LANDSCAPING
	EXISTING ASPHALT ROADWAY

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0.53 AC. PERMANENT VEGETATION TO BE SEEDED AND MAINTAINED AS SOLAR FARM SEED MIX IN ACCORDANCE WITH LANDSCAPING DETAILS

EXISTING 24" CMP CULVERT
EXISTING 24" CMP CULVERT



PROJECT:		RPIL SOLAR 10, LLC S BARNES ROAD SOLAR KANE COUNTY, IL	
TITLE: POST-DEVELOPMENT STORMWATER CATCHMENTS			
DRAWN BY:	N. EDWIN	PROJ. NO.:	567363.0003.0000
CHECKED BY:	N. SCHULTZ	FIGURE 2	
APPROVED BY:	A. ROWLEY		
DATE:	FEBRUARY 2024		
		230 West Monroe St. Suite 1840 Chicago, IL 60606 Phone: 312.578.0870	
FILE NO.:	567363.0003.0000 - S Barnes Road Solar - SW_POST.dwg		

Attachment 1
Bulletin 70 Precipitation Estimates

Results

Frequency Estimates

To determine the precipitation frequency, the previously described regional frequency analysis was applied to the AMS data. The results were then converted to the PDS domain based on the relationship defined in Eq. 1 and adjusted for the trend (Eq. 3). These results, however, still had occasional minor inconsistencies caused by several factors, such as variable data length for different durations, which resulted in irregular frequency curves. To produce the final curves, these irregularities had to be smoothed out, which was done based on the authors' professional judgment and knowledge of specific regions and gages.

The results for all sections are shown in the following tables. Table 4 displays the key for the codes used in Table 5 where the results are presented numerically. The results are shown graphically in Figures 8–12.

Table 4 Storm and Sectional Codes for Table 5

<i>Storm Code</i>		<i>Sectional Code</i>	
1	240 hours	1	Northwest
2	120 hours	2	Northeast
3	72 hours	3	West
4	48 hours	4	Central
5	24 hours	5	East
6	18 hours	6	West Southwest
7	12 hours	7	Southeast
8	6 hours	8	Southwest
9	3 hours	9	Southeast
10	2 hours	10	South
11	1 hour		

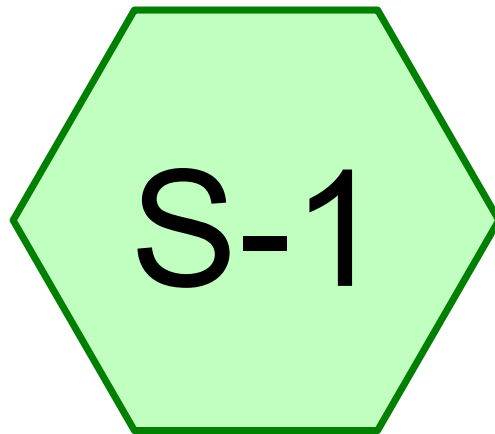
Table 5 Rainfall Frequencies

Station code	Section code	Rainfall (inches) for given recurrence interval						
		2-year	5 year	10 year	25-year	50-year	100-year	500-year
1	1	5.48	6.86	7.98	9.55	10.84	12.14	15.65
1	2	5.60	7.09	8.25	9.90	11.26	12.65	16.00
1	3	5.62	7.00	8.10	9.60	10.65	11.64	13.99
1	4	5.46	6.87	8.04	9.53	10.55	11.50	13.65
1	5	5.50	6.84	7.90	9.35	10.45	11.55	13.96
1	6	6.00	7.38	8.47	9.95	10.99	11.95	14.08
1	7	6.57	7.86	8.90	10.20	11.20	12.06	13.95
1	8	6.75	8.18	9.30	10.80	11.95	13.10	15.95
1	9	7.06	8.30	9.22	10.37	11.21	11.96	13.75
1	10	6.36	7.65	8.76	10.40	11.66	12.96	16.20
2	1	4.35	5.51	6.46	7.88	8.96	10.20	13.33
2	2	4.42	5.63	6.68	8.16	9.39	10.66	13.81
2	3	4.51	5.66	6.62	7.94	8.93	9.83	11.99
2	4	4.27	5.42	6.42	7.75	8.72	9.60	11.54
2	5	4.34	5.43	6.41	7.73	8.79	9.80	11.93
2	6	4.49	5.60	6.49	7.77	8.69	9.57	11.53
2	7	5.00	6.11	7.01	8.23	9.11	9.95	11.71
2	8	5.31	6.51	7.47	8.79	9.81	10.84	13.45
2	9	5.73	6.78	7.60	8.64	9.47	10.20	11.97
2	10	5.18	6.30	7.29	8.69	9.78	10.91	13.84
3	1	3.90	4.95	5.87	7.21	8.30	9.45	12.30
3	2	3.97	5.08	6.05	7.49	8.64	9.85	12.81
3	3	4.11	5.18	6.08	7.34	8.31	9.18	11.27
3	4	3.88	4.96	5.90	7.17	8.09	8.98	10.81
3	5	3.88	4.90	5.78	7.04	8.01	8.93	11.00
3	6	4.00	5.00	5.83	7.01	7.91	8.73	10.61
3	7	4.35	5.37	6.19	7.34	8.19	8.97	10.57
3	8	4.74	5.82	6.71	7.96	8.89	9.86	12.32
3	9	5.13	6.09	6.86	7.87	8.63	9.34	10.93
3	10	4.54	5.61	6.50	7.78	8.79	9.86	12.55

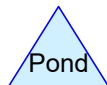
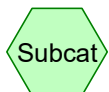
Table 5 (continued)

		<i>Rainfall (inches) for given recurrence interval</i>						
<i>Storm code</i>	<i>Section code</i>	<i>2-year</i>	<i>5-year</i>	<i>10-year</i>	<i>25-year</i>	<i>50-year</i>	<i>100-year</i>	<i>500-year</i>
4	1	3.61	4.59	5.43	6.72	7.73	8.83	11.53
4	2	3.66	4.71	5.62	6.99	8.13	9.28	12.10
4	3	3.76	4.76	5.62	6.81	7.72	8.60	10.58
4	4	3.59	4.61	5.47	6.65	7.55	8.40	10.21
4	5	3.54	4.49	5.32	6.48	7.38	8.27	10.26
4	6	3.66	4.61	5.38	6.48	7.33	8.11	9.93
4	7	3.92	4.85	5.61	6.67	7.46	8.21	9.76
4	8	4.28	5.29	6.10	7.25	8.15	9.08	11.40
4	9	4.64	5.54	6.27	7.24	7.94	8.58	10.06
4	10	4.06	5.02	5.86	7.04	8.01	9.02	11.56
5	1	3.34	4.22	5.03	6.20	7.20	8.25	10.84
5	2	3.34	4.30	5.15	6.45	7.50	8.57	11.24
5	3	3.48	4.45	5.24	6.38	7.25	8.06	9.91
5	4	3.32	4.30	5.10	6.20	7.05	7.85	9.53
5	5	3.12	3.97	4.71	5.78	6.62	7.43	9.32
5	6	3.23	4.07	4.76	5.79	6.56	7.31	9.04
5	7	3.49	4.33	5.00	5.98	6.71	7.40	8.84
5	8	3.69	4.56	5.27	6.30	7.14	7.96	10.06
5	9	4.07	4.89	5.55	6.42	7.06	7.68	8.99
5	10	3.63	4.52	5.28	6.38	7.29	8.23	10.57
6	1	3.14	3.97	4.73	5.83	6.77	7.75	10.19
6	2	3.14	4.04	4.84	6.06	7.05	8.06	10.57
6	3	3.27	4.18	4.93	6.00	6.82	7.58	9.32
6	4	3.12	4.04	4.79	5.83	6.63	7.38	8.96
6	5	2.93	3.73	4.43	5.43	6.22	6.98	8.76
6	6	3.04	3.83	4.47	5.44	6.17	6.87	8.50
6	7	3.28	4.07	4.70	5.62	6.31	6.96	8.31
6	8	3.47	4.29	4.95	5.92	6.71	7.48	9.45
6	9	3.83	4.60	5.22	6.03	6.64	7.22	8.45
6	10	3.41	4.25	4.96	6.00	6.85	7.73	9.93

Attachment 2
Pre-Development HydroCAD Calculations



Subcatchment 1



PreCon S Barnes

Prepared by TRC Companies

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Printed 2/16/2024

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Huff B70 0-10sm	3Q	Scale	24.00	1	3.34	2
2	100-year	Huff B70 0-10sm	3Q	Scale	24.00	1	8.57	2

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Page 3

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.509	74	>75% Grass cover, Good, HSG C (S-1)
0.324	80	>75% Grass cover, Good, HSG D (S-1)
0.263	89	Pasture/grassland/range, Poor, HSG D (S-1)
0.266	98	Paved roads w/open ditches, 50% imp, HSG C (S-1)
0.103	98	Paved roads w/open ditches, 50% imp, HSG D (S-1)
18.689	82	Row crops, SR + CR, Good, HSG C (S-1)
18.732	85	Row crops, SR + CR, Good, HSG D (S-1)
0.411	73	Woods, Fair, HSG C (S-1)
0.698	79	Woods, Fair, HSG D (S-1)
39.995	83	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
19.875	HSG C	S-1
20.120	HSG D	S-1
0.000	Other	
39.995		TOTAL AREA

PreCon S Barnes

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.509	0.324	0.000	0.833	>75% Grass cover, Good	
0.000	0.000	0.000	0.263	0.000	0.263	Pasture/grassland/range, Poor	
0.000	0.000	0.266	0.103	0.000	0.369	Paved roads w/open ditches, 50% imp	
0.000	0.000	18.689	18.732	0.000	37.421	Row crops, SR + CR, Good	
0.000	0.000	0.411	0.698	0.000	1.109	Woods, Fair	
0.000	0.000	19.875	20.120	0.000	39.995	TOTAL AREA	

PreCon S Barnes

Huff B70 0-10sm 3Q scaled to 24.00 hrs 2-year Rainfall=3.34"

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Time span=2.00-26.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS-1: Subcatchment1

Runoff Area=39.995 ac 0.46% Impervious Runoff Depth=1.72"
Flow Length=1,961' Tc=30.7 min CN=83 Runoff=9.48 cfs 5.749 af

Total Runoff Area = 39.995 ac Runoff Volume = 5.749 af Average Runoff Depth = 1.72"
99.54% Pervious = 39.811 ac 0.46% Impervious = 0.184 ac

Summary for Subcatchment S-1: Subcatchment 1

Runoff = 9.48 cfs @ 16.55 hrs, Volume= 5.749 af, Depth= 1.72"

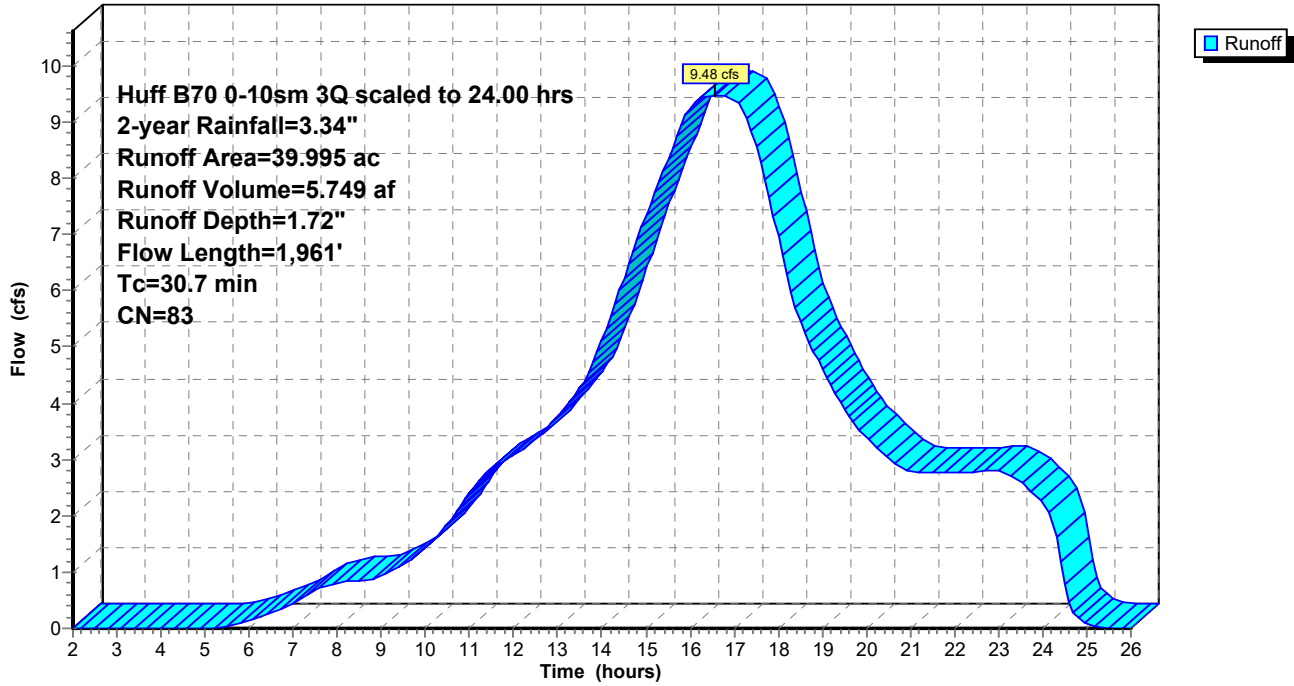
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-26.00 hrs, dt= 0.10 hrs
 Huff B70 0-10sm 3Q scaled to 24.00 hrs 2-year Rainfall=3.34"

Area (ac)	CN	Description
0.187	74	>75% Grass cover, Good, HSG C
0.322	74	>75% Grass cover, Good, HSG C
0.324	80	>75% Grass cover, Good, HSG D
0.041	89	Pasture/grassland/range, Poor, HSG D
0.117	89	Pasture/grassland/range, Poor, HSG D
0.092	89	Pasture/grassland/range, Poor, HSG D
0.013	89	Pasture/grassland/range, Poor, HSG D
0.315	82	Row crops, SR + CR, Good, HSG C
8.383	82	Row crops, SR + CR, Good, HSG C
9.991	82	Row crops, SR + CR, Good, HSG C
0.246	85	Row crops, SR + CR, Good, HSG D
18.486	85	Row crops, SR + CR, Good, HSG D
* 0.089	98	Paved roads w/open ditches, 50% imp, HSG C
* 0.177	98	Paved roads w/open ditches, 50% imp, HSG C
* 0.103	98	Paved roads w/open ditches, 50% imp, HSG D
0.411	73	Woods, Fair, HSG C
0.138	79	Woods, Fair, HSG D
0.560	79	Woods, Fair, HSG D
39.995	83	Weighted Average
39.811		99.54% Pervious Area
0.184		0.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0740	0.27		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.34"
24.2	1,845	0.0200	1.27		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
0.2	16	0.0060	1.16		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
30.7	1,961	Total			

Subcatchment S-1: Subcatchment 1

Hydrograph



PreCon S Barnes

Huff B70 0-10sm 3Q scaled to 24.00 hrs 100-year Rainfall=8.57"

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Time span=2.00-26.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS-1: Subcatchment1

Runoff Area=39.995 ac 0.46% Impervious Runoff Depth=6.52"
Flow Length=1,961' Tc=30.7 min CN=83 Runoff=31.42 cfs 21.741 af

Total Runoff Area = 39.995 ac Runoff Volume = 21.741 af Average Runoff Depth = 6.52"
99.54% Pervious = 39.811 ac 0.46% Impervious = 0.184 ac

Summary for Subcatchment S-1: Subcatchment 1

Runoff = 31.42 cfs @ 16.21 hrs, Volume= 21.741 af, Depth= 6.52"

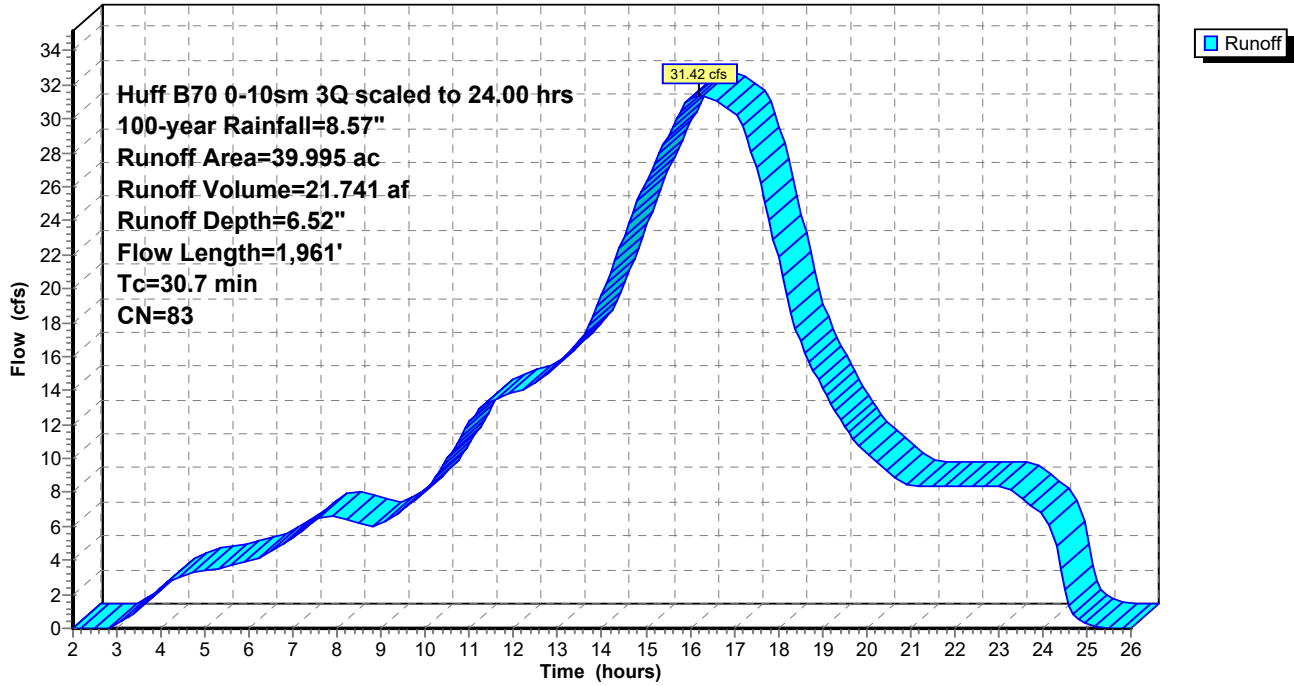
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-26.00 hrs, dt= 0.10 hrs
 Huff B70 0-10sm 3Q scaled to 24.00 hrs 100-year Rainfall=8.57"

Area (ac)	CN	Description
0.187	74	>75% Grass cover, Good, HSG C
0.322	74	>75% Grass cover, Good, HSG C
0.324	80	>75% Grass cover, Good, HSG D
0.041	89	Pasture/grassland/range, Poor, HSG D
0.117	89	Pasture/grassland/range, Poor, HSG D
0.092	89	Pasture/grassland/range, Poor, HSG D
0.013	89	Pasture/grassland/range, Poor, HSG D
0.315	82	Row crops, SR + CR, Good, HSG C
8.383	82	Row crops, SR + CR, Good, HSG C
9.991	82	Row crops, SR + CR, Good, HSG C
0.246	85	Row crops, SR + CR, Good, HSG D
18.486	85	Row crops, SR + CR, Good, HSG D
* 0.089	98	Paved roads w/open ditches, 50% imp, HSG C
* 0.177	98	Paved roads w/open ditches, 50% imp, HSG C
* 0.103	98	Paved roads w/open ditches, 50% imp, HSG D
0.411	73	Woods, Fair, HSG C
0.138	79	Woods, Fair, HSG D
0.560	79	Woods, Fair, HSG D
39.995	83	Weighted Average
39.811		99.54% Pervious Area
0.184		0.46% Impervious Area

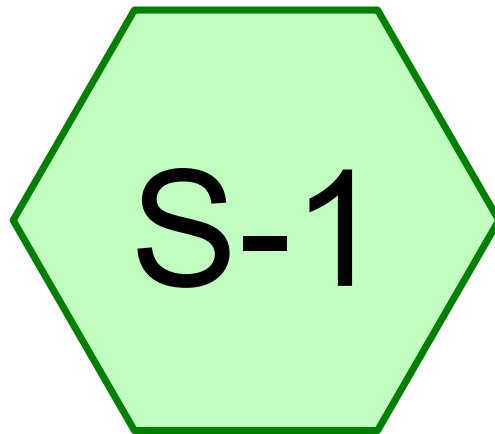
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0740	0.27		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.34"
24.2	1,845	0.0200	1.27		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
0.2	16	0.0060	1.16		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
30.7	1,961	Total			

Subcatchment S-1: Subcatchment 1

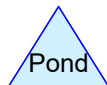
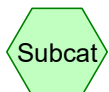
Hydrograph



Attachment 3
Post-Development HydroCAD Calculations



Subcatchment 1



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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Huff B70 0-10sm	3Q	Scale	24.00	1	3.34	2
2	100-year	Huff B70 0-10sm	3Q	Scale	24.00	1	8.57	2

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.495	74	>75% Grass cover, Good, HSG C (S-1)
0.324	80	>75% Grass cover, Good, HSG D (S-1)
0.137	89	Gravel roads, HSG C (S-1)
0.201	91	Gravel roads, HSG D (S-1)
17.629	71	Meadow, non-grazed, HSG C (S-1)
18.086	78	Meadow, non-grazed, HSG D (S-1)
0.266	98	Paved roads w/open ditches, 50% imp, HSG C (S-1)
0.103	98	Paved roads w/open ditches, 50% imp, HSG D (S-1)
0.935	82	Row crops, SR + CR, Good, HSG C (S-1)
0.718	85	Row crops, SR + CR, Good, HSG D (S-1)
0.014	98	Unconnected pavement, HSG C (S-1)
0.399	73	Woods, Fair, HSG C (S-1)
0.688	79	Woods, Fair, HSG D (S-1)
39.995	75	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
19.875	HSG C	S-1
20.120	HSG D	S-1
0.000	Other	
39.995		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.495	0.324	0.000	0.819	>75% Grass cover, Good	
0.000	0.000	0.137	0.201	0.000	0.338	Gravel roads	
0.000	0.000	17.629	18.086	0.000	35.715	Meadow, non-grazed	
0.000	0.000	0.266	0.103	0.000	0.369	Paved roads w/open ditches, 50% imp	
0.000	0.000	0.935	0.718	0.000	1.653	Row crops, SR + CR, Good	
0.000	0.000	0.014	0.000	0.000	0.014	Unconnected pavement	
0.000	0.000	0.399	0.688	0.000	1.087	Woods, Fair	
0.000	0.000	19.875	20.120	0.000	39.995	TOTAL AREA	

PostCon S Barnes

Huff B70 0-10sm 3Q scaled to 24.00 hrs 2-year Rainfall=3.34"

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Time span=2.00-27.00 hrs, dt=0.10 hrs, 251 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS-1: Subcatchment1

Runoff Area=39.995 ac 0.50% Impervious Runoff Depth=1.19"
Flow Length=1,961' Tc=43.9 min CN=75 Runoff=7.15 cfs 3.965 af

Total Runoff Area = 39.995 ac Runoff Volume = 3.965 af Average Runoff Depth = 1.19"
99.50% Pervious = 39.797 ac 0.50% Impervious = 0.198 ac

Summary for Subcatchment S-1: Subcatchment 1

Runoff = 7.15 cfs @ 17.12 hrs, Volume= 3.965 af, Depth= 1.19"

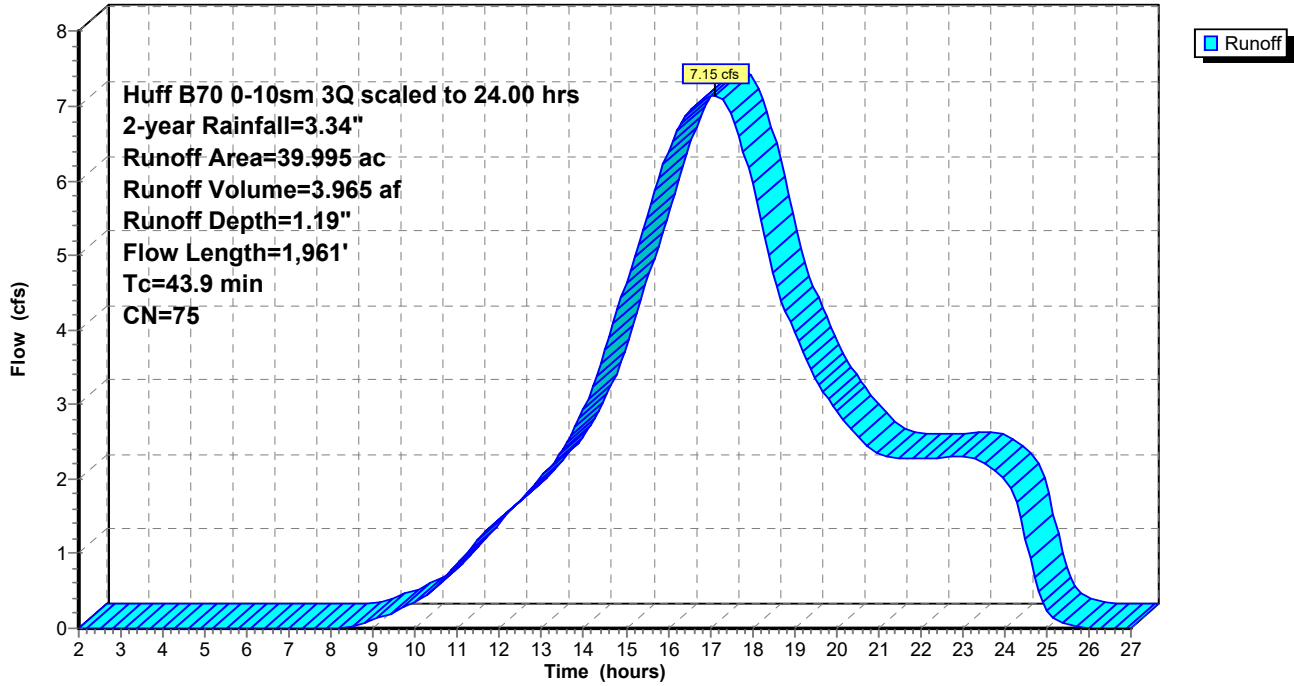
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-27.00 hrs, dt= 0.10 hrs
 Huff B70 0-10sm 3Q scaled to 24.00 hrs 2-year Rainfall=3.34"

Area (ac)	CN	Description
0.495	74	>75% Grass cover, Good, HSG C
0.324	80	>75% Grass cover, Good, HSG D
0.137	89	Gravel roads, HSG C
0.201	91	Gravel roads, HSG D
17.629	71	Meadow, non-grazed, HSG C
18.086	78	Meadow, non-grazed, HSG D
0.935	82	Row crops, SR + CR, Good, HSG C
0.718	85	Row crops, SR + CR, Good, HSG D
* 0.266	98	Paved roads w/open ditches, 50% imp, HSG C
* 0.103	98	Paved roads w/open ditches, 50% imp, HSG D
0.399	73	Woods, Fair, HSG C
0.688	79	Woods, Fair, HSG D
0.014	98	Unconnected pavement, HSG C
39.995	75	Weighted Average
39.797		99.50% Pervious Area
0.198		0.50% Impervious Area
0.014		7.05% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	13	0.0610	0.16		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.34"
11.0	87	0.0760	0.13		Sheet Flow, Check surface desc. Woods: Light underbrush n= 0.400 P2= 3.34"
30.4	1,808	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.0	37	0.0050	0.64		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
0.2	16	0.0060	1.16		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
43.9	1,961	Total			

Subcatchment S-1: Subcatchment 1

Hydrograph



PostCon S Barnes

Huff B70 0-10sm 3Q scaled to 24.00 hrs 100-year Rainfall=8.57"

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Time span=2.00-27.00 hrs, dt=0.10 hrs, 251 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS-1: Subcatchment1

Runoff Area=39.995 ac 0.50% Impervious Runoff Depth=5.56"
Flow Length=1,961' Tc=43.9 min CN=75 Runoff=28.37 cfs 18.527 af

Total Runoff Area = 39.995 ac Runoff Volume = 18.527 af Average Runoff Depth = 5.56"
99.50% Pervious = 39.797 ac 0.50% Impervious = 0.198 ac

Summary for Subcatchment S-1: Subcatchment 1

Runoff = 28.37 cfs @ 16.58 hrs, Volume= 18.527 af, Depth= 5.56"

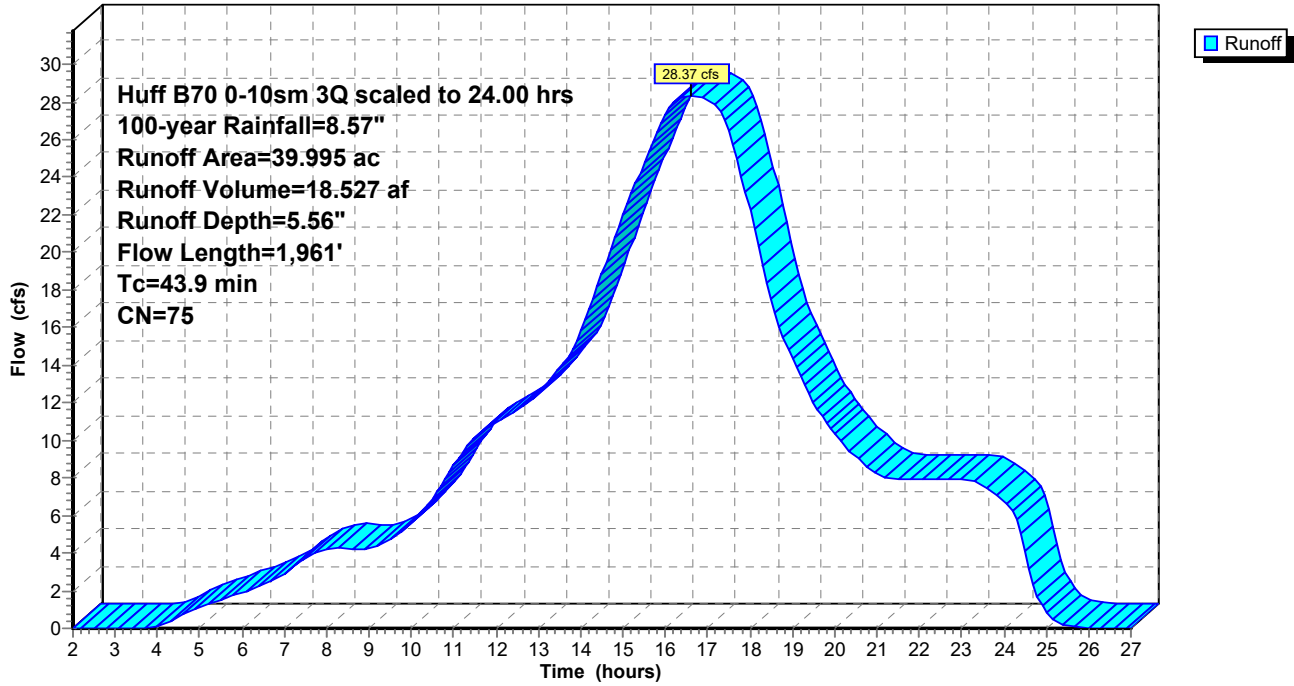
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-27.00 hrs, dt= 0.10 hrs
 Huff B70 0-10sm 3Q scaled to 24.00 hrs 100-year Rainfall=8.57"

Area (ac)	CN	Description
0.495	74	>75% Grass cover, Good, HSG C
0.324	80	>75% Grass cover, Good, HSG D
0.137	89	Gravel roads, HSG C
0.201	91	Gravel roads, HSG D
17.629	71	Meadow, non-grazed, HSG C
18.086	78	Meadow, non-grazed, HSG D
0.935	82	Row crops, SR + CR, Good, HSG C
0.718	85	Row crops, SR + CR, Good, HSG D
* 0.266	98	Paved roads w/open ditches, 50% imp, HSG C
* 0.103	98	Paved roads w/open ditches, 50% imp, HSG D
0.399	73	Woods, Fair, HSG C
0.688	79	Woods, Fair, HSG D
0.014	98	Unconnected pavement, HSG C
39.995	75	Weighted Average
39.797		99.50% Pervious Area
0.198		0.50% Impervious Area
0.014		7.05% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	13	0.0610	0.16		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.34"
11.0	87	0.0760	0.13		Sheet Flow, Check surface desc. Woods: Light underbrush n= 0.400 P2= 3.34"
30.4	1,808	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.0	37	0.0050	0.64		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
0.2	16	0.0060	1.16		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
43.9	1,961	Total			

Subcatchment S-1: Subcatchment 1

Hydrograph



Attachment 4
BMP Sizing Calculations



PROJECT NAME / LOCATION: RPIL Solar 10		
SUBJECT: BMP Volume Reduction Calculations		
PREPARED BY: N. Schultz	DATE: 2/6/2024	PROJECT NO.
CHECKED BY: C. Zumm	DATE: 2/6/2024	50015.0003.0000

BMP Sizing

Purpose: This calculation determines the required area of Permanent Vegetation that must be implemented to meet volume reduction requirements.

Methodology: The TR-55 Method was determined to be appropriate for calculating runoff volumes. The curve number (CN) is the primary variable for calculation of runoff volumes. The Kane County Stormwater Management Ordinance requires volume reduction of 1-inch over the proposed impervious area. To be conservative, these calculations use the 2-year, 24-hour storm value of 3.34 inches over the impervious area as the standard for volume reduction.

Curve numbers are representative of existing and proposed land covers. Existing and proposed covers on-site include row crops, meadow, and gravel roads.

Variables: Q = total runoff (in), P = rainfall (in), S = potential maximum retention after runoff begins (in),
I_a = initial abstraction (in)

RUNOFF VOLUME COMPUTATION		
TR-55		
EXISTING SITE INFO		
CN=	82	(Row crops, SR+CR, Good)
2-year, 24-hour P=	3.34	in
S=(1000/CN)-10		
S=	2.20	
INITIAL ABSTRACTION		
I _a = 0.2*S =	0.44	in
RUNOFF		
Q = (P-I _a) ² / (P-I _a +S)		
Q=	1.65	in

RUNOFF VOLUME COMPUTATION		
TR-55		
PROPOSED SITE INFO		
CN=	71	(Meadow, non-grazed)
2-year, 24-hour P=	3.34	in
S=(1000/CN)-10		
S=	4.08	
INITIAL ABSTRACTION		
I _a =	0.82	in
RUNOFF		
Q = (P-I _a) ² / (P-I _a +S)		
Q=	0.96	in

REQUIRED VOLUME REDUCTION COMPUTATION		
Proposed Impevious Area=	15332	sf
24 hr P=	1.00	in
RUNOFF VOLUME (NO ABSTRACTIONS)		
V=A*P		
V=	1277.67	cf

ACTUAL VOLUME REDUCTION COMPUTATION		
$\Delta Q = Q_{\text{existing}} - Q_{\text{proposed}}$		
$Q_{\text{existing}} - Q_{\text{proposed}} =$	0.69	in
Proposed BMP AREA = A =	23000	sf
Proposed Volume Reduction		
$V = Q * A$		
V =	1319	cf

Results: The proposed BMP volume reduction requirements will be met by adding a minimum of 23,000 square feet (approximately 0.53 acres) of permanent vegetation.