STORMWATER IMPACT REPORT

FOR

DADA BHAGWAN VIGNAN INSTITUTE (DBVI)

BLOCK 37.02 - LOT 46.03
630 SOUTH MIDDLEBUSH ROAD
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

OCTOBER 2019
REVISED APRIL 2020

Prepared For:

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TRG Project No. 14-001

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I. PROJECT SUMMARY

The applicant proposes to construct a 21,083 square-foot house of worship and associated site improvements on this property on South Middlebush Road. These improvements will include widening and paving the existing driveway, the construction of two parking areas, walkways, landscaping and various utility improvements. The site is accessed via the existing driveway off S. Middlebush Road. The area of the site is 695,276 sf or 15.96 acres; the total existing impervious coverage on the site is 0.15 acres. The existing dwelling and a portion of the existing gravel driveway will remain. The total proposed impervious coverage is 2.97 acres.

The additional impervious coverage will result in an increase in site stormwater runoff. In order to mitigate the impact of this increase, a combination of structural and non-structural techniques is proposed. An infiltration basin with extended detention storage volume is proposed to collect, store and release, at a reduced rate, stormwater runoff from a majority of the developed portion of the site. The basin will be constructed in accordance with state and local stormwater management regulations. In order to address runoff impacts for the areas which will bypass the detention basin, vegetated filter strips and non-structural methods will be utilized. A Low Impact Development (LID) Checklist and Non-Structural Strategies Point System (NSPS) Spreadsheet for this project are provided in Appendix G. The design of the structural stormwater BMPs and the overall stormwater management plan for this project are discussed in detail below.

II. DISCUSSION OF STORMWATER IMPACT

A. STORMWATER QUANTITY

The existing site consists of a large, wooded area encompassing 70% of the site with a previously cultivated area that is now maintained grassland covering the remainder of the property. The gravel driveway, existing dwelling and surrounding pocket of lawn area sits within the wooded area. According to the USDA Web Soil Survey the site is comprised of Lansdowne, Penn, Rowland and Royce silt loams, which are all classified as Hydrologic Soil Group ‘C’.

Since the proposed development will result in an increase in on-site impervious area, measures must be taken to mitigate the impact of the resulting increase in stormwater runoff. In order to adequately design these measures, a hydrologic study of the site has been performed. The hydrologic study reflects the natural topography of the existing site in that there are three subareas of analysis. As shown on the Existing Conditions Drainage Area Map (DA-1), Drainage Area #1 flows into the existing wetlands pocket in the southeastern corner of the site. Drainage Area #2 flows primarily toward the northeasterly property line. Drainage Area #3 flows toward South Middlebush Road. The hydrologic analysis compares existing and proposed site flows from the three drainage areas, as well as the combined overall site flow.

In accordance with state and local stormwater regulations, the analysis of the stormwater runoff impact must reflect a reduction in flows after any improvements which increase runoff from the site. As such, the flow analysis includes the computation of "allowable" post development flows. These allowable flows are existing flow values with appropriate reduction factors applied to the undeveloped portion of the site which will be improved. The appropriate reduction factors are as follows: 50% for the 2-year frequency storm, 75% for the 10-year storm, and 80% for the 100-year storm. In the case of this development, the reduction factors were applied to all existing pervious areas, including the gravel driveway, which will become impervious, and existing wooded areas that will become lawn. The reduction factors have not been applied to those areas outside of the project limit of disturbance, nor to those existing developed areas, including lawns, which will remain as they are.

In order to reduce the stormwater runoff from the site to required levels, an infiltration basin with sufficient storage volume to provide extended detention is proposed. The proposed basin is located in Proposed Drainage Sub-Area #1A. The required reduction in runoff will be achieved by capturing, storing and releasing at a reduced rate the runoff from the proposed building, two parking areas and a portion of the resurfaced driveway.

Due to the natural topography of the site, a portion of the proposed driveway will bypass the detention basin. The developed flow from this 0.4-acre driveway impervious coverage located in Drainage Areas 2 & 3 will be offset by re-vegetating part of the previously cultivated areas within those drainage areas. The re-vegetation will consist of native deciduous shrubs and grasses. This environmental restoration will serve as a non-structural, low impact development (LID) technique to reduce runoff from Drainage Areas 2 and 3. The planted area will act as "brush" (NRCS TR-55 methodology curve number classification), thereby reducing the curve number and subsequent runoff from this portion of the existing open space area. The area of re-vegetation has been sized so that post development flows in the two drainage areas will be less than allowable.

The proposed stormwater BMPs have been designed to reduce the site runoff to below allowable flow values through either storage and attenuation of site flows (detention basin) or reduction in runoff (re-vegetation). The site flows were developed using SCS methodology and HydroCAD modelling software. The complete output from the 2, 10 and 100-year HydroCAD models (allowable and proposed conditions) is located in Appendix B. The results of the hydrologic models are summarized in the table below.

Summary of Site Flows:

ALLOWABLE FLOW	*Storm Frequency (years)*		
	2	**10**	**100**
All-1: Allowable DA-1 flow to SE corner	3.11	7.76	17.79
All-2: Allowable DA-2 flow to NE property line	2.92	6.87	15.29
All-3: Allowable DA-3 flow to S. Middlebush Rd	2.36	5.61	12.55
Tot Allow: Combined Allowable flow from site	8.20	19.99	45.12

PROPOSED FLOW	*Storm Frequency (years)*		
	2	**10**	**100**
Pr-1: Proposed DA-1 flow to SE corner[1]	3.06	6.16	17.64
Pr-2: Proposed DA-2 flow to NE property line	2.80	6.16	13.47
Pr-3: Proposed DA-3 flow to S. Middlebush Rd	2.21	5.11	11.59
Tot Prop: Combined Proposed flow from site	7.91	17.72	41.24

[1] *The proposed flow from DA-1 is the summation of the hydrographs representing the basin outflow and the bypass flow (Proposed Subcatchment 1b in HydroCAD model). The basin inflow is represented by Proposed Subcatchment 1a.*

Summary of Infiltration/Detention Basin Output (Basin in DA-1a):

Storm Frequency:	**2-year**	**10-year**	**100-year**
Basin Inflow (cfs)	6.59	10.63	18.63
Basin Outflow (cfs)	0.23	0.46	4.33
Water Surface Elev.	106.47	107.37	108.44

** The crest elevation of the Emergency Spillway is 108.50; therefore, the required 100-yr storm storage volume is contained within the basin.*

As indicated in the tables above, the proposed infiltration/extended detention basin will provide adequate storage volume to control the rate of runoff from the site to allowable flow levels in Drainage Area #1. The LID technique will effectuate a reduction in proposed runoff to allowable runoff rates for Drainage Area #2 and #3.

In order to safely convey extraordinary flows from the basin, a 20-foot wide emergency spillway will be provided. To check the adequacy of the spillway width, the NJDEP emergency storm (100-year + 50%) has been routed through the basin. The results of this model can be found in Appendix B and are summarized below:

Infiltration/Detention Basin – Emergency Spillway Storm 20'-wide Spillway – Crest @ 108.50	
100 yr Infiltration Basin Inflow	28.99 cfs
Flow through Emergency Spillway	23.12 cfs
Peak Water Surface Elevation	108.88
Top of Berm Elevation	110.0

Since the peak water surface elevation of the model with flow through the emergency spillway is less than the top of berm elevation with ten inches of freeboard provided, the spillway is adequately sized. The 20-foot wide spillway is not in a fill area; therefore, a grass-lined spillway channel is proposed. The spillway flow has been analyzed to determine its velocity in the downstream channel. As shown in the calculation sheet

included at the end of Appendix B, for a flow of 23.12 cfs in a 20-foot wide grass-lined channel at 4.8%, the velocity of flow is 1.97 fps. Since this velocity is below maximum allowable velocity for silt loam (2.0 fps), a vegetated channel is sufficient.

B. STORMWATER QUALITY

In addition to providing quantity control, the proposed infiltration/extended detention basin will provide water quality treatment for the site runoff. Per the NJDEP Stormwater BMP Manual, infiltration of the water quality storm through 6-inch thick sand bottom will provide 80% TSS removal. In order to design the BMP to adequately provide treatment, the water quality design storm was routed through the basin to determine the invert of the lowest quantity control outlet, consistent with best management practices for the design of infiltration basins. This model is located in Appendix C and is summarized in the table below:

Bio-Retention Basin – WQ Storm	
Water Quality Inflow	4.77 cfs
Water Quality Outflow	0.0
WQ Water Surface Elev.	105.32
Depth of Peak Storage	9.8 inches

The peak elevation of the water quality design storm is 105.32, about 10 inches above the basin bottom (elev. 104.5). The lowest outlet, a 4" orifice, is set above this peak elevation at 106.00. Therefore, the entire water quality design storm will be infiltrated.

The infiltration basin has been designed to the meet the criteria outlined in Chapter 9.5 in the New Jersey Stormwater Best Management Practices Manual. The sand bottom will be 6 inches thick. Soils testing was performed by Bayer-Risse Engineering, Inc. (see excerpts of their report in Appendix E). Soil Log numbers 0627-3 and 0627-4 pertain to the proposed infiltration/detention basin location. As noted in the Soil Test Summary Data table located in the appendix, the depth of groundwater observed in stormwater soil logs #3 and #4 were 100" and 80", respectively. Based upon the ground elevation at these test locations, the observed elevations of groundwater were 101.87 and 100.83. Using the more conservative elevation (101.87), in order to meet the BMP criteria that the bottom of the 6-inch thick sand layer be a minimum of 2 feet above seasonal high groundwater, the surface elevation of the basin bottom must be at least 104.37. The proposed bottom surface elevation of 104.5 therefore meets this criterion.

As noted in Section B above, not all proposed impervious surfaces can be conveyed to the infiltration basin. The front portion of the drive is instead designed without curbing to allow runoff to sheet flow across the adjacent existing wooded area. This area will serve

as a vegetated filter strip. The natural, forested filter strip has been evaluated per the criteria noted in Chapter 9.10 of the NJDEP Stormwater BMP Manual. This evaluation indicates that the natural vegetated filter strips within Drainage Areas #2 and #3, meet the criteria for 80% TSS Removal. The summary below reflects the more detailed analysis provided in Appendix C of this report.

Drainage Area [1]	Actual Min. Length of Filter	Actual Max. Average Slope [2]	Min. Required Length for 80% TSS Removal [3]
2	90 ft	3.5%	40 ft
3	70 ft	4.0%	43 ft

[1] Soils in both Drainage Areas are Hydrologic Soil Group C
[2] Maximum Allowable slope for filter in Existing Forest Area is 8%
[3] From Chart D (for HSG C) and Existing Forest Areas Curve

The on-site stormwater management measures, a combination of the proposed infiltration basin and the vegetated filter strips, will therefore meet state and local stormwater pollutant removal criteria by reducing the average annual total suspended solids load by 80 percent.

C. GROUNDWATER RECHARGE

As noted above, the stormwater management BMP proposed as part of the site improvements has been designed to infiltrate stormwater runoff. The New Jersey Groundwater Recharge Spreadsheet (NJGRS) has been utilized to provide an analysis of the pre and post development annual groundwater recharge. As shown in the computations provided in Appendix D, the required effective depth of the stormwater BMP (dBMP) to provide the appropriate recharge volume (i.e., the post-development annual recharge deficit) is 3.9 inches. Since a depth of 18 inches is provided in the basin below the first outlet (the 4" orifice at 106.00), the infiltration basin as designed provides enough storage volume to effectively recharge stormwater runoff from the post-development site.

An investigation of the permeability of the onsite soils has been performed, by Bayer-Risse Engineering, Inc., to ensure that the runoff to the stormwater management basin will infiltrate at an acceptable rate. Test pits #3 and #4 were excavated within the footprint of the infiltration basin (see Drainage Area map #2 for location). As shown in the soil testing results provided in Appendix E of this report, the soils in this area are primarily a mix of sandy clay with sandstone pebbles. The testing conducted yielded permeability rates of 160.0 and 114.7 inches per hour for test pits 3 and 4, respectively. These rates are more than sufficient to allow the infiltration of stormwater runoff in this area. In accordance with the NJDEP Stormwater BMP Manual, the maximum design infiltration rate of 10 inches per hour was used in calculations.

As a best management practice, no standing water shall remain in an infiltration basin 72 hours after the design rainfall event. The peak storage calculated with the infiltration basin and the maximum design permeability rate allowed were used to compute the drain time for the stormwater BMP (see Appendix D). The drain time for the infiltration design flow, which is the runoff resulting from the water quality storm, has been calculated to be 1.8 hours.

D. GROUNDWATER MOUNDING

A groundwater mounding analysis has been performed using the Hantush equation spreadsheet. The analysis indicates that the mounding created by the infiltration of runoff in the stormwater management facility will not adversely impact the functioning of the infiltration basin. The permeability parameters for the site and the calculation methodology described in the USGS/NJDEP report "Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins" were used in the analysis. The resulting groundwater mounding height is 2.4 feet. Based on the soils testing data, the observed depths of the seasonal high water table results in an estimated average groundwater elevation within the basin of 101.35. Applying the calculated mounding height to this elevation results in a peak mound elevation of 103.75, which is below the bottom of the basin sand layer (104.0). The spreadsheet result for this analysis is located in Appendix D.

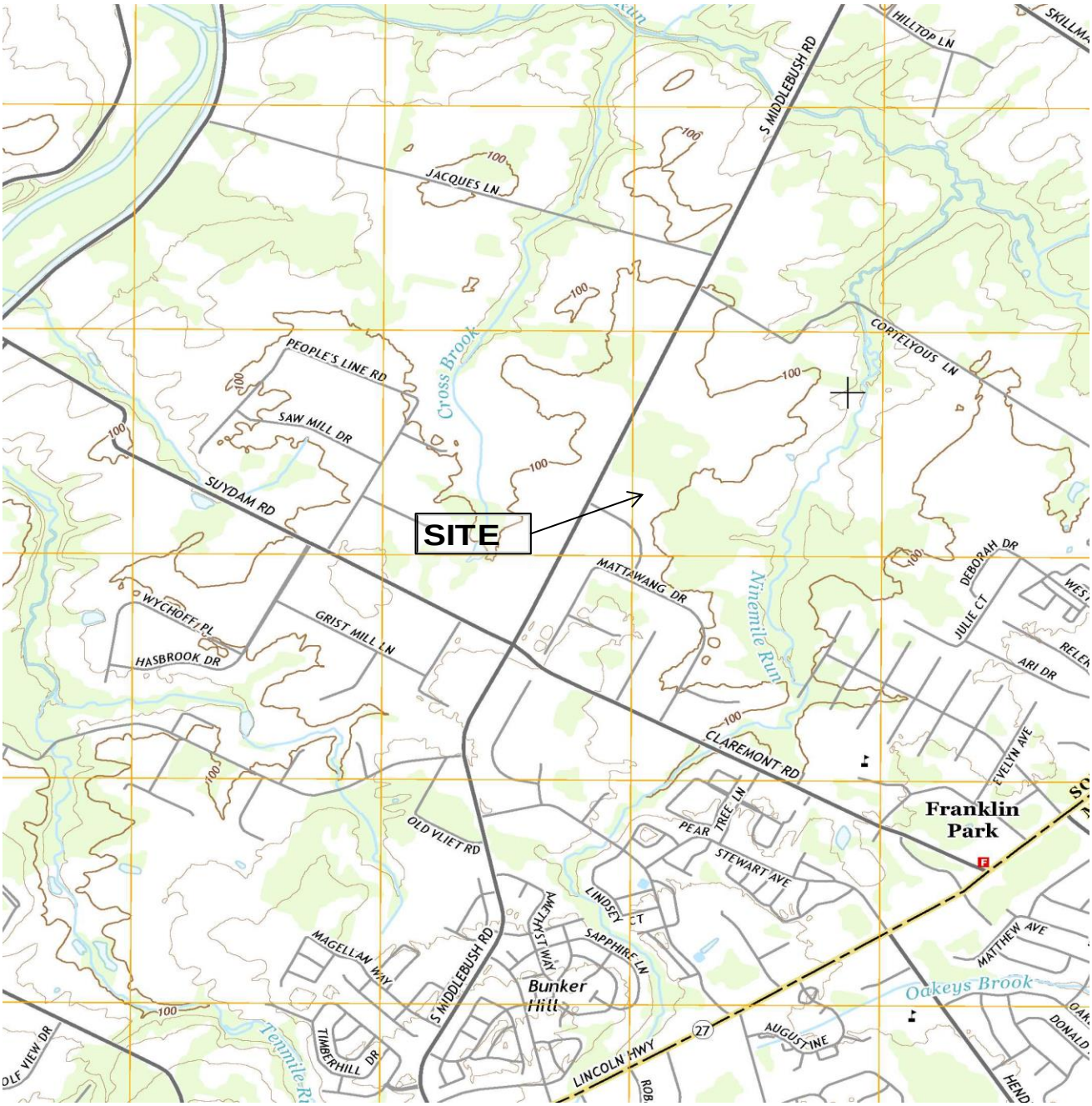
III. STORMWATER CONVEYANCE SYSTEM DESIGN

Calculations supporting the design of the proposed stormwater conveyance system are in Appendix F of this report. The inlet flows were computed using the Rational Method and cumulative pipe flows are compared to pipe capacity. A 25-year design storm was utilized; the critical pipe runs directly into in detention basin were checked for 100-year capacity. Inlet drainage areas are shown on map DA-2.

The design of the stormwater management basin reflects New Jersey's Standards for Soil Erosion and Sediment Control. Calculations supporting the size of the conduit outlet protection (riprap aprons) provided at the infiltration basin inflow and outlet pipes are also located in Appendix F.

APPENDIX A

MAP FIGURES



LOCATION MAP

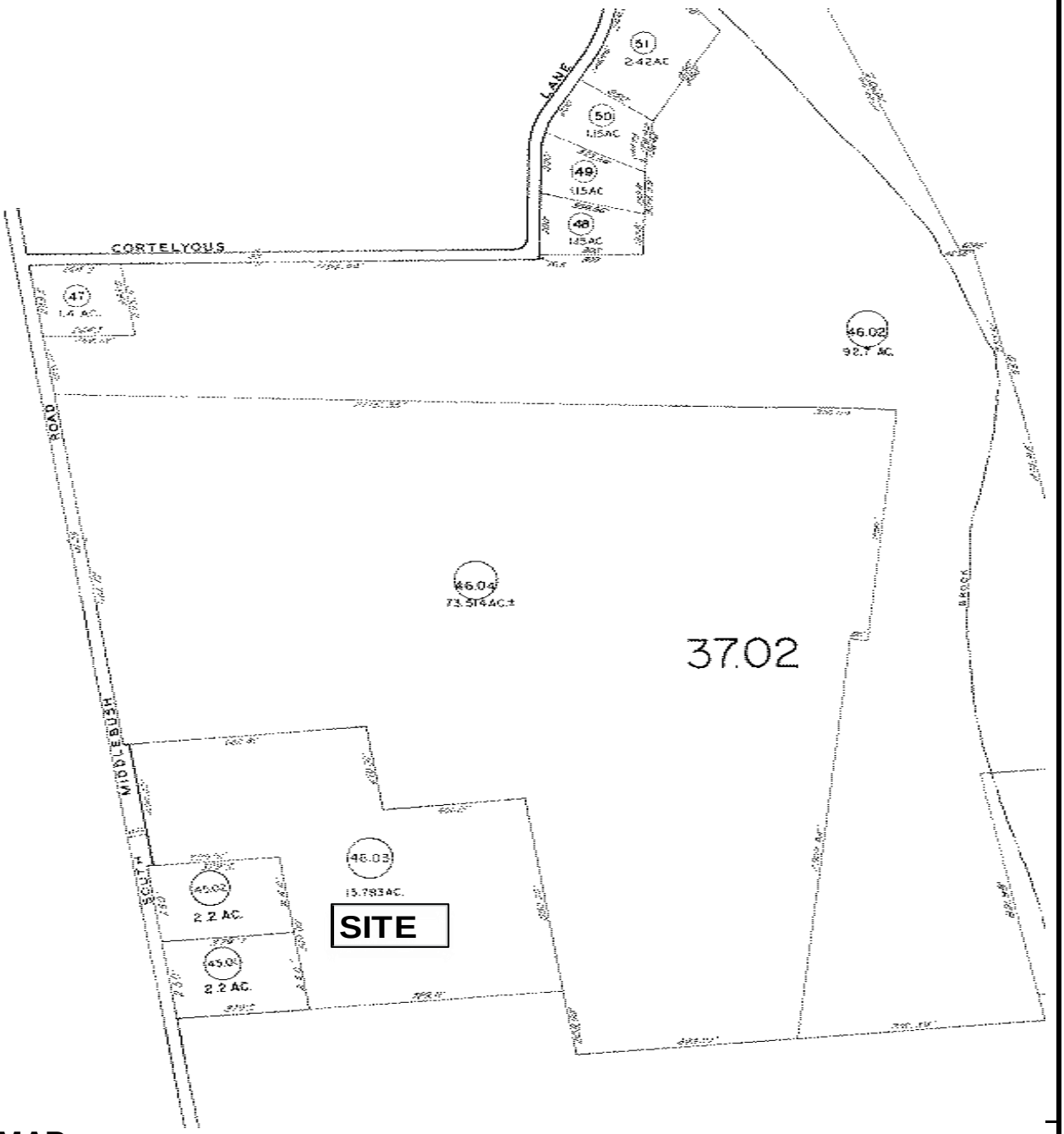
SITE:

DVBI
BLOCK 37.02, LOT 46.03
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

State Plane Coordinates
N: 591,003
E: 478,357

SOURCE:
USGS TOPOGRAPHIC MAP
MONMOUTH JUNCTION QUAD
SCALE: 1" = 2000' +/-

FIGURE: 1



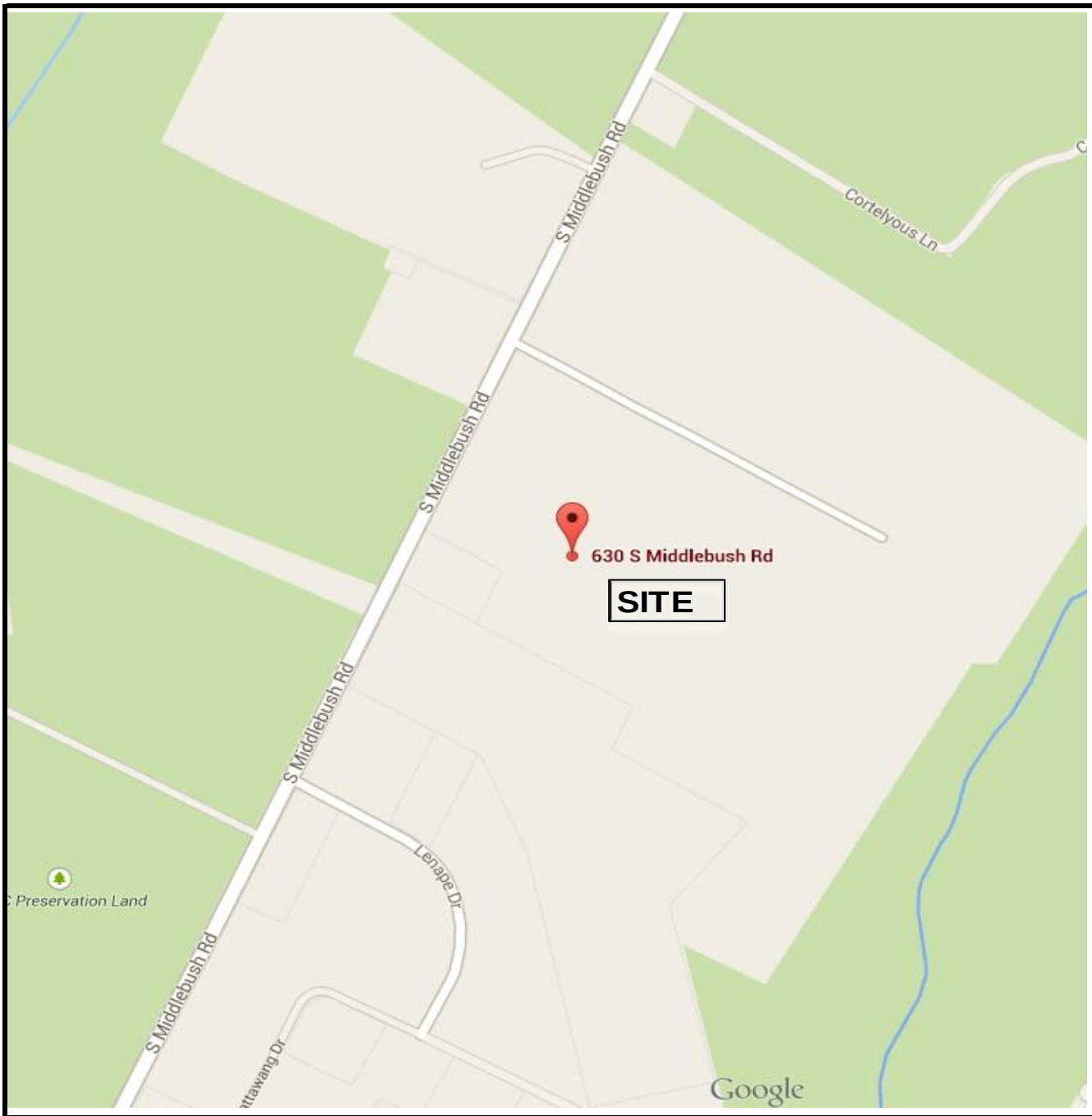
TAX MAP

SITE:

DVBI
BLOCK 37.02, LOT 46.03
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

SOURCE:
TOWNSHIP OF FRANKLIN TAX MAP
SHEET No. 33

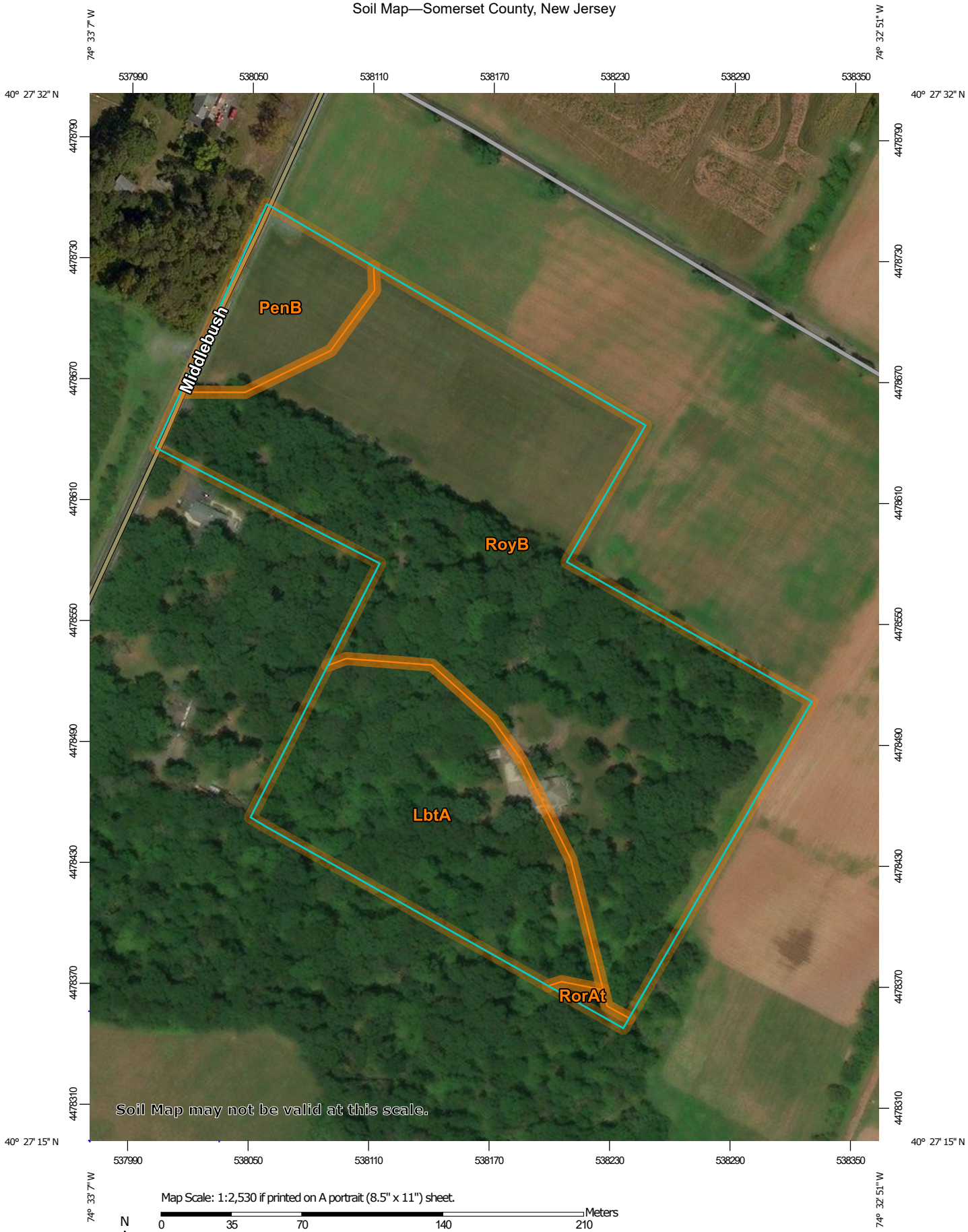
FIGURE: 2



ROAD MAP

SITE: **DVBI** **BLOCK 37.02, LOT 46.03** **TOWNSHIP OF FRANKLIN** **SOMERSET COUNTY, NEW JERSEY**	*SOURCE:* GOOGLE MAP **FIGURE: 3**

Soil Map—Somerset County, New Jersey



Map Scale: 1:2,530 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

FIGURE 4

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LbtA	Lansdowne silt loam, 0 to 2 percent slopes	3.9	24.3%
PenB	Penn silt loam, 2 to 6 percent slopes	1.2	7.7%
RorAt	Rowland silt loam, 0 to 2 percent slopes, frequently flooded	0.1	0.5%
RoyB	Royce silt loam, 2 to 6 percent slopes	10.8	67.5%
Totals for Area of Interest		**15.9**	**100.0%**

APPENDIX B

STORMWATER RUNOFF CALCULATIONS

- **Allowable Conditions HydroCAD models**
  2, 10 and 100-year storms

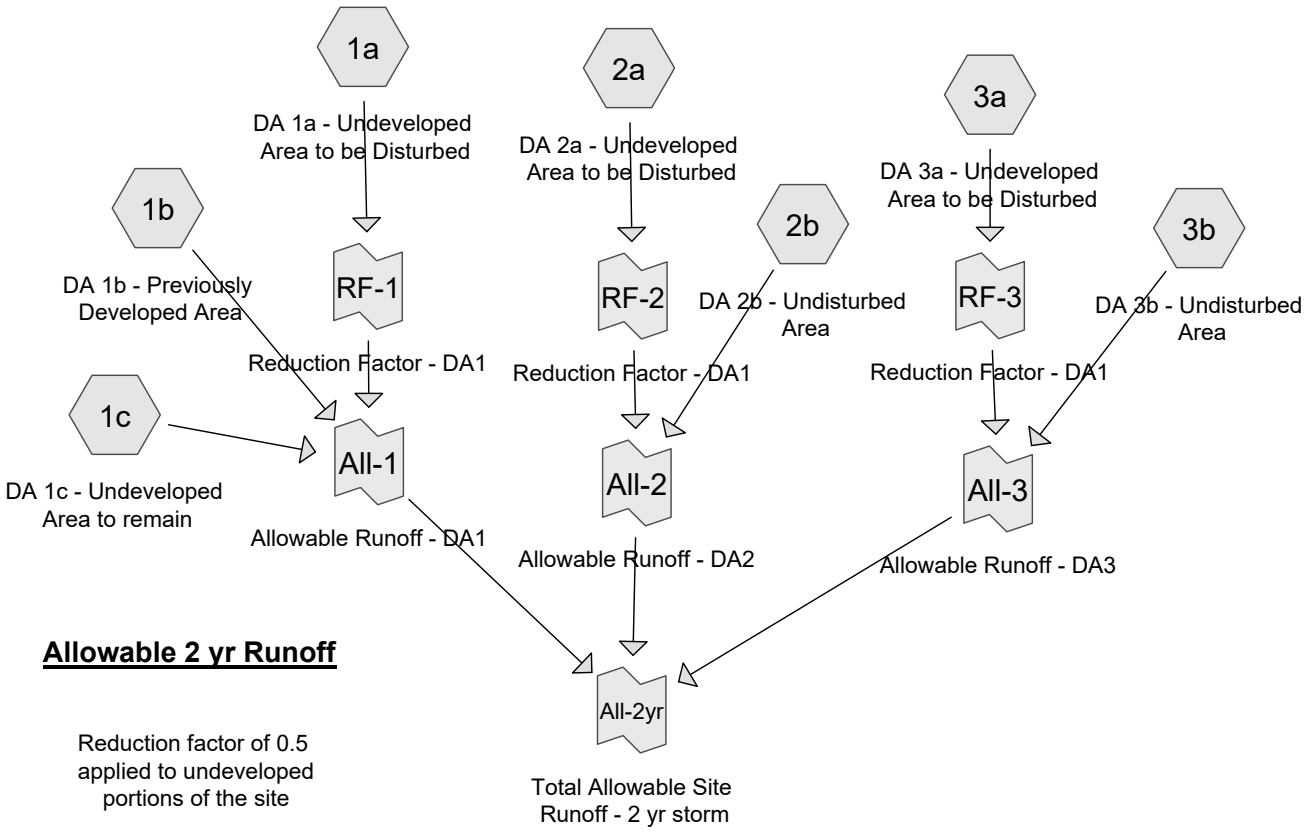
- **Proposed Condition HydroCAD model**
  2, 10 and 100-year

- **Emergency Spillway HydroCAD models**
  100-year storm with Outlet Structure blocked

Allowable Conditions

HydroCAD Models

2,10 & 100 yr storms



Allowable 2 yr Runoff

Reduction factor of 0.5 applied to undeveloped portions of the site

Subcat Reach Pond Link

Routing Diagram for DBVI Allowable Flow-2 yr
Prepared by Microsoft, Printed 10/17/2019

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1a: DA 1a - Undeveloped Runoff Area=3.508 ac 0.00% Impervious Runoff Depth=1.02"
Flow Length=745' Tc=48.7 min CN=72/0 Runoff=1.76 cfs 0.297 af

Subcatchment 1b: DA 1b - Previously Runoff Area=1.324 ac 11.18% Impervious Runoff Depth=1.35"
Flow Length=300' Tc=17.0 min CN=74/98 Runoff=1.53 cfs 0.149 af

Subcatchment 1c: DA 1c - Undeveloped Runoff Area=2.328 ac 0.00% Impervious Runoff Depth=0.91"
Flow Length=150' Slope=0.0240 '/' Tc=27.0 min CN=70/0 Runoff=1.41 cfs 0.177 af

Subcatchment 2a: DA 2a - Undeveloped Runoff Area=0.879 ac 0.00% Impervious Runoff Depth=1.07"
Flow Length=475' Tc=31.3 min CN=73/0 Runoff=0.60 cfs 0.079 af

Subcatchment 2b: DA 2b - Undisturbed Area Runoff Area=3.823 ac 0.00% Impervious Runoff Depth=1.07"
Flow Length=475' Tc=31.3 min CN=73/0 Runoff=2.62 cfs 0.342 af

Subcatchment 3a: DA 3a - Undeveloped Runoff Area=0.576 ac 0.00% Impervious Runoff Depth=1.31"
Flow Length=150' Slope=0.0120 '/' Tc=35.7 min CN=77/0 Runoff=0.47 cfs 0.063 af

Subcatchment 3b: DA 3b - Undisturbed Area Runoff Area=3.522 ac 0.00% Impervious Runoff Depth=1.02"
Flow Length=300' Tc=34.9 min CN=72/0 Runoff=2.13 cfs 0.299 af

Link All-1: Allowable Runoff - DA1 Inflow=3.11 cfs 0.475 af
Primary=3.11 cfs 0.475 af

Link All-2: Allowable Runoff - DA2 Inflow=2.92 cfs 0.381 af
Primary=2.92 cfs 0.381 af

Link All-2yr: Total Allowable Site Runoff - 2 yr storm Inflow=8.20 cfs 1.186 af
Primary=8.20 cfs 1.186 af

Link All-3: Allowable Runoff - DA3 Inflow=2.36 cfs 0.330 af
Primary=2.36 cfs 0.330 af

Link RF-1: Reduction Factor - DA1 x 0.50 Inflow=1.76 cfs 0.297 af
Primary=0.88 cfs 0.149 af Secondary=0.88 cfs 0.149 af

Link RF-2: Reduction Factor - DA1 x 0.50 Inflow=0.60 cfs 0.079 af
Primary=0.30 cfs 0.039 af Secondary=0.30 cfs 0.039 af

Link RF-3: Reduction Factor - DA1 x 0.50 Inflow=0.47 cfs 0.063 af
Primary=0.23 cfs 0.032 af Secondary=0.23 cfs 0.032 af

Total Runoff Area = 15.960 ac Runoff Volume = 1.406 af Average Runoff Depth = 1.06"
99.07% Pervious = 15.812 ac 0.93% Impervious = 0.148 ac

Summary for Subcatchment 1a: DA 1a - Undeveloped Area to be Disturbed

Runoff = 1.76 cfs @ 12.72 hrs, Volume= 0.297 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
2.498	70	Woods, Good, HSG C
0.837	74	>75% Grass cover, Good, HSG C
0.173	96	Gravel surface, HSG C
3.508	72	Weighted Average
3.508		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.2	150	0.0070	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.7	160	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.8	435	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
48.7	745	Total			

Summary for Subcatchment 1b: DA 1b - Previously Developed Area

Runoff = 1.53 cfs @ 12.27 hrs, Volume= 0.149 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
*	0.148	98	Roof, Imperv. Prkg & Walks, HSG C
	0.640	74	>75% Grass cover, Good, HSG C
	0.536	74	Pasture/grassland/range, Good, HSG C
	1.324	77	Weighted Average
	1.176		88.82% Pervious Area
	0.148		11.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
1.3	200	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.0	300	Total			

Summary for Subcatchment 1c: DA 1c - Undeveloped Area to remain

Runoff = 1.41 cfs @ 12.42 hrs, Volume= 0.177 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
2.328	70	Woods, Good, HSG C
2.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.0	150	0.0240	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Summary for Subcatchment 2a: DA 2a - Undeveloped Area to be Disturbed

Runoff = 0.60 cfs @ 12.47 hrs, Volume= 0.079 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.664	70	Woods, Good, HSG C
0.120	74	>75% Grass cover, Good, HSG C
0.095	96	Gravel surface, HSG C
0.879	73	Weighted Average
0.879		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	115	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
2.5	360	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
31.3	475	Total			

Summary for Subcatchment 2b: DA 2b - Undisturbed Area

Runoff = 2.62 cfs @ 12.47 hrs, Volume= 0.342 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
1.236	70	Woods, Good, HSG C
2.587	74	Pasture/grassland/range, Good, HSG C
3.823	73	Weighted Average
3.823		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	115	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
2.5	360	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
31.3	475	Total			

Summary for Subcatchment 3a: DA 3a - Undeveloped Area to be Disturbed

Runoff = 0.47 cfs @ 12.52 hrs, Volume= 0.063 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.422	70	Woods, Good, HSG C
0.154	96	Gravel surface, HSG C
0.576	77	Weighted Average
0.576		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	150	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Summary for Subcatchment 3b: DA 3b - Undisturbed Area

Runoff = 2.13 cfs @ 12.53 hrs, Volume= 0.299 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
1.742	70	Woods, Good, HSG C
1.780	74	Pasture/grassland/range, Good, HSG C
3.522	72	Weighted Average
3.522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	150	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	150	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.9	300	Total			

Summary for Link All-1: Allowable Runoff - DA1

Inflow Area = 7.160 ac, 2.07% Impervious, Inflow Depth = 0.80" for 2-Year event
Inflow = 3.11 cfs @ 12.36 hrs, Volume= 0.475 af
Primary = 3.11 cfs @ 12.36 hrs, Volume= 0.475 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-2: Allowable Runoff - DA2

Inflow Area = 4.702 ac, 0.00% Impervious, Inflow Depth = 0.97" for 2-Year event
Inflow = 2.92 cfs @ 12.47 hrs, Volume= 0.381 af
Primary = 2.92 cfs @ 12.47 hrs, Volume= 0.381 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-2yr: Total Allowable Site Runoff - 2 yr storm

Inflow Area = 15.960 ac, 0.93% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 8.20 cfs @ 12.47 hrs, Volume= 1.186 af
Primary = 8.20 cfs @ 12.47 hrs, Volume= 1.186 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-3: Allowable Runoff - DA3

Inflow Area = 4.098 ac, 0.00% Impervious, Inflow Depth = 0.97" for 2-Year event
Inflow = 2.36 cfs @ 12.52 hrs, Volume= 0.330 af
Primary = 2.36 cfs @ 12.52 hrs, Volume= 0.330 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-1: Reduction Factor - DA1

Inflow Area = 3.508 ac, 0.00% Impervious, Inflow Depth = 1.02" for 2-Year event
Inflow = 1.76 cfs @ 12.72 hrs, Volume= 0.297 af
Primary = 0.88 cfs @ 12.72 hrs, Volume= 0.149 af, Atten= 50%, Lag= 0.0 min
Secondary = 0.88 cfs @ 12.72 hrs, Volume= 0.149 af

Primary outflow = Inflow x 0.50, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-2: Reduction Factor - DA1

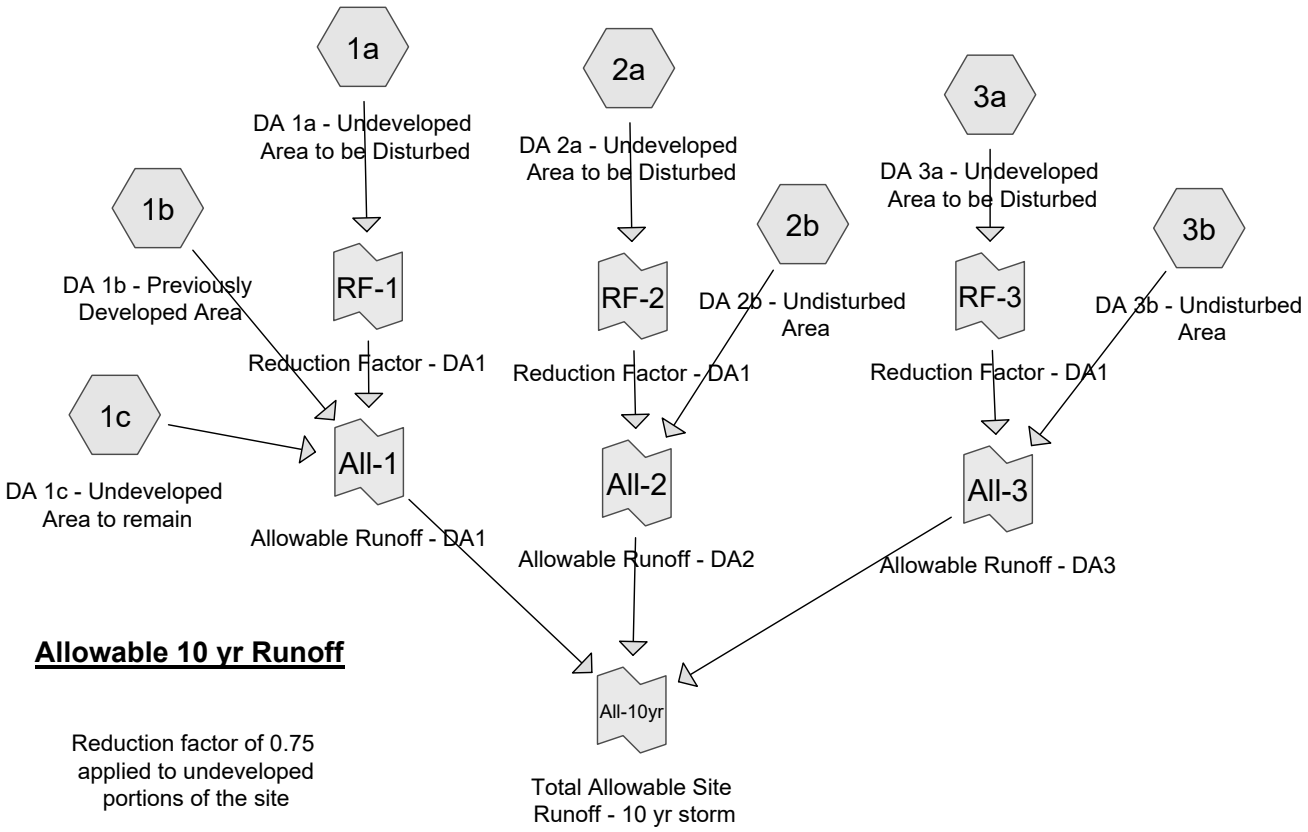
Inflow Area = 0.879 ac, 0.00% Impervious, Inflow Depth = 1.07" for 2-Year event
Inflow = 0.60 cfs @ 12.47 hrs, Volume= 0.079 af
Primary = 0.30 cfs @ 12.47 hrs, Volume= 0.039 af, Atten= 50%, Lag= 0.0 min
Secondary = 0.30 cfs @ 12.47 hrs, Volume= 0.039 af

Primary outflow = Inflow x 0.50, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-3: Reduction Factor - DA1

Inflow Area = 0.576 ac, 0.00% Impervious, Inflow Depth = 1.31" for 2-Year event
Inflow = 0.47 cfs @ 12.52 hrs, Volume= 0.063 af
Primary = 0.23 cfs @ 12.52 hrs, Volume= 0.032 af, Atten= 50%, Lag= 0.0 min
Secondary = 0.23 cfs @ 12.52 hrs, Volume= 0.032 af

Primary outflow = Inflow x 0.50, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs



Allowable 10 yr Runoff

Reduction factor of 0.75 applied to undeveloped portions of the site

Subcat Reach Pond Link

Routing Diagram for DBVI Allowable Flow-10 yr
Prepared by Microsoft, Printed 10/17/2019

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1a: DA 1a - Undeveloped Runoff Area=3.508 ac 0.00% Impervious Runoff Depth=2.21"
Flow Length=745' Tc=48.7 min CN=72/0 Runoff=4.06 cfs 0.645 af

Subcatchment 1b: DA 1b - Previously Runoff Area=1.324 ac 11.18% Impervious Runoff Depth=2.64"
Flow Length=300' Tc=17.0 min CN=74/98 Runoff=3.08 cfs 0.291 af

Subcatchment 1c: DA 1c - Undeveloped Runoff Area=2.328 ac 0.00% Impervious Runoff Depth=2.04"
Flow Length=150' Slope=0.0240 '/' Tc=27.0 min CN=70/0 Runoff=3.41 cfs 0.396 af

Subcatchment 2a: DA 2a - Undeveloped Runoff Area=0.879 ac 0.00% Impervious Runoff Depth=2.29"
Flow Length=475' Tc=31.3 min CN=73/0 Runoff=1.35 cfs 0.168 af

Subcatchment 2b: DA 2b - Undisturbed Area Runoff Area=3.823 ac 0.00% Impervious Runoff Depth=2.29"
Flow Length=475' Tc=31.3 min CN=73/0 Runoff=5.86 cfs 0.729 af

Subcatchment 3a: DA 3a - Undeveloped Runoff Area=0.576 ac 0.00% Impervious Runoff Depth=2.63"
Flow Length=150' Slope=0.0120 '/' Tc=35.7 min CN=77/0 Runoff=0.96 cfs 0.126 af

Subcatchment 3b: DA 3b - Undisturbed Area Runoff Area=3.522 ac 0.00% Impervious Runoff Depth=2.21"
Flow Length=300' Tc=34.9 min CN=72/0 Runoff=4.89 cfs 0.647 af

Link All-1: Allowable Runoff - DA1 Inflow=7.76 cfs 1.171 af
Primary=7.76 cfs 1.171 af

Link All-10yr: Total Allowable Site Runoff - 10 yr storm Inflow=19.99 cfs 2.768 af
Primary=19.99 cfs 2.768 af

Link All-2: Allowable Runoff - DA2 Inflow=6.87 cfs 0.855 af
Primary=6.87 cfs 0.855 af

Link All-3: Allowable Runoff - DA3 Inflow=5.61 cfs 0.742 af
Primary=5.61 cfs 0.742 af

Link RF-1: Reduction Factor - DA1 x 0.75 Inflow=4.06 cfs 0.645 af
Primary=3.04 cfs 0.484 af Secondary=1.01 cfs 0.161 af

Link RF-2: Reduction Factor - DA1 x 0.75 Inflow=1.35 cfs 0.168 af
Primary=1.01 cfs 0.126 af Secondary=0.34 cfs 0.042 af

Link RF-3: Reduction Factor - DA1 x 0.75 Inflow=0.96 cfs 0.126 af
Primary=0.72 cfs 0.095 af Secondary=0.24 cfs 0.032 af

Total Runoff Area = 15.960 ac Runoff Volume = 3.003 af Average Runoff Depth = 2.26"
99.07% Pervious = 15.812 ac 0.93% Impervious = 0.148 ac

Summary for Subcatchment 1a: DA 1a - Undeveloped Area to be Disturbed

Runoff = 4.06 cfs @ 12.70 hrs, Volume= 0.645 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
2.498	70	Woods, Good, HSG C
0.837	74	>75% Grass cover, Good, HSG C
0.173	96	Gravel surface, HSG C
3.508	72	Weighted Average
3.508		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.2	150	0.0070	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.7	160	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.8	435	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
48.7	745	Total			

Summary for Subcatchment 1b: DA 1b - Previously Developed Area

Runoff = 3.08 cfs @ 12.26 hrs, Volume= 0.291 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
*	0.148	98	Roof, Imperv. Prkg & Walks, HSG C
	0.640	74	>75% Grass cover, Good, HSG C
	0.536	74	Pasture/grassland/range, Good, HSG C
	1.324	77	Weighted Average
	1.176		88.82% Pervious Area
	0.148		11.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
1.3	200	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.0	300	Total			

Summary for Subcatchment 1c: DA 1c - Undeveloped Area to remain

Runoff = 3.41 cfs @ 12.40 hrs, Volume= 0.396 af, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
2.328	70	Woods, Good, HSG C
2.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.0	150	0.0240	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Summary for Subcatchment 2a: DA 2a - Undeveloped Area to be Disturbed

Runoff = 1.35 cfs @ 12.45 hrs, Volume= 0.168 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.664	70	Woods, Good, HSG C
0.120	74	>75% Grass cover, Good, HSG C
0.095	96	Gravel surface, HSG C
0.879	73	Weighted Average
0.879		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	115	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
2.5	360	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
31.3	475	Total			

Summary for Subcatchment 2b: DA 2b - Undisturbed Area

Runoff = 5.86 cfs @ 12.45 hrs, Volume= 0.729 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
1.236	70	Woods, Good, HSG C
2.587	74	Pasture/grassland/range, Good, HSG C
3.823	73	Weighted Average
3.823		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	115	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
2.5	360	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
31.3	475	Total			

Summary for Subcatchment 3a: DA 3a - Undeveloped Area to be Disturbed

Runoff = 0.96 cfs @ 12.51 hrs, Volume= 0.126 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.422	70	Woods, Good, HSG C
0.154	96	Gravel surface, HSG C
0.576	77	Weighted Average
0.576		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	150	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Summary for Subcatchment 3b: DA 3b - Undisturbed Area

Runoff = 4.89 cfs @ 12.50 hrs, Volume= 0.647 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
1.742	70	Woods, Good, HSG C
1.780	74	Pasture/grassland/range, Good, HSG C
3.522	72	Weighted Average
3.522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	150	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	150	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.9	300	Total			

Summary for Link All-1: Allowable Runoff - DA1

Inflow Area = 7.160 ac, 2.07% Impervious, Inflow Depth = 1.96" for 10-Year event
Inflow = 7.76 cfs @ 12.37 hrs, Volume= 1.171 af
Primary = 7.76 cfs @ 12.37 hrs, Volume= 1.171 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-10yr: Total Allowable Site Runoff - 10 yr storm

Inflow Area = 15.960 ac, 0.93% Impervious, Inflow Depth = 2.08" for 10-Year event
Inflow = 19.99 cfs @ 12.45 hrs, Volume= 2.768 af
Primary = 19.99 cfs @ 12.45 hrs, Volume= 2.768 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-2: Allowable Runoff - DA2

Inflow Area = 4.702 ac, 0.00% Impervious, Inflow Depth = 2.18" for 10-Year event
Inflow = 6.87 cfs @ 12.45 hrs, Volume= 0.855 af
Primary = 6.87 cfs @ 12.45 hrs, Volume= 0.855 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-3: Allowable Runoff - DA3

Inflow Area = 4.098 ac, 0.00% Impervious, Inflow Depth = 2.17" for 10-Year event
Inflow = 5.61 cfs @ 12.50 hrs, Volume= 0.742 af
Primary = 5.61 cfs @ 12.50 hrs, Volume= 0.742 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-1: Reduction Factor - DA1

Inflow Area = 3.508 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 4.06 cfs @ 12.70 hrs, Volume= 0.645 af
Primary = 3.04 cfs @ 12.70 hrs, Volume= 0.484 af, Atten= 25%, Lag= 0.0 min
Secondary = 1.01 cfs @ 12.70 hrs, Volume= 0.161 af

Primary outflow = Inflow x 0.75, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-2: Reduction Factor - DA1

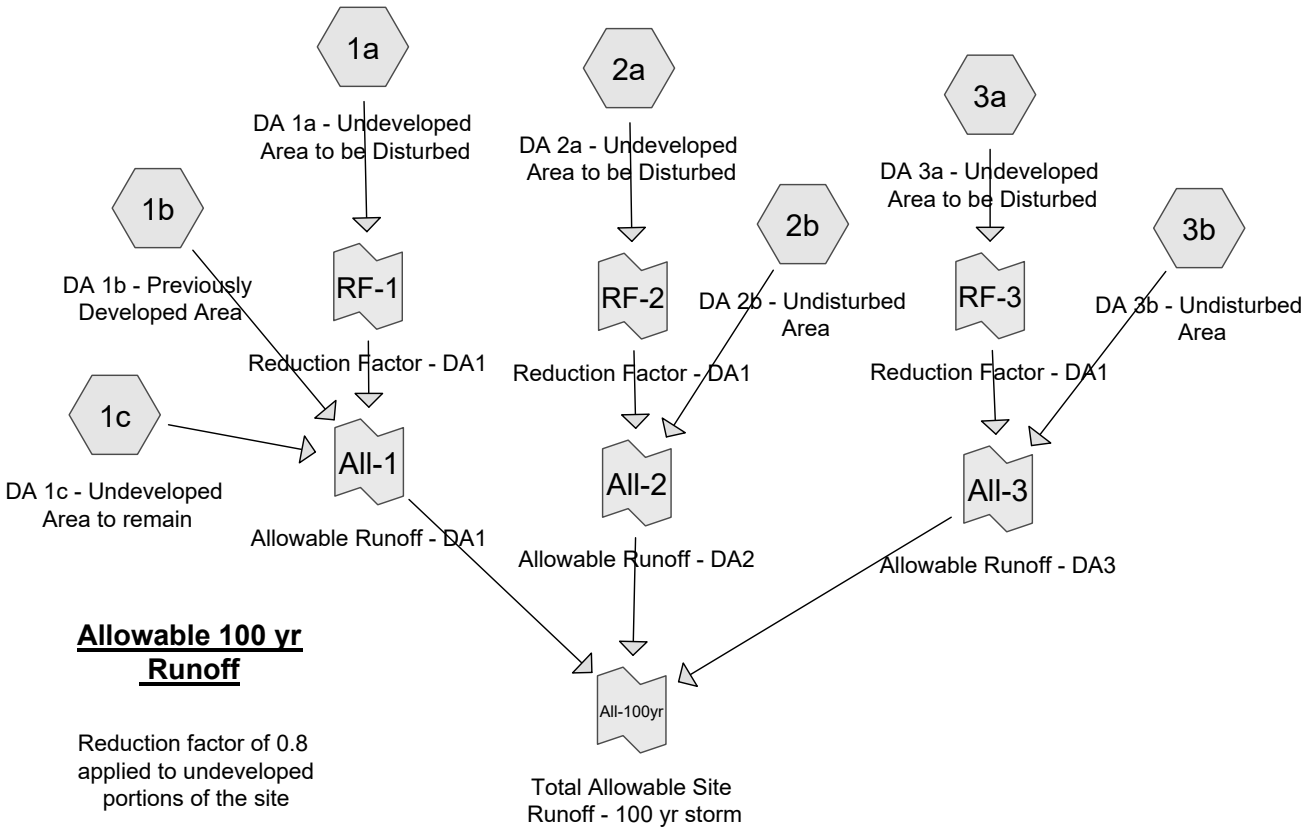
Inflow Area = 0.879 ac, 0.00% Impervious, Inflow Depth = 2.29" for 10-Year event
Inflow = 1.35 cfs @ 12.45 hrs, Volume= 0.168 af
Primary = 1.01 cfs @ 12.45 hrs, Volume= 0.126 af, Atten= 25%, Lag= 0.0 min
Secondary = 0.34 cfs @ 12.45 hrs, Volume= 0.042 af

Primary outflow = Inflow x 0.75, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-3: Reduction Factor - DA1

Inflow Area = 0.576 ac, 0.00% Impervious, Inflow Depth = 2.63" for 10-Year event
Inflow = 0.96 cfs @ 12.51 hrs, Volume= 0.126 af
Primary = 0.72 cfs @ 12.51 hrs, Volume= 0.095 af, Atten= 25%, Lag= 0.0 min
Secondary = 0.24 cfs @ 12.51 hrs, Volume= 0.032 af

Primary outflow = Inflow x 0.75, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs



Allowable 100 yr Runoff

Reduction factor of 0.8 applied to undeveloped portions of the site

Subcat Reach Pond Link

Routing Diagram for DBVI Allowable Flow-100 yr
Prepared by Microsoft, Printed 10/17/2019

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1a: DA 1a - Undeveloped Runoff Area=3.508 ac 0.00% Impervious Runoff Depth=4.88"
Flow Length=745' Tc=48.7 min CN=72/0 Runoff=9.10 cfs 1.426 af

Subcatchment 1b: DA 1b - Previously Runoff Area=1.324 ac 11.18% Impervious Runoff Depth=5.43"
Flow Length=300' Tc=17.0 min CN=74/98 Runoff=6.35 cfs 0.599 af

Subcatchment 1c: DA 1c - Undeveloped Runoff Area=2.328 ac 0.00% Impervious Runoff Depth=4.65"
Flow Length=150' Slope=0.0240 '/' Tc=27.0 min CN=70/0 Runoff=7.89 cfs 0.901 af

Subcatchment 2a: DA 2a - Undeveloped Runoff Area=0.879 ac 0.00% Impervious Runoff Depth=5.00"
Flow Length=475' Tc=31.3 min CN=73/0 Runoff=2.97 cfs 0.366 af

Subcatchment 2b: DA 2b - Undisturbed Area Runoff Area=3.823 ac 0.00% Impervious Runoff Depth=5.00"
Flow Length=475' Tc=31.3 min CN=73/0 Runoff=12.91 cfs 1.592 af

Subcatchment 3a: DA 3a - Undeveloped Runoff Area=0.576 ac 0.00% Impervious Runoff Depth=5.47"
Flow Length=150' Slope=0.0120 '/' Tc=35.7 min CN=77/0 Runoff=1.98 cfs 0.262 af

Subcatchment 3b: DA 3b - Undisturbed Area Runoff Area=3.522 ac 0.00% Impervious Runoff Depth=4.88"
Flow Length=300' Tc=34.9 min CN=72/0 Runoff=10.97 cfs 1.432 af

Link All-1: Allowable Runoff - DA1 Inflow=17.79 cfs 2.642 af
Primary=17.79 cfs 2.642 af

Link All-100yr: Total Allowable Site Runoff - 100 yr storm Inflow=45.12 cfs 6.168 af
Primary=45.12 cfs 6.168 af

Link All-2: Allowable Runoff - DA2 Inflow=15.29 cfs 1.885 af
Primary=15.29 cfs 1.885 af

Link All-3: Allowable Runoff - DA3 Inflow=12.55 cfs 1.642 af
Primary=12.55 cfs 1.642 af

Link RF-1: Reduction Factor - DA1 x 0.80 Inflow=9.10 cfs 1.426 af
Primary=7.28 cfs 1.141 af Secondary=1.82 cfs 0.285 af

Link RF-2: Reduction Factor - DA1 x 0.80 Inflow=2.97 cfs 0.366 af
Primary=2.37 cfs 0.293 af Secondary=0.59 cfs 0.073 af

Link RF-3: Reduction Factor - DA1 x 0.80 Inflow=1.98 cfs 0.262 af
Primary=1.58 cfs 0.210 af Secondary=0.40 cfs 0.052 af

Total Runoff Area = 15.960 ac Runoff Volume = 6.579 af Average Runoff Depth = 4.95"
99.07% Pervious = 15.812 ac 0.93% Impervious = 0.148 ac

Summary for Subcatchment 1a: DA 1a - Undeveloped Area to be Disturbed

Runoff = 9.10 cfs @ 12.67 hrs, Volume= 1.426 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
2.498	70	Woods, Good, HSG C
0.837	74	>75% Grass cover, Good, HSG C
0.173	96	Gravel surface, HSG C
3.508	72	Weighted Average
3.508		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.2	150	0.0070	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.7	160	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.8	435	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
48.7	745	Total			

Summary for Subcatchment 1b: DA 1b - Previously Developed Area

Runoff = 6.35 cfs @ 12.26 hrs, Volume= 0.599 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
*	0.148	98	Roof, Imperv. Prkg & Walks, HSG C
	0.640	74	>75% Grass cover, Good, HSG C
	0.536	74	Pasture/grassland/range, Good, HSG C
	1.324	77	Weighted Average
	1.176		88.82% Pervious Area
	0.148		11.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
1.3	200	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.0	300	Total			

Summary for Subcatchment 1c: DA 1c - Undeveloped Area to remain

Runoff = 7.89 cfs @ 12.39 hrs, Volume= 0.901 af, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
2.328	70	Woods, Good, HSG C
2.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.0	150	0.0240	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Summary for Subcatchment 2a: DA 2a - Undeveloped Area to be Disturbed

Runoff = 2.97 cfs @ 12.43 hrs, Volume= 0.366 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.664	70	Woods, Good, HSG C
0.120	74	>75% Grass cover, Good, HSG C
0.095	96	Gravel surface, HSG C
0.879	73	Weighted Average
0.879		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	115	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
2.5	360	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
31.3	475	Total			

Summary for Subcatchment 2b: DA 2b - Undisturbed Area

Runoff = 12.91 cfs @ 12.43 hrs, Volume= 1.592 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
1.236	70	Woods, Good, HSG C
2.587	74	Pasture/grassland/range, Good, HSG C
3.823	73	Weighted Average
3.823		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	115	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
2.5	360	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
31.3	475	Total			

Summary for Subcatchment 3a: DA 3a - Undeveloped Area to be Disturbed

Runoff = 1.98 cfs @ 12.49 hrs, Volume= 0.262 af, Depth= 5.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.422	70	Woods, Good, HSG C
0.154	96	Gravel surface, HSG C
0.576	77	Weighted Average
0.576		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	150	0.0120	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Summary for Subcatchment 3b: DA 3b - Undisturbed Area

Runoff = 10.97 cfs @ 12.48 hrs, Volume= 1.432 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
1.742	70	Woods, Good, HSG C
1.780	74	Pasture/grassland/range, Good, HSG C
3.522	72	Weighted Average
3.522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	150	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	150	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.9	300	Total			

Summary for Link All-1: Allowable Runoff - DA1

Inflow Area = 7.160 ac, 2.07% Impervious, Inflow Depth = 4.43" for 100-Year event
Inflow = 17.79 cfs @ 12.37 hrs, Volume= 2.642 af
Primary = 17.79 cfs @ 12.37 hrs, Volume= 2.642 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-100yr: Total Allowable Site Runoff - 100 yr storm

Inflow Area = 15.960 ac, 0.93% Impervious, Inflow Depth = 4.64" for 100-Year event
Inflow = 45.12 cfs @ 12.44 hrs, Volume= 6.168 af
Primary = 45.12 cfs @ 12.44 hrs, Volume= 6.168 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-2: Allowable Runoff - DA2

Inflow Area = 4.702 ac, 0.00% Impervious, Inflow Depth = 4.81" for 100-Year event
Inflow = 15.29 cfs @ 12.43 hrs, Volume= 1.885 af
Primary = 15.29 cfs @ 12.43 hrs, Volume= 1.885 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link All-3: Allowable Runoff - DA3

Inflow Area = 4.098 ac, 0.00% Impervious, Inflow Depth = 4.81" for 100-Year event
Inflow = 12.55 cfs @ 12.48 hrs, Volume= 1.642 af
Primary = 12.55 cfs @ 12.48 hrs, Volume= 1.642 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-1: Reduction Factor - DA1

Inflow Area = 3.508 ac, 0.00% Impervious, Inflow Depth = 4.88" for 100-Year event
Inflow = 9.10 cfs @ 12.67 hrs, Volume= 1.426 af
Primary = 7.28 cfs @ 12.67 hrs, Volume= 1.141 af, Atten= 20%, Lag= 0.0 min
Secondary = 1.82 cfs @ 12.67 hrs, Volume= 0.285 af

Primary outflow = Inflow x 0.80, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-2: Reduction Factor - DA1

Inflow Area = 0.879 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 2.97 cfs @ 12.43 hrs, Volume= 0.366 af
Primary = 2.37 cfs @ 12.43 hrs, Volume= 0.293 af, Atten= 20%, Lag= 0.0 min
Secondary = 0.59 cfs @ 12.43 hrs, Volume= 0.073 af

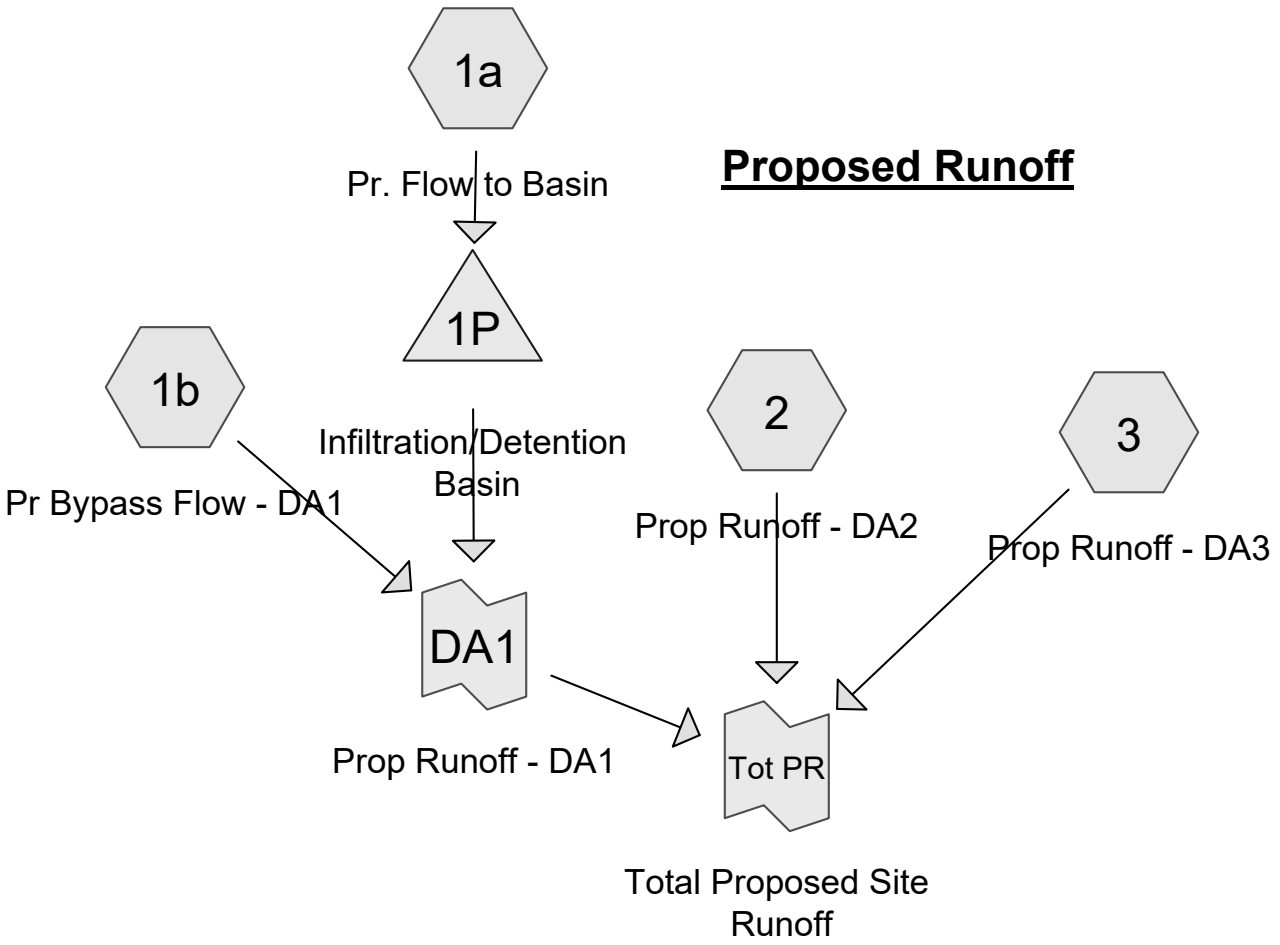
Primary outflow = Inflow x 0.80, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link RF-3: Reduction Factor - DA1

Inflow Area = 0.576 ac, 0.00% Impervious, Inflow Depth = 5.47" for 100-Year event
Inflow = 1.98 cfs @ 12.49 hrs, Volume= 0.262 af
Primary = 1.58 cfs @ 12.49 hrs, Volume= 0.210 af, Atten= 20%, Lag= 0.0 min
Secondary = 0.40 cfs @ 12.49 hrs, Volume= 0.052 af

Primary outflow = Inflow x 0.80, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Proposed Conditions
HydroCAD Model
2,10 & 100 yr storms



Subcat Reach Pond Link

Routing Diagram for DBVI Proposed Flows - 2, 10, 100 yr storms
Prepared by Microsoft, Printed 4/4/2020

Summary for Subcatchment 1a: Pr. Flow to Basin

Runoff = 6.59 cfs @ 12.24 hrs, Volume= 0.661 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
	0.198	70	Woods, Good, HSG C
	0.795	74	>75% Grass cover, Good, HSG C
*	2.209	98	Roof, Imperv. Prkg & Walks, HSG C
	3.202	90	Weighted Average
	0.993		31.01% Pervious Area
	2.209		68.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	20	0.0050	0.03		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
5.1	20	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	140	Total			

Summary for Subcatchment 1b: Pr Bypass Flow - DA1

Runoff = 3.02 cfs @ 12.64 hrs, Volume= 0.480 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
	2.129	70	Woods, Good, HSG C
	2.148	74	>75% Grass cover, Good, HSG C
	0.097	96	Gravel surface, HSG C
*	0.343	98	Impervious Surfaces, HSG C
	4.717	74	Weighted Average
	4.374		92.73% Pervious Area
	0.343		7.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	60	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
16.9	90	0.0100	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
2.8	430	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
44.0	580	Total			

Summary for Subcatchment 2: Prop Runoff - DA2

Runoff = 2.80 cfs @ 12.51 hrs, Volume= 0.393 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
1.146	70	Woods, Good, HSG C
2.661	74	>75% Grass cover, Good, HSG C
0.205	98	Paved parking, HSG C
0.200	65	Brush, Good, HSG C
4.212	74	Weighted Average
4.007		95.13% Pervious Area
0.205		4.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	90	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
8.5	60	0.0250	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
2.3	335	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.5	485	Total			

Summary for Subcatchment 3: Prop Runoff - DA3

Runoff = 2.21 cfs @ 12.53 hrs, Volume= 0.320 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
1.934	70	Woods, Good, HSG C
1.164	74	>75% Grass cover, Good, HSG C
0.161	98	Paved parking, HSG C
0.570	65	Brush, Good, HSG C
3.829	72	Weighted Average
3.668		95.80% Pervious Area
0.161		4.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	150	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	150	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.9	300	Total			

Summary for Pond 1P: Infiltration/Detention Basin

Inflow Area = 3.202 ac, 68.99% Impervious, Inflow Depth = 2.48" for 2-Year event
Inflow = 6.59 cfs @ 12.24 hrs, Volume= 0.661 af
Outflow = 0.23 cfs @ 16.20 hrs, Volume= 0.285 af, Atten= 96%, Lag= 237.4 min
Primary = 0.23 cfs @ 16.20 hrs, Volume= 0.285 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Peak Elev= 106.47' @ 16.20 hrs Surf.Area= 12,569 sf Storage= 22,054 cf

Plug-Flow detention time= 788.4 min calculated for 0.285 af (43% of inflow)
Center-of-Mass det. time= 646.6 min (1,427.2 - 780.6)

Volume	Invert	Avail.Storage	Storage Description
#1	104.50'	75,378 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
104.50	9,429	0	0
105.00	10,650	5,020	5,020
106.00	11,936	11,293	16,313
107.00	13,287	12,612	28,924
108.00	14,704	13,996	42,920
109.00	16,185	15,445	58,364
110.00	17,842	17,014	75,378

Device	Routing	Invert	Outlet Devices
#1	Device 4	106.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 4	108.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	108.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Primary	104.00'	**15.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 104.00' / 103.68' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.23 cfs @ 16.20 hrs HW=106.47' (Free Discharge)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Culvert** (Passes 0.23 cfs of 7.83 cfs potential flow)
  - **1=Orifice/Grate** (Orifice Controls 0.23 cfs @ 2.65 fps)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DA1: Prop Runoff - DA1

Inflow Area = 7.919 ac, 32.23% Impervious, Inflow Depth > 1.16" for 2-Year event
Inflow = 3.06 cfs @ 12.66 hrs, Volume= 0.765 af
Primary = 3.06 cfs @ 12.66 hrs, Volume= 0.765 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Summary for Link Tot PR: Total Proposed Site Runoff

Inflow Area = 15.960 ac, 18.28% Impervious, Inflow Depth = 1.11" for 2-Year event
Inflow = 7.91 cfs @ 12.56 hrs, Volume= 1.478 af
Primary = 7.91 cfs @ 12.56 hrs, Volume= 1.478 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1a: Pr. Flow to Basin

Runoff = 10.63 cfs @ 12.24 hrs, Volume= 1.068 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
	0.198	70	Woods, Good, HSG C
	0.795	74	>75% Grass cover, Good, HSG C
*	2.209	98	Roof, Imperv. Prkg & Walks, HSG C
	3.202	90	Weighted Average
	0.993		31.01% Pervious Area
	2.209		68.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	20	0.0050	0.03		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
5.1	20	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	140	Total			

Summary for Subcatchment 1b: Pr Bypass Flow - DA1

Runoff = 6.38 cfs @ 12.62 hrs, Volume= 0.971 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
	2.129	70	Woods, Good, HSG C
	2.148	74	>75% Grass cover, Good, HSG C
	0.097	96	Gravel surface, HSG C
*	0.343	98	Impervious Surfaces, HSG C
	4.717	74	Weighted Average
	4.374		92.73% Pervious Area
	0.343		7.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	60	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
16.9	90	0.0100	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
2.8	430	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
44.0	580	Total			

Summary for Subcatchment 2: Prop Runoff - DA2

Runoff = 6.16 cfs @ 12.49 hrs, Volume= 0.818 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
1.146	70	Woods, Good, HSG C
2.661	74	>75% Grass cover, Good, HSG C
0.205	98	Paved parking, HSG C
0.200	65	Brush, Good, HSG C
4.212	74	Weighted Average
4.007		95.13% Pervious Area
0.205		4.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	90	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
8.5	60	0.0250	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
2.3	335	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.5	485	Total			

Summary for Subcatchment 3: Prop Runoff - DA3

Runoff = 5.11 cfs @ 12.50 hrs, Volume= 0.689 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
1.934	70	Woods, Good, HSG C
1.164	74	>75% Grass cover, Good, HSG C
0.161	98	Paved parking, HSG C
0.570	65	Brush, Good, HSG C
3.829	72	Weighted Average
3.668		95.80% Pervious Area
0.161		4.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	150	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	150	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.9	300	Total			

Summary for Pond 1P: Infiltration/Detention Basin

Inflow Area = 3.202 ac, 68.99% Impervious, Inflow Depth = 4.00" for 10-Year event
Inflow = 10.63 cfs @ 12.24 hrs, Volume= 1.068 af
Outflow = 0.46 cfs @ 15.09 hrs, Volume= 0.692 af, Atten= 96%, Lag= 171.0 min
Primary = 0.46 cfs @ 15.09 hrs, Volume= 0.692 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Peak Elev= 107.37' @ 15.09 hrs Surf.Area= 13,818 sf Storage= 34,001 cf

Plug-Flow detention time= 766.5 min calculated for 0.692 af (65% of inflow)
Center-of-Mass det. time= 659.0 min (1,433.8 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1	104.50'	75,378 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
104.50	9,429	0	0
105.00	10,650	5,020	5,020
106.00	11,936	11,293	16,313
107.00	13,287	12,612	28,924
108.00	14,704	13,996	42,920
109.00	16,185	15,445	58,364
110.00	17,842	17,014	75,378

Device	Routing	Invert	Outlet Devices
#1	Device 4	106.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 4	108.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	108.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Primary	104.00'	**15.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 104.00' / 103.68' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.46 cfs @ 15.09 hrs HW=107.37' (Free Discharge)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Culvert** (Passes 0.46 cfs of 9.80 cfs potential flow)
  - **1=Orifice/Grate** (Orifice Controls 0.46 cfs @ 5.29 fps)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DA1: Prop Runoff - DA1

Inflow Area = 7.919 ac, 32.23% Impervious, Inflow Depth > 2.52" for 10-Year event
Inflow = 6.76 cfs @ 12.63 hrs, Volume= 1.662 af
Primary = 6.76 cfs @ 12.63 hrs, Volume= 1.662 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Summary for Link Tot PR: Total Proposed Site Runoff

Inflow Area = 15.960 ac, 18.28% Impervious, Inflow Depth = 2.38" for 10-Year event
Inflow = 17.72 cfs @ 12.54 hrs, Volume= 3.169 af
Primary = 17.72 cfs @ 12.54 hrs, Volume= 3.169 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1a: Pr. Flow to Basin

Runoff = 18.63 cfs @ 12.24 hrs, Volume= 1.881 af, Depth= 7.05"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
	0.198	70	Woods, Good, HSG C
	0.795	74	>75% Grass cover, Good, HSG C
*	2.209	98	Roof, Imperv. Prkg & Walks, HSG C
	3.202	90	Weighted Average
	0.993		31.01% Pervious Area
	2.209		68.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	20	0.0050	0.03		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
5.1	20	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	140	Total			

Summary for Subcatchment 1b: Pr Bypass Flow - DA1

Runoff = 13.62 cfs @ 12.60 hrs, Volume= 2.049 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
	2.129	70	Woods, Good, HSG C
	2.148	74	>75% Grass cover, Good, HSG C
	0.097	96	Gravel surface, HSG C
*	0.343	98	Impervious Surfaces, HSG C
	4.717	74	Weighted Average
	4.374		92.73% Pervious Area
	0.343		7.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	60	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
16.9	90	0.0100	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
2.8	430	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
44.0	580	Total			

Summary for Subcatchment 2: Prop Runoff - DA2

Runoff = 13.47 cfs @ 12.48 hrs, Volume= 1.765 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
1.146	70	Woods, Good, HSG C
2.661	74	>75% Grass cover, Good, HSG C
0.205	98	Paved parking, HSG C
0.200	65	Brush, Good, HSG C
4.212	74	Weighted Average
4.007		95.13% Pervious Area
0.205		4.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	90	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
8.5	60	0.0250	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
2.3	335	0.0225	2.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.5	485	Total			

Summary for Subcatchment 3: Prop Runoff - DA3

Runoff = 11.59 cfs @ 12.48 hrs, Volume= 1.527 af, Depth= 4.79"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
1.934	70	Woods, Good, HSG C
1.164	74	>75% Grass cover, Good, HSG C
0.161	98	Paved parking, HSG C
0.570	65	Brush, Good, HSG C
3.829	72	Weighted Average
3.668		95.80% Pervious Area
0.161		4.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	150	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	150	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
34.9	300	Total			

Summary for Pond 1P: Infiltration/Detention Basin

Inflow Area = 3.202 ac, 68.99% Impervious, Inflow Depth = 7.05" for 100-Year event
Inflow = 18.63 cfs @ 12.24 hrs, Volume= 1.881 af
Outflow = 4.33 cfs @ 12.75 hrs, Volume= 1.504 af, Atten= 77%, Lag= 30.9 min
Primary = 4.33 cfs @ 12.75 hrs, Volume= 1.504 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Peak Elev= 108.44' @ 12.75 hrs Surf.Area= 15,351 sf Storage= 49,488 cf

Plug-Flow detention time= 631.1 min calculated for 1.504 af (80% of inflow)
Center-of-Mass det. time= 549.6 min (1,317.7 - 768.1)

Volume	Invert	Avail.Storage	Storage Description
#1	104.50'	75,378 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
104.50	9,429	0	0
105.00	10,650	5,020	5,020
106.00	11,936	11,293	16,313
107.00	13,287	12,612	28,924
108.00	14,704	13,996	42,920
109.00	16,185	15,445	58,364
110.00	17,842	17,014	75,378

Device	Routing	Invert	Outlet Devices
#1	Device 4	106.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 4	108.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	108.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Primary	104.00'	**15.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 104.00' / 103.68' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=4.33 cfs @ 12.75 hrs HW=108.44' (Free Discharge)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Culvert** (Passes 4.33 cfs of 11.54 cfs potential flow)
  - **1=Orifice/Grate** (Orifice Controls 0.63 cfs @ 7.25 fps)
  - **2=Sharp-Crested Rectangular Weir** (Weir Controls 3.69 cfs @ 2.16 fps)

Summary for Link DA1: Prop Runoff - DA1

Inflow Area = 7.919 ac, 32.23% Impervious, Inflow Depth = 5.38" for 100-Year event
Inflow = 17.64 cfs @ 12.65 hrs, Volume= 3.553 af
Primary = 17.64 cfs @ 12.65 hrs, Volume= 3.553 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Summary for Link Tot PR: Total Proposed Site Runoff

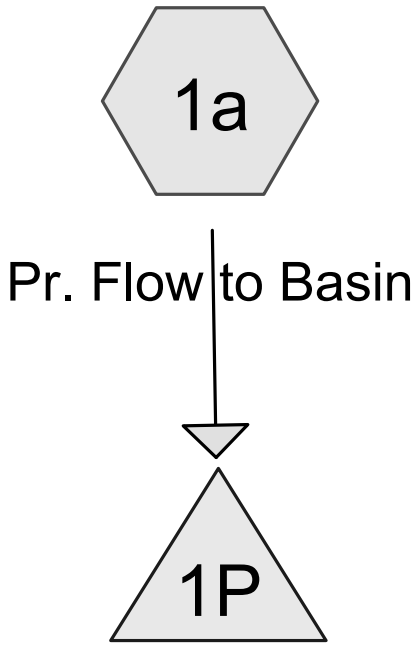
Inflow Area = 15.960 ac, 18.28% Impervious, Inflow Depth = 5.15" for 100-Year event
Inflow = 41.24 cfs @ 12.55 hrs, Volume= 6.845 af
Primary = 41.24 cfs @ 12.55 hrs, Volume= 6.845 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Emergency Spillway
HydroCAD Model
100 yr storm + OS blocked

Emergency Spillway Check

100-year flow + 50%



Infiltration/Detention Basin

Subcat Reach Pond Link

Routing Diagram for DBVI Proposed ES Spillway NJDEP
Prepared by Microsoft, Printed 4/4/2020

Summary for Subcatchment 1a: Pr. Flow to Basin

Runoff = 28.99 cfs @ 12.24 hrs, Volume= 2.947 af, Depth=11.04"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100 yr + 50% Rainfall=12.31"

	Area (ac)	CN	Description
	0.198	70	Woods, Good, HSG C
	0.795	74	>75% Grass cover, Good, HSG C
*	2.209	98	Roof, Imperv. Prkg & Walks, HSG C
	3.202	90	Weighted Average
	0.993		31.01% Pervious Area
	2.209		68.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	20	0.0050	0.03		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
5.1	20	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	140	Total			

Summary for Pond 1P: Infiltration/Detention Basin

Inflow Area = 3.202 ac, 68.99% Impervious, Inflow Depth = 11.04" for 100 yr + 50% event
Inflow = 28.99 cfs @ 12.24 hrs, Volume= 2.947 af
Outflow = 23.12 cfs @ 12.35 hrs, Volume= 2.568 af, Atten= 20%, Lag= 6.9 min
Primary = 23.12 cfs @ 12.35 hrs, Volume= 2.568 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 108.88' @ 12.35 hrs Surf.Area= 16,010 sf Storage= 56,462 cf

Plug-Flow detention time= 434.7 min calculated for 2.566 af (87% of inflow)
Center-of-Mass det. time= 374.2 min (1,137.0 - 762.8)

Volume	Invert	Avail.Storage	Storage Description
#1	104.50'	75,378 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
104.50	9,429	0	0
105.00	10,650	5,020	5,020
106.00	11,936	11,293	16,313
107.00	13,287	12,612	28,924
108.00	14,704	13,996	42,920
109.00	16,185	15,445	58,364
110.00	17,842	17,014	75,378

Device	Routing	Invert	Outlet Devices
#1	Device 4	106.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 4	108.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	108.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Primary	104.00'	**15.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 104.00' / 103.68' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=23.00 cfs @ 12.35 hrs HW=108.88' (Free Discharge)
- **3=Broad-Crested Rectangular Weir** (Weir Controls 11.98 cfs @ 1.57 fps)
- **4=Culvert** (Passes 11.02 cfs of 12.19 cfs potential flow)
  - **1=Orifice/Grate** (Orifice Controls 0.69 cfs @ 7.93 fps)
  - **2=Sharp-Crested Rectangular Weir** (Weir Controls 10.33 cfs @ 3.07 fps)

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 30 2020

DBVI - Flow in Emergency Spillway Channel

Trapezoidal

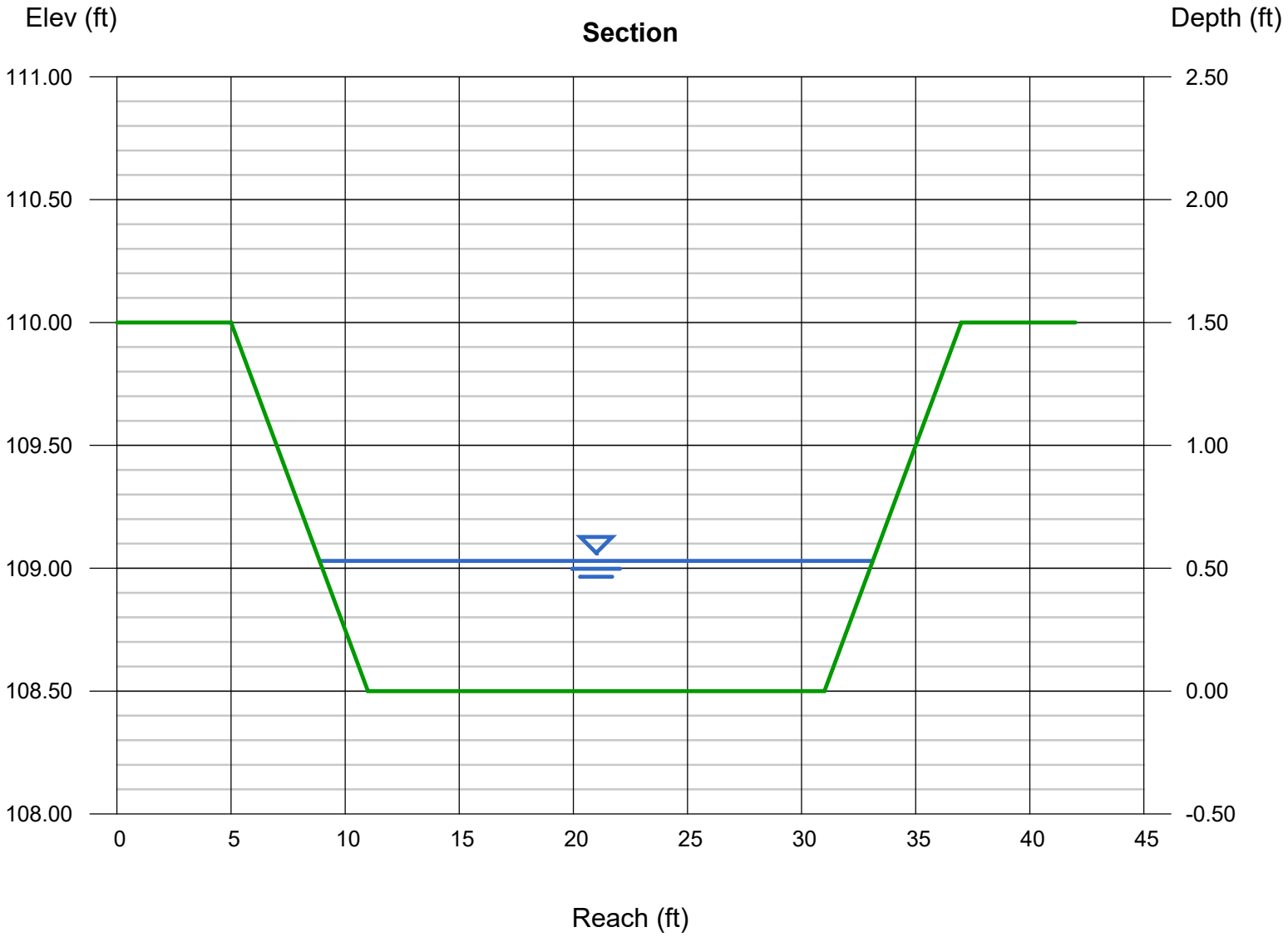
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 108.50
Slope (%)	= 4.80
N-Value	= 0.100

Calculations

Compute by:	Known Q
Known Q (cfs)	= 23.12

Highlighted

Depth (ft)	= 0.53
Q (cfs)	= 23.12
Area (sqft)	= 11.72
Velocity (ft/s)	= 1.97
Wetted Perim (ft)	= 24.37
Crit Depth, Yc (ft)	= 0.34
Top Width (ft)	= 24.24
EGL (ft)	= 0.59



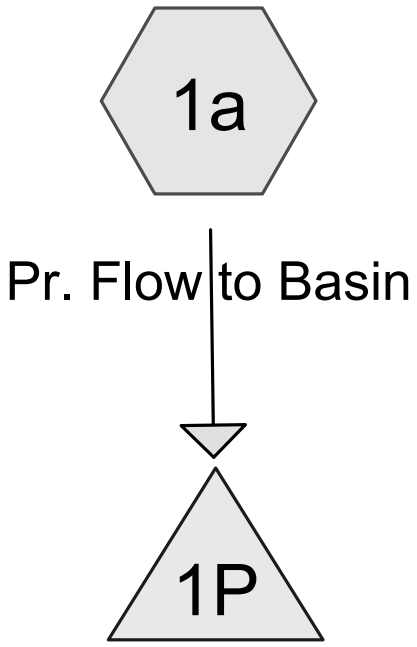
APPENDIX C

WATER QUALITY ANALYSIS

- WQ storm HydroCad model
- Vegetated Filter Strip evaluation

Water Quality Storm

1.25" rainfall in 2 hour



Infiltration/Detention
Basin

Subcat Reach Pond Link

Routing Diagram for DBVI Proposed WQ Storm
Prepared by Microsoft, Printed 4/4/2020

Summary for Subcatchment 1a: Pr. Flow to Basin

Runoff = 4.77 cfs @ 1.22 hrs, Volume= 0.196 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr WQ Storm Rainfall=1.25"

	Area (ac)	CN	Description
	0.198	70	Woods, Good, HSG C
	0.795	74	>75% Grass cover, Good, HSG C
*	2.209	98	Roof, Imperv. Prkg & Walks, HSG C
	3.202	90	Weighted Average
	0.993		31.01% Pervious Area
	2.209		68.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	20	0.0050	0.03		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
5.1	20	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.34"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	140	Total			

Summary for Pond 1P: Infiltration/Detention Basin

Inflow Area = 3.202 ac, 68.99% Impervious, Inflow Depth = 0.73" for WQ Storm event
Inflow = 4.77 cfs @ 1.22 hrs, Volume= 0.196 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Peak Elev= 105.32' @ 2.95 hrs Surf.Area= 11,064 sf Storage= 8,519 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	104.50'	75,378 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
104.50	9,429	0	0
105.00	10,650	5,020	5,020
106.00	11,936	11,293	16,313
107.00	13,287	12,612	28,924
108.00	14,704	13,996	42,920
109.00	16,185	15,445	58,364
110.00	17,842	17,014	75,378

Device	Routing	Invert	Outlet Devices
#1	Device 4	106.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 4	108.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	109.00'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Primary	104.00'	**15.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 104.00' / 103.68' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=104.50' (Free Discharge)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Culvert** (Passes 0.00 cfs of 0.95 cfs potential flow)
  - **1=Orifice/Grate** (Controls 0.00 cfs)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

The Reynolds Group Inc.

PROJECT: DBVI
LOCATION: Franklin Twp.
DATE: October 2019

VEGETATED FILTER STRIP

The reconstructed entrance drive will drain towards the existing wooded area that runs along the edge of proposed pavement. This area will act as a vegetated filter strip that will treat the stormwater runoff from the asphalt driveway. The wooded area has been analyzed for each hydrologic drainage area (DA #2 and DA #3) to determine its pollutant removal capabilities and its viability to serve as a vegetated filter strip.

Supporting computations and information consistent with DRCC and NJ Stormwater regulations is as follows:

Drainage Area #2

Existing forested area adjacent to the asphalt drive:

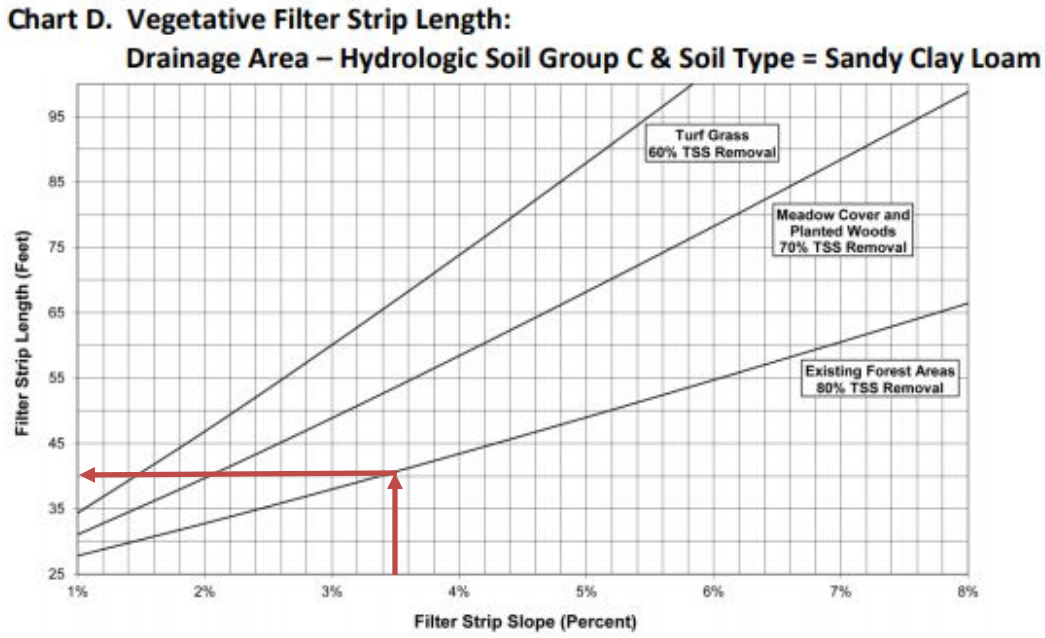
Minimum Average Length = **90 feet**

Maximum Average Slope = **3.5%**

Royce loam, **HSG C**

This area will act as a Vegetated Filter Strip to enhance water quality in accordance with the parameters outlined in Chapter 9.10 of the NJ Stormwater BMP Manual. The 3.5% slope is less than the maximum allowable (8%) for Existing Forest Areas in soils with HSG C.

Use Chart D from Ch. 9.10, the minimum required filter strip length for 'C' soils at 3.5% in an Existing Forest Area is approximately 40 feet.



Since the length of the existing forest area downslope of the asphalt drive is 90 feet, the filter strip area meets the requirement for 80% TSS Removal Rate.

Drainage Area #3

Existing forested area adjacent to the asphalt drive:

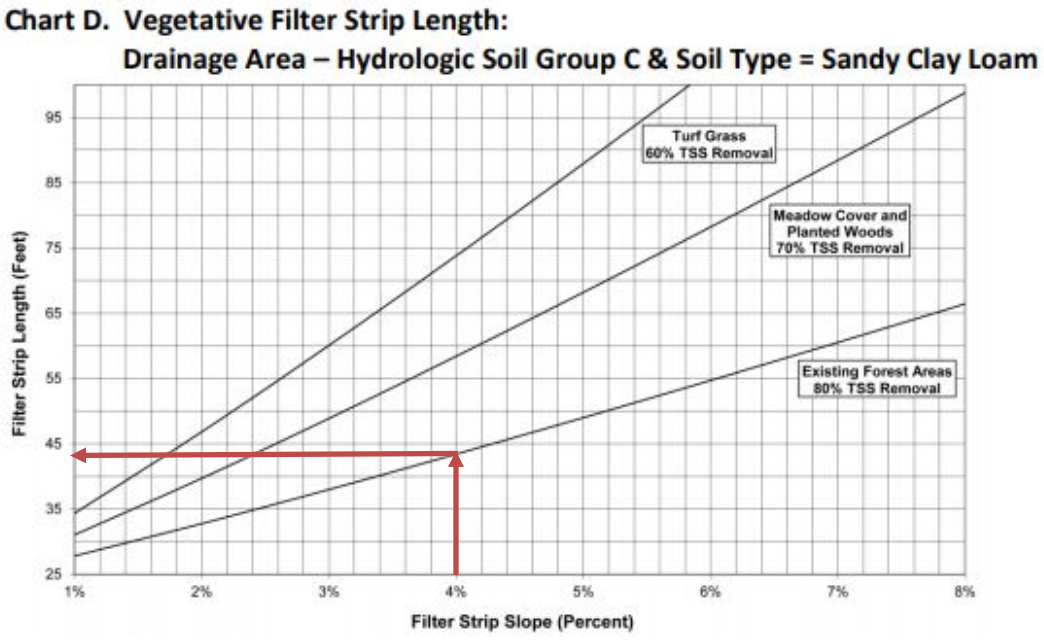
Minimum Length = **70 feet**

Maximum Average Slope = **4%**

Royce loam, **HSG C**

This area will act as a Vegetated Filter Strip to enhance water quality in accordance with the parameters outlined in Chapter 9.10 of the NJ Stormwater BMP Manual. The 4% slope is less than the maximum allowable (8%) for Existing Forest Areas in soils with HSG C.

Use Chart D from Ch. 9.10, the minimum required filter strip length for 'C' soils at 4% in an Existing Forest Area is approximately 43 feet.



Since the length of the existing forest area downslope of the asphalt drive is 70 feet, the filter strip area meets the requirement for 80% TSS Removal Rate.

APPENDIX D

GROUNDWATER IMPACT ANALYSES

- NJGRS Annual Groundwater Recharge Analysis
- Calculation for Drain Time
- Hantush Spreadsheet output

New Jersey Groundwater Recharge Spreadsheet Version 2.0 November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
SOMERSET CO., FRANKLIN TWP	45.7	1.48

Project Name:	DBVI
Description:	South Middlebush Road
Analysis Date:	10/10/19

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	1.137	Open space	Royce	12.0	49,495
2	0.631	Open space	Lansdowne	12.4	28,346
3	3.531	Woods	Lansdowne	12.3	157,702
4	0.028	Woods	Penn	12.9	1,307
5	0.079	Woods	Rowland	11.9	3,408
6	5.252	Woods	Royce	12.2	232,011
7	1.03	Open space	Penn	12.3	46,017
8	3.702	Open space	Royce	12.0	161,152
9	0.029	Gravel, dirt	Lansdowne	6.9	721
10	0.393	Gravel, dirt	Royce	6.4	9,095
11	0.088	Impervious areas	Lansdowne	0.0	-
12	0.06	Impervious areas	Royce	0.0	-
13	0				
14	0				
15	0				
Total =	16.0			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				11.9	689,253

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	4.297	Open space	Royce	12.0	187,053
2	1.97	Open space	Lansdowne	12.4	88,496
3	1.711	Woods	Lansdowne	12.3	76,417
4	0.031	Woods	Penn	12.9	1,447
5	0.079	Woods	Rowland	11.9	3,408
6	3.631	Woods	Royce	12.2	160,402
7	0.569	Impervious areas	Lansdowne	0.0	-
8	2.348	Impervious areas	Royce	0.0	-
9	0.2	Brush	Royce	13.5	9,768
10	0.57	Brush	Penn	13.9	28,779
11	0.068	Gravel, dirt	Royce	6.4	1,574
12	0.029	Gravel, dirt	Lansdowne	6.9	721
13	0.457	Open space	Penn	12.3	20,417
14	0				
15	0				
Total =	16.0			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				10.0	578,481

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)	127,065
Post-Development Annual Recharge Deficit=	*110,771*	(cubic feet)	

Recharge Efficiency Parameters Calculations (area averages)

RWC=	5.34	(in)	DRWC=	5.34	(in)
ERWC =	1.39	(in)	EDRWC=	1.39	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
DBVI	South Middlebush Road	10/10/19	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	9429.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	3.9	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-18.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	2	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	1.05	in
ERWC Modified to consider dEXC	EDRWC	1.05	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.84	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.38	in
Inches of Rainfall to capture	Pdesign	0.49	in
Recharge Provided Avg. over Imp. Area		13.8	in
Runoff Captured Avg. over imp. Area		20.1	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.10	unitless
BMP Volume	VBMP	3,028	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> OK
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	110,771	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	96,224	sq.ft
Root Zone Water Capacity	RWC	4.06	in
RWC Modified to consider dEXC	DRWC	4.06	in
Climatic Factor	C-factor	1.48	no units
Average Annual P	Pavg	45.7	in
Recharge Requirement over Imp. Area	dr	10.5	in

System Performance Calculated Parameters

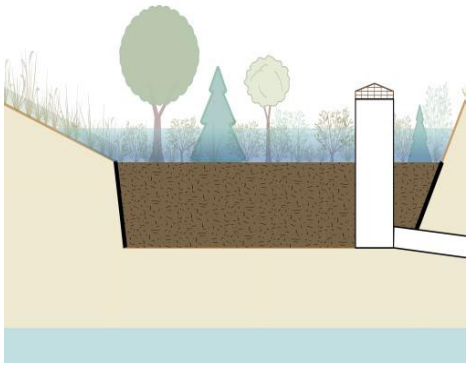
Annual BMP Recharge Volume		110,771	cu.ft
Avg BMP Recharge Efficiency		68.8%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.9%	%
%Runoff Infiltrated		56.4%	%
%Runoff Recharged		29.4%	%
%Rainfall Recharged		22.9%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Infiltration Basin Drain Time



ESTIMATED WQ DRAIN TIME:

Design Data:

WQ Design Runoff Volume	**13,846 CF***
Basin Bottom Surface Area	**9,429 SF**
Design Permeability Rate	**10 inch/hr****

* Peak WQ Storm Water Surface Elevation = 105.32; WQ Storm Storage = 8,519 CF
However, 4" Orifice Elev. = 106.0: Storage @ El. 106.0 = **13,846 CF** (Use for Drain Time calc.)

** Permeability Tests dated 6/26/19: SL-3 : Permeability rate = 160.0 inch/hr ,
SL-4 : Permeability rate = 114.7 inch/hr
For Design Permeability, use maximum allowed from NJDEP BMP Manual, Section 9.5
Max. Design Permeability rate = 10 inch/hr

$$W.Q.\ Drain\ Time = \frac{\text{Water Quality Design Storm Runoff Volume}}{\text{Surface Area x Subsoil Design Permeability Rate}}$$

$$W.Q.\ Drain\ Time = \frac{13{,}846\ \text{cu. ft.}}{9{,}429\ \text{sq. ft. x}\ 10\ \frac{\text{inch}}{\text{hr}}\ x\ \frac{1ft}{12\ inches}}$$

$$W.Q.\ Drain\ Time = 1.8\ \text{hours}$$

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

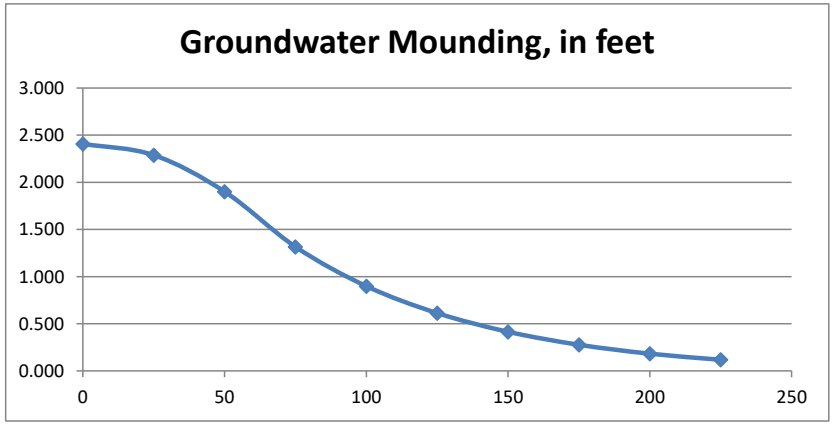
Input Values

2.0000	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
60.00	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
58.000	**x**	**1/2 length of basin (x direction, in feet)**
42.000	**y**	**1/2 width of basin (y direction, in feet)**
0.750	**t**	**duration of infiltration period (days)**
30.000	**hi(0)**	**initial thickness of saturated zone (feet)**

32.408	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.408	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.408	**0**
2.288	**25**
1.902	**50**
1.316	**75**
0.899	**100**
0.613	**125**
0.415	**150**
0.277	**175**
0.182	**200**
0.118	**225**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

APPENDIX E

SOILS INVESTIGATION RESULTS

DBVI
NATIONAL EXECUTIVE COMMITTEE
25 HIGHLAND AVENUE
METUCHEN, N.J.

SOIL SUITABILITY REPORT FOR STORMWATER & SEPTIC DESIGN

630 SOUTH MIDDLEBUSH ROAD

BLOCK 37, LOT 46.03
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NJ

PREPARED BY BAYER-RISSE
ENGINEERING, INC.

THEODORE H. BAYER, P.E.
SEPTEMBER 4, 2019

Executive Summary

Bayer-Risse Engineering, Inc. conducted an onsite soils evaluation at a proposed development site of a DBVI – National Executive Committee facility to be constructed on a parcel of land identified as Lot 46.03 in Block 37 located in the Township of Franklin, Somerset County, NJ. The purpose of the evaluation was to investigate the subsurface soil & groundwater conditions and record appropriate data for the purposes of stormwater & septic system design. Ten (10) soil logs were excavated and recorded in areas identified by RG The Reynolds Group Inc. designated to construct proposed stormwater management & septic system features. The storm water management basins, infiltration areas and the test pit locations identified as TP-1 through TP-8 (Soil Logs SL-0627-1 to SL-0627-8) including the septic area (SL-0626-1 & 2) are illustrated on the Test Pit Location Plan included in the Appendix of this report.

Overall, the areas identified for proposed stormwater management basins provide suitable depth to seasonal high water table levels and permeability for stormwater recharge systems. Further, the area identified for the proposed septic system provides suitable depth to seasonal high water table level for a zone of treatment and permeability for the septic system's zone of disposal.

Soil Test Information

Bayer-Risse Engineering, Inc (BRE) excavated a total of eight (8) soil logs and permeability tests on the property for purposes of identifying site conditions relative to the design of three (3) storm water management systems. These soil logs (each with a permeability test), SL-0627-1 to SL-0627-8, are located in areas designated for the proposed stormwater management systems. An additional two (2) soil logs, SL-0626-1 & 2 with one (1) pit bail test were performed in the area designated for a proposed septic system. All tests were performed in substantial conformance with the NJ Stormwater BMP Manual, Appendix E: Soil Testing Criteria and N.J.A.C. 7:9A.

The soils found in the vicinity of the proposed stormwater management facilities and septic system, in general, consist of a 2 to 6" layer of topsoil underlain by a silt loam soil horizon underlain by a permeable fractured red shale. The soils and/or shale horizons are subject to seasonal high water table at various depths that were evident within the excavated soil profile pits. The depth to the seasonal high regional water table is taken as greater than or equal to the bottom of each soil log or, if observed, groundwater and/or mottling. Refer to Soil Test Summary Table in the Appendix for detailed data specific to soil log descriptions, groundwater level determinations, depths to machine refusal and permeability rates.

BRE employed in situ constant head permeability test methods prescribed by the U.S. Department of Interior, Bureau of Reclamation Procedure "Performing Field Permeability Testing by the Well Permeameter Method" (USBR 7300-89) to determine field measured permeability rates in unsaturated fractured rock (non-soil) conditions. The field measured permeability rates in the unsaturated subsurface conditions in the proposed stormwater management areas (SL-0627-1 to 3 and 5 to 8) were between 4.4 to 188 inches/hour. Pit bail permeability tests were performed in soil logs SL-0626-2 and SL-0627-4 where saturated

subsurface conditions were encountered. The pit bail tests verified positive permeability (36.7 & 87.2 inches/hour respectively) in the area of the septic system area and one proposed stormwater management basin.

A soil log interpretation form 2b has been prepared for each soil log excavated. A general soil description, SL-0626-1 and companion pit bail test was performed in soil log SL-0626-2 were witnessed by a representative of the Somerset County Health Department. The tests were performed in accordance with the method specified at NJAC 7:9A.

The following photographs present the basin flood test and the constant head well permeameter test:

Typical Constant Head Well Permeameter Test

Typical Pit Bail Test

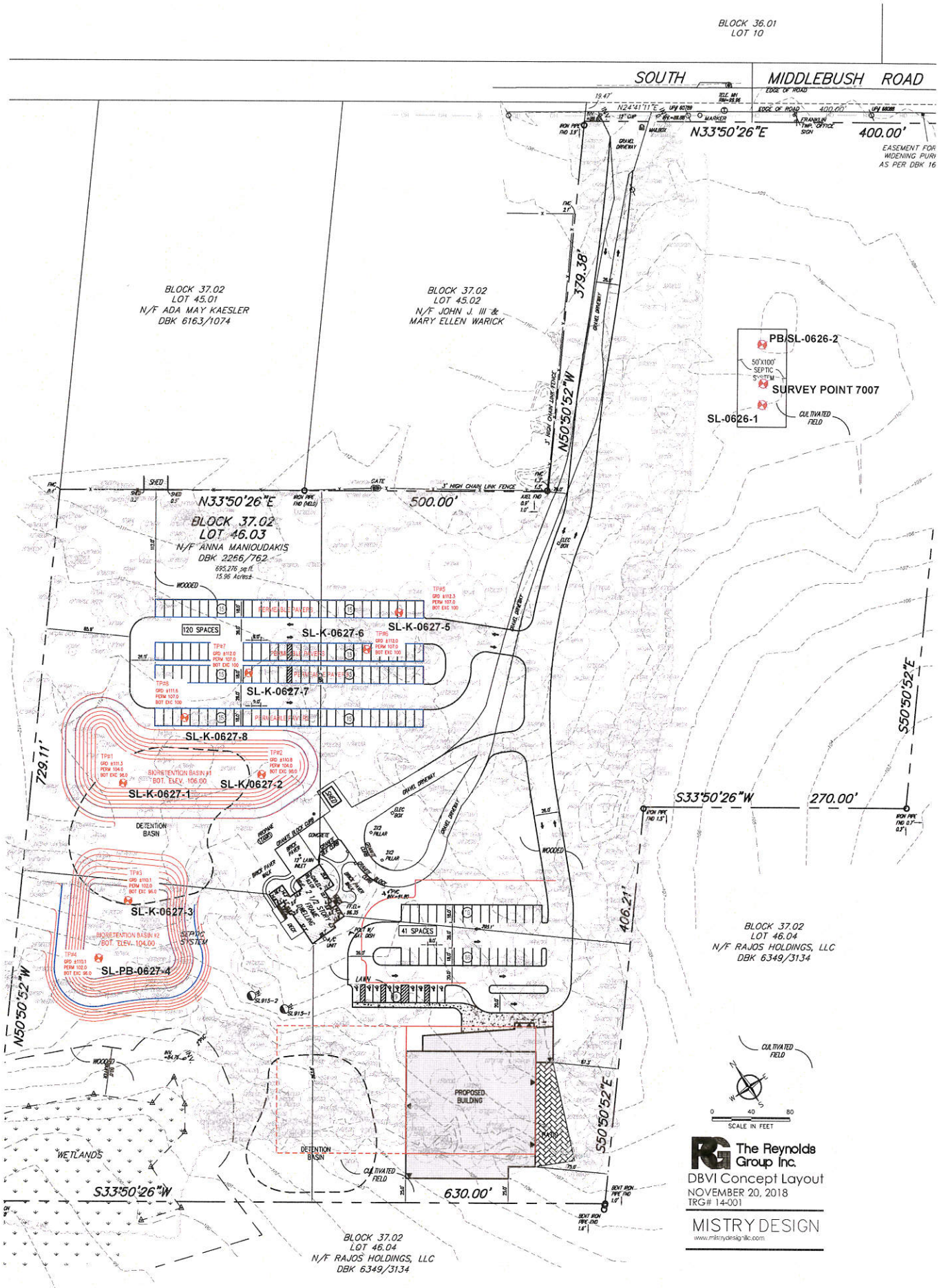
Conclusion

The soil underlying the areas designated for the stormwater management facilities are suitable for installation of a subsurface recharge system. Due to the relatively deep depth of the seasonal high water table in the tested areas of the property, the bottom of the stormwater management features do not need to be elevated above the natural grade to provide the separation distance between the seasonal high water table and the bottom of the basin. We recommend that a design permeability rate of 2.2 inches per hour (one half of the slowest permeability tested in a horizon that extends above the seasonal high water table) be used as the basis of design for the stormwater management facilities.

The Appendix to this report contains the soil log reporting forms, pit bail test results, well permeameter test hole configuration details and the well permeameter test data evaluations to determine respective permeability rates.

SOIL TEST SUMMARY DATA

YEAR	Soil Log No.	Permeability Test No.	Permeability Test Rate/Status (in/hr @ Depth)	Depth to Seasonal High Water Table	Depth to Refusal (R) and/or Limit of Test (L)
2019	**Septic System Soil Testing**				
	0626-1	---	---	60"	130" (L)
	0626-2	PB-0626-2	36.7 @ 110"	34"	110" (R)
	Stormwater Soil Testing				
	0627-1	K-0627-1	188.0 @ 88"	90"	100" (R)
	0627-2	K-0627-2	4.4 @ 79"	114"	114" (R)
	0627-3	K-0627-3	160.0 @ 97"	100"	102" (R)
	0627-4	PB-0627-4	114.7 @ 105"	80"	105" (R)
	0627-5	K-0627-5	33.8 @ 66"	90"	156" (L)
	0627-6	K-0627-6	10.1 @ 60"	108"	108" (R)
	0627-7	K-0627-7	16.9 @ 60"	144"	150" (L)
	0627-8	K-0627-8	8.4 @ 66"	102"	125" (R)
Notes:	K denotes Constant Head Permeability Test above groundwater				
	PB denotes Pit Bail Permeability Test in groundwater				



TEST PIT LOCATION PLAN

NTS

TOWNSHIP OF FRANKLIN, SOMERSET COUNTY, NJ

Form 2b Soil Log and Interpretation

Block **37** **Lot** **46.03**

1. Log Number **0627-3** Method: ☑Profile Pit ☐Boring

2. Soil Log: Date Recorded: **June 27, 2019**

Depth (Inches) Top - Bottom	Munsell Color Name and Symbol; Estimated Textural Class; Estimated Volume % Coarse Fragment, If Present; Structure; Moist or Dry Consistence; Mottling Abundance, Size and Contrast, If Present
0-4"	**Topsoil with medium roots.**
4-24"	**5YR4/4 Reddish Brown Silt Loam; subangular blocky, friable, 30% gravel; no mottling, no seepage.**
24-102"	**Nonsoil with 20% fillings; no mottling, no seepage.**
>102"	**Machine Refusal. Constant Head Permeability Test K-0627-3; Depth: 97"; Rate: 160.0 in/hr**

2a. If mottling give reason for mottling: _____

3. Ground Water Observations:
☐Seepage - Indicate Depth: _____
☐Pit/Boring Flooded Depth after _____ hours = _____

4. Soil Limiting Zones:
☑Fractured Rock Substratum - Depth to Top: **24"**
☐Massive Rock Substratum - Depth to Top: _____
☐Excessively Coarse Horizon - Depth Top to Bottom: _____
☐Excessively Coarse Substratum - Depth to Top: _____
☐Hydraulically Restrictive Horizon - Depth Top to Bottom: _____
☐Hydraulically Restrictive Substratum - Depth to Top: _____
☐Perched Zone of Saturation - Depth Top to Bottom: _____
☐Regional Zone of Saturation - Depth to Top: _____

5. Soil Suitability Classification: **IISc**

6. I hereby certify that the information furnished on Form 2b of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator Mark B Anderson Date September 4, 2019

Signature of Professional Engineer _____ Date September 4, 2019

Seal

N.J. License No. 33806

PERMEABILITY TEST EVALUATION: CONDITION II

REFERENCE: US Department of the Interior, Bureau of Reclamation Procedure for "Performing Field Permeability Testing by the Well Permeameter Method", USBR 7300-89

BRE Job No. 14-1400 **Soil Log 0627-3, Permeability Test No. K-0627-3**
Test Date: 6/27/19

Condition II

Depth of Test (in)	97	Duration of Test	138	min
Height of water h (in)	14.0	Average head	14.0	in
Radius of pipe (in)	1	Area of pipe ($in^{2)}$	3.14	
Radius of hole (in)	16.2	Area of hole ($in^{2)}$	824.0616	
T_u (in)	19			
Volume of water used for test:	460			

Vi=Ai*h	43.96	in^3
Vo=(Ao-Ai)*h	4022.52	in^3
Vt=Vi+Vo	4066.48	in^3

Measured infiltration rate =		770.05	ci/min	3.33 gal/min
			in^3/min	0.45 cf/min

qV/(2Pi*h^2)	0.63
h/r	14.00
Viscosity of water (@ 20° C)	1.00
ln(h/r)	2.64
$1/6+1/3(h/T_u)^{\wedge -1}$	0.62

K_{20} = 160.0 in/hr

Field Data & Calculations:

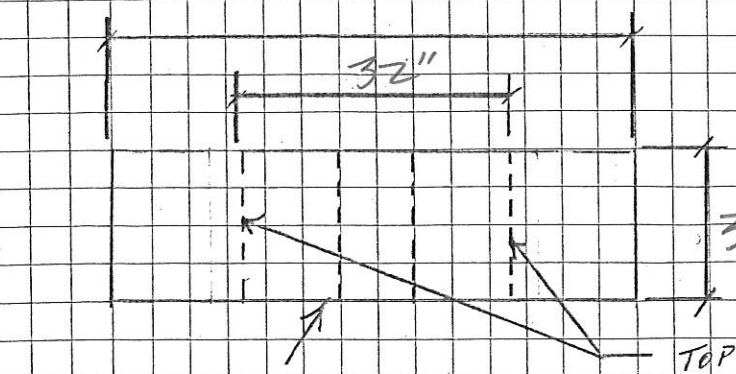
Time of Reading (6/27/19)	Difference in Time	Time Interval (minutes)	Flow Rate (gpm)	Inflow Volume (Gallons)	Depth above Reference Point (inches)	**h** (inches)
13:17	0	0	3.33	0	14.0	14.0
15:35	2:18	138	3.33	460	14.0	14.0
Total/ Average		**138**	**3.3**	**460**	**14.0**	**14.0**

Prepared By: Bayer-Risse Engineering, Inc.
Date: 7/30/19

K TEST GEOMETRY

NTS

BAYER-RISSE ENGINEERING, INC.
Engineering Calculation Sheet
SL-0627-3
Project Name: DBVI
BRE Job #: 14-1400
Engineer: MBA/SGG
Date: 6/27/19



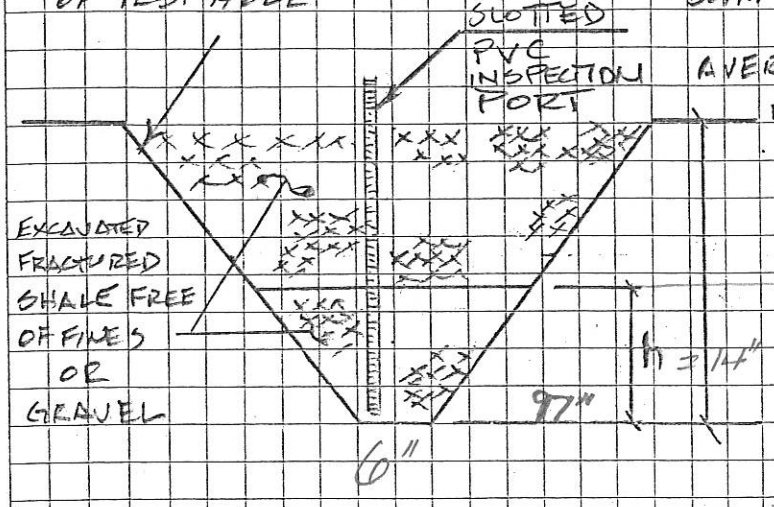
PLAN

TOP WETTED AREA: 2.67 x 2.67 = 7.13 ; PERIMETER = 10.68 Ft.

BOTTOM WETTED AREA: 0.5 x 2.69 = 1.34 ; PERIMETER = 6.34 Ft.

AVERAGE AREA = (7.13 + 1.34)/2 = 4.24

AVERAGE PERIMETER = 8.51



18" SECTION

Tu = 19"

10Z" IMPERVIOUS

FOR PERMEABILITY EVALUATION USE:

EFFECTIVE RADIUS (R) = 8.51 = 2πR = 1.35' = 16.2"

EFFECTIVE AREA (A): $\pi R^2 = \pi(1.35)^2 = 5.73'$

FOR USBR 7300-89 CONDITION II

$h < Tu < 3h$

$14 < 19 < 42$ ✓

TOWNSHIP OF FRANKLIN, SOMERSET COUNTY, NJ

Form 2b Soil Log and Interpretation

Block **37** **Lot** **46.03**

1. Log Number **0627-4** Method: ☑Profile Pit ☐Boring

2. Soil Log: Date Recorded: **June 27, 2019**

Depth (Inches) Top - Bottom	Munsell Color Name and Symbol; Estimated Textural Class; Estimated Volume % Coarse Fragment, If Present; Structure; Moist or Dry Consistence; Mottling Abundance, Size and Contrast, If Present
0-6"	**Topsoil with medium roots.**
6-36"	**5YR4/4 Reddish Brown Silt Loam; subangular blocky, friable, 20% gravel; no mottling, no seepage.**
36-105"	**Nonsoil with 30% fillings; no mottling, moderate seepage at 80".**
>105"	**Machine Refusal Pit Bail PB 0627-4; Depth: 105"; K = 114.7 in/hr; 24 hr. SWL = 85"**

2a. If mottling give reason for mottling: _____

3. Ground Water Observations:
☑Seepage - Indicate Depth: **80"**
☑Pit/Boring Flooded Depth after **24** hours = **85"**

4. Soil Limiting Zones:
☑Fractured Rock Substratum - Depth to Top: **36"**
☐Massive Rock Substratum - Depth to Top: _____
☐Excessively Coarse Horizon - Depth Top to Bottom: _____
☐Excessively Coarse Substratum - Depth to Top: _____
☐Hydraulically Restrictive Horizon - Depth Top to Bottom: _____
☐Hydraulically Restrictive Substratum - Depth to Top: _____
☐Perched Zone of Saturation - Depth Top to Bottom: _____
☑Regional Zone of Saturation - Depth to Top: **80"**

5. Soil Suitability Classification: **IISc**

6. I hereby certify that the information furnished on Form 2b of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Soil Evaluator Mark B Anderson Date September 4, 2019

Signature of Professional Engineer _____ Date September 4, 2019

Seal

N.J. License No. 33806

TOWNSHIP OF FRANKLIN, SOMERSET COUNTY, NJ

Form 3f. Pit-Bailing Test Data
(1 of 2)

Block **37** **Lot** **46.03**

ALL DATA MUST BE IN MEASUREMENT UNITS INDICATED (FEET OR INCHES). ONLY ONE PITBAIL TEST PER SHEET.

1. Test Number **PB 627-4** Reference Soil Log #: **SL 627-4** Date Tested: **6/27/2019**

2. Using the reference level established, measure and record the following:

- Depth to Bottom of Pit, ft, D_{pit} = **8.75**
- Depth to Water Level after 24 hr Stabilization Period, ft, D_{water} = **7.08**
- Depth to Impermeable Stratum, ft, $D_{stratum}$ = **8.75**
  (If depth is unknown assume it to be 1.5 times D_{pit})
- Height of Water Level above Impermeable Stratum, ft, H= **1.67**
  ($H = D_{stratum} - D_{water}$).
- Length of Time Interval, min., T = **varies**

3. Record the following data in the table below:

- Time in minutes, enter actual time interval for each measurement taken, t_n, minutes.
- Depth of Water Level Below Reference Level in inches, d_a
- Water Surface Dimensions in feet l & w

4. Calculate the following values and enter in the table below:

- Water Surface Area, ft^2, A_a
- Water Level Rise, in, h_r (Subtract current value of d_a from previous value)
- Average Water Surface Area, ft^2, A_{av} (take average of A_a and previous A_a)
- Average Height of Water Level Above Impermeable Stratum, ft, h
  (Take average of d_a and previous d_a, convert to ft., and subtract from $D_{stratum}$)
- Permeability, in/hr, K_n.(Calculate using formula):
  $K_a = (h_r / T) \times (A_{av}/(2.27 \times (H^2-h^2)) \times 60$ min/hr

Time (h:mm)	t_n (min)	d_n (in)	**l** (ft)	**w** (ft)	**An** (sf)	h_{rise} (in)	A_{avg} (sf)	**h** (ft)	**Ka** (in/hr)
9:59 AM	0	98.00	3.42	2.67	9.11				
10:00 AM	1	96.00	3.50	2.67	9.33	2.00	9.22	0.67	208.9
10:03 AM	3	93.50	3.67	2.67	9.78	2.50	9.56	0.85	102.8
10:06 AM	3	91.00	3.92	2.67	10.44	2.50	10.11	1.06	135.1
10:09 AM	3	89.50	3.92	2.67	10.44	1.50	10.44	1.23	109.0
10:12 AM	3	88.50	3.92	2.67	10.44	1.00	10.44	1.33	92.0
10:15 AM	3	88.00	3.92	2.67	10.44	0.50	10.44	1.40	55.5
10:21 AM	6	87.00	3.92	2.67	10.44	1.00	10.44	1.46	70.7
10:27 AM	6	86.00	3.92	2.67	10.44	1.00	10.44	1.54	114.7

Form 3f Pit-Bailing Test Data
(2 of 2)

5. Record the Following Data:

- Final Depth of Pit, ft, D_{pit} = **8.75**
- ☑ Check here if testing was stopped due to machine refusal or machine limitations. {(See step 6 of Pitbail Test NJAC 7:9A-6.5(c)}
- Final Depth to Impermeable Stratum, ft, $D_{stratum}$ = **8.75** (If no impermeable stratum is encountered, assume $D_{stratum} = D_{pit}$)
- Height of Standpipe Above Reference Level, ft, h_{pipe} = **N/A**
- Depth to Water Level after 24 hr Stabilization Period, ft, D_{water} = **7.08** (Take measurements from top of standpipe. Subtract h_{pipe}) (enter 0 if standpipe not used)
- Height of Static Water Level Above Impermeable Stratum, ft, H= **1.67** ($H = D_{stratum} - D_{water}$)
- Average Height of Water Level Above Impermeable Stratum, ft, h = **1.54**
- (Take average d_a from beginning and end of last time interval recorded in Section 4, convert to ft., and subtract from final $D_{stratum}$.)

6. Re-calculation of K using data from Section 5 above and from final time interval of Section 4:

$K = (h_{rise}/ t_n,) \times (A_{avg}/(2.27 \times (H^2-h^2))) \times 60$ min/hr
$K = (\mathbf{1.00/6.0}) \times (\mathbf{10.44}/(2.27 \times (\mathbf{1.67^2} - \mathbf{1.54^2}))) \times 60$ min/hr
$K =$ **114.7 in/hr**

7. I hereby certify that the information furnished on Form 3e of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Site Evaluator Mark B Anderson Date September 4, 2019

Signature of Professional Engineer Date September 4, 2019

N.J. License No. 33806 Seal

APPENDIX F

CONVEYANCE SYSTEM CALCULATIONS

- Storm Sewer Pipe Computations
- C.O.P. Sizing
- Anti-Seep Collar Calculation

The Reynolds Group Inc.

CALCULATIONS FOR STORM SEWER SYSTEM

PROJECT NAME: DBVI TRG #: 14-001

STORM FREQ.: 25 years * PREPARED BY: LMK DATE: 31-Mar-20

INLET from	to	AREA (acres)	C	AxC	TOTAL AxC	Tc (min.)	I (in/hr)	Q (cfs)	PIPE SIZE (in)	SLOPE (%)	CAPACITY (cfs)	FF VEL. (fps)	NOTES
	102	0.64	0.83	0.53		12	5.29	2.8					
102	101				0.53	12	5.29	2.8	15	1.0	6.5		140 lf RCP
	101	0.47	0.96	0.45		10	5.64	2.5					
101	100				0.98	12	5.29	5.2	15	1.0	6.5		181 lf RCP
101	100	**(100 yr Storm check) >>>***			0.98	12	6.09	6.0	15	1.0	6.5		181 lf RCP
	204	0.44	0.71	0.31		15	4.76	1.5					
204	203				0.31	15	4.76	1.5	15	0.5	5.0		166 lf HDPE
	203	0.21	0.77	0.16		12	5.29	0.9					
203	202				0.47	15	4.76	2.3	15	0.6	5.0		49 lf HDPE
	202	0.36	0.89	0.32		10	5.64	1.8					
202	201				0.79	15	4.76	3.8	15	0.6	5.0		150 lf RCP
201	200				0.79	15	4.76	3.8	15	0.6	5.0		88 lf RCP
201	200	**(100 yr Storm check) >>>***			0.79	15	5.48	4.3	15	0.6	5.0		88 lf RCP
	*	Rainfall Intensity, I, for a 25 year event was used for the pipe design.											
		For final pipe runs into detention basin, capacity check was performed using 100 year storm rainfall intensity											
O.S.	300	**(100 yr Storm Outflow from Basin) >>>**						4.33	15	0.8	5.8		40 lf RCP

NOAA Atlas 14, Volume 2, Version 3
Location name: Somerset, New Jersey, USA*
Latitude: 40.4559°, Longitude: -74.5495°
Elevation: 110.78 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

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/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.00** (3.61-4.43)	**4.75** (4.30-5.27)	**5.64** (5.09-6.24)	**6.29** (5.66-6.95)	**7.08** (6.35-7.81)	**7.63** (6.80-8.42)	**8.18** (7.27-9.05)	**8.69** (7.68-9.61)	**9.31** (8.16-10.3)	**9.78** (8.51-10.9)
10-min	**3.19** (2.89-3.53)	**3.80** (3.44-4.21)	**4.52** (4.07-5.00)	**5.03** (4.53-5.56)	**5.64** (5.05-6.22)	**6.08** (5.42-6.70)	**6.50** (5.78-7.18)	**6.89** (6.09-7.61)	**7.37** (6.45-8.17)	**7.70** (6.70-8.57)
15-min	**2.66** (2.40-2.94)	**3.19** (2.88-3.53)	**3.81** (3.44-4.22)	**4.24** (3.82-4.69)	**4.76** (4.27-5.26)	**5.13** (4.58-5.66)	**5.48** (4.87-6.05)	**5.79** (5.12-6.41)	**6.18** (5.41-6.86)	**6.44** (5.60-7.17)
30-min	**1.82** (1.65-2.02)	**2.20** (1.99-2.44)	**2.71** (2.44-2.99)	**3.07** (2.77-3.40)	**3.53** (3.16-3.89)	**3.86** (3.45-4.26)	**4.20** (3.73-4.64)	**4.51** (3.99-4.99)	**4.92** (4.31-5.45)	**5.22** (4.54-5.80)
60-min	**1.14** (1.03-1.26)	**1.38** (1.25-1.53)	**1.74** (1.57-1.92)	**2.00** (1.80-2.21)	**2.35** (2.11-2.59)	**2.62** (2.34-2.89)	**2.89** (2.57-3.19)	**3.16** (2.80-3.50)	**3.53** (3.09-3.91)	**3.81** (3.31-4.24)
2-hr	**0.694** (0.624-0.772)	**0.845** (0.760-0.939)	**1.07** (0.964-1.19)	**1.25** (1.12-1.39)	**1.49** (1.33-1.65)	**1.69** (1.50-1.87)	**1.90** (1.67-2.10)	**2.11** (1.84-2.34)	**2.40** (2.08-2.68)	**2.64** (2.26-2.94)
3-hr	**0.513** (0.462-0.573)	**0.625** (0.563-0.698)	**0.794** (0.714-0.886)	**0.926** (0.830-1.03)	**1.11** (0.988-1.23)	**1.26** (1.12-1.40)	**1.41** (1.24-1.57)	**1.58** (1.38-1.75)	**1.80** (1.55-2.01)	**1.98** (1.69-2.22)
6-hr	**0.328** (0.295-0.367)	**0.398** (0.358-0.445)	**0.505** (0.452-0.563)	**0.592** (0.529-0.658)	**0.717** (0.634-0.796)	**0.822** (0.723-0.910)	**0.934** (0.813-1.03)	**1.06** (0.909-1.17)	**1.23** (1.04-1.36)	**1.37** (1.15-1.53)
12-hr	**0.197** (0.177-0.223)	**0.239** (0.214-0.269)	**0.305** (0.272-0.343)	**0.361** (0.320-0.404)	**0.444** (0.391-0.495)	**0.515** (0.450-0.574)	**0.593** (0.513-0.660)	**0.680** (0.580-0.758)	**0.808** (0.677-0.903)	**0.918** (0.757-1.03)
24-hr	**0.113** (0.104-0.124)	**0.137** (0.126-0.150)	**0.176** (0.161-0.192)	**0.209** (0.191-0.228)	**0.258** (0.235-0.281)	**0.301** (0.271-0.328)	**0.349** (0.312-0.380)	**0.402** (0.355-0.439)	**0.481** (0.419-0.527)	**0.550** (0.471-0.604)
2-day	**0.065** (0.060-0.072)	**0.079** (0.073-0.087)	**0.101** (0.092-0.112)	**0.120** (0.109-0.132)	**0.147** (0.133-0.161)	**0.170** (0.153-0.186)	**0.195** (0.174-0.214)	**0.223** (0.196-0.245)	**0.263** (0.228-0.291)	**0.297** (0.255-0.330)
3-day	**0.046** (0.042-0.051)	**0.056** (0.051-0.062)	**0.071** (0.065-0.078)	**0.084** (0.077-0.092)	**0.102** (0.093-0.112)	**0.118** (0.106-0.129)	**0.135** (0.120-0.148)	**0.153** (0.135-0.168)	**0.180** (0.157-0.198)	**0.202** (0.174-0.224)
4-day	**0.037** (0.034-0.040)	**0.045** (0.041-0.049)	**0.056** (0.052-0.062)	**0.066** (0.060-0.072)	**0.080** (0.073-0.088)	**0.092** (0.083-0.101)	**0.105** (0.094-0.114)	**0.118** (0.105-0.130)	**0.138** (0.121-0.152)	**0.154** (0.134-0.170)
7-day	**0.025** (0.023-0.027)	**0.030** (0.027-0.032)	**0.037** (0.034-0.040)	**0.043** (0.039-0.046)	**0.051** (0.047-0.056)	**0.058** (0.053-0.063)	**0.066** (0.060-0.072)	**0.074** (0.066-0.081)	**0.086** (0.076-0.094)	**0.095** (0.083-0.105)
10-day	**0.020** (0.018-0.021)	**0.023** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.036)	**0.039** (0.036-0.042)	**0.044** (0.040-0.048)	**0.049** (0.045-0.053)	**0.055** (0.050-0.059)	**0.063** (0.056-0.068)	**0.069** (0.061-0.075)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.030** (0.027-0.032)	**0.032** (0.030-0.034)	**0.036** (0.033-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.022** (0.021-0.024)	**0.024** (0.022-0.025)	**0.026** (0.024-0.028)	**0.028** (0.026-0.030)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.012)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.020-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.014-0.015)	**0.015** (0.015-0.016)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)

[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

The Reynolds Group Inc.

DBVI SITE PLAN
630 So. Middlebush Road
Franklin, NJ

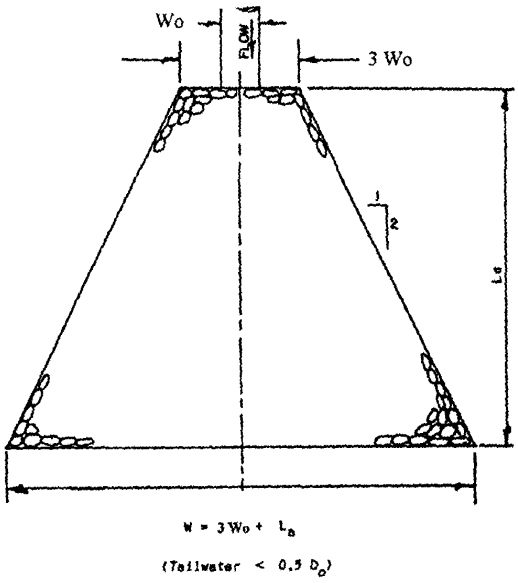
RIPRAP APRON DATA SHEET

PROJECT NAME: DBVI
STORM FREQENCIES: 25 &100 Year
TRG #: 14-001
DATE: . 03/30/20
BY: LMK

For Tailwater < 0.5D_o

OUTLET STRUCT.	YEAR STORM	Q (cfs)	VELOCITY-max (fps)	PIPE HEIGHT (in)	PIPE WIDTH (in)	TAILWATER (ft)	La (ft)	W (beg) (ft)	W (end) (ft)	d50 * (in)
FES #100	25	**5.20**	6.20	15	15	0.25	**15.4**	**3.8**	**19.2**	**6.4**
FES #200	25	**3.80**	4.70	15	15	0.25	**13.6**	**3.8**	**17.4**	**4.2**
HW #300	100	**4.33**	5.40	15	15	0.25	**14.3**	**3.8**	**18.1**	**5.0**

* Q to HW #1 is 25 year discharge from detention basin - see output which follo



For tailwater elevation less than the elevation of the center of the pipe,

$W = 3\ W_o + L_a$

$$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7Do \qquad TW < \tfrac{1}{2} D_o$$

$$d_{50} = \frac{0.02}{Tw} q^{1.33} \qquad \text{where } q = \frac{Q}{Wo}$$

For areas where Tw cannot be computed, use $Tw = 0.2\ D_o$

The Reynolds Group Inc.

State Certificate of Authorization
No. 24GA27969200
Engineers
Landscape Architects
Land Surveyors

Job No.	14-001	Name	DBVI
Sheet No.	1	Of	1
Calculated by	LMK	Checked by	LMK
Date	03-27-20	Scale	n.t.s.

ANTI-SEEP COLLAR CALCULATIONS

Per NJAC Title 5, Chapter 21, the following criteria shall be used to determine size and number of anti-seep collars:

Let V = vertical and horizontal projection of anti-seep collar in feet,

Let L = length in feet of the zone of saturation, and

Let n = number of anti-seep collars.

The ratio of (L + 2nV) / L shall be at least 1.15.

Collars shall be spaced at a distance of not more than 25 feet.

For the proposed Infiltration/Extended Detention Basin,

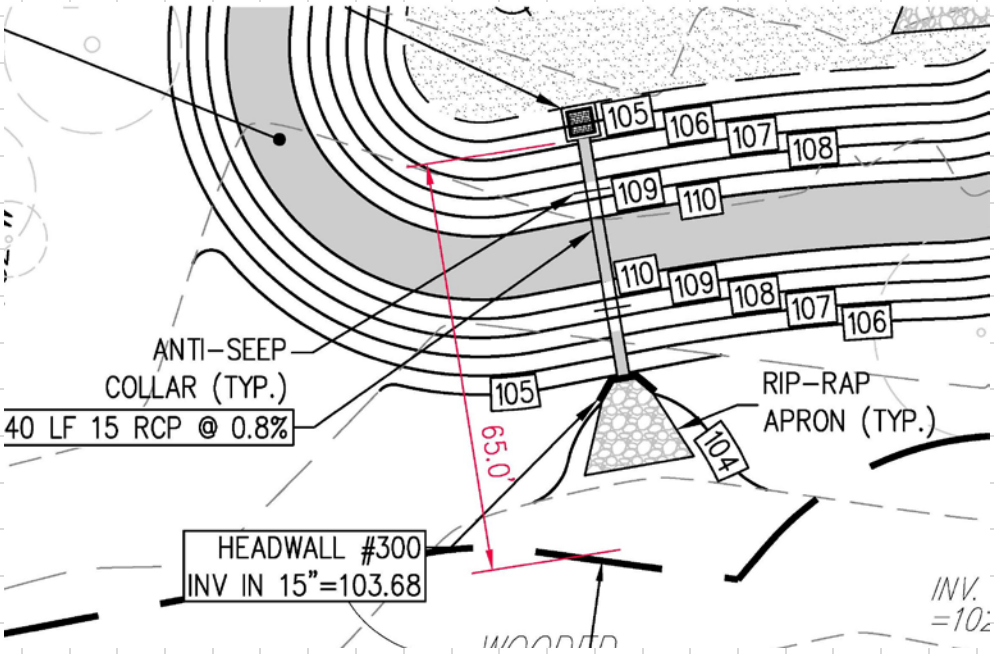
V = 2.5 feet

L = 65 feet (see image below)

n = 2

(L + 2nV) / L = (65 + 2*2*2.5) / 65 = 75/65 = 1.154 > 1.15 ,

Therefore, 2 collars with a 2.5-foot projection in each direction are adequate.



APPENDIX G

NONSTRUCTURAL STRATEGIES

- Low Impact Development (LID) Checklist
- Nonstructural Strategies Point System (NSPS) Spreadsheet

New Jersey Stormwater Best Management Practices Manual

February 2004

APPENDIX A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: FranklinTownship

County: Somerset Date: March 26, 2020

Review board or agency: Franklin Township Zoning Board of Adjustment

Proposed land development name: DBVI Proposed House of Worship

Lot(s): 46.03 Block(s): 37.02

Project or application number: ZBA-19-00040

Applicant's name: Dada Bhagwan Vignan Institute

Applicant's address: 630 South Middlebush Road
Somerset, NJ 08873

Telephone: 732-470-6517 Fax:

Email address: bhupenipatel@gmail.com

Designer's name: Mitchel Ardman

Designer's address: 575 Route 28 - Suite 110
Raritan, NJ

Telephone: 908-722-1500 Fax: 908-722-7035

Email address: mardman@reynoldsgrp.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

The proposed site improvements were designed so as to avoid disturbance of wetlands buffers, preserve existing vegetation where possible, minimize visual impacts to the area and . A perservation area will be established to permanently protect the wetland buffer.

The site design utilizes and improves the existing driveway to provide access to the proposed house of worship in order to minimize disturbance of existing vegetation. Portions of existing cultivated areas will be re-vegetated with natural ground cover. This nonstructural technique will reduce site flows by increasing runoff absorption.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

Franklin Township Ordinance, Chapter 330 - Stormwater Management

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: Include minimizing the increase of stormwater runoff rates and volumes, maximizing the protection of natural drainage features (such as wetlands) and vegetation, minimize land disturbance and soil compaction, minimize use of pollutants.

List LID-BMPs prohibited by local regulations: none found

Pre-design meeting held? Yes: _____ Date: _____ No: X

Meeting held with: _____

Pre-design site walk held? Yes: _____ Date: _____ No: X

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: Somerset County Planning Board

Required approval: Site Plan

Name: Somerset-Union Soil Conservation District

Required approval: Plan Certification

Name: Delaware-Raritan Canal Commission

Required approval: Certificate of Approval (staff technical approval granted)

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No: _____

If yes, was this inventory a factor in the site's layout and design? Yes: X No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: _____ If yes, specify % of site: 21.6%

Native ground cover? Yes: X No: _____ If yes, specify % of site: 4.8%

Vegetated buffers? Yes: X No: _____ If yes, specify % of site: 15.0%

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: _____ If yes, specify % of site: N/A

Native ground cover? Yes: _____ No: X If yes, specify % of site: _____

Vegetated buffers? Yes: X No: _____ If yes, specify % of site: N/A

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: X No: _____

Reduce runoff pollutant loads through runoff treatment: Yes: X No: _____

Maintain groundwater recharge by preserving natural areas: Yes: X No: _____

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X No: _____

If yes, were these inventories factors in the site's layout and design? Yes: X No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: X No: _____

If yes, how: A preservation area will be established around the wetland buffer and filter strips.

Restrict temporary site disturbance during construction? Yes: X No: _____

If yes, how: The limit of disturbance protects existing trees and other vegetation that do not need to be disturbed to accommodate the proposed improvements. This limit will be delineated with silt fence.

Consider soils and slopes in selecting disturbance limits? N/A Yes: _____ No: _____

If yes, how: _____

C. Specify percentage of site to be cleared: 29.6% Regraded: 23.7%

D. Specify percentage of cleared areas done so for buildings: 12.5%

For driveways and parking: 51% For roadways: _____

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

The House of Worship would have to be made smaller or relocated in order to reduce the amount of clearing. The location of the building is based on recommendations by Township officials.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: _____ HSG B: _____ HSG C: 100% HSG D: _____

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: _____ HSG B: _____ HSG C: 30.5% HSG D: _____

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

On-site soils are exclusively HSG C. There are no HSG A or B soils within the property.

I. Does the site include Karst topography? Yes: _____ No: X

If yes, discuss measures taken to limit Karst impacts:

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 3.6% Proposed: 18.6%

B. Specify maximum site impervious coverage allowed by regulations: 40%

C. Compare proposed street cartway widths with those required by regulations: N/A

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking		
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9' x 18' Regulations: 9' x 18'

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 157 Regulations: 153

F. Specify percentage of total site impervious cover created by buildings: 19.5%

By driveways and parking: 80.5% By roadways: _____

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

To reduce these percentages, applicant would have to reduce the size of the building or provide less parking.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 27.6% Buildings:_____ Driveways and parking: 27.6% Roads: _____

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: _____ Driveways and parking: _____ Roads: _____

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 0%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 37% Vegetated swale: _____ Natural channel: 24%

Stormwater management facility: 19% Other: 20%

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

Additional existing wooded areas would need to be disturbed in order to construct vegetated swales to convey stormwater to the detention basin.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: Decrease size of parking areas; not practical since number of parking spaces proposed is required by Township ordinance.

Increase overland flow roughness: Decrease size of parking areas; not practical since number of parking spaces proposed is required by Township ordinance.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: 1 dumpster with recycling provisions

Specify the spacing between the trash receptacles: N/A

Compare trash receptacles proposed with those required by regulations:

Proposed: N/A Regulations: _____

B. Pet Waste Stations business

Specify the number of pet waste stations provided: _____

Specify the spacing between the pet waste stations: _____

Compare pet waste stations proposed with those required by regulations:

Proposed: _____ Regulations: _____

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities: N/A

Street sweeping: Proposed: _____ Regulations: _____

Litter collection: Proposed: _____ Regulations: _____

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

_____

_____

E. Prevention and Containment of Spills - N/A

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.	X	
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.		X
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

In order to provide vegetated open channel conveyance, additional wooded areas would need to be disturbed. This would not be desirable.

NJDEP Nonstructural Strategies Points System (NSPS)

Version: January 31, 2006

Note: Input Values in Yellow Cells Only

Project:	DBVI - Proposed House of Worship
Date:	October 7, 2019
User:	The Reynolds Group, Inc.
Notes:	Site Plan on South Middlebush Road in Franklin Twp, Somerset County

Step 1 - Provide Basic Major Development Site Information

A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 = 16.0 **Acres**

B. Specify by Percent the Various Planning Areas Located within the Development Site:

State Plan Planning Area:	PA-1	PA-2	PA-3	PA-4	PA-4B	PA-5	Total % Area
Percent of Each Planning Area within Site:				100.0%			100.0%

Note: See User's Guide for Equivalent Zones within Designated Centers and the NJ Meadowlands, Pinelands, and Highlands Districts

Step 2 - Describe Existing or Pre-Developed Site Conditions

A. Specify Existing Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers					0.0		0
2	Lawn and Open Space			6.5		6.5		94
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous			8.9		8.9		180
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt			0.4		0.4		4
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious					0.0		0
14	Unconnected Impervious with Small D/S Pervious					0.0		0
15	Unconnected Impervious with Large D/S Pervious			0.1		0.1		2
	HSG Subtotals (Acres):	0.0	0.0	16.0	0.0		**Total Area:**	16.0
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		**Total % Area:**	100.0%

Points Subtotal: **279**

Total Existing Site Points: **279**

Step 3 - Describe Proposed or Post-Developed Site Conditions

A. Specify Proposed Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers					0.0		0
2	Lawn and Open Space			6.6		6.6		95
3	Brush and Shrub			0.9		0.9		14
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous			5.5		5.5		110
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt			0.1		0.1		1
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious			2.4		2.4		0
14	Unconnected Impervious with Small D/S Pervious					0.0		0
15	Unconnected Impervious with Large D/S Pervious			0.5		0.5		6
	HSG Subtotals (Acres):	0.0	0.0	16.0	0.0		**Total Area:**	16.0
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		**Total % Area:**	100.0%
							Points Subtotal:	**226**

B. Compare Proposed Impervious Coverage with Maximum Allowable Impervious Coverage:

Total Directly Connected Impervious Coverage =	15%	% of Site
Total Unconnected Impervious Coverage with Small D/S Pervious =	0%	% of Site
Total Unconnected Impervious Coverage with Large D/S Pervious =	3%	% of Site
Total Site Impervious Coverage =	18%	% of Site
Effective Site Impervious Coverage =	17%	% of Site
Specify Source of Maximum Allowable Impervious Coverage:	Table	(None or Table)
Allowable Site Impervious Cover from Maximum Impervious Cover Table:	12%	

Note: See Maximum Impervious Cover Table Worksheet for Details

Points Subtotal: 0

C. Compare Proposed Site Disturbance with Maximum Allowable Site Disturbance:

Total Proposed Site Disturbance =	30%	% of Site
Maximum Allowable Site Disturbance by Municipal Ordinance =	90%	% of Site

Points Subtotal: 31

D. Describe Proposed Runoff Conveyance System:

Total Length of Runoff Conveyance System =	1180	Feet
Length of Vegetated Runoff Conveyance System =	405	Feet
% of Total Runoff Conveyance System That is Vegetated =	34%	

Points Subtotal: 32

E. Residential Lot Clustering:

Percent of Total Site Area that will be Clustered =		% of Site
Minimum Standard Lot Size as Per Zoning (Note: 1/2 Acre or Greater) =		Acres
Maximum Proposed Cluster Lot Size (Note:1/4 Acre or Less) =		Acres
Percent of Clustered Portion of Site to be Preserved as Vegetated Open Space =		% of Clustered Site Portion

Points Subtotal: 0

F. Will the Following be Utilized to Minimize Soil Compaction?

Proposed Lawn Areas will be Graded with Lightweight Construction Equipment:	Yes	(Yes or No)
Percent of Proposed Lawn Areas to be Graded with Such Equipment:	50%	% of Lawn Areas

Points Subtotal: 12

G. Are Any of the Following Stormwater Management Standards Met Using Only Nonstructural Strategies and Measures?

Groundwater Recharge Standards (NJAC 7:8-5.4-a-2):	No	(Yes or No)
Stormwater Runoff Quality Standards (NJAC 7:8-5.5):	No	(Yes or No)
Stormwater Runoff Quantity Standards (NJAC 7:8-5.4-a-3):	No	(Yes or No)

Points Subtotal: 0

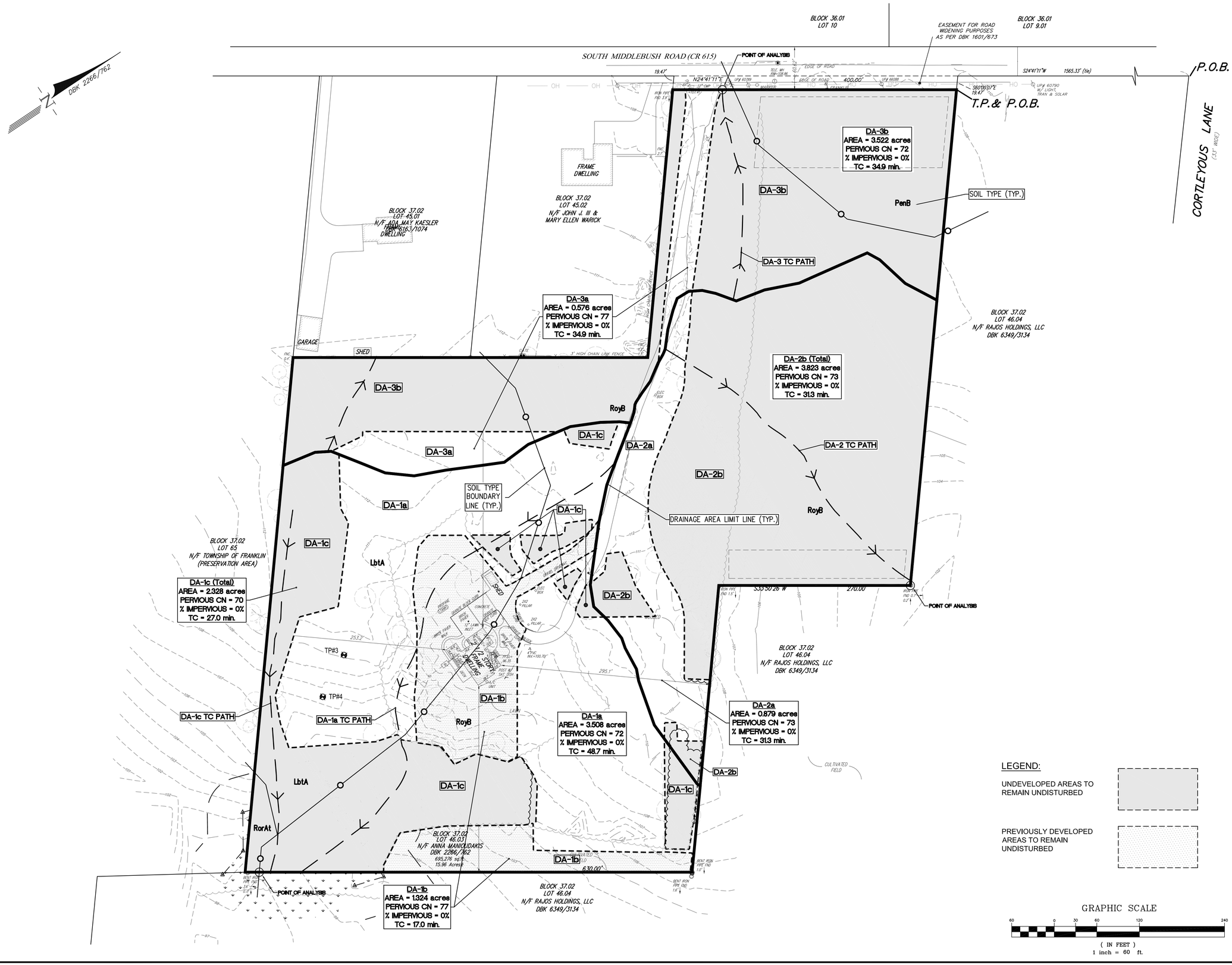
Note: If the Answers to All Three Questions at G Above are "Yes", Adequate Nonstructural Measures have been Utilized.

Total Proposed Site Points: 300

Ratio of Proposed to Existing Site Points: 108%

Required Site Points Ratio: 104%

Nonstructural Point System Results: Proposed Nonstructural Measures are Adequate



revisions		
no.	date	description
1	11/05/19	COMPLETENESS REVIEW
2	04/07/20	PER SCD COMMENTS AND TOWNSHIP STAFF REVIEW

LEGEND

- GAS VALVE
- GAS METER
- WATER VALVE
- HYDRANT
- WATER METER
- CURB STOP
- DRAINAGE MH
- CURB INLET
- LAWN INLET
- SANITARY MH
- CLEANOUT
- BOLLARD
- SIGN
- LIGHT
- MAIL BOX
- GUY WIRE
- UTILITY POLE
- ELECTRIC MH
- CONIFEROUS TREE
- DECIDUOUS TREE
- — X — FENCE
- GATE POST
- — W — WATER LINE
- — G — GAS LINE
- — E — ELECTRIC LINE
- — S — SANITARY LINE
- —OH— OVERHEAD WIRES

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The Reynolds Group Inc.

State of New Jersey
Certificate of Authorization
Number 24GA27969200
21MH00004300

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project

DADA BHAGWAN VIGNAN INSTITUTE (DBVI)

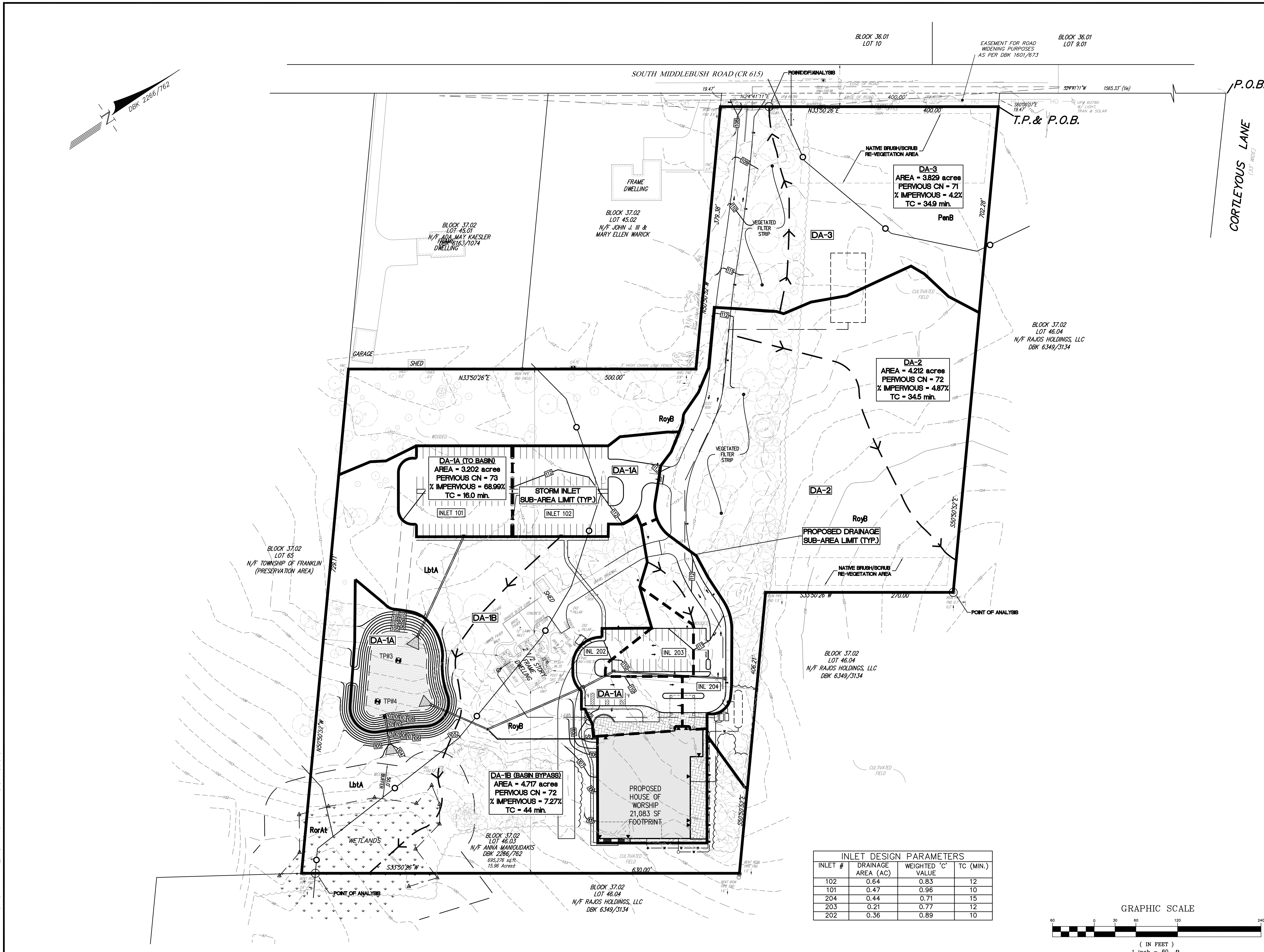
BLOCK 37.02, LOT 46.03
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

drawing title

EXISTING CONDITION DRAINAGE AREA MAP

job number	drawing number
14-001	DA-1
scale: 1"=60'	
checked by: FMA	
drawn by: GH	
date: 10/17/2019	sheet 1 of 2

J:\ENGINEERING PROJECTS\2014\14-001 DBVI MCS_CAR\DRAINAGE\14-001 DRAINAGE (PD).DWG (4/7/20)



INLET DESIGN PARAMETERS			
INLET #	DRAINAGE AREA (AC)	WEIGHTED 'C' VALUE	TC (MIN.)
102	0.64	0.83	12
101	0.47	0.96	10
204	0.44	0.71	15
203	0.21	0.77	12
202	0.36	0.89	10

revisions		
no.	date	description
1	11/05/19	COMPLETENESS REVIEW
2	04/07/20	PER SCD COMMENTS AND TOWNSHIP STAFF REVIEW

LEGEND

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drawing title

PROPOSED CONDITION DRAINAGE AREA MAP

job number: 14-001
drawing number: DA-2
scale: 1"=60'
checked by: FMA
drawn by: GH
date: 10/17/2019
sheet 2 of 2