Introduction

The Little Bennett Regional Park is located in northern Montgomery County off of Frederick Road (MD 355) in Clarksburg, MD. The proposed connector trail will run parallel to the westbound lane of Frederick Road and cross over a steep, environmentally sensitive ravine. The purpose of this project is to design a connector trail that will allow park visitors to easily and safely access the future Day Use area from the main campground area. On-site stormwater management through low impact development (LID) retrofit options was utilized to treat stormwater runoff expected to be created from the new trail. Stormwater management treatment was designed to meet the 2000 Maryland Department of the Environmental (MDE), Chapter 5 Environmental Site Design (ESD) criteria goals.

Hydrologic Analysis

Charles P. Johnson & Associates, Inc. (CPJ) completed a hydrologic analysis using table top and visual methods. The site impervious area and drainage area to each facility was delineated using a combination of field run survey performed by CPJ in Winter 2013 and Summer 2014 and Montgomery County GIS data. The project area is located in the Little Bennett Creek watershed and a small portion of the Little Seneca Creek Watershed within a Special Protection Area. The trail project crosses three drainage areas, of which all are classified as Use III-P, Natural Trout Waters.

The total project site across the three drainage areas is 83.94 acres. The proposed total limit of disturbance is 3.71 acres. The trail designed within this area is proposed to drain in an easterly direction into the park property. The project site consists of predominantly 'C' soils with some 'D' soils within the largest drainage area that encompasses the ravine. The majority of the site is within forested park property and a small portion of the trail nearest the future Day Use Area is within a private property used for agricultural purposes. No recreational facilities currently exist in the area of the park where the trail is proposed to connect the campground to the Day Use Area. Due to the natural hydrologic drainage divisions on site, three study points were identified and the site was divided into three drainage areas. The proposed impervious for each drainage area ranges from 14% to 43% and is entirely the responsibility of Maryland National Capital Park and Planning Commission (MNCPPC) with regard to stormwater management treatment. When calculating the impervious area for the site, the portion of the trail that is raised was assumed to be pervious.

Existing Site Description

The site within the Little Bennett Regional Park is owned by MNCPPC and located on Parcels P999, P100, P426, P380, P195, and P141. The small portion on private property (P020) is owned by Henry Hamm and KG. MNCPPC is currently coordinating with the property owner for the trail project and has initial permissions to construct a new trail on this property. Since there are no recreational facilities currently located in the area of the new trail, no stormwater management measures are present. The forested stream valley that encompasses a degraded stream channel nearest the intersection with Comus Road drains to a first order tributary to Soper Branch. Site constraints include a very limited, linear project area, existing steep slopes greater than 5%, and larger drainage areas that prohibit many low impact stormwater management treatments.

Proposed Retrofit/Restoration Opportunities

The proposed design for the trail includes a non-slip, ADA accessible multi-use trail through several unique ecosystems, such as abandoned field, early, mid and late successional forests and non-tidal wetlands in a stream valley. The trail will provide an essential connection to the future Day Use Area, rest/overlook areas, and environmental education opportunities through interpretative signage. Using the drainage parameters computed and described above and the technical requirements for ESD to the MEP criteria found in the Chapter 5 revision to the 2000 MDE SWM Manual and Montgomery County Department of Permitting Service's Water Resources Technical Policy WRTP-5, CPJ computed the Water Quality (WQ) Volume and ESD Volume treatment requirements for the site. Detailed calculations can be found in the appendix.

	Unit	DA 1	DA 2	DA 3
Parameter		Requirement	Requirement	Requirement
LOD Area (DA)	Acres	0.87	2.09	0.75
Target PE Value	Inches	1.0	1.0	1.0
LOD Impervious Area (IA)	Acres	0.30	0.29	0.27
Target Water Quality Volume (WQv)	CF	1,130	1,320	1,030
Target Environmental Site Design Volume (ESDv)	CF	1,130	1,320	1,030

Table 4. Hydrologic Analysis Summary

Stormwater management will be provided through sheet flow to conservation area, a rain garden, pervious pavement, and non-rooftop disconnection. Detailed computations for each facility can be found in the appendix. The proposed design treats a total of 3,665 CF, which is 105.3% of the required ESD volume.

Summary Table			
Drainage Area	WQv/ESD Required (cf)	WQv/ESD Proposed (cf)	% Treated
Drainage Area 1	1,130	1,156	102.3%
Drainage Area 2	1,320	1,423	107.8%
Drainage Area 3	1,030	1,086	105.4%
Total	3,450	3,665	105.3%

Conclusion

The proposed concept will allow the connection between the existing camping area at the Little Bennett Regional Park and future Day Use Area while providing full ESD treatment on-site. The proposed designs for Drainage Areas 1 through 3 provide a treatment volume of 1,156 cf, 1,423 cf, and 1,086 cf respectively which exceeds the required ESD volume for each drainage area.



STORMWATER MANAGEMENT REQUIREMENTS

Project No.:	Little Bennet Trail						
J	42-520	-	Date:	5/8/2015		By: KMO	
		Study Area	a: DA 1				
Site Data:	County	Montgomery					
Sile Data.	Project Type:						
	• • • •	North Fredrick	Road				
	Location.						
			to Study Point	LOD Area to Study	Point		
	Total Area:		44 AC	0.87 AC			
	Impervious Area:		2 AC	0.30 AC			
P	ercent Impervious:	1:	5.5%	34.0%			
Soils	: F	łSG	RCN ¹	Parcel Area (Ac.)	Perce	ent	
		A ²	38	0.00	0%		
]	В	55	0.00	0%		
	(С	70	10.44	1009	%	
]	D	77	0.00	0%		
				dition" (Table 2-2, TR-			
		² Actual RCN	for Hydrologic S	Soil Group 'A' is less that	n 30, us	e RCN=38	
Determine We	ter Quality (WQ	v) Requiremen	nte				
	-	-					
A. D	etermine target V	VQ Volume <u>fo</u>	r Disturbed Are	<u>ea</u>			
					Where:	$P_E = 1.00$ inches	
	WQv =	$P_E * Rv * A$				Rv = 0.05 + (0.009*I) = 0	.36
		12				I = 34.0%	
	WQv Required =	1,124.94 CH	, USE:	1,130 CF		A= 0.87 AC	
A. D			-	er Resources Technical	2		
	RCN _{woods} =			for Site Area 'A' Area) + ('B' RCN * 'B' Are	a) + ('C' R	CN * 'C' Area) + ('D' RCN * 'D' Area)	
				'A' Area) + ('B' RCN * 'B' Are	a) + ('C' R otal Area	CN * 'C' Area) + ('D' RCN * 'D' Area)	
				'A' Area) + ('B' RCN * 'B' Are		CN * 'C' Area) + ('D' RCN * 'D' Area)	
вD	$RCN_{woods} =$ $RCN_{woods} =$	70.00	('A' RCN * ' Use	'A' Area) + ('B' RCN * 'B' Are Tr 70		CN * 'C' Area) + ('D' RCN * 'D' Area)	
B. D	RCN _{woods} = RCN _{woods} = etermine Target I	70.00 P _E <u>based on Pa</u>	('A' RCN * ' Use	'A' Area) + ('B' RCN * 'B' Are Tr 70		CN * 'C' Area) + ('D' RCN * 'D' Area)	
B. D	RCN _{woods} = RCN _{woods} = etermine Target I % I = 15	70.00 P _E <u>based on Pa</u> 5.5%	('A' RCN * ' Use urcel Area Char	'A' Area) + ('B' RCN * 'B' Are T 70 racteristics	otal Area	CN * 'C' Area) + ('D' RCN * 'D' Area)	
	RCN _{woods} = RCN _{woods} = etermine Target I % I = 15 Us	70.00 P _E <u>based on Pa</u> 5.5% se % I =	('A' RCN * ' Use arcel Area Char 20.0 %	'A' Area) + ('B' RCN * 'B' Are Tr 70 racteristics to determine Target P _I	otal Area		
	RCN _{woods} = RCN _{woods} = etermine Target I % I = 15 Us	70.00 P _E <u>based on Pa</u> 5.5% se % I =	('A' RCN * ' Use arcel Area Char 20.0 %	'A' Area) + ('B' RCN * 'B' Are T 70 racteristics	otal Area		
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E <u>based on Pa</u> 5.5% se % I =	('A' RCN * ' Use arcel Area Char 20.0 %	'A' Area) + ('B' RCN * 'B' Are Tr 70 racteristics to determine Target P _I	otal Area		
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E <u>based on P:</u> 5.5% se % I = each soil group	('A' RCN * ' Use arcel Area Char 20.0 % present in the dr	'A' Area) + ('B' RCN * 'B' Are Tr 70 racteristics to determine Target P _I	otal Area		
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E <u>based on Ps</u> 5.5% se % I = each soil group ISG A B	('A' RCN * ' Use arcel Area Char 20.0 % present in the dr P _E	'A' Area) + ('B' RCN * 'B' Are Tr 70 racteristics to determine Target P _I	otal Area		
	$RCN_{woods} =$ $RCN_{woods} =$ etermine Target I % I = 15 Us Determine P _E for e	70.00 P_E based on Pa5.5%se % I =each soil groupISGABC	('A' RCN * ' Use urcel Area Char 20.0 % present in the dr P_E 0.00 0.00 1.00	'A' Area) + ('B' RCN * 'B' Are Tr 70 racteristics to determine Target P _I	otal Area		
	$RCN_{woods} =$ $RCN_{woods} =$ etermine Target I % I = 15 Us Determine P _E for e	70.00 P _E <u>based on Ps</u> 5.5% se % I = each soil group ISG A B	('A' RCN * ' Use urcel Area Char 20.0 % present in the dr P_E 0.00 0.00	'A' Area) + ('B' RCN * 'B' Are Tr 70 racteristics to determine Target P _I	otal Area		
	$RCN_{woods} =$ $RCN_{woods} =$ etermine Target I % I = 15 Us Determine P _E for e	70.00 P_E based on Pa5.5%se % I =each soil groupISGABC	('A' RCN * ' Use urcel Area Char 20.0 % present in the dr P_E 0.00 0.00 1.00 0.00	'A' Area) + ('B' RCN * 'B' Are 70 racteristics to determine Target P _I ainage area using % I va	alue and	Table 5.3.	
	$RCN_{woods} =$ $RCN_{woods} =$ etermine Target I % I = 15 Us Determine P _E for e	70.00 P_E based on Pa5.5%se % I =each soil groupISGABC	('A' RCN * ' Use urcel Area Char 20.0 % present in the dr P_E 0.00 0.00 1.00 0.00	'A' Area) + ('B' RCN * 'B' Area 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Area	alue and		
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E based on P2 5.5% se % I = each soil group ISG A B C D	('A' RCN * ' Use urcel Area Char 20.0 % present in the dr P_E 0.00 0.00 1.00 0.00 ('A' P_E	'A' Area) + ('B' RCN * 'B' Area 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Area	a) + ('C' P	Table 5.3.	
	$RCN_{woods} =$ $RCN_{woods} =$ etermine Target I % I = 15 Us Determine P _E for e	70.00 P _E based on Ps 5.5% se % I = each soil group HSG A B C D 1.00 Inches	('A' RCN * ' Use Use Use Use 0.00 % present in the dr P_E 0.00 0.00 1.00 0.00 ('A' P_E	'A' Area) + ('B' RCN * 'B' Are 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Are T	a) + ('C' P	Table 5.3.	
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E based on Ps 5.5% se % I = each soil group HSG A B C D 1.00 Inches	('A' RCN * ' Use Use Use Use 0.00 % present in the dr P_E 0.00 0.00 1.00 0.00 ('A' P_E	'A' Area) + ('B' RCN * 'B' Are 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Are Tr <u>ea</u>	a) + ('C' P tal Area	Table 5.3. _E * 'C' Area) + ('D' P _E * 'D' Area)	
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E based on P2 5.5% se % I = each soil group ISG A B C D 1.00 Inches SD Volume <u>fc</u>	('A' RCN * ' Use Use Use Use 0.00 % present in the dr P_E 0.00 0.00 1.00 0.00 ('A' P_E	'A' Area) + ('B' RCN * 'B' Are 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Are Tr <u>ea</u>	a) + ('C' P	Table 5.3. $_{\rm E} * '{\rm C'} {\rm Area}) + ('{\rm D'} {\rm P_{\rm E}} * '{\rm D'} {\rm Area})$ ${\rm P_{\rm E}} = 1.00$ inches	
	$RCN_{woods} = RCN_{woods} = $	70.00 P _E based on P2 5.5% se % I = each soil group ISG A B C D 1.00 Inches SD Volume <u>fc</u>	('A' RCN * ' Use Use Use Use 0.00 % present in the dr P_E 0.00 0.00 1.00 0.00 ('A' P_E	'A' Area) + ('B' RCN * 'B' Are 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Are Tr <u>ea</u>	a) + ('C' P tal Area	Table 5.3. $_{\rm E} * '{\rm C'} {\rm Area}) + ('{\rm D'} {\rm P_{\rm E}} * '{\rm D'} {\rm Area})$ ${\rm P_{\rm E}} = 1.00$ inches	.36
С. D	$RCN_{woods} =$ $RCN_{woods} =$ etermine Target I % I = 15 Us Determine P _E for e	70.00 P _E based on P ₂ 5.5% se % I = each soil group HSG A B C D 1.00 Inches CSD Volume for P _E * Rv * A 12	('A' RCN * ' Use urcel Area Char 20.0 % present in the dr P _E 0.00 0.00 1.00 0.00 ('A' P _E 	'A' Area) + ('B' RCN * 'B' Are 70 acteristics to determine Target P _I ainage area using % I va * 'A' Area) + ('B' P _E * 'B' Are Tr <u>ea</u>	a) + ('C' P tal Area	Table 5.3. $_{\rm E} * '{\rm C'} {\rm Area}) + ('{\rm D'} {\rm P_{\rm E}} * '{\rm D'} {\rm Area})$ ${\rm P_{\rm E}} = 1.00$ inches	.36



www.cpja.com Gaithersburg, MD • Frederick, MD • Stevensville, MD • Fairfax, VA

STORMWATER MANAGEMENT CONCEPT PLAN SUMMARY

Project Name:	Little Bennet Trail		
Project No.:	42-520	Date: 5/8/2015	By: KMO
Importing Anos Analysi	a		

Impervious Area Analysis

Total Disturbed Area	0.87 AC
Total Impervious Area within LOD	0.30 AC

Total Site Percent Impervious (I) = Impervious Area to be Treated/Total Area I = 34.0%

Target Rainfall Depth (PE) =	1.00"	Composite PE value previously calculation
Target RCN (Woods Good Condition) =	70	Composite RCN value previously calculated
10 Yr. Safety Storm Intensity (i) =	7.00 in./hr.	from MSHA Highway Drainage Maunual Table 61.1-403.1

LOD Area Rv =	0.36	Rv value perviously calculated
Required WQv =	1,130 CF	Required WQv value previously calculated
Required ESDv =	1,130 CF	Required ESDv value previously calculated

Study Area DA 1 Summary Table

			Exi	isting Hydrolog	у		S	Stormwater	Manageme	ent	
Study			Total		Target Volumes (cf)			Volume Percent	Percent		
Area	BMP #	Facility Type	Drainage Area (ac)	Impervious Area (ac)	Percent Impervious	WQv	ESDv	1 Yr. Volume (Max)	Provided (cf)	WQv Treated	ESDv Treated
DA 1	A2-1	Permeable Pavement	0.10	0.1	100%	340	340	884	688	202.1%	202.1%
DA 1	N3-1	Sheet Flow to Conservation Area	0.07	0.07	100%	247	247	641	247	100.0%	100.0%
DA 1	M7-1	Rain Garden	0.16	0.02	14%	105	188	272	222	212.4%	118.0%
	Tot	al Area to SWM facilities (ac)		0.19							
		Study Area DA 1 Total (ac)	10.44	1.619							
Total T	reatment	Volume Provided and Percent	nt of Required	d Treatment '	Volume (Stu	idy Area	DA 1)		1156	102.3%	102.3%

PE Treated = (12*ESDv treated)/(Rv*A) = 1.03"

ESD reequirements have been satisfied. Additional stormwater management through structural practices is not necessary.



SHEET FLOW TO CONSERVATION AREA - CONCEPT DESIGN

Project Name: Project No.:	Little Ber 42-520	nnet Trail Date: 5/8/20	15 B	y: KMO
Facility Summa	ry			
Facility Name:	N3-1		Facility Type:	Sheet Flow to Conservation Area
Study Area:	DA 1			

Hydrology Summary					
Land Use	Area (sf)	Area (ac)	%		
Impervious Area	3116	0.07	100%		

Facility Concept Design

Facility Name:N3-1Facility Type:Sheet Flow to Conservation Area

		Target WQ Rainfall Depth (P) =	1.00"]
Total Impervious Area =	3,116 SF	Target WQv =	247 CF	WQv = [P * Rv * A]/12
I =	100%	Target ESD Rainfall Depth (P_E) =	1.00"	Composite P_E value calculated for Study Area
Rv =	0.95	Target ESDv =	247 CF	ESDv = [PE * Rv * A]/12
C =	0.90	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
		1-Year 24-Hour Storm Runoff Volume =	641 CF	Using WQv formula with P= Rainfall Depth

Target ESD Rainfall Depth is equal to 1 inch or less. Therefore, the Total ESDv can be treated if sufficient disconnection length can be provided.

Compute Treatment Volume Provided

Is the disconnection slope less than or equal to 5%?

NO

Disconnection slopes greater than 5% require a 2' gravel diaphragm

Sizing Factors	
Total Conservation Length =	389 FT
Min Conservation Area Width =	100 FT
Total Conservation Area =	38900 SF
Provided Pe =	1.0
Imervious Area Draining to	3116 SF

Treated Rainfall, $P_E = 1.0$ Inches $P_E = (ESDv * 12) / (Rv * A)$

Treatment Volume Provided = 247 CF The lesser of the Provided Facility Storage or the 1-Year Storm Runoff Volume



PERMEABLE PAVEMENT - CONCEPT DESIGN

Project Name: Project No.:	Little Ber 42-520	nnet Trail	Date: 5/8/201	5	By:	КМО
Facility Summar	y				2	
Facility Name: Study Area:	A2-1 DA 1			Facility Type	:	Permeable Pavement

Hydrology Summary								
Land Use	Area (sf)	Area (ac)	%					
Impervious Area	4297	0.1	100%					

Facility Concept Design

A2-1

Facility Name:

	rmeable	Pavement			
			Target WQ Rainfall Depth (P) =	1.00"	
Total Impervious A	rea =	4,297 SF	Target WQv =	340 CF	WQv = [P * Rv * A]/12
	I =	100%	Target ESD Rainfall Depth (P_E) =	1.00"	Composite P_E value calculated for Study Area
	$\mathbf{R}\mathbf{v} =$	0.95	Target ESDv =	340 CF	ESDv = [PE * Rv * A]/12
	C =	0.90	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
			1-Year 24-Hour Storm Runoff Volume =	884 CF	Using WQv formula with P= Rainfall Depth

Required ESDv is less than 1 Yr. runoff volume. Therefore, the Total ESDv can be treated.

Compute Treatment Volume Provided

 Facility Dimensions

 Pavement Area =
 4297 FT

 Subbase Depth =
 12.0 Inches

 Equivalent ESDv/sf =
 0.16

 Determined using Table 1 from the MDE ESD Process & Computations Suppliment dated July 2010

Provided ESDv Storage = Pavement Area * Equivalent ESDv/sf = **688 CF**

Treated Rainfall, $P_E = 2.0$ Inches $P_E = (ESDv * 12) / (Rv * A)$



RAIN GARDEN FACILITY - PRELIMINARY DESIGN

Project Name: Project No.:	Little Bennet 42-520	Trail Date: 5/8/2015	By: KMO	
Facility Summa	ry			
Facility Name:	M7-1	Facili	ty Type: Rain Garden	
Study Area:	DA 1			

Hydrology Summary							
Land Use	Area (sf)	Area (ac)	%				
Impervious Area	1005	0.02	14%				
Open Space/Woods	5995	0.14	86%				
Total Drainage Area	7000	0.16	100%				

Facility Preliminary Design

Facility Name:M7-1Facility Type:Rain Garden

Drainage Area (DA) =	7,000 SF	Target WQ Rainfall Depth (P) =	1.00"	
Total Impervious Area =	1,005 SF	Target WQv =	105 CF	WQv = [P * Rv * A]/12
I =	14%	Target ESD Rainfall Depth (P_E) =	1.80"	Composite P_E value calculated for Study Area
Rv =	0.18	Target ESDv =	188 CF	ESDv = [PE * Rv * A]/12
C =	0.34	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
		1-Year 24-Hour Storm Runoff Volume =	272 CF	Using WQv formula with P= Rainfall Depth

Required ESDv is less than 1 Yr. runoff volume. Therefore, the Total ESDv can be treated.

Compute Treatment Volume Provided

Facility Dimensions	
Filter Bed Elevation	660.5
Overflow Crest Elevation	661.0
Top of Embankment Elevation	661.0
Bottom Surface Area (Af)	247 SF
Ponding Depth	6.00 IN
Ponding Storage Provided *	124 CF
Bed Depth (Mulch & Media)	1.00 FT
Filter Bed Porosity	0.40

* Ponding Storage Provided calculated as Bottom Surface Area * Ponding Depth

Safety Storm		_
$T_c (min) =$	5	
i ₁₀ =	7.07	
$A_{10} =$	0.16 AC	
$Q_{10} =$	0.39 CFS	Q=ciA
Weir Length =	4.00 FT	
$WSEL_{10} =$	661.10	

Compute Safety Storm WSEL using Weir Equation***

WSEL = ESD WSEL + (Q/3.1*LW)2/3

***Note: Safety storm WSEL must be less than top of dam

Provided Facility Storage = Ponding Storage + Filter Bed Storage = 222 CF

Treatment Volume Provided = 22	2 CF	The lesser of the Provided Facility Storage or the 1-Year Storm Runoff Volume
Treated Rainfall, $P_E = 2.1$	Inches	$P_E = (ESDv * 12) / (Rv * A)$



STORMWATER MANAGEMENT REQUIREMENTS

	Little Bennet Trail						
Project No.:	42-520		Date:	5/8/2015		By:	КМО
		Study Area	: DA 2				
Site Data:	County:	Montgomery					
Site Dutui	Project Type:						
		North Fredrick	Road				
	20000000						
			to Study Point	LOD Area to Study	Point		
	Total Area:		54 AC	2.09 AC			
	Impervious Area:		3 AC	0.29 AC			
1	Percent Impervious:	Ζ.	9%	13.7%			
Soil	ls: I	ISG	RCN ¹	Parcel Area (Ac.)	Percer	nt	
		A^2	38	0.00	0%		
		B	55	0.00	0%		
		С	70	43.33	78%		
		D	77	12.21	22%		
		¹ RCN for "wo	ods in good con	dition" (Table 2-2, TR-	55)		
			-	Soil Group 'A' is less that		RCN=38	
_							
Determine W	ater Quality (WQ	v) Requiremen	ts				
A. 1	Determine target V	VQ Volume <u>for</u>	· Disturbed Are	<u>ea</u>			
					Where:	$P_E =$	1.00 inches
						Rv =	= 0.05 + (0.009*I) = 0.1
	WOv =	$P_F * Rv * A$					
	WQv =	$P_{\rm E} * {\rm Rv} * {\rm A}$	_				. ,
		12		1.320 CF		I =	= 13.7%
	WQv = WQv Required =	12		1,320 CF		I =	. ,
Determine E		12		1,320 CF		I =	= 13.7%
Determine E	WQv Required = SD Requirements	1,313.70 CF	, USE:	1,320 CF er Resources Technical	Policy W	I = A=	= 13.7%
	WQv Required = SD Requirements Methodology per	1,313.70 CF Montgomery Co	, USE: ounty DPS Wate	er Resources Technical	Policy W	I = A=	= 13.7%
	WQv Required = SD Requirements Methodology per Determine RCN fo	1,313.70 CF Montgomery Co r ''woods in go	, USE: ounty DPS Wate	er Resources Technical	-	I = A= RTP-5	= 13.7% 2.09 AC
	WQv Required = SD Requirements Methodology per	1,313.70 CF Montgomery Co r ''woods in go	, USE: ounty DPS Wate	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are	ea) + ('C' RC	I = A= RTP-5	= 13.7% 2.09 AC
	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} =	1,313.70 CF Montgomery Co r ''woods in go	, USE: ounty DPS Wate od condition'' f ('A'RCN * '	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T	-	I = A= RTP-5	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} =	1,313.70 CF Montgomery Co r ''woods in go 71.54	, USE: ounty DPS Wate od condition'' f ('A'RCN * ' Use	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72	ea) + ('C' RC	I = A= RTP-5	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target 1	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E <u>based on Pa</u>	, USE: ounty DPS Wate od condition'' f ('A'RCN * ' Use	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72	ea) + ('C' RC	I = A= RTP-5	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target I % I = 2	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E <u>based on Pa</u> .9%	, USE: ounty DPS Wate ood condition'' f ('A' RCN * ' Use rcel Area Char	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72 racteristics	a) + ('C' RC otal Area	I = A= RTP-5	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target I % I = 2	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E <u>based on Pa</u>	, USE: ounty DPS Wate od condition'' f ('A'RCN * ' Use	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72	a) + ('C' RC otal Area	I = A= RTP-5	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target % I = 2 U	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E <u>based on Pa</u> .9% se % I =	, USE: ounty DPS Wate od condition'' f ('A' RCN * ' Use <u>rcel Area Char</u> 3.0 %	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E <u>based on Pa</u> .9% se % I = each soil group p	, USE: ounty DPS Wate od condition'' f ('A' RCN * ' Use <u>rcel Area Char</u> 3.0 % present in the dr	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72 racteristics	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E <u>based on Pa</u> .9% se % I = each soil group p ISG	, USE: ounty DPS Wate od condition'' f ('A' RCN *' Use <u>rcel Area Char</u> 3.0 % present in the dr P _E	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p ISG A	, USE: ounty DPS Wate od condition" f ('A' RCN * ' Use rcel Area Char 3.0 % present in the dr P_E 0.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p ISG A B	, USE: ounty DPS Wate od condition" f ('A' RCN * ' Use rcel Area Char 3.0 % present in the dr P_E 0.00 0.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P_E based on Pa .9% se % I = each soil group p ISG A B C	, USE: ounty DPS Wate od condition'' f ('A' RCN * ' Use rcel Area Char 3.0 % present in the dr P _E 0.00 0.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p ISG A B	, USE: ounty DPS Wate od condition" f ('A' RCN * ' Use rcel Area Char 3.0 % present in the dr P_E 0.00 0.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC otal Area	I = A= RTP-5 CN * 'C' Area	= 13.7% 2.09 AC
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P_E based on Pa .9% se % I = each soil group p ISG A B C	, USE: ounty DPS Wate od condition" f ('A' RCN * ' Use rcel Area Char 3.0 % present in the dr P_E 0.00 0.00 1.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁	a) + ('C' RC total Area	I = A= RTP-5 <u>CN * 'C' Area</u> Table 5.3.	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area)
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P_E based on Pa .9% se % I = each soil group p ISG A B C	, USE: ounty DPS Wate od condition" f ('A' RCN * ' Use rcel Area Char 3.0 % present in the dr P_E 0.00 0.00 1.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va a	a) + ('C' RC total Area	I = A= RTP-5 <u>CN * 'C' Area</u> Table 5.3.	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area)
A. I	WQv Required = SD Requirements Methodology per Determine RCN fo $RCN_{woods} =$ $RCN_{woods} =$ Determine Target I % I = 2 U Determine P _E for C	1,313.70 CF Montgomery Co r ''woods in go 71.54 P_E based on Pa .9% se % I = each soil group p ISG A B C	, USE: ounty DPS Wate od condition'' f ('A'RCN *' Use rcel Area Char 3.0 % present in the dr P_E 0.00 0.00 1.00 1.00 ('A'P_E	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Are T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va a	(C' RC) otal Area alue and T $(C' P_E)$	I = A= RTP-5 <u>CN * 'C' Area</u> Table 5.3.	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area)
A. 1 B. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target I % I = 2 U Determine P _E for C E Composite $P_{E} =$	1,213.70 CF 1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p ISG A D 1.00 Inches	, USE: ounty DPS Wate od condition'' f ('A' RCN *' Use rcel Area Char 3.0 % present in the dr P _E 0.00 0.00 1.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va and % I va and % I	(C' RC) otal Area alue and T $(C' P_E)$	I = A= RTP-5 <u>CN * 'C' Area</u> Table 5.3.	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area)
A. 1 B. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target I % I = 2 U Determine P _E for o F Composite $P_{E=}$	1,213.70 CF 1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p ISG A D 1.00 Inches	, USE: ounty DPS Wate od condition'' f ('A' RCN *' Use rcel Area Char 3.0 % present in the dr P _E 0.00 0.00 1.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va and % I va and % I	(C' RC) otal Area alue and T $(a) + (C' P_E)$ otal Area	I = A= RTP-5 CN * 'C' Area Table 5.3.	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area)
A. 1 B. I	WQv Required = SD Requirements Methodology per Determine RCN for RCN _{woods} = RCN _{woods} = Determine Target I % I = 2 U Determine P _E for of Composite P _E = Composite P _E = Determine target F	1,313.70 CF 1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p HSG A B C D 1.00 Inches SD Volume for	, USE: ounty DPS Wate od condition'' f ('A' RCN *' Use rcel Area Char 3.0 % present in the dr P _E 0.00 0.00 1.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va and % I va and % I	(C' RC) otal Area alue and T $(C' P_E)$	I = A= RTP-5 <u>CN * 'C' Area</u> Table 5.3. <u>* 'C' Area) +</u> P _E =	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area) - ('D' P _E * 'D' Area) = 1.00 inches
A. 1 B. I	WQv Required = SD Requirements Methodology per Determine RCN for RCN _{woods} = RCN _{woods} = Determine Target I % I = 2 U Determine P _E for of Composite P _E = Composite P _E = Determine target F	1,313.70 CF 1,313.70 CF Montgomery Cor r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p HSG A B C D 1.00 Inches SD Volume for	, USE: ounty DPS Wate od condition'' f ('A' RCN *' Use rcel Area Char 3.0 % present in the dr P _E 0.00 0.00 1.00 1.00	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va and % I va and % I	(C' RC) otal Area alue and T $(a) + (C' P_E)$ otal Area	I = A= RTP-5 <u>CN * 'C' Area</u> Table 5.3. <u>* 'C' Area) +</u> P _E =	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area) = ('D' P _E * 'D' Area) = 1.00 inches = 0.05 + (0.009*I) = 0.1
A. 1 B. I	WQv Required = SD Requirements Methodology per Determine RCN fo RCN _{woods} = RCN _{woods} = Determine Target I % I = 2 U Determine P _E for C E Composite $P_{E =}$	1,313.70 CF 1,313.70 CF Montgomery Co r ''woods in go 71.54 P _E based on Pa .9% se % I = each soil group p ISG A B C D 1.00 Inches CSD Volume for P _E * Rv * A 12	, USE: ounty DPS Wate od condition'' f ('A' RCN *' Use rcel Area Char 3.0 % present in the dr P _E 0.00 0.00 1.00 1.00 ('A' P _E	er Resources Technical for Site Area 'A' Area) + ('B' RCN * 'B' Area T 72 racteristics to determine Target P ₁ rainage area using % I va and a sing % I va and % I va and % I	(C' RC) otal Area alue and T $(a) + (C' P_E)$ otal Area	I = A = A = A = A = A = A = A = A = A =	= 13.7% 2.09 AC) + ('D' RCN * 'D' Area) = ('D' P _E * 'D' Area) = 1.00 inches = 0.05 + (0.009*I) = 0.1



www.cpja.com Gaithersburg, MD • Frederick, MD • Stevensville, MD • Fairfax, VA

STORMWATER MANAGEMENT CONCEPT PLAN SUMMARY

Project Name:	Little Bennet Trail		
Project No.:	42-520	Date: 5/8/2015	By: KMO
Importing Ano Analysi	a		

Impervious Area Analysis

Total Disturbed Area	2.09 AC
Total Impervious Area within LOD	0.29 AC

Total Site Percent Impervious (I) = Impervious Area to be Treated/Total Area I = 13.7%

Target Rainfall Depth (PE) =	1.00"	Composite PE value previously calculation
Target RCN (Woods Good Condition) =	72	Composite RCN value previously calculated
10 Yr. Safety Storm Intensity (i) =	7.00 in./hr.	from MSHA Highway Drainage Maunual Table 61.1-403.1

LOD Area Rv =	0.17	Rv value perviously calculated
Required WQv =	1,320 CF	Required WQv value previously calculated
Required ESDv =	1,320 CF	Required ESDv value previously calculated

Study Area DA 2 Summary Table

			Existing Hydrology			Stormwater Management					
Study	Study Area BMP # Facility Type			Total		Target Volumes (cf)		Volume	Percent	Percent	
		(ac)	Impervious	Percent Impervious	WQv	ESDv	1 Yr. Volume (Max)	Provided (cf)	WQv Treated	ESDv Treated	
DA 2	N3-2	Sheet Flow to Conservation Area	0.14	0.14	100%	482	482	1254	482	100.0%	100.0%
DA 2	A2-2	Permeable Pavement	0.14	0.14	100%	466	466	1211	941	202.1%	202.1%
	Tot	al Area to SWM facilities (ac)		0.28							
		Study Area DA 2 Total (ac)	55.54	1.63							
Total Treatment Volume Provided and Percent of Required Treatment Volume (Study Area							DA 2)		1423	107.8%	107.8%

PE Treated = (12*ESDv treated)/(Rv*A) = 1.08"

ESD reequirements have been satisfied. Additional stormwater management through structural practices is not necessary.



SHEET FLOW TO CONSERVATION AREA - CONCEPT DESIGN

Project Name: Project No.:	Little Bennet Trail 42-520	Date: 5/8/2015	By:	KMO
Facility Summar	·y			
Facility Name: Study Area:	N3-2 DA 2		Facility Type:	Sheet Flow to Conservation Area

Hydrology Summary							
Land Use	Area (sf)	Area (ac)	%				
Impervious Area	6093	0.14	100%				

Facility Concept Design

Facility Name:N3-2Facility Type:Sheet Flow to Conservation Area

		Target WQ Rainfall Depth (P) =	1.00"]
Total Impervious Area =	6,093 SF	Target WQv =	482 CF	WQv = [P * Rv * A]/12
I =	100%	Target ESD Rainfall Depth (P_E) =	1.00"	Composite P_E value calculated for Study Area
Rv =	0.95	Target ESDv =	482 CF	ESDv = [PE * Rv * A]/12
C =	0.90	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
		1-Year 24-Hour Storm Runoff Volume =	1,254 CF	Using WQv formula with P= Rainfall Depth

Target ESD Rainfall Depth is equal to 1 inch or less. Therefore, the Total ESDv can be treated if sufficient disconnection length can be provided.

Compute Treatment Volume Provided

Is the disconnection slope less than or equal to 5%?

NO

Disconnection slopes greater than 5% require a 2' gravel diaphragm

Sizing Factors	
Total Conservation Length =	762 FT
Min Conservation Area Width =	100 FT
Total Conservation Area =	76200 SF
Provided Pe =	1.0
Imervious Area Draining to	6093 SF

Treated Rainfall, $P_E = 1.0$ Inches $P_E = (ESDv * 12) / (Rv * A)$

Treatment Volume Provided = 482 CF The lesser of the Provided Facility Storage or the 1-Year Storm Runoff Volume



PERMEABLE PAVEMENT - CONCEPT DESIGN

Project Name: Project No.:	Little Ber 42-520	 ate: <u>5/8</u> /	/2015	By:	КМО
Facility Summar	·y				
Facility Name:	A2-2		Facil	ity Type:	Permeable Pavement
Study Area:	DA 2				

Hydrology Summary							
Land Use	Area (sf)	Area (ac)	%				
Impervious Area	5882	0.14	100%				

Facility Concept Design

A2-2

Facility Name:

			e Pavement	Permeable	Facility Type:
1.00"	1.00"	Target WQ Rainfall Depth (P) =			
466 CF $WQv = [P * Rv * A]/12$	466 CF	Target WQv =	5,882 SF	ous Area =	Total Impervio
1.00" Composite P_E value calculated for Study	1.00"	Target ESD Rainfall Depth (P_E) =	100%	I =	
466 CF $ESDv = [PE * Rv * A]/12$	466 CF	Target ESDv =	0.95	Rv =	
2.60"	2.60"	1-Year 24-Hour Storm Rainfall Depth =	0.90	C =	
,211 CF Using WQv formula with P = Rainfall De	1,211 CF	1-Year 24-Hour Storm Runoff Volume =			

Required ESDv is less than 1 Yr. runoff volume. Therefore, the Total ESDv can be treated.

Compute Treatment Volume Provided

Facility Dimensions

 Pavement Area =
 5882 SF

 Subbase Depth =
 12.0 Inches

 Equivalent ESDv/sf =
 0.16

 Determined using Table 1 from the MDE ESD Process & Computations Suppliment dated July 2010

Provided ESDv Storage = Pavement Area * Equivalent ESDv/sf = 941 CF

Treated Rainfall, $P_E = 2.0$ Inches $P_E = (ESDv * 12) / (Rv * A)$



STORMWATER MANAGEMENT REQUIREMENTS

	Little Bennet Trail						
Project No.:	42-520	-	Date	: 5/8/2015		By: KMO	
		Study Area	n: DA 3				
Site Data:	County:	Montgomery					
	Project Type:						
		North Fredrick	Road				
		Dancel Area	to Study Point	LOD Area to Study	Doint		
	Total Area:		P6 AC	LOD Area to Study 0.75 AC	Point		
	Impervious Area:		0 AC	0.75 AC			
I	Percent Impervious:		2%	36.4%			
		· · · · · · · · · · · · · · · · · · ·					
Soil		ISG	RCN ¹	Parcel Area (Ac.)	Perce		
		A ²	38	0.00	0%		
		B	55	0.00	0%		
		C D	70 77	17.96 0.00	100		
				ndition" (Table 2-2, TR-		, <u> </u>	
			-	Soil Group 'A' is less that		a PCN-38	
				Son Group A is less the	50, us	NUN-J0	
Determine W	ater Quality (WQ	v) Requiremen	its				
A. I	Determine target V	VQ Volume <u>fo</u>	r Disturbed Ar	<u>ea</u>			
					Where:	$P_E = 1.00$ inches	
	WQv =	P _E * Rv * A				Rv = 0.05 + (0.009*I) = 0	.38
	·	$\frac{P_E * Rv * A}{12}$				I = 36.4%	
	WQv Required =	1,024.20 CF	, USE:	1,030 CF		A= 0.75 AC	
Determine ES	SD Requirements	Martin	DDC W		D. 1' W		
	Methodology per	Montgomery C	ounty DPS wat	ter Resources Technical	Policy w	VRIP-3	
A. I	Determine RCN fo						
	$RCN_{woods} =$		('A' RCN *	" 'A' Area) + ('B' RCN * 'B' Area	ea) + ('C' R	RCN * 'C' Area) + ('D' RCN * 'D' Area)	
	DCN				otal Area		
	$RCN_{woods} =$	70.00	Use	70			
B. I	Determine Target 1	P _E <u>based on Pa</u>	rcel Area Cha	<u>racteristics</u>			
		.2%					
	U	se % I =	8.0 %	to determine Target P	E•		
	Dotormino D. for	ach coil mour	propont in the J	roinago aros voing 0/ I	لا مد مداه	Table 5.3	
				rainage area using % I v	alue allu	1 able 5.5.	
		ISG	P _E	4			
		A	0.00	_			
		B C	0.00	-			
		D	0.00	-			
		2	0.00				
	Composite $P_{E=}$		('A' P	$E_{\rm E}$ * 'A' Area) + ('B' $P_{\rm E}$ * 'B' Area	ea) + ('C' P	$P_{\rm E} * '{\rm C'} {\rm Area}) + ('{\rm D'} P_{\rm E} * '{\rm D'} {\rm Area})$	
			-	Т	otal Area		
	Composite $P_{E=}$	1.00 Inches					
С. І	Determine target E	SD Volume fo	r Disturbed A	rea			
					Where:	$P_E = 1.00$ inches	
	ESDv =	$P_{E} * Rv * A$.38
	ESDv =	12	_			I = 36.4%	
	ESDv Required =		USE	1,030 CF		A = 0.75 AC	
	LSD / Required -	1,024.20 CI	, 052.	1,050 CF		n- 0.75 mc	



www.cpja.com Gaithersburg, MD • Frederick, MD • Stevensville, MD • Fairfax, VA

STORMWATER MANAGEMENT CONCEPT PLAN SUMMARY

Project Name: Little Bennet Trail								
Project No.: 42-520 Date: 5/8/2015 By: KMO								
Impervious Area Analysis								
Total Disturbed Area 0.75 AC	0.75 AC							
Total Impervious Area within LOD0.27 AC								
Total Site Percent Impervious (I) = Impervious Area to be Treated/Total Area I = 36.4%								
Target Rainfall Depth (PE) = 1.00" Composite PE value previously calculation								
Target RCN (Woods Good Condition) = 70 Composite RCN value previously calculated	70 Composite RCN value previously calculated							
10 Yr. Safety Storm Intensity (i) = 7.00 in./hr. from MSHA Highway Drainage Maunual Table 61.1-403.1	7.00 in./hr. from MSHA Highway Drainage Maunual Table 61.1-403.1							
LOD Area Rv = 0.38 <i>Rv value perviously calculated</i>	Rv value perviously calculated							
Required WQv = 1,030 CF Required WQv value previously calculated								
Required ESDv = 1,030 CF Required ESDv value previously calculated	Required ESDv value previously calculated							
Study Area DA 3 Summary Table								
Existing Hydrology Stormwater Management								
Study Target Volumes (cf) Volume Par	ant Dercent							
Study Area BMP # Facility Type Drainage Area (ac) Total Impervious Area (ac) Total Impervious Area (ac) Percent Impervious Area (ac) Target Volumes (cf) Volume Provided (Max) Volume Volume (Max)	v ESDv							

 Total Area to SWM facilities (ac)
 0.19

 Study Area DA 3 Total (ac)
 17.96

Permeable Pavement

DA 3

A2-3

Subtotal Treatment Volume Provided and Percent of Required Treatment Volume (Study Area DA 3) 1086

0.13

086 105.4% 105.4%

202.1%

202.1%

PE Treated = (12*ESDv treated)/(Rv*A) = 1.06"

ESD requirements have been satisfied, additional SWM through structural practices is not required.

0.13

0.19

1.3

100%

439

439

1141

887



NON-ROOFTOP DISCONNECTION - CONCEPT DESIGN

Project Name: Project No.:	Little Bennet Trai 42-520	il Date: 5/8/2015	By:	КМО
Facility Summa	ry			
Facility Name: Study Area:	N2-1 DA 3]	Facility Type:	Non-Rooftop Disconnectior

Hydrology Summary						
Land Use	Area (sf)	Area (ac)	%			
Impervious Area	2514	0.06	100%			

Facility Concept Design

Facility Name:	N2-1
Facility Type:	Non-Rooftop Disconnection

		Target WQ Rainfall Depth (P) =	1.00"	
Total Impervious Area =	2,514 SF	Target WQv =	199 CF	WQv = [P * Rv * A]/12
I =	100%	Target ESD Rainfall Depth (P_E) =	1.00"	Composite P_E value calculated for Study Area
Rv =	0.95	Target ESDv =	199 CF	ESDv = [PE * Rv * A]/12
C =	0.90	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
		1-Year 24-Hour Storm Runoff Volume =	517 CF	Using WQv formula with P= Rainfall Depth

Target ESD Rainfall Depth is equal to 1 inch or less. Therefore, the Total ESDv can be treated if sufficient disconnection length can be provided.

Compute Treatment Volume Provided

Facility Dimensions			
Max Contribution Lenth =	18 FT	Is the disconnection slope less than or equal to 5%?	YES
Max Disconnection Length =	18 FT		

Treated Rainfall, $P_E = 1.0$ Inches $P_E = (ESD_V * 12) / (R_V * A)$ Treatment Volume Provided =199 CFThe lesser of the Provided Facility Storage or the 1-Year Storm Runoff Volume



PERMEABLE PAVEMENT - CONCEPT DESIGN

Project Name: Project No.:	Little Ber 42-520	nnet Trail	Date:	5/8/2015	i	By:	КМО
Facility Summar	y						
Facility Name:	A2-3				Facility Typ	e:	Permeable Pavement
Study Area:	DA 3						

Hydrology Summary						
Land Use	Area (sf)	Area (ac)	%			
Impervious Area	5542	0.13	100%			

Facility Concept Design

A2-3

Facility Name:

Facility Type:	Permeable	e Pavement			
			Target WQ Rainfall Depth (P) =	1.00"	
Total Impervious	s Area = I =	5,542 SF 100%	Target WQv = Target ESD Rainfall Depth (P_E) =		WQv = [P * Rv * A]/12 Composite P _E value calculated for Study Area
	Rv =	0.95	Target ESDv =	439 CF	ESDv = [PE * Rv * A]/12
	C =	0.90	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
			1-Year 24-Hour Storm Runoff Volume =	1,141 CF	Using WQv formula with P= Rainfall Depth

Required ESDv is less than 1 Yr. runoff volume. Therefore, the Total ESDv can be treated.

Compute Treatment Volume Provided

 Facility Dimensions

 Pavement Area =
 5542 FT

 Subbase Depth =
 12.0 Inches

 Equivalent ESDv/sf =
 0.16

 Determined using Table 1 from the MDE ESD Process & Computations Suppliment dated July 2010

Provided ESDv Storage = Pavement Area * Equivalent ESDv/sf = **887 CF**

Treated Rainfall, $P_E = 2.0$ Inches $P_E = (ESDv * 12) / (Rv * A)$



MICRO-BIORETENTION FACILITY - CONCEPT DESIGN

Project Name: Project No.:	Little Ber 42-520	nnet Trail Date: 5/8/2	2015	By:	КМО
Facility Summar	ry				
Facility Name:	M6-1		Facility Type	:	Micro-Bioretention
Study Area:	NA				

NOTE: this facility is not required to meet stormwater management requirements for the proposed trail. This facility is proposed to provide additional ms4 treatment.

Hydrology Summary						
Land Use	Area (sf)	Area (ac)	%			
Impervious Area	8564	0.2	49%			
Open Space/Woods	8876	0.2	51%			
Total Drainage Area	17440	0.4	100%			

Facility Concept Design

Facility Name: M6-1 Facility Type: Micro-Bio	pretention			
Drainage Area (DA) =	17,440 SF	Target WQ Rainfall Depth (P) =	1.00"	
Total Impervious Area =	8,564 SF	Target WQv =	715 CF	WQv = [P * Rv * A]/12
I =	49%	Target ESD Rainfall Depth (P_E) =	1.00"	Composite P_E value calculated for Study Area
$\mathbf{R}\mathbf{v} =$	0.49	Target ESDv =	715 CF	ESDv = [PE * Rv * A]/12
C =	0.57	1-Year 24-Hour Storm Rainfall Depth =	2.60"	
		1-Year 24-Hour Storm Runoff Volume =	1,859 CF	Using WQv formula with P= Rainfall Depth

Required ESDv is less than 1 Yr. runoff volume. Therefore, the Total ESDv can be treated.

Compute Treatment Volume Provided

Facility Dimensions		
Filter Bed Elevation	650.0	
Overflow Crest Elevation	651.0	
Top of Embankment Elevation	652.0	0.74' of Freeboard is provided
Bottom Surface Area (Af)	834 SF	
Ponding Depth	1.00 FT	
Ponding Storage Provided	834 CF	
Bed Depth (Media & Sand)	3.25 FT	
Filter Bed Porosity	0.40	
Additional Stone Storage Area	00 SF	Applicable if facility is an enhanced filter
Additional Stone Storage Depth	0.00 FT	Applicable if facility is an enhanced filter
Additional Stone Storage Porosi	0.40	

Safety Storm		
T_c (min) =	5	
i ₁₀ =	7.07	
A ₁₀ =	0.40 AC	
Q ₁₀ =	1.61 CFS	Q=ciA
Weir Length =	3.93 FT	15 " Diam. Nyloplast Str.
$WSEL_{10} =$	651.26	

Compute Safety Storm WSEL using Weir Equation*** WSEL = ESD WSEL + (Q/3.1*LW)2/3

***Note: Safety storm WSEL must be less than top of dam

Provided Facility Storage = Ponding Storage + Filter Bed Storage + Additional Stone Storage 1,918 CF =

Treatment Volume Provided = 1,859 CF The lesser of the Provided Facility Storage or the 1-Year Storm Runoff Volume Treated Rainfall, $P_E = 2.6$ Inches $P_E = (ESDv * 12)/(Rv * A)$