Sizing Worksheet - BIO-1 Biofiltration/BIO-2 Planter Box with Underdrain

Designer: Project Proponent: Date: Project: Location:	
Type of Vegetation:	
Pretreatment Feature:	
Outflow Collection:	
Step 1: Determine water quality design volume	
1-1. Enter Project area (acres), $A_{project}$ If this BMP captures runoff from a portion of the project area, enter the tributary area	$A_{project}$ = acres
1-2. Enter Project impervious fraction, *Imp* (e.g. 60% = 0.60)	Imp=
1-3. Determine pervious runoff coefficient using Table C-1, C_p	C_p =
1-4. Calculate runoff coefficient, $C = 0.95*imp + C_p (1-imp)$	C =
1-5. Enter design rainfall depth of the storm (in), P_i	P_i = in
1-6. Calculate rainfall depth (ft), $P = P_i/12$	P = ft
1-7. Calculate water quality design volume (ft^3) and multiply by 150% $SQDV=1.5x43560xC*P*A_{project)}$	SQDV= ft^3
Step 2: Determine the design percolation rate	
2-1. Enter the design saturated hydraulic conductivity of the amended filter media as 2.5 in/hr, K_{design}	K_{design} = in/hr
Step 3: Calculate Biofiltration/Planter Box surface area	
3-1. Enter water quality design volume (ft^3), *SQDV*	SQDV = ft^3
3-2. Enter design saturated hydraulic conductivity as 2.5 in/hr, K_{design}	K_{design} = in/hr
3-3. Enter ponding depth (max 1.5 ft for Biofiltration, 1 ft for Planter Box) above area, d_p	d_p = ft
3-4. Select thickness of amended media (ft, 2 feet minimum, 3 preferred), l_{media}	l_{media}= ft

3-5. Enter porosity of amended media (roughly 25% or 0.25 ft/ft), n_{media}	n_{media} =	ft/ft
3-6. Select thickness of gravel layer (ft) to flowline, l_{gravel}	l_{gravel} =	ft
3-7. Enter porosity of gravel (roughly 30% or 0.3 ft/ft), n_{gravel}	n_{gravel}=	ft/ft
3-8. Calculate the total effective storage depth of biofiltration facility (ft): $d_{effective} = (d_p + n_{media}l_{media} + n_{gravel}l_{gravel})$	$d_{effective}$=	ft
3-9. Check that the entire effective depth leave the biofiltration system in required drainage time of 72 hour or lesss: $t_{total} = (d_{effective}/K_{design}) \times 12$ If t_{total} > 72 hours, reduce surface ponding depth and/or amended media thickness and/or gravel thickness and return to 3-3. If $t_{total} \leq 72$ hours, proceed to 3-10.	t_{total} =	hours
3-10. Calculate the required infiltrating surface area (ft2): $A_{req} = SQDV/d_{effective}$	A_{req} =	ft^2
Step 4: Calculate Area Total Footprint		
4-1. Calculate total footprint required by including a buffer for side slopes and freeboard (ft^2) [A_{req} is measured at the as the filter bottom area (toe of side slopes)], A_{tot}	A_{tot} =	ft^2
Step 5: Calculate Underdrain System Capacity		
To calculate the underdrain system capacity, continue through steps 5-1 to 5-7.		
5-1. Calculated filtered flow rate to be conveyed by the longitudinal drainpipe, $Q_f = K_{design} \times A_{req}/43{,}200$	Q_f =	cfs
5-2. Enter minimum slope for energy gradient, S_e	S_e =	
5-3. Enter Hazen-Williams coefficient for plastic, C_{HW}	C_{HW} =	
5-4. Enter pipe diameter (min 4 inches), D	D =	in
5-5. Calculate pipe hydraulic radius (ft), $R_h = D/48$	R_h =	ft
5-6. Calculate velocity at the outlet of the pipe (ft/s), $V_p = 1.318 C_{HW} R_h^{0.63} S_e^{0.54}$	V_p =	ft/s
5-7. Calculate pipe capacity (cfs), $Q_{cap} = 0.25\pi(D/12)^2 V_p$	Q_{cap} =	cfs