Sizing Worksheet - HM-2 Wet Detention Basin

Designer: Project Proponent: Date: Project: Location:	
Type of Vegetation: (Check type used or describe “Other”)	___ Native Grasses ___ Irrigated Turf Grass ___ Emergent Aquatic Plants (specify type / density) ___ Other____________________ ___________________________
Outflow Collection:	
Outlet Type (check one)	Single Orifice _____ Multi-orifice Plate _____ Perforated Pipe _____ Other _______________________
Depth of water above bottom orifice	Depth = _____ feet
Single Orifice Outlet	
1)Diameter	D = _____ feet
2) Area	A = _____ square feet
Multiple Orifice Outlet	
1) Area per row of perforations	A = _____ square feet
2) Perforation Diameter (2 inches max.)	D = _____ inches
3) No. of Perforations (columns) per Row	Perforations = _____
4) No. of Rows (4 inch spacing)	Rows = _____
5) Total Orifice Area (Area per row) x (Number of Rows)	Area = _____ square feet

Step 1: Determine water quality design volume	
1-1. Enter project area, $A_{project}$ 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, P_i (in)	P_i =	in
1-6. Calculate rainfall depth, $P = P_i/12$	P =	ft
1-7. Calculate water quality design volume, $SQDV = 43560 \bullet P*A_{project}*C$	SQDV =	ft^3
Step 2: Determine active design volume for the wet pond without extended detention		
2-1. Calculate the active design volume (without extended detention), $V_a = 1.05*SQDV$	V_a =	ft^3
Step 3: Determine Pond Location and Preliminary Geometry Based on Site Constraints		
3-1. Based on site constraints, determine the pond geometry and the storage available by developing an elevation-storage relationship for the pond. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2.		
3-2. Enter the total surface area of the pond footprint based on site constraints, A_{tot}	A_{tot} =	ft^2
3-3. Enter the length of the pond footprint based on site constraints, L_{tot}	L_{tot} =	ft
3-4. Calculate the width of the pond footprint, $W_{tot} = A_{tot} / L_{tot}$	W_{tot} =	ft
3-5. Enter interior side slope as length per unit height (min = 3), Z	Z =	
3-6. Enter desired freeboard depth, d_{fb} (1 ft min)	d_{fb} =	ft
3-7. Calculate the length of the water quality volume surface area including the internal berm but excluding freeboard, $L_{av\text{-}tot} = L_{tot} - 2Zd_{fb}$	$L_{av\text{-}tot}$ =	ft
3-8. Calculate the width of the water quality volume surface area including the internal berm but excluding freeboard, $W_{av\text{-}tot} = W_{tot} - 2Zd_{fb}$	$W_{av\text{-}tot}$ =	ft
3-9. Calculate the total water quality volume surface area including the internal berm and excluding freeboard, $A_{av\text{-}tot} = L_{av\text{-}tot} \bullet W_{av\text{-}tot}$	$A_{av\text{-}tot}$ =	ft^2
3-10. Enter the width of the internal berm (6 ft min), W_{berm}	W_{berm} =	ft
3-11. Enter the length of the internal berm, $L_{berm} = W_{av\text{-}tot}$	L_{berm} =	ft
3-12. Calculate the area of the berm, $A_{berm} = W_{berm} \bullet L_{berm}$	A_{berm} =	ft^2
3-13. Calculate the water quality volume surface area excluding the internal berm and freeboard, $A_{av} = A_{av\text{-}tot} - A_{berm}$	A_{av} =	ft^2

Step 4: Determine Dimensions of forebay		
4-1. Enter the percent of V_a in forebay (5-10% required), *%V₁* → $\%V_1$	$\%V_1$ =	%
4-2. Calculate the active volume of forebay (includes sediment storage volume), $V_1 = V_a \bullet \%V_1$	V_1 =	ft^3
4-3. Enter desired average depth of forebay (5-9 ft including sediment storage of 1 ft), d_1	d_1 =	ft
4-4. Calculate the surface area for the active volume of forebay, $A_1 = V_1 / d_1$	A_1 =	ft^2
4-5. Enter the width of forebay, $W_1 = W_{av\text{-}tot} = L_{berm}$	W_1 =	ft
4-6. Calculate the length of forebay (<u>Note:</u> inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W1$	L_1 =	ft
Step 5: Determine Dimensions of Cell 2		
5-1. Calculate the active volume of Cell 2, $V_2 = V_a - V_1$	V_2 =	ft^3
5-2. Determine minimum wetpool surface area, $A_{min2} = V_2 \bullet 0.3$	A_{min2} =	ft^2
5-3. Determine actual wetpool surface area, $A_2 = A_{av} – A_1$	A_2 =	ft^2
5-4. If A_2 is greater than A_{min2} then move on to step 5-5. If A_2 is less than A_{min2}, then modify input parameters to increase A_2 until it is greater than A_{min2}. If site constraints limit this criterion, then another site for the pond should be chosen.		
5-5. Enter width of Cell 2, $W_2 = W_1 = W_{av\text{-}tot} = L_{berm}$	W_2 =	ft
5-6. Calculate top length of Cell 2, $L_2 = A_2 / W_2$	L_2 =	ft
5-7. Verify that the length-to-width ratio of Cell 2 is at least 1.5:1 with ≥ 2:1 preferred. If the length-to-width ratio is less than 1.5:1, modify input parameters until a ratio of at least 1.5:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the pond should be chosen, $LW_2 = L_2 / W_2$	LW_2 =	
5-8. Enter percent of surface area that will be planted with emergent vegetation (25-75%), $\%A_{ev}$	$\%A_{ev}$ =	%
5-9. Calculate emergent vegetation surface area, $A_{ev} = A_2 \bullet \%A_{ev}$	A_{ev} =	ft^2
5-10. Enter average depth of emergent vegetation shallow zone (1.5 – 3 ft), d_{ev}	d_{ev} =	ft

5-11. Calculate volume of emergent vegetation shallow zone (1.5 – 3 ft), $V_{ev} = A_{ev} \bullet d_{ev}$	V_{ev} =	ft^3
5-12. Enter width of emergent vegetation shallow zone, $W_{ev} = W_2$	W_{ev}=	ft
5-13. Calculate length of emergent vegetation shallow zone, $L_{ev} = A_{ev} / W_{ev}$	L_{ev} =	ft
5-14. Calculate volume of deep zone, $V_{deep} = V_2 – V_{ev}$	V_{deep} =	ft^3
5-15. Calculate surface area of deep (>3 ft) zone, $A_{deep} = A_2 – A_{ev}$	A_{deep} =	ft^2
5-16. Calculate average depth of deep zone (4 - 8 ft), $d_{deep} = V_{deep} / A_{deep}$	d_{deep} =	ft
5-17. Enter width of deep zone, $W_{deep} = W_2$	W_{deep} =	ft
5-18. Calculate length of deep zone, $L_{deep} = A_{deep} / W_{deeo}$	L_{deep} =	ft
Step 6: Ensure Design Requirements and Site Constraints are Achieved		
6-1. Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the basin is inadequate to meet the design requirements, choose a new location for the BMP.		
Step 7: Size Outlet Structure		
7-1. The basin outlet pipe shall be sized, at a minimum, to pass flows greater than the stormwater quality design peak flow for off-line basins or flows greater than the peak runoff discharge rate for the 100-year, 24-hr design storm for on-line basins.		
Step 8: Determine Emergency Spillway Requirements		
8-1. For online basins, an emergency overflow spillway should be sized to pass flows greater than the design peak runoff discharge rate for the 100-yr, 24-hr storm to prevent overtopping of the walls or berms in the event that a blockage of the riser occurs. For offline basins, an emergency spillway or riser should be sized to pass the water quality design storm. For sites where the emergency spillway discharges to a steep slope, an emergency overflow riser, in addition to the spillway should be provided.		