

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**  
ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY



Worksheet to Develop the Stage - Discharge Characteristics of the Outflow Structure for the Stormwater Detention / Retention Facility

Rev. 12/11

<b>Example for Detention / Retention Manual</b>
<b>ADS</b>
<b>Wednesday, September 19, 2012</b>
<b>Appendix J PC-ROUTE_01Spreadsheet.xls</b>

**Project Address**  
**Data Sheet Preparer**  
**Run Date**  
**Program File Name**

**Note:** Populate characteristics of selected outflow elements corresponding to facility outlet configuration (blue shaded areas), or overwrite purple shaded areas with outflows calculated outside this worksheet, as a function of the given facility stages. Storage (last column) at each stage is interpolated from stage-volume relationship (see "Stage Vol" tab). **Do not add rows** to this worksheet; it automatically divides maximum facility design stage into 100 increments to develop the volume-outflow curve.

**GOVERNING EQUATIONS:**

Orifice equation:  $Q_o = C \cdot A \cdot (2 \cdot g \cdot H)^{0.5}$  and see weir flow equation on "Circ Crit Y" tab  
 Rectangular Weir Equation:  $Q_w = C \cdot L \cdot H^{1.5}$   
 Triangular Weir Equation:  $Q_w = C_1 \cdot \tan(\Theta/2) \cdot H^{2.5}$   
 Box Culvert Equation: See Box Culvert equations for Inlet Control on "Box" tab

ORIFICE OUTFLOW ELEMENT				TRIANGULAR WEIR OUTFLOW ELEMENT				RECTANGULAR WEIR OUTFLOW ELEMENT(S)				BOX CULVERT OUTFLOW ELEMENT							
$d_o$ (in) =	6	diameter	area (ft <sup>2</sup> ) =	0.196	Z =	0.839	side slope	rect 1	rect 2	rect 3	crest length	D (ft) =	1.5	barrel rise					
C (dim) =	0.6	disch coefficient			$E_w$ (ft) =	0.5	stage at crest	L (ft) =	1	0	0	C =	3	3	3	disch coefficient	B (ft) =	0.5	barrel span
$E_o$ (ft) =	5	stage at center	inv (in) =	57.00	$C_1$ =	2.5	disch coefficient	$E_w$ (ft) =	3	3	3	stage at crest	$E_b$ (ft) =	5	5	5	stage at crest		
			inv (ft) =	4.750	$\Theta$ (deg) =	80.0	notch angle												

Basin Stage H, ft	Weir Element(s)						Outflow Q, cfs	$\Sigma$ vol S, af
	Orifice Q, cfs	Triang 1 Q, cfs	Rect 1 Q, cfs	Rect 2 Q, cfs	Rect 3 Q, cfs	RCP Box Q, cfs		

Intermediate Calcs:

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00000
0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03004
0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03690
0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04375
0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04872
0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05616
0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06360
0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07124
0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07926
0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08462
0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09264
0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10106
0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10968
0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11829
0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12403
0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13323
0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14243
0.59	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.15163
0.62	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.16122
0.64	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.16775
0.67	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.17753
0.70	0.00	0.04	0.00	0.00	0.00	0.00	0.04	0.18732
0.73	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.19769
0.76	0.00	0.07	0.00	0.00	0.00	0.00	0.07	0.20806
0.78	0.00	0.09	0.00	0.00	0.00	0.00	0.09	0.21498
0.81	0.00	0.11	0.00	0.00	0.00	0.00	0.11	0.22551
0.84	0.00	0.14	0.00	0.00	0.00	0.00	0.14	0.23637
0.87	0.00	0.17	0.00	0.00	0.00	0.00	0.17	0.24724
0.90	0.00	0.21	0.00	0.00	0.00	0.00	0.21	0.25810
0.92	0.00	0.24	0.00	0.00	0.00	0.00	0.24	0.26560
0.95	0.00	0.28	0.00	0.00	0.00	0.00	0.28	0.27686
0.98	0.00	0.33	0.00	0.00	0.00	0.00	0.33	0.28811
1.01	0.00	0.39	0.00	0.00	0.00	0.00	0.39	0.29950
1.04	0.00	0.45	0.00	0.00	0.00	0.00	0.45	0.31115
1.06	0.00	0.49	0.00	0.00	0.00	0.00	0.49	0.31892
1.09	0.00	0.56	0.00	0.00	0.00	0.00	0.56	0.33057
1.12	0.00	0.63	0.00	0.00	0.00	0.00	0.63	0.34248
1.15	0.00	0.71	0.00	0.00	0.00	0.00	0.71	0.35453
1.18	0.00	0.80	0.00	0.00	0.00	0.00	0.80	0.36657
1.20	0.00	0.86	0.00	0.00	0.00	0.00	0.86	0.37460
1.23	0.00	0.96	0.00	0.00	0.00	0.00	0.96	0.38704
1.26	0.00	1.06	0.00	0.00	0.00	0.00	1.06	0.39948
1.29	0.00	1.16	0.00	0.00	0.00	0.00	1.16	0.41192
1.32	0.00	1.28	0.00	0.00	0.00	0.00	1.28	0.42462
1.34	0.00	1.36	0.00	0.00	0.00	0.00	1.36	0.43317
1.37	0.00	1.48	0.00	0.00	0.00	0.00	1.48	0.44600
1.40	0.00	1.61	0.00	0.00	0.00	0.00	1.61	0.45884
1.43	0.00	1.75	0.00	0.00	0.00	0.00	1.75	0.47206
1.46	0.00	1.89	0.00	0.00	0.00	0.00	1.89	0.48529
1.48	0.00	1.99	0.00	0.00	0.00	0.00	1.99	0.49411

**SIMULATION RESULTS PRESENTED HERE TO FACILITATE OUTLET DESIGN**

Max Outflow =	10.4	cfs	at Stage (H) =	2.40	ft	& t =	32	min
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