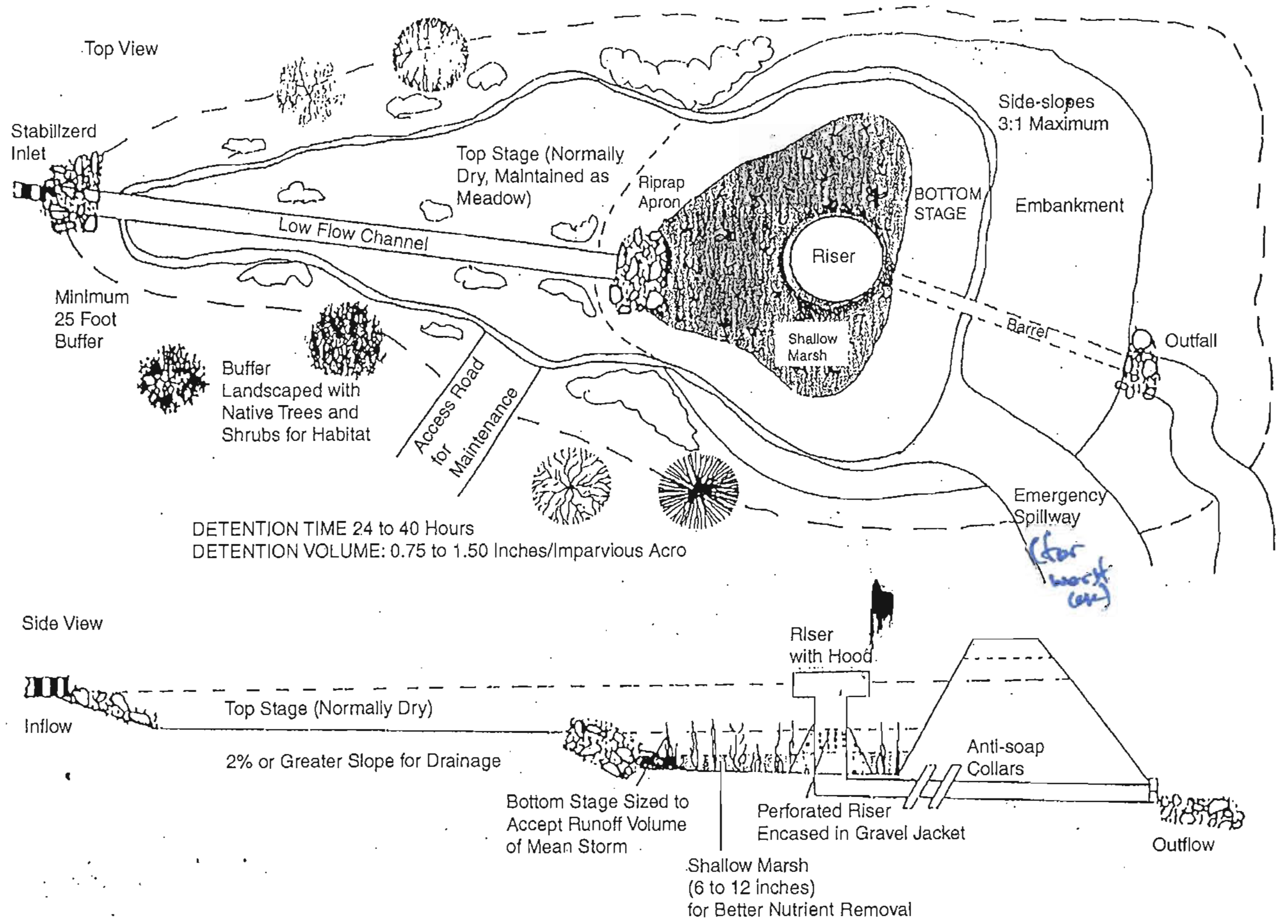

FIGURE 7.12 Schematic of an extended detention basin. (After Schueler, 1987)

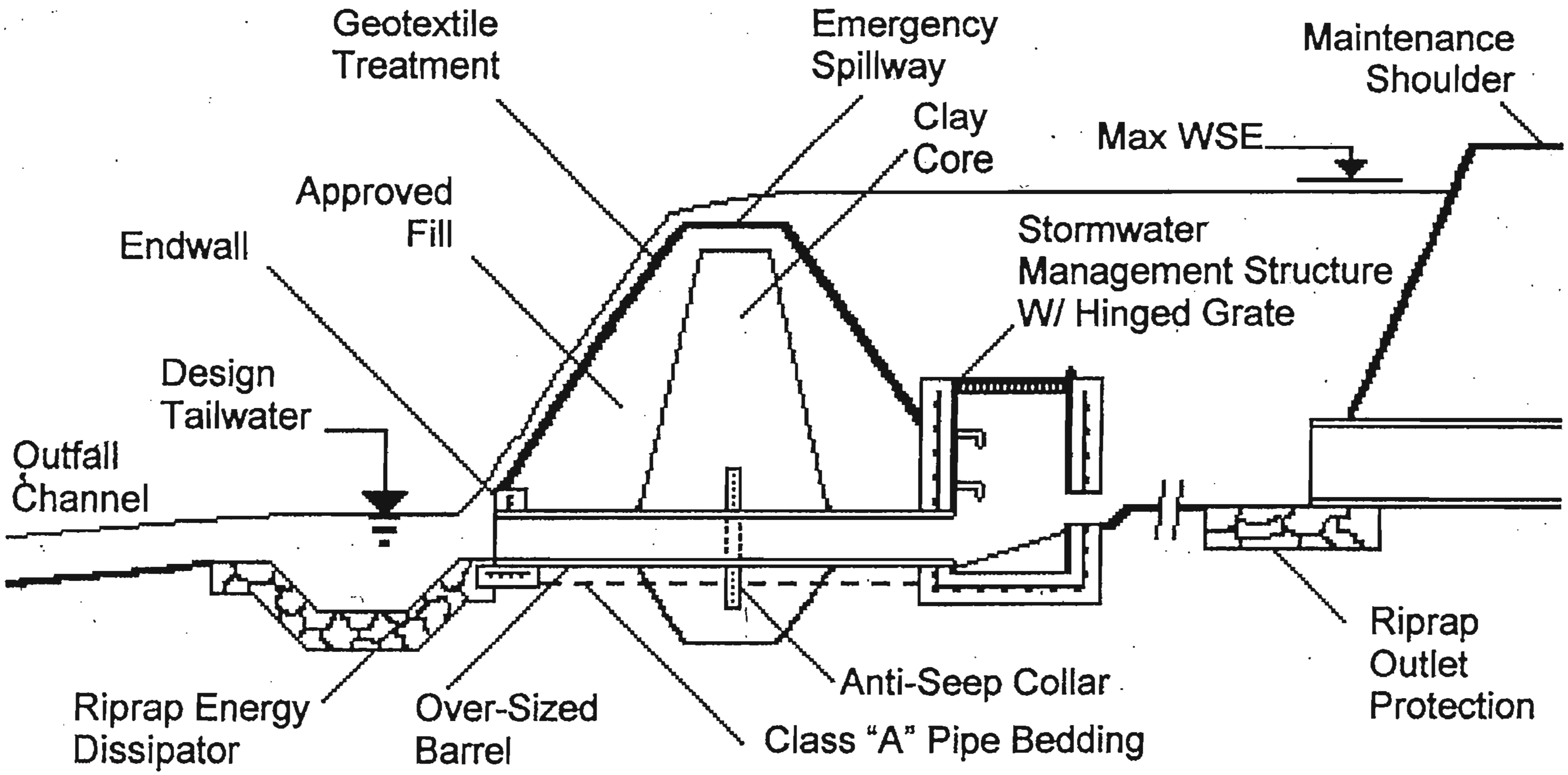

FIGURE 7.1 Schematic of a detention basin.

TABLE 7.4 Design-Aid Equations

Equation	Number of outlets	Outlet types(s)	Remarks	Reference
$\frac{S_{max}}{S_R} = \frac{1.291(1 - Q_p/I_p)^{0.753}}{(T_b/t_p)^{0.411}}$	Not specified	Not specified	Based on numerical simulation T_6 = time base of inflow hydrograph	Wycoff and Singh (1976)
$\frac{S_{max}}{S_R} = \left(1 - \frac{Q_p}{I_p}\right)^2$	Not specified	Not specified	Triangular inflow hydrograph, trapezoid	Abt and Grigg (1978)
$\frac{S_{max}}{S_R} = 1 - \frac{Q_p}{I_p}$	Not specified	Not specified	Triangular inflow and outflow hydrograph	Baker (1979)
$\frac{S_{max}}{S_R} = 0.660 - 1.76\left(\frac{Q_p}{I_p}\right) + 1.96\left(\frac{Q_p}{I_p}\right)^2 - 0.730\left(\frac{Q_p}{I_p}\right)^3$	Not specified	Not specified	For SCS 24-Hour Types I and I	Soil Conservation Service (1986)
$\frac{S_{max}}{S_R} = 0.682 - 1.43\left(\frac{Q_p}{I_p}\right) + 1.64\left(\frac{Q_p}{I_p}\right)^2 - 0.804\left(\frac{Q_p}{I_p}\right)^3$	Not specified	Not specified	For SCS 24-Hour Types II and I	
			t_d = storm duration, T_c = time of concentration	
$S_{max} = I_p t_d - Q_p\left(\frac{t_d + T_c}{2}\right)$	Not specified	Not specified	Trapezoidal inflow hydrograph, rising limb of outflow hydrograph is linear,	Aron and Kibler (1990)
$\frac{S_{max}}{S_R} = 0.932 - 0.792\frac{Q_p}{I_p}$	Single	Weir type	$0.2 < \frac{Q_p}{I_p} < 0.9$ Constant reservoir surface area	Kessler and Diskin (1991)
$\frac{S_{max}}{S_R} = 0.872 - 0.861\frac{Q_p}{I_p}$	Single	Orifice type	$0.2 < \frac{Q_p}{I_p} < 0.9$ Constant reservoir surface area	Kessler and Diskin (1991)
$\frac{S_{max}}{S_R} = 0.98 - 1.17\frac{Q_p}{I_p} + 0.77\left(\frac{Q_p}{I_p}\right)^2 - 0.46\left(\frac{Q_p}{I_p}\right)^3$	Single	Weir type	Gamma function inflow hydrograph	McEnroe (1992)
$\frac{S_{max}}{S_R} = 0.97 - 1.42\frac{Q_p}{I_p} + 0.82\left(\frac{Q_p}{I_p}\right)^2 - 0.46\left(\frac{Q_p}{I_p}\right)^3$	Single	Orifice type	Gamma function inflow hydrograph	McEnroe (1992)

TABLE 7.4 Design-Aid Equations (*Continued*)

Equation	Number of outlets	Outlet types(s)	Remarks	Reference
$\frac{S_{max}}{S_R} = 0.922 - 0.787\left(\frac{Q_p}{I_p}\right)$ $h_{max} = \left(\frac{0.922S_R - 0.787\frac{Q_p}{I_p}S_R}{b}\right)^{1/c}$ $L_c = \left(\frac{b}{0.922S_R - 0.787\frac{Q_p}{I_p}S_R}\right)^{1.5/c}\frac{Q_p}{k_w\sqrt{2g}}$	Single	Weir Type	Gamma function inflow hydrograph relationship: $S = bh^c$, h = stage, L_c = weir crest length k_w = weir discharge coefficient, g = gravitational acceleration	Currey and Akan (1998)
$a_o = \left(\frac{b}{0.847\,S_R - 0.841\frac{Q_p}{I_p}S_R}\right)^{0.5/c}\frac{Q_p}{k_o\sqrt{2g}}$ $\frac{S_{max}}{S_R} = 0.847 - 0.841\left(\frac{Q_p}{I_p}\right)$ $h_{max} = \left(\frac{0.847\,S_R - 0.841\frac{Q_p}{I_p}S_R}{b}\right)^{1/c}$	Single	Orifice type	Gamma function inflow hydrograph relationship: $S = bh^c$, h = stage, a_o = orifice area, k_o = orifice discharge coefficient, g = gravitational acceleration	Currey and Akan (1998)

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Stage h (ft)	Discharge Q (cfs)	Storage (10^3 ft^3)	$(2S/\Delta t) + Q$ (cfs)
0.0	0.0	0	0.0
0.5	3.5	20	70.2
1.0	10.0	40	143.3
1.5	18.3	60	218.3
2.0	28.3	80	295.0
2.5	39.5	100	372.8
3.0	52.0	120	452.0
3.5	65.5	140	532.2
4.0	80.0	160	613.3
4.5	95.5	180	695.5
5.0	111.8	200	778.5
5.5	129.0	220	862.3
6.0	147.0	240	947.0
6.5	165.7	260	1032.6
7.0	185.2	280	1118.5
7.5	204.9	300	1204.9
8.0	223.6	320	1290.3
8.5	244.1	340	1377.4
9.0	263.0	360	1463.0

Time step	t_1	t_2	I_1	I_2	$I_1 + I_2$	$[2S_1/\Delta t)-Q_1]$ (cfs)	$[2S_2/\Delta t)+Q_2]$ (cfs)	Q_2 (cfs)	$[2S_2/\Delta t)-Q_2]$ (cfs)
1	0	10	0	50	50	0	50	2.5	45
2	10	20	50	100	150			15.0	
3	20	30	100	150	250			45.0	
4	30	40	150	200	350			90.0	
5	40	50	200	250	450			145.0	
6	50	60	250	300	550			204.0	
7	60	70	300	270	570			240.5	
8	70	80	270	240	510			247.5	
9	80	90	240	210	450			237.5	
10	90	100	210	180	390			215.5	
11	100	110	180	150	330			194.3	
12	110	120	150	120	270			167.5	
13	120	130	120	90	210			140.5	
14	130	140	90	60	150			112.5	
15	140	150	60	30	90			86.0	
16	150	160	30	0	30			60.5	
17	160	170	0	0	0			42.5	
18	170	180	0	0	0			30.0	
19	180	190	0	0	0			20.75	
20	190	200	0	0	0			17.25	
21	200	210	0	0	0			13.0	