Table C-1. Airfield Drainage - Drain-Inlet Capacities Required Drainage Section: Taxiway, Hangar and Aprons

AREA NO.	DRAINAGE AREA (D.A.) IN ACRES				Average Roughness Factor "n"	Avg. Slope "S", percent	LENGTH L (FT.)			STANDARD SUPPLY CURVE NO. X D.A.				Weighted Supply Curve (Col. 14 ÷ Col. 5)	DRAIN-INLET CAPACITY			CRITICAL CONTRIBUTION TO SYSTEM		
	Paved	Unpaved		Total			Actual or effective length, ft	Equivalent L for n=0.40 and S=1%	L Adopted for Selecting Diagrams	Paved Areas	Unpaved Areas		Total		t_c minutes	q_d c.f.s. per Acre of D.A.	Q_d c.f.s (Col. 17 x Col. 5)	t'_c minutes	q_d c.f.s. per Acre of D.A.	Q_d c.f.s. (Col. 20 x Col. 5)
		Bare	Turf								Bare	Turf								
	n=0.01	n=	n=0.3																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	4.25		16.10	20.35	0.24	1.2	300	170												
					0.12	1.0	1650	460	630	2.98		8.05	11.03	0.54	95	0.25	5.1D			
2	1.37		13.59	14.96	0.27	1.1	600	380												
					0.23	0.5	600	470	850	0.96		6.80	7.76	0.52	120+	0.17	2.5	20	0.11	1.6D
3	4.42			4.42	0.01	1.0	250	10												
					0.01	0.8	550	20	30	3.09			3.09	0.70	10	1.95	8.6	15	1.47	6.5
																		20	1.37	6.1D
4	1.91			1.91	0.01	1.0	300	20	20	1.34			1.34	0.70	10	2.22	4.2	15	1.68	3.2D
																		20	1.45	2.8
																		25	1.26	2.4
7	0.96		0.54	1.50	0.11	2.0	300	60	60	0.67		0.27	0.94	0.63	13	1.02	1.5	15	1.02	1.5D
																		20	0.98	1.5
																		25	0.92	1.4
8	0.76		0.89	1.65	0.16	5.0	60	20												
					0.10	1.3	300	70	90	0.53		0.45	0.98	0.59	18	0.83	1.4	15	0.83	1.4D
																		20	0.82	1.3
																		25	0.80	1.3
9	0.80		0.54	1.35	0.13	1.0	60	20												
					0.12	1.0	150	40	60	0.56		0.27	0.83	0.62	13	1.02	1.4	15	1.02	1.4D
																		20	0.98	1.3
																		30	0.87	1.2

Drainage areas from Figure C-1

1. No ponding allowed in arctic and subarctic areas
2. Average roughness factor "n" (Col. 6) for channel sections obtained from Figure 2-6 assuming a hydraulic radius of 0.9 and a grass coefficient of 1.4.
3. Values indicated by "D" are used in design. (See Table C-2)

Table C-2. Airfield Drainage - Size and Profile of Underground Storm Drains-Drainage Section: Taxiway, Hangar and Aprons

Supply Curve Nos.		Project	Illustration
For Paved Areas	0.7	Location	Subarctic
For Bare Areas		Division Office	
For Turfed Areas	0.5	District Office	

POINT OF DESIGN			Critial Runoff Time to Produce Maximum Flow in Underground Drain							Rate of Inflow Into Underground Drains, in C.F.S. Corresponding to Adopted Value of t'$_c$ (Column 10)									
	Distance, ft					Drain Time, min				Inlet Number									
INLET OR JUNCTION NUMBER	From main outlet	From Preceding inlet	Critical Inlet	Critical Inlet Time, t_c min *	Assumed Velocity in Pipe, ft/sec	From Preceding Inlet	Accum. Total	Approx. t'$_c$ (Col.5 + Col.8)	Adopted t'$_c$ in min	Area 9	Area 8	Area 7	Area 6	Area 5	Area 4	Area 3	Area 2	Area 1	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	450	0	A	13	--	0	0	13	15			1.5			1.6**				3.1
B	150	300	A	13	3.5	2	2	15	15		1.4	0.5			3.2				6.1
C	0	150	A	13	3.0	1	3	16	15	1.4	1.4	1.5			3.2				7.5
D	0	0	D	95	--	--	--	95	95									5.1	5.1
E***	250	0	E	10	0.5	9	9	19	20							6.1	1.6		7.7

Runoff from Areas 5 and 6 not needed for this illustration.
Rates of inflow are design values (D) from Table C-1.
*From Col. 16, Table C-1.
**Half of Area 4 drains to Inlet "A" and half to Inlet "B".
*** The critical time is the time it takes Area 3 to drain to point "E". Velocity shown is assumed velocity in the ditch from Area 3 to point "E".

Table C-4. Airfield Drainage Drain-Inlet Capacities Required to Limit Ponding to Permissible Volumes with Drainage Section on East Side of Airfield and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas

INLET NO.	DRAINAGE AREA (D.A.) IN ACRES					PERMISSIBLE PONDING					LENGTH, L, FT		
	Paved	Unpaved											
		Bare	Turf	Total	Depth at Inlet, ft	Pond area, Thousands of sq. ft	Volume Thousands of cu ft	Volume, cu ft/acre D.A.	Average Coefficient of Roughness "n"	Average Slope "S" in Percent	Actual Length, ft	Effective L for n=0.40 and S=1%	L Adopted for Selecting Diagrams
	n=0.01	n=	n=0.40										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
10	5.93			5.93					0.01	1.0	400	30	30
9	7.40			7.40					0.01	1.0	425	30	30
8	5.93			5.93					0.01	1.0	400	30	31
7	5.93			5.93					0.01	1.0	400	30	30
6[a]	1.41		17.18	18.59					0.37	1.5	775	580	580
4	5.97		26.81	32.78	3.00	138	207	6310	0.33	2.0	525	310	310
3	5.69		25.54	31.23	1.73	145	125	4000	0.33	2.8	340	170	170
2	5.69		25.54	31.23	2.73	270	369	11800	0.33	2.8	340	170	170
Notes:	1		1	1	2	2	3	4	5	6	6	7	

[a] No ponding permitted.

(Continued)

Table C-4. Airfield Drainage Drain-Inlet Capacities Required to Limit Ponding to Permissible Volumes with Drainage Section on East Side of Airfield and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas – Continued

STANDARD SUPPLY CURVE NO. x D.A.				Weighted Supply Curve (Col. 18 ÷ Col. 5)	DRAIN-INLET CAPACITY			CRITICAL CONTRIBUTION TO SYSTEM		
Paved Areas	Unpaved		Total		t_c,min	q_d, cfs/acre of D.A.	Q_d, cfs (Col. 21 x Col. 5)	t'_c, min	q_d, cfs/acre of D.A.	Q_d, cfs (Col. 24 x Col. 5)
	Bare	Turf								
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
11.86			11.86	2.0	10	4.7	27.9	15	4.3	25.5
								20	3.8	22.5
								30	3.2	19.0
14.80			14.80	2.0	10	4.7	34.8	15	4.3	31.8
								20	3.8	28.1
								30	3.2	23.7
11.86			11.86	2.0	10	4.7	27.9	15	4.3	25.5
								20	3.8	22.5
								30	3.2	19.0
11.86			11.86	2.0	10	4.7	27.9	15	4.3	25.5
								20	3.8	22.5
								30	3.2	19.0
2.82		25.77	28.59	1.5	32	1.3	24.2	20	1.2	22.3[a]
11.94		40.21	52.15	1.6	b	0.51	16.7			
11.38		38.31	49.69	1.6	b	0.51	15.9			
11.38		38.31	49.69	1.6	b	0.51	15.9			
Notes:					8	9		10	11	

[a] No ponding permitted.

[b] Not required when appreciable ponding is permissible.

(Continued)

Table C-4. Airfield Drainage Drain-Inlet Capacities Required to Limit Ponding to Permissible Volumes with Drainage Section on East Side of Airfield and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas - Continued

Notes:

1. Both paved and turfed drainage areas have been previously computed and are provided for this example.
2. Permissible depth and area of temporary storage pond have been previously computed and are provided for this example.
3. Total ponding volume for inlet 4 is computed as follows:
   v = (0 + 138,000)/2 x 3.0 = 207,000 cu ft
4. Ponding volume for inlet 4 per acre of drainage area is computed as follows:
   v = 207,000/32.78 = 6,315 cu ft/acre of drainage area
5. Average coefficient of roughness "n" for inlet 4 is computed as follows:
   n_w = [(0.01 x 5.97) + (0.40 x 26.81)]/(5.97 + 26.81) = 0.33
6. Average slope and actual length of drainage area to inlet have been previously determined and are provided for this example.
7. See Figure 2-5 (main text) for determination of this length.
8. For inlets 10, 9, 8, and 7, consult either Figure 2-4 or 3-9. The critical duration of supply t_c for L = 30 ft is about 8 min; however, Section 3-3.2 specifies that minimum allowable t_c for paved areas is 10 min. For inlet 6, consult Figures 3-4 and 3-5 or Figure 3-15 to determine the stated value.
9. For inlets 10, 9, 8, and 7, the drain-inlet capacities q_d are determined from Figure 2-4 or 3-15. Figure 3-17 could be used if the maximum storage line, 0 cu ft/acre were extended. The drain-inlet capacity for inlet 6 is determined from Figures 3-4 and 3-5, 3-15, or 3-20. Drain-inlet capacities for inlets 4, 3, and 2 where ponding is permissible are determined from the 4-line in Figures 3-18 and 3-19. The 4-line is used because the permissible volume of storage exceeds the net volume of runoff for a 4-hr storm having the stated rate of supply.
10. Values for duration from critical inlet t'_c are described in Table C-5.
11. Values of q_d are determined for inlets 7, 8, 9, and 10 from Figure 2-4, the weighted supply curve 2.0 (column 19), using the 15, 20, and 30-min values of t'_c (column 23), and the effective length, L, of 30 ft (column 14). A similar procedure is followed for inlet 6 using only a 20-min value of t'_c and the effective length, L, of 580 ft. (See note 5 for Table C-5). The q_d values are read on the vertical axis labeled maximum rate of runoff. Figure 3-15 cannot be used in determining these values.

(Sheet 3 of 3)

Table C-5. Airfield Drainage Size and Profile of Underground Storm Drains with Drainage Section on East Side of Airfield and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas

POINT OF DESIGN			Critical Runoff Time to Produce Maximum Flow in Underground Drain						
Inlet or Junction Number	Distance, ft		Critical Inlet	Critical Inlet Time, t_c min	Assumed Velocity In Pipe, ft/sec	Drain Time, min		Approx. t'_c (Col. 5 + Col. 8)	Adopted t'_c, min
	From Main Outlet	From Preceding Outlet				From Preceding Inlet	Accum. Total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
9	2740		9	10				10	10
8	2355	385	9	10	3.0	2	2	12	10
7	1580	775	9	10	3.0	4	6	16	15
6	730	850	9	10	3.0	5	11	21	20
6	730	850	9						30
10	1965		10	10				10	10
4	4805								
3	3155	1650							
2	1505	1650							
Notes:	1	1	2	3		4			5

(Continued)

Table C-5. Airfield Drainage Size and Profile of Underground Storm Drains with Drainage Section on East Side of Airfield and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas – Continued

Rate of Inflow Into Underground Drains, in C.F.S., Corresponding to Adopted Value of t'_c (Column 10)												
Inlet Number												
9	8	7	10	6		4	3	2				Total
(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
34.8												34.8
34.8	27.8											62.6
31.8	25.5	25.5	25.5									108.3
28.1	22.5	22.5	22.5	22.3								117.9
23.7	19.0	19.0	19.0	24.2								104.9
			27.9									27.9
						16.7						16.7
						16.7	15.9					32.6
						16.7	15.9	15.9				48.5
Notes:												
6	6	6	6	6		6	6	6				

(Continued)

Table C-5. Airfield Drainage Size and Profile of Underground Storm Drains with Drainage Section on East Side of Airfield and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas - Continued

Notes:

1. Distances between inlets and from any inlet to the main outlet have been previously determined and are provided for this example.
2. Normally the most distant inlet in each drainage line from the main outlet.
3. Refers to t_c for the most critical inlet and not the t_c for the numbered inlet.
4. Drain time from inlet 9 to 8 is calculated as follows:
   $385/(3 \times 60) \approx 2$ min
5. Adopted t'_c values are rounded to the nearest 5 min in accordance with Section 3-3.2. These values reflect the total time required for a quantity of water to travel from the most remote portion of the critical inlet area to the inlet being considered. To determine the value of t'_c for inlet 6, the total flow at that point must be computed for each condition to ascertain which is the largest and governing rate of flow into the system. In this example, the maximum flow is associated with a time of concentration (20 min) from the upstream areas rather than the time of concentration (30 min) for the area contributing to inlet 6.
6. Values used are obtained from Table C-4, column 25. These values reflect the total quantity of water contributing to the entire system at any given inlet in the system. At inlet 6 rates of inflow are provided based on the critical duration of supply time for both the critical inlet (inlet 9) and the inlet under consideration, because the t'_c for inlet 6 is greater than the t'_c for the entire system. These calculations indicate the rate of inflow for t'_c is the more critical or governing value.

(Sheet 3 of 3)

Table C-6. Hydraulic Design Data on Underground Storm Drains Where Ponding is Permissible

Inlet or Junction Numbers			Trial Design					Adopted Design						Construction Data			
								Losses				Hydraulic Gradient at Inlet				Elevation of Invert at Design Point (Col. 2), ft	
From	To	Distance Between Design Points, ft, Measured to C L of Inlet or Junction	Design Discharge Capacity, cfs	Approx. Gradient Between Design Points, ft/ft	Mean Velocity of Design Discharge in ft/sec	Required Size of Pipe, in.	Selected Size of Pipe, in.	Head Velocity, $V^2/2g$	Inlet Coeff., K	Inlet Loss, ft (Col. 9 x Col. 11)	Friction Loss, ft	Outgoing Pipe	Incoming Pipe	Slope, ft/ft	Length of Pipe Between Design Point, ft	Incoming Pipe	Outgoing Pipe
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	2	1505	48.5	0.0020	5.1	41	42					487.54					484.04
						51	48[a]	0.39	0.12	0.05	3.00	490.59	490.09	0.0020			
2	3	1650	32.6	0.0020	4.6	36	36										
						44	42[a]	0.33	0.12	0.04	3.55	493.68	493.18	0.0020			
3	4	1650	16.7	0.0014	3.4	29	30										
						37	36[a]	0.18	0.12	0.02	2.33	495.53		0.0014			
5	6	730	117.9	0.0018	6.1	59	60					498.86					493.86
						74	72[a]	0.58	0.12	0.07	1.32	500.25	499.75	0.0018			
6	7	850	108.3	0.0026	6.8	53	54										
						66	66[a]	0.74	0.12	0.09	2.25	502.09	501.09	0.0026			
7	8	775	62.6	0.0033	6.5	42	42										
						51	48[a]	0.66	0.12	0.08	2.56	503.73	503.23	0.0033			
8	9	385	34.8	0.0024	4.9	36	36										
						44	42[a]	0.39	0.12	0.04	0.92	504.19		0.0024			
7	10	385	27.9	0.0040	5.7	29	30					499.09					
						37	36[a]										
								0.50	0.12	0.06	1.57	500.72		0.0040			
Notes:			1	2	3	4	5		6		7	8	9				

[a] Pipe diameters required using "n" = 0.021 for ¼d paved invert corrugated metal pipe. Size differential limited to 6 inches where feasible.

(Continued)

Table C-6. Hydraulic Design Data on Underground Storm Drains Where Ponding is Permissible - Continued

Notes:

1. Values come from Table C-5, column 23
2. Values developed from profile of drainage line and have been provided for this example.
3. Values derived from use of Manning's formula in nomograph form (Figure 3-22) for smooth interior pipe flowing full. The velocities indicated are higher than those assumed in Table C-5, column 6, and in an actual problem these new values would be used in Table C-5 for a second trial to develop new rates of inflow. Seldom are more than three iterations warranted.
4. Values derived from the use of Figures 3-22 and 3-23. Values in column 8 rounded off to nearest commercially available pipe size.
6. Inlet coefficients are available in many publications; however, the following general criteria are satisfactory for most airfield storm drainage systems:

Entrance loss coefficients, K, inlets

	Rectangular		Circular	
Slope percent	Socket of Pipe Projecting Slightly into Riser	Square-Edge Pipe Opening Into Riser	0.25D Radius	Square Edge
0	0.12	1.2	--	--
10	0.13	0.87	--	--
20	0.13	0.82	0.50	0.66

(Continued)

Table C-6. Hydraulic Design Data on Underground Storm Drains Where Ponding is Permissible - Continued

7. Friction loss can be computed by the formula:

$$H_f = 2.88n^2V^2L/D^{1.333} \text{ or } H_f = fLV^2/(D \times 2g)$$

The factor f can be obtained from many texts; however, the following tabulation provides values sufficient for most cases:

Friction factors

	Values of f			
D (in.)	n = 0.012	n = 0.021	n = 0.024	n = 0.033
6	0.0336	0.1029	0.1344	0.2541
12	0.0267	0.0817	0.1067	0.2017
18	0.0233	0.0713	0.0932	0.1762
24	0.0212	0.0648	0.0847	0.1601
30	0.0196	0.0602	0.0786	0.1486
36	0.0185	0.0566	0.0740	0.1398
42	0.0176	0.0538	0.0703	0.1328
48	0.0168	0.0515	0.0672	0.1271
54	0.0162	0.0495	0.0646	0.1222
60	0.0156	0.0478	0.0624	0.1179
66	0.0151	0.0463	0.0604	0.1143
72	0.0147	0.0449	0.0587	0.1110
84	0.0139	0.0427	0.0558	0.1054

8. Hydraulic gradient for the outgoing pipe at an inlet is computed by adding the friction and inlet losses to the hydraulic gradient of the inlet pipe at the previous inlet. The hydraulic gradient at the outfall of the drain is the elevation of the crest of this pipe. When computing hydraulic gradients by this method, start at the outfall end of the storm drain.
9. Hydraulic gradient for incoming pipe at an inlet is equal to the hydraulic gradient of the outgoing pipe plus or minus the change in pipe size. The bottom of the inlet is assumed to be level and the inverts of both pipes at the same elevation.

Table C-7. Airfield Drainage Drain-Inlet Capacities Required to Limit Ponding to Permissible Volumes with Drainage Section in Which No Ponding of Runoff is Assumed and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas

INLET NO.	DRAINAGE AREA (D.A.) IN ACRES				PERMISSIBLE PONDING				Average Coefficient of Roughness "n"	LENGTH, L (FT.)			
	Paved n = 0.01	Unpaved		Total	Depth at Inlet, ft	Pond Area Thousands of sq ft	Volume Thousands of cu ft	Volume, cu ft Per		Average Slope "S" in Percent	Actual Length, ft	Effective L for n = 0.40 and 3 S = 1%	L Adopted for Selecting Diagrams
		Bare n =	Turf n = 0.40										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
4	5.967		26.81	32.78					0.33	2.0	575	330	330
3	5.69		25.54	31.23					0.33	2.8	575	290	290
2	5.69		25.54	31.23					0.33	2.8	575	290	290
Notes:											1		

1. Actual length of drainage area to an inlet has been previously determined and is provided for this example. Length is longer than in Table C-4 because temporary ponding is not allowed resulting in a net increase in length of runoff.

(Continued)

Table C-7. Airfield Drainage Drain-Inlet Capacities Required to Limit Ponding to Permissible Volumes with Drainage Section in Which No Ponding of Runoff is Assumed and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas – Continued

STANDARD SUPPLY CURVE NO. x D.A.				Weighted Supply Curve (Col. 18 ÷ Col. 5)	DRAIN-INLET CAPACITY		CRITICAL CONTRIBUTION TO SYSTEM			
Paved Areas	Unpaved		Total		T_c, min	q_d, cfs/acre of D.A.	Q_d, cfs (Col. 21 x Col 5)	t'_c, min	q_d, cfs/acre of D.A.	Q_d, cfs (Col. 24 x Col 5)
	Bare	Turf								
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
11.94		40.21	52.15	1.6	24	1.9	62.3	25	1.9	62.3
								35	1.8	59.0
								40	1.7	55.7
11.38		38.31	49.69	1.6	22	2.0	62.5	25	2.0	62.5
								35	1.9	59.3
								40	1.8	56.2
11.38		38.31	49.69	1.6	22	2.0	62.5	25	2.0	62.5
								35	1.9	59.3
								40	1.8	56.2
Notes:					2	3		4	5	

2. Consult either Figure 3-5 or 3-9 to determine the stated value.
3. Drain-inlet capacities, q_d, are determined from Figure 3-18.
4. Values for duration of supply from critical inlet, t'_c, are described in Table C-8.
5. Values of q_d are determined from Figure 3-5, supply curve No. 1.6, using the 25, 35, and 40-min values of t'_c (column 23), the effective length L (column 14), and the weighted supply curve of 1.6 (column 19). The q_d values are read on the vertical axis labeled maximum rate of runoff. Figure 3-9 cannot be used to determine these values.

(Sheet 2 of 2)

Table C-8. Airfield Drainage Size and Profile of Underground Storm Drains with Drainage Section in Which No Ponding of Runoff is Assumed and with Supply Curves No. 2.0 for Paved Areas and 1.5 for Turfed Areas

POINT OF DESIGN			Critical Runoff Time to Produce Maximum Flow in Underground Drain							Rate of Inflow Into Underground Drains, cfs, Corresponding to Adopted Value of t'_c (Column 10)							
INLET JUNCTION NUMBER	Distance, ft		Critical Inlet	Critical Inlet Time, t_c, min.	Assumed Velocity in Pipe, ft/sec	Drain Time, min		Approx. t'_c (Col. 5 + Col. 8)	Adopted t'_c, min	Inlet Numbers							
	From Main Outlet	From Preceding Outlet				From Preceding Inlet	Accum. Total			4	3	2					Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
4	4805			24	3.0			24	25	62.3							62.3
3	3155	1650	4	24	3.0	9.2	9.2	33	35	59.0	59.3						118.3
2	1505	1650	4	24	3.0	9.2	18.4	42	40	55.7	56.2	56.2					168.1
Notes:										2	2	2					

1. These values reflect the time required for a quantity of water to travel from the most remote portion of the critical inlet area to the inlet being considered.
2. These values reflect the total quantity of water contributing to the entire system at any given inlet in the system.

Table C-9. Hydraulic Design Data on Underground Storm Drains Where Ponding is Not Acceptable

Inlet or Junction Numbers		Distance Between Design Points, ft, Measured to C_L of Inlet or Junction	Trial Design					Adopted Design						Construction Data			
								Losses				Hydraulic Gradient at Inlet				Elevation of Invert at Design Point, (Col. 2), ft	
From	To		Design Discharge Capacity, cfs	Approx. Gradient Between Design Points, ft/ft	Mean Velocity of Design Discharge in ft/sec	Required Size of Pipe, in.	Selected Size of Pipe, in.	Velocity Head $V^2/2g$	Inlet Coefficient, K	Inlet Loss, ft	Friction Loss, ft	Outgoing Pipe	Incoming Pipe	Slope in ft/ft	Length of Pipe Between Design Points, ft	Incoming Pipe	Outgoing Pipe
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
												489.04					
1	2	1505	168.1	0.0036	8.6	60	60	1.15	0.12	0.14	5.39	494.57	494.07	0.0036			484.04
						73	72[a]										
2	3	1650	118.3	0.0031	7.4	53	54	0.85	0.12	0.10	5.01	499.18	498.68	0.0031			
						66	66[a]										
3	4	1650	62.3	0.0016	5.0	48	48	0.39	0.12	0.05	2.70	501.43		0.0016			
						59	60[a]										

[a] Pipe diameters required using "n" = 0.021 for ¼d paved invert corrugated metal pipe. Size differential limited to 6 in. where feasible.