Entellus

City of Scottsdale
64th Street Supplementary Hydraulic Calculations

Entellus No. 410.32

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City of Scottsdale
64th Street Supplementary Hydraulic Calculations

Entellus No. 410.32

November 1997

STORM DRAIN

HYDRAULIC GRADE LINE

CALCULATIONS

64th Street/Oak Street Hydraulic Grade Line Calculations South of Oak Street

Entellus Job No. 410.32

October 9, 1997

Revise per Q change

Description	Starting Station or Offset	Ending Station or Offset	Pipe Size (inches)	Flowrate (cfs)	Area (sf)	Equivalent Circular Diameter (ft)	Perimeter (lf)	Pipe Length (ft)	Manning's "n"	Coefficient "K"	Hydraulic Radius (ft)	Slope (ft/ft)	Velocity (ft/s)	Friction Loss (ft)	Minor Loss (ft)	Total HGL Elevation (ft)
Oak Street																
Box Inle (Master Plan)		23+08.42						81'/KH							*	1260.01
60" Friction	23+08.42	22+30.38	60	320	19.63495	5	15.70796	78.04	0.013	0	1.25	0.015	16.30	1.17		1261.18
Manhole loss	22+30.38	22+25.38						5		0.1					0.41	1261.59
Expansion/contraction	22+25.38	22+25.38												0.00		1261.59
60" Pipe loss	22+25.38	22+01.53	60	267	19.63495	5	15.70796	23.85	0.013	0	1.25	0.0105	13.60	0.25		1261.84
Catch Basin Entrance loss	22+01.53	22+01.53								0.01					0.03	1261.87
60" Pipe loss	22+01.53	21+79.38	60	267	19.63495	5	15.70796	22.15	0.013	0	1.25	0.0105	13.60	0.23		1262.10
Catch Basin Entrance	21+79.38	21+79.38								0.01					0.03	1262.13
60" Pipe loss	21+79.38	13+35.47	60	267	19.63495	5	15.70796	843.91	0.013	0	1.25	0.0105	13.60	8.82		1270.95
Manhole loss	13+35.47	13+30.47						5		0.06					0.17	1271.12
Expansion/contraction losses	13+30.47	13+30.47													0.00	1271.12
60 Friction	13+30.47	9+38.16	60	267	19.63495	5	15.70796	392.31	0.013	0	1.25	0.0105	13.60	4.10		1275.22
Bend loss + junction	9+38.16	9+33.16						5		0.3					0.86	1276.09
64th Street																
Oak Street Base Point		35+60.00														1276.09
54	35+60.00	35+02.50	54	267	15.90431	4.5	14.13717	57.5	0.013	0	1.125	0.0183	16.79	1.05		1277.14
Juntion minor loss	35+02.50	34+97.50						5							0.99	1278.13
Expacion/contraction losses	34+97.50	34+97.50												0.00		1278.13
54" Pipe friction	34+97.50	32+92.50	54	140	15.90431	4.5	14.13717	205	0.013	0	1.125	0.005	8.80	1.03		1279.16
Manhole loss	32+92.50	32+87.50						5		0.05					0.06	1279.22
54" Pipe friction	32+87.50	26+34.50	54	140	15.90431	4.5	14.13717	653	0.013	0	1.125	0.005	8.80	3.29		1282.52
Manhole loss	26+34.50	26+29.50						5		0.05					0.10	1282.61
Expancion/contraction losses	26+29.50	26+29.50													0.08	1282.70
48" Pipe loss	26+29.50	24+62.50	48	140	12.56637	4	12.56637	167	0.013	0	1	0.0094	11.14	1.58		1284.28
Junction loss	24+62.50	24+57.50						5							0.96	1285.23
Expancion/contraction loss	24+57.50	24+57.50														1285.23
24" Pipe loss	24+57.50	18+52.59	24	10.35	3.141593	2	6.283185	604.91	0.013	0	0.5	0.0021	3.29	1.26		1286.49

* Downsrtream HGL elevation used Master Plan HGL +.88ft added for additional losses at structure

* 64th Vertical Datum = Master Plan -1.773

0.7 more appropriate for 90° bend

172' on plan

overestimated

Add since box structure at end

$S_f = Q^2/K^2$

From Stn. 23+08.42 to stn. 22+25.38 Dist. = 84'

$$S_f = \frac{(.013)^2(320)^2}{(1.25)^{4/3}\,(19.63)^2(1.49)^2} = \frac{(.0002)(102{,}400)}{(1.3465)(385.34)(2.22)} = .0178 \quad K = L/S_f = 1.4935$$

$\frac{\pi D^2}{4}$ & πd

$H_f =$

$$Q = \frac{1.49}{n}\left(\frac{D}{4}\right)^{2/3} S^{1/2} A = \left(\frac{Qn}{1.49\ S^{1/2}}\right)^{3/2}$$

64th Street/Oak Street Hydraulic Grade Line Calculations South of Oak Street
Entellus Job No. 410.32
October 9, 1997

Description	Starting Station or Offset	Ending Station or Offset	Pipe Size (inches)	Flowrate (cfs)	Area (sf)	Equivalent Circular Diameter (ft)	Perimeter (lf)	Pipe Length (ft)	Manning's "n"	Coefficient "K"	Hydraulic Radius (ft)	Slope (ft/ft)	Velocity (ft/s)	Friction Loss (ft)	Minor Loss (ft)	Total HGL Elevation (ft)
Oak Street																
Box Inle (Master Plan)		2308.42						81							*	1260.01
60" Friction	2308.42	2230.38	60	267	19.63495	5	15.708	78.04	0.013	0	1.25	0.0105	13.60	0.82		1260.83
Manhole loss	2230.38	2225.38						5		0.1					0.29	1261.11
Expansion/contraction	2225.38	2225.38												0.00		1261.11
60" Pipe loss	2225.38	2201.53	60	267	19.63495	5	15.708	23.85	0.013	0	1.25	0.0105	13.60	0.25		1261.36
Catch Basin Entrance loss	2201.53	2201.53								0.01					0.03	1261.39
60" Pipe loss	2201.53	2179.38	60	267	19.63495	5	15.708	22.15	0.013	0	1.25	0.0105	13.60	0.23		1261.62
Catch Basin Entrance	2179.38	2179.38								0.01					0.03	1261.65
60" Pipe loss	2179.38	1335.47	60	267	19.63495	5	15.708	843.91	0.013	0	1.25	0.0105	13.60	8.82		1270.47
Manhole loss	1335.47	1330.47						5		0.06					0.17	1270.64
Expansion/contraction losses	1330.47	1330.47													0.00	1270.64
60 Friction	1330.47	938.16	60	267	19.63495	5	15.708	392.31	0.013	0	1.25	0.0105	13.60	4.10		1274.74
Bend loss + junction	938.16	938.16						5		0.7					2.01	1276.75
64th Street																
Oak Street Base Point		3560						60								1276.75
54	3560	3502.5	54	267	15.90431	4.5	14.1372	57.5	0.013	0	1.125	0.0183	16.79	1.05		1277.81
Juntion minor loss	3502.5	3497.5		140				5							0.99	1278.80
Expacion/contraction losses	3497.5	3497.5												0.00		1278.80
54" Pipe friction	3497.5	3292.5	54	140	15.90431	4.5	14.1372	205	0.013	0	1.125	0.005	8.80	1.03		1279.83
Manhole loss	3292.5	3287.5						5		0.05					0.06	1279.89
54" Pipe friction	3287.5	2634.5	54	140	15.90431	4.5	14.1372	653	0.013	0	1.125	0.005	8.80	3.29		1283.18
Manhole loss	2634.5	2629.5						5		0.05					0.10	1283.28
Expancion/contraction losses	2629.5	2629.5													0.08	1283.36
48" Pipe loss	2629.5	2462.5	48	140	12.56637	4	12.5664	167	0.013	0	1	0.0094	11.14	1.58	//////////	#VALUE!
Junction loss	2462.5	2457.5						5							0.96	#VALUE!
Expancion/contraction loss	2457.5	2457.5														#VALUE!
24" Pipe loss	2457.5	1852.59	24	10.35	3.141593	2	6.28319	604.91	0.013	0	0.5	0.0021	3.29	1.26		#VALUE!

* Downsrtream HGL elevation used Master Plan HGL +.88ft added for additional losses at structure

* 64th Vertical Datum = Master Plan -1.773

$$S_f = \frac{(140)^2(.013)^2}{(2.22)(15.9)^2(1.125)^{4/3}} = .005$$

mine: 8.05'

Method in spreadsheet not appropriate where Q's change at junction. Refer to DDM, section 4.3.3.3

What is this for?

66th Street Hydraulic Grade Line Calculations
Entellus Job No. 410.32
October 8, 1997

0.19 for 15° bends

underestimated

Description	Starting Station or Offset	Ending Station or Offset	Pipe Size (inches)	Flowrate (cfs)	Area (sf)	Equivalent Circular Diameter (ft)	Perimeter (lf)	Pipe Length (ft)	Manning's "n"	Coefficient "K"	Hydraulic Radius (ft)	Slope (ft/ft)	Velocity (ft/s)	Elevation Change (ft)	Minor Loss (ft)	Total HGL Elevation (ft)
Oak Street Base Point		25+57.66		241 per KH												1259.13
Friction	25+57.66	22+38.49	72	252	28.27433	6	18.84956	319.17	0.013	0	1.5	0.0035	8.91	1.12		1260.25
Bend 6- 15Dbends(.01*6)	25+57.66	22+38.49								0.06					~~0.07~~ 1.4	1260.33
Friction	22+38.49	21+96.67	72	252	28.27433	6	18.84956	41.82	0.013	0	1.5	0.0035	8.91	0.15		1260.47
Catch Basin Entrance	21+96.67	21+96.67													0.00	1260.47
Friction	21+96.67	19+21.43	72	252	28.27433	6	18.84956	275.24	0.013	0	1.5	0.0035	8.91	0.97		1261.44
Catch Basin Entrance	19+21.43	19+21.43													0.00	1261.44
Friction	19+21.43	16+57.11	72	252	28.27433	6	18.84956	264.32	0.013	0	1.5	0.0035	8.91	0.93		1262.37
Catch Basin Entrance	16+57.11	16+57.11													0.00	1262.37
Friction	16+57.11	14+06.23	72	252	28.27433	6	18.84956	250.88	0.013	0	1.5	0.0035	8.91	0.88		1263.26
Catch Basin Entrance	14+06.23	14+06.23													0.00	1263.26
Friction	14+06.23	14+03.00	72	252	28.27433	6	18.84956	3.23	0.013	0	1.5	0.0035	8.91	0.01		1263.27
Manhole 12	14+03.00	13+97.00						6		0.05					0.06	1263.33
Expansion	13+97.00	13+97.00														1263.33
Friction	13+97.00	9+60.13	66	181	23.75829	5.5	17.27876	436.87	0.013	0	1.375	0.0029	7.62	1.26		1264.59
Catch Basin Entrance	9+60.13	9+60.13													0.00	1264.59
Friction	9+60.13	9+08.00	66	181	23.75829	5.5	17.27876	52.13	0.013	0	1.375	0.0029	7.62	0.15		1264.74
Manhole 13	9+08.00	9+08.00						0		0.05					0.05	1264.79
Friction	9+08.00	8+53.00	66	181	23.75829	5.5	17.27876	55	0.013	0	1.375	0.0029	7.62	0.16		1264.95
45 bend	8+53.00	8+53.00						0		0.1					0.09	1265.04
Friction	8+53.00	8+23.00	66	181	23.75829	5.5	17.27876	30	0.013	0	1.375	0.0029	7.62	0.09		1265.12
Inlet loss	8+23.00	8+23.00	66	181	23.75829	5.5	17.27876	0		0.5	1.375	0	7.62	0.00	0.45	1265.57

*- Starting Hydraulic Grade Elevation is Based off Flood Control District Plans Dated 7/31/97
- Difference in Datum Requires 1.773 Subtracted from the Flood Control Plans

$$\frac{(252)^2(.013)^2}{(2.22)(28.27)^2(1.5)^{4/3}} = 26.84$$

Add 1.3'

Add junction loss at stn. 14+35 ;

$$(H_j + D_1 - D_2)\left(\frac{A_1+A_2}{2}\right) = \frac{Q_2^2}{A_2 g} - \frac{Q_1^2}{A_1 g} = \left[\frac{\frac{241^2}{(28.3)(32.2)} - \frac{181^2}{(23.75)(32.2)}}{26.03}\right] + 6 - 5.5$$

$$= 1.3'$$

H.G.L. 64th Street From Polo Grounds to Thomas Rd.
Entellus Job No. 410.32
October 9, 1997

Description	Sta	Flowrate (cfs)	Area (sf)	Equivalent Circular Diameter (ft)	Perimeter (lf)	Pipe Length (ft)	Manning's "n"	Coefficient "K"	Hydraulic Radius (ft)	Slope (ft/ft)	Velocity (ft/s)	Elevation Change (ft)	Minor Loss (ft)	Total HGL Elevation (ft)	Road Elevation (ft)
Manhole #10	62+08.00													1264.00	1271.05
36" Pipe	61+94.50	58	7.06858	3	9.424778	13.5	0.013	0	0.75	0.0075	8.21	0.10		1264.10	
Pressure MH	61+89.50					5		0.05					0.05	1264.15	1270.83
36" Pipe	58+67.50	58	7.06858	3	9.424778	322	0.013	0	0.75	0.0075	8.21	2.42		1266.58	
Manhole # 9	58+62.50					5		0.05					0.05	1266.63	
36" Pipe	53+82.50	58	7.06858	3	9.424778	480	0.013	0	0.75	0.0075	8.21	3.61		1270.24	
Manhole # 8	53+77.50					5		0.05					0.05	1270.29	
36" Pipe	48+42.50	58	7.06858	3	9.424778	535	0.013	0	0.75	0.0075	8.21	4.02		1274.31	
Bend Manhole #7	48+37.50					5		0.39					0.41	1274.72	
36" Connector	48+04.50	58	7.06858	3	9.424778	33	0.013	0	0.75	0.0075	8.21	0.25		1274.97	
Entrance loss	48+04.50							0.4					0.42	1275.39	1276.00

OAK STREET

RUNOFF COEFFICIENT

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SHEET _____ OF _____

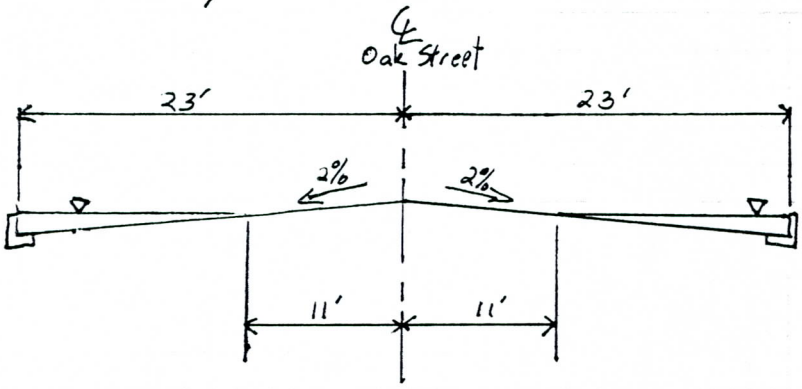
BY WAL DATE 9/8/97

CHECK ES DATE 09/16/97

CLIENT C. O. Scottsdale

JOB NAME 64th St. Improvements

JOB NO. 410.32



Water Surface:

one lane open each direction

width = 12'

depth = 12' * 0.02 = 0.24'

area = ½(12)(.24) = 1.44sf

water confined to road

width = 23'

depth = 0.46

area = 5.29sf

Road Slope = 0.0124%

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SHEET _____ OF _____

BY WAL DATE 9/5/97

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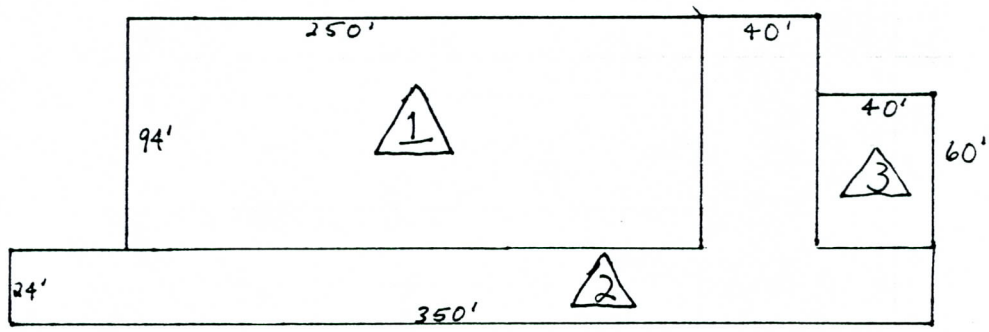
CLIENT C.O.S.

JOB NAME 64th Street

JOB NO. 410.32

Oak Street Basin 1N (11N)



1

$A = 250' * 94' = 23,500 \text{ sf}$

$C = 0.75(0.95) + 0.25(0.5(0.83) + 0.5(0.31))$

$C = 0.855$ for 1

2

$A = 40' * 94' + 24' * 350' = 12,160 \text{ sf}$

$C = 0.95$ for 2

3

$A = 40' * 60' = 2,400 \text{ sf}$

$C = 0.5(0.95) + 0.5(0.5(0.83) + 0.5(0.31))$

$C = 0.76$ for 3

Composite $C = 0.855\left(\frac{23,500}{23,500+12,160+2400}\right) + 0.95\left(\frac{12,160}{23,500+12,160+2400}\right) + 0.76\left(\frac{2400}{23,500+12,160+2400}\right)$

$C = 0.88$ for Basin 1N (11N)

$A_T = 23,500 + 12,160 + 2,400 = 38,060 \text{ sf} = 0.87 \text{ acres}$

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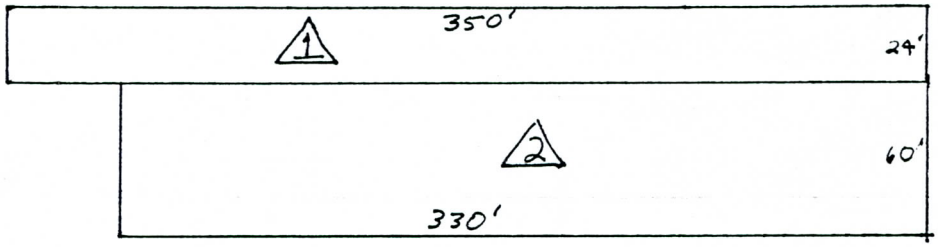
CLIENT C.O.S.

JOB NAME 64th St.

JOB NO. 410.32

Oak Street Basin 1S (11S)



1 $A = 24' * 350' = 8{,}400$ sf
$C = 0.95$

2 $A = 330' * 60' = 19{,}800$ sf
$C = 0.5(0.95) + 0.5(0.5(0.83) + 0.5(0.31))$
$C = 0.76$

$A_T = 8{,}400 + 19{,}800 = 28{,}200 = 0.65$ acres

Composite $C = 0.95\left(\frac{8400}{28{,}200}\right) + 0.76\left(\frac{19{,}800}{28{,}200}\right)$
$C = 0.82$

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BY WAL DATE 9/8/97

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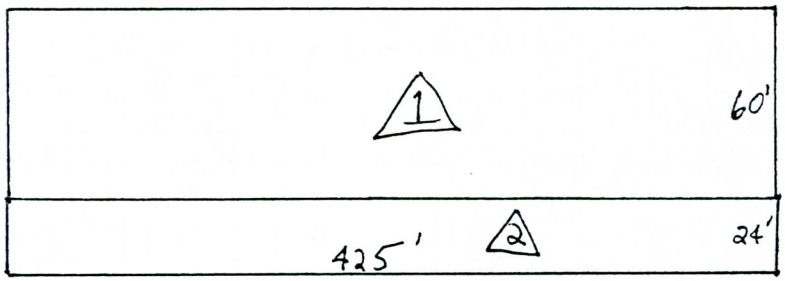
CLIENT C.O.S.

JOB NAME 64th St.

JOB NO. 410.32

Oak Street Basin 2N (12N)



1 $A = 425' * 60' = 25{,}500$ sf

$C = 0.5(0.95) + 0.5(0.5(0.83) + 0.5(0.31))$

$C = 0.76$ for 1

2 $A = 425 * 24 = 10{,}200$ sf

$C = 0.95$ for 2

$A_T = 25{,}500 + 10{,}200 = 35{,}700$ sf $= 0.82$ acres

Composite $C = 0.76\left(\frac{25{,}500}{35{,}700}\right) + 0.95\left(\frac{10{,}200}{35{,}700}\right)$

$C = 0.81$ for Basin 2N (12N)

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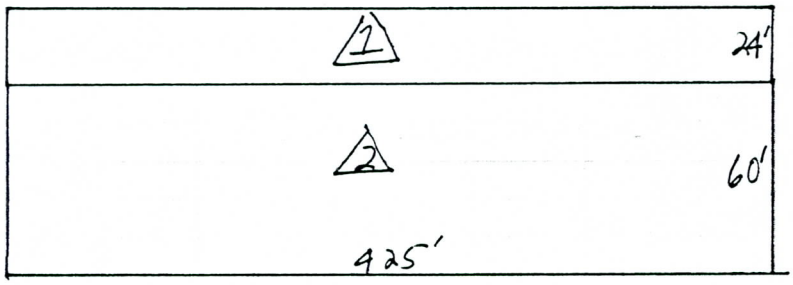
JOB NAME 64th St.

JOB NO. 410.32

Oak Street Basin 25 (125)



1 $A = 24 * 425 = 10{,}200\,sf$

$C = 0.95$ for 1

2 $A = 60 * 425 = 25{,}500\,sf$

$C = 0.5(0.95) + 0.5(0.5(0.83) + 0.5(0.31))$

$C = 0.76$ for 2

$A_T = 25{,}500 + 10{,}200 = 35{,}700\,sf = 0.82$ acres

Composite $C = 0.76\left(\frac{25{,}500}{35{,}700}\right) + 0.95\left(\frac{10{,}200}{35{,}700}\right)$

$C = 0.81$ for Basin 25 (125)

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BY WAL DATE 9/8/97

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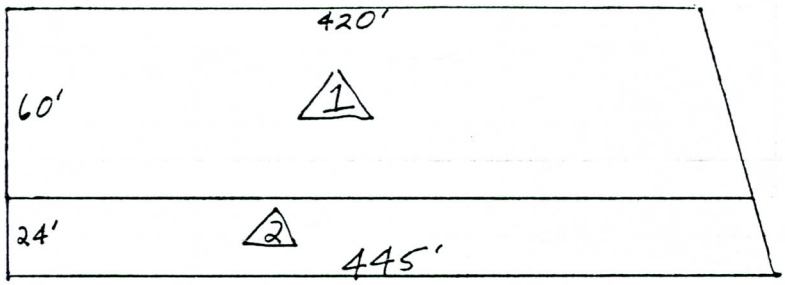
JOB NAME 64th St.

JOB NO. 410.32

Oak Street Basin 3N (13N)



1 $A = 60 * 420 + \frac{1}{2}(60)(17.9) = 25{,}737\ sf$

$C = 0.5(0.95) + 0.5(0.5(0.83) + 0.5(0.31))$

$C = 0.76$ for 1

2 $A = 24 * (\cancel{436.9}\ 437.9) + \frac{1}{2}(\cancel{8.1}\ 7.1)(24) = \cancel{10{,}583}\ 10{,}595\ sf$

$C = 0.95$ for 2

$A_T = 25{,}737 + 10{,}\cancel{583}\ 595 = 36{,}\cancel{320}\ 332\ sf = 0.83$ acres

Composite $C = 0.76\left(\frac{25{,}737}{36{,}320}\right) + 0.95\left(\frac{10{,}583}{36{,}320}\right)$

$C = 0.82$

Combining 2N + 3N (12N + 13N)

$A_T = 36{,}\cancel{320}\ 332 + 35{,}700 = 72{,}\cancel{020}\ 032\ sf = 1.65$ acres

Composite $C = 0.76\left(\frac{25{,}500}{72{,}020}\right) + 0.95\left(\frac{10{,}200}{72{,}020}\right) + 0.76\left(\frac{25{,}737}{72{,}020}\right) + 0.95\left(\frac{10{,}583}{72{,}020}\right)$

$C = 0.81$

Entellus™

SHEET _____ OF _____

BY SWAL DATE 9/8/97

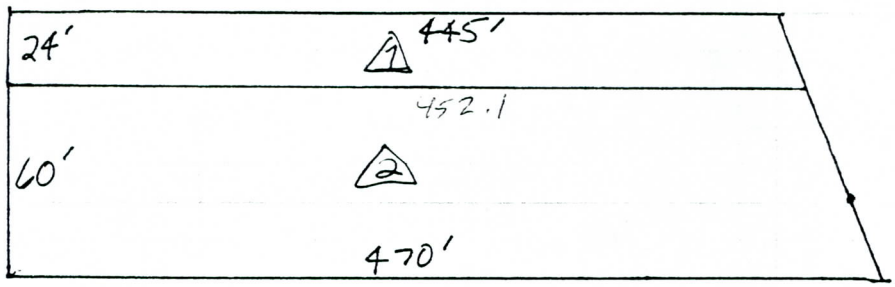
CHECK ES DATE 09/11/97

CLIENT C.O.S.

JOB NAME 64th St.

JOB NO. 410.32

Oak Street Basin 3S (13S)



1 $A = 24 * 445 + 0.5(\cancel{8.1}\ 7.1)(24) = \cancel{10,777}\ 10,765$ sf

$C = 0.95$

2 $A = 60 * \cancel{453.1}\ 452.1 + 0.5(17.9)(\cancel{24}\ 60) = \cancel{27,401}\ 27,663$ sf

$C = 0.5(0.95) + 0.5(0.5(0.83) + 0.5(0.31))$

$C = 0.76$

$A_T = \cancel{10,777}\ 10,765 + \cancel{27,401}\ 27,663 = \cancel{38,178}\ 38,428$ sf $= 0.88$ acres

Composite $C = 0.76\left(\frac{27,401}{38,178}\right) + 0.95\left(\frac{10,777}{38,178}\right)$

$C = 0.81$

Combining 2S + 3S (12S + 13S)

$A_T = \cancel{38,178}\ 38,428 + 35,700 = 73,878$ sf $= 1.70$ acres

Composite $C = 0.76\left(\frac{25,500}{73,878}\right) + .95\left(\frac{10,200}{73,878}\right) + 0.76\left(\frac{27,401}{73,878}\right) + 0.95\left(\frac{10,777}{73,878}\right)$

$C = 0.81$

Runoff Coefficients

Land Use	"C" Value Hydrologic Soil Group B	C	D
Composite Area-wide Values			
Commercial and industrial areas:	0.90		
Residential areas-single family (average lot size):			
R1-1-190:	0.33	0.50	0.58
R1-130:	0.35	0.51	0.59
R1-70:	0.37	0.52	0.60
R1-43:	0.38	0.55	0.61
R1-35 (35,000 sq. ft./lot):	0.40	0.56	0.62
R1-18 (18,000 sq. ft./lot):	0.43	0.58	0.64
R1-10 (10,000 sq. ft./lot):	0.47	0.62	0.67
R1-7 (7,000 sq. ft./lot):	0.51	0.64	0.70
Townhouses (R-2, R-4):	0.63	0.74	0.78
Apartments and condominiums (R-3, R-5):	0.76	0.83	0.87
Specific Surface Type Values			
Paved streets or parking lot (concrete or asphalt), roofs, dirveways, etc.	0.95		
Lawns, golf courses, and parks (grassed areas):	0.33	0.56	0.66
Undisturbed natural desert or desert landscaping (no impervious weed barrier):	0.31	0.48	0.56
Desert landscaping (with impervious weed barrier)	0.83	0.83	0.83
Mountain terrain - slopes greater than 10%:	0.70	0.70	0.70
Agricultural areas (Flood Irrigated Fields):	0.20	0.20	0.20

FIGURE 2.2-17

Runoff Coefficients (C) for use with the Rational Formula

1O-YR RUNOFF

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64th St Q's

CLIENT C.O.S.

JOB NAME 64th St. Improvements

JOB NO. 410.

AREA : 64th St. 1E

C: $C = 0.88$

I: Length = 755' $S = 0.0056$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0056^{0.5}\, 0.32^{0.67}$$

$$= 2.44 \text{ fps}$$

$$T_c = 755 / (2.44 * 60) = 5.2 \text{ min}$$

Fig. 2.2-13 : Rainfall Intensity I_{10} = ~~6.75~~ 6.0 in/hr.

A: Area = 0.70 acres

$$Q_{10} = C\, I_{10}\, A\, F_{10,C} + Q_b$$

$$= (0.88)(\cancel{6.75}\ 6.0)(0.70)1.00 + 0$$

$$Q_{10} = \cancel{4.16} \text{ cfs } 3.70 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{10}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{\cancel{4.16}\ 3.70\,(0.016)(0.02)}{0.56\,(0.0056)^{0.5}}\right)^{3/8}$$

$d = \cancel{0.27'}$ 0.26' water surface width = ~~0.27~~ 0.26 / 0.02 = ~~13.5'~~ 13.0'

< 16' OK

Fig 3-46 $Q_i = \cancel{0.81}\ 0.88\ (\cancel{4.16}\ 3.70) = \cancel{3.37}\ 3.26$ cfs

$Q_b = Q - Q_i = \cancel{4.16 - 3.37} = \cancel{0.79}$ cfs

3.70 − 3.26 = 0.44 cfs

∴ Use C.O.P. Catch Basin Type M-1, L = 10'

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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA : 64th St. 1E

C: $C = 0.88$

I: Length = 755' $S = 0.0056$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0056^{0.5}\, 0.32^{0.67}$$

$$= 2.44 \text{ fps}$$

$$T_c = 755 / (2.44 * 60) = 5.2 \text{ min}$$

Fig. 2.2-13 : Rainfall Intensity I_{10} = ~~6.75~~ 6.0 in/hr.

A: Area = 0.70 acres

$$Q_{10} = C\, I_{10}\, A\, F_{10/C} + Q_b$$

$$= (0.88)(\cancel{6.75}\ 6.0)(0.70)1.00 + 0$$

$$Q_{10} = \cancel{4.16} \text{ cfs } 3.70 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{10}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{\cancel{4.16}\ 3.70\,(0.016)(0.02)}{0.56\,(0.0056)^{0.5}}\right)^{3/8}$$

d = ~~0.27'~~ 0.26' water surface width = ~~0.27~~ 0.26 / 0.02 = ~~13.5'~~ 13.0'

< 16' OK

Fig 3-46 Q_i = ~~0.81~~ 0.88 (~~4.16~~ 3.70) = ~~3.37~~ 3.26 cfs

$Q_b = Q - Q_i$ = ~~4.16 - 3.37~~ = ~~0.79~~ cfs

3.70 - 3.26 = 0.44 cfs

∴ Use C.O.P. Catch Basin Type M-1, L=10'

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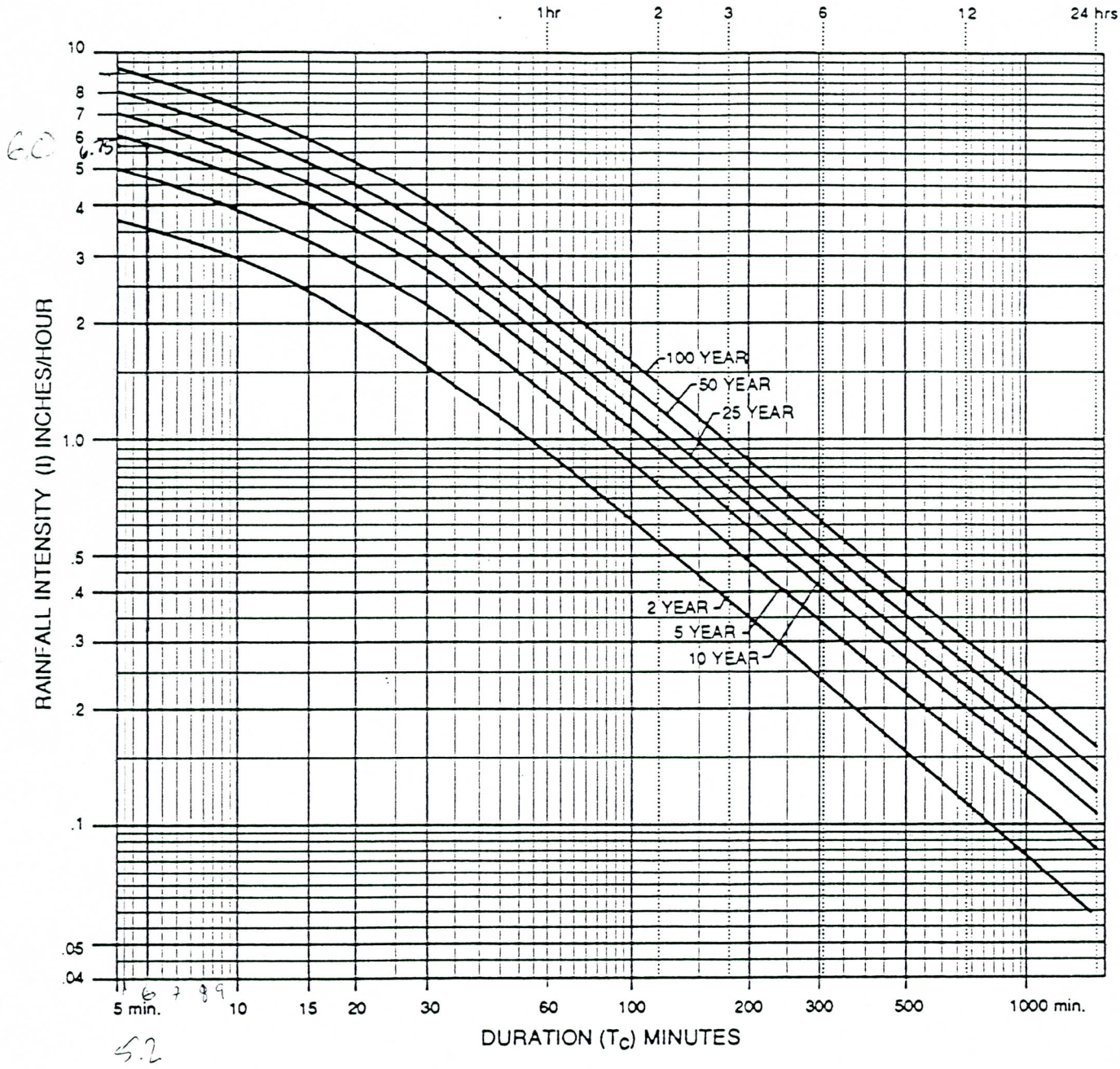

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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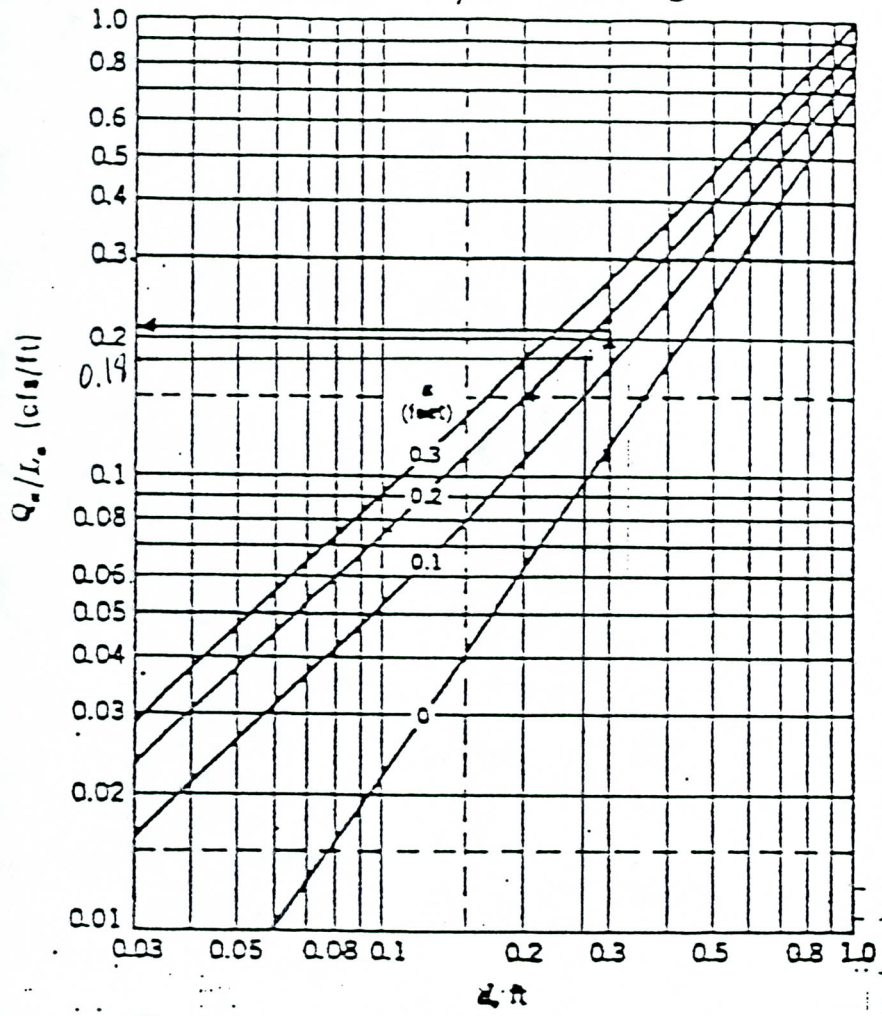
JOB NAME 64th St. Improvements JOB NO. 410.32



a

Fig. 3-46

DESIGN CHARTS FOR

CURB-OPENING INLETS ON

CONTINUOUS GRADES

AREA: 64th St. 1 E

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' d = ~~0.27~~ 0.26'

a = 0.167' (2") a = 0.167'

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.18$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs Q_a = ~~4.19~~ cfs 3.72

L = 10' L = 13'

Find: Q

$\frac{0.167}{0.26} = 0.6$

$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = \cancel{0.62}$

$3.7/18 = 20.6$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = \cancel{23.3}$

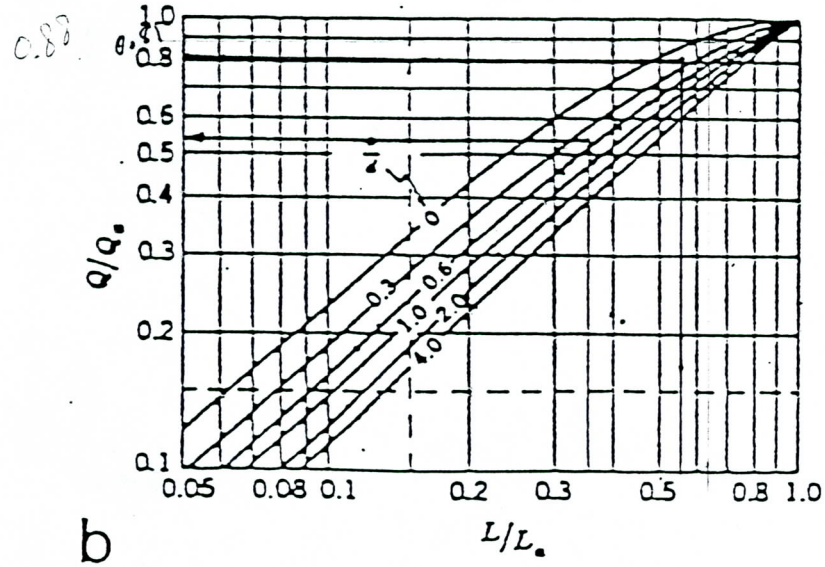
$13/20.6 = 0.6$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.56$

0.88

$\frac{Q}{Q_a} = 0.53$ $Q/Q_a = \cancel{0.81}$

Q = (0.53)(5.9) = 3.1 cfs



b

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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak St. 1N (1N)

C: $C = 0.88$

I: Length = 350' $S = 0.0124$ ft/ft

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\ 0.24^{0.67}$$

$$= 3.00 \text{ fps}$$

$$T_c = 350'/(3.00 * 60) = 1.9 \text{ min} \Rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{10} = 6.1$ in/hr.

A: Area = 0.87 acres

$$Q_{10} = C\, I_{10}\, A\, F_{10} + Q_b$$
$$= (0.88)(6.1)(0.87)1.00 + 0$$
$$Q_{10} = 4.67 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{10}\ n\ S_x}{0.56\ S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{4.67(0.016)(0.02)}{0.56\ (0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.247$ water surface width $= 0.247/0.02 = 12.35'$ Ok

Fig 3-46 $Q_i = 0.85(4.67) = 3.97$ cfs

$Q_b = Q - Q_i = 4.67 - 3.97 = 0.70$ cfs

∴ Use C.O.P. Catch Basin Type M-1, L=17'

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JOB NAME 64th St. Improvements JOB NO. 410.32

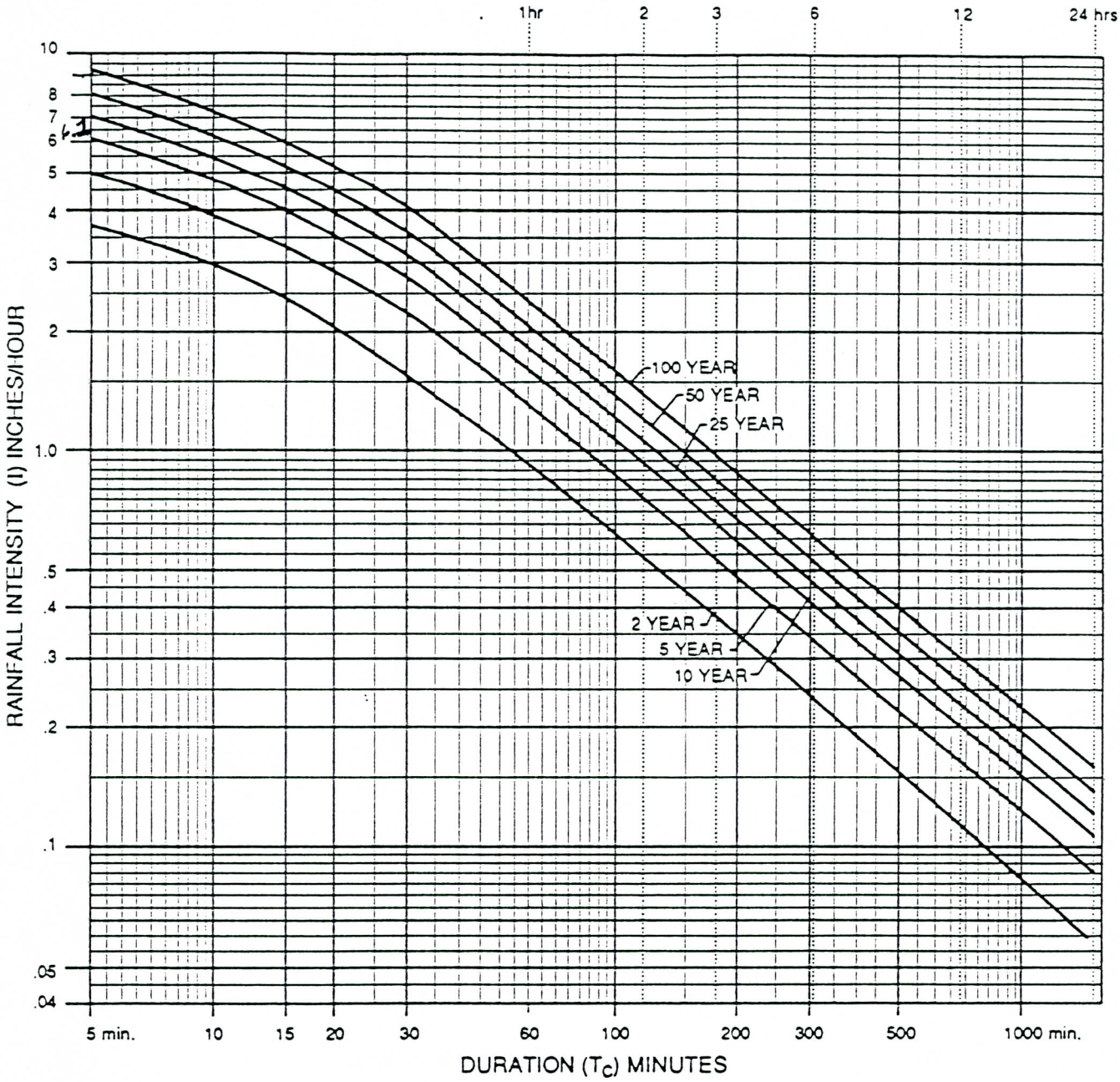

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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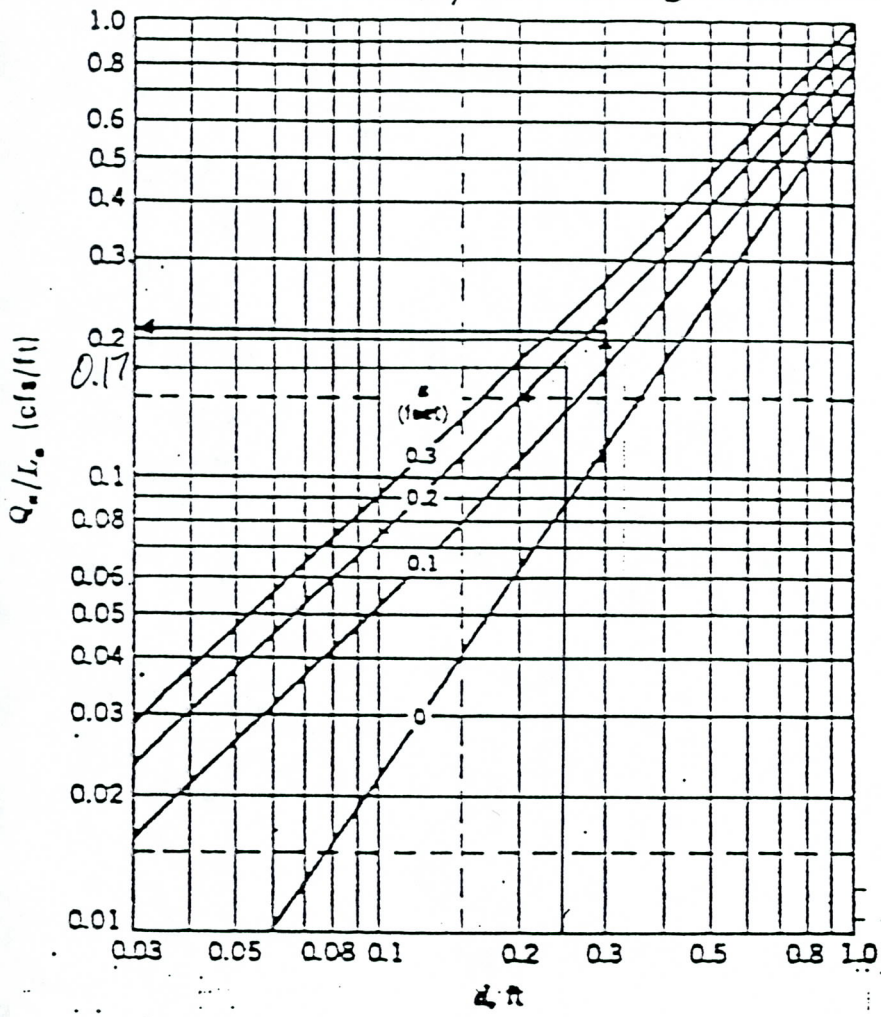
JOB NAME 64th St. Improvements JOB NO. 410.32



a

Fig. 3-46

DESIGN CHARTS FOR

CURB-OPENING INLETS ON

CONTINUOUS GRADES

AREA : Oak St. 1N (11N)

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' $d = 0.25$

a = 0.167' (2") $a = 0.167'$

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.17$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs $Q_a = 4.67$ cfs

L = 10' $L = 13'$ or $20'$

Find: Q

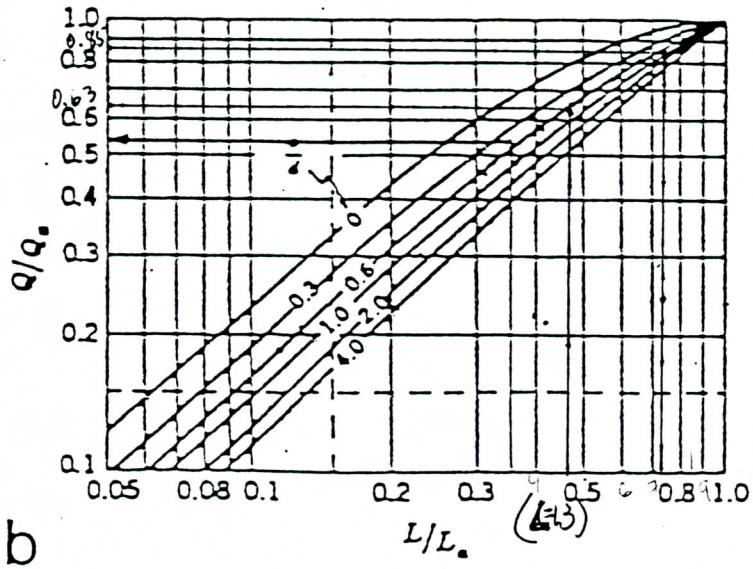
$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = 0.67$

$L_a = \frac{5.9}{0.21} = 28'$ $\frac{4.67}{.17}$ $L_a = 27.5'$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.47$ or

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = 0.63$ or 0.85

Q = (0.53)(5.9) = 3.1 cfs



b

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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak St. 2N + 3N (Combined) (12N + 13N)

C: $C = 0.81$

I: Length = 870' $S = 0.0124$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\, 0.24^{0.67}$$

$$= 3.00 \text{ fps}$$

$$T_c = 870 / (3.00 * 60) = 4.8 \text{ min} \Rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{10} = 6.1$ in/hr.

A: Area = 1.65 acres

$$Q_{10} = C\, I_{10}\, A\, F_{10} + Q_b$$
$$= (0.81)(6.1)(1.65)1.00 + 0.70$$
$$Q_{10} = 8.85 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{10}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{8.85(0.016)(0.02)}{0.56\,(0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.31$ water surface width $= 0.31/0.02 = 15.5$

Fig 3-46 $Q_i = 8.85(0.69) = 6.11$ cfs

$Q_b = Q - Q_i = 8.85 - 6.11 = 2.74$ cfs

∴ Use C.O.P. Catch Basin Type M-1, L=17'

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JOB NAME 64th St. Improvements

JOB NO. 410.32

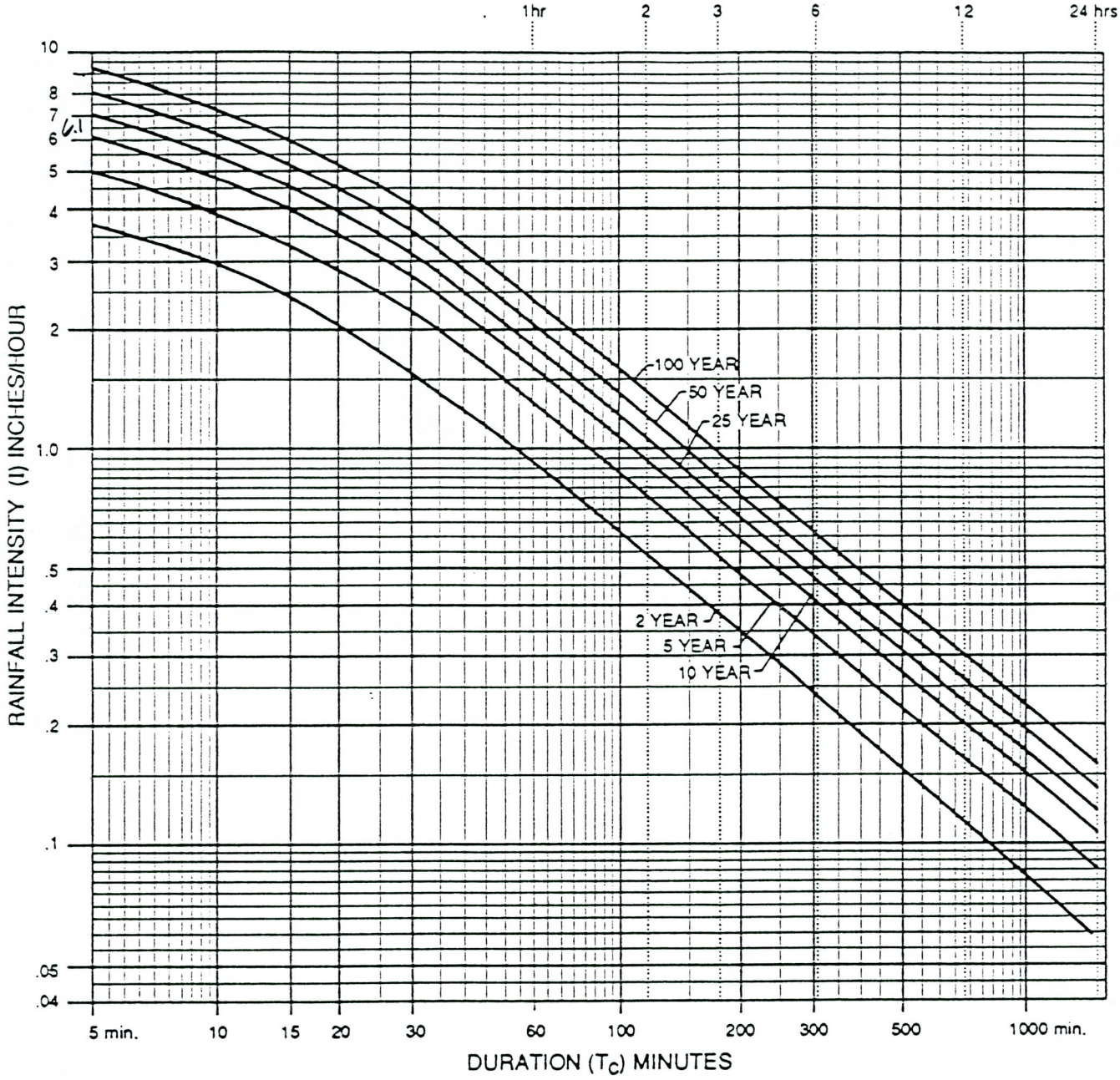

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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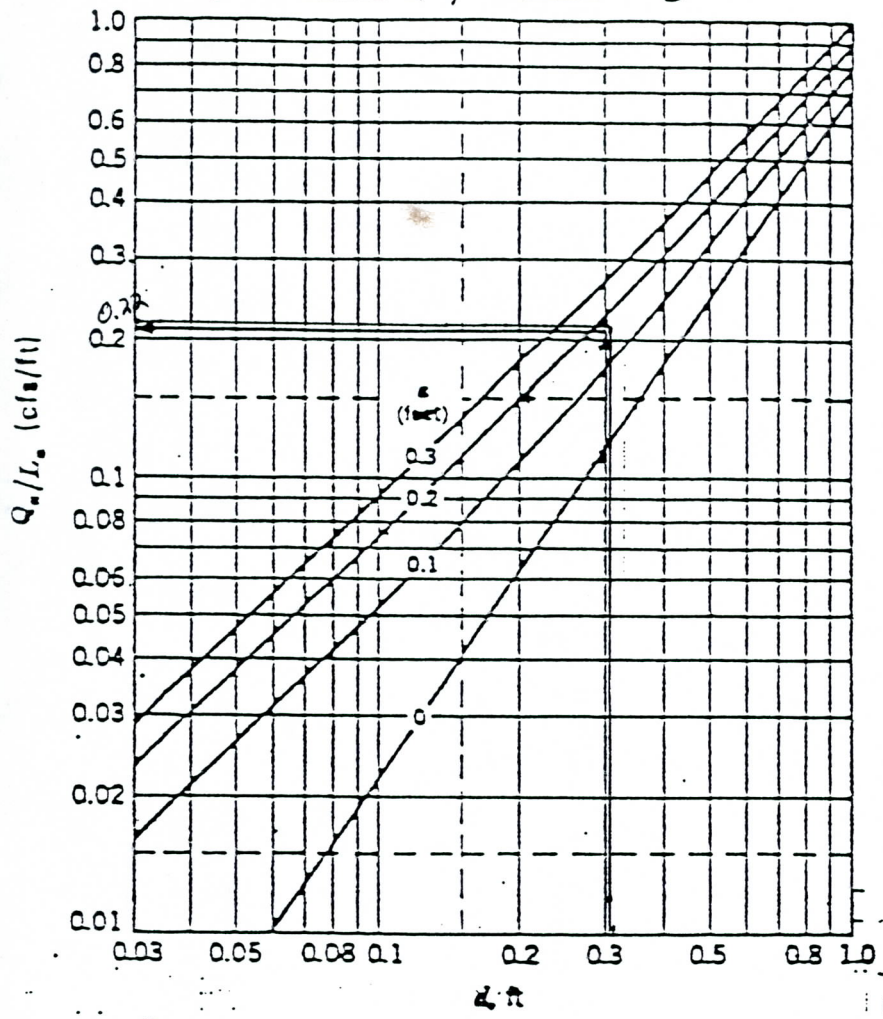


Fig. 3-46

DESIGN CHARTS FOR

CURB-OPENING INLETS ON

CONTINUOUS GRADES

AREA: 12N + 13N

EXAMPLE USING FIGURE 3-46a

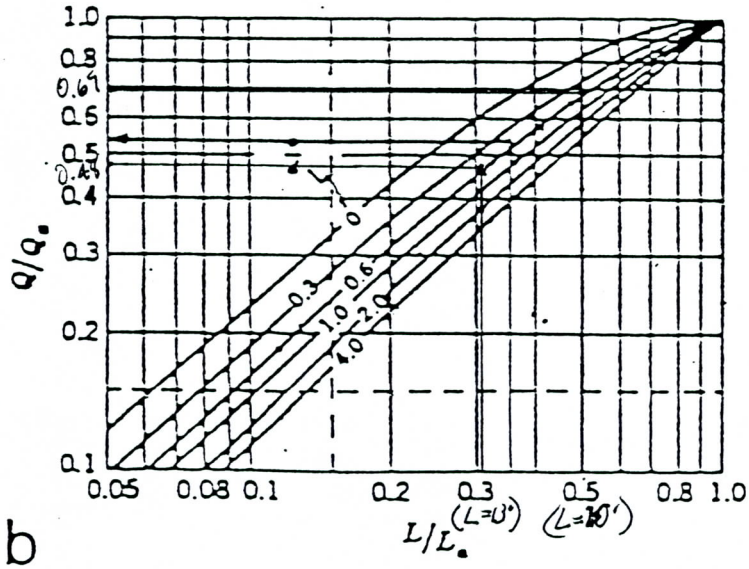
Given:

d = 0.3' d = 0.31

a = 0.167' (2") a = 0.167'

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.22$



EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs $Q_a = 8.85$

L = 10' $L = 13'$ or $20'$

Find: Q

$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = 0.54$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = 40.2$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.32$ or 0.5

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = 0.48$ or 0.69

Q = (0.53)(5.9) = 3.1 cfs

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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak St. IS (11 S)

C: $C = 0.82$

I: Length = 350' $S = 0.0124$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\ 0.24^{0.67}$$

$$= 3.00 \text{ fps}$$

$$T_c = 350 / (3.00 * 60) = 1.9 \text{ min} \rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{10} = 6.1$ in/hr.

A: Area = 0.65

$$Q_{10} = C\, I_{10}\, A\, F_{10} + Q_b$$

$$= (0.82)(6.1)(0.65)1.00 + \cancel{0.79}\ 0.94$$

$$Q_{10} = \cancel{4.04}\ 3.69 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{10}\ n\ S_x}{0.56\ S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{\cancel{4.04}\ 3.69\ (0.016)(0.02)}{0.56\ (0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.23'$ water surface width $= 0.23/0.02 = 11.5'$ ok

Fig 3-46 $Q_i = \cancel{0.89}\ 0.71\ (\cancel{4.04}\ 3.69) = \cancel{3.60}\ 2.62$ cfs

$Q_b = Q - Q_i = \cancel{4.04 - 3.60} = \cancel{0.44}$ cfs

$3.69 - 2.62 = 1.07$

∴ Use C.O.P. Catch Basin Type M-1; L = ~~17'~~ 10'

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JOB NAME 64th St. Improvements JOB NO. 410.32

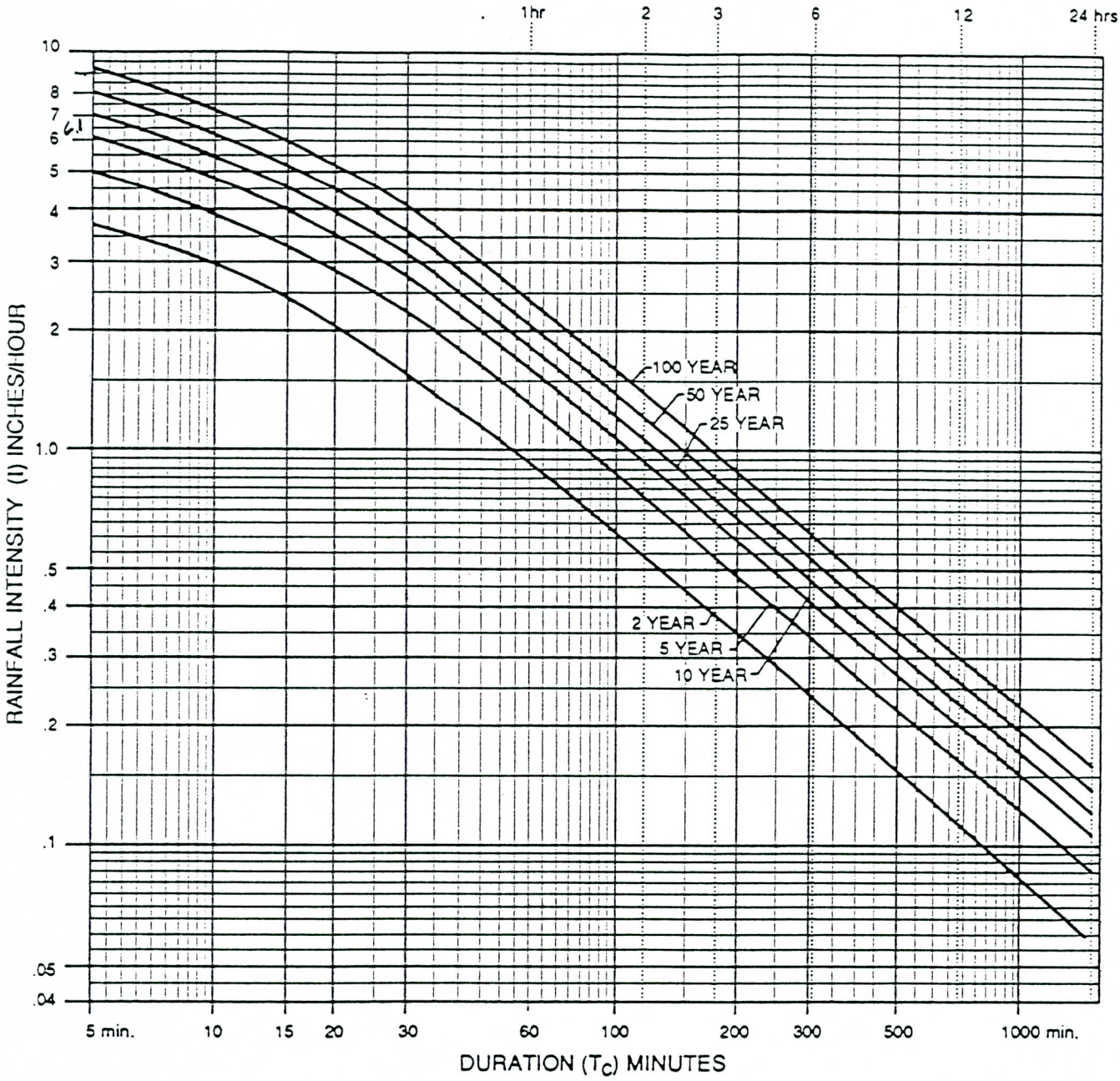

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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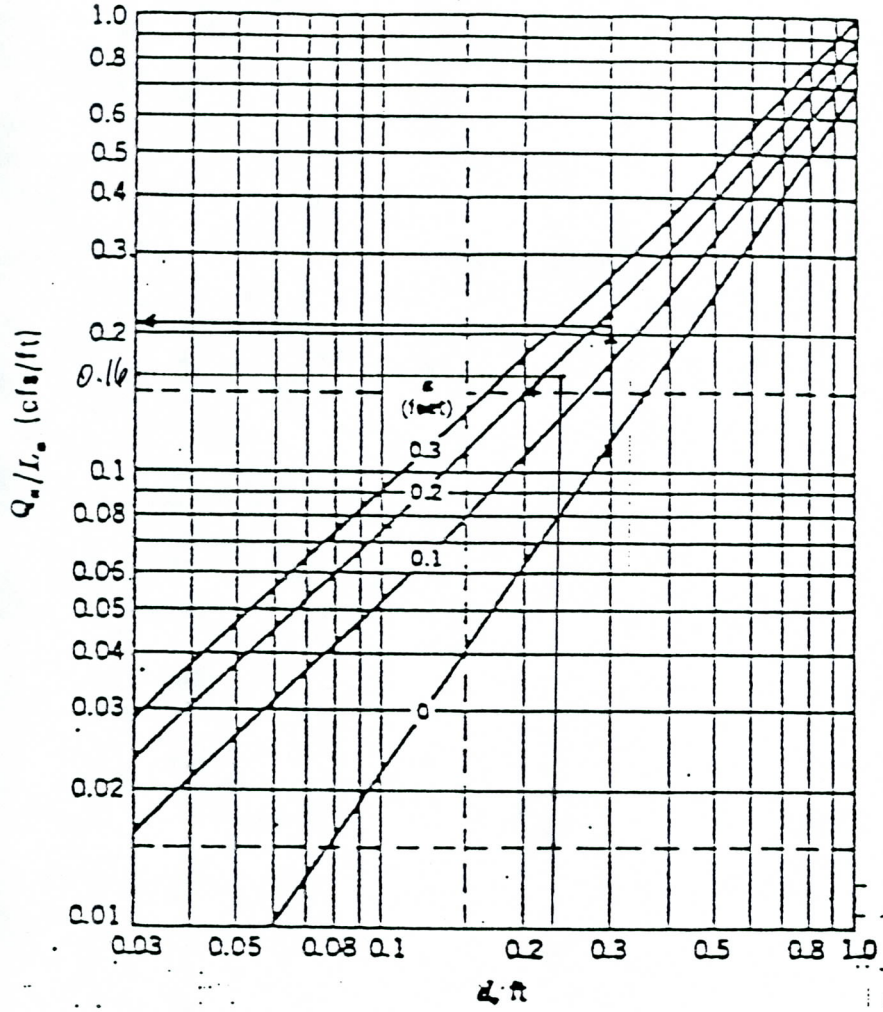
CLIENT C.O.S

JOB NAME 64th St. Improvements JOB NO. 410.32



a

Fig. 3-46

DESIGN CHARTS FOR CURB-OPENING INLETS ON CONTINUOUS GRADES

AREA : Oak St. 15 (115)

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' d = 0.23

a = 0.167' (2") a = 0.167

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.16$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and 3.69

Q_a = 5.9 cfs $Q_a = \cancel{4.04}$ cfs

L = 10' L = 13' or 20'

Find: Q

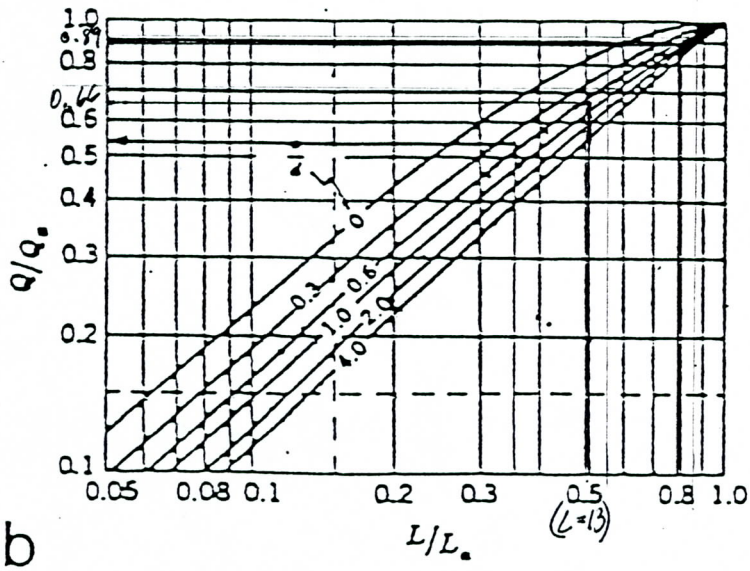
$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = 0.73$

$L_a = \frac{5.9}{0.21} = 28'$ (3.69/.16) $L_a = \cancel{25.3}'$ (23.1)

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = \cancel{0.51}$ (0.56) or $\cancel{0.7}$ (0.8)

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = \cancel{0.66}$ (0.71) or $\cancel{0.89}$ (0.92)

Q = (0.53)(5.9) = 3.1 cfs



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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak St. 2S & 3S (combined) (12S & 13S)

C: $C = 0.81$

I: Length = 870' $S = 0.0124$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\, 0.24^{0.67}$$

$$= 3.00 \text{ fps}$$

$$T_c = 870' / (300 * 60) = 4.8 \text{ min} \rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{10} = 6.1$ in/hr.

A: Area = 1.70 acres

$$Q_{10} = C\, I_{10}\, A\, F_{10} + Q_b$$

$$= (0.81)(6.1)(1.70)1.00 + \cancel{0.44}\ 1.07$$

$$Q_{10} = \cancel{8.84}\ 9.47 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{10}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{\cancel{8.84}\ 9.47\ (0.016)(0.02)}{0.56\ (0.0124)^{0.5}}\right)^{3/8}$$

$d = \cancel{0.31}\ 0.32$ water surface width $= \cancel{0.31}\ 0.32 / 0.02 = \cancel{15.5}\ 16.0'$ OK

Fig 3-46 $Q_i = 0.69\ (\cancel{8.84}\ 9.47) = \cancel{6.10}\ 6.53$ cfs

$Q_b = Q - Q_i = \cancel{2}8.85 - 6.10 = 2.75$ cfs

9.47 − 6.53 = 2.94 cfs

∴ Use C.O.P. Catch Basin Type M-1, L=17'

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JOB NAME 64th St. Improvements JOB NO. 410.32

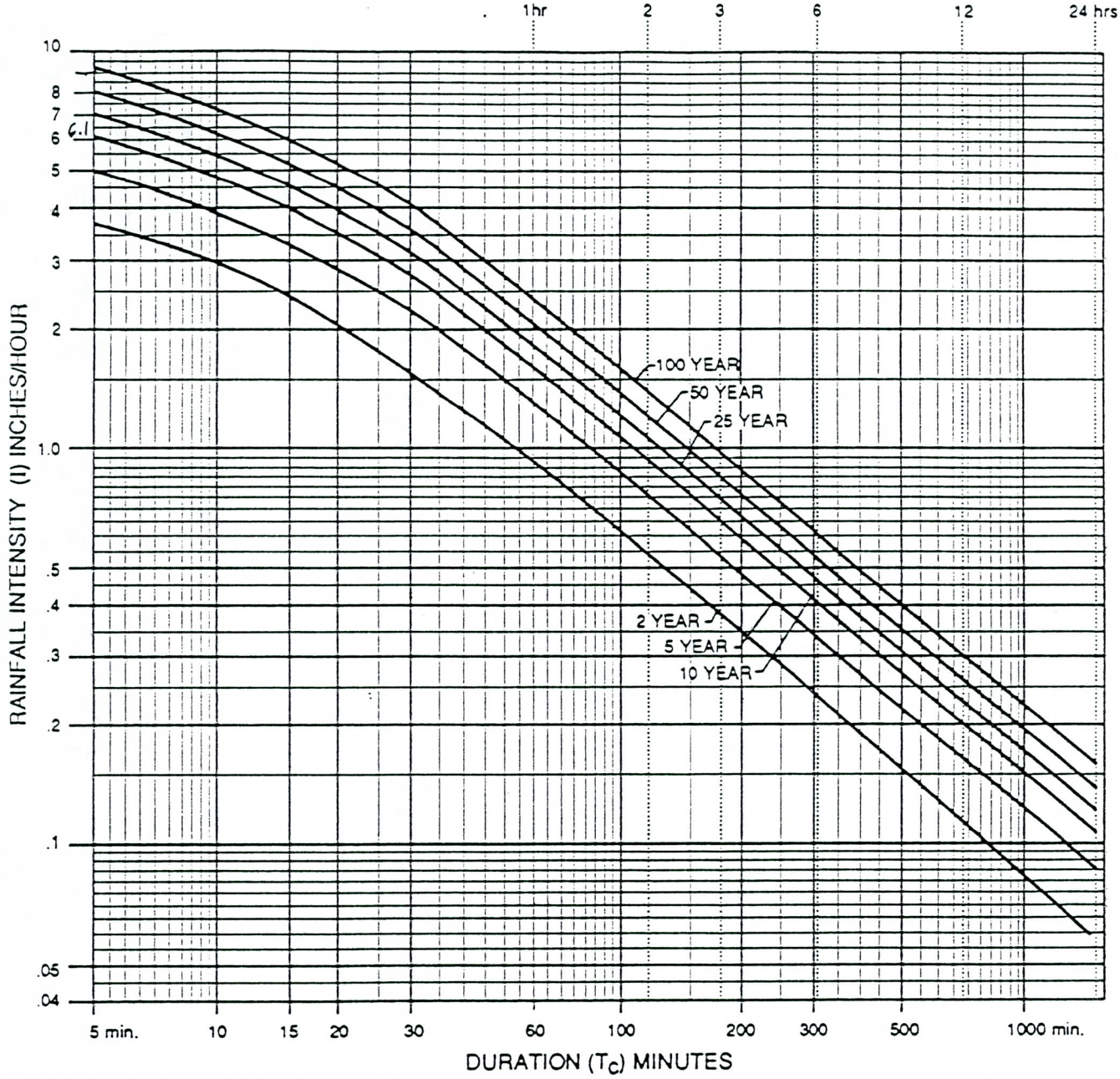

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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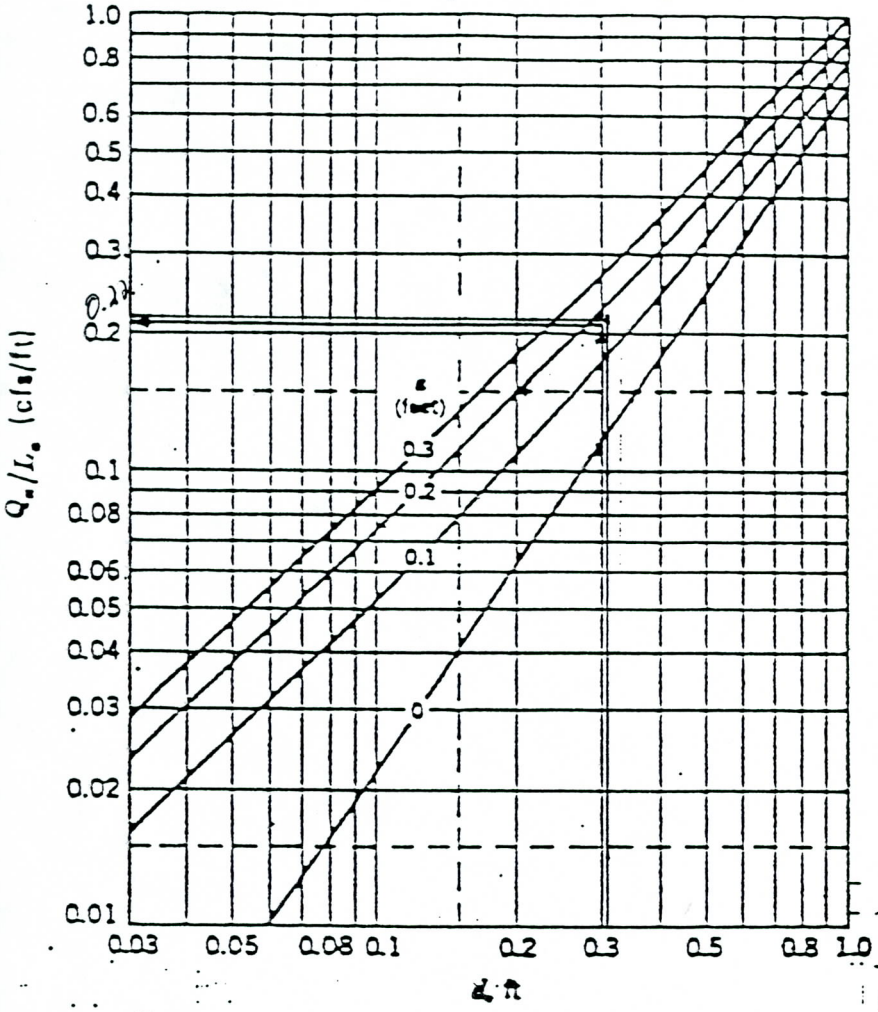
JOB NAME 64th St. Improvements

JOB NO. 410.32



a

Fig. 3-46

DESIGN CHARTS FOR

CURB-OPENING INLETS ON

CONTINUOUS GRADES

AREA : Oak St. 25+35 (125+135)

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' $d = \cancel{0.31}\ 0.32$

a = 0.167' (2") $a = 0.167$

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = \cancel{0.22}\ 0.23$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs $Q_a = \cancel{8.84}\ 9.47$ cfs

L = 10' $L = 8'$ or $20'$

Find: Q

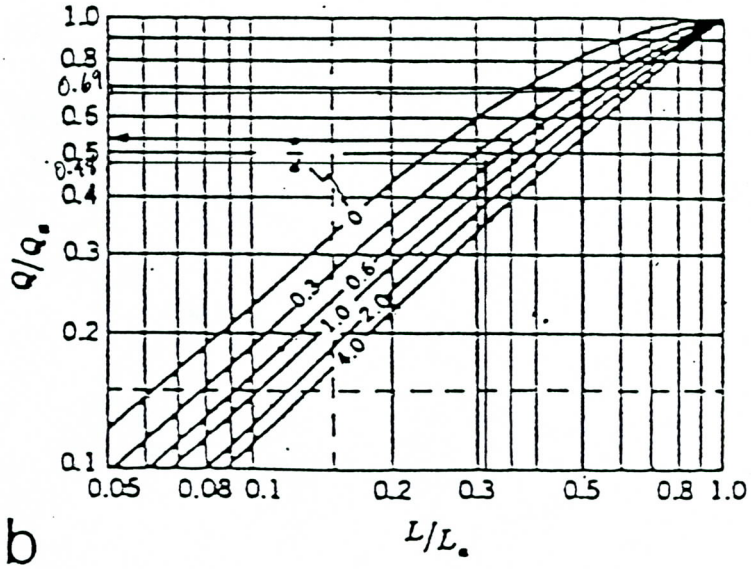
$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $a/d = \cancel{0.54}\ 0.55$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = \cancel{40.2}\ 41.2'$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.32$ or 0.51

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = 0.48$ or 0.69

Q = (0.53)(5.9) = 3.1 cfs



b

100-YR RUNOFF

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JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: 64th St. IE

C: $C = 0.88$

I: Length = 755' $S = 0.0056\%$

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0056^{0.5}\, 0.32^{0.67}$$

$$= 2.44 \text{ fps}$$

$$T_c = 755 / (2.44 * 60) = 5.2 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{100} = \cancel{8.8}$ 9.1 in/hr.

A: Area = 0.70 acres

$$Q_{100} = C\, I_{100} A F_{100} + Q_b$$

$$= (0.88)(\cancel{8.8}\ 9.1)(0.70)1.25 + 0$$

$$Q_{100} = \cancel{6.78}\ 7.01 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{100}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{\cancel{6.78}\ 7.01\,(0.016)(0.02)}{0.56\,(0.0056)^{0.5}}\right)^{3/8}$$

$d = 0.33$ water surface width $= 0.33/0.02 = 16.5$ OK confine w/in st

Fig 3-46 $Q_i = \cancel{6.78}\ 7.01(0.65) = \cancel{4.41}\ 4.56$ cfs

$Q_b = Q - Q_i = \cancel{6.78 - 4.41 = 2.37}$ cfs

$7.01 - 4.56 = 2.45$ cfs

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JOB NAME 64th St. Improvements JOB NO. 410.32

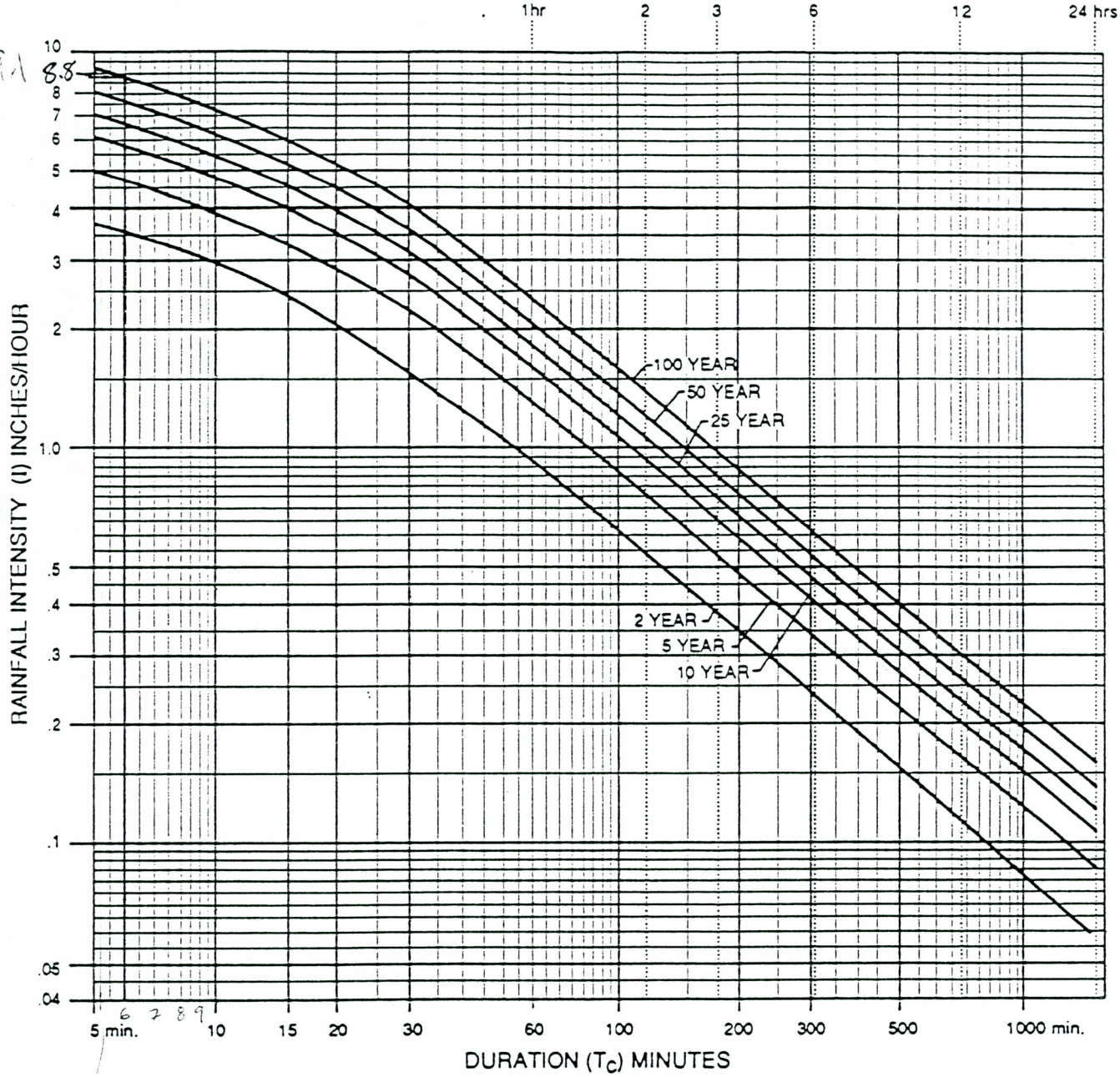

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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JOB NAME 64th St. Improvements

JOB NO. 410.32

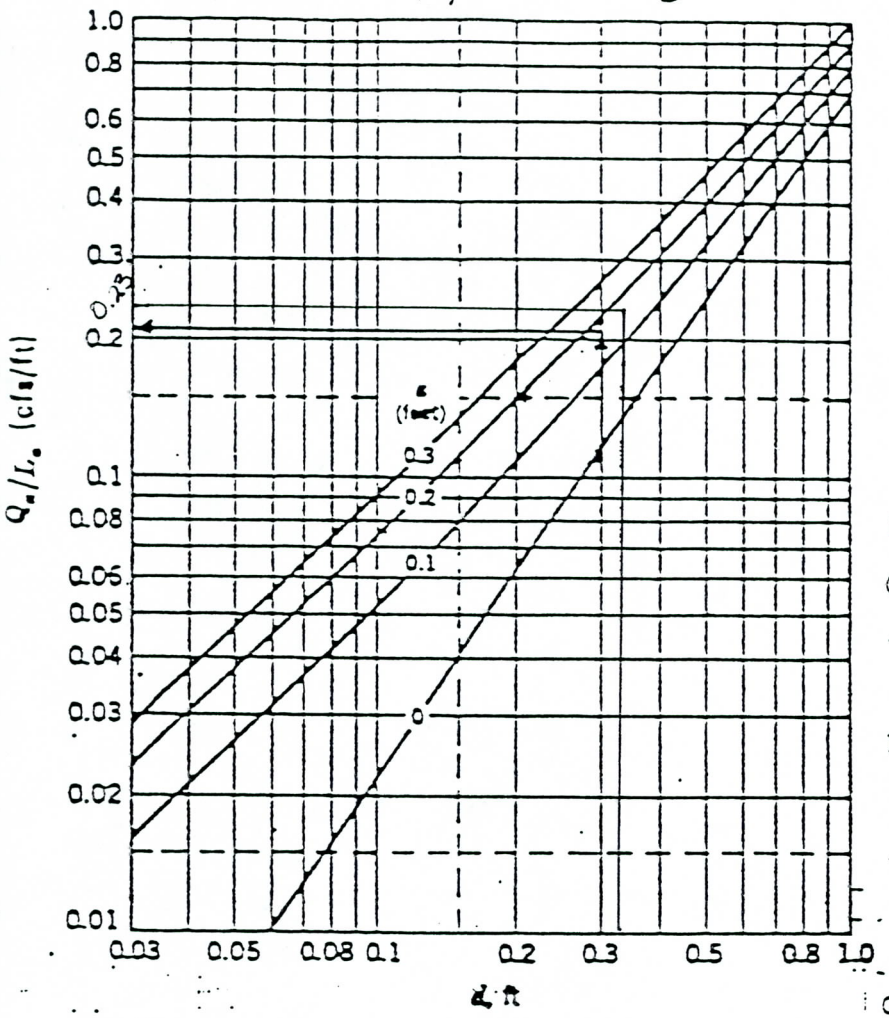


Fig. 3-46

DESIGN CHARTS FOR

CURB-OPENING INLETS ON

CONTINUOUS GRADES

AREA: 64th St. 1E

EXAMPLE USING FIGURE 3-46a

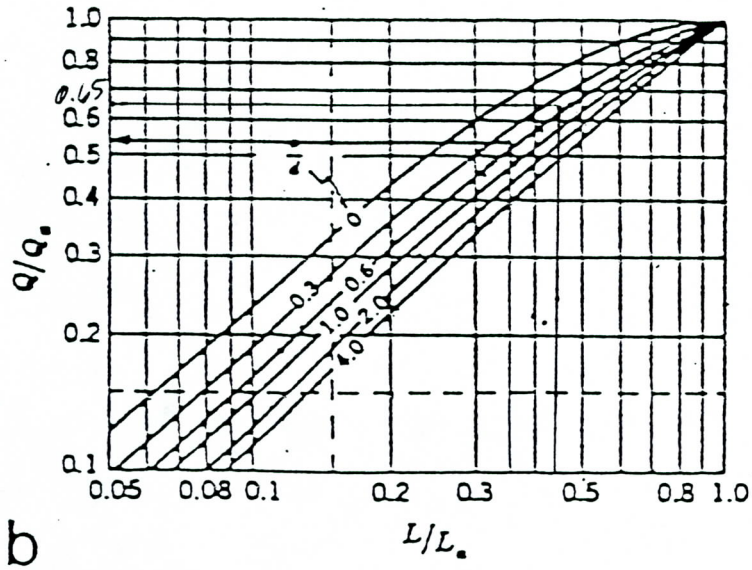
Given:

d = 0.3' $d = 0.33'$

a = 0.167' (2") $a = 0.167'$

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.23$



EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs $Q_a = \cancel{6.78}$ 7.01

L = 10' $L = 13'$

Find: Q

$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $a/d = 0.51$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = \cancel{29.5'}$ 30.5

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = \cancel{0.44}$ $\frac{13}{30.5} = 0.43$

$\frac{Q}{Q_a}$ = 0.53 $\frac{Q}{Q_a} = 0.65$

Q = (0.53)(5.9) = 3.1 cfs

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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak Street Basin 1N (11N)

C: $C = 0.88$

I: Length = 350' $S = 0.0124$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5} \; 0.46^{0.67}$$

$$= \cancel{4.91}\ 4.63 \text{ fps}$$

$$T_c = 350' / (\cancel{4.91}\ 4.63 * 60) = \cancel{2.95}\ 1.26 \text{ min} \rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{100} = 9.2$ in/hr.

A: Area = 0.87 acres

$$Q_{100} = C\, I_{100}\, A\, F_{100} + Q_b$$
$$= (0.88)(9.2)(0.87)1.25 + 0$$
$$Q_{100} = 8.80 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{100}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{8.80(0.016)(0.02)}{0.56\,(0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.31$ water surface width $= 0.31/0.02 = 15.5$
< 23 ∴ Ok

Fig 3-46 $Q_i = 0.70(8.80) = 6.16$ cfs
$Q_b = Q - Q_i = 8.80 - 6.16 = 2.64$ cfs

∴ use C.O.P. Catch Basin Type M-1, L=17

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JOB NAME 64th St.

JOB NO. 410.32

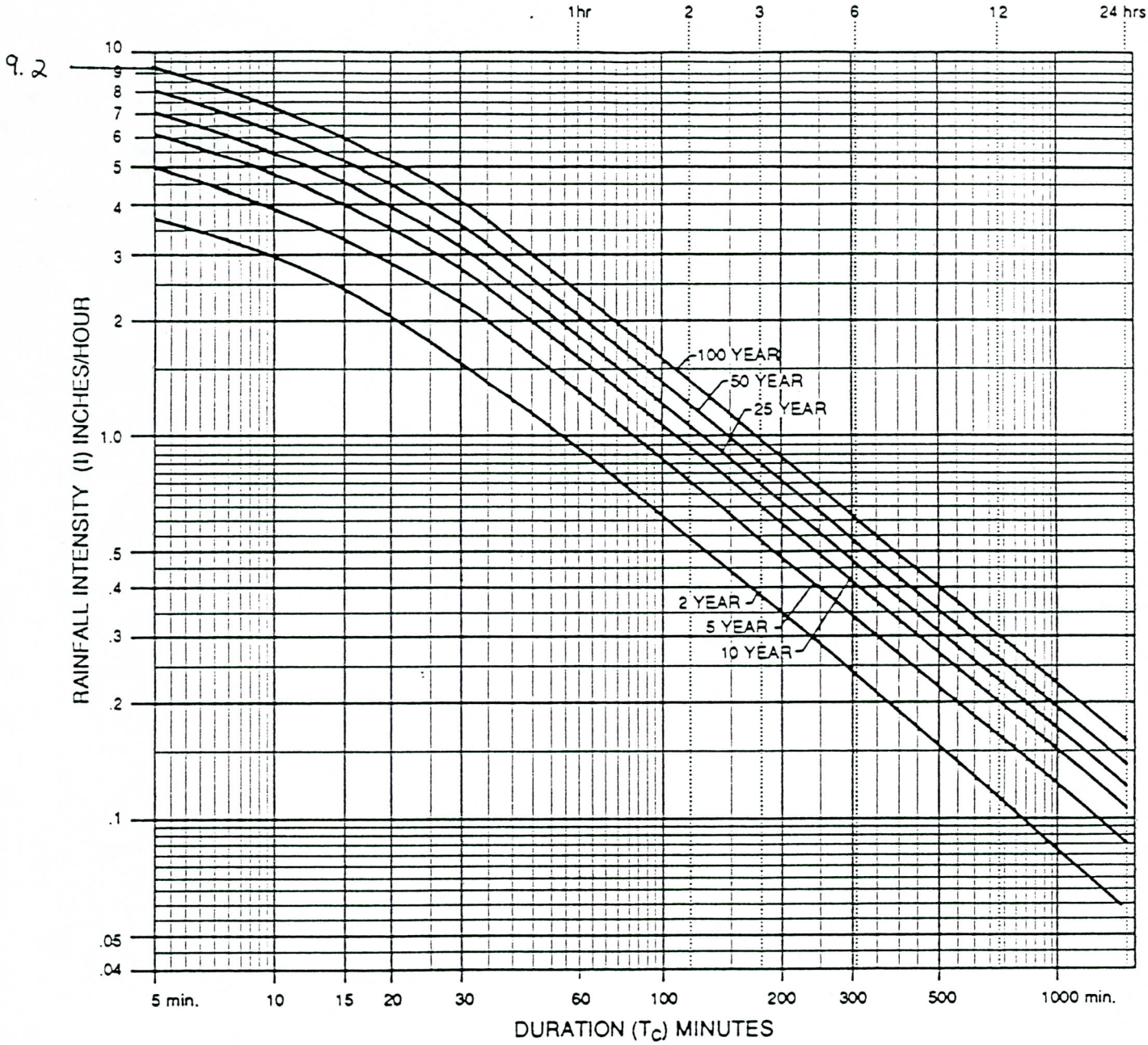

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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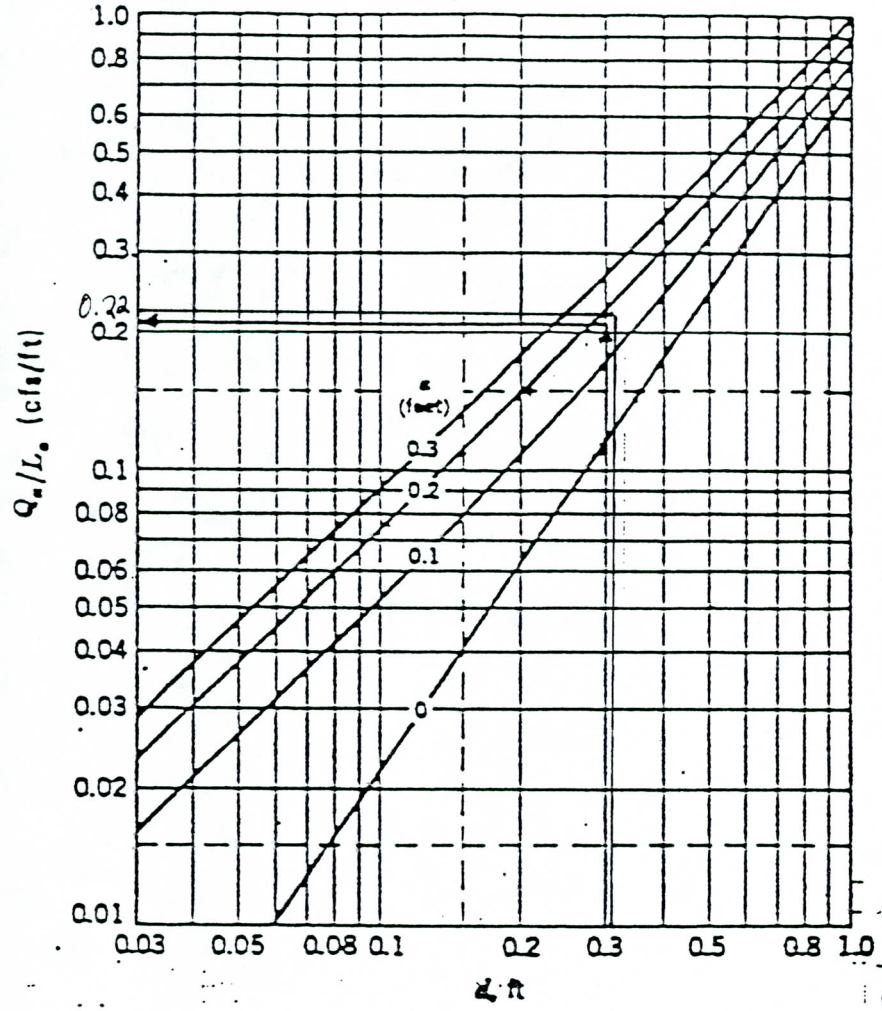
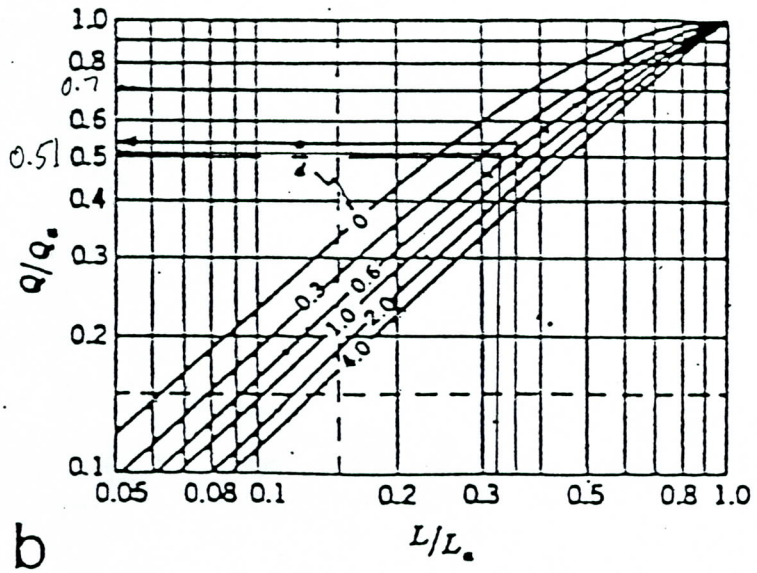
JOB NAME 64th St. Improvements JOB NO. 410.32



a



b

Fig. 3-46

DESIGN CHARTS FOR CURB-OPENING INLETS ON CONTINUOUS GRADES

AREA: Oak Street IN (11N)

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' $d = 0.31'$

a = 0.167' (2") $a = 0.167'$

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.22$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs $Q_a = 8.80$ cfs

L = 10' $L = 13'$ or $L = 20'$

Find: Q

$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = 0.54$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = 40$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.325$ or $= 0.5$

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = 0.51$ or 0.

Q = (0.53)(5.9) = 3.1 cfs

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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak Street Basins 2N + 3N (combined) (12N + 13N)

C: $C = 0.81$

I: Length = 870 $S = 0.0124$ ft/ft

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\, 0.\cancel{46}^{0.67}$$

$$= \cancel{4.91}\ 4.63 \text{ fps}$$

$$T_c = 870 / (\cancel{4.91}\ 4.63 * 60) = \cancel{2.95}\ 3.13 \text{ min} \rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{100} = 9.2$ in/hr.

A: Area = 1.65 acres

$$Q_{100} = C\, I_{100}\, A\, F_{100} + Q_b$$
$$= (0.81)(9.2)(1.65)1.25 + 2.64$$
$$Q_{100} = 18.01 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{100}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{18.01\,(0.016)(0.02)}{0.56\,(0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.41'$ water surface width $= 0.41'/0.02 = 20.5'$ < 23 ok

Fig 3-46 $Q_i = 0.5(18.01) = 9.01$ cfs

$Q_b = Q - Q_i = 18.01 - 9.01 = 9.00$ cfs

∴ Use C.O.P. Catch Basin Type M-1, L=17'

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CLIENT C.O.S.

JOB NAME 64th St.

JOB NO. 910.32

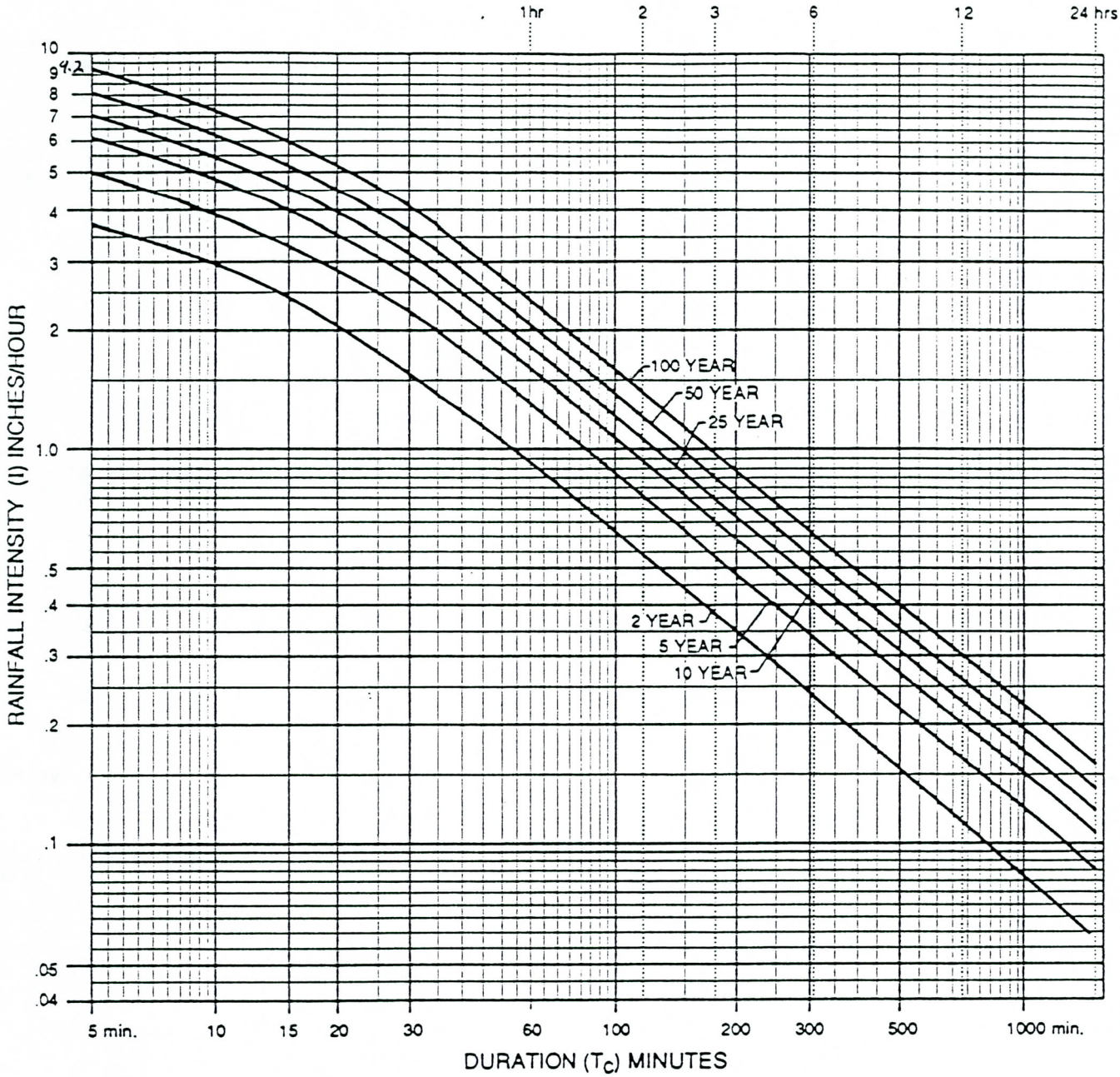

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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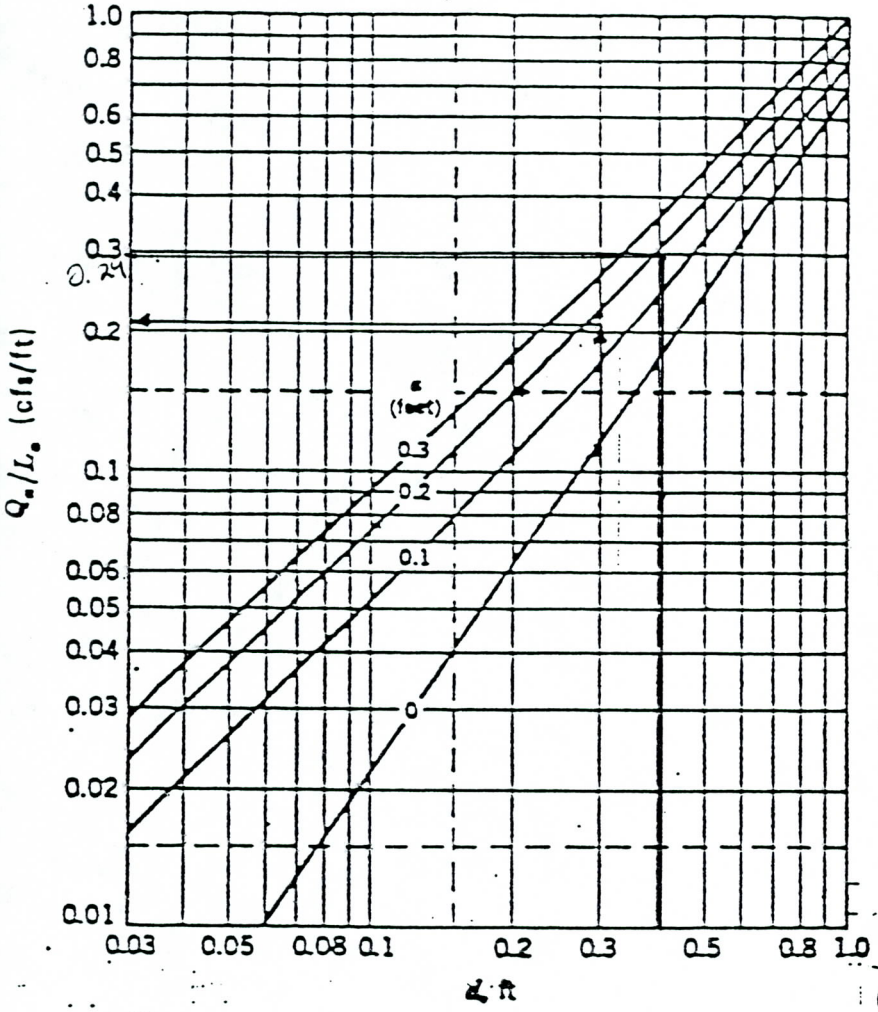
CLIENT C.O.S

JOB NAME 64th St. Improvements JOB NO. 410.32



a

Fig. 3-46

DESIGN CHARTS FOR CURB-OPENING INLETS ON CONTINUOUS GRADES

AREA: Oak Street Basins 2N+3N (combined) (12N+13N

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' d = 0.41'

a = 0.167' (2") a = 0.167'

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.29$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs $Q_a = 18.01$

L = 10' L = 20'

Find: Q

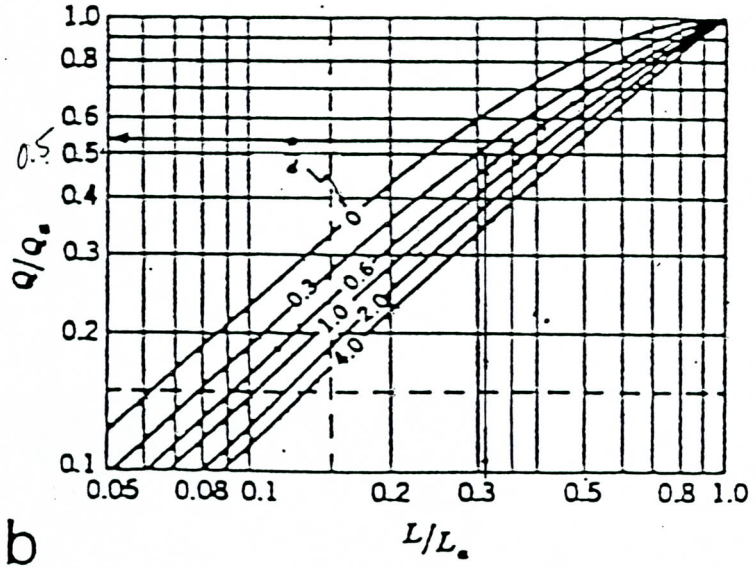
$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = 0.41$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = 62.1$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.32$

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = 0.5$

Q = (0.53)(5.9) = 3.1 cfs



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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak St. Basin 1S (11S)

C: $C = 0.82$

I: Length = 350' $S = 0.0124$ %

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\, 0.46^{0.67}$$

$$= \cancel{4.91}\ 4.63 \text{ fps}$$

$$T_c = 350 / (\cancel{4.91}\ 4.63 * 60) = \cancel{2.95}\ 1.26 \text{ min} \rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{100} = 9.2$ in/hr.

A: Area = 0.65 acres

$$Q_{100} = C\, I_{100}\, A\, F_{100} + Q_b$$

$$= (0.82)(9.2)(0.65)1.25 + \cancel{2.37}\ 2.45$$

$$Q_{100} = \cancel{8.50}\ 8.58 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{100}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$

$$= \left(\frac{8.50(0.016)(0.02)}{0.56\,(0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.31$ water surface width $= 0.31/0.02 = 15.5'$ < 23' OK

Fig 3-46 $Q_i = \cancel{0.72}\ 0.71(8.50) = \cancel{6.12}\ 6.09$ cfs

$Q_b = Q - Q_i = \cancel{8.50}\ 8.58 - 6.12 = 2.38$ cfs

$8.58 - 6.09 = 2.49$

∴ use C.O.P. Catch Basin Type M-1, L=17

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JOB NO. 410.32

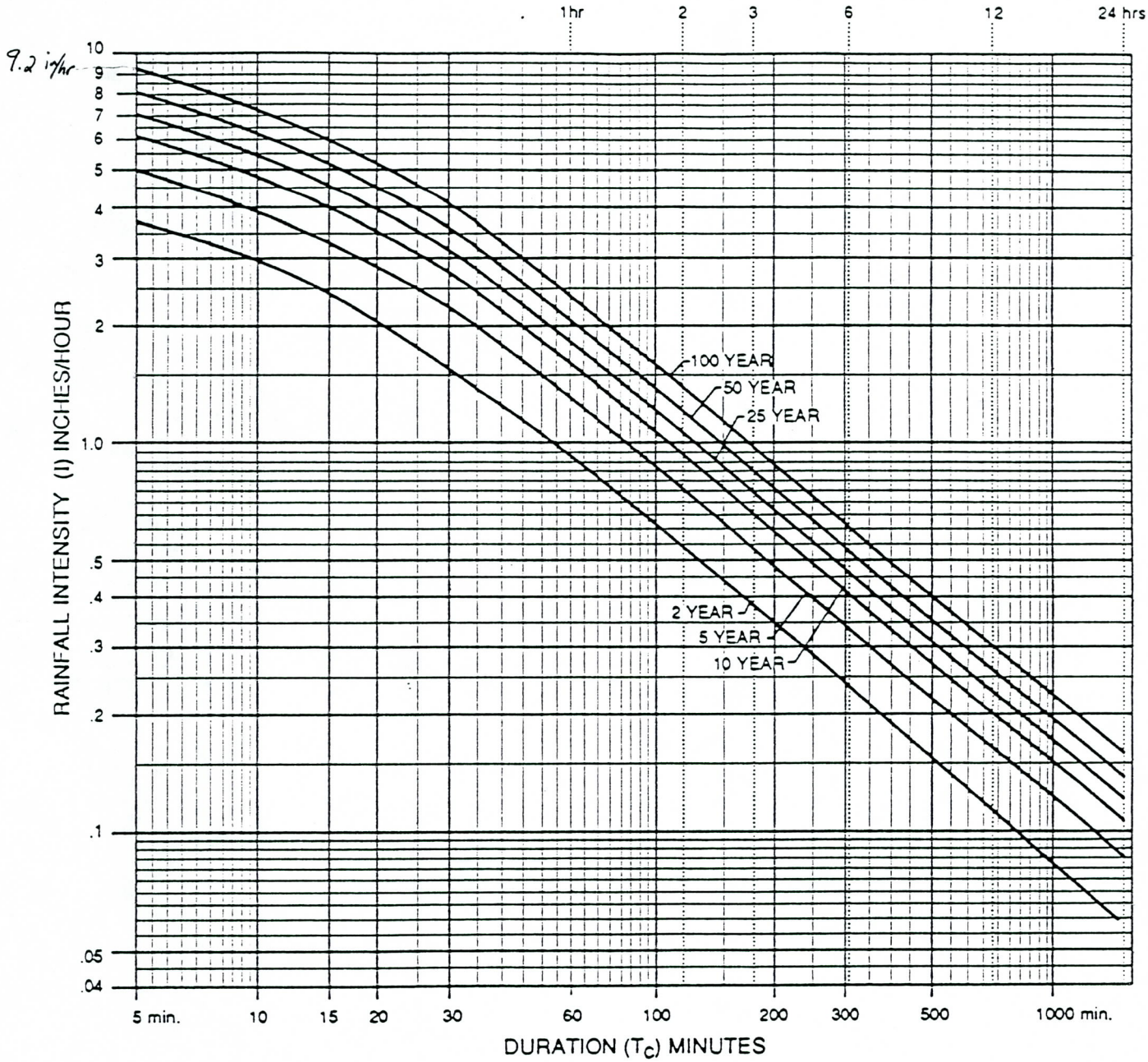

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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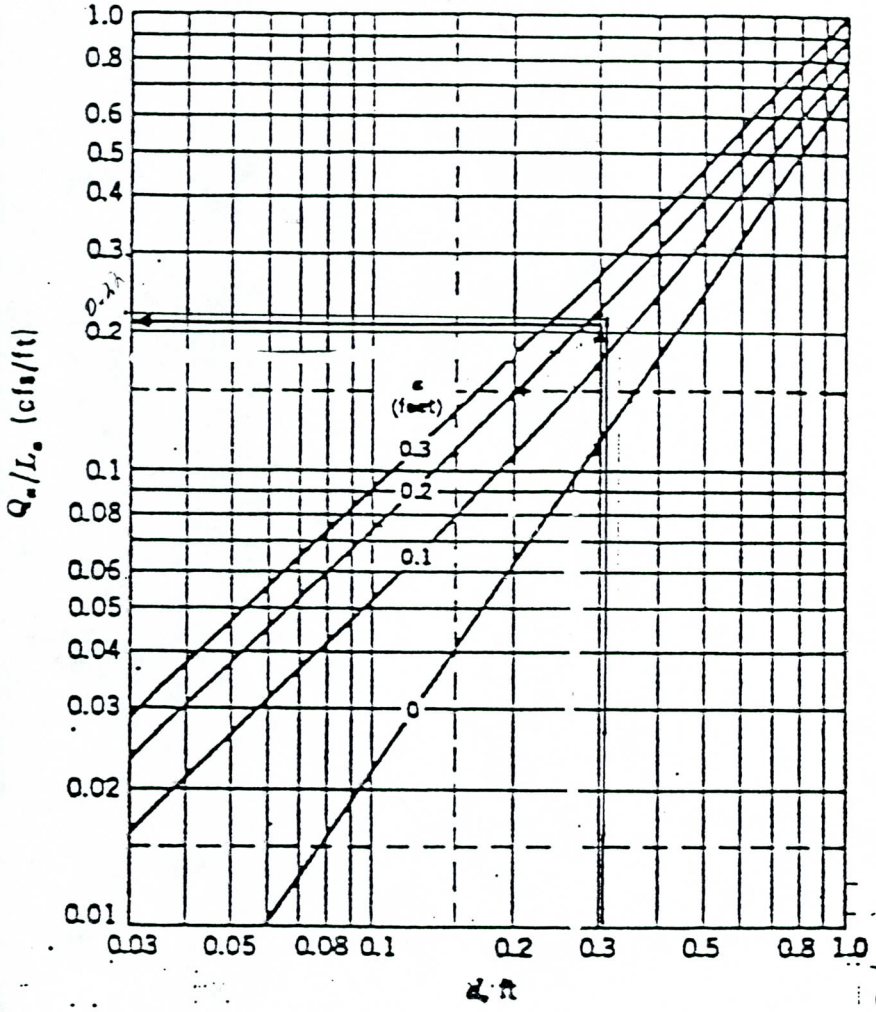
JOB NAME 64th St. Improvements JOB NO. 410.32



a

Fig. 3-46

DESIGN CHARTS FOR CURB-OPENING INLETS ON CONTINUOUS GRADES

AREA : Oak Street 1S (11S)

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' d = 0.31

a = 0.167' (2") a = 0.167

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a}$ = 0.22

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs Q_a = 8.50 cfs

L = 10' L = 20'

Find: Q

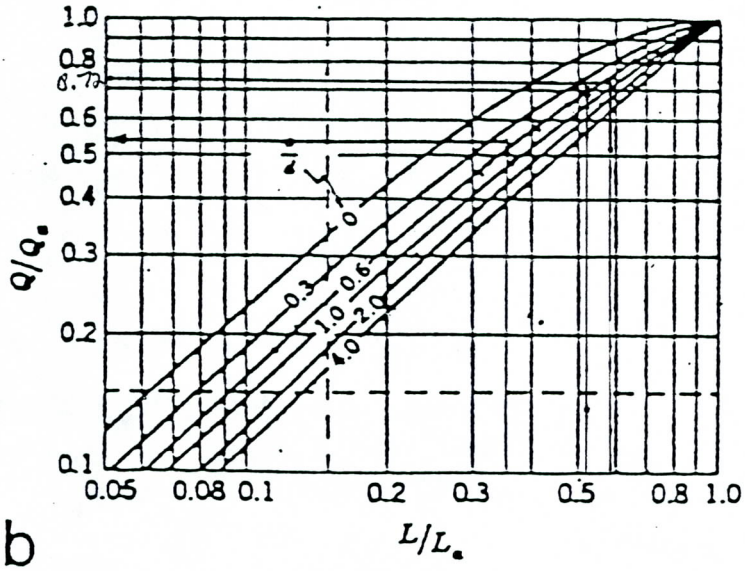
$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d}$ = 0.54

$L_a = \frac{5.9}{0.21} = 28'$ L_a = 38.65

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a}$ = 0.52

$\frac{Q}{Q_a}$ = 0.53 $\frac{Q}{Q_a}$ = 0.72 0.71

Q = (0.53)(5.9) = 3.1 cfs



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CLIENT C.O.S.

JOB NAME 64th St. Improvements JOB NO. 410.32

AREA: Oak Street Basins 25+35 (combined) (25+135)

C: $C = 0.81$

I: Length = 870' $S = 0.024$ ft/ft

$$\text{Velocity} = \left(\frac{1.12}{n}\right) S^{0.5} d^{0.67}$$

$$= \left(\frac{1.12}{0.016}\right) 0.0124^{0.5}\ 0.46^{0.67}$$

$$= \cancel{4.91}\ 4.63 \text{ fps}$$

$$T_c = 870 / (\cancel{4.91}\ 4.63 * 60) = \cancel{2.95}\ 3.13 \text{ min} \rightarrow 5 \text{ min}$$

Fig. 2.2-13: Rainfall Intensity $I_{100} = 9.2$ in/hr.

A: Area = 1.70 acres

$$Q_{100} = C\, I_{100} A F_{100} + Q_b$$
$$= (0.81)(9.2)(1.7)1.25 + \cancel{2.37}\ 2.49$$
$$Q_{100} = \cancel{18.21}\ 18.33 \text{ cfs}$$

$$\text{Depth} = \left(\frac{Q_{100}\, n\, S_x}{0.56\, S^{0.5}}\right)^{3/8}$$
$$= \left(\frac{\cancel{18.21}\ 18.33 (0.016)(0.02)}{0.56\, (0.0124)^{0.5}}\right)^{3/8}$$

$d = 0.41$ water surface width $= 0.41 / 0.02 = 20.5 < 23$ OK

Fig 3-46 $Q_i = 0.51 (\cancel{18.21}\ 18.33) = \cancel{9.29}\ 9.35$ cfs

$Q_b = Q - Q_i = \cancel{18.21 - 9.29}\ 18.33 - 9.35 = \cancel{8.92}\ 8.98$ cfs

∴ Use C.O.P. Cath Basin Type M-1, L = 17'

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JOB NAME 64th St.

JOB NO. 410.32

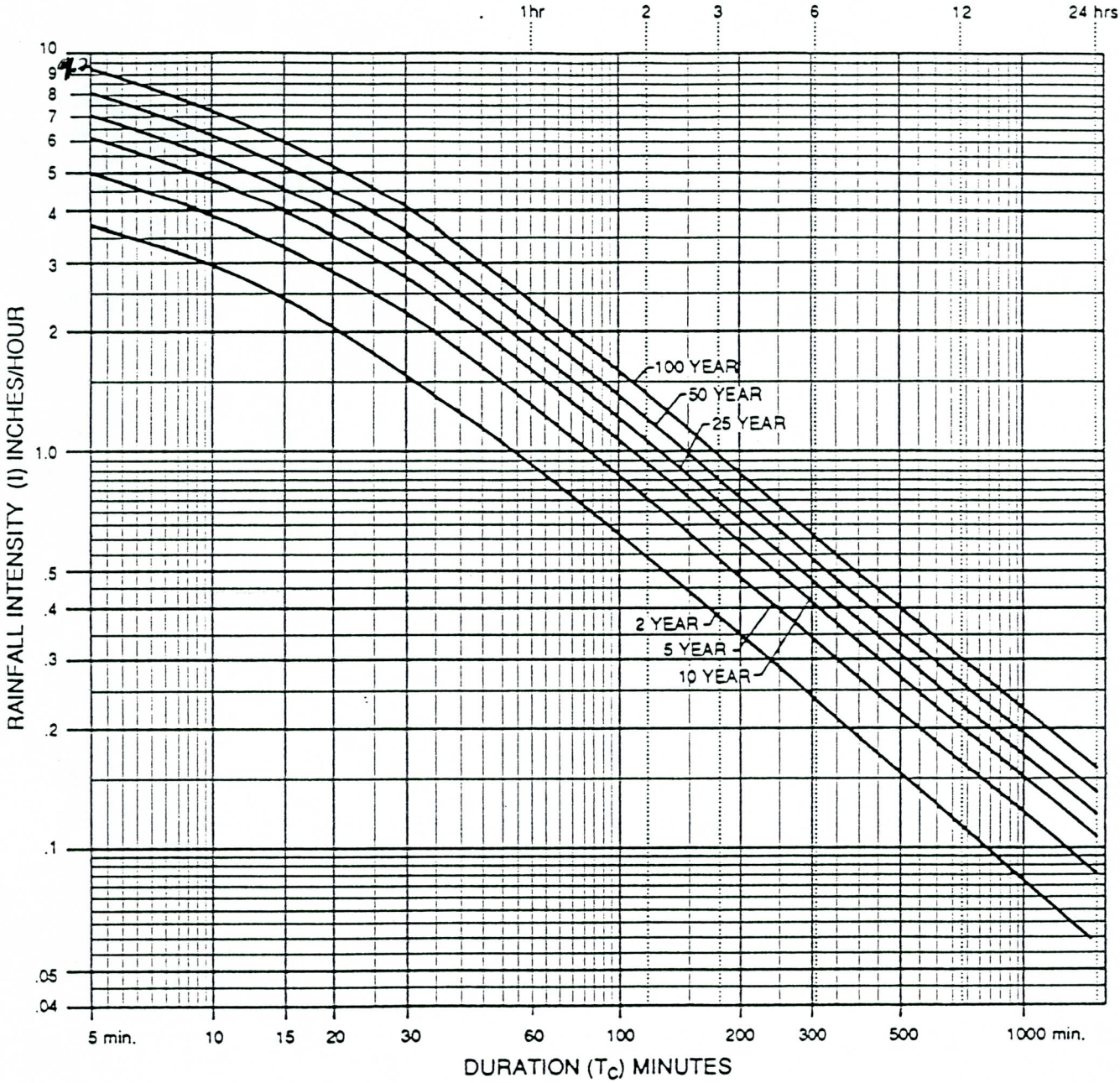

FIGURE 2.2-13

Rainfall Intensity (I) Values for Use in Rational Method

Source: Hydrologic Design Manual for Maricopa County

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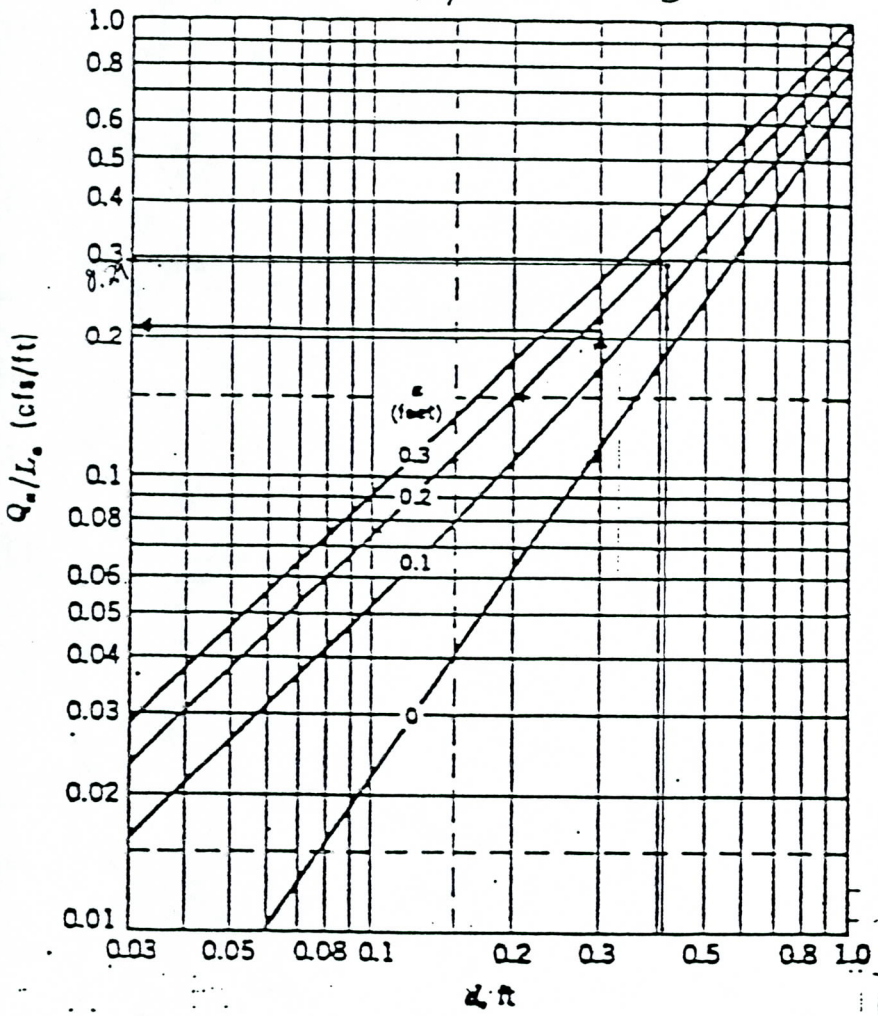


a

Fig. 3-46

DESIGN CHARTS FOR CURB-OPENING INLETS ON CONTINUOUS GRADES

AREA : Oak St. Basins 25+35 (12S+13

EXAMPLE USING FIGURE 3-46a

Given:

d = 0.3' $d = 0.41'$

a = 0.167' (2") $a = 0.167'$

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft. $\frac{Q_a}{L_a} = 0.29$

EXAMPLE USING FIGURE 3-46b

Given:

The above information and 18.33

Q_a = 5.9 cfs $Q_a = \cancel{18.21}$ cfs

L = 10' $L = 20'$

Find: Q

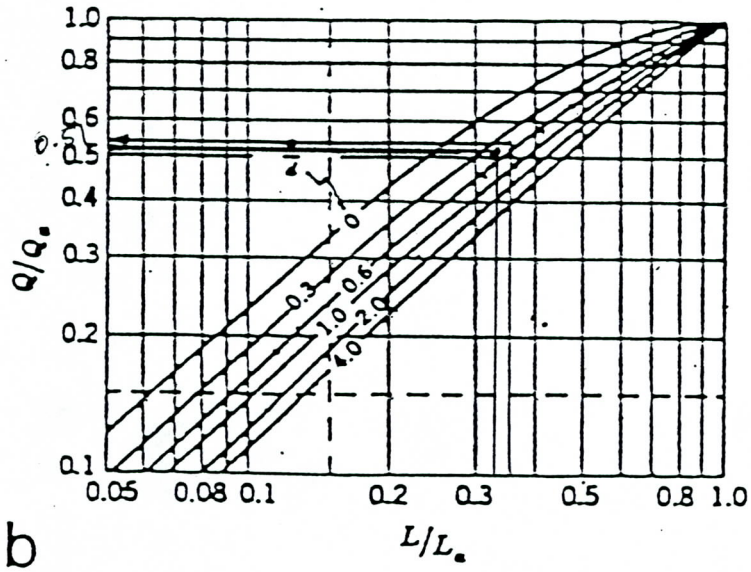
$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$ $\frac{a}{d} = 0.41$

$L_a = \frac{5.9}{0.21} = 28'$ $L_a = \cancel{62.8}$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$ $\frac{L}{L_a} = 0.32$

$\frac{Q}{Q_a} = 0.53$ $\frac{Q}{Q_a} = 0.51$

Q = (0.53)(5.9) = 3.1 cfs



b

HEADWALL INLETS

Entellus™

SHEET _____ OF _____

BY WAL DATE 8/29/97

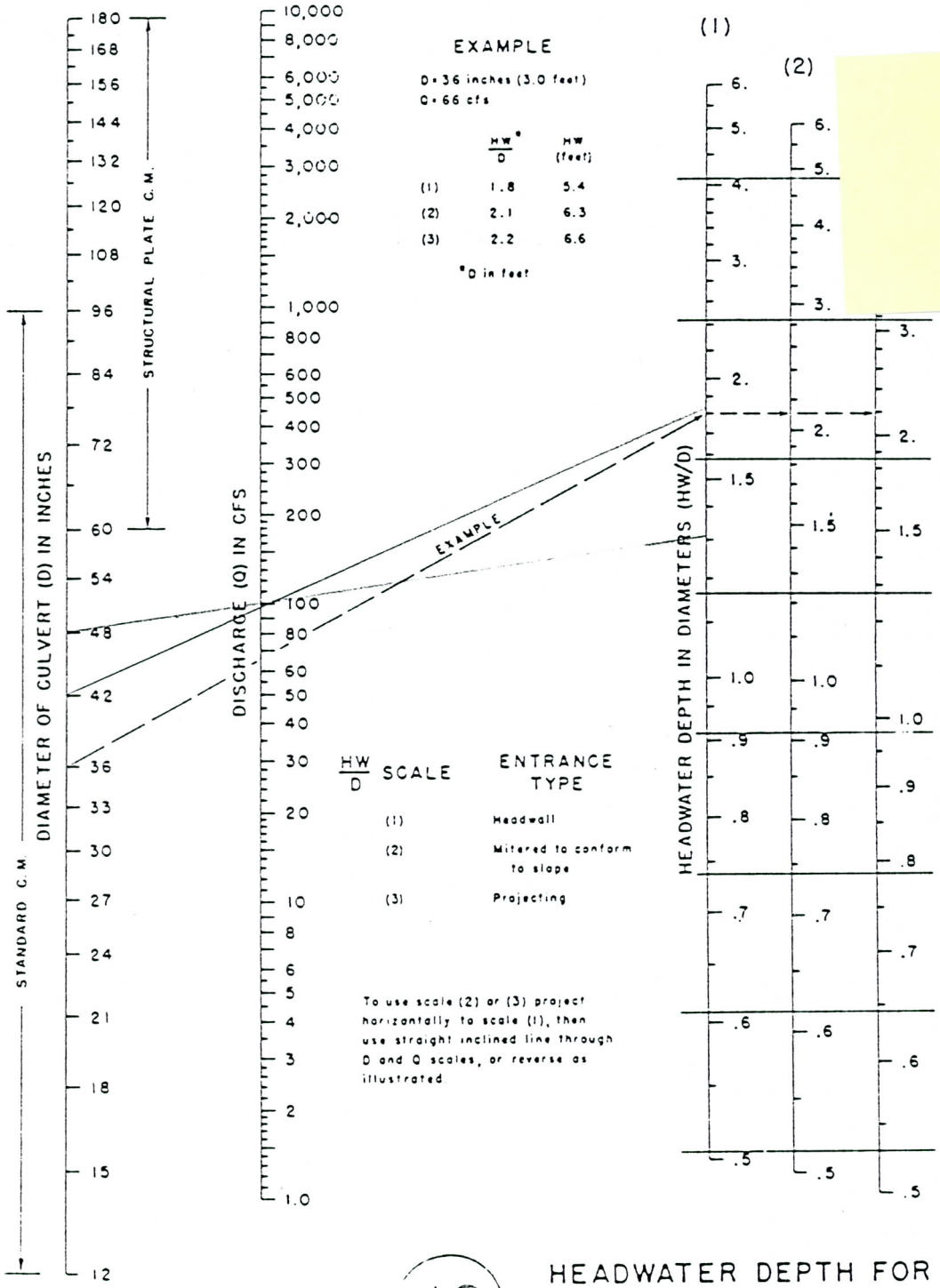
CHECK _____ DATE _____

CLIENT City of Scottsdale

JOB NAME 64th Street Improvements
Hubbell Street Inlet

JOB NO. 410.22

CHART 5



Headwall Inlet Calcs

1.84(42) = 77.
= 6.44'

1.3(4) = 5.2

Pipe Inv

Roadway 6 - 0.5 -

= 1286.75 - 0.5 - 5.2

= 1281.05

48

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

Entellus™

SHEET _____ OF _____

BY WAL DATE 8/29/97

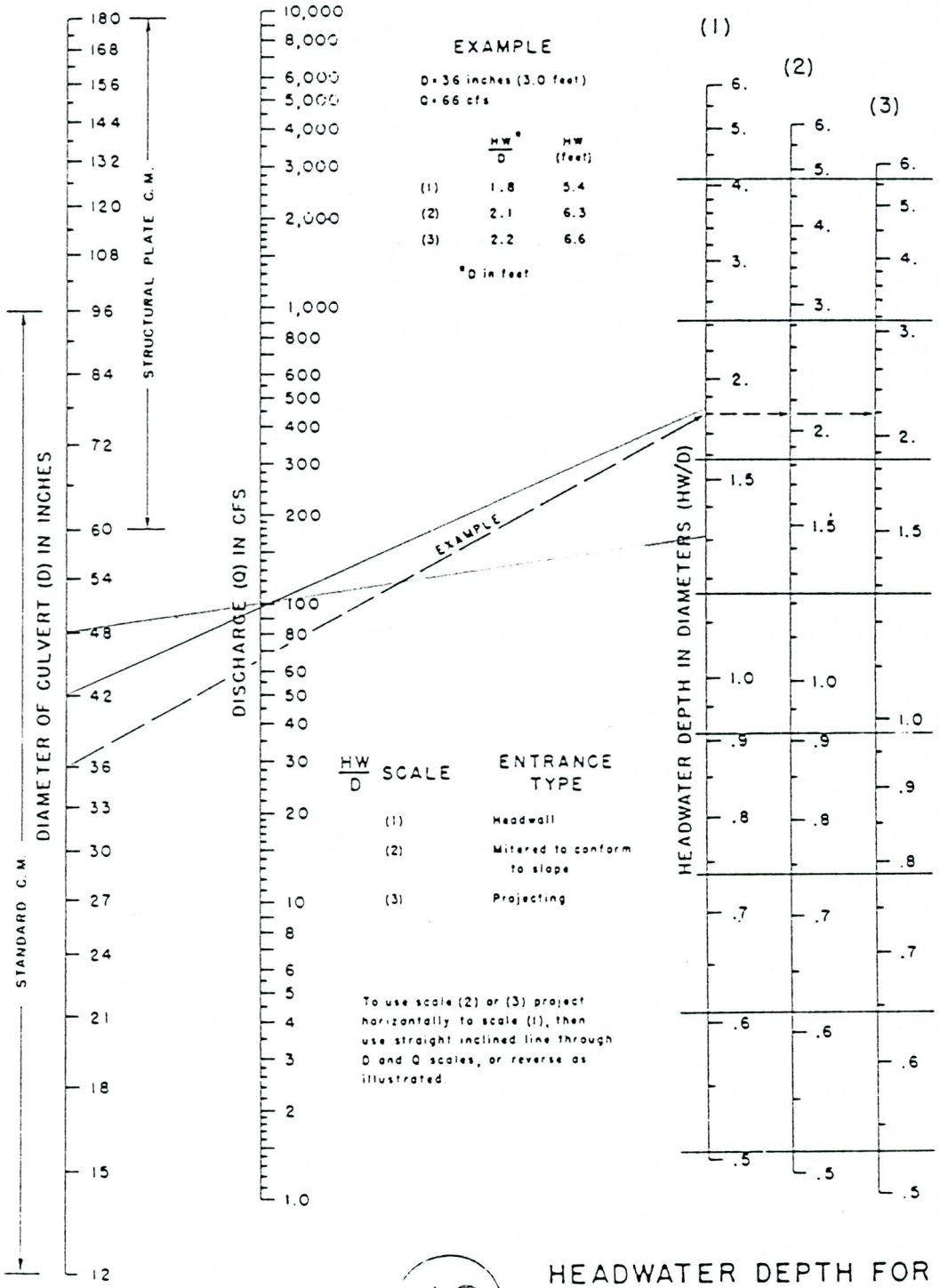
CHECK _____ DATE _____

CLIENT City of Scottsdale

JOB NAME 64th Street Improvements
Hubbell Street Inlet

JOB NO. 410.22

CHART 5



1.84(42) = 77.
= 6.44'

1.3(4) = 5.2

Pipe Inv

Roadway 6 - 0.5 -

= 1286.75 - 0.5 - 5.

= 1281.05

48

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

Entellus™

SHEET _____ OF _____

BY WAL DATE 9/2/97

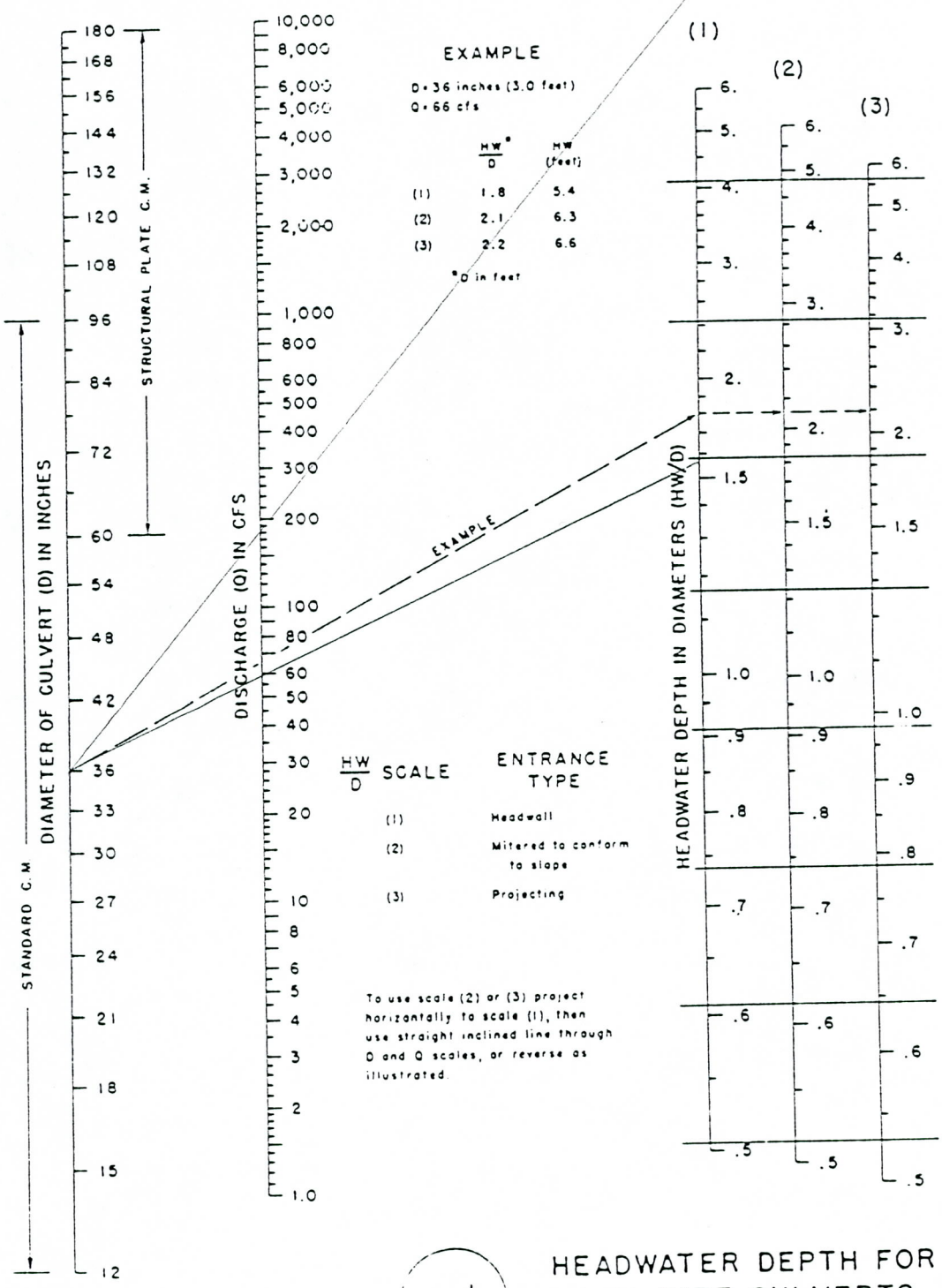
CHECK _____ DATE _____

CLIENT City of Scottsdale

JOB NAME 64th Street Improvements
Riding Club Inlet

JOB NO. 410.32

CHART 5



1.68(3.0 ft) = 5'

36

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

Entellus™

SHEET _____ OF _____

BY WAL DATE 8/29/17

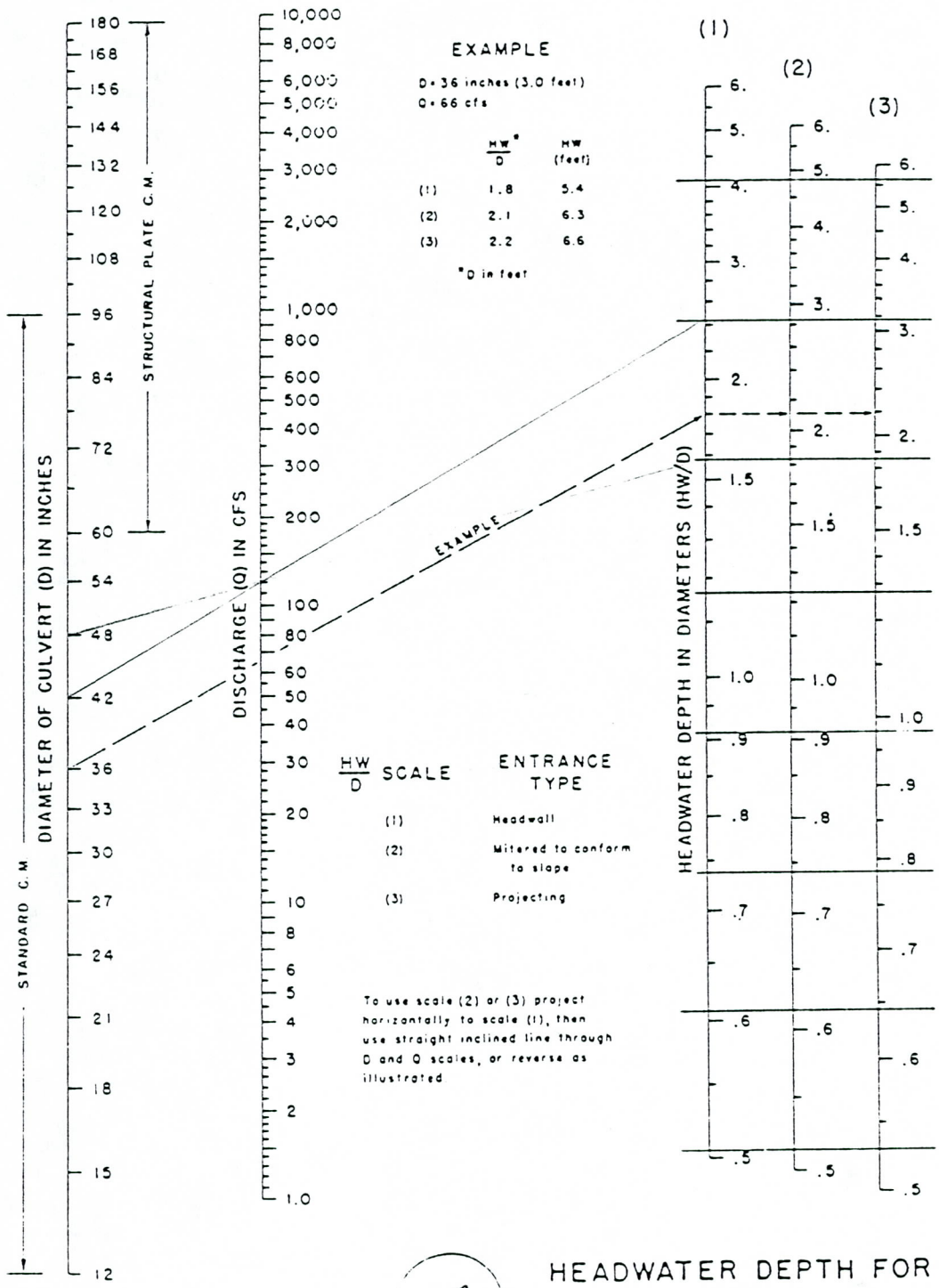
CHECK _____ DATE _____

CLIENT City of Scottsdale

JOB NAME 64th Street Improvements
Army Reserve Inlet

JOB NO. 410.32

CHART 5



2.43 (42) = 102.06"
= 8.51'

1.8 (42) =

48

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

66TH STREET CATCH BASINS

Entellus™

SHEET 1 OF 16

BY WAC DATE 9/16/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th St. JOB NO. 410.32

Have 90 cfs entering system from offsite

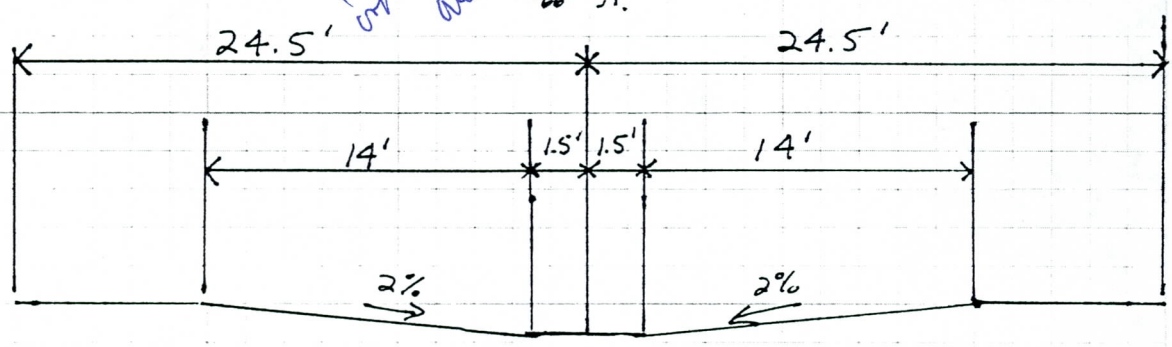
Percentage of flow per "basin"

(21) Basin 1 — 23% → 20.7 cfs
(22) Basin 2 — 24% → 21.6 cfs
(23) Basin 3 — 26% → 23.4 cfs
(24) Basin 4 — 15% → 13.5 cfs
(25) Basin 5 — 12% → 10.8 cfs

+5.68
5.01

What is meant by this?

what is meaning



Approx. Street Grade = 0.0012%

Entellus™

SHEET 1 OF 16

BY WAL DATE 9/16/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th St.

JOB NO. 410.32

Have 90 cfs entering system from offsite

Percentage of flow per "basin"

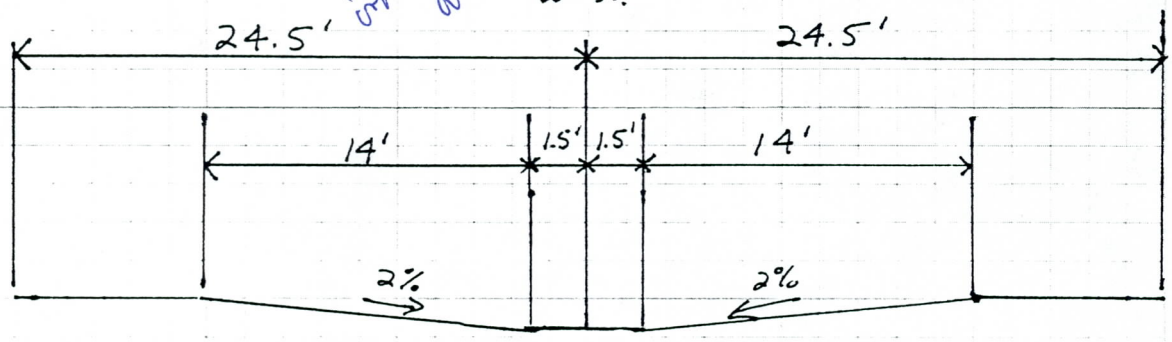
(21) Basin 1 – 23% → 20.7 cfs
(22) Basin 2 – 24% → 21.6 cfs
(23) Basin 3 – 26% → 23.4 cfs
(24) Basin 4 – 15% → 13.5 cfs
(25) Basin 5 – 12% → 10.8 cfs

+5.68 cfs from Oak

What is meant by this?

what is meaning

℄ 66th St.



Approx. Street Grade = 0.0012%

Entellus™

SHEET 2 OF 16

BY WAL DATE 9/18/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th Street

JOB NO. 410.32

BASIN 5 (25)

$Q = Q_s + Q_b = 10.8 + 0 = 10.8$ cfs $Q_b = 2.74 + 2.94 = 5.68$

Depth (from HEC-2) = ~~0.44'~~ → 0.52

From design chart:

Q_i = ~~5 cfs~~ 6.4 cfs

Recommend Catch Basin:

1 Double

$Q_b = Q - 2 * Q_i = \cancel{10.8}\ 16.5 - 2 * \cancel{5}\ 6.4 = \cancel{0.8\ cfs}\ 3.7$ cfs

THIS RUN EXECUTED 17SEP97 17:31:08

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

City of Scottsdale

SUMMARY PRINTOUT

SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
5.000	10.80	1.44	.00	.44	31.05	1.23
	16.5	1.52		.52	31.08	1.45

Entellus™

SHEET 4 OF 16

BY WAL DATE 9/18/97

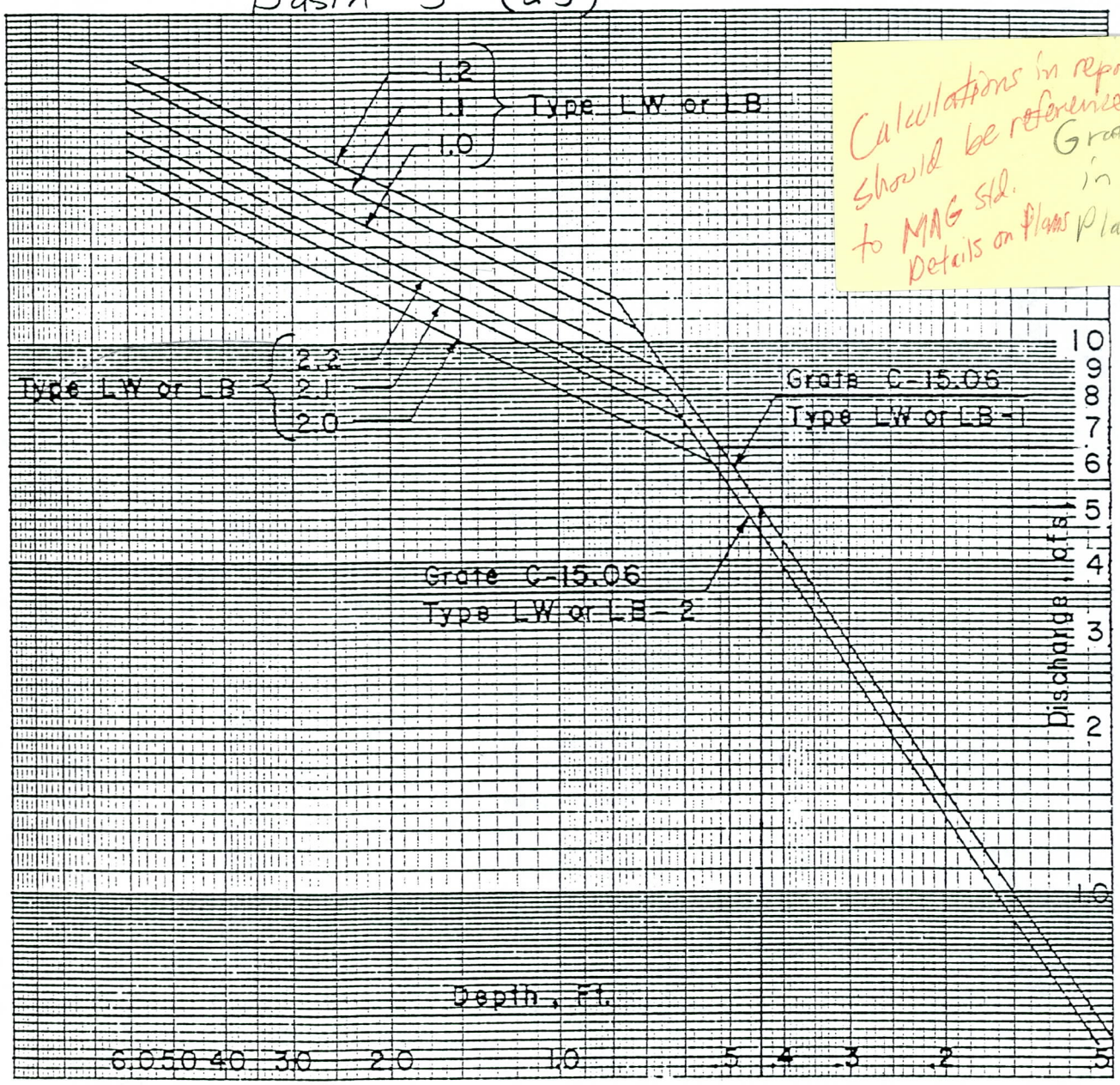
CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th Street

JOB NO. 410.32

Basin 5 (25)



Calculations in report should be referenced to MAG Std. Details on Plans

Grates in Plans

cfs

Chart 1

AHD
Structures Section
Hydraulics Branch
10-15-72

HYDRAULIC CAPACITY CHART
MEDIAN CATCH BASIN

Standard C-15.08 CB Type 4
(Off roadway location)
50% Clogging

FHWA
HEC #12

Grates types in plans should be referenced to this.

Entellus™

SHEET 4 OF 16

BY WAL DATE 9/18/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th Street

JOB NO. 410.32

Basin 5 (25)

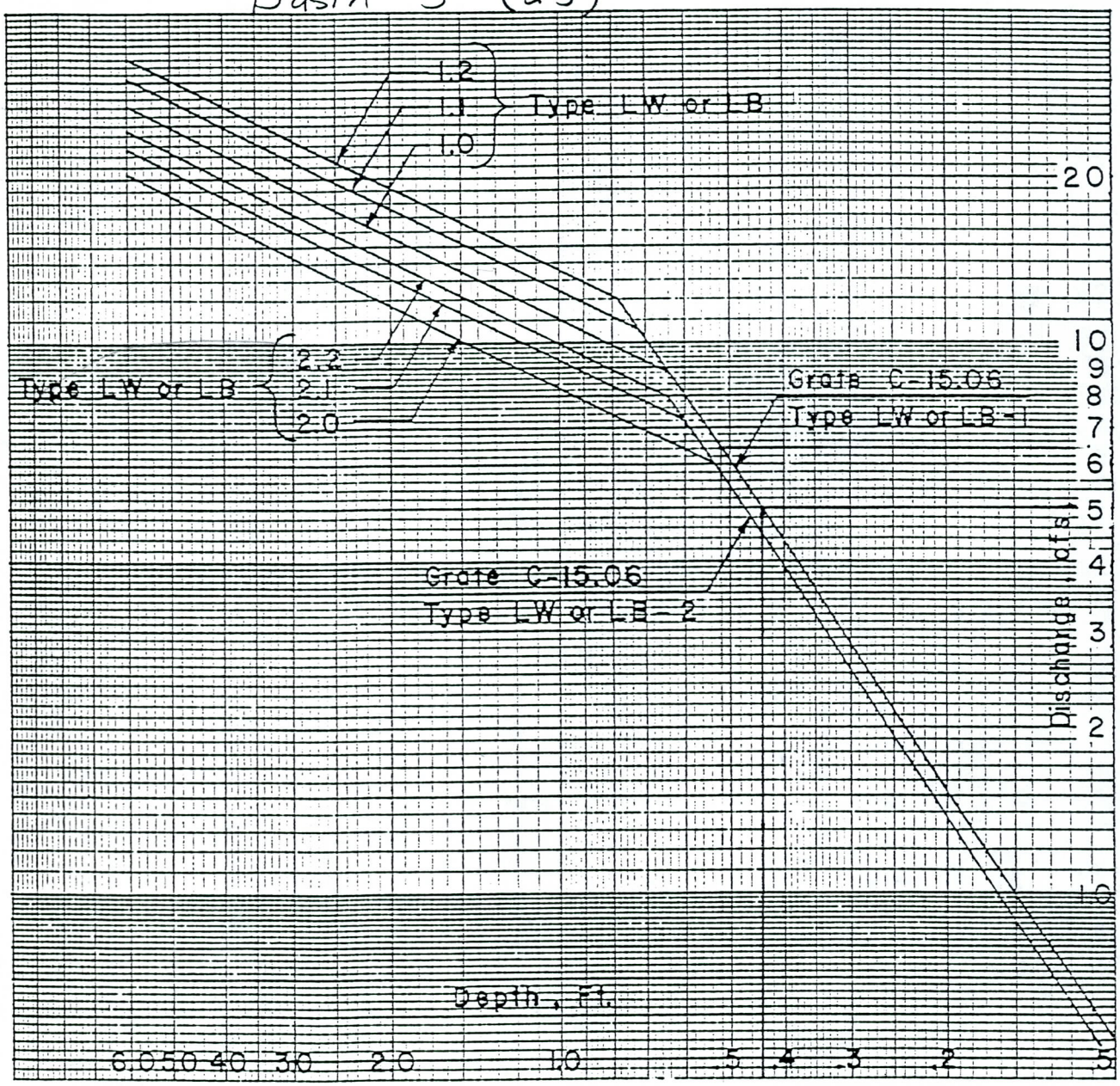


Chart 1

AHD
Structures Section
Hydraulics Branch
10-15-72

HYDRAULIC CAPACITY CHART
MEDIAN CATCH BASIN

Standard C-15.08 CB Type 4
(Off roadway location)
50% Clogging

FHWA
HEC #12

Grates types in plans should be referenced to this.

Entellus™

SHEET 5 OF 16

BY WAL DATE 9/18/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th St.

JOB NO. 410.32

BASIN 4 (24)

$Q = Q_4 + Q_b = 13.5 + \cancel{0.8}\ 3.7 = \cancel{14.3}\ 17.2$ cfs

Depth (from HEC-2) = ~~0.49'~~ 0.53'

From Design Chart:

Q_i = ~~5.9 cfs~~ 6.7 cfs

Recommend Catch Basin:

1 Double

$Q_b = Q - 2*Q_i = \cancel{14.3}\ 17.2 - 2*\cancel{5.9}\ 6.7 = \cancel{2.5}\ 3.8$ cfs

THIS RUN EXECUTED 18SEP97 07:39:28

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

City of Scottsdale

SUMMARY PRINTOUT

SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
4.000	~~14.30~~ 17.20	~~1.49~~ 1.53	.00	~~.49~~ 0.53	~~31.07~~ 31.09	~~1.37~~ 1.47

Entellus™

SHEET 7 OF 16

BY WAL DATE 9/18/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th Street

JOB NO. 410.32

Basin 4 (24)

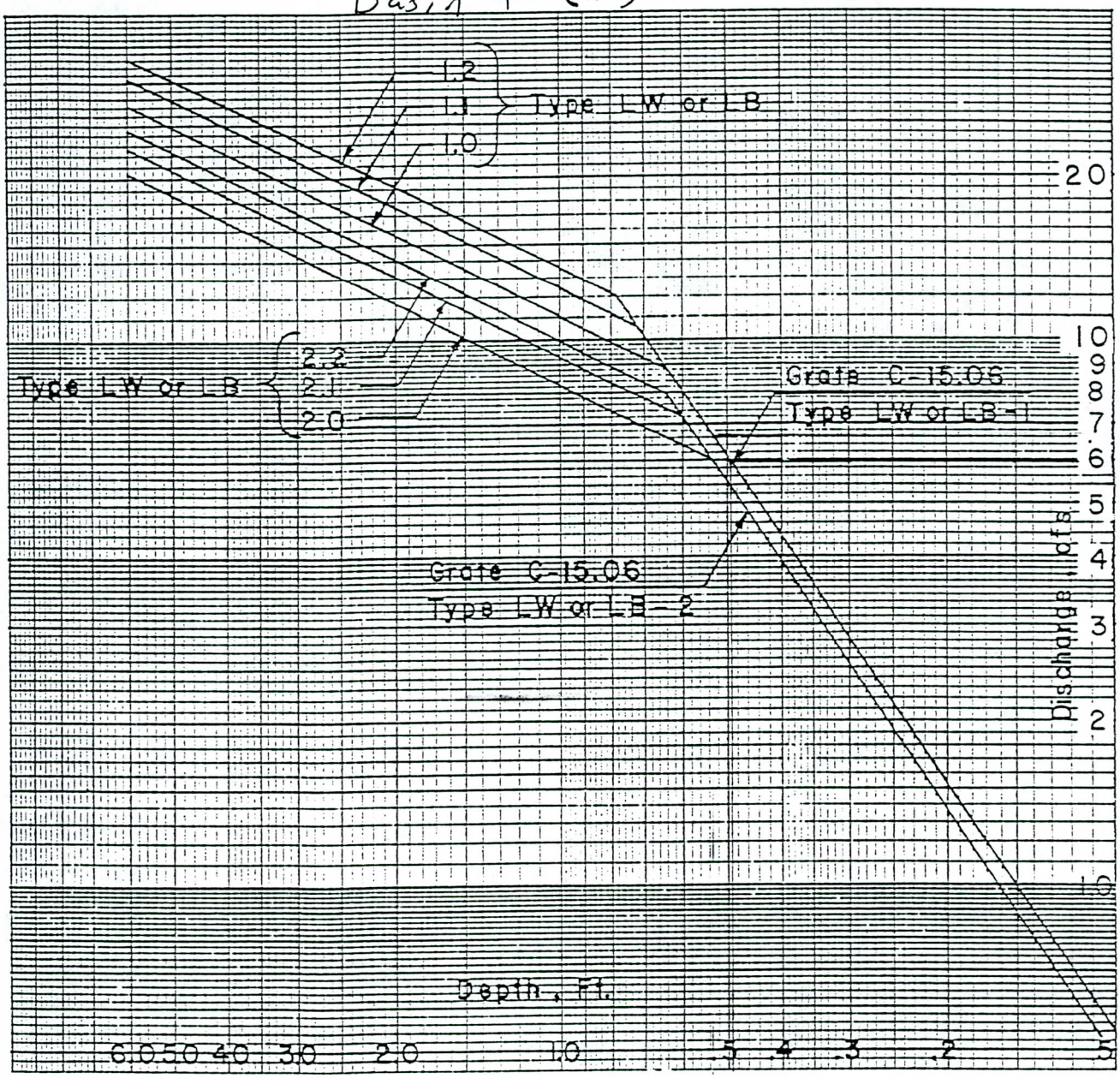


Chart 1

AHD
Structures Section
Hydraulics Branch
10-15-72

FHWA
HEC #12

HYDRAULIC CAPACITY CHART
MEDIAN CATCH BASIN

Standard C-15.08 CB Type 4
(Off roadway location)
50% Clogging

Entellus™

SHEET 8 OF 16

BY WAL DATE 9/8/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th St.

JOB NO. 410.32

BASIN 3 (23)

$Q = Q_3 + Q_b = 23.4 + \cancel{2.5}\ 3.8 = \cancel{25.9}\ 27.2$ cfs

Depth (from Hec-2) = ~~0.64~~ 0.65

From Design Chart:

$Q_i =$ ~~8 cfs~~ 9.0 cfs

Recommended Catch Basin:

1 Triple

$Q_b = Q - 3 * Q_i = \cancel{25.9}\ 27.2 - 3 * \cancel{8}\ 9 = \cancel{1.9}\ 0.2$ cfs

THIS RUN EXECUTED 18SEP97 08:04:41

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

City of Scottsdale

SUMMARY PRINTOUT

SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
3.000	25.90	1.64	.00	.64	31.13	~~1.73~~
	27.20	1.65		0.65	31.14	1.77

Entellus™

SHEET 10 OF 16
BY WAL DATE 9/18/97
CHECK _____ DATE _____

CLIENT C.O. Scottsdale
JOB NAME 64th Street
JOB NO. 410.32

Basin 3 (23)

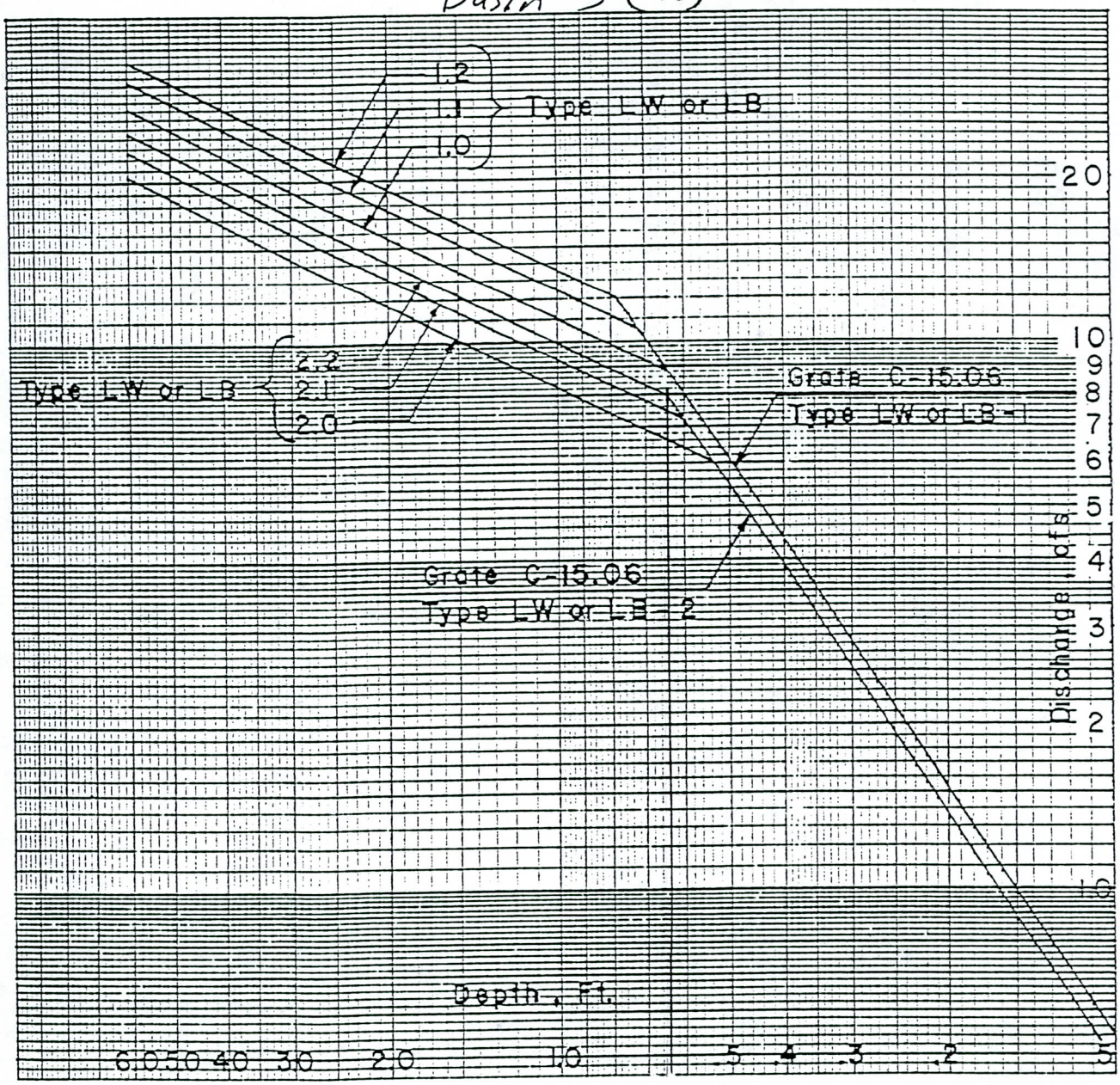


Chart 1

AHD
Structures Section
Hydraulics Branch
10-15-72

FHWA
HEC #12

HYDRAULIC CAPACITY CHART
MEDIAN CATCH BASIN

Standard C-15.08 CB Type 4
(Off roadway location)
50% Clogging

Entellus™

SHEET 11 OF 16

BY WAL DATE 9/18/97

CHECK _____ DATE _____

CLIENT C. O. Scottsdale

JOB NAME 64th St.

JOB NO. 410.32

BASIN 2 (22)

$Q = Q_2 + Q_b = 21.6 + \cancel{1.9}\ 0.2 = \cancel{23.5}\ 21.8$ cfs

Depth (from HEC-2) = ~~0.61~~ 0.59

From Design Chart:

$Q_i = \cancel{8.2}\ 7.9$ cfs

Recommended Catch Basin:

1 Double 1 Triple

$Q_b = Q - 2 * Q_i = \cancel{23.5}\ 21.8 - \cancel{16.4}\ 23.7 = \cancel{7.1}\ 0$ cfs

Using 1 Triple:

$Q_b = 0$

THIS RUN EXECUTED 18SEP97 08:55:17

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

City of Scottsdale

SUMMARY PRINTOUT

SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
2.000	23.50	1.61	.00	.61	31.12	1.67
	21.80	1.59		0.59	31.11	1.62

Entellus™

SHEET 13 OF 16
BY WAL DATE 9/18/97
CHECK _____ DATE _____

CLIENT C.O. Scottsdale
JOB NAME 64th Street
JOB NO. 410.32

Basin 2 (22)

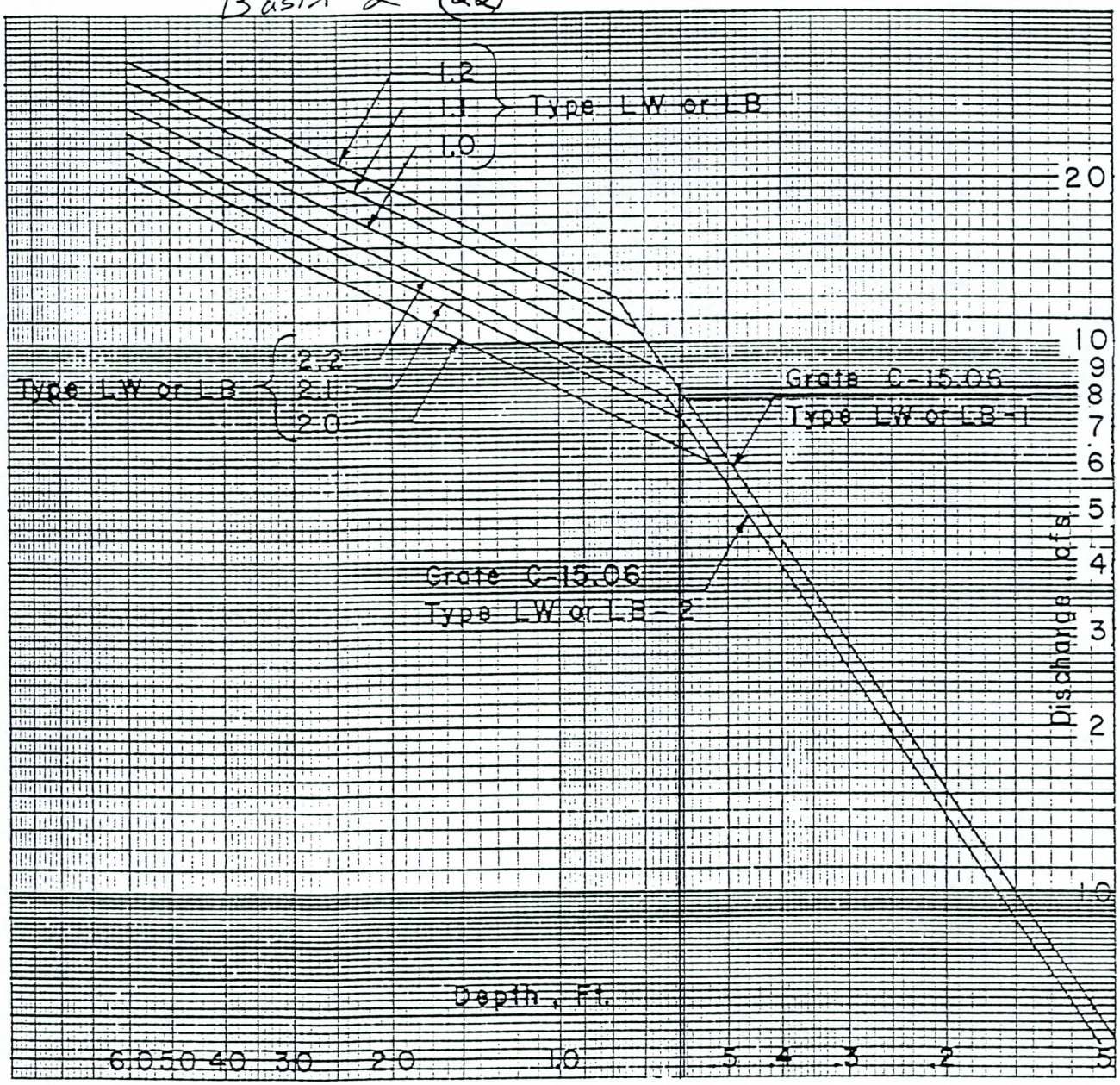


Chart 1

AHD
Structures Section
Hydraulics Branch
10-15-72

FHWA
HEC #12

HYDRAULIC CAPACITY CHART
MEDIAN CATCH BASIN

Standard C-15.08 CB Type 4
(Off roadway location)
50% Clogging

Entellus™

SHEET 14 OF 16

BY WAC DATE 9/18/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th St.

JOB NO. 410.32

BASIN 1 (21)

w/ Q_b $Q = Q_1 + Q_b = 20.7 + 7.1 = 28.8$ cfs

Depth (from HEC-2) = 0.67'

From Design Chart:

$Q_i = 9$ cfs ← Need 4 singles to intercept entire flow

w/out Q_b $Q = 20.7$ ← Ok

Depth (from HEC-2) = 0.58 cfs

From Design Chart:
$Q_i = 7.6$ cfs ← Need 1 triple to intercept entire flow

Best Option:

Use a triple for Basin 2 (22) + a triple for Basin 1 (21)

THIS RUN EXECUTED 18SEP97 08:54:17

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

City of Scottsdale

SUMMARY PRINTOUT

SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
1.000	20.70	1.58	.00	.58	31.11	1.59

Entellus™

SHEET 16 OF 16

BY WAL DATE 9/18/97

CHECK _____ DATE _____

CLIENT C.O. Scottsdale

JOB NAME 64th Street

JOB NO. 410.32

Basin 1 (21)

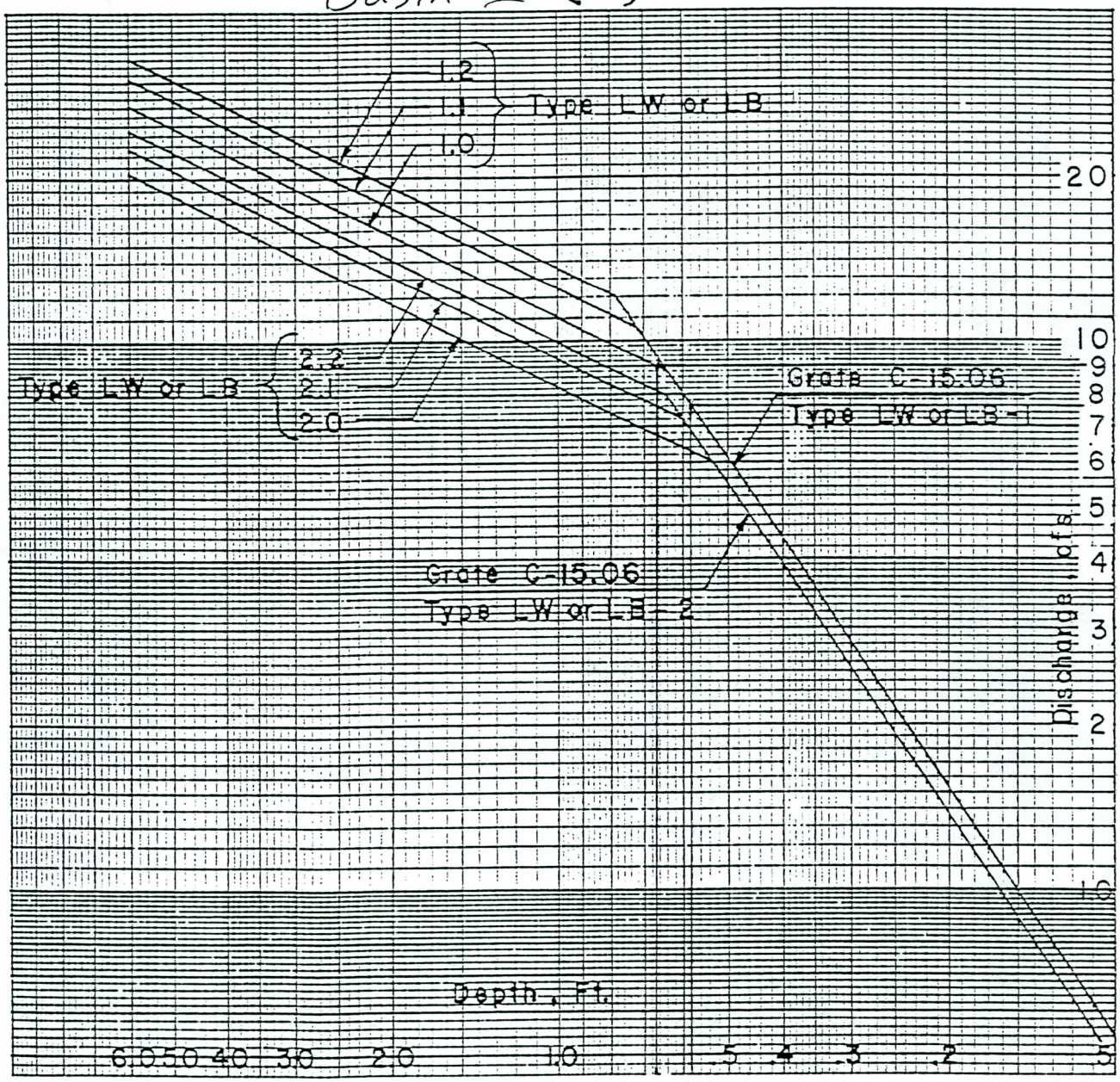


Chart 1

AHD
Structures Section
Hydraulics Branch
10-15-72

FHWA
HEC #12

HYDRAULIC CAPACITY CHART
MEDIAN CATCH BASIN

Standard C-15.08 CB Type 4
(Off roadway location)
50% Clogging

User Name: Hernan A Aristizabal, AGK Engi
Project: c:\entellus\41032\acad\survey.STM

!

0

STORM SEWER HEC 12 SINGLE INLET REPORT

FLOW RESULTS (cfs)			PONDING WIDTH (ft)	=	36.85
Total Flow to inlet	=	30.00	DEPTH AT CURB (ft)	=	0.74
			EFFICIENCY (%)		
			Curb =	*	
Intercepted by current inlet	=	27.18	Grate =	82.48	Total = 90.60
Bypassed by current inlet	=	2.82	Slot =	46.32	

INPUT PARAMETERS:

Inlet Type	= COMBINATION2 ON GRADE		Longitudinal Slope (ft/ft)	=	0.002
Gutter Width (ft)	=	2.000	Pavement Cross Slope (ft/ft)	=	0.020
Inlet n-value	=	0.016	Gutter Cross Slope (ft/ft)	=	0.020
Downstream Inlet Number	=	0	Gutter depression (in)	=	0.00
Grate Type		P-1-7/8			
Grate Length (ft)	=	7.00			
Splash-Over Vel. (ft/s)	=	17.69			
Combo2 Length (ft)	=	20.00			

Locations of
All these should be referenced to plans
by station and sheet ID #.

User Name: Hernan A Aristizabal, AGK Engi
Project: c:\entellus\41032\acad\survey.STM

Date: 10-29-97
Time: 12:43:55
Page: 1

STORM SEWER HEC 12 SINGLE INLET REPORT

FLOW RESULTS (cfs)		PONDING WIDTH (ft)	=	36.85	
Total Flow to inlet	= 30.00	DEPTH AT CURB (ft)	=	0.74	
		EFFICIENCY (%)			
		Curb =	*		
Intercepted by current inlet	= 27.18	Grate =	82.48	Total =	90.60
Bypassed by current inlet	= 2.82	Slot =	46.32		

INPUT PARAMETERS:

Inlet Type	= COMBINATION2 ON GRADE	Longitudinal Slope (ft/ft)	= 0.002
Gutter Width (ft)	= 2.000	Pavement Cross Slope (ft/ft)	= 0.020
Inlet n-value	= 0.016	Gutter Cross Slope (ft/ft)	= 0.020
Downstream Inlet Number	= 0	Gutter depression (in)	= 0.00
Grate Type	P-1-7/8		
Grate Length (ft)	= 7.00		
Splash-Over Vel. (ft/s)	= 17.69		
Combo2 Length (ft)	= 20.00		

Locations of
All these should be referenced to plans
by station and sheet ID #.

User Name: Hernan A Aristizabal, AGK Engi
Project: c:\entellus\41032\acad\survey.STM

Date: 10-29-97
Time: 12:44:22
Page: 1

STORM SEWER HEC 12 SINGLE INLET REPORT

FLOW RESULTS (cfs)
Total Flow to inlet = 30.00

PONDING WIDTH (ft) = 36.85
DEPTH AT CURB (ft) = 0.74
EFFICIENCY (%)
Curb = *
Grate = 87.16 Total = 96.54
Slot = 73.01

Intercepted by current inlet = 28.96
Bypassed by current inlet = 1.04

INPUT PARAMETERS:

Inlet Type	= COMBINATION2 ON GRADE	Longitudinal Slope (ft/ft)	= 0.002
Gutter Width (ft)	= 2.000	Pavement Cross Slope (ft/ft)	= 0.020
Inlet n-value	= 0.016	Gutter Cross Slope (ft/ft)	= 0.020
Downstream Inlet Number	= 0	Gutter depression (in)	= 0.00
Grate Type	P-1-7/8		
Grate Length (ft)	= 7.00		
Splash-Over Vel. (ft/s)	= 17.69		
Combo2 Length (ft)	= 30.00		

User Name: Hernan A Aristizabal, AGK Engi
Project: c:\entellus\41032\acad\survey.STM

Date: 10-29-97
Time: 12:45:14
Page: 1

STORM SEWER HEC 12 SINGLE INLET REPORT

FLOW RESULTS (cfs)
Total Flow to inlet = 33.00

PONDING WIDTH (ft) = 38.68
DEPTH AT CURB (ft) = 0.77
EFFICIENCY (%)
Curb = *

Intercepted by current inlet = 31.78
Bypassed by current inlet = 1.22

Grate = 86.82 Total = 96.31
Slot = 72.01

INPUT PARAMETERS:

Inlet Type	= COMBINATION2 ON GRADE	Longitudinal Slope (ft/ft)	= 0.001
Gutter Width (ft)	= 2.000	Pavement Cross Slope (ft/ft)	= 0.020
Inlet n-value	= 0.016	Gutter Cross Slope (ft/ft)	= 0.020
Downstream Inlet Number	= 0	Gutter depression (in)	= 0.00
Grate Type	P-1-7/8		
Grate Length (ft)	= 7.00		
Splash-Over Vel. (ft/s)	= 17.69		
Combo2 Length (ft)	= 30.00		

User Name: Hernan A Aristizabal, AGK Engi
Project: c:\entellus\41032\acad\survey.STM

Date: 10-06-97
Time: 14:09:21
Page: 1

STORM SEWER HEC 12 SINGLE INLET REPORT

FLOW RESULTS (cfs)
Total Flow to inlet = 23.40

PONDING WIDTH (ft) = 31.81
DEPTH AT CURB (ft) = 0.64
EFFICIENCY (%)
Curb = *

Intercepted by current inlet = 21.17
Bypassed by current inlet = 2.23

Grate = 82.01 Total = 90.47
Slot = 47.04

INPUT PARAMETERS:

Inlet Type	= COMBINATION2 ON GRADE	Longitudinal Slope (ft/ft)	= 0.002
Gutter Width (ft)	= 2.000	Pavement Cross Slope (ft/ft)	= 0.020
Inlet n-value	= 0.016	Gutter Cross Slope (ft/ft)	= 0.020
Downstream Inlet Number	= 0	Gutter depression (in)	= 0.00
Grate Type	P-1-7/8		
Grate Length (ft)	= 7.00		
Splash-Over Vel. (ft/s)	= 17.69		
Combo2 Length (ft)	= 20.00		

User Name: Hernan A Aristizabal, AGK Engi
Project: c:\entellus\41032\acad\cont-adj.STM

Date: 09-18-97
Time: 14:35:05
Page: 1

STORM SEWER HEC 12 SINGLE INLET REPORT

FLOW RESULTS (cfs)
Total Flow to inlet = 23.00

Intercepted by current inlet = 19.16
Bypassed by current inlet = 3.84

PONDING WIDTH (ft) = 31.61
DEPTH AT CURB (ft) = 0.63
EFFICIENCY (%)
Curb = *
Grate = 74.65 Total = 83.32
Slot = 34.20

INPUT PARAMETERS:
Inlet Type = COMBINATION2 ON GRADE
Gutter Width (ft) = 2.000
Inlet n-value = 0.016
Downstream Inlet Number = 0
Grate Type P-1-7/8
Grate Length (ft) = 6.00
Splash-Over Vel. (ft/s) = 15.04
Combo2 Length (ft) = 15.00

Longitudinal Slope (ft/ft) = 0.002
Pavement Cross Slope (ft/ft) = 0.020
Gutter Cross Slope (ft/ft) = 0.020
Gutter depression (in) = 0.00