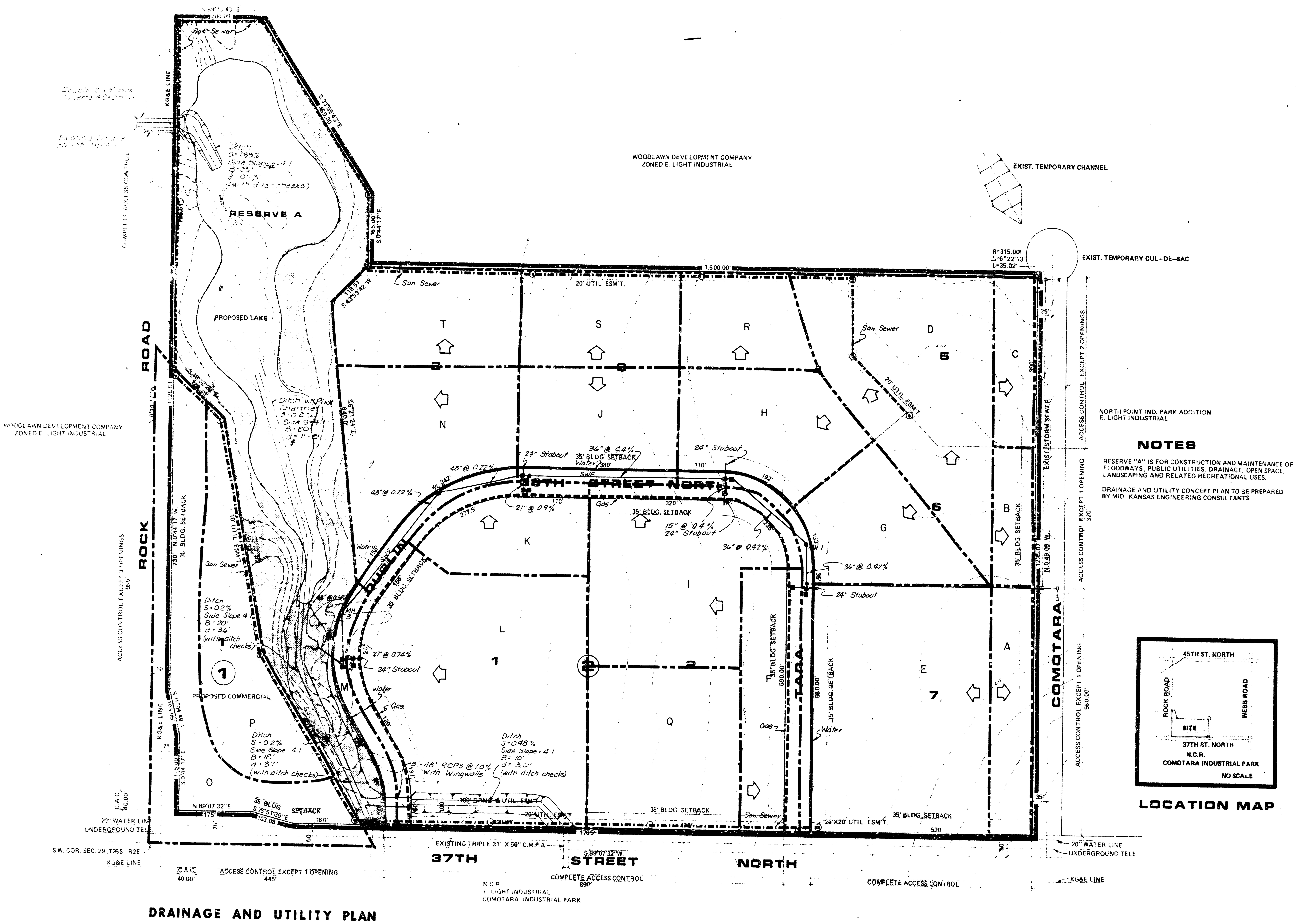

NOTES

RESERVE "A" IS FOR CONSTRUCTION AND MAINTENANCE OF FLOODWAYS, PUBLIC UTILITIES, DRAINAGE, OPEN SPACE, LANDSCAPING AND RELATED RECREATIONAL USES.

DRAINAGE AND UTILITY CONCEPT PLAN TO BE PREPARED BY MID KANSAS ENGINEERING CONSULTANTS

DRAINAGE AND UTILITY PLAN
COMOTARA HI-TECH CENTER

OWNER: WOODLAWN DEVELOPMENT COMPANY, 3500 N. ROCK ROAD, NO. 100, WICHITA, KANSAS 67226

SHEET 1

BILL G. YUNG DESIGN
8225 E. 35 TH. ST. NORTH, WICHITA, KS. 37226
316-683-5567

date NOVEMBER 16, 1984
rev. NOV 28, 1984

sheet title PRELIMINARY PLAT

project COMOTARA HI-TECH CENTER

sheet 1

	AREA (ACRES)	AREA ACCUM.	C	T_c (MIN)	I_5 (IN/HR)	I_{100} (IN/HR)	Q_5 (CFS)	Q_{100} (CFS)	PIPE SLOPE	PIPE SIZE	INLETS
A	1.26		0.70	15	5.21	8.98	4.6	7.9			
		15.76	0.70	19	4.76	8.19	52.5	90.4		Exist.	Existing
B	0.72		0.70	15	5.21	8.98	2.6	4.5			
		16.48	0.70	19	4.76	8.19	54.9	94.5		Exist.	Existing
C	0.89		0.70	15	5.21	8.98	3.2	5.6			
		17.37	0.70	19	4.76	8.19	57.9	99.6		Exist.	Existing
D	4.82		0.70	20	4.56	8.03	15.7	27.1			
E	6.01		0.70	16	5.09	8.76	21.4	36.9			[illegible]
F	1.96		0.70	15	5.21	8.98	[illegible]	12.3	0.48%	18"	[illegible]
		7.97	0.70	16	5.09	8.76	28.4	48.9	0.20%	36"	
G	2.18		0.70	15	5.21	8.98	8.0	13.7			
		10.15	0.70	18	4.86	8.37	34.5	59.5			
H	2.53		0.70	15	5.21	8.98	9.2	15.9			[illegible]
		12.68	0.70	19	4.76	8.19	42.2	72.7	0.44%	36"	
I	3.90		0.70	15	5.21	8.98	14.2	24.5			[illegible]
		16.58	0.70	20	4.56	8.03	54.1	93.2			
J	2.23		0.70	15	5.21	8.98	8.1	14.0			[illegible]
		18.81	0.70	21	4.57	7.88	60.2	103.8	0.22%	48"	
K	1.75		0.70	15	5.21	8.98	6.4	11.0			2 Inlets
		20.56	0.70	23	4.41	7.60	63.5	109.4	0.22%	48"	
L	7.22		0.70	16	5.09	8.76	25.7	44.3			[illegible]
		27.78	0.70	25	4.27	7.36	83.0	143.1			
M	0.48		0.35	15	5.21	8.98	1.4	4.1			2 Inlets
		28.26	0.71	26	4.21	7.25	84.5	145.5	0.34%	48"	
N	3.37		0.70	15	5.21	8.98	12.3	29.0		Not Req'd	
O	4.50		0.70	15	5.21	8.98	16.4	28.3		Not Req'd	
P	4.58		0.70	15	5.21	8.98	16.7	28.8		Not Req'd	
Q	3.20		0.70	15	5.21	8.98	[illegible]	20.11		Not Req'd	
R	1.52		0.70	15	5.21	8.98	5.5	9.6		Not Req'd	
S	1.98		0.70	15	5.21	8.98	7.2	12.4		Not Req'd	
T	2.32		0.70	15	5.21	8.98	8.5	14.6		Not Req'd	
Reserve A	12.67		0.70	15	5.21	8.98	46.2	79.6		Not Req'd	
Ditch in Reserve A	Ditch will nee[illegible]ch checks to control erosion.										
Initial	13.92		0.70	18	4.86	8.37	47.4	81.6			
At Culvert Under Dublin		81.90	0.70	37	3.33	5.76	190.9	330.2			
Final		110.16	0.70	39	3.19	5.53	246.3	426.4			
Total Acreage of Runoff to Lake	145.18		0.70	45	2.86	4.95	290.7	503.0			

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FBN 1/18/85

Culverts - 1

Determine max Q through the 4 - 31"x50" CMPA's

Approx. Design Data

$L = 110'$ CMPA w/ square-edge [illegible]
$S_o = 0.004$ ft/ft $K_e = 0.5$

Allowable $HW = 4'$ Max rise $= 31" = 2.5833'$

A. For Inlet Control

$\frac{HW}{D} = \frac{4}{2.5833} = 1.55$ from Chart 6 for 1 CMPA, $Q = 65$ cfs

Total $Q = 4 \times 65 = 260$ cfs

B. For Outlet Control

$HW = 4' = H + h_o - LS_o \Rightarrow H + h_o = [illegible] = 4.44'$

$H = 4.44 - 2.5833 = 1.8567'$ from Chart 12, $Q = 46$ cfs

Total $Q = 4 \times 46 = 184$ cfs

Design Ditch based on $Q = 260$ cfs. Present ditch is approx 5' deep. ∴ set $d = 4'$; [illegible]

Flow from Area $= 3.2(.7)(8.98) = 20.1$ cfs

Ditch: $B = 6'$, $d = 4'$, $S = 0.002$ '/' & Side Slope 4:1

Initial ℄ Elev of Ditch $= 206 - 5 = 201$

℄ Elev @ R.O.W. of Dublin $= 201 - 0.002(4[illegible]5) = 200.17$

To get ditch 5' in ground, ℄ Elev @ R.O.W. of Dublin must = 202 - 5 = 197.0. Then S must = [illegible]

With 2 ditch checks, S = [illegible] = .0048

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Culverts - 2

Try $B = 8'$, $d = 3'$, Side slopes 4:1 - $Q = 264.3$ cfs N.G.

Try $B = 10'$, $d = 3'$, " " 4:1 $Q = 297.8$ cfs > 280 cfs OK

Ditch configuration

[sketch: $d = 3'$, $D = 4.0'$, $B = 10'$, width = 38' 42']

Initial ℄ Elev of Ditch $= 206 - 4.0 = 202.0$ - Is this the existing ℄ of [illegible] CMPA?

℄ Elev @ R.O.W. of Dublin $= 202.0 - .001(415) = 197.85$

Approx. depth below Dublin $= 205 - 197.85 = 7.15'$

Before the culvert under Dublin can be designed, the ℄ of the ditch to the lake must be determine. To determine this ℄, the box culvert @ Sta 12+50, 37th St N. must be designed. ℄ Elev @ Outlet of RCBC will be approx. 196.75. Assuming a slope of 0.2% on the ditch to the lake, the ℄ Elev of the ditch @ the outlet of the Dublin culvert would be $196.75 - .002(50) = 196.65$

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Culverts - 3

A. For Inlet Control

RCP	Try 2 - 36" (Chart 2)	$\frac{HW}{D} = \frac{4}{3} = 1.33$	$Q = 50$ cfs $\times 2 = 100$ cfs	N.G.
	Try. 3 - 42"	$\frac{HW}{D} = \frac{48}{42} = 1.14$	$Q = 60$ cfs $\times 3 = 180$ cfs	N.G.
	Try 3 - 48"	$\frac{HW}{D} = \frac{48}{48} = 1.0$	$Q = 80$ cfs $\times 3 = 240$ cfs	N.G.
HERCP	Try 3 - 38"x60" (Chart 3)	$\frac{HW}{D} = 1.26$	$Q = 93$ cfs $\times 3 = 279$ cfs	OK
CMP	Try 3 - 48" (Chart 5)	$\frac{HW}{D} = 1.0$	$Q = 72 \times 3 = 216$ cfs	N.G.
CMPA	Try 3 - 36"x58" (Chart 6)	$\frac{HW}{D} = 1.33$	$Q = 70 \times 3 = 210$ cfs	N.G

B. For Outlet Control

Try 3 - 48" RCP's $Q = 93$ cfs $H = 1.55$ (Chart 9)

$d_c = 2.9'$ (Chart 16) $TW = 4' - (197.19 - 196.65) = 3.46'$

$\frac{d_c + D}{2} = \frac{2.9 + 4}{2} = 3.45'$ $HW = H + h_o - LS_o = 1.55 + 3.45 - (66).01 = 4.34' > 4$

Try 3 - 38" x 60" HERCP $Q = 94$ cfs $H = 1.48'$ (Chart 10)

$d_c = 2.46$ (Chart 17) $\frac{d_c + D}{2} = \frac{2.46 + 3.17}{2} = 2.81$ $TW = 3.46'$

$HW = 1.48 + 3.46 - 66(.01) = 4.28' \ngtr 4$

An HW of 4' would put the water surface @ 197.85 + 4 = 201.85.

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Culverts - 4

A. For Inlet Control

$\frac{HW}{D} = \frac{4.65}{4} = 1.16$ Chart 2 $Q = 95$ cfs $\times 3 = 285$ cfs OK

$\frac{HW}{D} = \frac{5}{4} = 1.25$ $Q = 100$ cfs $\times 3 = 300$ cfs OK

B. For Outlet Control

3 - 48" RCP $Q = 95$ cfs $H = 1.55'$ (Chart 9) $TW = 3.46$

$d_c = 2.95'$ (Chart 16) $\frac{d_c + D}{2} = \frac{2.95 + 4}{2} = 3.48$ $HW = 1.55 + 3.48 - .66 = 4.37' < 4.65'$ O

Ditch To Lake

Initial $Q = 81.2$ cfs. Configuration of ditch would initially $S = 0.2\%$, Side Slope 4:1, Total Depth $= 204.5 - 197.1 = 7.4'$. With 4:1 side slope, the side slopes of ditch would be 30'. With $B = 8'$, $d = 2.25'$ $Q = 92.6$ cfs

Total width of ditch would be $(30 \times 2) + 8 = 68' < 75'$ easemt.

@ Dublin culvert $Q_{100} = 330.2$ cfs

$S = 0.2\%$ Side Slope $= 4:1$, $B = 12'$, $d = 3.7'$ $Q = 331.2$ cfs > 330.2 cfs OK

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FBN 1/25/85

Culverts - 5

Culvert under Rock Road

Proposed top of curb for Rock Rd @ proposed culvert, Elev = 193.18

Top of Culvert must ∴ be @ 193.18 - 2' = 191.18

Per KHE, assume Lake is a ditch, rather than detention basin. ∴ Determine Time of Travel, T_t, to culvert from 48" RCP End Sect.

Approx $S = 0.5\%$, approx side slopes 18:1; approx $B = 20'$

approx $d = 2.25'$ $Q = 498$ cfs

Area of channel X-section $= 136$ sq ft, $V = \frac{498}{136} = 3.7$ fps

$T_t = 1300$ ft $\div [3.7$ fps $\times \frac{60 sec}{1 min}] = 5.9$ min

$T_c = 6 + 39 = 45$ min $Q_{100} = 505$ cfs

To minimize the depth of the ℄ @ Rock Rd make culvert height 3' max. ∴ approx. ℄ elev of culvert $= 191.18 - 3 - 1 = 187.18$ (approx. top thickness)

A. For Inlet Control

Try two 8' x 3' RCBC's w/ 45° Wingwalls   Chart 1

$Q_{per\ box} = \frac{505}{2} = 252.5$ cfs $\frac{Q}{B} = \frac{252.5}{8} = 31.6$. From Chart 1,

$\frac{HW}{D} = 2.05$. $HW = 2.05(3) = 6.05'$ $187.12 + 6.05 = 193.23 > 193.18$ N.

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Culverts - 6

Based on d_c, $HW = H - h_o - LS_o = .62 + 3 - [illegible](.005) = 3.57' > 5'$ OK

Max $HW = 5.4'$ for inlet control ∴ HW must be less than that to keep culvert under inlet control. This makes $TW < HW - H + LS_o = 5.4 - .62 + .55 = 5.25'$

In order for flow to continue west of Rock Rd a ditch will be required. Per map, the nearest 185 contour is approximately 350' on west. The slope of the ditch, $S = \frac{187 - 185}{350} = .0057$ Use 0.005'/'

Ave. Elev in this area = 190 ∴ depth of ditch ≈ 3'

Try $B = 20'$, $d = 3.0'$, Side Slopes = 4:1, $Q = 479.5 < 505$ cfs

Try $B = 25'$, $d = 2.5'$, " " ", $Q = 405.5$ cfs < 505 cfs

Try $B = 25'$, $d = 2.6'$, $Q = 435$ [illegible] <

Try $B = 26'$, $d = 2.8'$; $Q = 5[illegible]$ cfs > 505 cfs OK

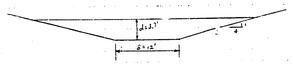
$TW = 2.8' < 5.27'$ OK

Centura HL-Tech Center
FCN 1/28/84

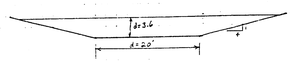
Ditch Cross-Sections - 1

Ditch in Reserve A, N. of 3-48" RCP's

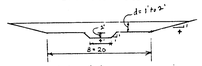
Initial Cross Section



2nd Cross Section



3rd Cross Section



Ditch in Reserve A, South of Double 9'x3' Box Culverts.

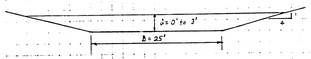
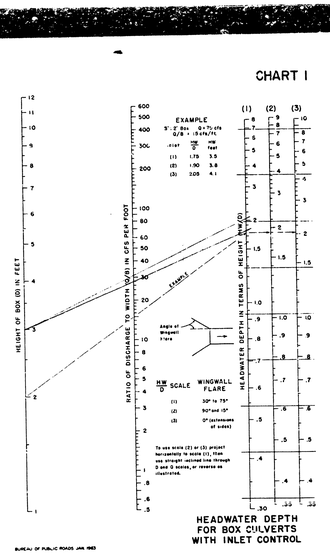


CHART 1

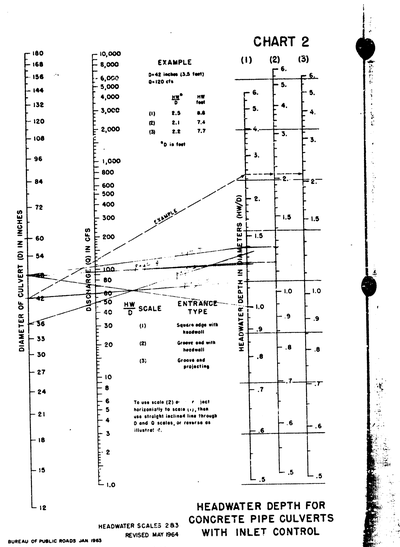


HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-21

CHART 2



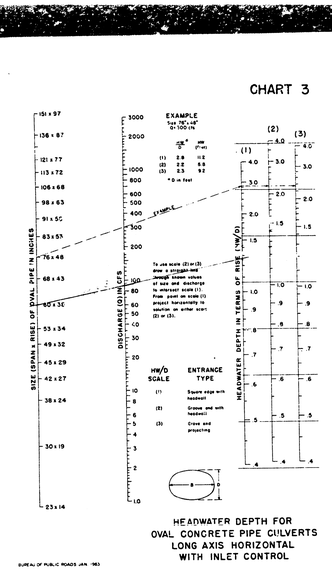
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3 REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN 1963

5-22

CHART 3

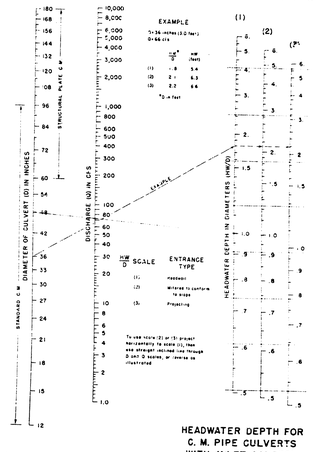


HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-23

CHART 5

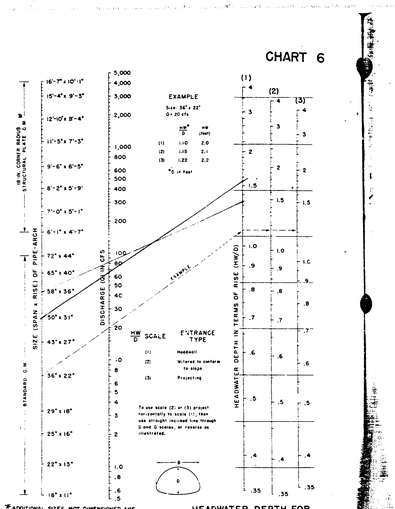


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-25

CHART 6

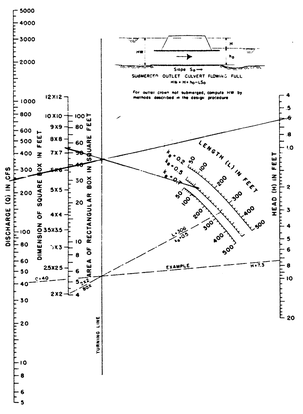


HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-26

CHART 8

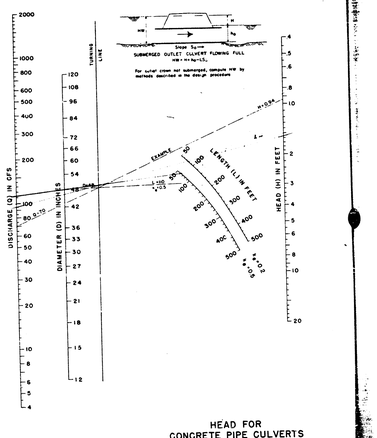


HEAD FOR CONCRETE BOX CULVERTS FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

5-31

CHART 9

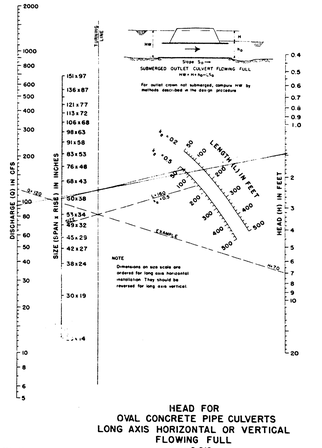


HEAD FOR CONCRETE PIPE CULVERTS FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN 1963

5-32

CHART 10

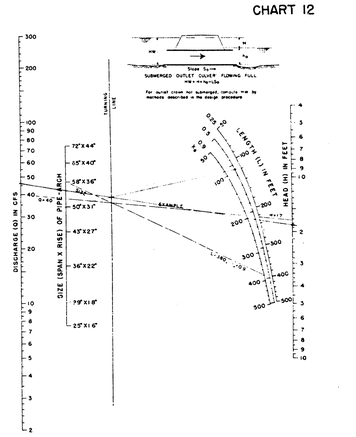


HEAD FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL OR VERTICAL FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

5-33

CHART 12



HEAD FOR STANDARD C.M. PIPE-ARCH CULVERTS FLOWING FULL n=0.024

BUREAU OF PUBLIC ROADS JAN. 1963

5-35

Chart 15

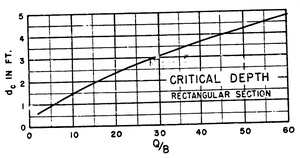


CHART 16

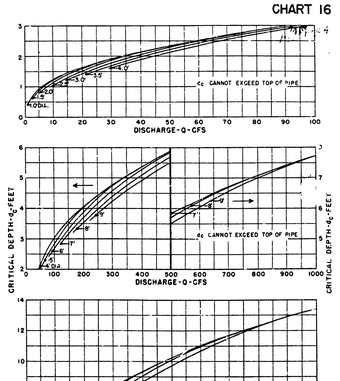


CHART 17