APPENDIX D, TABLE D-1

Street Design Standards

TYPE ROADWAY	ROW	STREET WIDTH	DESIGN SPEED
Local*	60'	25’ B/B - 28' B/B	25 mph
Local Industrial	60'	32' B/B	25 mph
Neighborhood Collector	60'	28' B/B	25 mph
Minor Collector 2nd class	60' – 80’	28' B/B – 38’ B/B	25 - 35 mph
Minor Collector	80'	24’ – 49’	35 - 45 mph
Major Collector	100' – 120’	48’ - 60'	45 - 50 mph
Minor Arterial	100' – 120’	48’ - 60'	45 - 55 mph
Principal Arterial	120'	60'	45 - 55 mph

- Cul-de-sac or side streets, serving 60 lots or less, may reduce the Street Width to 25’ B/B provided the following:
    - Street does not stub to an adjacent undeveloped parcel
    - Lots have a front yard setback of thirty feet (30’) or more
    - Street must be marked with “No Parking” signs on one side of the street, fire hydrant side is preferred
    - Neighborhood traffic only, not for non-residential traffic developments
    - Does not serve multi-family or multi-use developments

APPENDIX D, TABLE D-2

The Rational Method - The basic formula is $Q=ACI$ where:

Q = *Peak rate of runoff in cubic feet per second (CFS)*
A = *The drainage area in acres*
C = *Runoff coefficient representing the characteristics of drainage areas*
I = *Average intensity of rainfall in inches per hour for a selected storm frequency and given time of concentration*

(1) Runoff Coefficient (c) - Please refer to Appendix D, Table D-3 for average acceptable runoff coefficients for use with the Rational Method.

(2) Rainfall Intensity (I) - The value for rainfall intensity can be calculated using the following precipitation formulas:

Frequency	Formula
2	I = 106/(Tc + 17)
5	I = 131/(Tc + 19)
10	I = 170/(Tc + 23)
25	I = 230/(Tc + 30)
50	I = 250/(Tc + 27)
100	I = 300/(Tc + 31)

(3) Time of Concentration (Tc) - Appendix D, Table D-4 provides a graphical method for estimating overland flow time. The minimum time of concentration to a street inlet is 10 minutes. Channel flow time (length divided by average velocity) may be used to calculate the remaining Tc to the inlet or to the point of reference downstream.

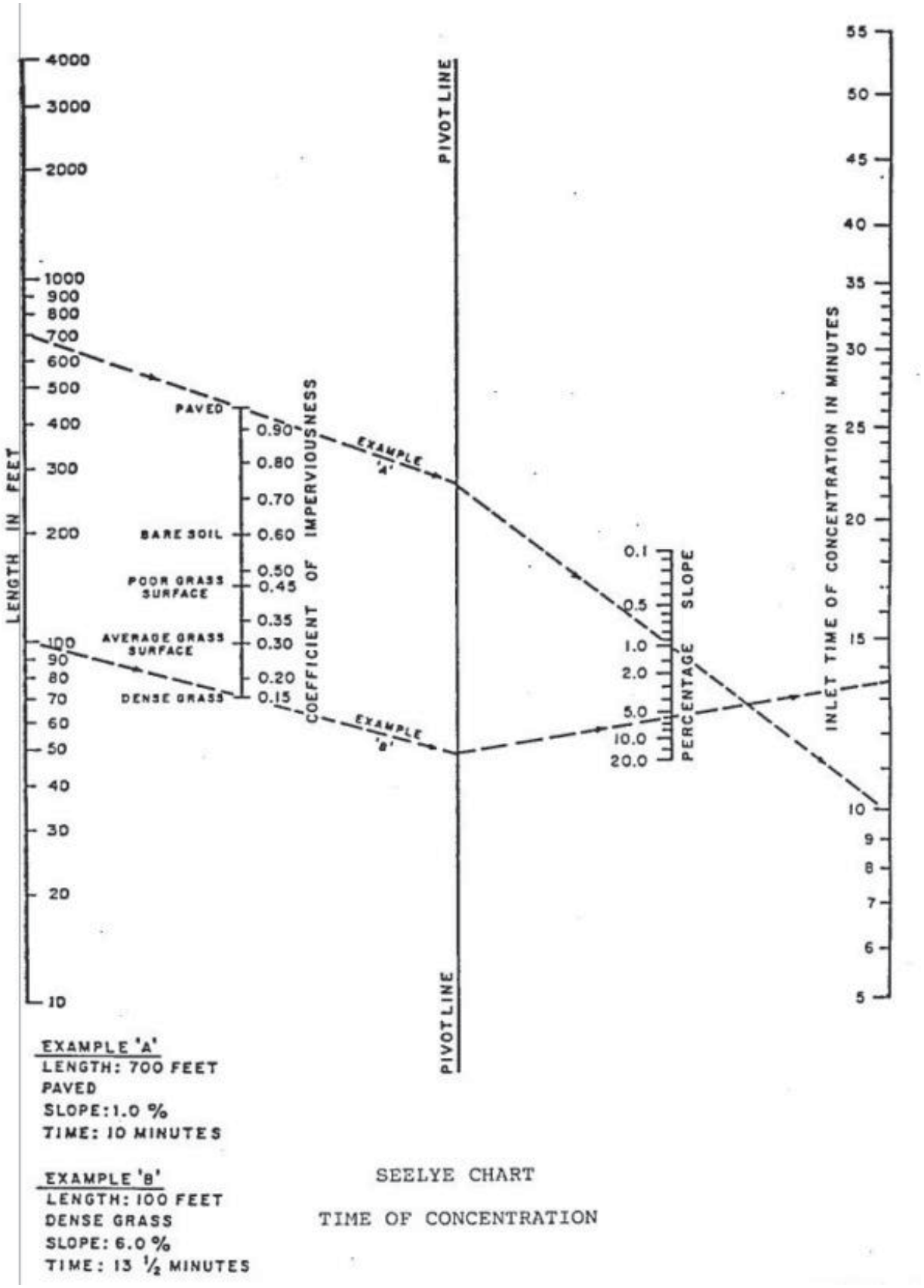
APPENDIX D, TABLE D-3

Runoff Coeffecient

RUNOFF COEFFICIENT General Slope					
Description of Area	< 2%	3%	4%	5%	7%>
Commercial	.75	.78	.81	.84	.90
Residential					
Single Family	.40	.42	.44	.46	.50
Multi Units	.60	.63	.66	.69	.75
Apartments	.60	.64	.68	.72	.80
Industrial					
Light	.60	.64	.68	.72	.80
Heavy	.75	.78	.81	.84	.90
Cropland (rowcrop)	.40	.42	.44	.46	.50
Grassland	.25	.28	.31	.34	.40
Woodland	.20	.24	.28	.32	.40
Parks, Cemeteries	.25	.28	.31	.34	.40

Composite Runoff Coefficient	
Pavement	
Asphalt and Concrete	.95
Roofs	.95
Slopes 1 to 2%	
Impervious soils (heavy)	.40 to .65
Impervious soils (with turf)	.30 to .55
Slightly pervious soils	.15 to .40
Slightly pervious soils (with turf)	.10 to .30
Moderately pervious soils	.05 to .20
Moderately pervious soils (with turf)	.00 to .10

APPENDIX D, TABLE D-4



SEELYE CHART

TIME OF CONCENTRATION

APPENDIX D, TABLE D-5

Manning Equation: $Q = \frac{1.486}{n} (A) (R)^{\frac{2}{3}} (S)^{\frac{1}{2}}$

Where:

R = Hydraulic Radius = A/P, in feet
S = Slope of pipe, in ft/ft
n = Roughness Coefficient
A = Cross Sectional Area in Sq. Ft.
P = Wetted Perimeter, in feet
Q = Flow (C.F.S.)

APPENDIX D, TABLE D-6

Material Specification Numbers

Material	***Specification Numbers***	***Bedding ASTM Designation (D-2321)***
Concrete Pipe: Non-Reinforced Concr Pipe Reinforce Concr Circ Pipe Reinforce Concr Elliptic Culvert Storm Drainage & Swr Pipe	706.01 706.02 706.04	IA, IB, II
Corrugated Steel Pipe: Aluminized Type 2 Bituminous Corrug Steel Pipe Pipe Arches w/ Paved Invert	707.01/707.02 707.05/707.07	IA, IB, II
Plastic Pipe: PVC Profile Pipe HG Density Polyethylene	707.42 707.33	IA, IB, II

APPENDIX D-6

Storm Sewer and Culvert Specifications

I. Material Specifications

All culvert shall meet the material and installation requirements of ODOT item #603 type A conduits.

All storm sewers shall meet the material and installation requirements of ODOT item #603 type B conduits, with post construction testing as defined in Section II.

All 707.01 or 707.02 conduits shall be aluminized type II.

II. Deflection Testing for Storm Sewers and Culverts

15% of all storm sewers shall be tested for deflection within thirty days after they are complete. Butler County Engineer or his designated representative will determine what 15% shall be tested. If any storm sewer in the original 15% is found out of compliance, deflection tests will be required on 100% of the remaining storm sewer. A vertical ring deflection greater than 5% will not be allowed. This defelction is defined as 5% reduction in the vertical base or average inside diameter. The method of testing shall be subject to the approval of the engineer. If rigid balls or mandrels are used to test pipe deflection, no mechanical pulling devices shall be used. The deflection test may be conducted with a nine prong mandrel, a ball or a cylinder or another manner acceptable to the Butler County Engineer or his designated representative. The testing will be accomplished from manhole to manhole or catchbasin to catchbasin, following the complete flushing of the line. The contractor shall furnish all equipment required to complete the deflection testing. The deflection test shall be witnessed by the County Engineer or his designated representative. Any section of pipe that fails to meet the aforementioned requirements shall be rerounded by a procedure acceptable to the County or be excavated and either be relayed or replaced, and retested until the requirements are met.

APPENDIX D, TABLE D-7

Sump Line Specifications

4" LINE		**6" LINE**	
GRADE	***# SUMP HOOKUPS***	***GRADE***	***# SUMP HOOKUPS***
1%	2	1%	7
2%	3	2%	10
3%	4	3%	12
4%	5	4%	14
5%	5	5%	16
6%	6	6%	18

APPENDIX D, TABLE D-8

Entrance Loss Coefficient

END TREATMENT	*CONCRETE PIPE*	*PLASTIC AND CORRUGATED STEEL PIPE*
Project from fill	.2 (groove end)	.9
Head Wall	.2 to .5	.5
Mitered to slope	--	.7
End Section Conform to Slope	.5	.5
Box Culvert	.2 to .5	--

APPENDIX D, TABLE D-9

Manning Coefficient Open Channel Design

MANNING "n" VALUE:	
Sod or Jute Lining	.05
Pave Lining	.015
Rock Protection	.08
Natural Stream Channels Fairly regular section	
Some grass and weeds, little or no brush	.030 - .035
Dense growth of weeds, depth of flow is substantially greater than weed height	.035 - .05
Some weeds, light brush on banks	.035 - .05
Some weeds, heavy brush on banks	.05 - .07
Trees within channel, branches submerged at high stage, increase all above values by	.01 - .02

APPENDIX D, TABLE D-10

Anti-Seep Collar Specifications

- All pipe connections and anti-seep collar connections shall be water tight.

- The combination of the number of collars must increase the length of the line of seepage by 15%.

The number of collars required is calculated by:
N = 0.075 L/V

Where:

V = Collar projection (ft) - Collar projection is the distance above and below the pipe not including the pipe diameter. Example: if the collar is 5 ft. by 5 ft. and the pipe is a 24 inch diameter, then the projection is 3 ft. (1.5 ft above and 1.5 ft below the pipe).

N = Minimum number of collars
L = Length of buried pipe (ft)

APPENDIX D, TABLE D-11

Butler County Modified Critical Storm Method

Using TR-55 determine the total volume of runoff from a 1 (one) year frequency, 24 (twenty-four) hour storm event for the development area before and after development. Then determine the percentage increase in the volume of runoff due to development, and using the chart below, select the 24 (twenty-four) hour critical storm.

Runoff Volume Increase (%)		**Critical Storm**
Equal to or greater than	**And less than**	**Peak Rate Control**
--	10	1-year
10	20	2-year
20	50	5-year
50	100	10-year
100	250	25-year
250	500	50-year
500	--	100-year

Stage 1 OEPA Water Quality Volume Orifice
Stage 2 Critical Storm Event Orifice
Stage 3 Subsequent Frequency Storms
Stage N Emergency Spillway