HYDROLOGY D11/D6 2 of 2 7 PLANS

lines and the edge of the pond. This will protect any walls which might be constructed. In no case should ponded waters be allowed to stand against the wall or house foundation.

2. Ponds should average 6" deep and the minimum surface area should not be less than 17%[4]. of the total area drained into the pond.
3. Flows within the streets of the development are distributed enough so that no one street assumes a critical burden in carrying capacities. However, no street should be graded at less than 0.5% slope in order to insure adequate carrying capacities.
4. Runoffs from Area O-S-1 and A-1 shall be diverted to Mariposa Basin via Taylor Ranch Boulevard.
5. Runoffs from Area A-2 and A-4 shall be emptied into the Mariposa Basin located south of the site.
6. Flows from Area O-S-2 and A-3 shall be discharged into the proposed channel adjacent to the west boundary of the site.
7. A drainage diversion ditch is recommended along the north boundary of the site to carry offsite flow from O-S-1 and O-S-2 (see Fig. V). The drainage ditch shall be 10' wide bottom, 2:1 side slopes and allow a 1' water depth.

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4. See Appendix-2.

SUMMARY

The subject property, by utilizing backyard ponding on all lots will contribute no more surface runoff to surrounding areas than that which existed before development.

In conclusion, the development of this site should have a beneficial effect on the drainage characteristics of this area, and can be developed safely with no harm to life or property.

Respectfully submitted,

Carl A. Tebbens
N.M.P.E. No. 6309

APPENDIX

APPENDIX-1

COMPOSITE RUNOFF COEFFICIENTS

Undeveloped Land

$C = 0.31^{1.} \times 1.25^{2.} = 0.38$

Developed Land

Typical Lot Area

Gross Area			83.0 Ac.
Less:	Commercial Area	11.5 Ac.	
	Area in Streets	18.0 Ac.	
Area in Lots			53.50 Ac.
Average Lot Area (256 Lots)			9,100 sq.ft.
Typical Lot Width			70 ft.

Ponded Lots

C = 0.80	Streets & Walk Area	20x70	1,400 sq.ft.
	Roof Area	25x55	1,375 sq.ft.
	Driveway	30x15	450 sq.ft.
	Total Impervious Area		3,225 sq.ft.
C = 0.12	Front and Side Yards	70x55	3,850 sq.ft.
	Less Roof Area	55x25	-1,375 sq.ft.
	Less Driveway	30x15	-450 sq.ft.
	Total Pervious Area		2,025 sq.ft.

Impervious Area	3,225 sq.ft.	0.61% @ 0.80	0.49
Pervious Area	2,025 sq.ft.	0.39% @ 0.12	0.05
Total Area	5,250 sq.ft.	100%	0.54

Composite Runoff Coefficient - $C \times C_f = 0.54 \times 1.25 = 0.68$

1. See Bibliography, Item (1) Table XII
2. See Bibliography, Item (4) Article 3.7

Non-Ponded Lots

C = 0.80	Streets & Walk Area	20x70	1,400 sq.ft.
	Roof Area	50x55	2,750 sq.ft.
	Driveway	30x15	450 sq.ft.
	Total Impervious Area		4,600 sq.ft.
C = 0.12	Total Lot Area		9,100 sq.ft.
	Less Roof Area		-2,750 sq.ft.
	Less Driveway		-450 sq.ft.
	Total Pervious Area		5,900 sq.ft.

Impervious Area	4,600 sq.ft.	0.44% @ 0.80	0.353
Pervious Area	5,900 sq.ft.	0.56% @ 0.12	0.067
Total Area	10,500 sq.ft.	100%	0.42

Composite Runoff Coefficient - $C \times C_f = 0.42 \times 1.25 = 0.53$

Commercial Area

$C = 0.72 \times 1.25 = 0.90$

APPENDIX-2

Ponding Requirements

Average Lot Area		9,100 sq.ft.
1/2 roof area	25x55	1,375 sq.ft.
Patio area	10x10	100 sq.ft.
Rear lawn area		2,725 sq.ft.
Total Area Draining to Pond		4,200 sq.ft.

Runoff Coefficient

Impervious Area:

$$C = 0.80 \frac{1475}{4200} = 0.28$$

Pervious Area:

$$C = 0.12 \frac{2725}{4200} = \underline{0.08}$$

$$0.36$$

$$C \times C_f = 0.36 \times 1.25 = .45$$

Pond Volume Requirements:

100 year 6-hour precipitation = 2.2 inch

Volume = Runoff Coefficient x Area x Precipitation

$V = 2.2/12 \times .45 \times 4200 = 346.5$ ft.^{3}

Depth of Pond 0.50 ft. (6")

Minimum ARea of Pond = 693 ft.^{2}

Pond area as a percentage of area drained = 17%

$V = 17\% \times 4200 \times 0.5 = 357$ ft.^{3} area of pond = 714 ft.^{2} @ 0.5' deep.

APPENDIX-3

RUNOFF COMPUTATIONS

Sheet No. 1

Project: HOMESTEAD HILLS

Drainage Area No. A-1

Area = 13.0 acres

Maximum Overland Flow: L = 120' S = 0.033

Maximum Channel Flow:

Channel No. 1 L = 2000' S = 0.026

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 13.0 min.

Channel No. 1 Flow:

Velocity = 3.2 ft/sec; Time = $\frac{2000}{3.2 \times 60}$ = 10.4 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 23.4 min.

$I = \frac{189}{t+25} = \frac{189}{48.5} = 3.89$

Q = CIA = (0.61) (3.89) (13) = 30.8 c.f.s.

57.7% Ponded @ 0.68 = 0.39

42.3% Non Ponded @ 0.53 = 0.22

0.61

Date: 3-25-77

Comp. by: Subhas Shah

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 2

Project: HOMESTEAD HILLS

Drainage Area No. A-2

Area = 23.0 acres

Maximum Overland Flow: L = 120' S = 0.066

Maximum Channel Flow:

Channel No. 1 L = 2250' S = 0.017

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 11.0 min.

Channel No. 1 Flow:

Velocity = 2.65 ft/sec; Time = $\frac{2250}{2.65 \times 60}$ = 14.2 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 25.2 min.

$I = \frac{189}{t+25} = \frac{189}{50.2} = 3.76$

Q = CIA = (0.63) (3.76) (23) = 54.4 c.f.s.

67.6 % Ponded @ 0.68 = 0.46

32.4 % Non Ponded @ 0.53 = 0.17

0.63

Date: 3-25-77

Comp. by: Subhas Shah

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 3

Project: HOMESTEAD HILLS

Drainage Area No. A-3

Area = 16 acres

Maximum Overland Flow: L = 120' S = 0.05

Maximum Channel Flow:

Channel No. 1 L = 1450' S = 0.012

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 11.5 min.

Channel No. 1 Flow:

Velocity = 2.35 ft/sec; Time = $\frac{1450}{2.35 \times 60}$ = 10.3 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 21.8 min.

$I = \frac{189}{t+25} = \frac{189}{46.8} = 4.04$

Q = CIA = (0.57) (4.04) (16) = 37 c.f.s.

30% Ponded @ 0.68 = 0.20

70% Non Ponded @ 0.53 = 0.37

0.57

Date: 3-25-77

Comp. by: Subhas Shah

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 4

Project: HOMESTEAD HILLS

Drainage Area No. A-4

Area = 12.0 acres

Maximum Overland Flow: L = 840' S = 0.005

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = _____ min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = _____ min.

Total Accumulation Time: T = 10 min.

$I = \frac{189}{t+25} = \frac{189}{35} = 5.4$

Q = CIA = (0.9) (5.4) (12) = 58 c.f.s.

C = 0.72 x 1.25 = 0.9

Date: 3-25-77

Comp. by: Subhas Shah

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 5

Project: HOMESTEAD HILLS

Drainage Area No. A-1, A-2, A-3, A-4

Area = 64.0 acres

Maximum Overland Flow: L = 120' S = 0.066

Maximum Channel Flow:

Channel No. 1 L = 2250' S = 0.017

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 11.0 min.

Channel No. 1 Flow:

Velocity = 2.65 ft/sec; Time = $\frac{2250}{2.65 \times 60}$ = 14.2 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 25.2 min.

$I = \frac{189}{t+25} = \frac{189}{50.2} = 3.76$

Q = CIA = (0.66) (3.76) (64) = 158.8 c.f.s.

Date: 3-25-77

Comp. by: Subhas Shah

Checked by: _____

3.6 Continued

TABLE 3-2 (8)

RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS

Character of Surface	Runoff Coefficients
Streets:	
Asphaltic	0.70 to 0.95
Concrete	0.80 to 0.95
Drives and Walks	0.75 to 0.85
Roofs	0.75 to 0.95
Lawns, Sandy Soil:	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, Heavy Soil:	
Flat, 2%	0.15 to 0.20
Average, 2 to 7%	0.20 to 0.25
Steep, 7%	0.25 to 0.35

The coefficients in these two tabulations are applicable for storms of 5-year to 10-year frequencies. Less frequent higher-intensity storms will require modification of the coefficient because infiltration and other losses have a proportionally smaller effect on runoff, as given in the following section.

3.7 Adjustment for Infrequent Storms

The adjustment of the Rational Method for use with major storms can be made by multiplying the right side of the Rational Formula by a frequency factor C_f, which is used to account for antecedent precipitation conditions. The Rational Formula now becomes:

$$Q = CIAC_f \qquad (3\text{-}2)$$

The following table of C_f values can be used. The product of C times C_f should not exceed 1.0.

1-15-69

3.7 Continued

TABLE 3-3

FREQUENCY FACTORS FOR RATIONAL FORMULA

Recurrence Interval (years)	C_f
2 to 10	1.0
25	1.1
50	1.2
100	1.25

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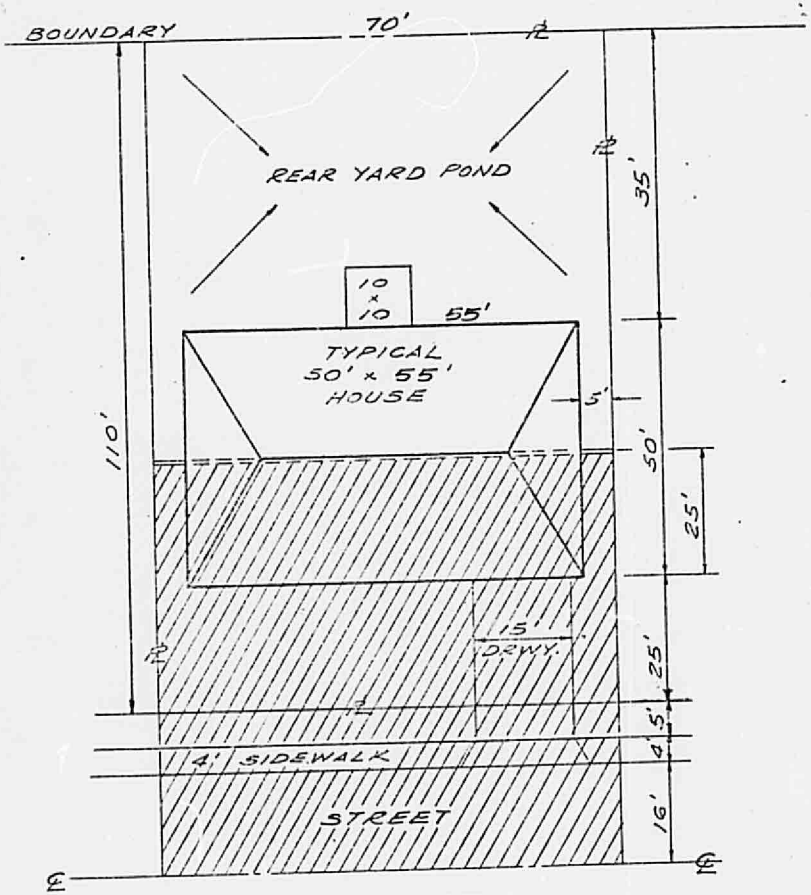
(1) Herkenhoff, Gordon & Associates, "Master Plan of Drainage City of Albuquerque, New Mexico and Environs, 1963". Albuquerque; Gordon Herkenhoff & Associates, Consulting Engineers.

(2) Wright-McLaughlin Engineers, "Urban Storm Drainage Criteria Manual, Volume 1", Denver, Colorado: Wright-McLaughlin Engineers, 1969.

(3) U.S. Department of Commerce, "Technical Paper, No. 40, Rainfall Frequency Atlas of the United States", Washington, D.C., U.S. Government Printing Office, 1963.



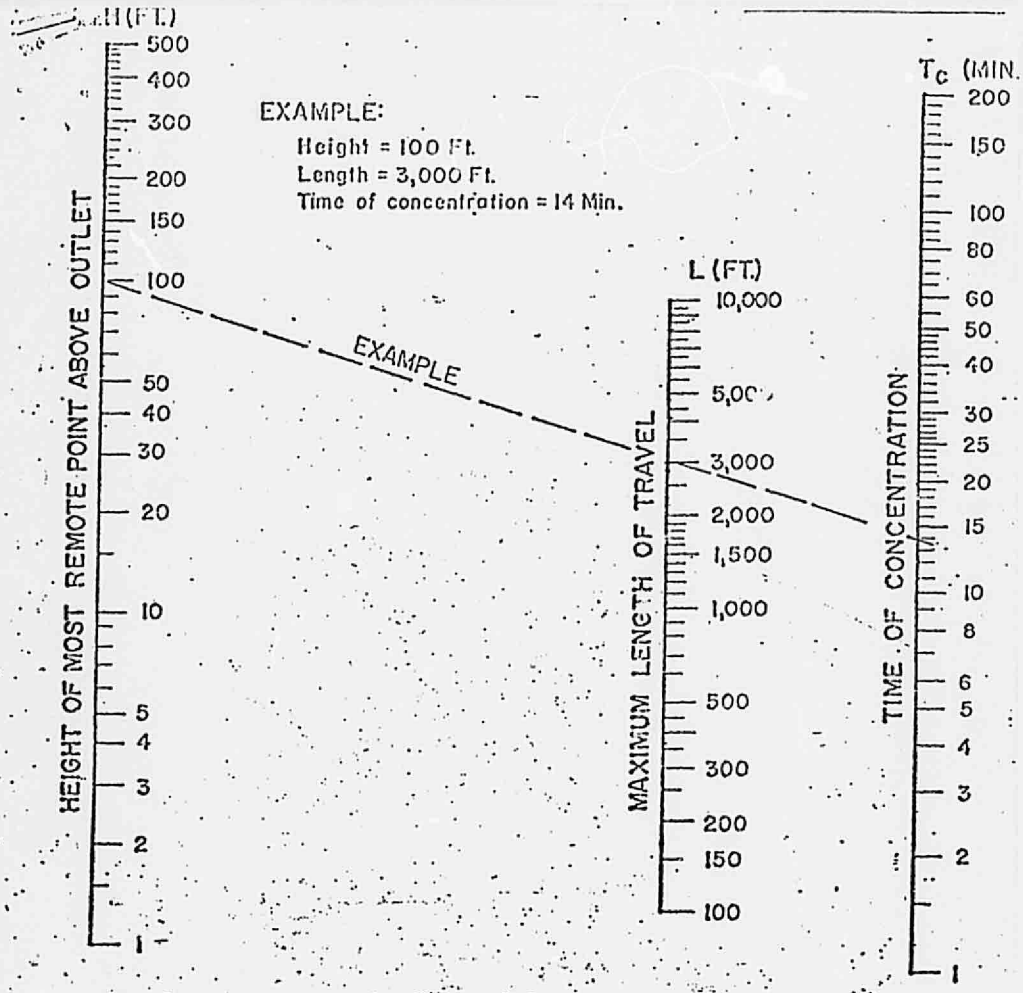
NOTE: REFER APPENDIX FOR CALCULATION

AREA DRAINED

FIGURE II
TYPICAL LOT DRAINAGE

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING·PLANNING·SURVEYING

JOB NO. _____ DATE _____
PROJECT _____
SCALE _____



Based on study by P. Z. Kirpich,
Civil Engineering, Vol. 10, No. 6, June 1940, p. 332

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Reprinted from "Design of Roadside Drainage Channels - Hydraulic Engineering Circular No. 6", April 1962, U. S. Dept.

FIG. III

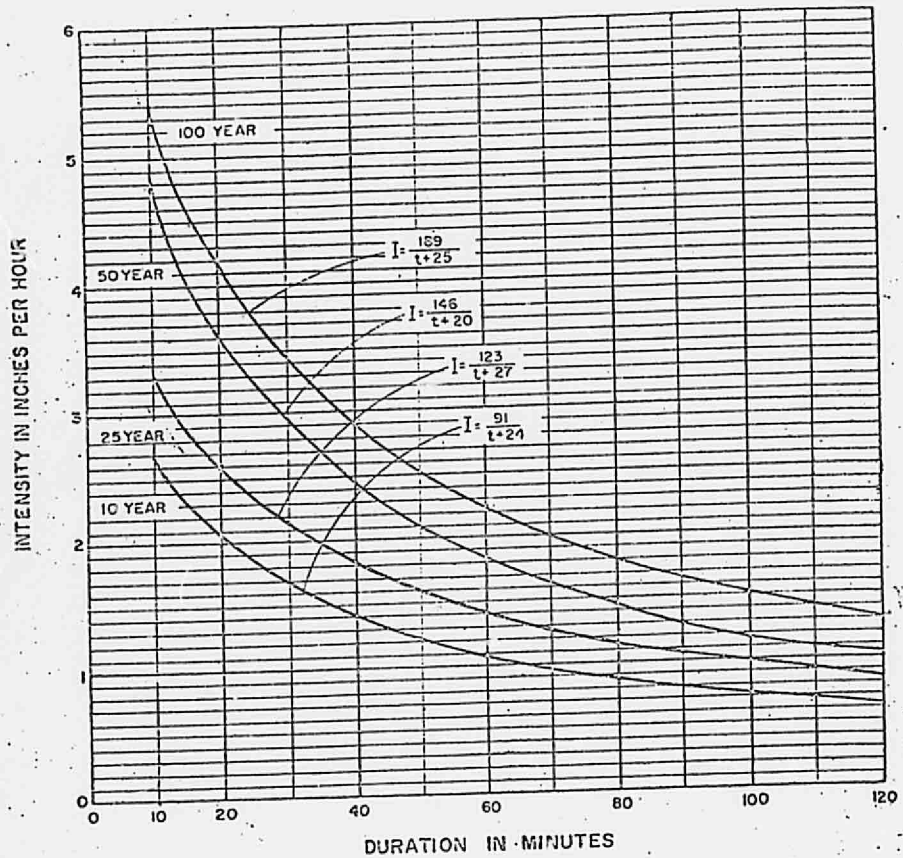


FIGURE IV

MASTER PLAN OF DRAINAGE
CITY OF ALBUQUERQUE - NEW MEXICO
AND ENVIRONS

INTENSITY DURATION
FREQUENCY CURVES

(ALBUQUERQUE AREA - 1961)

GORDON HERKENHOFF & ASSOC
CONSULTING ENGINEERS

CHART
1