HYDROLOGY D11/D3 5 PLANS

D11/D3

5 PLANS

LETTER OF TRANSMITTAL

Genge/Murray-McCormick
2601 Wyoming Blvd. N.E. Suite F
Albuquerque, N.M. 87110/505 292-1936

Date July 14, 1977

To City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Attn. V. M. Kimmick, City Engineer

Re: Homestead Hills East (Taylor Ranch Tract #8) Drainage Report

Comments:

Three copies of the subject Drainage Report is transmitted for your review.

Enclosures:

Quantity	Type of Enclosure and Description
3	Drainage Reports

Signed: Frank Kam

Copy to:

If enclosures are not as noted, kindly notify us at once.

Genge/Murray-McCormick
2601 Wyoming Blvd., N.E. Suite F
Albuquerque, N.M. 87110/505 292-1936
Engineering · Surveying · Planning
Tucson · Phoenix · Denver · Pueblo

August 2, 1977

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87110

Re: Homestead Hills East (Tract 8) Drainage

Dear Mr. Kimmick:

This is an addendum to the "Drainage Report for Homestead Hills East, Taylor Ranch Tract 8" prepared by this office in June 1977.

This addendum more precisely defines the historic runoff from the site. Originally the historic discharge for the 100-year frequency storm was based on the entire site as one unit. This addendum addresses the fact that the site discharges runoff at two general locations on the site prior to development. As the attached calculations show the larger area, 29.1 acres, drains to the southeast with sheet flows generally along the south boundary. The undeveloped flow calculates to be 56.5 cfs. The smaller area that naturally drains to the northeast corner of the project discharges 9.0 cfs. The developed flows are 25.4 cfs at the southeast corner and 11.4 cfs at the northeast corner.

Since the design of the final construction plans we have ponded additional lots (Lots 11 through 17, Block 8) in Area C-1 thereby decreasing the developed flow out of the northeast corner to 9.8 cfs.

This addendum is intended to give additional detail to the original report.

Should there be any questions regarding this addendum, please feel free to call.

Very truly yours,

GENGE/MURRAY-McCORMICK, INC.

Carl A. Tebbens

Carl A. Tebbens, P.E.
Vice President

CAT:dw

Encl.

cc: Don Greene

MEURER, SERAFINI AND MEURER, INC.
CONSULTING ENGINEERS • SURVEYORS • PLANNERS
2601 WYOMING BLVD., N.E., SUITE F • ALBUQUERQUE, NEW MEXICO 87110 • (505) 292-1936

Bruno

September 16, 1977

Mr. V. M. Kimmick, City Engineer
City of Albuquerque
P. O.Box 1293
Albuquerque, New Mexico 87103

Re: Homestead Hills East (Taylor Ranch Tract 8)

Dear Mr. Kimmick:

At the request of Mr. Bruno Conegliano we are submitting this addendum to the "Drainage Report for Homestead Hills East, Taylor Ranch Tract 8" dated June, 1977.

This addendum addresses the method of handling the storm run-off discharge to the south of the subject development and corrects a flow quantity originally calculated.

The attached calculations show the revision of the developed flow quantity which discharges from the site to the south (Σ A-1 thru A-7). Due to an error in the calculation of the Tc the flow discharge at Area A-7 increases from 25.38 cfs to 35.6 cfs. The corresponding Tc is 22.5 min. Until such time as the land to the south of this site is developed the 100-year discharge of 35.6 cfs will be conveyed to the south and west in an earthen channel having a shape as shown on the attached drainage plan. The runoff will be conveyed under Taylor Ranch Drive and will discharge into the proposed major detention pond west of Taylor Ranch Drive and south of Homestead Hills.

With respect to the sequence of channel construction, AMBELL has made the commitment for the sequence of channel construction as stated in the "Taylor Ranch Comprehensive Drainage Study" dated April, 1977. More specifically, on page 8 of the above report, it is stated that the Piedras Marcadas Arroyo-South Branch will be constructed simultaneously with the development of Tract 8. In addition the above report details the sequence of channel construction with respect to other development within Taylor Ranch.

MEURER, SERAFINI AND MEURER, INC.

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With this addendum to the Tract 8 drainage report, it is our desire to obtain approval of the drainage study as soon as possible.

Very truly yours,

MEURER, SERAFINI AND MEURER, INC.

Carl A. Tebbens

Carl A. Tebbens, P.E.
Vice President

CAT:dw

cc: Bruno Conegliano
Don Greene

DALE BELLAMAH CORPORATION

POST OFFICE BOX 3325
6400 UPTOWN BOULEVARD, N.E.
EAST TOWER, SUITE 600

ALBUQUERQUE, NEW MEXICO 87110
TELEPHONE (505) 299-7631

June 1, 1977

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico
87103

RE: HOMESTEAD HILLS DRAINAGE

Dear Mr. Kimmick:

In response to our meeting of May 31, 1977, we will provide you with the following information.

A. The revised outflow figures for the Homestead Hills Subdivision using different "C" values and

B. A plan showing where the offsite flows will be collected.

Additionally, we certify that we will build and maintain any temporary drainage structures necessary to handle these flows until permanent structures are completed.

I believe that these were the primary concerns for drainage of the Homestead Hills Subdivision and hope that you can now approve the plat.

Thank you for your cooperation. If you have any questions, please do not hesitate to contact me.

Very truly yours,
AMBELL
DALE BELLAMAH LAND CO., INC.
A Partner

Donald F. Greene

Donald F. Greene
Development Engineer

/kc

BUILDERS—DEVELOPERS—REALTORS

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7/17/77
CJT

Undeveloped flow

Area X = 29.1 Ac

Δ Elev = 5137.0 − 5115.5 = 21.5'

Distance traveled = 1650 L.F.

Using Tc for Small Drainage Basins
Tc = 12 min

$$I_{100} = \frac{189}{T_c + 25} = 5.11$$

$$Q_{100} = C\ I\ A$$
$$= (0.39)(5.11)\ 29.1\ ac$$
$$= \underline{\underline{56.5\ cfs}}$$

1.

Undeveloped Flow (con't'd)

Area Y = 4.4 Ac.

Δ Elev = 5132 − 5123 = 9.0 ft

Distance travelled = 750 LF

T_c = 7 min Use 10 min

$I_{100} = \frac{189}{T_c + 25} = 5.4$

$Q_{100} = (0.38)(5.4)\,4.4$
$= 9.0$ cfs

Amended
DRAINAGE REPORT

FOR

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

ALBUQUERQUE, NEW MEXICO

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ECOSYSTEMS ANALYSIS • PLANNING • LAND SURVEYS • ENGINEERING

2601 WYOMING BLVD., NE. SUITE F / ALBUQUERQUE, N.M. 87110 / 505-292-1936

Amended
DRAINAGE REPORT

FOR

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

ALBUQUERQUE, NEW MEXICO

Prepared For

AMBELL
6400 Uptown Boulevard N.E.
Albuquerque, New Mexico

Prepared By

Genge/Murray-McCormick, Inc.
2601 Wyoming Boulevard N.E.
Albuquerque, New Mexico 87110
(505) 292-1936

June 1977
Amended September 1977

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APPENDIX-2	Ponding Requirements
APPENDIX-3	Runoff Computations
APPENDIX-4	Frequency Factor
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DRAINAGE REPORT

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

PURPOSE AND SCOPE

AMBELL, a joint venture of AMDEC and Dale Bellamah Land Company, is currently developing lands located on the western Albuquerque metropolitan area known as Taylor Ranch. Taylor Ranch is a many faceted development, master planned concept which includes single family, multi-family, parks, schools, and commercial areas. Homestead Hills East, Taylor Ranch Tract 8, is a single family subdivision.

The purpose of this report is to present a plan for controlling surface runoff from the said subdivision in a manner acceptable to the Albuquerque Metropolitan Arroyo Flood Control Authority and the Albuquerque City Engineer's office.

SITE LOCATION AND TOPOGRAPHY

Taylor Ranch Tract 8 is located within Section 23, Township 11 North, Range 2 East, N.M.P.M., Bernalillo County, New Mexico. Surrounding terrain is unimproved land.

A proposed Piedras Mercadas channel is located on the north boundary of the proposed site. West of the site are Homestead Hills and proposed Tract 14. On the south the site is bounded by a proposed civic centre and school site and on the east by undeveloped lands of others.

The soil of the site is generally comprised of eolian sand. The natural ground slopes from northwest to southeast. Ground cover consists mainly of rabbitbrush, yucca, and the cactus.

Proposed Taylor Ranch Drive on the west and proposed Piedras Mercadas Arroyo on the north will intercept offsite flows entering the site when channel improvements are in place.

DESIGN CRITERIA

In analyzing the storm runoff, the Rational Formula, $Q = CIA C_f$ is used.[1]

Where:

Q = Runoff quantity in cubic feet/second.

A = Contributing area in acres.

C_f = Frequency factor for Rational Formula.

I = Intensity in inches/hour for a duration equal to the time of accumulation (duration) measured in minutes and obtained from Figure IV, Intensity Duration Frequency Curves, Albuquerque Area 1961 (Note: Where a Time of Concentration [Tc] is less than ten minutes from Figure III, the intensity value equal to ten minuess is employed.

C = Runoff Coefficient (No Unit). This coefficient represents the integrated effects of infiltration, detention storage, evaporation, retention, flow routing, and interception which all affect the time distribution and peak rate of runoff.

ESTIMATED RUNOFF UNDEVELOPED STATE:

Drainage within the boundary of the site is in the form of small swales. The total runoff in the undeveloped site forms the basis for comparison with the flow in the developed state.

1. See Bibliography, Item (2), paragraph 3.7. - Appendix-4

TABLE 1

RUNOFF IN UNDEVELOPED STATE

Drainage Basin	Elev. Diff.	Length of Flow	Tc Min.	I_{100} yr. In./Hr.	C[2.]	Area Ac.	Q C.F.S.
ONSITE	22.5	1650'	12	5.11	0.38	33.51	65

ESTIMATED RUNOFF DEVELOPED STATE

As development occurs, the area of impervious surfaces increases and thereby the amount of runoff also increases. To offset this increase, onsite restrictions of flows must be incorporated into the development. While this can take different forms, the most practical solution for this type of development is to utilize on-lot ponding. The contributing area to the backyard ponding includes the backyard, sideyard, and in a majority of cases, one-half of the roof area due to the popularity of the pitched roof concept. The area drained to the street includes the front yard, driveway, sidewalk-parkway areas, and one-half the roof area. This approach will satisfy AMAFCA's requirement that the runoff rate from the developed tract not to exceed the runoff rate from the tract in its natural state.

The runoff coefficient prior to the C_f adjustment, for various surfaces are as follows:

Streets, Walks and Drives	C = 0.90
Roofs	C = 0.90
Lawns, Sandy Soil (Average 2 to 7% slope)	C = 0.12

2. See Appendix 1

TABLE 2

RUNOFF - DEVELOPED STATE

Drainage Basin	Area Ac.	C[3]	I 100 Yr. In./Hr.	Q C.F.S.
A-1	.69	0.75	6.42	3.32
A-2	1.82	0.625	4.98	5.66
A-3	2.66	0.74	4.57	9.00
A-4	.47	0.74	5.07	1.76
A-5	2.11	0.66	4.46	6.21
A-6	2.88	0.675	4.49	8.73
A-7	2.32	0.74	4.66	8.00
B-1	2.25	0.74	4.74	6.29
C-1	3.80	0.688	4.37	11.42
E-1	.52	0.75	5.15	2.00
A-1 - A-3	3.61	0.70	4.64	16.80
A-1 - A-6	7.29	0.69	4.06	29.60
A-1 - A-7	8.94	0.69	3.98	35.60

EXPLANATION OF RESULTS:

Undeveloped Runoff:

Onsite Flow = 65.0 c.f.s.

DEVELOPED RUNOFF
ONSITE FLOWS

A-1 to A-7	35.60 c.f.s.
B-1	6.29 c.f.s.
C-1	11.42 c.f.s.
E-1	2.00 c.f.s.
	55.31 c.f.s.

3. See Appendix-3

In order for the Piedras Marcadas Arroyo to intercept off-site flows from the north and northwest, it will be necessary to construct the arroyo adjacent to the subject site in the form of an open channel designed to convey the 100 year frequency storm runoff. The 100 year runoff for the arroyo is 197 c.f.s. as indicated in the "Drainage Management Plan, Western Albuquerque Metro Area, Vol. II", by Wm. Matotan and Assoc., on sheet 112 of 121. The channel should be extended to the west of Taylor Ranch Drive in order to direct the flows properly and keep them out of Taylor Ranch Drive. The cross section of the proposed channel will be defined at the time of final design. The conceptual and preliminary design is shown in the above referenced report.

The grading of the subject site and the channel grading will have to be carefully coordinated.

Comparing the developed runoff vs. undeveloped runoff, the development of this project including lot ponding, will not increase the storm runoff over that occurring in the natural undeveloped state.

In the developed state, flows from areas A-1 thru A-7, B-1, and C-1 follow the street patterns as shown in Figure 1.

Flows from Area C-1 shall empty north into Piedras Marcadas Arroyo via concrete lined channel between Lots 6 and 7, Block 8. Also flows from Areas A-1 thru A-7 shall be diverted south via concrete lined channel between Lots 9 and 10, Block 12. Runoffs from Area B-1 and E-1 shall drain south on Taylor Ranch Drive.

RECOMMENDATIONS:

The following recommendations are made to enable the developer of this site and the local government to complete this project within the design criteria:

1. The ponding areas in each backyard would be best situated toward the rear of the yard. There should be a minimum of five feet (5') buffer zone between the rear property lines and the edge of the pond. This buffer will protect 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 18.0%4. of the total area drained into the pond.
3. Flows within the streets of the development are diverted 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. Construction of the Piedras Marcadas Arroyo will be required adjacent to and west of the subject site to convey flows from this arroyo north of the site.
5. Runoff from Area C-1 (11.42 c.f.s.) shall follow street pattern and empty north into the proposed Piedras Marcadas Arroyo via concrete lined channel located between Lots 6 and 7, Block 8. (See Fig. 1 Section A-A)
6. Flows from Areas A-1 thru A-7 follow street pattern and drain south via concrete lined channel located between Lots 9 and 10, Block 12. (See Fig. 1 Section A-A).

7. Runoffs from Area B-1 (6.29 c.f.s.) and E-1 (2.00 c.f.s.) shall drain south on Taylor Ranch Drive.

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

BIBLIOGRAPHY OF REFERENCES

(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.

APPENDIX

APPENDIX-1

COMPOSITE RUNOFF COEFFICIENT

Undeveloped Land

$C = 0.30^{1.} \times 1.25^{2.} = 0.38$

Developed Land

Typical Lot Area

Gross Area	33.51 Ac.
Less area in streets	8.20 Ac.
Area in Lots	25.31
Avg. Lot Area (127 lots)	8750.00
Typical lot width	65 ft.

Ponded Lots

C = 0.90

Streets & walk area	20 x 65	=	1300 S.F.
Roof Area	25 x 50	=	1250 S.F.
Driveway	30 x 15	=	450 S.F.
Total Impervious Area		=	3000 S.F.

C = 0.12

Front & Sideyards	65 x 57.5	=	3737.50
Less Roof Area	50 x 25	=	-1250.00
Less Driveway	30 x 15	=	-450.00
Total Pervious Area		=	2037.50

Impervious Area	3000 S.F.	0.60%	@	0.90	= 0.54
Pervious Area	2037.50 S.F.	0.40%	@	0.12	= 0.05
Total Area	5037.50 S.F.	100%			= 0.59

Composite Runoff Coefficient $C \times C_f = 0.59 \times 1.25 = 0.74$

APPENDIX-2

Ponding Requirements

Average Lot Area		8750.00 S.F.
1/2 Roof Area	25 x 50	1250.00 S.F.
Patio Area	10 x 10	100.00 S.F.
Rear Lawn Area		2875.00 S.F.
Total Area Drained to Pond		4525.00 S.F.

Runoff Coefficient

Impervious Area:

$$C = 0.90 \ \frac{1350}{4525} = 0.27$$

Pervious Area:

$$C = 0.12 \ \frac{3200}{4525} = 0.08$$

$$C \times C_f = 0.35 \times 1.25 = 0.44$$

Pond Volume Requirements:

100 Year 6-hour precipitation = 2.2 inch.

Volume = Runoff Coeff. x Area x Precipitation

$V = 2.2/12 \times 0.44 \times 4525.00 = 365.02 \ ft^3$

Depth of Pond 0.50 ft. (6")

Minimun Area of Pond = 730.04 ft^2

Pond area as a percentage of area = 16%

$V = 16\% \times 4525 \times 0.5 = 362 \ ft^3$ Area of Pond = 724 ft^2

@ 0.5 deep

Non Ponded Lots

C = .90

Street & Walk Area	20 x 65	=	1300 S.F.
Roof Area	50 x 50	=	2500 S.F.
Driveway	30 x 15	=	450 S.F.
Total Impervious Area			4250 S.F.

C = .12

Total Lot Area	8750 S.F.
Less Roof Area	-2500 S.F.
Less Driveway	-450 S.F.
Total Pervious Area	5800 S.F.

Impervious Area	4250 S.F.	0.42%	@ 0.9 =	.38
Pervious Area	5800 S.F.	0.58%	@ 0.12 =	.07
Total Area	10050 S.F.	100%		.45

Composite Runoff Coeff. $C \times C_f = 0.45 \times 1.25 = .56$

UBDIVISION TAYLOR RANCH TRACT #8
CATION ALBUQ N.M.
OB NO.
ESIGN STORM 100 YR. RECURRENCE INTERVAL
AJOR STORM 100 YR.
OMPUTATIONS BY SKS/EK DATE

RUNOFF COMPUTATIONS
(Rational Method)

APPENDIX #3

PAGE OF

Area Designation	A (Acres)	c	c_f	$\bar{c}$ = (c x c_f)	A·$\bar{c}$	ΣA·$\bar{c}$	tc (min)	I (in/hr)	Q = (ΣA·$\bar{c}$) x I cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Slope %	Length ft.	VEL V fps	Δt (min)	
A-1	.69	0.45 0.15	1.25	0.75	0.50	0.50	4.43	6.42	3.32								50% @ 0.9 50% @ 0.3
A-2	1.82	0.22 0.28	1.25	0.625	1.14	1.14	12.96	4.98	5.66								36.8% P@0.59 63.2% NP@0.45
A-3	2.66	0.59	1.25	0.74	1.97	1.97	12.14	5.09	10.03								69.0% P@0.59 31.0% NP@0.45
A-4	.47	0.59	1.25	0.74	.35	.35	12.28	5.07	1.76								PONDED LOTS @ 0.59
A-5	2.11	0.30 0.23	1.25	0.66	1.39	1.39	17.34	4.46	6.21								50% P@0.59 50% NP@0.45
A-6	2.88	0.40 0.14	1.25	0.675	1.94	1.54	17.14	4.49	8.73								68% P@0.59 32% NP@0.45
A-7	2.32	0.59	1.25	0.74	1.72	1.72	15.56	4.66	8.00								PONDED LOTS @ 0.59
A1-A3	5.17	0.47 0.09	1.25		3.61		15.69	4.69	16.80								
A1-A6	10.63	0.41 0.14	1.25		7.29		21.54	4.06	29.60								
A1-A7	12.95	0.45 0.10	1.25		8.94		22.54	3.98	35.58								

DIVISION TALOR RANCH TRACT #8
ATION ALBUQ N.M.
NO.
SIGN STORM 100 YR. RECURRENCE INTERVAL
JOR STORM 100 YR.
MPUTATIONS BY SKS/FK DATE

RUNOFF COMPUTATIONS
(Rational Method)

APPENDIX #3

PAGE ____ OF

Area Designation	A (Acres)	c	c_f	$\bar{c}$ = (c x c_f)	A·$\bar{c}$	ΣA·$\bar{c}$	tc (min)	I (in/hr)	Q = (ΣA·$\bar{c}$) x I cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Slope %	Length ft.	VEL V fps	Δt (min)	
																	PONDED LOTS 0.59
B-1	2.25	0.59	1.25	0.74	1.67	1.67	14.84	4.74	6.29								~~PONDED LOTS 0.59~~
C-1	3.80	0.41 0.14	1.25	0.688	2.61	2.61	18.23	4.37	11.42								

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

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.

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

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

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

0.40%

Flow Quantities

D=0.17

n= .01500
S= .00400
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 1.19
Q= 1.73

Flow Quantities

D=0.33

n= .01500
S= .00400
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 1.85
Q= 9.81

Flow Quantities

D=0.50

n= .01500
S= .00400
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 2.96
Q= 31.73

Flow Quantities

D=0.67

n= .01500
S= .00400
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 3.81
Q= 60.44

0.50%

Flow Quantities

n= .01500
S= .00500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 1.34
Q= 1.94

Flow Quantities

n= .01500
S= .00500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 2.07
Q= 10.97

Flow Quantities

n= .01500
S= .00500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 3.31
Q= 35.48

Flow Quantities

n= .01500
S= .00500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 4.26
Q= 67.57

32' F-F
8" Std C & G
4" CROWN

1.00%

Flow Quantities

D=0.17

n= .01500
S= .01000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 1.89
Q= 2.74

Flow Quantities

D=0.33

n= .01500
S= .01000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 2.93
Q= 15.51

Flow Quantities

D=0.50

n= .01500
S= .01000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 4.68
Q= 50.18

Flow Quantities

D=0.67

n= .01500
S= .01000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 6.03
Q= 95.56

1.50%

Flow Quantities

n= .01500
S= .01500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 2.32
Q= 3.36

Flow Quantities

n= .01500
S= .01500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 3.59
Q= 19.00

Flow Quantities

n= .01500
S= .01500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 5.73
Q= 61.46

Flow Quantities

n= .01500
S= .01500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 7.38
Q= 117.04

32' F-F
8" std. C. & G
4" Crown

2.00%

D=0.17

Flow Quantities

n= .01500
S= .02000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 2.68
Q= 3.88

D=0.33

Flow Quantities

n= .01500
S= .02000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 4.15
Q= 21.94

D=0.50

Flow Quantities

n= .01500
S= .02000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 6.62
Q= 70.97

D=0.67

Flow Quantities

n= .01500
S= .02000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 8.53
Q= 135.14

2.50%

Flow Quantities

n= .01500
S= .02500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 2.99
Q= 4.34

Flow Quantities

n= .01500
S= .02500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 4.64
Q= 24.53

Flow Quantities

n= .01500
S= .02500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 7.40
Q= 79.34

Flow Quantities

n= .01500
S= .02500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 9.53
Q= 151.10

32' F-F
8" Std. C & G.
4" CROWN

3.00%

D=0.17

Flow Quantities

n= .01500
S= .03000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 3.28
Q= 4.75

D=0.33

Flow Quantities

n= .01500
S= .03000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 5.09
Q= 26.88

D=0.50

Flow Quantities

n= .01500
S= .03000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 8.10
Q= 86.92

D=0.67

Flow Quantities

n= .01500
S= .03000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 10.44
Q= 165.52

3.50%

Flow Quantities

n= .01500
S= .03500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 3.54
Q= 5.14

Flow Quantities

n= .01500
S= .03500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 5.49
Q= 29.03

Flow Quantities

n= .01500
S= .03500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 8.75
Q= 93.88

Flow Quantities

n= .01500
S= .03500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 11.28
Q= 178.78

32' F.F.
8" STD C&G.
4" CROWN

4.00%

Flow Quantities

D=0.17

n= .01500
S= .04000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 3.79
Q= 5.49

Flow Quantities

D=0.33

n= .01500
S= .04000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 5.87
Q= 31.03

Flow Quantities

D=0.50

n= .01500
S= .04000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 9.36
Q= 100.37

Flow Quantities

D=0.67

n= .01500
S= .04000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 12.06
Q= 191.12

4.50%

Flow Quantities

n= .01500
S= .04500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 4.02
Q= 5.82

Flow Quantities

n= .01500
S= .04500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 6.23
Q= 32.92

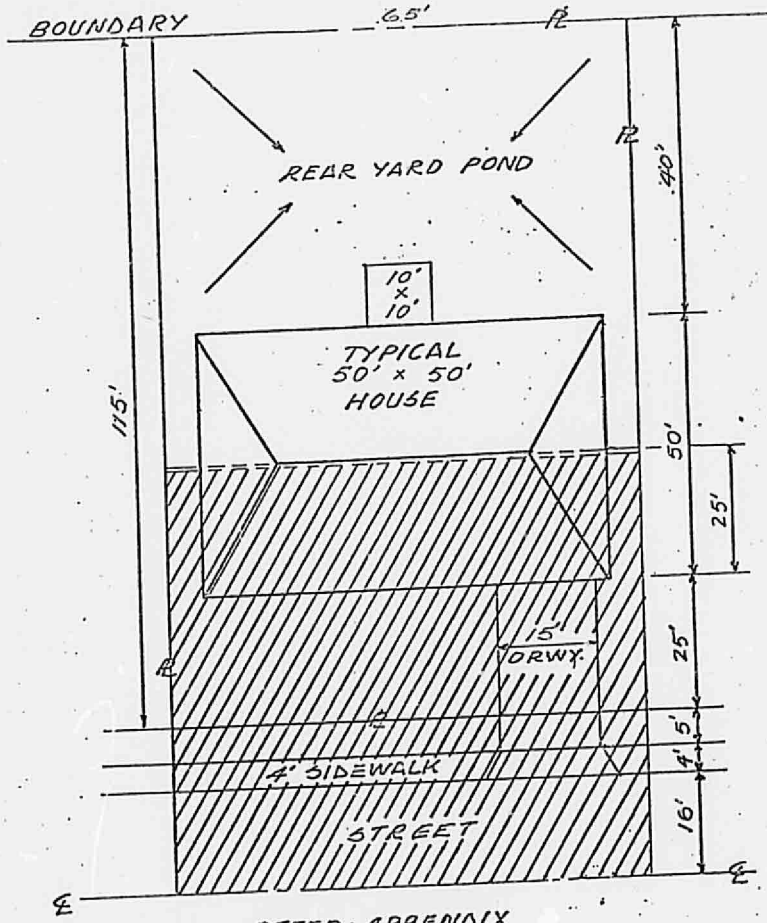
Flow Quantities

n= .01500
S= .04500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 9.93
Q= 106.45

Flow Quantities

n= .01500
S= .04500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 12.79
Q= 202.72

32' F+F
8" std C&G
4" CROWN



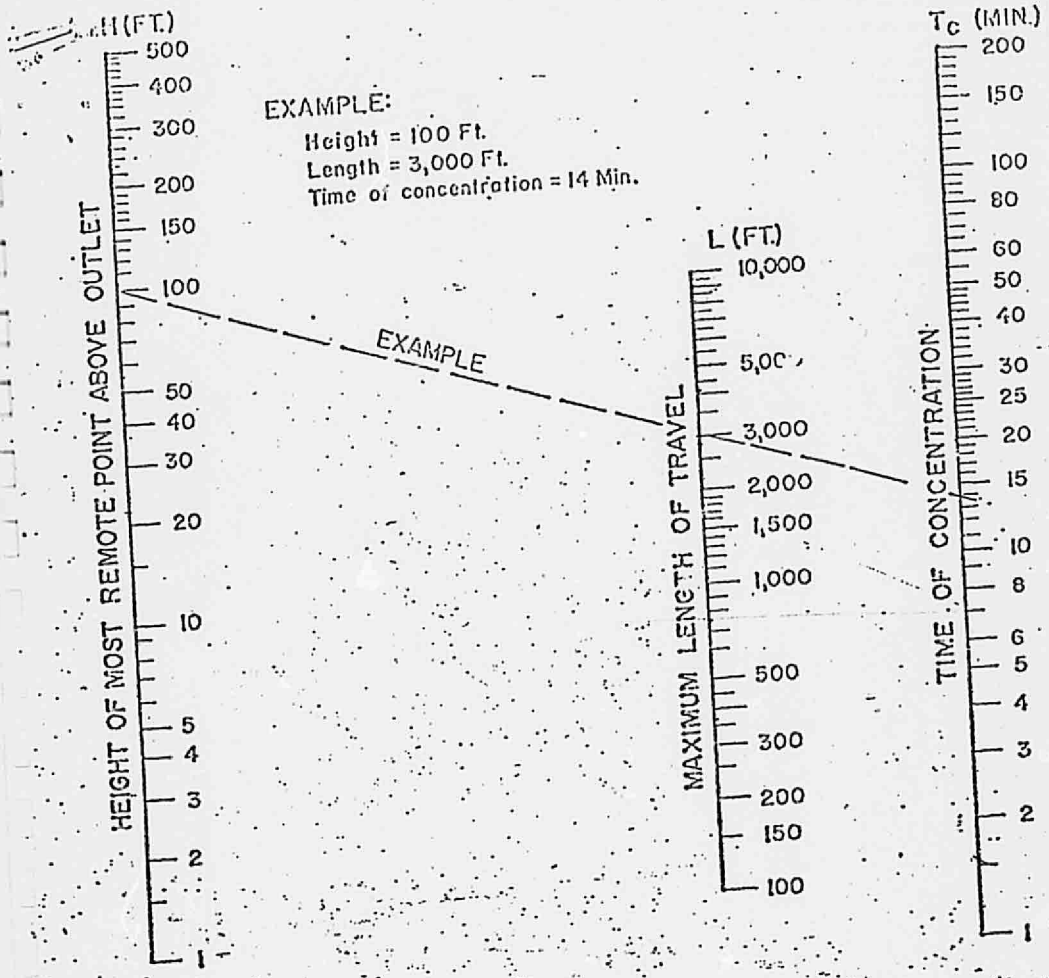
NOTE: REFER APPENDIX FOR CALCULATION

AREA DRAINED

FIGURE II
TYPICAL LOT DRAINAGE

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING·PLANNING·SURVEYING
2601 WYOMING BLVD N.E. SUITE F/ALBUQUERQUE NEW MEXICO 87112/505-292-1936

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

FIG. III

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

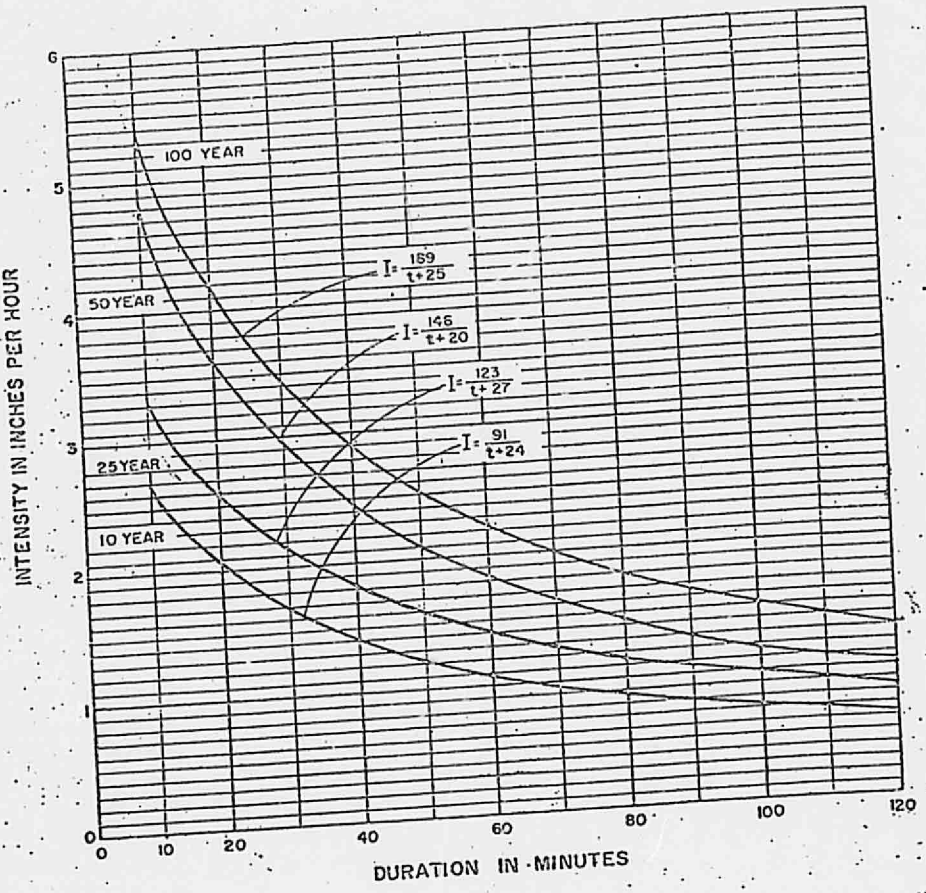


FIGURE IV

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

INTENSITY DURATION
FREQUENCY CURVES

(ALBUQUERQUE AREA-1961)

GORDON HEKKENHOFF & ASSOC
CONSULTING ENGINEERS
ALBUQUERQUE, NEW MEXICO

CHART
1

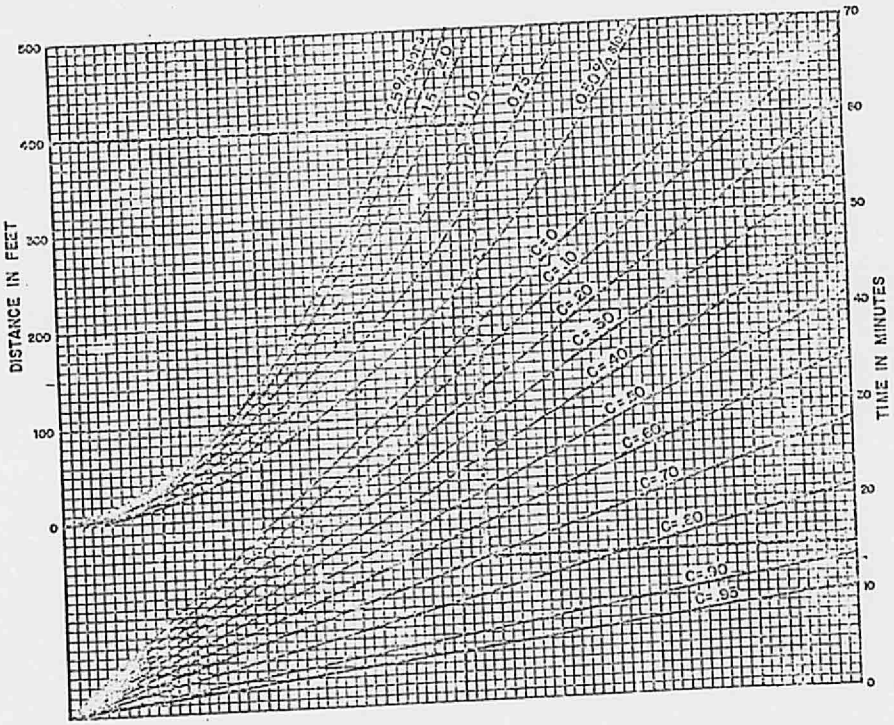


FIGURE V OVERLAND TIME OF FLOW CURVES (7)

HOMESTEAD HILLS EAST
TRACT #8

RUNOFF COMPUTATIONS

Sheet No. 1

Project: _____

Drainage Area No. A-1

Area = 0.69 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 150 S = 1.61

Channel No. 2 L = 360 S = .53

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: _____ min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{150}{2.5 \times 60}$ = 1.0 min.

Channel No. 2 Flow:

Velocity = 1.75 ft/sec; Time = $\frac{360}{1.75 \times 60}$ = 3.43 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 4.43 min

$I = \frac{189}{t+25} = \frac{189}{4.43+25} = 6.42$

$Q = CIA = (.75)\ (6.42)\ (.69) = 3.32$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 2

Project: _____

Drainage Area No. A-2

Area = 1.82 acres

Maximum Overland Flow: L = 151.98 S = 2.88%

Maximum Channel Flow:

Channel No. 1 L = 355 S = 1.00%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.0 ft/sec; Time = $\frac{355}{2.0 \times 60}$ = 2.96 min

Channel No. 2 Flow:

Velocity = ~~2.0~~ 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 = 12.96 min

$I = \frac{189}{t+25} = \frac{189}{12.96+25} = 4.98$

$Q = CIA = (.625)\ (4.98)\ (1.82) = 5.66$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 3

Project: _____

Drainage Area No. A-3

Area = 2.66 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 107.00 S = 2.26%

Channel No. 2 L = 484.65 S = .48%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = .30 ft/sec; Time = 10.7 / 3.0 X 60 = .59 min

Channel No. 2 Flow:

Velocity = 1.40 ft/sec; Time = 180 / 1.40 X 60 = 2.14 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 12.14 min

$I = \frac{189}{t+25} = \frac{189}{12.14+25} = 5.09$

$Q = CIA = (.74)(5.09)(2.66) = 10.03$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 4

Project: _____

Drainage Area No. A-4

Area = .47 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 176 S = 1.55%

Channel No. 2 L = 95 S = .40%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.55 ft/sec; Time = $\frac{176}{2.55 \times 60}$ = 1.15 min

Channel No. 2 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{95}{1.40 \times 60}$ = 1.13 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 12.28 min

$I = \frac{185}{t+25} = \frac{185}{12.28+25} = 5.07$

Q = CIA = (.74) (5.07) (.47) = 1.76 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 5

Project: _____

Drainage Area No. A-5

Area = 2.11 acres

Maximum Overland Flow: L = 95 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 616.36 S = .40%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{616.36}{1.40 \times 60}$ = 7.34 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 = 17.34 min

$I = \frac{189}{t+25} = \frac{189}{17.34+25} = 4.46$

Q = CIA = (.66) (4.46) (2.11) = 6.21 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 6

Project: A-6

Drainage Area No. _____

Area = 2.88 acres

Maximum Overland Flow: L = 95 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 600 S = .40%

Channel No. 2 L = 460 S = .40%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{600}{1.40 \times 60}$ = 7.14 min.

Routing time to Drainage R.O.W.

Channel No. 2 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{300}{1.40 \times 60}$ = 3.57 min.

Channel No. 3 Flow:

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

T = 17.14 min.

Total Accumulation Time:

$i = \frac{189}{t+25} = \frac{189}{17.14+25} = 4.49$

Q = CIA = (.675) (4.49) (2.88) = 8.73 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 7

Project: _____

Drainage Area No. A-7

Area = 2.32 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 750 S = 1.24%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.25 ft/sec; Time = $\frac{750}{2.25 \times 60}$ = 5.56 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 = 15.56 min

I = $\frac{189}{T+25}$ = $\frac{189}{15.56+25}$ = 4.66

Q = CIA = (.74) (4.66) (2.32) = 8.00 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ %	Ponded	C	___ ___
___ %	Non-Ponded	C	___ ___
___ %	_____	C	___ ___
100 %	TOTAL		___

RUNOFF COMPUTATIONS

Sheet No. 8

Project: _____

Drainage Area No. A1-A3

Area = 5.17 acres

Maximum Overland Flow: L = _____ S = _____

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: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 12.96 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 2.73 min.

Channel No. 3 Flow:

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

Total Accumulation Time: T = 15.69 min.

I = 189 / 2.125 = 189 / 15.69+25 = 4.64

Q = CIA = (.70) (4.64) (3.61) = 16.75 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ %	Ponded	0	___
___ %	Non-Ponded	0	___
___ %	_____	0	___
100 %	TOTAL		___

RUNOFF COMPUTATIONS

Sheet No. 9

Project: _____

Drainage Area No. A1-A6

Area = 2.63 acres

Maximum Overland Flow: L = _____ S = _____

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: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 12.96 / 2.73 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 2.28 / 3.57 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 21.54 min

I = 189 / t+25 = 189 / 21.54+25 = 4.06

Q = CIA = ( ) (4.06) (7.3) = 29.60 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 10

Project: _____

Drainage Area No. A1-A7

Area = 12.95 acres

Maximum Overland Flow: L = _____ S = _____

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: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = 12.96 / X 60 = 2.73 min

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = 2.28 / X 60 = 3.57 min

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = 1.0 / X 60 = _____ min

T = 22.54 min

Total Accumulation Time:

I = 189 / 22.54+25 = 189 / 22.54+25 = 3.58

Q = CIA = (.69) (3.58) (8.54) = 35.58 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 11

Project: _____

Drainage Area No. C-1

Area = 3.80 acres

Maximum Overland Flow: L = 151.98 S = 2.88%

Maximum Channel Flow:

Channel No. 1 L = 210.71 S = 1.24%

Channel No. 2 L = 520.49 S = .40%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.25 ft/sec; Time = $\frac{210.71}{2.25 \times 60}$ = 1.56 min

Channel No. 2 Flow:

Velocity = 1.30 ft/sec; Time = $\frac{520.49}{1.30 \times 60}$ = 6.67 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 18.23 min

I = $\frac{189}{6+25}$ = $\frac{189}{18.23+25}$ = 4.37

Q = CIA = (.688) (4.37) (3.80) = 11.42 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. _____

Project: _____

Drainage Area No. B-1

Area = 2.25 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 203.04 S = 2.40%

Channel No. 2 L = 450.00 S = 0.98%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 3.10 ft/sec; Time = $\frac{203.04}{3.10 \times 60}$ = 1.09 min.

Channel No. 2 Flow:

Velocity = 2.00 ft/sec; Time = $\frac{450}{2.00 \times 60}$ = 3.75 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 14.84 min

$I = \frac{189}{t+25} = \frac{189}{14.84+25} = 4.74$

Q = CIA = (.53) (4.74) (2.25) = 6.29 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

0 2 5 4

HYDROLOGY D11/D3 5 PLANS

D11/D3

5 PLANS

LETTER OF TRANSMITTAL

Genge/Murray-McCormick
2601 Wyoming Blvd., N.E. Suite F
Albuquerque, N.M. 87110/505 292-1936

Date July 14, 1977

To City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Attn. V. M. Kimmick, City Engineer

Re: Homestead Hills East (Taylor Ranch Tract #8) Drainage Report

Comments:

Three copies of the subject Drainage Report is transmitted for your review.

Enclosures:

Quantity	Type of Enclosure and Description
3	Drainage Reports

Signed: Frank Genge

Copy to:

If enclosures are not as noted, kindly notify us at once.

Genge/Murray-McCormick

2601 Wyoming Blvd., N.E. Suite F
Albuquerque, N.M. 87110 / 505 292-1936
Engineering · Surveying · Planning
Tucson · Phoenix · Denver · Pueblo

August 2, 1977

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87110

Re: Homestead Hills East (Tract 8) Drainage

Dear Mr. Kimmick:

This is an addendum to the "Drainage Report for Homestead Hills East, Taylor Ranch Tract 8" prepared by this office in June 1977.

This addendum more precisely defines the historic runoff from the site. Originally the historic discharge for the 100-year frequency storm was based on the entire site as one unit. This addendum addresses the fact that the site discharges runoff at two general locations on the site prior to development. As the attached calculations show the larger area, 29.1 acres, drains to the southeast with sheet flows generally along the south boundary. The undeveloped flow calculates to be 56.5 cfs. The smaller area that naturally drains to the northeast corner of the project discharges 9.0 cfs. The developed flows are 25.4 cfs at the southeast corner and 11.4 cfs at the northeast corner.

Since the design of the final construction plans we have ponded additional lots (Lots 11 through 17, Block 8) in Area C-1 thereby decreasing the developed flow out of the northeast corner to 9.8 cfs.

This addendum is intended to give additional detail to the original report.

Should there be any questions regarding this addendum, please feel free to call.

Very truly yours,

GENGE/MURRAY-McCORMICK, INC.

Carl A. Tebbens

Carl A. Tebbens, P.E.
Vice President

CAT:dw

Encl.

cc: Don Greene

MEURER, SERAFINI AND MEURER, INC.

CONSULTING ENGINEERS • SURVEYORS • PLANNERS

2601 WYOMING BLVD., N.E., SUITE F • ALBUQUERQUE, NEW MEXICO 87110 • (505) 292-1936

Bruno

September 16, 1977

Mr. V. M. Kimmick, City Engineer
City of Albuquerque
P. O.Box 1293
Albuquerque, New Mexico 87103

Re: Homestead Hills East (Taylor Ranch Tract 8)

Dear Mr. Kimmick:

At the request of Mr. Bruno Conegliano we are submitting this addendum to the "Drainage Report for Homestead Hills East, Taylor Ranch Tract 8" dated June, 1977.

This addendum addresses the method of handling the storm run-off discharge to the south of the subject development and corrects a flow quantity originally calculated.

The attached calculations show the revision of the developed flow quantity which discharges from the site to the south (Σ A-1 thru A-7). Due to an error in the calculation of the Tc the flow discharge at Area A-7 increases from 25.38 cfs to 35.6 cfs. The corresponding Tc is 22.5 min. Until such time as the land to the south of this site is developed the 100-year discharge of 35.6 cfs will be conveyed to the south and west in an earthen channel having a shape as shown on the attached drainage plan. The runoff will be conveyed under Taylor Ranch Drive and will discharge into the proposed major detention pond west of Taylor Ranch Drive and south of Homestead Hills.

With respect to the sequence of channel construction, AMBELL has made the commitment for the sequence of channel construction as stated in the "Taylor Ranch Comprehensive Drainage Study" dated April, 1977. More specifically, on page 8 of the above report, it is stated that the Piedras Marcadas Arroyo-South Branch will be constructed simultaneously with the development of Tract 8. In addition the above report details the sequence of channel construction with respect to other development within Taylor Ranch.

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With this addendum to the Tract 8 drainage report, it is our desire to obtain approval of the drainage study as soon as possible.

Very truly yours,

MEURER, SERAFINI AND MEURER, INC.

Carl A. Tebbens

Carl A. Tebbens, P.E.
Vice President

CAT:dw

cc: Bruno Conegliano
Don Greene

DALE BELLAMAH CORPORATION

POST OFFICE BOX 3325
6400 UPTOWN BOULEVARD, N.E.
EAST TOWER, SUITE 600

ALBUQUERQUE, NEW MEXICO 87110
TELEPHONE (505) 299-7631

June 1, 1977

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico
87103

RE: HOMESTEAD HILLS DRAINAGE

Dear Mr. Kimmick:

In response to our meeting of May 31, 1977, we will provide you with the following information.

A. The revised outflow figures for the Homestead Hills Subdivision using different "C" values and

B. A plan showing where the offsite flows will be collected.

Additionally, we certify that we will build and maintain any temporary drainage structures necessary to handle these flows until permanent structures are completed.

I believe that these were the primary concerns for drainage of the Homestead Hills Subdivision and hope that you can now approve the plat.

Thank you for your cooperation. If you have any questions, please do not hesitate to contact me.

Very truly yours,
AMBELL
DALE BELLAMAH LAND CO., INC.
A Partner

Donald F. Greene

Donald F. Greene
Development Engineer

/kc

BUILDERS—DEVELOPERS—REALTORS

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7/17/77
CJT

Undeveloped Flow

Area X = 29.1 Ac

Δ Elev = 5137.0 − 5115.5 = 21.5'

Distance travelled = 1650 L.F

Using Tc for Small Drainage Basins
Tc = 12 min

$$I_{100} = \frac{189}{T_c + 25} = 5.11$$

$$Q_{100} = C\ I\ A$$
$$= (0.39)(5.11)\ 29.1\ ac$$
$$= \underline{\underline{50.5\ cfs}}$$

1.

Undeveloped Flow (con't'd)

Area Y = 4.4 Ac.

Δ Elev = 5132 − 5123 = 9.0 ft

Distance travelled = 750 LF

T_c = 7 min Use 10 min

$I_{100} = \frac{189}{T_c + 25} = 5.4$

$Q_{100} = (0.33)(5.4)\,4.4$
$= 9.0$ cfs

Amended
DRAINAGE REPORT

FOR

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

ALBUQUERQUE, NEW MEXICO

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ECOSYSTEMS ANALYSIS · PLANNING · LAND SURVEYS · ENGINEERING

2601 WYOMING BLVD., NE. SUITE F / ALBUQUERQUE, N.M. 87110 / 505-292-1936

Amended
DRAINAGE REPORT

FOR

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

ALBUQUERQUE, NEW MEXICO

Prepared For

AMBELL
6400 Uptown Boulevard N.E.
Albuquerque, New Mexico

Prepared By

Genge/Murray-McCormick, Inc.
2601 Wyoming Boulevard N.E.
Albuquerque, New Mexico 87110
(505) 292-1936

June 1977
Amended September 1977

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APPENDIX-4	Frequency Factor
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DRAINAGE REPORT

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

PURPOSE AND SCOPE

AMBELL, a joint venture of AMDEC and Dale Bellamah Land Company, is currently developing lands located on the western Albuquerque metropolitan area known as Taylor Ranch. Taylor Ranch is a many faceted development, master planned concept which includes single family, multi-family, parks, schools, and commercial areas. Homestead Hills East, Taylor Ranch Tract 8, is a single family subdivision.

The purpose of this report is to present a plan for controlling surface runoff from the said subdivision in a manner acceptable to the Albuquerque Metropolitan Arroyo Flood Control Authority and the Albuquerque City Engineer's office.

SITE LOCATION AND TOPOGRAPHY

Taylor Ranch Tract 8 is located within Section 23, Township 11 North, Range 2 East, N.M.P.M., Bernalillo County, New Mexico. Surrounding terrain is unimproved land.

A proposed Piedras Mercadas channel is located on the north boundary of the proposed site. West of the site are Homestead Hills and proposed Tract 14. On the south the site is bounded by a proposed civic centre and school site and on the east by undeveloped lands of others.

The soil of the site is generally comprised of eolian sand. The natural ground slopes from northwest to southeast. Ground cover consists mainly of rabbitbrush, yucca, and the cactus.

Proposed Taylor Ranch Drive on the west and proposed Piedras Mercadas Arroyo on the north will intercept offsite flows entering the site when channel improvements are in place.

DESIGN CRITERIA

In analyzing the storm runoff, the Rational Formula, $Q = CIA C_f$ is used.[1]

Where:

Q = Runoff quantity in cubic feet/second.

A = Contributing area in acres.

C_f = Frequency factor for Rational Formula.

I = Intensity in inches/hour for a duration equal to the time of accumulation (duration) measured in minutes and obtained from Figure I., Intensity Duration Frequency Curves, Albuquerque Area 1961. (Note: Where a Time of Concentration [Tc] is less than ten minutes from Figure III, the intensity value equal to ten minuess is employed.

C = Runoff Coefficient (No Unit). This coefficient represents the integrated effects of infiltration, detention storage, evaporation, retention, flow routing, and interception which all affect the time distribution and peak rate of runoff.

ESTIMATED RUNOFF UNDEVELOPED STATE:

Drainage within the boundary of the site is in the form of small swales. The total runoff in the undeveloped site forms the basis for comparison with the flow in the developed state.

1. See Bibliography, Item (2), paragraph 3.7. - Appendix-4

TABLE 1

RUNOFF IN UNDEVELOPED STATE

Drainage Basin	Elev. Diff.	Length of Flow	Tc Min.	I_{100} yr. In./Hr.	C[2]	Area Ac.	Q C.F.S.
ONSITE	22.5	1650'	12	5.11	0.38	33.51	65

ESTIMATED RUNOFF DEVELOPED STATE

As development occurs, the area of impervious surfaces increases and thereby the amount of runoff also increases. To offset this increase, onsite restrictions of flows must be incorporated into the development. While this can take different forms, the most practical solution for this type of development is to utilize on-lot ponding. The contributing area to the backyard ponding includes the backyard, sideyard, and in a majority of cases, one-half of the roof area due to the popularity of the pitched roof concept. The area drained to the street includes the front yard, driveway, sidewalk-parkway areas, and one-half the roof area. This approach will satisfy AMAFCA's requirement that the runoff rate from the developed tract not to exceed the runoff rate from the tract in its natural state.

The runoff coefficient prior to the C_f adjustment, for various surfaces are as follows:

Streets, Walks and Drives	C = 0.90
Roofs	C = 0.90
Lawns, Sandy Soil (Average 2 to 7% slope)	C = 0.12

2. See Appendix 1

TABLE 2

RUNOFF - DEVELOPED STATE

Drainage Basin	Area Ac.	C[3].	I 100 Yr. In./Hr.	Q C.F.S.
A-1	.69	0.75	6.42	3.32
A-2	1.82	0.625	4.98	5.66
A-3	2.66	0.74	4.57	9.00
A-4	.47	0.74	5.07	1.76
A-5	2.11	0.66	4.46	6.21
A-6	2.88	0.675	4.49	8.73
A-7	2.32	0.74	4.66	8.00
B-1	2.25	0.74	4.74	6.29
C-1	3.80	0.688	4.37	11.42
E-1	.52	0.75	5.15	2.00
A-1 - A-3	3.61	0.70	4.64	16.80
A-1 - A-6	7.29	0.69	4.06	29.60
A-1 - A-7	8.94	0.69	3.98	35.60

EXPLANATION OF RESULTS:

Undeveloped Runoff:

Onsite Flow = 65.0 c.f.s.

DEVELOPED RUNOFF
ONSITE FLOWS

A-1 to A-7	35.60 c.f.s.
B-1	6.29 c.f.s.
C-1	11.42 c.f.s.
E-1	2.00 c.f.s.
	55.31 c.f.s.

3. See Appendix-3

In order for the Piedras Marcadas Arroyo to intercept off-site flows from the north and northwest, it will be necessary to construct the arroyo adjacent to the subject site in the form of an open channel designed to convey the 100 year frequency storm runoff. The 100 year runoff for the arroyo is 197 c.f.s. as indicated in the "Drainage Management Plan, Western Albuquerque Metro Area, Vol. II", by Wm. Matotan and Assoc., on sheet 112 of 121. The channel should be extended to the west of Taylor Ranch Drive in order to direct the flows properly and keep them out of Taylor Ranch Drive. The cross section of the proposed channel will be defined at the time of final design. The conceptual and preliminary design is shown in the above referenced report.

The grading of the subject site and the channel grading will have to be carefully coordinated.

Comparing the developed runoff vs. undeveloped runoff, the development of this project including lot ponding, will not increase the storm runoff over that occurring in the natural undeveloped state.

In the developed state, flows from areas A-1 thru A-7, B-1, and C-1 follow the street patterns as shown in Figure 1.

Flows from Area C-1 shall empty north into Piedras Marcadas Arroyo via concrete lined channel between Lots 6 and 7, Block 8. Also flows from Areas A-1 thru A-7 shall be diverted south via concrete lined channel between Lots 9 and 10, Block 12. Runoffs from Area B-1 and E-1 shall drain south on Taylor Ranch Drive.

RECOMMENDATIONS:

The following recommendations are made to enable the developer of this site and the local government to complete this project within the design criteria:

1. The ponding areas in each backyard would be best situated toward the rear of the yard. There should be a minimum of five feet (5') buffer zone between the rear property lines and the edge of the pond. This buffer will protect 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 18.0%[4]. of the total area drained into the pond.
3. Flows within the streets of the development are diverted 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. Construction of the Piedras Marcadas Arroyo will be required adjacent to and west of the subject site to convey flows from this arroyo north of the site.
5. Runoff from Area C-1 (11.42 c.f.s.) shall follow street pattern and empty north into the proposed Piedras Marcadas Arroyo via concrete lined channel located between Lots 6 and 7, Block 8. (See Fig. 1 Section A-A)
6. Flows from Areas A-1 thru A-7 follow street pattern and drain south via concrete lined channel located between Lots 9 and 10, Block 12. (See Fig. 1 Section A-A).

7. Runoffs from Area B-1 (6.29 c.f.s.) and E-1 (2.00 c.f.s.) shall drain south on Taylor Ranch Drive.

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

BIBLIOGRAPHY OF REFERENCES

(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.

APPENDIX

APPENDIX-1

COMPOSITE RUNOFF COEFFICIENT

Undeveloped Land

$C = 0.30^{1.} \times 1.25^{2.} = 0.38$

Developed Land

Typical Lot Area

Gross Area	33.51 Ac.
Less area in streets	8.20 Ac.
Area in Lots	25.31
Avg. Lot Area (127 lots)	8750.00
Typical lot width	65 ft.

Ponded Lots

C = 0.90

Streets & walk area	20 x 65	=	1300 S.F.
Roof Area	25 x 50	=	1250 S.F.
Driveway	30 x 15	=	450 S.F.
Total Impervious Area		=	3000 S.F.

C = 0.12

Front & Sideyards	65 x 57.5	=	3737.50
Less Roof Area	50 x 25	=	-1250.00
Less Driveway	30 x 15	=	-450.00
Total Pervious Area		=	2037.50

Impervious Area	3000 S.F.	0.60%	@	0.90	= 0.54
Pervious Area	2037.50 S.F.	0.40%	@	0.12	= 0.05
Total Area	5037.50 S.F.	100%			= 0.59

Composite Runoff Coefficient $C \times C_f = 0.59 \times 1.25 = 0.74$

APPENDIX-2

Ponding Requirements

Average Lot Area		8750.00 S.F.
1/2 Roof Area	25 x 50	1250.00 S.F.
Patio Area	10 x 10	100.00 S.F.
Rear Lawn Area		2875.00 S.F.
Total Area Drained to Pond		4525.00 S.F.

Runoff Coefficient

Impervious Area:

$$C = 0.90 \ \frac{1350}{4525} = 0.27$$

Pervious Area:

$$C = 0.12 \ \frac{3200}{4525} = 0.08$$

$$C \times C_f = 0.35 \times 1.25 = 0.44$$

Pond Volume Requirements:

100 Year 6-hour precipitation = 2.2 inch.

Volume = Runoff Coeff. x Area x Precipitation

$V = 2.2/12 \times 0.44 \times 4525.00 = 365.02 \ ft^3$

Depth of Pond 0.50 ft. (6")

Minimun Area of Pond = 730.04 ft^2

Pond area as a percentage of area = 16%

$V = 16\% \times 4525 \times 0.5 = 362 \ ft^3$ Area of Pond = 724 ft^2

@ 0.5 deep

Non Ponded Lots

C = .90

Street & Walk Area	20 x 65	=	1300 S.F.
Roof Area	50 x 50	=	2500 S.F.
Driveway	30 x 15	=	450 S.F.
Total Impervious Area			4250 S.F.

C = .12

Total Lot Area	8750 S.F.
Less Roof Area	-2500 S.F.
Less Driveway	-450 S.F.
Total Pervious Area	5800 S.F.

Impervious Area	4250 S.F.	0.42%	@ 0.9 =	.38
Pervious Area	5800 S.F.	0.58%	@ 0.12 =	.07
Total Area	10050 S.F.	100%		.45

Composite Runoff Coeff. $C \times C_f = 0.45 \times 1.25 = .56$

UBDIVISION TAYLOR RANCH TRACT #8
OCATION ALBUQ N.M.
OB NO.
ESIGN STORM 100 YR. RECURRENCE INTERVAL
AJOR STORM 100 YR.
OMPUTATIONS BY SKS/EK DATE

RUNOFF COMPUTATIONS
(Rational Method)

APPENDIX #3

PAGE OF

Area Designation	A (Acres)	c	c_f	$\bar{c}$ = (c x c_f)	A·$\bar{c}$	ΣA·$\bar{c}$	tc (min)	I (in/hr)	Q = (ΣA·$\bar{c}$) x I cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Slope %	Length ft.	VEL V fps	Δt (min)	
A-1	.69	0.45 0.15	1.25	0.75	0.50	0.50	4.43	6.42	3.32								50% @ 0.9 50% @ 0.3
A-2	1.82	0.22 0.28	1.25	0.625	1.14	1.14	12.96	4.98	5.66								36.8% P@0.59 63.2% NP@0.45
A-3	2.66	0.59	1.25	0.74	1.97	1.97	12.14	5.09	10.03								69.0% P@0.59 31.0% NP@0.45
A-4	.47	0.59	1.25	0.74	.35	.35	12.28	5.07	1.76								PONDED LOTS @ 0.59
A-5	2.11	0.30 0.23	1.25	0.66	1.39	1.39	17.34	4.46	6.21								50% P@0.59 50% NP@0.45
A-6	2.88	0.40 0.14	1.25	0.675	1.94	1.54	17.14	4.49	8.73								68% P@0.59 32% NP@0.45
A-7	2.32	0.59	1.25	0.74	1.72	1.72	15.56	4.66	8.00								PONDED LOTS @ 0.59
A1-A3	5.17	0.47 0.09	1.25		3.61		15.69	4.64	16.80								
A1-A6	10.63	0.41 0.14	1.25		7.29		21.54	4.06	29.60								
A1-A7	12.95	0.45 0.10	1.25		8.94		22.54	3.98	35.58								

DIVISION TALOR RANCH TRACT #8
ATION ALBUQ N.M.
NO.
SIGN STORM 100 YR. RECURRENCE INTERVAL
JOR STORM 100 YR.
MPUTATIONS BY SKS/FK DATE

RUNOFF COMPUTATIONS
(Rational Method)

APPENDIX #3

PAGE ____ OF

Area Designation	A (Acres)	c	c_f	$\bar{c}$ = (c x c_f)	A·$\bar{c}$	ΣA·$\bar{c}$	tc (min)	I (in/hr)	Q = (ΣA·$\bar{c}$) x I cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Slope %	Length ft.	VEL V fps	Δt (min)	
B-1	2.25	0.59	1.25	0.74	1.67	1.67	14.84	4.74	6.29								PONDED LOTS 0.59
C-1	3.80	0.41 0.14	1.25	0.688	2.61	2.61	18.23	4.37	11.42								~~PONDED LOTS 0.59~~

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

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.

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

HOMESTEAD HILLS EAST
TAYLOR RANCH TRACT 8

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

0.40%

Flow Quantities

D=0.17

n= .01500
S= .00400
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 1.19
Q= 1.73

Flow Quantities

D=0.33

n= .01500
S= .00400
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 1.85
Q= 9.81

Flow Quantities

D=0.50

n= .01500
S= .00400
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 2.96
Q= 31.73

Flow Quantities

D=0.67

n= .01500
S= .00400
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 3.81
Q= 60.44

0.50%

Flow Quantities

n= .01500
S= .00500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 1.34
Q= 1.94

Flow Quantities

n= .01500
S= .00500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 2.07
Q= 10.97

Flow Quantities

n= .01500
S= .00500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 3.31
Q= 35.48

Flow Quantities

n= .01500
S= .00500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 4.26
Q= 67.57

32' F-F
8" Std C & G
4" Crown

1.00%

Flow Quantities

D=0.17

n= .01500
S= .01000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 1.89
Q= 2.74

Flow Quantities

D=0.33

n= .01500
S= .01000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 2.93
Q= 15.51

Flow Quantities

D=0.50

n= .01500
S= .01000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 4.68
Q= 50.18

Flow Quantities

D=0.67

n= .01500
S= .01000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 6.03
Q= 95.56

1.50%

Flow Quantities

n= .01500
S= .01500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 2.32
Q= 3.36

Flow Quantities

n= .01500
S= .01500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 3.59
Q= 19.00

Flow Quantities

n= .01500
S= .01500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 5.73
Q= 61.46

Flow Quantities

n= .01500
S= .01500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 7.38
Q= 117.04

32' F-F
8" std. C. & G
4" Crown

2.00%

D=0.17

Flow Quantities

n= .01500
S= .02000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 2.68
Q= 3.88

D=0.33

Flow Quantities

n= .01500
S= .02000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 4.15
Q= 21.94

D=0.50

Flow Quantities

n= .01500
S= .02000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 6.62
Q= 70.97

D=0.67

Flow Quantities

n= .01500
S= .02000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 8.53
Q= 135.14

2.50%

Flow Quantities

n= .01500
S= .02500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 2.99
Q= 4.34

Flow Quantities

n= .01500
S= .02500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 4.64
Q= 24.53

Flow Quantities

n= .01500
S= .02500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 7.40
Q= 79.34

Flow Quantities

n= .01500
S= .02500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 9.53
Q= 151.10

32' F-F
8" Std. C & G.
4" CROWN

3.00%

Flow Quantities

D=0.17

n= .01500
S= .03000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 3.28
Q= 4.75

Flow Quantities

D= 0.33

n= .01500
S= .03000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 5.09
Q= 26.88

Flow Quantities

D= 0.50

n= .01500
S= .03000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 8.10
Q= 86.92

Flow Quantities

D= 0.67

n= .01500
S= .03000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 10.44
Q= 165.52

3.50%

Flow Quantities

n= .01500
S= .03500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 3.54
Q= 5.14

Flow Quantities

n= .01500
S= .03500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 5.49
Q= 29.03

Flow Quantities

n= .01500
S= .03500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 8.75
Q= 93.88

Flow Quantities

n= .01500
S= .03500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 11.28
Q= 178.78

32' F.F.
8" STD C&G.
4" CROWN

4.00%

D=0.17

Flow Quantities

n= .01500
S= .04000
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 3.79
Q= 5.49

D=0.33

Flow Quantities

n= .01500
S= .04000
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 5.87
Q= 31.03

D=0.50

Flow Quantities

n= .01500
S= .04000
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 9.36
Q= 100.37

D=0.67

Flow Quantities

n= .01500
S= .04000
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 12.06
Q= 191.12

4.50%

Flow Quantities

n= .01500
S= .04500
r= .08366
r 2/3= .19129
A= 1.45
P= 17.33
V= 4.02
Q= 5.82

Flow Quantities

n= .01500
S= .04500
r= .16161
r 2/3= .29670
A= 5.28
P= 32.67
V= 6.23
Q= 32.92

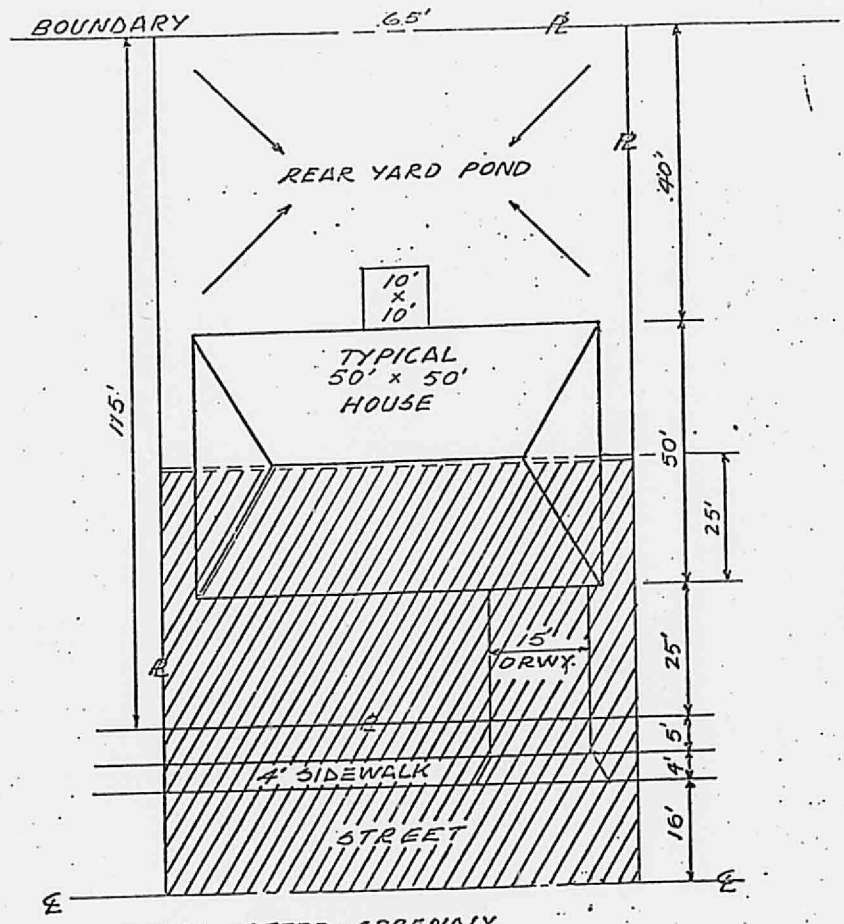
Flow Quantities

n= .01500
S= .04500
r= .32484
r 2/3= .47255
A= 10.72
P= 33.00
V= 9.93
Q= 106.45

Flow Quantities

n= .01500
S= .04500
r= .47524
r 2/3= .60899
A= 15.84
P= 33.33
V= 12.79
Q= 202.72

32' F-F
8" std C & G
4" CROWN



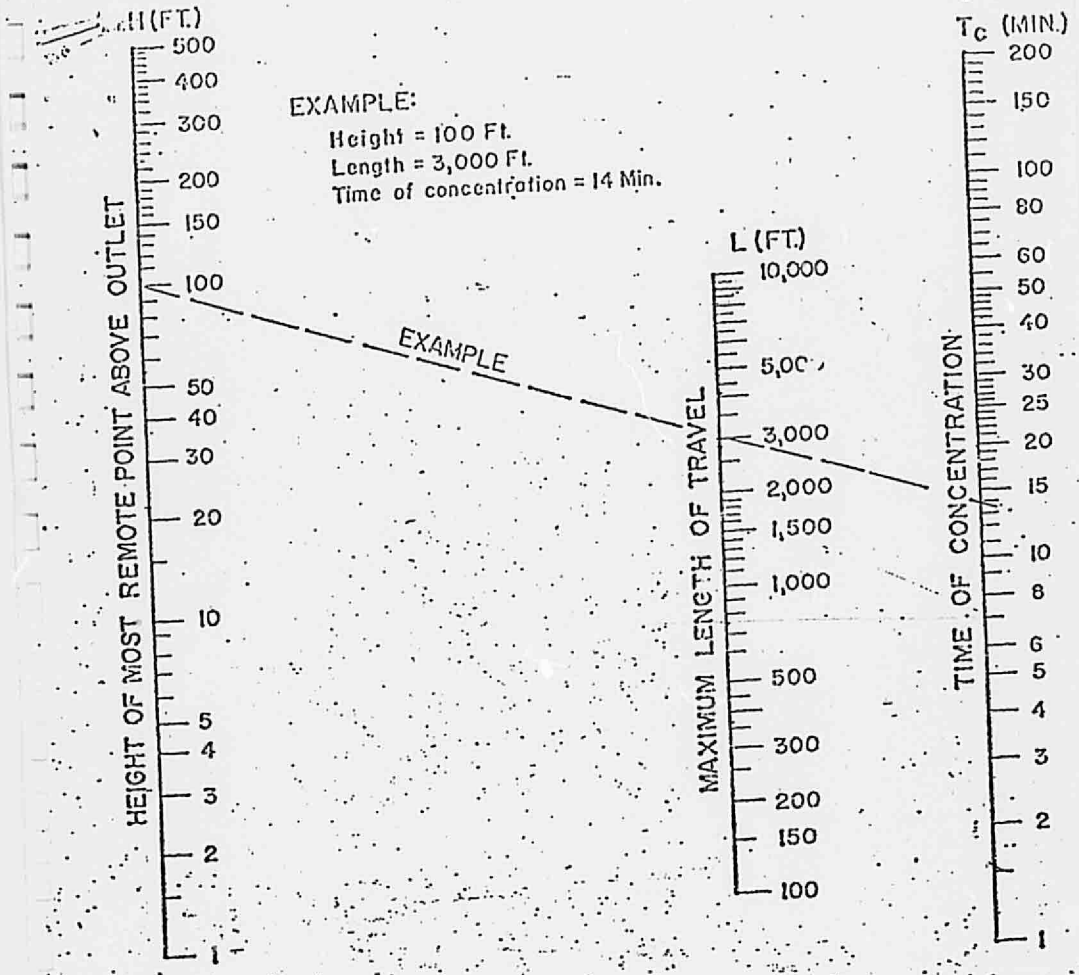
NOTE: REFER APPENDIX FOR CALCULATION

AREA DRAINED

FIGURE II
TYPICAL LOT DRAINAGE

MURRAY-McCORMICK, INC.
ENVIRONMENTAL DESIGN
ENGINEERING·PLANNING·SURVEYING
2601 WYOMING BLVD N.E. SUITE F ALBUQUERQUE NEW MEXICO 87110/505-292-1936

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

FIG. III

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

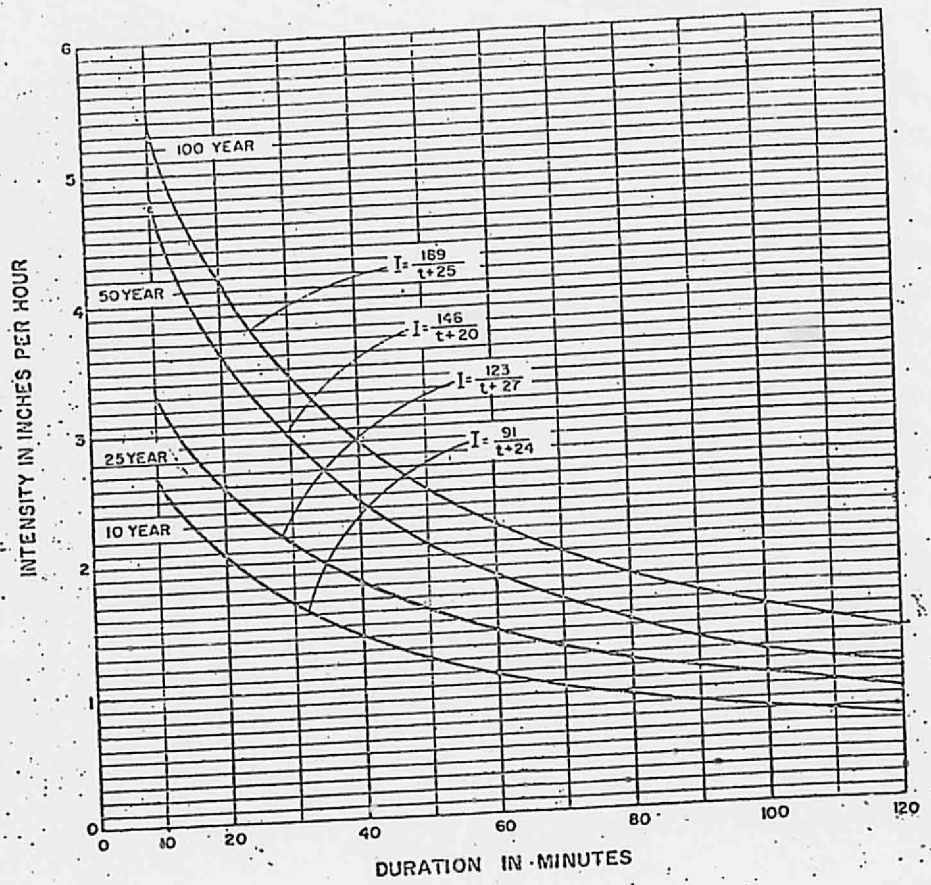


FIGURE IV

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

INTENSITY DURATION
FREQUENCY CURVES

(ALBUQUERQUE AREA-1961)

GORDON HERKENHOFF & ASSOC
CONSULTING ENGINEERS

CHART
I

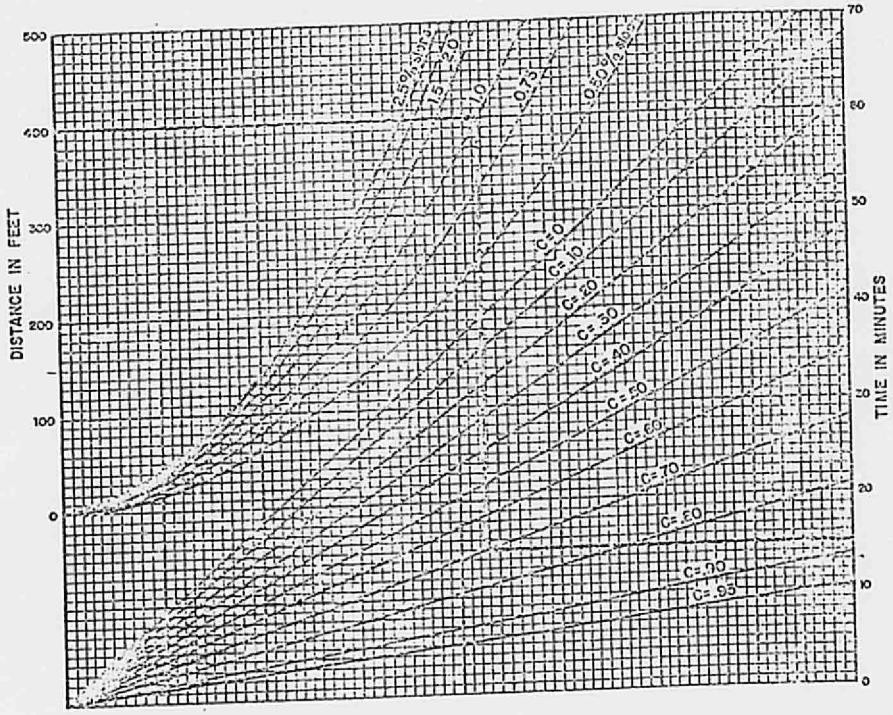


FIGURE V OVERLAND TIME OF FLOW CURVES (7)

HOMESTEAD HILLS EAST
TRACT #8

RUNOFF COMPUTATIONS

Sheet No. 1

Project: _____

Drainage Area No. A-1

Area = 0.69 acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = 150 S = 1.61

Channel No. 2 L = 360 S = .53

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: _____ min.

Channel No. 1 Flow:

Velocity = 2.5 ft/sec; Time = $\frac{150}{2.5 \times 60}$ = 1.0 min.

Channel No. 2 Flow:

Velocity = 1.75 ft/sec; Time = $\frac{360}{1.75 \times 60}$ = 3.43 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 4.43 min

$I = \frac{189}{t+25} = \frac{189}{4.43+25} = 6.42$

Q = CIA = (.75) (6.42) (.69) = 3.32 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 2

Project: _____

Drainage Area No. A-2

Area = 1.82 acres

Maximum Overland Flow: L = 151.98 S = 2.88%

Maximum Channel Flow:

Channel No. 1 L = 355 S = 1.00%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.0 ft/sec; Time = $\frac{355}{2.0 \times 60}$ = 2.96 min

Channel No. 2 Flow:

Velocity = ~~2.0~~ 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 = 12.96 min

$I = \frac{189}{t+25} = \frac{189}{12.96+25} = 4.98$

$Q = CIA = (.625)\ (4.98)\ (1.82) = 5.66$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 3

Project: _____

Drainage Area No. A-3

Area = 2.66 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 107.00 S = 2.26%

Channel No. 2 L = 484.65 S = .48%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = .30 ft/sec; Time = $\frac{107}{3.0 \times 60}$ = .59 min

Channel No. 2 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{180}{1.40 \times 60}$ = 2.14 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 12.14 min

$I = \frac{189}{t+25} = \frac{189}{12.14+25} = 5.09$

Q = CIA = (.74) (5.09) (2.66) = 10.03 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 4

Project: _____

Drainage Area No. A-4

Area = .47 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 176 S = 1.55%

Channel No. 2 L = 95 S = .40%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.55 ft/sec; Time = $\frac{176}{2.55 \times 60}$ = 1.15 min

Channel No. 2 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{95}{1.40 \times 60}$ = 1.13 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 12.28 min

$I = \frac{185}{t+25} = \frac{185}{12.28+25} = 5.07$

$Q = CIA = (.74)(5.07)(.47) = 1.76$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 5

Project: _____

Drainage Area No. A-5

Area = 2.11 acres

Maximum Overland Flow: L = 95 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 616.36 S = .40%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{616.36}{1.40 \times 60}$ = 7.34 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 = 17.34 min

$I = \frac{189}{t+25} = \frac{189}{17.34+25} = 4.46$

Q = CIA = (.66) (4.46) (2.11) = 6.21 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 6

Project: A-6

Drainage Area No. _____

Area = 2.88 acres

Maximum Overland Flow: L = 95 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 600 S = .40%

Channel No. 2 L = 460 S = .40%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{600}{1.40 \times 60}$ = 7.14 min.

Routing time to Drainage R.O.W.

Channel No. 2 Flow:

Velocity = 1.40 ft/sec; Time = $\frac{300}{1.40 \times 60}$ = 3.57 min.

Channel No. 3 Flow:

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

Total Accumulation Time: T = 17.14 min.

$I = \frac{189}{T+25} = \frac{189}{17.14+25} = 4.49$

$Q = CIA = (.675)(4.49)(2.88) = 8.73$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 7

Project: _____

Drainage Area No. A-7

Area = 2.32 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 750 S = 1.24%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.25 ft/sec; Time = $\frac{750}{2.25 \times 60}$ = 5.56 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 = 15.56 min

$I = \frac{189}{T^{.125}} = \frac{189}{15.56^{.125}} = 4.66$

$Q = CIA = (.74)(4.66)(2.32) = 8.00$ c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded C ___ ___

___ % Non-Ponded C ___ ___

___ % _____ C ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 8

Project: _____

Drainage Area No. A1-A3

Area = 5.17 acres

Maximum Overland Flow: L = _____ S = _____

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: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 12.96 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 2.73 min.

Channel No. 3 Flow:

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

Total Accumulation Time: T = 15.69 min.

I = 189 / 2.125 = 189 / 15.69+25 = 4.64

Q = CIA = (.70) (4.64) (3.61) = 16.75 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ %	Ponded	0	___ ___
___ %	Non-Ponded	0	___ ___
___ %	_____	0	___ ___
100 %	TOTAL		___

RUNOFF COMPUTATIONS

Sheet No. 9

Project: _____

Drainage Area No. A1-A6

Area = 10.63 acres

Maximum Overland Flow: L = _____ S = _____

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: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 12.96 / 2.73 min.

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 2.28 / 3.57 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 21.54 min

I = 189 / t+25 = 189 / 21.54+25 = 4.06

Q = CIA = ( ) (4.06) (7.3) = 29.60 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 10

Project: _____

Drainage Area No. A1-A7

Area = 12.95 acres

Maximum Overland Flow: L = _____ S = _____

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: _____ min.

Channel No. 1 Flow:

Velocity = _____ ft/sec; Time = 12.96 / X 60 = 2.73 min

Channel No. 2 Flow:

Velocity = _____ ft/sec; Time = 2.28 / X 60 = 3.57 min

Channel No. 3 Flow:

Velocity = _____ ft/sec; Time = _____ / X 60 = 1.0 min

Total Accumulation Time: T = 22.54 min

I = 189 / 22.54+25 = 189 / 22.54+25 = 3.58

Q = CIA = (.69) (3.58) (8.94) = 35.58 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. 11

Project: _____

Drainage Area No. C-1

Area = 3.80 acres

Maximum Overland Flow: L = 151.98 S = 2.88%

Maximum Channel Flow:

Channel No. 1 L = 210.71 S = 1.24%

Channel No. 2 L = 520.49 S = .40%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 2.25 ft/sec; Time = $\frac{210.71}{2.25 \times 60}$ = 1.56 min

Channel No. 2 Flow:

Velocity = 1.30 ft/sec; Time = $\frac{520.49}{1.30 \times 60}$ = 6.67 min

Channel No. 3 Flow:

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

T = 18.23 min

Total Accumulation Time:

I = $\frac{189}{6+25}$ = $\frac{189}{18.23+25}$ = 4.37

Q = CIA = (.688) (4.37) (3.80) = 11.42 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___

RUNOFF COMPUTATIONS

Sheet No. _____

Project: _____

Drainage Area No. B-1

Area = 2.25 acres

Maximum Overland Flow: L = 40 S = 1.00%

Maximum Channel Flow:

Channel No. 1 L = 203.04 S = 2.40%

Channel No. 2 L = 450.00 S = 0.98%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow or Inlet Time: 10 min.

Channel No. 1 Flow:

Velocity = 3.10 ft/sec; Time = $\frac{203.04}{3.10 \times 60}$ = 1.09 min.

Channel No. 2 Flow:

Velocity = 2.00 ft/sec; Time = $\frac{450}{2.00 \times 60}$ = 3.75 min

Channel No. 3 Flow:

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

Total Accumulation Time: T = 14.84 min

$I = \frac{189}{t+25} = \frac{189}{14.84+25} = 4.74$

Q = CIA = (.59) (4.74) (2.25) = 6.29 c.f.s.

Date: _____

Comp. by: _____

Checked by: _____

WEIGHTED RUNOFF COEFFICIENT

___ % Ponded @ ___ ___

___ % Non-Ponded @ ___ ___

___ % _____ @ ___ ___

100 % TOTAL ___