HYDROLOGY G21/D14 1 PLAN

G 21/D 14

1 PLAN

PRELIMINARY STORM DRAINAGE STUDY
RELATIVE TO THE DEVELOPMENT OF
TOLTEC SUBDIVISION

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PRELIMINARY STORM DRAINAGE STUDY
RELATIVE TO THE DEVELOPMENT OF
TOLTEC SUBDIVISION
ALBUQUERQUE, NEW MEXICO

MAY 1972

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PRELIMINARY STORM DRAINAGE STUDY
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TOLTEC SUBDIVISION

I. GENERAL

This report has been prepared to present findings of storm drainage conditions in an area proposed for development, known as Toltec Subdivision, and to describe proposed methods for providing adequate storm drainage in the area.

II. LOCATION

The area proposed for development is located in the northeast one-quarter (NE 1/4) of the northwest one-quarter (NW 1/4) of Section 4, Township 10 North (T 10 N), Range 4 East (R 4 E), New Mexico Principal Meridian (N.M.P.M.). It is located in the northeast part of Albuquerque, New Mexico between Morris Street and San Gabriel Village Addition, Unit 4; bound on the south by San Gabriel Village Addition, Unit 1, and on the north by San Gabriel Village, Unit 4, Tract A. Its relative location is shown on Exhibit "A", a copy of sheet G-21-Z of the Zone Atlas.

III. EXISTING DRAINAGE CONDITIONS

A. General

This area lies in the mesas and alluvial fans located on the west side of the Sandia Mountains, but is surrounded by developed land. The area appears to have been graded, but the topography shown on Exhibit "A" is satisfactory for analysis. There are no major drainage problems within the development, and streets should be adequate to carry the runoff during a 100 year storm.

B. Topography

As indicated previously, there are no major problems within the area. The topography was prepared by a licensed land surveyor and appears to be satisfactory for use in evaluating the existing and proposed drainage conditions. Through a field investigation by this firm on 30 May 1972 using a recent photo prepared by Koogle and Pouls Engineering, Inc., it was determined that previous grading in this area had taken place. No drainage channels were visible and the topography furnished by the client appears satisfactory for use in this study.

C. Drainage Areas and Channels

At the present time the only evidence of an existing drainage area is the existence of a lined channel near the southwest corner of the subdivision. The plat indicates a "10' Public Way for Drainage and Utility Purposes" will drain this area.

IV. PROPOSED DRAINAGE PLANS

A. General

In order to provide an adequate system of storm drainage for this proposed development, it was necessary to:

(1) Determine the drainage areas which can and will contribute storm runoff during a 100 year design storm.

(2) Determine the amount of runoff which could be expected after the entire area is developed.

(3) Prepare a table of street carrying capacities for use in sizing streets and overflow sections (section above high curb to property line).

(4) Determine the points where the storm runoff will concentrate.

(5) Determine the ability of each of the drainage channels, streets plus overflow sections, and structures to handle the runoff that may concentrate on them.

(6) Determine and recommend the means by which the expected runoff can be carried by the master planned area.

(7) Design additional channels and structures to simulate and distribute the expected runoff in a manner similar to the existing terrain at the outlet end.

B. Drainage Areas

A study of Exhibit "B" to determine the areas which could contribute to the development indicates that Morris Street and Montgomery Blvd. will effectively serve to turn runoff south and west around the subdivision. There are seven areas which will contribute to the lined channel into San Gabriel Village, Unit 4 near the southwest corner. All computations of runoff are contained in Exhibit "D", and a study of the drainage facilities downstream appear not exceed their capacity.

C. Runoff Quantities

The quantities of storm runoff to be expected from each drainage area were determined using the Rational Formula, Q=CIA, where: Q=quantity of storm runoff in cubic feet per second; C=coefficient of runoff dependent upon the type of surface drained; I=intensity of rainfall in inches per hour for a duration equal to the total accumulation time in minutes; and A=area of contributing watershed in acres.

The area of each separate contributing area (A) was determined by outlining the watershed on a scale photograph or the contour map and measuring the area (by planimeter) in acres.

The intensity of rainfall (I) was determined by assuming a 100 year frequency rainfall and then utilizing Intensity Duration Frequency Curves (Chart 1) for the Albuquerque Area, "master Plan of Drainage - City of Albuquerque, New Mexico and Environs," 1963, prepared by Gordon Herkenhoff and Associates, Consulting Engineers, together with expected accumulation of runoff from each of the areas. The total accumulation times are determined by a combination of Yarnell's method and probable future streets and drainage channel alignments and grades, as shown; assuming overland flows to cross either poor grass, asphalt pavement or bare soil surfaces, depending upon the probable type of development in each area and estimating the probable type of grading to be done in each area; assuming future streets to be asphalt paved with concrete curbs and crowned with either full crown (8"), 3/4 crown (6"), or 1/2 crown (4"). These times of flow were calculated by use of tables on pages 5.00, 5.04 and 5.05 of Design by E.E. Seelye.

The coefficient of runoff (C) was determined by assuming the maximum possible development in the areas under consideration. A coefficient of 0.65 is used for areas where dense residential development was most probable. A coefficient of 0.70 should be used for commercial areas or where a large amount of the exposed surface is impermeable.

The quantities of runoff are shown along with the areas after development on Exhibit"B", the Master Plan of Drainage for this subdivision.

D. Drainage Channels and Facilities

All existing structure capacities, as well as any proposed future structures, were verified from computer output sheet which forms a part of Exhibit "C" and are based on Manning's Equation, Q=AV, where $V=\frac{1.486}{n} R^{2/3}S^{1/2}$

when A=cross-sectional area of the channel or structure; R=hydraulic radius of channel or area divided by wetted perimeter; S=slope of channel or facility in feet per foot; and "n" values of 0.015 for concrete and asphalt surfaces, 0.013 for concrete pipes, 0.0225 for dirt lined channels or a composite "n" value based on proportional wetted surfaces with different values.

V. CONCLUSIONS AND RECOMMENDATIONS

On the basis of a field inspection, this study and its calculations, it is concluded that the development of this area can be accomplished satisfactorily provided adequate storm drainage is done as recommended below:

A. All ponded lots must be constructed in such a manner as to permit draining into the street or a drainage easement if or when they might become filled for any reason.

B. When drainage is into a drainage easement, it is recommended that it be properly protected which could mean fencing and/or lining to provide for unanticipated blocking or erosion (where velocities over 6 f.p.s. are expected).

C. A lined drainage easement is shown near the junction of Cielito Lindo and Karen Avenue, N.E., and it is recommended that it be constructed prior to or concurrently with the subdivision.

D. Due to the small maximum runoffs expected for a 100 year storm, a standard 32 foot face to face street may be used throughout by utilizing Exhibit "C" to verify that streets will carry the runoff shown on Exhibit "B". No grades should be designed for less than 0.5%.

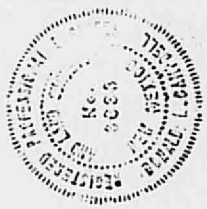
E. Provisions for diversionary block walls around the entire area excluding the frontage on Morris Street, N.E. is recommended.

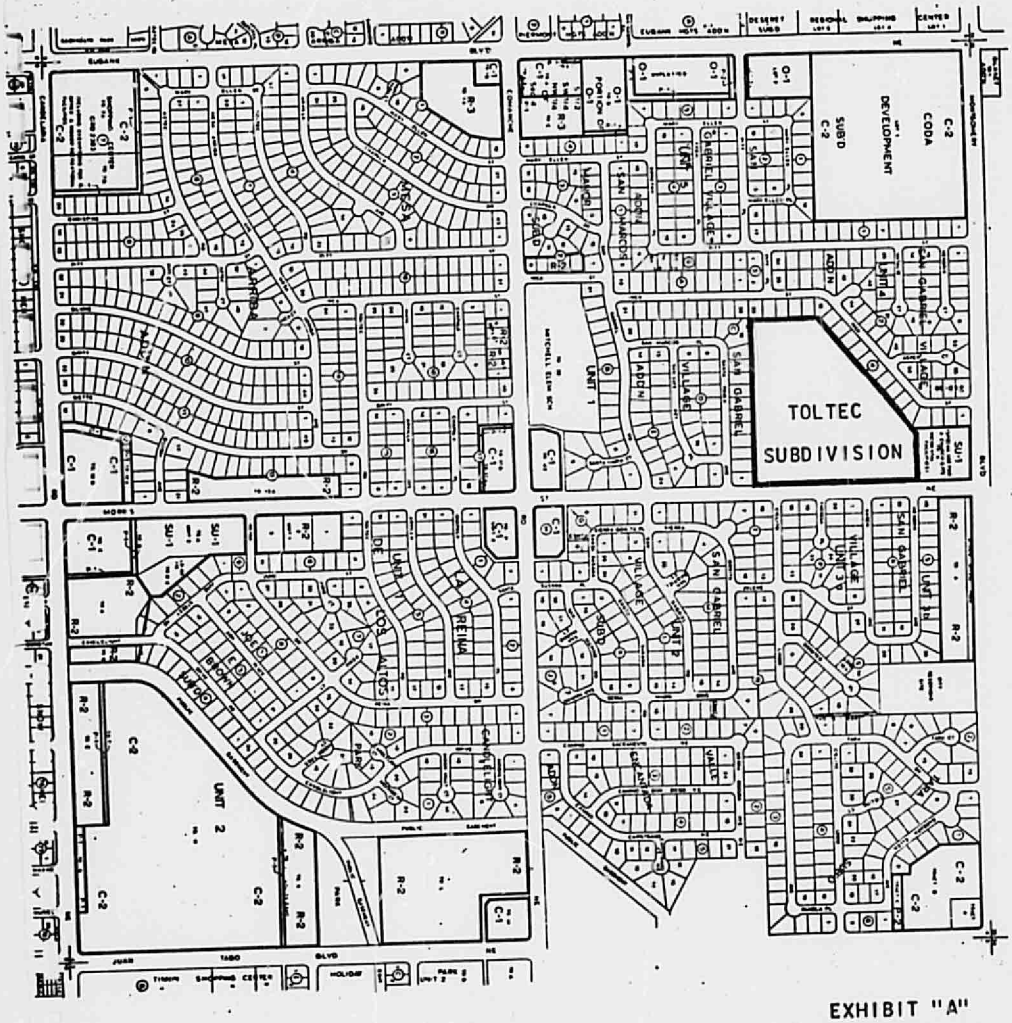
If all of the above recommendations are complied with, this should provide a very pleasing subdivision with excellent drainage design.

Respectfully submitted,

Donald L. Campbell

Donald L. Campbell
P.E. & L.S. No. 3633




TOLTEC
SUBDIVISION
C-2
CODA
DEVELOPMENT
SUBD
C-2
UNIT 1
SAN GABRIEL
VILLAGE
ADDN
UNIT 2
UNIT 3
UNIT 4
UNIT 5
UNIT 6
UNIT 7
UNIT 8
UNIT 9
UNIT 10
UNIT 11
UNIT 12
UNIT 13
UNIT 14
UNIT 15
UNIT 16
UNIT 17
UNIT 18
UNIT 19
UNIT 20
UNIT 21
UNIT

PROGRAM MAPIMAN

EXHIBIT C

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	7.1111	33.3703	.0050	.0707	.2131	.3568	2.4992	17.7719
.0150	7.1111	33.3703	.0100	.1000	.2131	.3568	3.5344	25.1333
.0150	7.1111	33.3703	.0150	.1225	.2131	.3568	4.3287	30.7819
.0150	7.1111	33.3703	.0200	.1414	.2131	.3568	4.9984	35.5439
.0150	7.1111	33.3703	.0250	.1581	.2131	.3568	5.5883	39.7392
.0150	7.1111	33.3703	.0300	.1732	.2131	.3568	6.1217	43.5322
.0150	7.1111	33.3703	.0350	.1871	.2131	.3568	6.6122	47.0201
.0150	7.1111	33.3703	.0400	.2000	.2131	.3568	7.0687	50.2666

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 6

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	10.6667	33.3542	.0050	.0707	.3198	.4676	3.2759	34.9430
.0150	10.6667	33.3542	.0100	.1000	.3198	.4676	4.6328	49.4169
.0150	10.6667	33.3542	.0150	.1225	.3198	.4676	5.6740	60.5231
.0150	10.6667	33.3542	.0200	.1414	.3198	.4676	6.5518	69.8660
.0150	10.6667	33.3542	.0250	.1581	.3198	.4676	7.3252	78.1350
.0150	10.6667	33.3542	.0300	.1732	.3198	.4676	8.0243	85.5926
.0150	10.6667	33.3542	.0350	.1871	.3198	.4676	8.6672	92.4505
.0150	10.6667	33.3542	.0400	.2000	.3198	.4676	9.2657	98.8338

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 4

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	14.2222	33.3426	.0050	.0707	.4265	.5666	3.9694	56.4537
.0150	14.2222	33.3426	.0100	.1000	.4265	.5666	5.6136	79.8375
.0150	14.2222	33.3426	.0150	.1225	.4265	.5666	6.8752	97.7806
.0150	14.2222	33.3426	.0200	.1414	.4265	.5666	7.9328	112.9073
.0150	14.2222	33.3426	.0250	.1581	.4265	.5666	8.8758	126.2342
.0150	14.2222	33.3426	.0300	.1732	.4265	.5666	9.7230	138.2827
.0150	14.2222	33.3426	.0350	.1871	.4265	.5666	10.5020	149.3623
.0150	14.2222	33.3426	.0400	.2000	.4265	.5666	11.2272	159.6751

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 2

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	17.7778	33.3356	.0050	.0707	.5333	.6576	4.6067	81.8972
.0150	17.7778	33.3356	.0100	.1000	.5333	.6576	6.5149	115.8201
.0150	17.7778	33.3356	.0150	.1225	.5333	.6576	7.9791	141.8501
.0150	17.7778	33.3356	.0200	.1414	.5333	.6576	9.2134	163.7944
.0150	17.7778	33.3356	.0250	.1581	.5333	.6576	10.3009	183.1277
.0150	17.7778	33.3356	.0300	.1732	.5333	.6576	11.2841	200.6064
.0150	17.7778	33.3356	.0350	.1871	.5333	.6576	12.1882	216.6796
.0150	17.7778	33.3356	.0400	.2000	.5333	.6576	13.0298	231.6403

FACE

0.640 / 1.192 / 3

EXHIBIT D

SUMMARY OF RUNOFF COMPUTATIONS

Sheet No.	Area No.	Area in Acres		Expected Runoff (in c.f.s.)	
		Individual	Total	Individual	Total
1	1	1.3		3	
2	2	1.8		6	
3	3	3.1	6.2	9	18
4	4	3.1		9	
5	5	2.7		7	
6	6	2.2	8.0	7	23
7	7	2.1	16.2	3	44

RUNOFF COMPUTATIONS

Sheet No. 1

Job No. T.S.

Drainage Area No. 1

Area = 1.3 acres

Maximum Overland Flow: L = 400' S = 0.65%

Maximum Channel Flow:

Channel No. 1 L = 110' S = 1.8%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 27.2 min.

Channel No. 1 Flow:

Velocity= 6.0 ft/sec; Time= $\frac{110}{6.0 \times 60}$ = 0.3 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 = 27.5 min.

$I = \frac{189}{T+25} = \frac{189}{27.5+25} = 3.60$

$Q = CIA = (0.65)(3.60)(1.3) = 3$ c.f.s.

Date: 6-1-72

Comp. by: DWR

Checked by: WHP

RUNOFF COMPUTATIONS

Sheet No. 2

Job No. T.S.

Drainage Area No. 2

Area = 1.8 acres

Maximum Overland Flow: L = 90' S = 1.8 %

Maximum Channel Flow:

Channel No. 1 L = 255' S = 3.8 %

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.2 min.

Channel No. 1 Flow:

Velocity= 9.0 ft/sec; Time= $\frac{255}{90 \times 60}$ = 0.5 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 = 12.7 min.

$I = \frac{189}{T+25} = \frac{189}{12.7+25} = 5.02$

$Q = CIA = (0.65)(5.02)(1.8) =$ 6 c.f.s.

Date: 6-1-72

Comp. by: DRC

Checked by: JHS

RUNOFF COMPUTATIONS

Sheet No. 3

Job No. T.S.

Drainage Area No. 3

Area = 3.1 acres

Maximum Overland Flow: L = 150' S = 1.3 %

Maximum Channel Flow:

Channel No. 1 L = 312' S = 3.8 %

Channel No. 2 L = 350' S = 2.8 %

Channel No. 3 L = 103' S = 1.2 %

Accumulation Time

Overland Flow: 16.8 min.

Channel No. 1 Flow:

Velocity= 9.0 ft/sec; Time= $\frac{312}{9.0 \times 60}$ = 0.6 min.

Channel No. 2 Flow:

Velocity= 7.7 ft/sec; Time= $\frac{350}{7.7 \times 60}$ = 0.8 min.

Channel No. 3 Flow:

Velocity= 5.0 ft/sec; Time= $\frac{103}{5.0 \times 60}$ = 0.3 min.

Total Accumulation Time: T = 18.5 min.

$I = \frac{189}{T+25} = \frac{189}{18.5+25} = 4.34$

$Q = CIA = (0.65)(4.34)(3.1) = 9$ c.f.s.

Date: 6-1-72

Comp. by:

Checked by:

Totals: $A = 3.1 + 1.8 + 1.3 = 6.2$ Acres

$Q = 9 + 3 + 6 = 18$ C.F.S.

RUNOFF COMPUTATIONS

Sheet No. 4

Job No. T.S.

Drainage Area No. 4

Area = 3.1 acres

Maximum Overland Flow: L = 160' S = 1.8%

Maximum Channel Flow:

Channel No. 1 L = 262' S = 3.1%

Channel No. 2 L = 225' S = 1.8%

Channel No. 3 L = 100' S = 3.4%

Accumulation Time

Overland Flow: 15.9 min.

Channel No. 1 Flow:

Velocity= 8.1 ft/sec; Time= $\frac{262}{8.1 \times 60}$ = 0.5 min.

Channel No. 2 Flow:

Velocity= 6.0 ft/sec; Time= $\frac{225}{6.0 \times 60}$ = 0.6 min.

Channel No. 3 Flow:

Velocity= 8.5 ft/sec; Time= $\frac{100}{8.5 \times 60}$ = 0.2 min.

Total Accumulation Time: T = 17.2 min.

$I = \frac{189}{T+25} = \frac{189}{17.2+25} = 4.44$

$Q = CIA = (0.65)(4.44)(3.1) =$ 9 c.f.s.

Date: 6-1-72

Comp. by:

Checked by:

RUNOFF COMPUTATIONS

Sheet No. 5

Job No. T.S.

Drainage Area No. 5

Area = 2.7 acres

Maximum Overland Flow: L = 160' S = 0.5%

Maximum Channel Flow:

Channel No. 1 L = 100' S = 1.0 %

Channel No. 2 L = 150' S = 6.0 %

Channel No. 3 L = 185' S = 3.0 %

Accumulation Time

Overland Flow: 21.0 min.

Channel No. 1 Flow:

Velocity= 4.6 ft/sec; Time= $\frac{100}{4.6 \times 60}$ = 0.4 min.

Channel No. 2 Flow:

Velocity= 12.0 ft/sec; Time= $\frac{150}{12.0 \times 60}$ = 0.2 min.

Channel No. 3 Flow:

Velocity= 8.0 ft/sec; Time= $\frac{185}{8.0 \times 60}$ = 0.5 min.

Total Accumulation Time: T = 22.0 min.

$I = \frac{189}{T+25} = \frac{189}{22.0+25} = 4.02$

$Q = CIA = (0.65)(4.02)(2.7) = 7$ c.f.s.

Date: 6-1-77

Comp. by: [signature]

Checked by: [signature]

RUNOFF COMPUTATIONS

Sheet No. 6

Job No. T.S.

Drainage Area No. 6

Area = 2.2 acres

Maximum Overland Flow: L = 160' S = 1.8 %

Maximum Channel Flow:

Channel No. 1 L = 305' S = 3.0 %

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 15.9 min.

Channel No. 1 Flow:

Velocity= 8.0 ft/sec; Time= $\frac{305}{8.0 \times 60}$ = 0.6 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 = 16.5 min.

$I = \frac{189}{T+25} = \frac{189}{16.5+25} = 4.55$

$Q = CIA = (0.65)(4.55)(2.2) =$ 7 c.f.s.

Date: 6-1-72

Comp. by: [signature]

Checked by: [signature]

Totals:

$A = 3.1 + 2.7 + 2.2 = 8$ Acres

$Q = 7 + 9 + 7 = 23$ C.F.S.

RUNOFF COMPUTATIONS

Sheet No. 7

Job No. T.S.

Drainage Area No. 7

Area = 2.1 acres

Maximum Overland Flow: L = 120' S = 2.1%

Maximum Channel Flow: L = 488' S = 3.3%; L = 306' S = 0.8%

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 61.9 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 = 61.9 min.

$I = \frac{189}{T+25} = \frac{189}{61.9+25} = 2.18$

$Q = CIA = (0.65)(2.18)(2.1) = 3$ c.f.s.

Totals: $A = 6.2 + 8.0 + 2.1 = 16.2$ Acres

$Q = 3 + 18 + 23 = 44$ C.F.S.

Date: 6-1-72

Comp. by: [signature]

Checked by: [signature]

EXHIBIT E

STREETS AND MAXIMUM RUNOFFS

STREET NAME	MAXIMUM RUNOFF (in c.f.s.)
Cielito Lindo, N.E. from just west of Morris Street, N.E. extending west about 825' to Karen Avenue, N.E.	23
Karen Avenue, N.E. from just west of Morris Street, N.E. extending west, southwest, and south about 1,112' to Cielito Lindo, N.E.	18
Theresa Place, N.E. from just west of Morris Street, N.E. extending west, southwest and south about 520' to Cielito Lindo, N.E.	9
Proposed lined easement from the junction between Cielito Lindo, N.E. and Karen Avenue, N.E. extending in a west-southwest direction to a wider channel in San Gabriel Village, Unit 4.	44

REFERENCES

1. Quality in Environment by David A. Crane and Associates, February 1972.

2. "Master Plan of Drainage - City of Albuquerque, New Mexico and Environs," by Gordon Herkenhoff and Associates, Consulting Engineers, 1963.

3. Design by Elwyn E. Seelye, Volume 1, 2nd edition, 1945.

4. Preliminary Storm Drainage Data - F.H.A. Storm Drainage Design Guide-Lines by Federal Housing Administration, Revised 10/23/63.

5. Handbook of Hydraulics by H.W. King and E.F. Brater, 5th edition, 1963.

6. Drainage study of San Gabriel Village, Unit 4 by Leverton Engineering, Inc., 1964.

7. Miscellaneous Publication No. 204 by David L. Yarnell, U.S. Department of Agriculture.