Use This

A. POND

2/3 Bldg. Roof = (2516)(2.4/12)(.9) = 453 FT³

Lands. area (46)(17) + (5)(68) = 782 − 340 = (1122)(2.4/12)(.4) = 90 FT³

543 FT³ Rq.

B. POND

Wk. top 8.5 × 5 = 42.5 × 20 = 850

7.5 × 15 = 113

(963)(2.4/12)(.9) = 173 FT³

Landscape. 54 × 7 = 378

7.5 × 10 = 75

4 × 20 = 80

(533)(2.4/12)(.4) = 43 FT³

216 FT³ Rq

POND

C. 58 FT³

D. 1/3 Bldg Roof = 1239

Stor = 132

(1371)(2.4/12)(.9 = 247 FT³

Landscape = 33 × 5 = 165

(16.5 × 42) − (143 ft²) = 550

(715)(2.4/12)(.4) = 57 ft³

304 FT³ Rq..

E. 19 FT³

543
216
304
1063 FT³

TOTAL PARKING, TO DRAIN OFFSITE.

Trash = 35

50 × 68 = 3400

(30 × 15)(2) = 900

34 × 40 = 1360

(5695)(2.4/12)(.9) = 1025 ft³

1080 FT³

Landscape

4 × 6.5 = 26

10 × 15 − 10 × 15 = 150

5 × 7.5 = 38

4 × 68 = 272

5 × 40 = 200 (686)(2.4)(.4) = 55 ft³

1080 FT³

Use This

A. POND

2/3 Bldg. Roof = (2516)(2.4/12)(.9) = 453 ft³

Lands. area (46)(17) + (5)(68) = 782 + 340 = (1122)(2.4/12)(.4) = 90 ft³

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10 × 15 − 10 × 15 = 150

5 × 7.5 = 38

4 × 68 = 272

5 × 40 = ~~200~~ (686)(2.4)(.4) = 55 ft³

1080 ft³

PLEASE RETURN WITH PLANS

437 MESILLA S.E. (EMIL MANN Lot 13+14 BLK 3)

STANDARD REQUIREMENTS FOR DRAINAGE PLANS

<u>PURPOSE</u>: The increasing volume of drainage plans submitted to this office makes it mandatory that such plans be standardized as much as possible in order to expedite reviews. This standardization is as much to the advantage of the developer and engineer as it is to the Hydrology Section which enforces the AMAFCA RES. 72-2. For parcels of land less than 20,000 sq. ft. in surface area no formal drainage report is required; the construction plans need only to include the standard form attached herein and the site drainage plan. Developers for larger parcels of land will have to submit a formal drainage report as specified in the Resolution.

<u>RUNOFF PONDING</u>: In most instances on site ponding is mandatory, with dispersal in the ground of the excess runoff arising from newly created impervious surfaces. The only exception allowed, is for those properties adjacent to a diversion channel which was designed for higher standard than 100 years frequency storm (existing conditions). For detailed computations of the runoff before and after development the assumed runoff coefficient recommended are C = 0.4 for undeveloped, landscaped or similar open areas and C = 0.9 for all other impervious surfaces, including areas in southwestern type landscaping with underlying polyethylene film and gravel covered parking areas where vehicular traffic will compact the soil and render it impervious. Due to the inadequacy of the existing drainage facilities in the valley area and to the limited capabilities of the City for providing relief, ponding requirements in the valley are higher than elsewhere.

<u>COMPUTATION OF VOLUME OF RETENTION</u>:

Valley Area = $1.0 \times \frac{2.2"}{12"} \times$ Area (ft.) = 0.18 x A

East and West Mesa = $(0.9 - 0.4) \times \frac{2.4"}{12"} \times$ Area (ft.) = 0.1 x A

In order to facilitate the design of drainage facilities, a checklist that will be followed in the review process is listed below:

CHECK LIST

1 - Flooding potential - adjacent water courses

Is property located in the flood plain? L19 FHBM 23

If so, is the finished floor above the 100 yrs. flood level?

Is property adjacent to a natural or artificial water course?

If so, what are the specific AMAFCA or City requirements?

[redacted]

[redacted] THE [redacted] .3' ft ELEV ABOVE TOP OF CURB WILL HAVE TO BE ADHERED TO. FLOODING POTENTIAL FROM STREET IS VERY POSSIBLE.

Are drainage R.O.W or easements shown on, or in the proximity of property? If so, are there drainage problems?

2 - Relation of property to surroundings

YES Per topo map, does property intercept other drainage upstream?

If so, how is runoff conveyed across property?

May there be erosion associated with offsite runoff conveyance?

May erosion or siltation result from proposed construction activities?

NO [redacted] Does development block drainage from adjacent property?
[redacted]

3 - Site grading

NO Does site plan show contours before development (extending a minimum of 25 ft. beyond property lines)?

Does site plan show proposed grading with adequate swale definition to convey water to ponds?

Is all runoff conveyed to ponding areas before it overflows to public facilities?

Does the proposed grading plan indicate that under cutting or back-filling adjacent to property lines may require retention walls?

Is there continuity between proposed new contours and old contours, [redacted] offsite? [redacted]

YES Is elevation of property line at least 0.3 ft. above top of curb? THIS WILL HAVE TO BE A MUST, BECAUSE FLOODING FROM STREET IS VERY POSSIBLE.

4 - Storm water retention

Is ponding volume adequate (supply detailed computation)?

NO Are ponds balanced with areas they drain (can area draining to each pond be easily identified and will actually water flow there)? The plot plan must outline each drainage area. SHOW THE [redacted] AREA DRAINING [redacted] TO EACH POND.

YES Can pond volume be computed and verified?

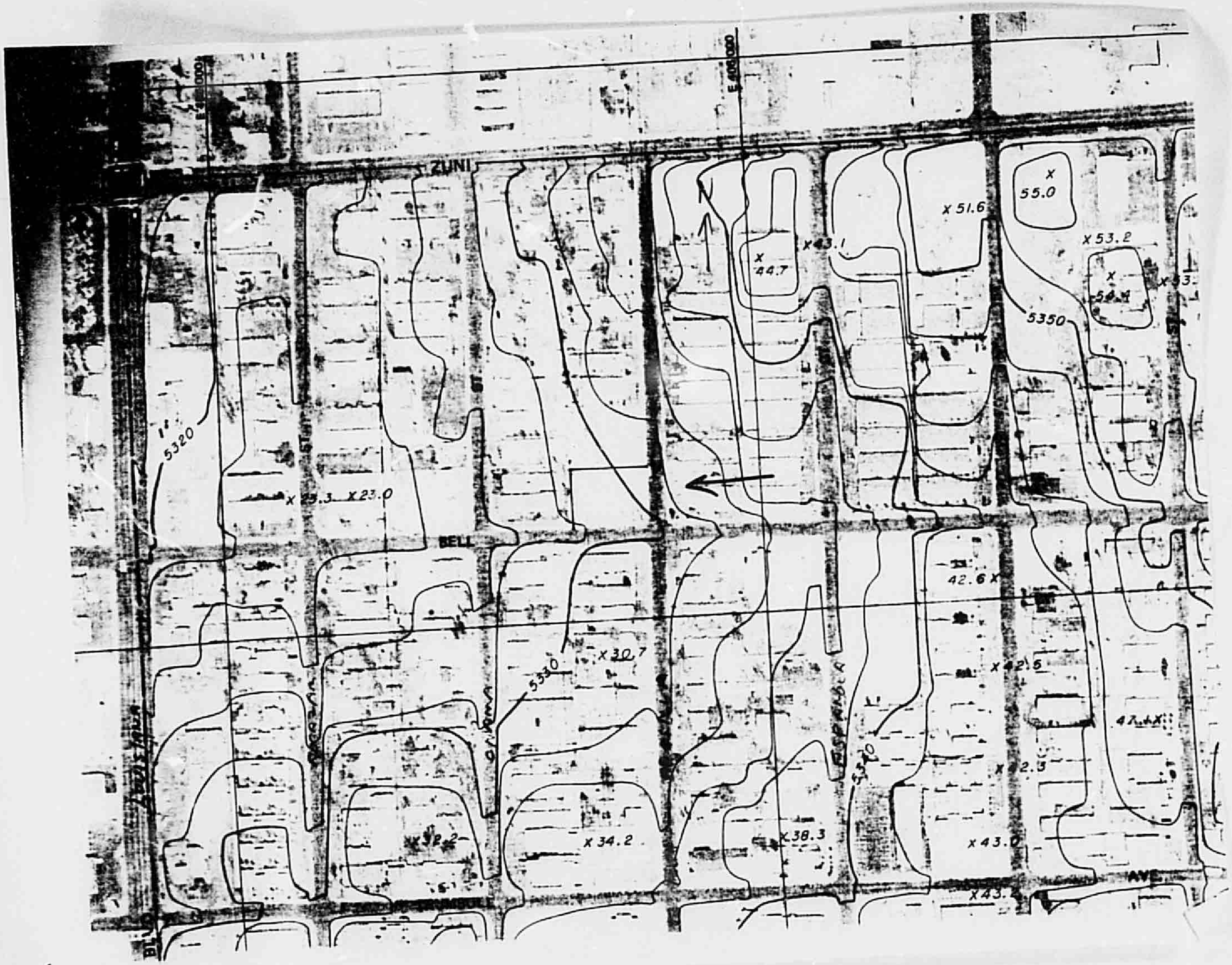
Are ponds practical, can they be built as shown?

5 - Safety

Do the drainage provisions constitute an attractive nuisance, or safety hazard?

If the pond depth is greater than 18",are safety provisions supplied? (Minimum 3.0 ft. high chain link fence or similar physical barrier of ponding areas are adjacent to public R.O.W.?)

In general, ponds of depth greater than 18" will not be accepted for both safety consideration and for long term effectiveness of the facilities. In those cases where limited space is available for ponding, the use of gravel pits under the parking areas is suggested. It must be pointed out that mainstream and effectiveness of these facilities is necessary and is the responsibility of the owner. Existing or planned City facilities (streets, channels, storm sewers) can accommodate the natural runoff volumes. Greater discharges would cause flooding downstream and need to be limited at the source.


ZUNI
BELL
AVE
x 55.0
x 53.2
x 51.6
5350
x 44.7
x 43.1
42.6 x
x 30.7
5330
5320
x 23.0
x 34.2
x 38.3
x 43.0
x 42.5

1.

COMPUTATION OF VOLUME OF RETENTION PER
CITY OF ALBUQ EQUATION

VALLEY AREA $\frac{1.0 \times 2.2''}{12} \times$ AREA (FT.) = 0.18 × A.

EAST & WEST MESA. = $\frac{(0.9 - 0.4) \times 2.4''}{12} \times$ AREA (FT.) = 0.1 × A

COMPUTATIONS FOR.

LOT. #13 & #14
BLK # 3
ADDITION. EMIL MANN

LOT	13,500 SQ.FT.
BUILDINGS	3899 SQ.FT
WALKS & BLACKTOP	6610 SQ.FT
TOP SOIL.	2991 SQ.FT

1. $\frac{0.4 \times 2.4 \times 13,500}{12}$ = 1080 ft³ EXISTING RUNOFF

2. $\frac{0.9 \times 2.4 \times 10509}{12}$ = 1892 ft³ IMPERVIOUS SURFACE RUNOFF

3. $\frac{0.4 \times 2.4 \times 2991}{12}$ = 239 ft³ TOP SOIL & LANDSCAPED RUNOFF

4. 0.1 × 10509 (IMP. AREA) = 1051 ft³ TOTAL RETENTION. VOLUME PER FORMULA

2 = 1892 ft³
3 = 239 ft³
a 2131 ft³ TOTAL. RUNOFF AFTER DEVELOPMENT.

a = 2131 ft³
1 = 1080 ft³
1051 ft³ TOTAL. RETENTION. REQUIRED

P.W. ROBINSON

POND.	TOP ft	DEPTH	BOT ft	AVE ft	VOL.	
A	736.0	1.0	400.0	568	568 ft³	423
B	416.0	1.0	55.0	236	236 ft³	210 ft³
C	100.0	1.0	16.0	58	58 ft³	58 ft³
D	453.0	1.0	143.0	298	298 ft³	413 ft³
E	37.5	1.0	–	19	19 ft³	19
					1179 ft³ TOTAL RETENTION	1123

CITY OF ALBUQUERQUE DRAINAGE REPORT

ZONE ATLAS NO.	NAME OF CONSTRUCTION	OBSERVER	DATE OBSERVED
	Apartment Complex	William R. Bower	3-27-79

ADDRESS: 437 Mesilla SE.

Reason for Field Check: For the drainage report on this apartment complex.

FINDINGS AND CONCLUSION: There are landing area on this apartment unit. All the ponds are ok. The slop from the roofs is to the pond & which is located on the north side of the roof bldg.

FOLLOW UP ACTION REQUIRED: No follow-up will be need because this Bldg is final.

SKETCH:

William R. Bower
OBSERVER

#1

CITY OF ALBUQUERQUE
February [illegible] 1965

W. T. Stevens - City Engineer

Proposed 80 acre subdivision - S ½ SE ¼ Sec. 10, Twp. 10 N. Range 4 E. Relevant to Drainage Report for New Mexico Savings and Loan Association.

C O P Y

1. Runoff flood quantities as set forth in subject report are adequate in all instances.

2. Regarding the proposed dike along the east portion of the subdivision - the construction of this dike will require a durable anchored riprap on the east face, as well as being of compacted fill density equivalent to 90% of modified proctor T-180.

3. The Engineer's recommendation (Page 6) of extending the channel to intersect existing channel to the east of proposed subdivision would be the best and most satisfactory manner of development.

Respectfully submitted,

Tom B. Thomas
Chief Construction Inspector

TBT:sb
CC: Planning Department

#2

DRAINAGE REPORT
FOR
NEW MEXICO SAVINGS & LOAN SITE

LOUISIANA & LOS ARBOLES

MARCH, 1974

BOHANNAN WESTMAN HUSTON

DRAINAGE REPORT
FOR
NEW MEXICO SAVINGS & LOAN SITE

LOUISIANA & LOS ARBOLES

MARCH, 1974

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.
4125 Carlisle Boulevard NE • Albuquerque, New Mexico 87107 • Phone 505 345-2681

ENGINEERS & PHOTOGRAMMETRISTS

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.

4125 CARLISLE BLVD., N.E.
ALBUQUERQUE, NEW MEXICO 87107
PHONE 505 345-2681

11 March 1974

Home Planning Development Corp.
4100 Carlisle Blvd NE
Albuquerque, New Mexico

ATTN: Mr. E. Cardon

RE: Drainage Report for New Mexico Savings and Loan Site
Louisiana Boulevard and Los Arboles NE

Dear Mr. Cardon:

We are transmitting two (2) copies of our Drainage Report on the subject New Mexico Savings and Loan Site to you. We will also make copies of this report available to the Albuquerque Metropolitan Arroyo Flood Control Authority and to the City of Albuquerque, upon your request.

Very truly yours,

Michial M. Emery

Michial M. Emery, PE
Chief Engineer

MME/teg

Enclosures

cc: AMAFCA
City of Albuquerque

APPROVED FOR DRAINAGE

SIGNATURE ______ DATE ______

TITLE ______

CONTINGENCIES ______

DRAINAGE REPORT

NEW MEXICO SAVINGS & LOANS

LOUISIANA BLVD & LOS ARBOLES AVENUE NE

ALBUQUERQUE, NEW MEXICO

FOR

HOME PLANNING DEVELOPMENT CO.,INC.
ALBUQUERQUE, NEW MEXICO

MARCH 1974

BOHANNAN WESTMAN HUSTON & ASSOCIATES,INC.
4125 Carlisle Blvd NE
Albuquerque, New Mexico 87107

Michial M. Emery, PE
Chief Engineer

STATE OF NEW MEXICO
MICHIAL M. EMERY
No. 5194
REGISTERED PROFESSIONAL ENGINEER

DRAINAGE REPORT

NEW MEXICO SAVINGS & LOAN SITE

TABLE OF CONTENTS

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	TABLE I - SITE DATA TABULATIONS	6
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DRAINAGE REPORT

NEW MEXICO SAVINGS & LOAN SITE

I. AUTHORIZATION

In March, 1974, Bohannan Westman Huston and Associates, Inc., was contacted by Cottrell Vaughan & Rowland and Home Planning Development Co., and authorized to conduct a drainage study on the property to be occupied by a branch office of New Mexico Savings and Loan. A report of findings and recommendations was requested as a product of this study to insure the development will take place in a manner satisfactory to regulatory authorities having jurisdiction over the project site.

II. LOCATION

The proposed site for the New Mexico Savings and Loan branch office is on the northeast corner of the intersection of Louisiana Blvd and Los Arboles Avenue NE, in the City of Albuquerque, New Mexico.

III. DESIGN REQUIREMENTS

The City of Albuquerque and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) have jurisdiction over matters concerning drainage of storm waters in the location of the project. It is a requirement of AMAFCA that all new construction and improvements accomplished in the area must not increase the rate or volume of discharge of storm waters from the property, above what exists before the development takes place. It is the purpose of this report to give the developer a method by which the above requirements can be met.

IV. STRATEGY

To accomplish the above requirements, infiltration areas were located at strategic points within the property so that storm water runoff could be easily captured within these areas. The total site was divided into five (5) main areas as shown on Plate I.

The purpose of these infiltration areas is two-fold. First, the required time to fill the infiltration areas can be added to the initial time of concentration for that area. This greatly reduces the intensity of rainfall that will contribute to the peak discharge for the area in question. Using the rational formula and an iterative trial computation procedure the time to fill the infiltration area and thus the revised time of concentration can be computed. A sample computation is given in the Appendix for Area 3. Given in Table I is the runoff rate for the site before and after development.

The second purpose of the infiltration areas is to physically retain a portion of the storm water on the site in an attempt to reduce the total volumetric runoff from the site. Water retained in the infiltration areas will be absorbed by the soil after the storm has passed. Table I gives the volumetric runoff for the site before and after development. Volumetric runoff figures were computed using a 100 year, 6 hour rainfall of 3.01 inches. No allowance in the computations were made for on-site infiltration during the storm after development takes place. The infiltration volumes used in the computations was 50% of the volume of the specified excavated area. This allows for an assumed void ratio of 50% for the gravel pack specified.

V. RESULTS OF STUDY

Given in Table I are the results of the rate and volumetric discharge computations from the property. These values indicate the rates and volumes of flow from the property are similar before and after development.

VI. RECOMMENDATIONS

Construct the infiltration areas as shown on Plate I and devise a grading plan that will result in the flow patterns illustrated.

Any possible effects of the infiltrated waters should be taken into account during the design of building foundations.

VII APPENDIX

ITERATIVE COMPUTATION METHOD

(1) $\dfrac{\text{Volume of Pond}}{Q\,(60)\ \text{Min.}} = T$

(2) T + 5 = Tc

(3) Tc → Graph = Intensity

(4) Q = A i c

(5) Q → Back to Step (1)

SAMPLE COMPUTATION - AREA 3

Volume of Pond = 2450 Ft^3

	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
Ac=	.406	.406	.406	.406	.406
c=	.9	.9	.9	.9	.9
I=	5.3	4.2	3.9	3.8	3.8
Tc=	5	18	21	23	23
Q=	1.93 cfs	1.53	1.42	1.38	1.[illegible]8

(1) $\dfrac{2450}{(1.93)(60)} = 13$

(2) 5 + 13 = 18 Tc

(3) See Graph

(4) (.406)(4.2)(.9) = 1.53 cfs

(5) $\dfrac{2450}{(1.53)(60)} = 16$

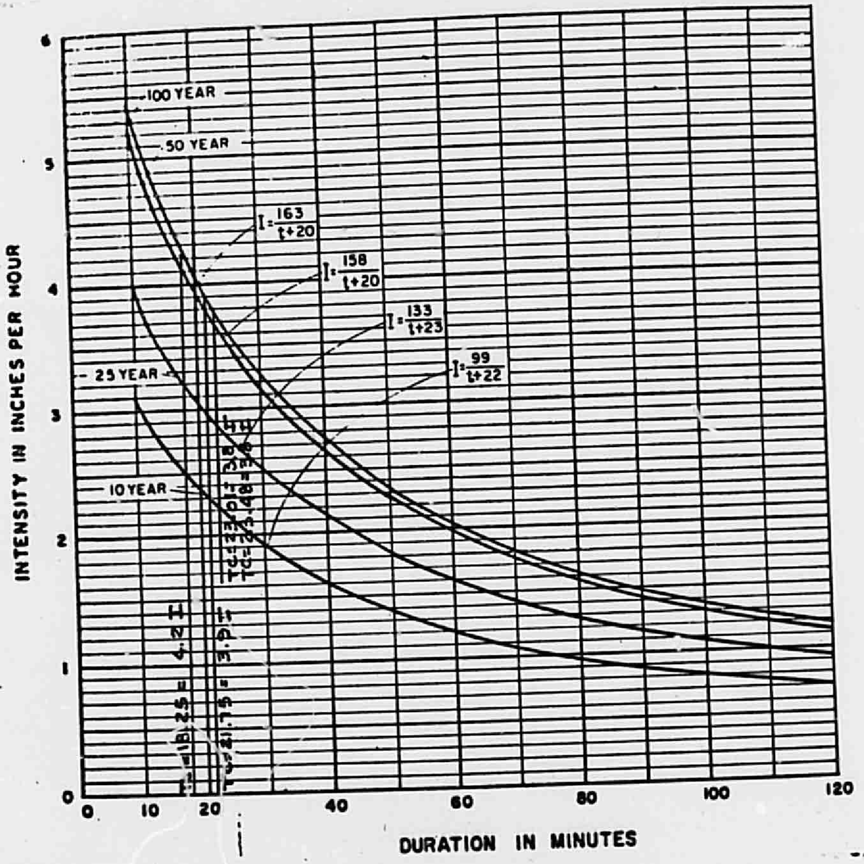

INTENSITY IN INCHES PER HOUR
DURATION IN MINUTES
0
1
2
3
4
5
6
0
10
20
40
60
80
100
120
100 YEAR
50 YEAR
25 YEAR
10 YEAR
$I = \frac{163}{t+20}$
$I = \frac{158}{t+20}$
$I = \frac{133}{t+23}$
$I = \frac{99}{t+22}$

TABLE I - SITE DATA TABULATIONS

DESCRIPTION	AREA (ACRE)	RUNOFF COEFFICIENT	CONCENTRATION TIME (MIN)	RAINFALL INTENSITY (IN/HR)	RESULTING FLOW RATE (CFS)	TOTAL RAINFALL (FT^3)	RETAINED OR INFILTRATED (FT^3)	RUNOFF VOLUME (FT^3)
				BEFORE DEVELOPMENT				
Undeveloped Site	1.55 Includes Sidewalks Adjacent To Street	.6	8.2	5	4.65	16,936	6,774 (40%) Infiltration	10,162
				AFTER DEVELOPMENT				
Area 1	.24	.9	47	2.4	.52	2,622	1,470	1,152
Area 2	.46	.9	36	2.95	1.22	5,026	2,450	2,576
Area 3	.40	.9	23	3.8	1.37	4,371	1,540	2,831
Area 4	.19	.9	71	1.95	.33	2,075	1,313	762
Area 5	.19	.9	6	5.3	.91	2,076	0	2,076
TOTALS	1.48 Excludes Sidewalk Adjacent To Streets				4.35 cfs		Volume of Retention Areas	9,397

DRAINAGE REPORT FOR

NEW MEXICO SAVINGS & LOAN ASSOCIATION

PLAT AT INDIAN SCHOOL ROAD & CHELWOOD PARK BLVD.

Prepared by

John Wright

D. F. MOLZEN & ASSOCIATES

CONSULTING ENGINEERS

ALBUQUERQUE, NEW MEXICO

DRAINAGE REPORT FOR NEW MEXICO SAVINGS & LOAN ASSOCIATION

PLAT AT INDIAN SCHOOL ROAD & CHELWOOD PARK BLVD.

PURPOSE:

This report was written to present the findings of a study into the drainage conditions of a parcel of land owned by the New Mexico Savings and Loan Association at Indian School Road and Chelwood Park Blvd. N. E., Albuquerque, New Mexico.

GENERAL:

The property under study lies in the "N. E. Heights" of Albuquerque, New Mexico. To the East of the property lies the Sandia Mountains and the general drainage is from east to west. An existing natural drainage course, the Embudo Arroyo, runs through the property. The Embudo has a drainage area of approximately 2900 acres at the eastern edge of the property in question. The Embudo enters the property at the east end about 700 feet north of the southern boundry which is the section line between sections 10 and 15.

There is an existing drainage channel to carry Embudo water on the property to the west which has been constructed along the north edge of Indian School Road, which is also along the section line. The construction of this channel forces the owners of the property in question to channel the Embudo water to the southern boundry along the section line. The channel required to carry the Embudo water has been designed as shown on ...ge 4.

If the Embudo Arroyo is channeled to the Southern section line, the property owners to the east will be required to follow suit. The owners of the property to the east have expressed their intentions to channel the Embudo in this manner. It should be noted that the natural channel of the Embudo Arroyo crosses the intended channel at a point about 4000 feet east of the property in question so that there will be no problem in constructing a channel along the section line for drainage of Embudo water.

The drainage of water from the east which is not in the Embudo Arroyo will be picked up by Panorama Drive and carried south to the Embudo channel. The drainage of water which falls on the property will be carried in the streets and drainage structures south and west to the Embudo channel as shown on the attached Plate II.

EMBUDO CHANNEL DRAINAGE:

The water which must be carried by a channel from the Embudo Arroyo comes from a water shed of 2915 acres. This water shed is outlined in the Master Plan of Drainage, City of Albuquerque, New Mexico and Environs, 1963 on Plate 7 and is outlined in this report on Plate I, a reproduction of a portion of two U. S. G. S. Quadrangle Maps.

From the rational formula $Q = cAi$, the runoff resulting from a 100 year storm is determined for the water shed as follows:

The value of A, area of the water shed in acres, was determined from Plate I by use of a planimeter and was found to be 2915 acres.

The value of i, intensity of rainfall in inches, for a 100 year **storm** was determined as 3.4 inches. This value was determined from Chart 1 of the <u>Master Plan of Drainage, City of Albuquerque, New Mexico and Environs, 1963</u> for a storm duration time of 30 minutes. The storm duration time was determined by assuming a theoretical ditch from the furthest point of the drainage area. The theoretical ditch has a grade of 16% and an assumed hydraulic radius of 0.355, coefficient of roughness, (n factor) of 0.0215, and a length of 25,000 feet.

With the above information and using Manning's formula, a runoff velocity if found as follows:

Formula: $$V = \frac{1.486}{n} \times R^{2/3} \times S^{1/2}$$

Where:
- V = velocity in feet per second
- n = roughness coefficient
- R = hydraulic radius
- S = slope in feet/foot

Therefor: $$V = \frac{1.486}{0.0215} \times 0.355^{2/3} \times 0.16^{1/2} = 13.87 \frac{ft.}{sec}$$

Runoff time = Distance Velocity

25,000 ft. ÷ 13.87 ft/sec = 1802 seconds = 30 min.

The flow from the equation Q = cAi in cubic feet per second is:

Q = 0.40 x 2915 x 3.40 = 3964 cfs

A proposed channel to carry this flow at the available grade of 5.11% will be 35 feet wide with 3:1 slopes and water depth of 4 feet with a total depth of 5 feet. Manning's formula is used to calculate and check the capacity of the proposed channel in cubic feet per second:

$$Q = A \times \frac{1.486}{n} \times R^{2/3} \times S^{1/2}$$

$$A = 35 \times 4 + (\tfrac{1}{2} \times 4 \times 12 \times 2) = 188 \text{ ft.}^2$$

$$n = 0.33$$

$$R = A/P = 188 \div (35 + 12 + 12) = 188 \div 59 = 3.19$$

$$R^{2/3} = 3.19^{2/3} = 2.16$$

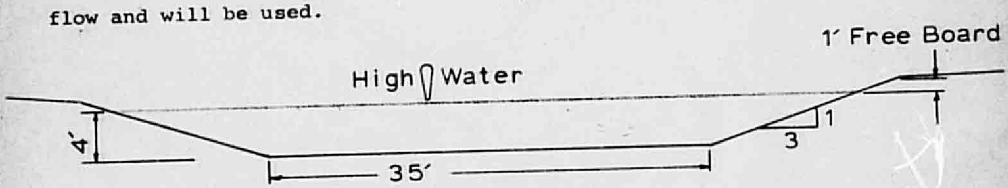
$$S = 0.0511 \ \frac{\text{ft.}}{\text{ft.}}$$

$$S^{1/2} = 0.0511^{1/2} = 0.226$$

$$\frac{1486}{n} = \frac{1.486}{0.033} = 45.03$$

$$Q = 188 \times 45.03 \times 2.16 \times 0.226 = 4133 \text{ c.f.s.}$$

The proposed channel will be more than adequate to carry the anticipated flow and will be used.



PROPOSED EMBUDO CHANNEL TO MATCH EXISTING CHANNEL

INTERNAL DRAINAGE:

The drainage of water which falls on the proposed area will be carried in the streets and drainage easements as shown on the attached

Plate II. Flow quantities for a 100 year storm have been calculated and it was found that a 10 foot easement will be sufficient for drainage purposes. Areas and runoff quantities were also calculated where each of the two main streets empty into the Embudo channel and are shown on the attached Plate II.

The flows calculated for the east and west areas were 139 C.F.S. and 103 C.F.S. respectively. This is a large flow to be carried by a typical crouned curb and gutter street. In all probability, Chelwood Park Blvd. and the next street east would need to be inverted croun for three blocks from the Embudo channel north to carry the expected 100 year storm flow.

CONCLUSIONS:

The area under study is suitable for a residential subdivision. The storm water can readily be handled by surface runoff. Drainage from the Embudo drainage area must be carried past the area in a special channel. Since a channel for Embudo drainage has been constructed at the southern boundry of the property to the west, the owners of the property in question have been forced to channel the Embudo to their southern boundry line. The owner of the property to the east has expressed his desire to channel the Embudo on the section line, however, the property to the east is not slated for development at this time.

The Embudo must be channeled to the section line if the property in question is to be developed. Three methods of construction of this channel are open to the owners of the property in question.

The first is to construct the channel due east on the section line until the main Embudo channel is intersected. This construction is shown on Plate I by a straight dashed line.

The second method of construction would be to construct an "S" shaped channel on the western edge of the property to the east. This construction is shown on Plate I by a solid "S" shaped line. The owner of the property to the east has expressed his willingness to consider construction of an Embudo channel on his property at this time, however, the actual arrangements for such construction go beyond the scope of this report.

The third method of construction would be for the Embudo to be channeled to the section line on the property in question. This construction is shown by broken lines on Plate II.

The Engineer recommends that if possible, the Embudo channel be constructed due east on the section line to intersect the existing channel. This method would eliminate any future construction and provide for the most economical land use.

D. F. MOLZEN & ASSOCIATES

John R. Wright
Professional Engineer
February 20, 1965

PLATE I

Location Plat & Drainage Area