PLANS/PLATS ON FILE

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PLANS/PLATS 1

BOHANNAN WESTMAN HUSTON

DRAINAGE REPORT
FOR
PRESLEY COMPANY OF
NEW MEXICO

ALTURA REAL SUBDIVISION

OCTOBER 10, 1974

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.
1125 Collier Boulevard NE - Albuquerque, New Mexico 87107 - Phone 505 [illegible] 2681

DRAINAGE REPORT

FOR

ALTURA REAL SUBDIVISION

OCTOBER, 1974

PREPARED FOR:
THE PRESLEY COMPANY
of NEW MEXICO

6601 Glendora Drive N.E.
Albuquerque, New Mexico

PREPARED BY:
BOHANNAN WESTMAN HUSTON & ASSOCIATES, INC.
4125 Carlisle Blvd. N.E.
Albuquerque, New Mexico 87107

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

Michial M. Emery

Michial M. Emery, P.E.
N.M.P.E. No.5194

This report covers only the hydrologic performance of the Altura Real Subdivision. If the concepts presented in this report are strictly followed, the flows resulting from a 100 year storm falling on the Subdivision shall not be increased in rate or volume due to the planned development. No other claim or guarantee is made or implied by this report.

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DRAINAGE REPORT FOR THE ALTURA REAL SUBDIVISION

PURPOSE AND SCOPE

The purpose and scope of this report is to determine an acceptable method for controlling the rate and volume of runoff resulting from a 100 year frequency storm falling on the Altura Real Subdivision and to define these resulting quantities.

LOCATION AND TERRAIN

The Altura Real Subdivision is located on the mesa east of Tramway Boulevard and north and adjacent to the extension of Copper Avenue (See Plate 1 for the exact location). The slopes on this part of the east mesa are in the six (6) to nine (9) percent range and the soils are mainly granular decomposed granite.

PROPOSED DEVELOPMENT

The Altura Real Subdivision will be developed as R-1 single family residences following the guidelines set forth by the Albuquerque Metropolitan Arroyo Flood Control Authority in their August 1972 Drainage Resolution. Streets will be constructed to form central drainage channels and retention of fifty (50) percent of the water falling on each lot will be required. Most streets will traverse the natural grades at slopes that are greatly reduced from those running perpendicular to the contours. Retention of fifty (50) percent of the water falling on each lot will be accomplished by means of backyard ponding. With this arrangement at least half of the water falling on each lot will be infiltrated on site

and will not contribute to runoff.

HYDROLOGIC ANALYSIS

A One Hundred Year Frequency Rain was used in conjunction with the rational method to compute the flow rate of storm water runoff originating from Altura Real and a One Hundred Year, six hour rain was used to compute the volume of the runoff. These flows and volumes were computed for both the developed and undeveloped conditions. To implement the use of the rational formula, data was obtained from each of the seven (7) areas comprising Altura Real. The data was taken from the contour maps included in the back of this report. A table of the data and the results of the hydrologic analysis is presented in the Appendix of this report and a discussion of each specific area follows in this section.

The upland drainage was computed using methods detailed in the Denver Regional Council of Government: Urban Storm Drainage Criteria Manual. These methods are commonly known as the Colorado Urban Hydrograph Procedure (CUHP).

INTERNAL DRAINAGE

Water falling on Area A (see Plate 1) will be conveyed by Calle de Campos to Turner Avenue and then to the Copper Channel Drainage Easement. Turner Avenue will also act as the means of conveyance for water leaving Altura Real Subdivision from Areas B, C, D and E. Existing water blocks

on the streets west of Turner Avenue prevent storm water from entering Unit C, City View Estates Subdivision, and insures water will flow south to the Copper Easement.

Storm water falling on Area F produces a runoff of 4.3 cfs. This flow will leave the subdivision via Oro Real and will flow onto the property north of Altura Real. The requirement of draining water in this direction is established by several existing physical features. First, the horizontal alignment of Oro Real was dictated by the existing water line easement that traverses the property. Installed in the easement at the present time is a large water transmission line owned by the City of Albuquerque. This water line in conjunction with the existing topography sets the vertical alignment of the street. The result is that Area F must be drained to the north. Ultimate drainage from Area F will be carried by the street system, developed for the property to the north, to Turner Avenue with ultimate disposition in the drainage channel to be constructed below the Lomas Dam.

Storm water falling on Area G will flow along the street system as indicated on Plate 1. These flows will eventually be discharged from the subdivision via the 20 foot drainage right-of-way at the end of the Plata Court Culdesac. At this point the flows will enter the drainage channel to be constructed adjacent to and north of Copper Avenue.

EXTERNAL DRAINAGE

Upland flows affecting the subdivision (see Plate 2) will have to be controlled by means of a two stage system. The first, an interim solution, will consist of an earth ditch dike section along the eastern edge of the subdivision in the Camino de la Sierra right-of-way, and an earth ditch section in the Copper Channel Easement along the southern edge of the subdivision. (See Plate 1 for typical details & locations.) For the interim period, the eastern channel will be designed for a flow of 904 cfs from Areas A_1 and A_1'. The section will have a ten (10) foot bottom width, 2½:1 side-slope, a depth of 5 feet, and a 5 foot berm by the property line. The Copper Channel will initially be designed for a flow of 1278 cfs from area A_1, A_1', A_2, and A_3. This earth section will have a 10 foot bottom, 2½:1 side slopes and a 5 foot depth. Presently there is a restriction on the Copper Channel at Turner Drive. At this location 2 - 36" C.M.P. culverts exist to convey the flow in the Copper Channel under Turner Drive. It is obvious this structure is inadequate to pass the projected flows it will receive. Under these conditions water can be expected to flow a maximum of 3.0 feet above the top chord elevation of the structure. To insure homes constructed on lots in Block 1 of Altura Real are protected, their finished floor elevations shall be set above this high water elevation. The development of Altura Real will not aggravate this problem but recognition of the

problem and adequate provisions for protection are essential

After construction of the proposed diversion channel east of the subdivision that will carry a majority of the upland drainage north to the Lomas Dam site, only a residual flow of 93.2 cfs will reach the east boundary of the subdivision. At this point in time the interim drainage facilities constructed in the Camino de la Sierra right of way can be abandoned and the flow easily carried south in the 50 foot street section to the Copper Drainage Channel. At this time the upland drainage flow rate in the Copper Channel will be reduced to 502 cfs that will have to be conveyed past the subdivision.

In the future the City of Albuquerque plans to construct concrete lining in the Copper Channel for its entire length and also to improve the crossing at Turner with a single 14' x 6' reinforced concrete box culvert. (See "Tramway Blvd. Corridor and Drainage Study, 1972" and "Storm Drainage Facilities Tramway East, 1974" prepared by Bohannan Westman Huston and Associates for the City of Albuquerque.) Until this work is accomplished, the interim measures proposed in this report will provide adequate protection to Altura Real Subdivision and not aggravate existing conditions down stream.

CONCLUSIONS

The runoff rates and volume of flows resulting from a 100 Year Storm falling on the Altura Real Subdivision do not

increase due to the development of the area. This is accomplished by retaining 50% of the water falling on each lot and by careful layout of streets and lot lines. Since the runoff rates and volumes do not change, the criterion for handling storm drainage set by the Albuquerque Metropolitan Arroyo Flood Control Authority are met.

The inadequacy of the Turner structure to pass flows that will reach that point by overland means or in the Copper Channel will not be aggravated by the construction of the Altura Real Subdivision. The provision of adequate diversion facilities along the east boundary of the subdivision will provide the needed protection to Altura Real Subdivision and existing subdivisions to the west but will still deliver storm water to the same location, the corner of Turner & Copper.

For the above reasons we recommend the approval of this drainage plan for the proposed subdivision.

APPENDIX

SUMMARY OF HYDROLOGIC DATA

AREA	ACRES	UNDEVELOPED Q(cfs)	UNDEVELOPED Vol(ac-ft)	DEVELOPED Q(cfs)	DEVELOPED Vol(ac-ft)
A	4.80	8.45	0.45	7.58	0.39
B	0.89	1.42	0.08	1.36	0.08
C	3.43	5.89	0.32	5.37	0.29
D	0.89	1.42	0.08	1.30	0.08
E	2.90	5.34	0.27	5.49	0.26
F	2.35	4.32	0.22	4.28	0.21
G	24.70	39.52	2.31	27.62	1.84
Total	39.96	66.36	3.73	53.00	3.15

SAMPLE CALCULATIONS

The runoff calculations were made using the rational formula. The time of concentration used in the calculations was found by the following empirical formula.

$$TC = \text{Log}^{-1}[.3641(B) + .3854\ \text{Log}(L) - .197\ \text{Log}(S) - .3613]$$

where:

S = Average slope of the basin in percent.

B = Ground factor.

Paved = .77

Bare Soil = 1.52

Poor Grass Surface = 1.84

Average Grass Surface = 2.16

Dense Grass Surface = 2.57

TC = Time of concentration.

L = Distance to Furthest Point in the Basin in Feet.

SAMPLE CALCULATION FOR AREA A

Undeveloped Runoff

Area (A)	4.80 Ac
Length of Area	550 ft
Ground Factor	1.84
Average Slope	6.36%

Time of Concentration (TC)

$TC = \text{Log}^{-1}[.3641(1.84) + .3854 \text{ Log } (550) - .197 \text{ Log } (6.36) - .3613]$

$TC = \text{Log}^{-1}[.3641(1.84) + .3854(2.740) - .197(.803) - .3613]$

$TC = \text{Log}^{-1}[1.2066] = 16.1$ min.

*Intensity (I)	4.4 in/hr
Runoff Coefficient (C)	0.4
Q = AIC	8.448 cfs
Total Rainfall (TR)	2.8 in.
Volume = (A) (C) (TR)/(12)	.448 acre feet

*Master Plan of Drainage, City of Albuquerque, New Mexico

Developed Runoff

The runoff from developed land was established by first determining the composite ground factor and runoff coefficient then using the rational formula to determine the flows.

Effective Area = Total Area - Retention Area

Bn = Area weighted ground factor

Bn = (B for surface) (Area of surface)/(Effective area)

$$\text{Composite Ground Factor} = \sum_{n=1}^{n} Bn$$

Cn = Area weighted runoff coefficient

Cn = (C for surface) (Area of surface)/(Effective area)

Composite runoff coefficient = $\sum_{n=1}^{n} Cn$

Type of Cover	n	Area	B	Bn	C	Cn
Streets	1	0.56	.77	.151	.95	0.186
Houses	2	0.92	.77	.248	.95	0.306
Lawns	3	1.38	2.57	1.240	.20	0.097
Total		2.86		1.639		0.589

Effective Area (A')*	2.86 Ac
Length of Area	700 ft
Ground Factor	1.639
Average Slope	5.00%
Time of Concentration	15.7 min
**Intensity (I)	4.5 in/hr
Runoff Coefficient	0.589
Q = AIC	7.580 cfs
Total Rainfall (TR)	2.8 in
Volume = (A') (C) (TR)/12	0.393 acre feet

*The water from 1.94 acres will be retained on site.

**Master Plan of Drainage, City of Albuquerque, New Mexico

Channel Design (Upland Drainage)

I. Interim Section along east side of Altura Real (Flow from A_1 & A_1', Q = 904 cfs)

Channel

Bottom Width	10 feet
Side Slopes	2.5:1
Water Depth	3.2 feet
Area (A)	57.6 sq ft
Hydraulic Radius (R)	2.115
Slope (S)	0.037 ft/ft max.
Mannings Coefficient (n)	0.03

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

$$Q = \frac{(57.6)\ 1.486}{.03} (2.115)^{2/3} (.037)^{1/2} = 904.4 \text{ cfs}$$

Velocity = 15.7 ft/sec

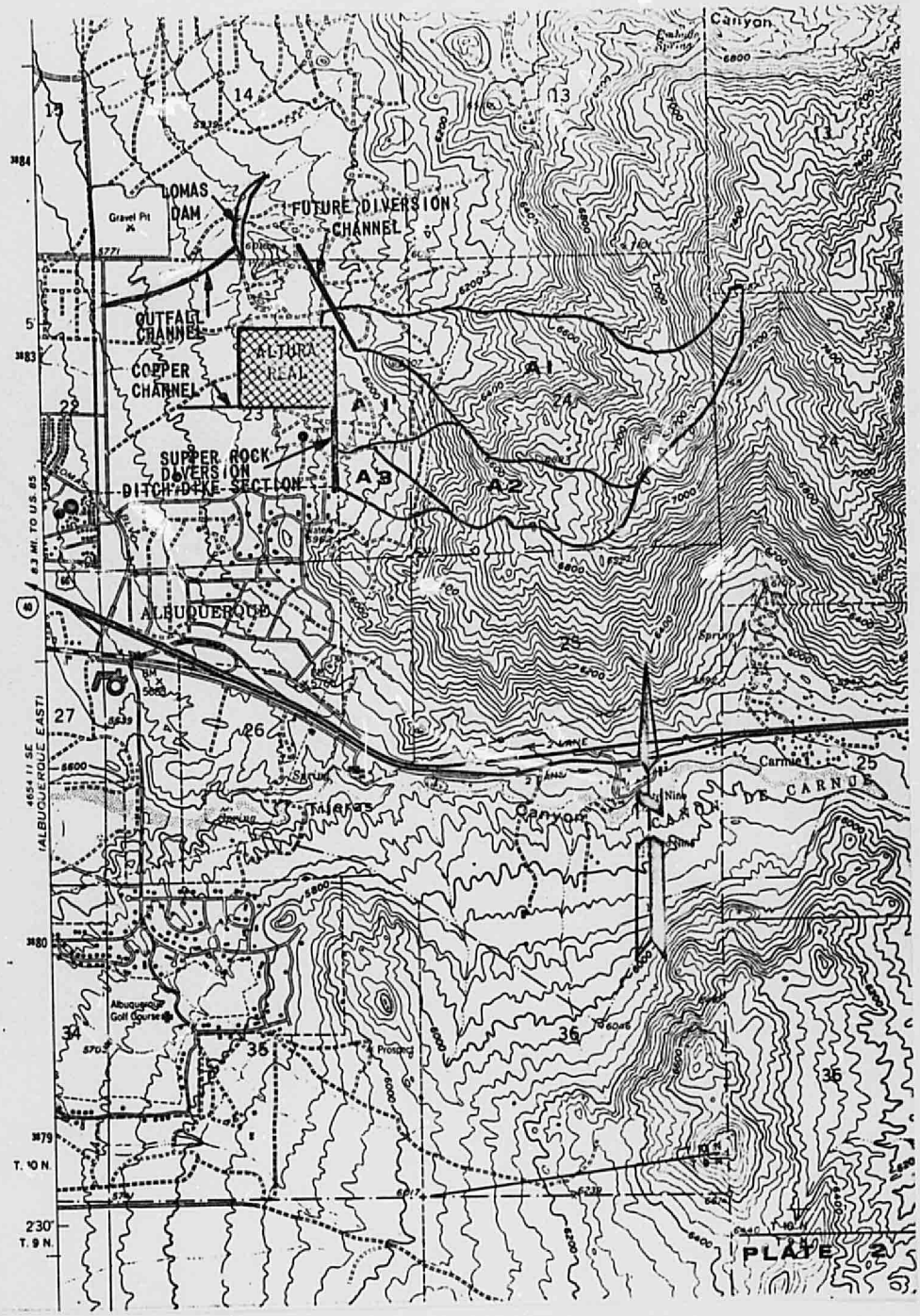
II. Interim Section along south side of Altura Real Subdivision for Copper Channel, Q = 1278 cfs

Bottom Width	10 feet
Side Slopes	2.5:1
Water Depth (D)	3.47 feet
Area (A)	64.80 ft^2
Hydraulic Radius (R)	2.259
Slope (S)	.053 ft/ft
Mannings Coefficient (N)	0.03

$$Q = \frac{A\ 1.486}{N} (R)^{2/3} S^{1/2}$$

$$Q = \frac{64.80\ 1.486}{0.03} (2.259)^{2/3} (.053)^{1/2} = 1273 \text{ cfs}$$

V = 19.7 fps


LOMAS DAM
FUTURE DIVERSION CHANNEL
OUTFALL CHANNEL
COPPER CHANNEL
ALTURA REAL
SUPPER ROCK DIVERSION DITCH-DIKE SECTION
A1
A2
A3
ALBUQUERQUE
Gravel Pit
Albuquerque Golf Course
Tijeras Canyon
Carnuel
DE CARNUE
CANYON
Canyon
8.3 MI. TO U.S. 85
(ALBUQUERQUE EAST)
T. 10 N.
T. 9 N.
PLATE 2

ENGINEERS & PHOTOGRAMMETRISTS

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.

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

October 21, 1974

RECEIVED
OCT 24 1974
CITY ENGINEERS

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

RE: Drainage Report for the Proposed Altura Real Subdivision

Gentlemen:

Enclosed you will find two copies of the Drainage Report for the subject subdivision for your review, comment and approval.

If you should have any questions concerning this drainage report, please feel free to contact this office. We will be anxious to receive your comment concerning this project and the associated channel and structure impact.

Sincerely yours,

Michial M. Emery

Michial M. Emery, P.E.
Chief Design Engineer

Enclosures

cc: Roberson Construction Company

The Presley Company of New Mexico
Attention: Mr. Charley Cook

MME/sh

CITY OF ALBUQUERQUE

ALBUQUERQUE, NEW MEXICO
June 14, 1968

INTER-OFFICE CORRESPONDENCE

TO: Rip Orr

SUBJECT: Drainage analysis of the Altura Addition

From analysation of the run-off of a portion of the Altura Addition, the main outlet will be Hannett Avenue west of Carlisle Boulevard. The area involved amounted to approximately 84 acres, a "C" factor was selected "as per Herkenhoff Master Plan of Drainage" of 0.623 and a 100 year storm of 20-minute duration. This resulted in a run-off of 220 c.f.s. From field observation it was noted the area involved includes a portion of Altura Park and certain portions that contributed questionably to flow down Hannett. Therefore, 4/5 of the 220 c.f.s was arbitrarily selected as the contributing flow in Hannett Avenue.

From actual cross sections taken on Hannett less than one half of the street can be considered as a carrier or 1/2 X 167 c.f.s. = 83 c.f.s. It is suggested that a branch of the storm sewer down Rita Drive be taken up Hannett to a point short of Carlisle. To be included would be 6 or 7 Double C inlets with locations on the south side of Hannett near Carlisle Boulevard crossing to the north side after the first 100 feet west of Carlisle. The rest of the inlets would be in the north flow line of Hannett as the cross sectional slope throws the flow to the North.

Robert W. Blair

ROBERT W. BLAIR
Chief Construction Inspector

RWB:lam

PLAN/PLATS

ON

FILE

HYDROLOGY K23/D1 1 PLAN

K23/D1

1 Plan

ENGINEERS & PHOTOGRAMMETRISTS

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Average Grass Surface = 2.16

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SAMPLE CALCULATION FOR AREA A

Undeveloped Runoff

Area (A)	4.80 Ac
Length of Area	550 ft
Ground Factor	1.84
Average Slope	6.36%

Time of Concentration (TC)

$TC = \text{Log}^{-1}[.3641(1.84) + .3854 \text{ Log } (550) - .197 \text{ Log } (6.36) - .3613]$

$TC = \text{Log}^{-1}[.3641(1.84) + .3854(2.740) - .197(.803) - .3613]$

$TC = \text{Log}^{-1}[1.2066] = 16.1$ min.

*Intensity (I)	4.4 in/hr
Runoff Coefficient (C)	0.4
Q = AIC	8.448 cfs
Total Rainfall (TR)	2.8 in.
Volume = (A) (C) (TR)/(12)	.448 acre feet

*Master Plan of Drainage, City of Albuquerque, New Mexico

Developed Runoff

The runoff from developed land was established by first determining the composite ground factor and runoff coefficient then using the rational formula to determine the flows.

Effective Area = Total Area - Retention Area

Bn = Area weighted ground factor

Bn = (B for surface) (Area of surface)/(Effective area)

$$\text{Composite Ground Factor} = \sum_{n=1}^{n} Bn$$

Cn = Area weighted runoff coefficient

Cn = (C for surface) (Area of surface)/(Effective area)

Composite runoff coefficient = $\sum_{n=1}^{n} Cn$

Type of Cover	n	Area	B	Bn	C	Cn
Streets	1	0.56	.77	.151	.95	0.186
Houses	2	0.92	.77	.248	.95	0.306
Lawns	3	1.38	2.57	1.240	.20	0.097
Total		2.86		1.639		0.589

Effective Area (A')*	2.86 Ac
Length of Area	700 ft
Ground Factor	1.639
Average Slope	5.00%
Time of Concentration	15.7 min
**Intensity (I)	4.5 in/hr
Runoff Coefficient	0.589
Q = AIC	7.580 cfs
Total Rainfall (TR)	2.8 in
Volume = (A') (C) (TR)/12	0.393 acre feet

*The water from 1.94 acres will be retained on site.

**Master Plan of Drainage, City of Albuquerque, New Mexico

Channel Design (Upland Drainage)

I. Interim Section along east side of Altura Real (Flow from A_1 & A_1', Q = 904 cfs)

Channel

Bottom Width	10 feet
Side Slopes	2.5:1
Water Depth	3.2 feet
Area (A)	57.6 sq ft
Hydraulic Radius (R)	2.115
Slope (S)	0.037 ft/ft max.
Mannings Coefficient (n)	0.03

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

$$Q = \frac{(57.6)\ 1.486}{.03} (2.115)^{2/3} (.037)^{1/2} = 904.4 \text{ cfs}$$

Velocity = 15.7 ft/sec

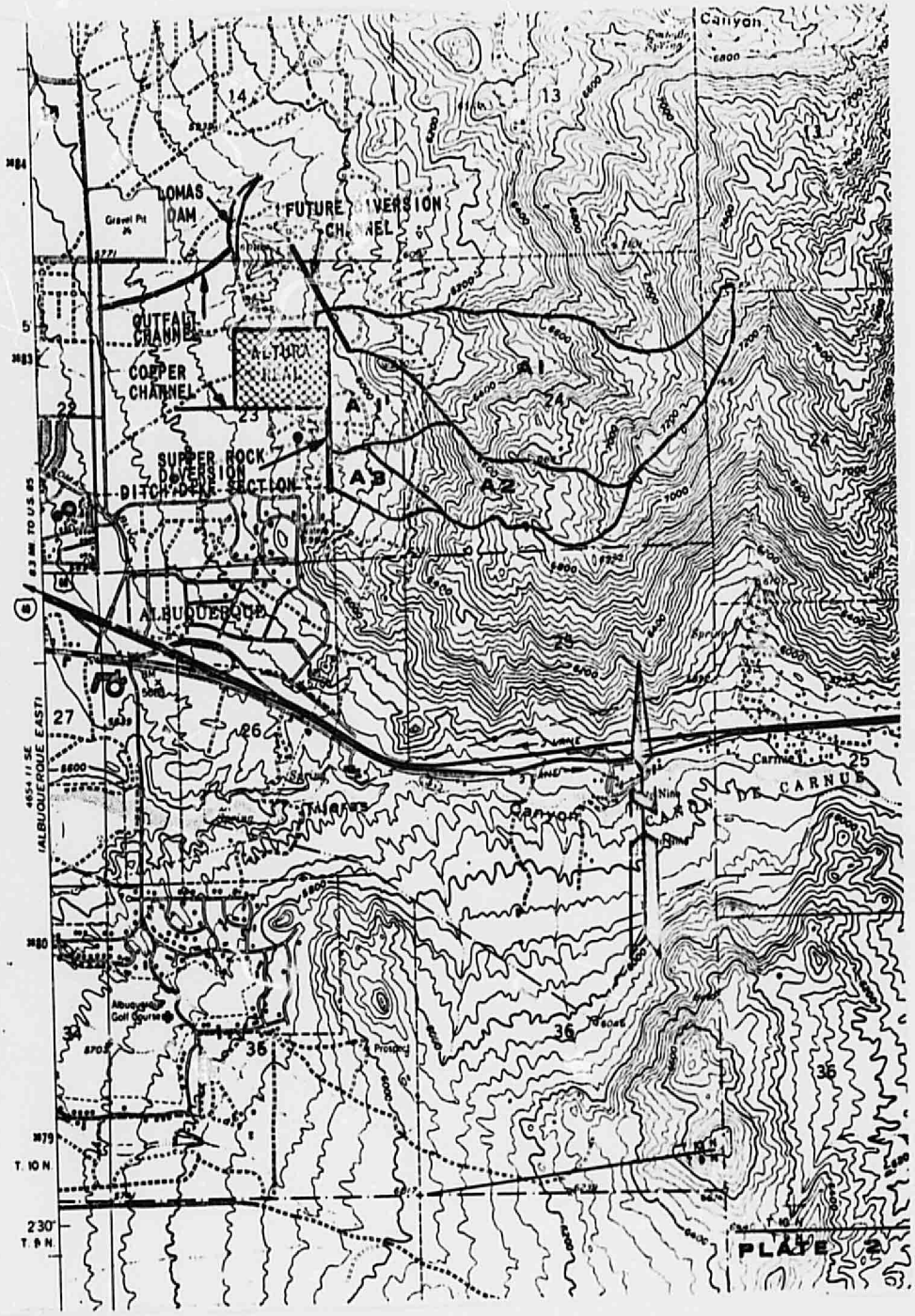
II. Interim Section along south side of Altura Real Subdivision for Copper Channel, Q = 1278 cfs

Bottom Width	10 feet
Side Slopes	2.5:1
Water Depth (D)	3.47 feet
Area (A)	64.80 ft^2
Hydraulic Radius (R)	2.259
Slope (S)	.053 ft/ft
Mannings Coefficient (N)	0.03

$$Q = \frac{A\ 1.486}{N} (R)^{2/3}\ S^{1/2}$$

$$Q = \frac{64.80\ 1.486}{0.03} (2.259)^{2/3} (.053)^{1/2} = 1273 \text{ cfs}$$

V = 19.7 fps


LOMAS DAM
FUTURE DIVERSION CHANNEL
OUTFALL CHANNEL
COPPER CHANNEL
ALTURA
SUPPER ROCK DIVERSION DITCH
DITCH
SECTION
A1
A2
A3
ALBUQUERQUE
Gravel Pit
Canyon
Carnue
DE CARNUE
Nine
Spring
Golf Course
83 MI TO U.S. 85
(ALBUQUERQUE EAST)
T. 10 N.
T. 9 N.
PLATE 2

BOHANNAN WESTMAN HUSTON & ASSOCIATES, INC.