City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

February 24, 1977

Mr. Allan L. Whitesel
Bohannan, Westman, Huston
& Assoc., Inc.
4125 Carlisle Blvd. N.E.
Albuquerque, New Mexico 87107

RE: Winrock Village Four, Drainage Analysis

Dear Mr. Whitesel:

Your letter of February 22, 1977 submitting data regarding the comments on the drainage analysis has been reviewed. All matters which were addressed in my letter dated February 17, 1977 are satisfactory to this office and upon receipt of the approved permit from the State Highway Department, the drainage report will be approved.

Very Truly Yours,

V. M. Kimmick
City Engineer

VMK/tl

Public Works Department

Director — Erwin F. Hensch, P. E. 766-7467
Engineering 766-7441 — V. M. Kimmick, P. E.
Street Maint. 766-7755 — G. E. Paul, P. E.
Ass't. Director — Harold R. Orr, Jr. P. E.
Liquid Waste 766-7535 — R. P. Lowe, P. E.
Water 766-7437 — W. H. Otto, P. E.

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BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.
ENGINEERS & PHOTOGRAMMETRISTS
4125 CARLISLE BLVD. N.E.
ALBUQUERQUE, NEW MEXICO 87107
PHONE 505 881-2000

February 22, 1977

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

Re: Winrock Village Four, Drainage Analysis

Dear Mr. Kimmick:

Your comments on subject drainage analysis, sent by letter dated February 17, 1977, have been reviewed. The following are comments and revisions on this drainage analysis.

1. An "Application For Permit To Install Utility Facilities Within Public Right-of-Way" (New Mexico form number M-202) has been sent to the New Mexico State Highway Department.

2. The manhole located east of the proposed earth channel has been located and it will not be disturbed. The City Water Department informed me that this is a terminal manhole for the 42" waterline tunnel under Pennsylvania Street, N.E. This manhole is now shown on Plate 2, which is attached as part of Addendum No. 1, dated February 22, 1977.

3. Calculation included in the Appendix of the drainage analysis indicate that the water velocity in the earth or riprap channel section, will be less than eight feet per second. Therefore, it probably is unnecessary to provide bank protection at the turn into the State Highway Department's drainage ditch.

4. The elevation of the 42" transmission waterline south of this parcel of land has been determined. This waterline will not require lowering, but a concrete collar must be placed around it under the proposed channel. This concrete collar is now shown on Plate 2, which is attached as part of Addendum No. 1, dated February 22, 1977.

5. Consideration has been given to providing a retaining wall in place of the earth berm north of the storm water entrance. It is felt that the earth berm will protect Winrock Village Four from flooding.

6. An alternate channel section has been added which uses riprap protection and a shallow footing retaining wall. This alternate section is shown on Plate 2 and noted as added by Addendum No. 1.

Attached are three (3) copies of Addendum No. 1, which reflects the above-noted revisions and comments.

If you have any questions regarding this matter, please feel free to contact me at this office.

Sincerely,

Allan L. Whitesel

Allan L. Whitesel, P.E.

ALW/dlj
Job No. 76-097

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Martinez

February 17, 1977

Mr. Allan L. Whitesel, P.E.
Bohannan, Westman, Huston & Assoc., Inc.
4125 Carlisle Blvd. N.E.
Albuquerque, New Mexico 87107

SUBJECT: WINROCK VILLAGE FOUR, DRAINAGE ANALYSIS

Dear Mr. Whitesel:

The drainage analysis submitted by your letter of February 8, 1977 has been reviewed.

The following are comments on this drainage analysis:

1. The I-40 drainage easement is on New Mexico Highway Department property, and use of the easement requires permission from that department.

2. There is a manhole located east of the last water line valve. It appears this line may fall within the proposed earth channel, unless it is the storm sewer which is to be removed.

3. The connection of the new earth channel on the southeast corner must have bank protection at the turn.

4. The elevation of the 42" water transmission line at the proposed earth channel should be determined to see if the channel is feasible.

Public Works Department

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Engineering 766-7441 – V. M. Kimmick, P. E.
Street Maint. 766-7755 – G. E. Paul, P. E.
Ass't. Director – Harold R. Orr, Jr. P. E.
Liquid Waste 766-7535 – R. P. Lowe, P. E.
Water 766-7437 – W. H. Otto, P. E.

retaining wall. (An extension of the one shown in Section B-B.)

This drainage analysis cannot be approved until Items 1,2,3 and 4 are completed.

At this time no assurance can be made that the area has been removed from the flood hazard area.

Sincerely,

V. M. Kimmick
City Engineer

VMK/fs

cc: Jim Smith
Bob Kielich
Dwayne Sheppard
Drainage File

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinheinz

February 17, 1977

Mr. Allan L. Whitesel, P.E.
Bohannan, Westman, Huston & Assoc., Inc.
4125 Carlisle Blvd. N.E.
Albuquerque, New Mexico 87107

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Public Works Department

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Sincerely,

V. M. Kimmick
City Engineer

VMK/fs

cc: Jim Smith
Bob Kielich
Dwayne Sheppard
Drainage File

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.
ENGINEERS & PHOTOGRAMMETRISTS
4125 CARLISLE BLVD., N.E.
ALBUQUERQUE, NEW MEXICO 87107
PHONE 505 881-2000

February 8, 1977

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

Re: Drainage Analysis for Winrock Village Four

Dear Mr. Kimmick:

Enclosed are two copies of the drainage analysis for Winrock Village Four for your review and comment.

The revised Flood Plain Map for this area indicates flooding will be limited to the Embudo Arroyo, north of Winrock Village Four, and the New Mexico State Highway Department's drainage ditch south and west of subject property.

The owner's contractor has already applied for a building permit on this parcel of land. Therefore, I request that you please send me your comments on this drainage analysis as soon as possible.

If you have any questions regarding this matter, please do not hesitate to contact me at this office.

Sincerely,

Allan L. Whitesel

Allan L. Whitesel, P.E.

Enclosures

ALW/dlj
Job No. 76-097

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.
ENGINEERS & PHOTOGRAMMETRISTS
4125 CARLISLE BLVD. N.E.
ALBUQUERQUE, NEW MEXICO 87107
PHONE 505 881-2000

January 26, 1977

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

RE: Winrock Village Four - Drainage Analysis

Dear Mr. Kimmick:

Enclosed are three copies of the drainage analysis for Winrock Village Four in Albuquerque. These copies are for your review.

If you have any questions, please contact me at this office.

Sincerely,

Allan L. Whitesel

Allan L. Whitesel, P.E.

Enclosures

ALW/ku
Job No. 76-097

Drainage file

RECEIVED
JAN 31 1977
CITY ENGINEERS

January 28, 1977

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

REFERENCE: Heritage Hills, Unit I

Dear Mr. Kimmick:

Transmitted for your review is the drainage report prepared for Heritage Hills Subdivision, Unit I. We submit this report for your review. Please advise if it meets with your satisfaction.

Very truly yours,

Thomas O. Isaacson
Senior Vice President

TOI:dd
Encl.

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505 266-5521

DELIVERY X PICK-UP _____

DATE 7.18.76

REQUESTED BY J. Whitesel

APPROVED BY RW REQUISITION NO. _____

COMPANY NAME City of Albuquerque Kleston Laws

ADDRESS 4th Flor 5th & Marquette

JOB NUMBER 76013

ITEM DESCRIPTION Drainage Report

SPECIAL INSTRUCTIONS Deliverto Kleston Laws
Ass City Eng

RECEIVED BY _____

COMPANY _____ DATE _____

ADDENDUM NO. 1

FOR THE
WINROCK VILLAGE FOUR
DRAINAGE ANALYSIS
ALBUQUERQUE, NEW MEXICO

February 22, 1977

Addendum No. 1 consists of the following:

1. Revised sheet number 3 of the Drainage Analysis (attached).

2. Revised Plate 2 of the Drainage Analysis (attached).

REGISTERED PROFESSIONAL ENGINEER
STATE OF
No.
5354
NEW MEXICO
ALLAN L. WHITESEL

Allan L. Whitesel

ALLAN L. WHITESEL, P. E.
N.M.P.E. NO. 5354

period than the existing drainage structure does. The result will be a significant reduction in the ponded area as well as the time the aera is ponded.

A preliminary utilities search of this area indicates it is likely that the proposed channel construction from Pennsylvania Street to the I-40 drainage easement will necessitate the relocation of a 12" CI water line and the main Public Service power cable into Winrock Shopping Center. It will also be necessary to encase the 42" I-40 water transmission line in a concrete collar as shown on Plate 2.

CONCLUSIONS

If internal drainage patterns, concrete rundown sections, and drainage easement slope protection are developed during construction, as shown on Plate 2, it is felt the internal drainage for Winrock Village Four can safely be conveyed to the drainage easements bordering this parcel of land.

The proposed earth berm, waterblocks, rundown curb, retaining wall, concrete slope paving, and the earth channel section from this intersection to the I-40 drainage easement should safely convey the upland runoff into the I-40 drainage easement.

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A preliminary utilities search of this area indicates it is likely that the proposed channel construction from Pennsylvania Street to the I-40 drainage easement will necessitate the relocation of a 12" CI water line and the main Public Service power cable into Winrock Shopping Center. It will also be necessary to encase the 42" I-40 water transmission line in a concrete collar as shown on Plate 2.

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If internal drainage patterns, concrete rundown sections, and drainage easement slope protection are developed during construction, as shown on Plate 2, it is felt the internal drainage for Winrock Village Four can safely be conveyed to the drainage easements bordering this parcel of land.

The proposed earth berm, waterblocks, rundown curb, retaining wall, concrete slope paving, and the earth channel section from this intersection to the I-40 drainage easement should safely convey the upland runoff into the I-40 drainage easement.

1. drainage at Penn & Bellamah
2. elevations or contours to show path of proposed drainage
3. Hwy permit
4. Method of getting flow to arroyo.
5. bench mark. elevations.
6. Hwy flood easement?

ENGINEER'S REPORT

ON

DRAINAGE

FOR

A PORTION OF WINROCK CENTER

HERTZMARK-PARNEGG COMPANY

head on south delivery water to channel.
NMSHD flood easement

AUGUST 1971

PREPARED BY
D. F. MOLZEN & ASSOCIATES, INC.
CONSULTING ENGINEERS
ALBUQUERQUE, NEW MEXICO

D. F. MOLZEN and Associates, Inc.
CONSULTING ENGINEERS
2127 MENAUL, N.E. • P.O. BOX 3632 • ALBUQUERQUE, NEW MEXICO 87110 • PHONE (505) 345-2459

August 23, 1971

Hertzmark-Parnegg Company
51 Winrock Center, N.E.
Albuquerque, New Mexico 87110
Attn: Mr. Sidney S. Hertzmark

RE: Drainage Study for a Portion of Winrock Center

Dear Mr. Hertzmark:

In accordance with your request, we are transmitting herewith five (5) copies of Drainage Study on a portion of Winrock Center.

If you have any question, feel free to contact us at any time.

Very truly yours,

D. F. MOLZEN & ASSOCIATES

Albert D. Corbin

Albert D. Corbin, P.E.

ADC/bg
Encls. 5

ENGINEER'S REPORT ON DRAINAGE

for

A PORTION OF WINROCK CENTER

I. PURPOSE AND SCOPE:

The purpose of this report is to analyze the hydrologic and hydraulic conditions that contribute to flooding of the property from surface runoff. This report will be limited to the area bounded by Pennsylvania Street on the east, Coronado Freeway on the south, and a 100 ft. wide drainage and utility easement on the northwest (an area of approximately 13 acres as shown on Map No. 2).

II. GENERAL:

The portion of the Winrock property covered in this report is located within the corporate limits of the City of Albuquerque, in the Southeast one-fourth of the Northwest one-fourth of Section 18, Township 10 North, Range 4 East, N.M.P.M. as indicated on Map No. 1. The general layout of the center area showing existing drainage easements or water courses and the contributing drainage area is also shown on Map No. 1. The two main branches of the Embudo Arroyo intersect within the Winrock property. The south branch is contained within the median of Coronado Freeway and is of no consequence as far as being a

flood hazard to Winrock; however, the north branch has a drainage area of approximately 15 square miles and the storm drainage structures north and east of Winrock are not sized to carry maximum runoff quantities. The structures are generally sized to handle a 10 year frequency storm, with overflow sections where possible to handle a 100 year frequency storm.

III. RUNOFF - NORTH BRANCH OF EMBUDO ARROYO:

After analyzing the drainage patterns on the north branch of the Embudo Arroyo, it is apparent that the only overflow of structures that will affect the Winrock area are the structures at Wyoming, Hendola and Pennsylvania. When the capacities of these structures and their overflow sections are exceeded, the excess runoff travels over various streets to the east of Winrock and eventually reaches Pennsylvania. The excess runoff then flows South on Pennsylvania and joins the excess runoff from the Wyoming and Hendola structures that reaches Pennsylvania via Bellamah. Prior to the construction of the Coronado Freeway, the excess runoff entered the south branch of the Embudo Arroyo at Constitution. With the construction of Pennsylvania over the Freeway and the closing of Constitution, a sag was created at the intersection of Pennsylvania and Bellamah. In order to drain this intersection, a catch basin was constructed on the west side of Pennsylvania with a 24-inch diameter outlet to a drainage ditch that was constructed along the south and westerly sides of the portion of Winrock property included in this report.

The estimated amount of maximum runoff at this intersection is approximately 3000 cubic feet per second. The existing 24-inch diameter line from the catch basin to the ditch has a capacity of from 25 to 30 c.f.s. Therefore, this area will require additional storm drainage improvements to prevent flooding of the Winrock property.

The structure at Pennsylvania at the northeast corner of this property will in all probability carry the maximum runoff that can reach it through the Hendola structure. The only exception to this will be if the structure is not maintained properly and allowed to silt up; thereby reducing the capacity.

IV. RUNOFF - LOCAL:

The local runoff from this area of the Winrock Center should be of no consequency as the property, except for the east side, is surrounded by drainage ditches and can be drained using surface drainage. This is based on the assumption that the improvements will not be constructed at an elevation so low that the finish grade will be below the aforementioned ditches.

V. CONCLUSIONS and RECOMMENDATIONS:

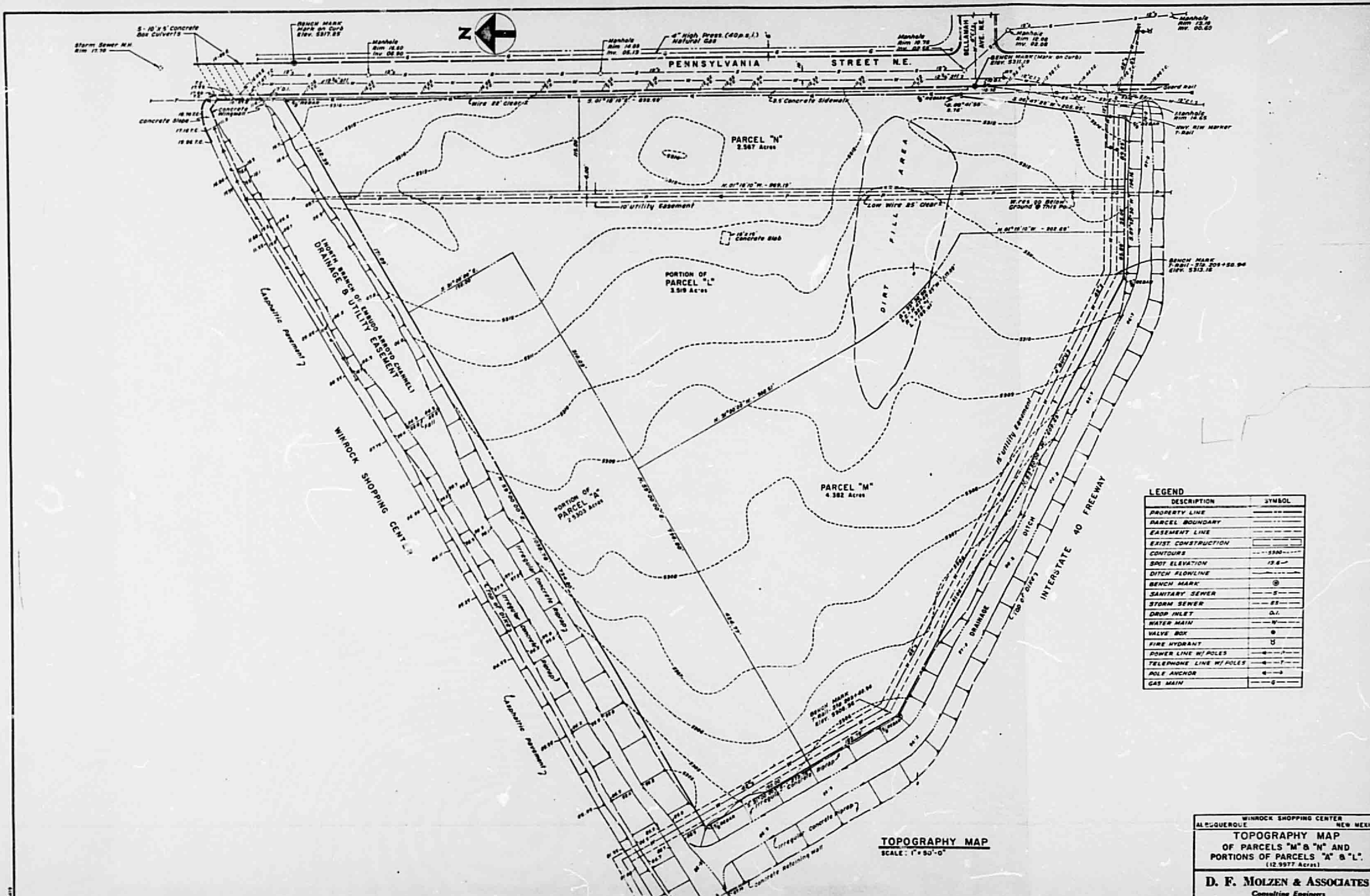
At the present time, any excess runoff not contained in the present channel of the north branch of the Embudo Arroyo, that flows south, ends up at Bellamah Street and Pennsylvania Avenue intersection. The only outlet for the storm runoff is a catch basin on the west side of the intersection with a 24-inch diameter pipe outlet to the ditch that is adjacent to the southerly boundary

of this parcel. The capacity of the 24-inch pipe is inadequate to handle the runoff so the water backs up on Pennsylvania until it reaches a depth of approximately 18 inches, then it flows across this portion of Winrock property to the above mentioned ditch approximately straight west of the intersection.

In order to protect this parcel of land, it is our recommendation that a retaining wall with a top elevation of 5317.50 (in relation to elevations shown on the topography map) be constructed between the property line on Pennsylvania Avenue and the building line set back wherever it blends in aesthetically and functionally with the development plans. This will not eliminate the flooding situation along Pennsylvania Avenue, but it will protect the Winrock property and will force the water to the ditch at the southerly boundary of the property instead of flowing across the property.

An open ditch could be constructed as an extension of Bellamah Street and this would convey the water from the intersection to the ditch along the southerly boundary of the property; however, Winrock would be giving up land and the portion south of this ditch would be unusable.

To convey the storm water from the intersection to the ditch along the southerly boundary by means of underground storm sewers would be prohibitive in cost because of the existing underground installations in the area.



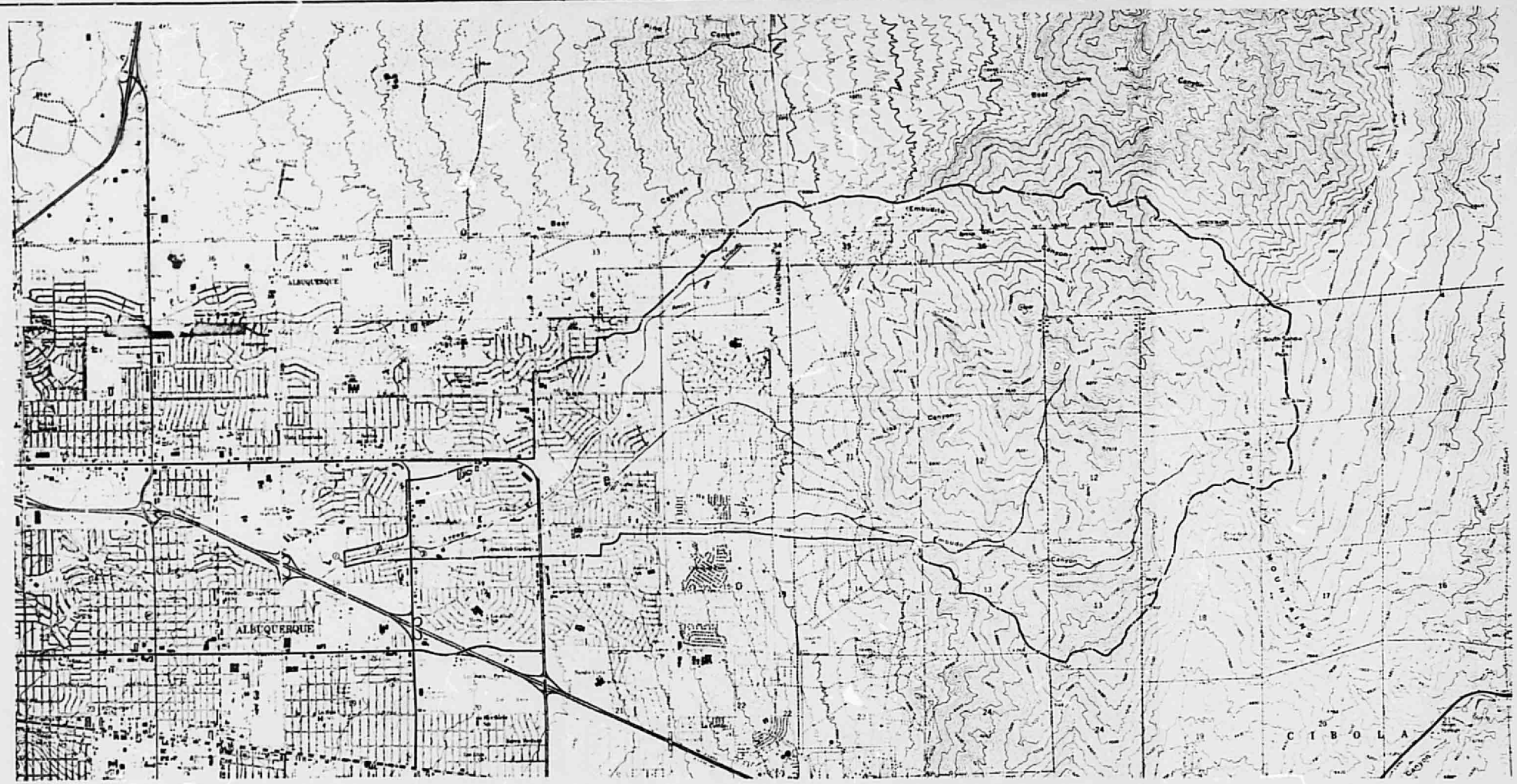
LEGEND

DESCRIPTION	SYMBOL
PROPERTY LINE	
PARCEL BOUNDARY	
EASEMENT LINE	
EXIST. CONSTRUCTION	
CONTOURS	---5300---
SPOT ELEVATION	13.6
DITCH FLOWLINE	
BENCH MARK	◉
SANITARY SEWER	—S—
STORM SEWER	—SS—
DROP INLET	D.I.
WATER MAIN	—W—
VALVE BOX	●
FIRE HYDRANT	
POWER LINE W/ POLES	—P—
TELEPHONE LINE W/ POLES	—T—
POLE ANCHOR	
GAS MAIN	—G—

WINROCK SHOPPING CENTER
ALBUQUERQUE NEW MEXICO

TOPOGRAPHY MAP
OF PARCELS "M" & "N" AND
PORTIONS OF PARCELS "A" & "L".
(12.9977 Acres)

D. F. MOLZEN & ASSOCIATES
Consulting Engineers
Albuquerque, New Mexico



KEYED NOTES
1. PENNSYLVANIA ST., DRAINAGE STRUCTURE
2. MENDOLA DR., DRAINAGE STRUCTURE
3. WYOMING BLVD., DRAINAGE STRUCTURE

DRAINAGE AREA MAP

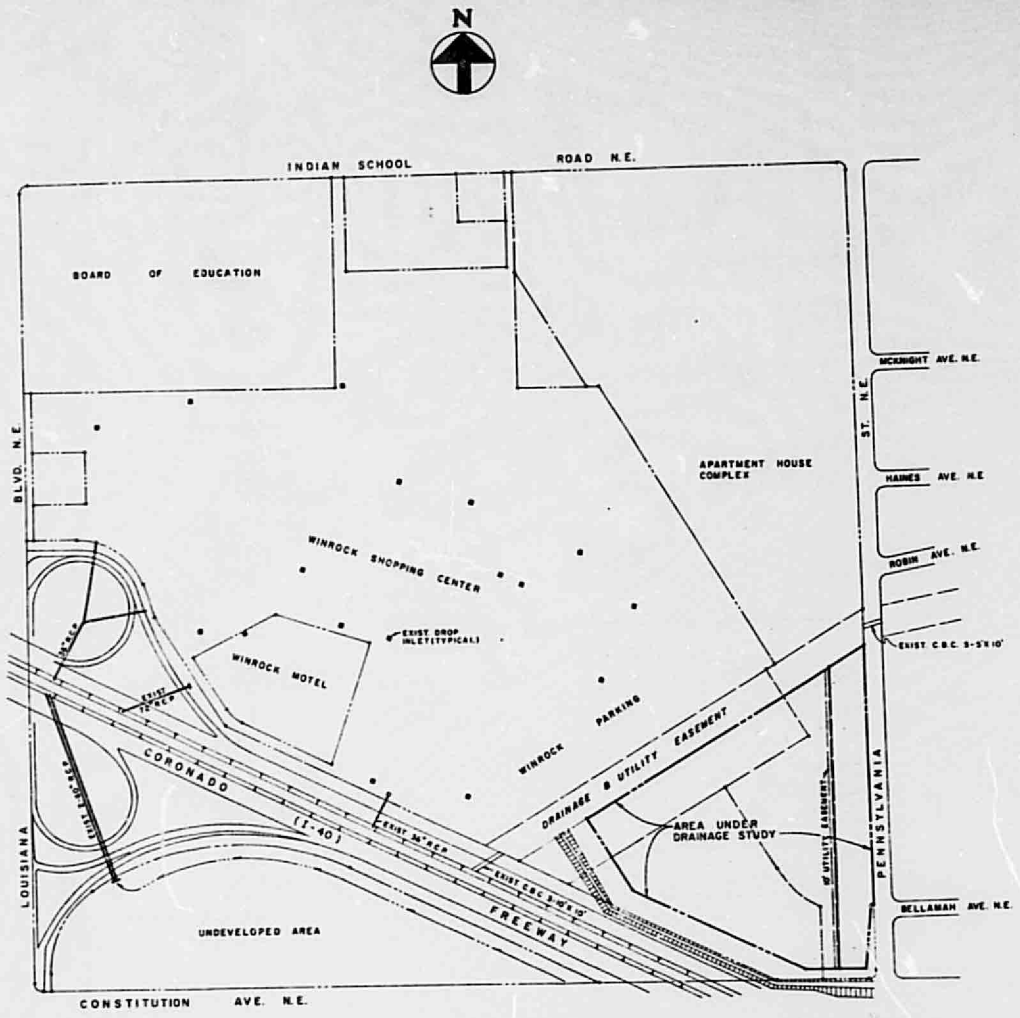
SCALE : 1" = 2000'

LEGEND
LIMITS OF DRAINAGE AREA

DRAINAGE AREA MAP

D. F. MOLZEN & ASSOCIATES
Consulting Engineers
ALBUQUERQUE NEW MEXICO

Drawn RGS	Checked C.W.W.		MAP No. 1
File 71-14	Date JULY 1971		



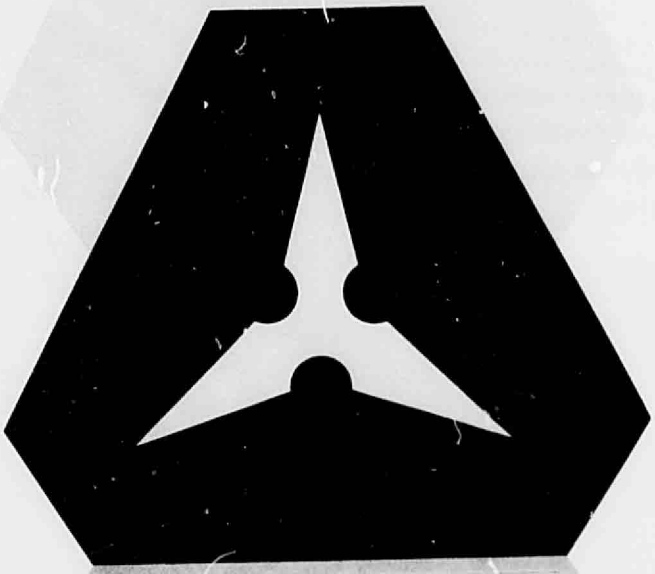
LAYOUT PLAN
SCALE: 1" = 200'-0"

LAYOUT PLAN

D. F. MOLZEN & ASSOCIATES
Consulting Engineers
ALBUQUERQUE NEW MEXICO

Drawn R.G.C.	Checked C.W.W.	MAP No. 2
File 71-14	Date JULY 1971	

Drainage
Book



DRAINAGE ANALYSIS
FOR
WINROCK VILLAGE FOUR
IN
ALBUQUERQUE, NEW MEXICO

JANUARY 1977

DRAINAGE ANALYSIS
FOR
WINROCK VILLAGE FOUR
IN
ALBUQUERQUE, NEW MEXICO

JANUARY 1977

BOHANNAN WESTMAN HUSTON & ASSOCIATES INC.
1905 Carlisle Boulevard NE Albuquerque, New Mexico 87107 Phone 881-2000

DRAINAGE ANALYSIS
FOR
WINROCK VILLAGE FOUR
IN
ALBUQUERQUE, NEW MEXICO

FOR

WINROCK ENTERPRISES, INC.
850 Tower Building
Little Rock, Arkansas

BY

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

REGISTERED PROFESSIONAL ENGINEER
STATE OF
No. 5354
NEW MEXICO
ALLAN L. WHITESEL

Allan L. Whitesel

ALLAN L. WHITESEL
N.M.P.E. No. 5354

TABLE OF CONTENTS

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PROPOSED DRAINAGE IMPROVEMENTS	2
CONCLUSIONS	3

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SAMPLE CALCULATIONS	4

LIST OF PLATES

PLATE 1 LOCATION MAP

PLATE 2 BUILDING LAYOUT, DRAINAGE PATTERNS, AND DRAINAGE IMPROVEMENT LOCATIONS AND DETAILS

DRAINAGE ANALYSIS
FOR
WINROCK VILLAGE FOUR

PURPOSE AND SCOPE

The purpose and scope of this report is to (1) determine an acceptable method of providing positive drainage for surface runoff resulting from a 100-year frequency storm falling on this property and (2) to determine an acceptable method of conveying the upland runoff from Pennsylvania Street and Bellamah Street into the I-40 drainage ditch south of this property. The upland drainage runoff is also based upon a 100-year frequency storm falling on contributing areas.

LOCATION

Winrock Village Four is a parcel of land in Albuquerque, New Mexico, which is bounded on the east by Pennsylvania Street, on the north by the Embudo Arroyo drainage easement, and on the south and west by the I-40 freeway drainage easement. Plate 1 shows the location of this property.

PROPOSED DEVELOPMENT

The parcel in question is zoned R-3. The proposed development is a multi-family apartment complex. Development of this piece of land with extensive areas of paving and building roofs will effectively concentrate surface runoff. Internal drainage patterns, as shown on Plate 2, can be established during construction and concrete rundowns, as shown on Plate 2, will convey the surface runoff into existing drainage easements without causing erosion damage.

HYDROLOGY

A. UPLAND DRAINAGE - The flow concentrating at the intersection of Pennsylvania Street and Bellamah Street is approximately 500 cfs. This 500 cfs is taken from calculations by Bohannan Westman Huston & Associates, Inc. for the East Side Arroyo Protection System - Phase II - 1976. It is based upon a 100-year frequency storm falling on the area contributing runoff flow to this point and the rational method of computing runoff.

B. INTERNAL DRAINAGE - The internal drainage is based upon a 100-year frequency storm falling on the subject parcel.

PROPOSED DRAINAGE IMPROVEMENTS

A. INTERNAL DRAINAGE - Internal drainage patterns, as shown on Plate 2, have been determined to insure positive surface drainage from the interior of this parcel of land to the exterior limits. Concrete rundown sections, as shown on Plate 2, have been provided to convey the surface runoff from the limits of this development to the drainage easements on the north, south, and west of the subject parcel of land. Riprap slope protection, as shown on Plate 2, must be provided in the I-40 drainage easement north and west of Winrock Village Four, at locations shown, to prevent erosion damage at these points.

It will also be necessary to provide water blocks on the west side of Pennsylvania Street at entrances into Winrock Village Four to prevent street runoff from entering this parcel of land.

B. UPLAND DRAINAGE - Presently, the upland runoff reaches the intersection of Pennsylvania Street and Bellamah Street via the various streets in Snow Heights Subdivision, Bellamah Street, Constitution Avenue, and Pennsylvania Street. Under existing conditions, the surface runoff concentrates at the intersection of Bellamah and Pennsylvania Streets, resulting in a serious ponding situation. There is an existing drop inlet and 24" storm drain line at this location to convey surface drainage into the I-40 drainage easement southwest of the intersection. The existing drop inlet and storm drain line are totally inadequate to handle the flow at this point and the water ponds in the intersection until it reaches a sufficient depth to overflow the curb. Once over the curb, the runoff spreads into sheet flow until it finally reaches the I-40 drainage easement along the south and west of the subject property.

Size should be measured.

In order to protect Winrock Village Four from flooding and also to decrease the hazard to traffic on Pennsylvania Street due to ponding, an earth berm on the west side of Pennsylvania Street, water blocks at entrance into the property, a 60' concrete rundown curb along the west side of Pennsylvania Street, a retaining wall, a paved concrete section between the laydown curb and the retaining wall, and a trapezoidal earth channel section from the concrete section to the I-40 drainage easement are proposed. These proposed improvements are shown on Plate 2. It is possible that during the 100-year frequency storm a short duration pond may exist in the intersection of Bellamah and Pennsylvania; however the proposed drainage improvements will greatly improve the existing situation at this location. The proposed improvements will drain the Pennsylvania-Bellamah Streets intersection in a much shorter

period than the existing drainage structure does. The result will be a significant reduction in the ponded area as well as the time the area is ponded.

A preliminary utilities search of this area indicates it is likely that the proposed channel construction from Pennsylvania Street to the I-40 drainage easement will necessitate the relocation of a 12" CI water line, a 42" transmission water line, and the main Public Service power cable into Winrock Shopping Center.

CONCLUSIONS

If internal drainage patterns, concrete rundown sections, and drainage easement slope protection are developed during construction, as shown on Plate 2, it is felt the internal drainage for Winrock Village Four can safely be conveyed to the drainage easements bordering this parcel of land.

The proposed earth berm, waterblocks, rundown curb, retaining wall, concrete slope paving, and the earth channel section from this intersection to the I-40 drainage easement should safely convey the upland runoff into the I-40 drainage easement.

SUMMARY OF HYDROLOGIC DATA

Area	Acres	Q cfs
A	5.50	16.7
B	6.38	20.4
C	1.36	4.9
Total	13.24 Ac	42.0 cfs

SAMPLE HYDROLOGIC CALCULATIONS

The runoff calculations were made using the rational formula. The time of concentration (Tc) 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 basin in percent.

B = Ground Factor.

Paved = .77

Bare Soil = 1.52

Average Grass = 2.16

Dense Grass = 2.57

L = Distance to furthest point in the basin in feet.

Tc = Time of concentration.

The composite ground factor and runoff coefficient was determined by the formula $Bn = \sum_{i}^{n}$ Area i x Bi/Area t and $Cn = \sum_{i}^{n}$ Area i x Ci/Area t. A representative area shown on sheet 7 served as the basis for developing a general ground factor and runoff coefficient and the calculations are shown below.

Type of Cover	n	Area(ac)	B	Bn	C	Cn
Buildings	1	.251	0.77	.193	0.95	.238
Sidewalks	2	.065	0.77	.050	0.95	.062
Pavement	3	.248	0.77	.191	0.95	.236
Grass Surface	4	.232	2.57	.596	0.20	.046
		.796		1.030		.582

$$Bn = \frac{1.030}{.796} = 1.294$$

$$Cn = \frac{.582}{.796} = .731$$

Sample Calculations For Area A

Total Area	5.50 Acres
Length of Area	1112.5 Ft.
Ground Factor	1.294
Average Slope	.737%
Time of Concentration	20.41 min.

$Tc = \log^{-1} [.3641 (1.294) + .3854 \log (1112.5) - .197 \log (.737) - .3613]$

$Tc = \log^{-1} [1.310] = 20.41$ min.

* Intensity (1) = 189/Tc + 25 = 4.16 in/hr.

Runoff Coefficient (c)	.731
Q = CIA	16.7 cfs.
(.731)(4.16)(5.50) = 16.7 cfs	

*Master Plan of Drainage, City of Albuquerque, 1963.

SAMPLE HYDRAULIC CALCULATIONS

Manning's Steady State Flow Equations were used to analyze flow in the open earth channel. Manning's Equations are:

$$V = \frac{(1.486)\ R\ 2/3\ S\frac{1}{2}}{n} \quad \text{and} \quad Q = \frac{1.486}{n} \frac{A5/3}{P2/3} S\frac{1}{2}$$

where:

A = Flow area ($ft.^2$)
R = Hydraulic Radius (ft.)
S = Slope (ft./ft.)
n = Manning's Roughness Coefficient
P = Wetted perimeter

Sample Calculations for Earth Channel in Drainage Easement

Bottom Width	40 Ft.
Side Slopes	2:1, 0:1
Water Depth	1.85 Ft.
Minimum Slope	.85%
Manning's Coefficient	.030
Flow Area	77.423 $Ft.^2$
Hydraulic Radius	1.684
Wetted Perimeter	45.987

$$V = \frac{1.486}{.030}(1.415)(.092) = 6.45 \text{ fps}$$

$$Q = \frac{1.486}{.030}\frac{(1406.43)}{(12.836)} .092 = 499.31 \text{ cfs}$$

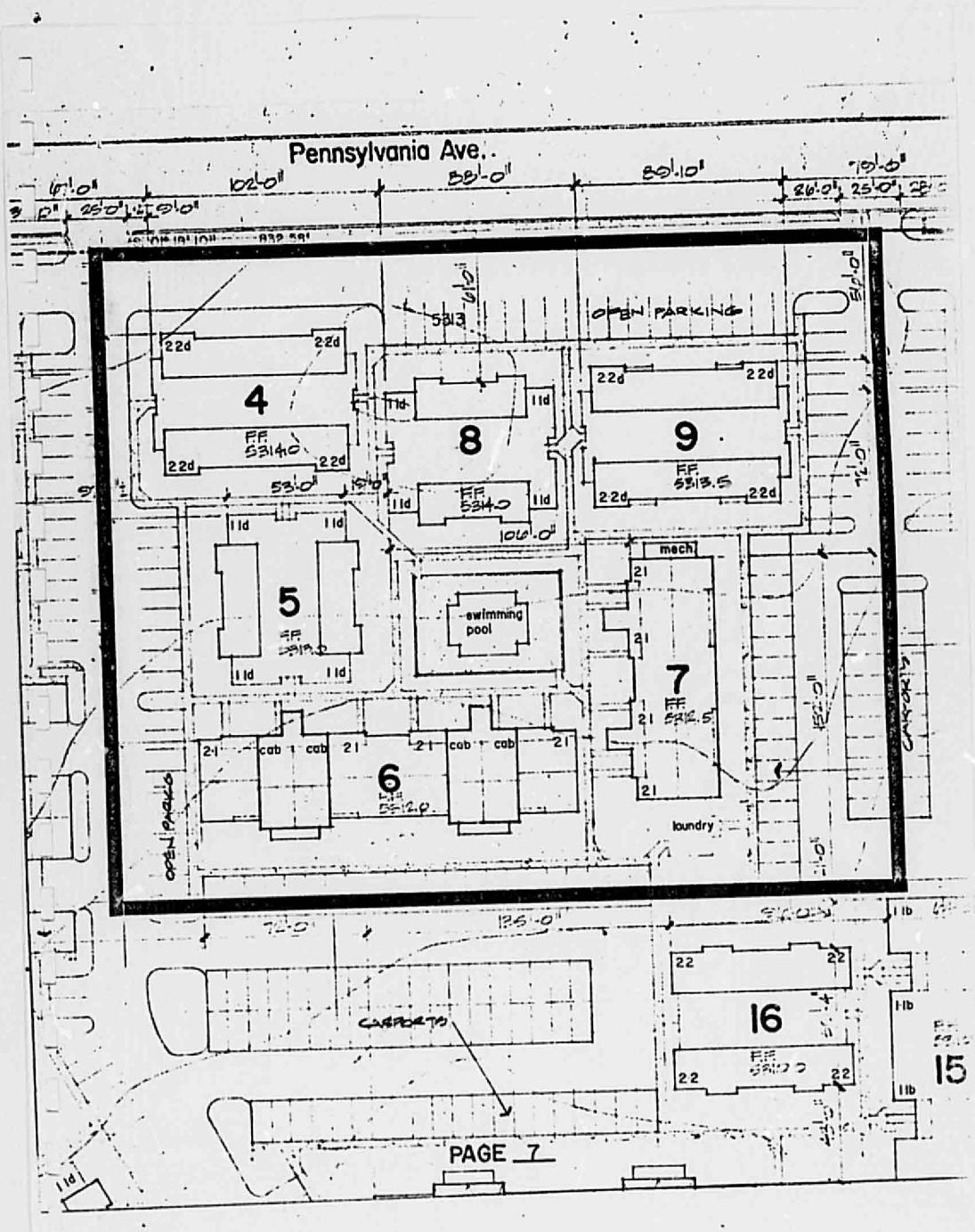
Retaining wall and berm minimum top elevations west of the Pennsylvania-Bellamah intersection were determined by calculating the depth of flow in Bellamah Street east of Pennsylvania Street and then making the conservative assumption that this height added to the flowline elevation of the rundown curb plus freeboard could be used as a safe top of berm and retaining wall elevation to prevent flooding into Winrock Village Four property.

Manning's steady state equations as noted in the previous calculations, were used to analyze the flow in Bellamah Street. The source data and results are:

Q Flow Rate	= 500 cfs
S Slope	= .009 1/1
N Manning Roughness Coefficient	= .015
BW Bottom Width	= 40 Ft.
SS Side Slopes	= 0 : 1
D Water Depth	= 1.21 Ft.
V Velocity	= 10.33 fps

Top of berm and retaining wall elevation = flow line of rundown curb (=10.50) + 1.21 + freeboard

= 5310.50 + 1.21 + 0.79 = 5312.50


Pennsylvania Ave..
OPEN PARKING
4
8
9
5
6
7
16
15
22d
11d
21
22
cab
mech
laundry
swimming pool
CARPORTS
OPEN PARKING
PAGE 7

J·19·Z

PLATE-I
LOCATION MAP