Consultants terra Del inc.

P.O. Box 142 Sandia Park, New Mexico 87047 (505) 281-1991

July 15, 1982

RECEIVED
JUL 16 1982
CITY ENGINEER

J-10
D-8

Mr. Fred Aguirre, P.E.
Civil Engineer/Hydrology
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

RE: Westwood Village - CCIC Project

Dear Fred:

As per your request, I have checked the proposed CCIC street elevations surrounding the site with those originally proposed in the drainage/grading plan prepared by CTS. All elevations at the curb returns match between the two drawings.

Thank you.

Respectfully,

Christopher L. Weiss, P.E.
President

CLW/vw

Enclosure

Consultant terrasol inc.

P.O. Box 142 Sandia Park, New Mexico 87047 (505) 281-1991

February 20, 1982

City of Albuquerque
Mr. Fred J. Aguirre, P.E.
Civil Engineer/Hydrology
P.O. Box 1293
Albuquerque, New Mexico 87103

RECEIVED
FEB 22 1982
ENGINEERING

RE: Westwood Village (J-10-D8)

Dear Fred:

Thank you for your comments concerning Westwood Village. In your letter you requested information concerning my client's preference in handling the certification of the construction details, either by plan or by having an engineer's certification of the actual construction. Dick Engstrom, of CCIC, has indicated that the Hunt Corporation will have the engineer inspect the site for compliance and issue a letter of certification when all details have been completed to plan.

The following comments refer to the Drainage Report Check List requirements:

Item 3B: The surveyor's stamp is shown on the Map and Survey by D.T. Morrison, Sheet C-2, which I have enclosed for your files.

Item 6: The zoning for the land to the west of the site is R-2. The minimum rear yard setback for this zone is 15', which will meet the minimum pond-to-foundation requirement.

Item 10: There are no existing drainage facilities adjacent to the site which can be utilized. I am unaware of future facilities being planned for the area.

Item 11A: We added further clarification of the interceptor swale, with drainage capacities noted on the plan, page C-3.

Item 12: I contacted Mr. Engstrom, CCIC, and he will work with the Hunt Corporation to provide the City with the required private easement, located along the west side of the site in the area of the interceptor berm/swale.

Item 21C-E: We have enclosed plans, Sheet C-6, which CCIC used for their utility layout. They said street grades shown are from plans prepared by the City. The actual status of approvals is unknown at this time, but CCIC will supply copies of approved plans to your department when they become available.

Item 21M: Dimensions have been added to cross-sections and plan.

Item 23: The client has been supplied with the required standard pond maintenance covenant.

Item 1: Addressed in first paragraph of letter.

If you have any further questions concerning this project, please contact either me or Mr. Dick Engstrom, with CCIC (Phone No. 266-5522).

Thank you.

Respectfully,

Christopher L. Weiss, P.E.
President

CLW/vw

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

January 8, 1982

Consultants Terra Sol Inc.
C/O Christopher L. Weiss, P.E.
President
P. O. Box 142
Sandia Park, New Mexico 87047

REFERENCE: WESTWOOD VILLAGE (J-10-D8)

Dear Chris:

Attached are my comments for the referenced drainage report, please address the items checked no and any comments listed.

This report was not reviewed for construction detail, therefore, before any building permit(s) can be released, compliance with the construction Check List will be required unless your client agrees to have his engineer certify said project.

This is recommended to minimize the amount of construction detail normally required on a project of this size and to lend some coordination between the engineer and the contractor.

Please advise us of your client's preferences.

Sincerely yours,

Fred J. Aguirre

Fred J. Aguirre, P.E.
Civil Engineer/Hydrology

FJA/el

cc: M. Hunt
Drainage File
Reading File

Enclosures

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

RECEIVED

NOV 10 1981

ENGINEERING

J10 - D8

DRAINAGE REPORT INFORMATION SHEET

PROJECT TITLE WESTWOOD VILLAGE

ZONE ATLAS PAGE NO. J-10-Z CITY ADDRESS Glenrio, 68th and Hanover Streets, N.W.

LEGAL ADDRESS

ENGINEERING FIRM Consultants/Terra Sol, Inc. CONTACT C. Weiss

ADDRESS P.O. Box 142, Sandia Park, N.M. 87047 PHONE (505)281-1991

OWNER Housing Properties, Inc CONTACT M. Hunt

ADDRESS P.O.Box 9368, El Paso,Texas 79984 PHONE (915)533-1122

ARCHITECT/SURVEYOR CCIC Design Group, Inc CONTACT A. Darby

ADDRESS 3600 Indian School, N.E. 87107 PHONE (505)266-5521

DATE SUBMITTED Novermber 10, 1981

BY

RECEIVED

NOV 10 1981

CITY ENGINEER

MUNICIPAL DEVELOPMENT DEPARTMENT

Richard S. Heller, P.E., City Engineer ENGINEERING DIVISION Telephone (505) 766-7467

4th Hydro

Frances -

766-7441

DRAINAGE REPORT & GRADING PLAN

for

Westwood Village,

HUD Housing Project

on 68th Street NW

Albuquerque, NM October 1981

Consultants terraSol inc.

Consultants terra-Sol inc.

P.O. Box 142 Sandia Park, New Mexico 87047 (505) 281-1991

October 28, 1981

Mr. Chuck Easterling
Principal Assistant City Engineer/Hydrology
City of Albuquerque
400 Marquette NW
Albuquerque, New Mexico 87102

RE: HUD Project on 68th Street.

Dear Mr. Easterling:

We are submitting the attached report, prepared by Consultants/Terra-Sol, Inc., together with a soils report for the subject property, for your review and comments necessary to obtain City approval.

Thank you.

Respectfully,

Christopher L. Weiss, P.E.
President

CLW/vw

Enclosures

DRAINAGE REPORT & GRADING PLAN
WESTWOOD VILLAGE

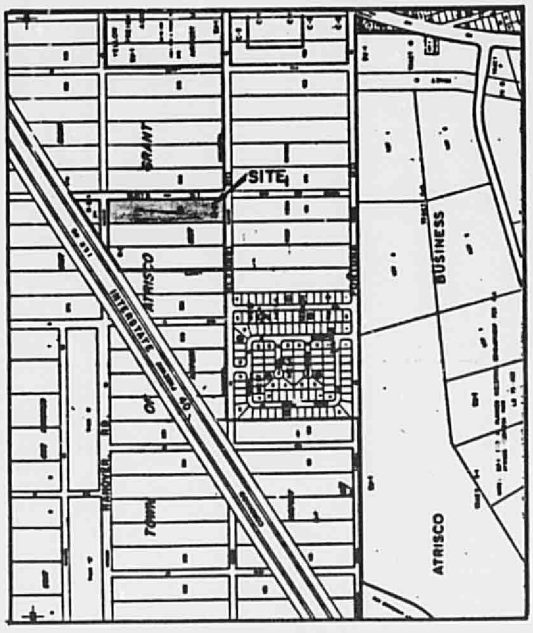
OCTOBER 1981

I N T R O D U C T I O N

At the request of Mr. Steve Serda, representative for Hunt Building Products, Consultants/Terra-Sol, Inc. has investigated the storm drainage for the proposed HUD Housing Project, known as Westwood Village. This investigation follows the criteria of the Interim '79 Drainage Guidelines established by the City of Albuquerque, in which all increased runoff created by development will be ponded, and sets forth recommendations for the developer to follow in order for the site to meet this criteria.

S I T E L O C A T I O N

The proposed housing project will occupy a 5 Acre Tract, known as No. 221 of the Town of Atrisco Grant. This tract is located west of and adjacent to 68th Street, between Glenrio Rd. and Hanover Rd. NW.



VICINITY MAP-J-10

WESTWOOD VILLAGE OCTOBER 1981

PROPOSED DEVELOPMENT

The proposed development will consist of 17 multi-family structures, related internal and offsite street improvements and storm drainage improvements. There will be no individual lot areas for each structure, but rather common areas for the overall project.

(CONDO OR TOWNHOME)

TOPOGRAPHIC MAP

The topographical map used as a basis for the grading plan is the result of a field survey conducted by the Architect, CCIC, Inc. in July, 1981. This plan represents the site topography as it now exists.

(ENGINEER OR SURVEY REQ. SURVEYED)

SOILS REPORT

The soil-type for the surface and sub-surface soils consists of dry, brown fine to medium grained silty sands (SM), with clayey sands (SC) and sandy clays (CL) in the north portion of the site. Specific drainage requires positive surface water drainage around and away from any building for the foundation design covered in the report. Additionally, any proposed ponding areas should be held a miminum of 15' away from foundations. (See Soils Report in back of this report).

DRAINAGE/GRADING EXHIBIT

The drainage/grading plan located in the back of this report, along with a ortho-photo map of the surrounding areas, shows the location of the proposed drainage improvements, the proposed final grades for the site, and the extent of the offsite drainage areas affecting the site.

EXISTING DRAINAGE

Existing conditons indicate that the site is affected by several offsite drainage areas.

A portion of the offsite areas lies on the west side of I-40 and drains onto the area adjacent to the west side of the site via three

culverts under I-40. The majority of all offsite drainage converges on the southern portion of the site for collection along the existing asphalt pavement of Glenrio Rd. at the intersection of 68th Street. The rest of the area affecting the site presently sheet flows across from the middle to northern portion of the site.

Offsite Area 1 (0.86 Acres) is a relatively minor area which lies adjacent to and drains under I-40 via a 30" I.D. pipe. The pipe is substantially blocked by silt at its outlet indicating a minor, infrequent usage. It appears that the main purpose of this pipe is to remove roadside runoff.

Offsite Area 2 (20.95 Acres), is the largest area extending to the west of I-40. The area doesn't have a defined arroyo system but rather, appears to sheet flow its runoff to I-40 for a collection against the road embankment by a 30" I.D. pipe, which is connected to a median drop inlet. This pipe was clear of debris or silt, indicating active usage.

Offsite Area 3 (9.47 Acres) is the third area which also extends to the west of I-40. Like Area 2, this area doesn't have a defined arroyo system, but delivers its runoff to a 36" I.D. pipe by collecting sheet flow against the I-40 embankment.

The drainage area upstream from Area 3 does not affect the site. Its runoff follows a defined arroyo to I-40 which drains under I-40 by a 30" I.D. pipe. These flows in turn drain to the south along the western edge of an existing R-1 development for collection by Fortuna Road.

All of these discharge points under I-40 are defined at their entrances by earth berms located on the downstream side of that respective pipe. The ortho-photo map does not reflect all of these berms, thus giving the impression that flows from one area can follow the I-40 embankment to the next lower pipe. This is not the case. The collection of flows from each area is controlled at that respective pipe.

The area on the east side of I-40, Area 4 (21.24 Acres), which the three offsite areas 1-3 drain onto, doesn't have a defined arroyo system but does have distinct features which collect surface flows for discharge onto the site at the southwest corner. These flows are presently collected in the general area of the intersection of 68th and Glenrio Road for routing to the east.

The remaining offsite area, on the east side of I-40, Area 5 (6.60 Acres), lies adjacent from the middle to the northern portion of the site. This area is unaffected by discharge from the west of I-40 and its drainage pattern is principally sheet flow to the west boundary of the site.

The site is not located in a Flood Hazard area, as determined by the recent revisions to the FHBM being prepared by Bohannan-Huston, Inc. (See ortho-photo map for flood limit information supplied by B-H).

DEVELOPED DRAINAGE

Offsite Flows

The offsite flows from Areas 1-4 will continue to enter the site at its historic point of drainage and pass through the site's internal drainage system for release onto the Glenrio Road street improvements. The offsite flows from Area 5 will be intercepted by a landscaped berm along the majority of the west edge of the site. Flows will be diverted to the south for collection by the site's internal street system for eventual discharge to the west. The diversion and collection of these offsite flows will occur entirely within the site boundaries with the final discharge point corresponding to the historical patterns. (See grading plan for details).

Onsite Flows

In a pre-design conference with Mr. Easterling, City of Albuquerque, it was determined that the site would be subject to the '79 Interim Guidelines for ponding all increased runoff caused by development, with the added proviso of capturing the Q5 storm runoff. The major ponds would have a controlled release onto adjoining streets, with the Q5 ponds capturing flows for infiltration into the subsoils.

Because the site has a relatively high density, and because the soils report has established a minimum 15' distance of ponds from foundations, the following approaches will be used to meet the City criteria:

1. Where surface ponding can be realized, the maximum pond depth will be held to 0.5' and the pond will be incorporated into the landscaping to resemble a depression, rather than a defined pond.

2. Where there is inadequate space to accomplish surface ponding, dry wells will be constructed to meet the pond volume requirements.

3. Outflow pipes will be provided to account for the discharge of volumes greater than the required capacity of the respective pond/dry well. Where relatively small areas contribute to a pond with overall adequate capacity, no outflow will be provided. The soil type for the area will provide adequate infiltration for small volumes.

The following table refers to offsite flow conditions:

Offsite Areas - Not gullied
- Soil type - MWA (Madurez-Wink)
- Hydrologic Soil Group = B
- Hydrologic Cover = Herbaseous/Good to Fair Range
- Runoff Curve No. = 65
- Point Runoff = 2.6"/Direct Runoff (Q) = 0.3"
- Distribution Curve = SD-1 (75)
- Offsite Runoff - 24 hr./100 yr. storm

Basin	Acres	% Slope	Vel.	Tc	cfs/Ac./in.	Peak Q
1	0.86	1	1'/sec.	0.1 hr.	1.5	0.4 cfs
2	20.95	2	1.4'/sec.	0.4 hrs.	1.2	8 cfs
3	9.47	2	1.4'/sec.	0.2 hrs.	1.5	4 cfs
4	21.24	1.3	1.1'/sec.	0.4 hrs.	1.2	8 cfs
5	6.60	1.3	1.1'/sec.	0.2 hrs.	1.5	3 cfs

Basin	T.Tc	Acres	cfs/Ac./in.	Peak Q	Remarks
1-4	0.71*	52.52	0.90	14 cfs	Direct Discharge into Site Pond.
5	0.2	6.6	1.5	3 cfs	Routing through site improvements to Site Pond

*includes pipe routing time

Culvert Capacities

Basin	Culvert I.D.	Basin Peak Q	Culvert Water Depth	Capacity @ Hw/D = 1.0
1	30"	0.4 cfs	0.2'	22 cfs
2	30"	8 cfs	1.2'	22 cfs
3	36"	4 cfs	0.5'	35 cfs

The net results are that the surface runoff from each basin upstream of I-40 contributes sheet flows for collection against the road embankment, before being passed under the embankment via three controlled points. These flows, conbined with the sheet flow of the area downstream of I-40, presently drain to the southwest region of the site for a more concentrated distribution prior to capture and routing against the Glenrio Road improvements in the general area of the street intersection of 60th Street. After the site improvements are completed, this drainage pattern will continue to follow its historical entrance and exit of the site, with the added proviso that the flows will be routed through the site's internal pond system.

The net effect of the existing pipe culverts under I-40 is that the pipes have little effect on the routing of the streamflow analysis. The capacities of the pipes versus the peak discharge of the basin determines that open channel flow conditions exist for these discharges through the pipes. Any lag in the runoff sequence caused by the collection of flows against the I-40 embankment will be insignificant, with the effect of causing a delay in the arrival of surface runoff by increasing the distance traveled or reducing the velocity of flow, thus reducing the peak discharge rate calculated.

Onsite Areas

The following table refers to onsite conditions:

All developed area "C"'s are a composite of surface types.

All undeveloped area "C"'s established as 0.40, City Standards, soil type not withstanding.

Vol.100 for area = 2.2"/6 hr. storm/Intensity = 5.4"/hr.

Vol.5 for area = 1.2"/6 hr. storm/Intensity = 2.43"/hr.

Drainage Area	Area ($ft.^2$)	Devel. "C" / Increase "C"	Vol.100 / Vol.5	Q100 / Q_5	Surface Pond Size L W D / Sub-Surface Pond L W D	Remarks
A	4000	0.45 0.05	330 $ft.^3$ —	— —	40x25x0.5 40x25x1.0	Complete ponding/ no outflow.
B	7040	0.51 0.11	658 $ft.^3$ —	— —	55x25x0.5 55x25x1.4	Complete ponding/ no outflow.
C	13600	0.54 0.14	1346 $ft.^3$ —	— —	90x50x0.5 90x50x0.3	Complete ponding with no outflow.
D	10800	0.54 0.14	— —	0.7 cfs —	— —	Unrestricted runoff to adjacent streets. 68th
E	39520	0.63 0.23	— —	3 cfs —	— —	Unrestricted runoff to adjacent streets. 68th
F	27840	0.48 0.08	2450 $ft.^3$ —	— 0.6 cfs	140x70x0.5 —	Complete ponding with outflow. 68th St.
G	42080	0.61 0.21	— —	3 cfs —	— —	Unrestricted runoff to adjacent streets. 68th
H	72920	0.60 0.40	2674 $ft.^3$ 1458 $ft.^3$	5 cfs 2 cfs	110x80x0.3 110x80x0.3	Increased volume ponded with Q_5 outlet. Glenrio

The net results of the treatment of the onsite flows are as follows:

Areas A,B,C: These areas drain to individual surface/sub-surface pond combinations which capture that basin's entire runoff. None of the ponds have outfall systems. Each surface pond will be 0.5' deep, with all pond's bottoms at a common elevation of 5105.50. The sub-surface portion of these ponds will be filled with gravel and extend below elevation 5105.50. - 1) 1.0' for pond #A, 2) 1.4' for pond #B, 3) 0.3' for pond #C.

Areas D,E,G: These areas drain to adjacent external streets by way of internal swales or through the internal street system of the site. Flows are unrestricted in that no ponding or controlled outlets affect the runoff.

Area F: This area drains to a surface pond system located in the common area open space. The pond bottom will be a elevation 5103.0, with a maximum pond depth of 0.5'. The pond will be capable of detaining the 100 yr. volume, while outflowing at less than a Q_5 rate of 0.6 cfs through a 4" diameter pipe onto 68th Street.

Area H: This area drains to a surface pond system located at the southwest corner of the site in the common area open space. Onsite flows captured in this pond will be the 1) increased volume for a Q_5 storm with no release, and 2) the increased volume for a Q_{100} storm with a controlled release of Q_5 of 2 cfs onto Glenrio Road. The pond bottom will be at elevation 5101.40. The equivalent Q_5 volume to be stored without release will be 0.3' deep. The outflow pipe invert will be set at 5101.70, to cause the capture of these Q_5 flows. The high water elevation to temporarily store the increased Q_{100} volume will be at 5102.0 The spillway lip will be set at this elevation, or 5102.0.

The pipe area required to control the release of these flows to 2 cfs under a head of 0.3' = 82 in.^{2}. Six - 4" diameter pipes would release slightly less than the Q_5 rate, or an equivalent rectangular hole could be constructed in the block wall, 5' long by 0.3' high with an invert at elevation 5101.70.

Because this pond is located in the historical pathway of the offsite flow patterns, flows from OSA's 1-4 will pass directly through the pond area for discharge onto Glenrio by way of the spillway system. The peak

discharge rate for OSA's 1-4 is 14 cfs. OSA-5 was not included in this peak discharge figure.

If OSA-5 is combined with Area H for a combined routing of flows to the pond/spillway, the peak discharge of this combination would equal 7 cfs. In most occurrences, the peak discharge of these two areas would pass through the pond/spillway system before the effect of the OSA's 1-4 could be felt.

The spillway of the pond in Area H will be designed to work under a maximum level of 0.4 feet at a high water elevation of 5102.40 to pass the peak discharge rate of 14 cfs. (Eq Q = CLH3/2 - Broadcrested wiers). The length of the wier will be 22' long, defined by a block wall constucted into the pond perimeter berm and located above the pipe outlet. The nearest site improvement will be constructed at an elevation of 5105.2, or 2.80' above the projected high water level of the pond with the spillway in operation.

Summary of Site Conditions:

Offsite Discharge, OSA's 1-4 - Routed through site at historic points of entry and released to adjoining street system.

OSA-5 - Diverted on-site to follow internal street system and pass through site's drainage system for release on adjoining street system.

Undeveloped Site Conditions

Sheet flow of on-site generated flow Q_{100} = 11 cfs.

Developed Site Conditions

Total unrestricted flow released from site onto adjacent existing or proposed street systems from Areas D, E, G of 6.7 cfs and controlled release rate from Areas F and H of 2.6 cfs for a total of 9.3 cfs versus an undeveloped flow rate of 11 cfs.

RECOMMENDATIONS TO DEVELOPER

1. Grade around each residential structure to provide a positive slope away from the foundation to discharge/pond points.

2. Grade side yard swales to discharge flows to controlled points of discharge at the appropriate drain locations.

3. Construct pond areas, surface and sub-surface, to dimensions shown in table of pond requirements. For sub-surface ponds, use 3/4 to 1 1/2" diameter washed gravel. Line all sub-basins with filter cloth, Mirafi 140S Fabric, or approved equal. Construct surface ponds to blend in with proposed landscaping.

4. Install all pond drains through curbs to City Standards for outlet pipes. Contractor to complete S.D. #19 documents for approval by City in addition to filing drainage covenants with City.

5. If the open areas where proposed ponds are to be located are compacted in site preparation procedures, overexcavate pond limits to penetrate into natural uncompacted material before completing pond construction.

6. Construct a 1' high berm 5' within the west propoerty line as shown on the plan to divert offsite sheet flows to the south to be picked up by the site's internal street system. See Section A on the Grading Plan.

7. Install one 4" diameter outflow pipe through the proposed street improvements of 68th Street to drain the pond for Area F, at invert elevations shown on plan.

8. Locate a pond spillway for Area H in the position shown on the plan. Construct the spillway with concrete block, length of 22', invert elevation at 5102.0. Locate pond outflow pipe system centered in the wall, pond side invert of 5101.70. Use 6 - 4" diameter pipes or construct a rectangular hole in block wall 5' long by 0.3' deep, invert at 5101.70. Blend in surrounding pond berms to spillway wall. Hold top of constructed berm at 5103.0. Extend block wall into berm a minimum of 5' on each side of spillway.

C O N C L U S I O N

The proposed drainage plan sets forth requirements to be followed by the developer, Hunt Building Products Co., in order to meet AMAFCA/City requirements for the area, and it analyses the effect of the impact of the offsite area flows on the site with steps to be taken to insure minimal effect on the site in the event of a 100 yr. storm.

The following pages contain the soils report for the site area.

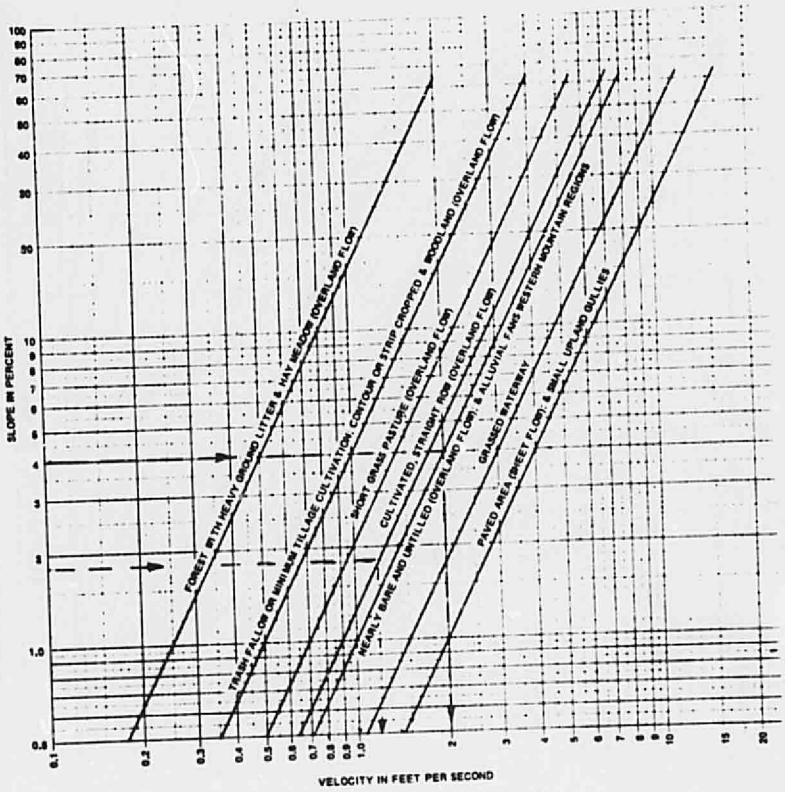


Figure 2-3 .Velocities for upland method of estimating T_c

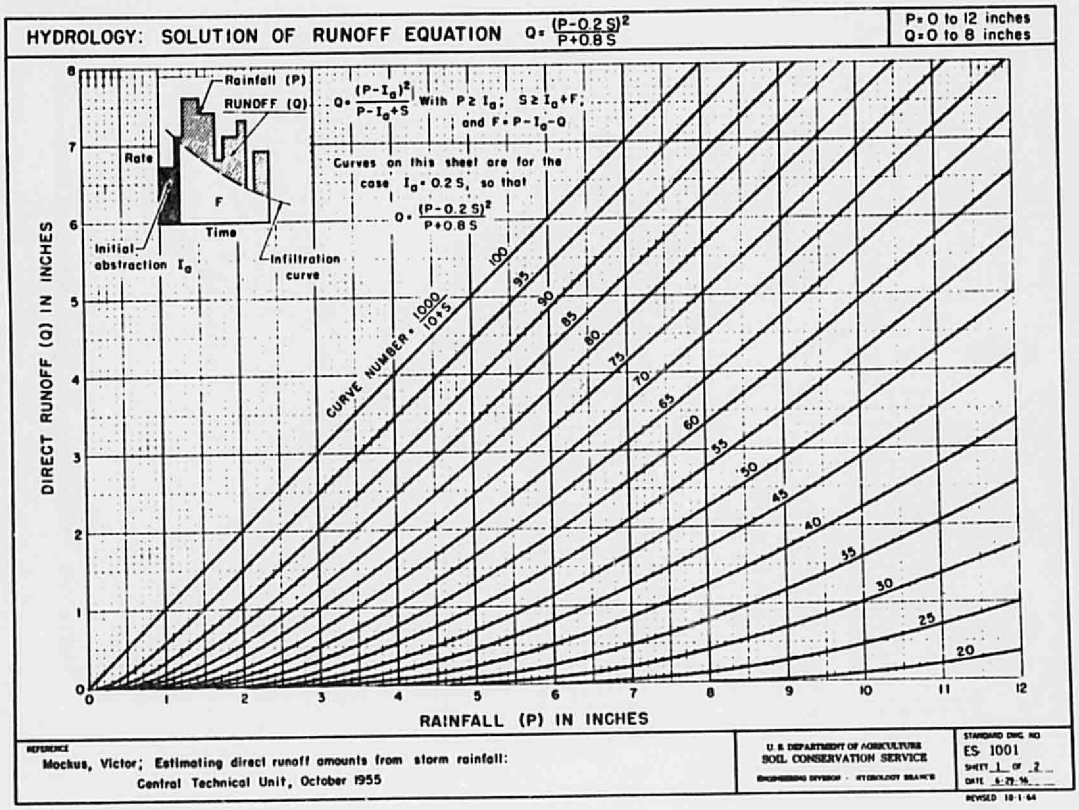

HYDROLOGY: SOLUTION OF RUNOFF EQUATION $Q = \frac{(P-0.2S)^2}{P+0.8S}$
P = 0 to 12 inches
Q = 0 to 8 inches
Rainfall (P)
RUNOFF (Q)
Rate
F
Time
Initial abstraction I_a
Infiltration curve
$Q = \frac{(P-I_a)^2}{P-I_a+S}$ With $P \geq I_a$; $S \geq I_a+F$; and $F = P-I_a-Q$
Curves on this sheet are for the case $I_a = 0.2S$, so that
$Q = \frac{(P-0.2S)^2}{P+0.8S}$
CURVE NUMBER = $\frac{1000}{10+S}$
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
DIRECT RUNOFF (Q) IN INCHES
RAINFALL (P) IN INCHES
0 1 2 3 4 5 6 7 8 9 10 11 12
REFERENCE
Mockus, Victor; Estimating direct runoff amounts from storm rainfall:
Central Technical Unit, October 1955
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STANDARD DWG. NO.
ES 1001
SHEET 1 OF 2
DATE 6-29-56
REVISED 10-1-64

Figure 2-4

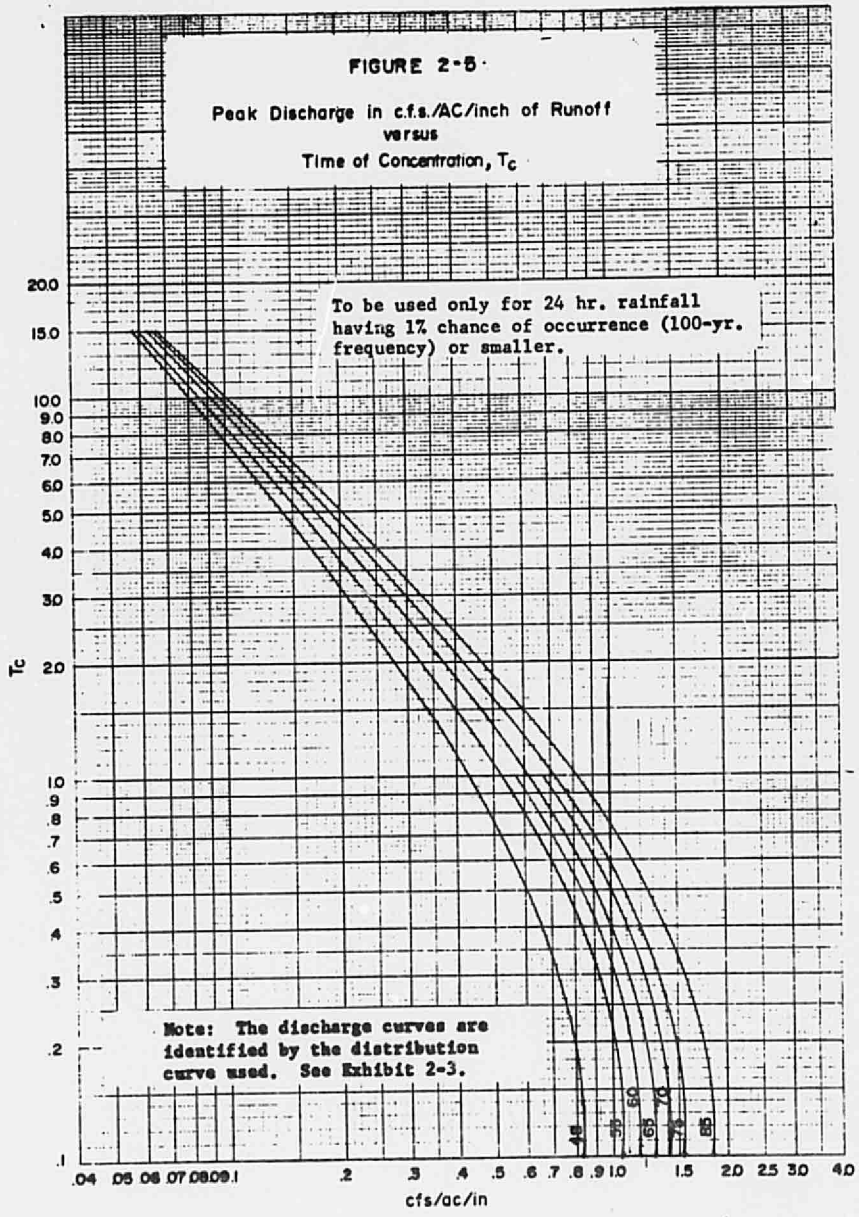


FIGURE 2-5
Peak Discharge in c.f.s./AC/inch of Runoff
versus
Time of Concentration, Tc
To be used only for 24 hr. rainfall having 1% chance of occurrence (100-yr. frequency) or smaller.
Note: The discharge curves are identified by the distribution curve used. See Exhibit 2-3.
Tc
20.0
15.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
.04 .05 .06 .07 .08 .09 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.5 2.0 2.5 3.0 4.0
cfs/ac/in
45
55
60
65
70
75
85

GEOTECHNICAL INVESTIGATION FOR THE
WESTWOOD VILLAGE DEVELOPMENT AT
GLENRIO ROAD AND 68TH STREET, N.W.,
ATL ENGINEERING SERVICES LAB. NO. 3404
JUNE 24, 1981

ATL ENGINEERING SERVICES

June 24, 1981

Hunt Building Corporation
P. O. Box 9368
El Paso, Texas 79984

Attention: Mr. Steve Serda

Re: ATL Engineering Services Lab. No. 3404. Geotechnical Investigation for the Westwood Village Development at Glenrio Road and 68th Street, N.W., Albuquerque New Mexico

Gentlemen:

Transmitted herewith is our GEOTECHNICAL INVESTIGATION REPORT for the above referenced project.

INTRODUCTION:

The test borings were drilled on June 17 and 19, 1981 using a Mobile B-56 "Pacemaker" rotary drill mounted on a 1969 Dodge "Powerwagon" 4 x 4 truck, the drill itself being powered by a Ford Industrial Engine. The test holes were advanced "dry" using 6-3/8" O.D. by 3-1/4" I.D., continuous flight, 5-foot sectional hollow stem augers. Standard penetration tests were made at 2½ to 5 foot vertical intervals in the holes and through the hollow stems of the augers at the time of drilling. The purpose of the standard penetration test is to obtain a measure of the relative density or consistency of the subsurface soils encountered and to obtain samples of the soils and/or rock for visual inspection and laboratory testing.

TEST DATA AND RESULTS:

A sketch showing the locations of the five (5) test holes is shown on Page 2 and was made from a print of the site plan furnished to our office. "Boring Log Graphs" of the test holes are shown on Pages 3 through 7 and depict the subsurface soils encountered in the holes along with the results of the standard penetration tests, natural or existing moisture content, dry densities where obtainable, grain size classifications and Atterberg Limit Tests made on typical recovered samples. Notes and Definitions pertaining to the "Log Graphs" are shown on Page 8. Conclusions and Recommendations follow.

If any questions should arise concerning the report, please contact our office.

Very truly yours,

ATL ENGINEERING SERVICES

Nicholas T. Korecki

Nicholas T. Korecki, E.I.T.

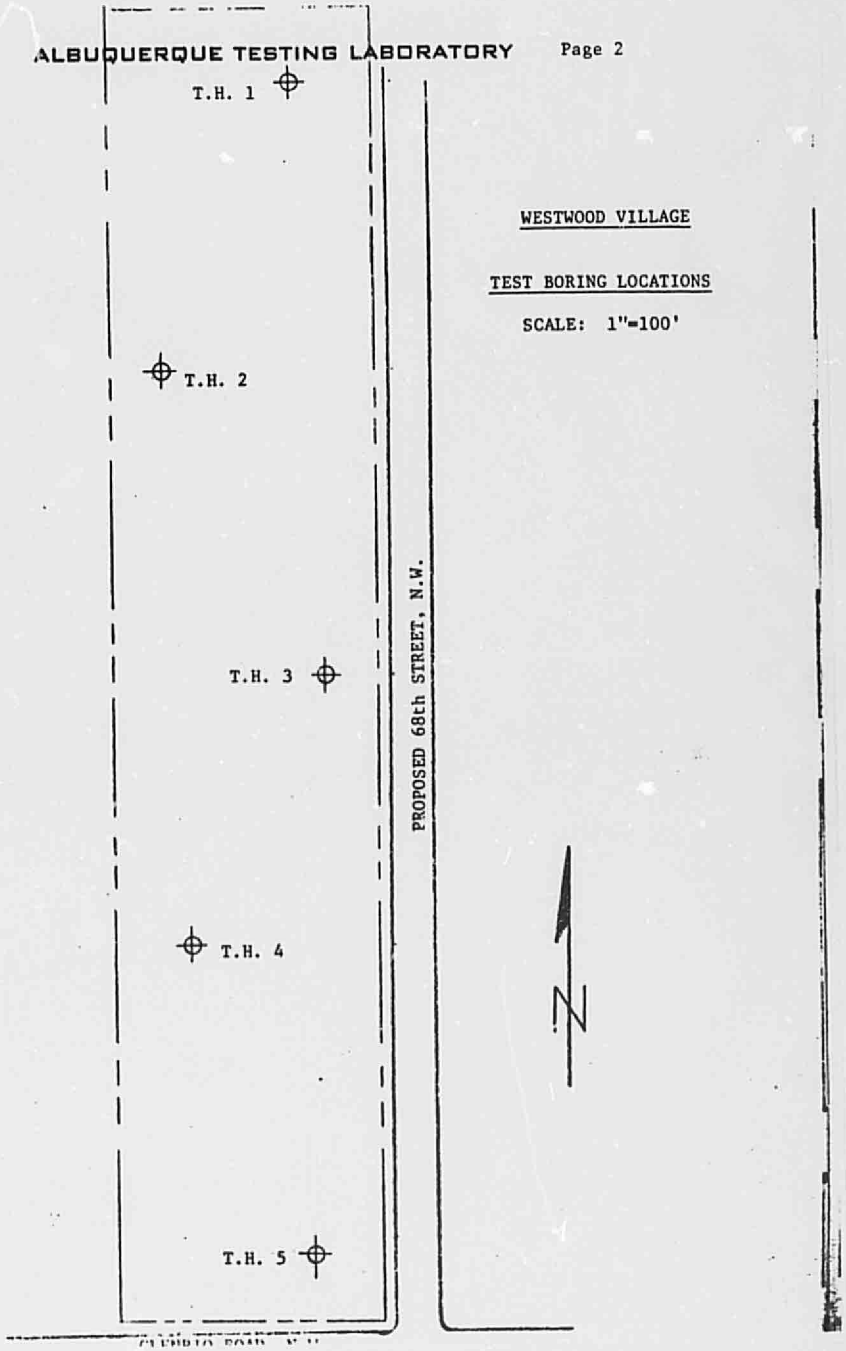
Reviewed by:

Robert K. Lloyd

Robert K. Lloyd, P.E.

cc: Randy Holt
Chambers, Campbell, Isaacson & Chaplin

NTK/kse



WESTWOOD VILLAGE

TEST BORING LOCATIONS

SCALE: 1"=100'

ALBUQUERQUE TESTING LABORATORY

PROJECT: Westwood Village

Lab No. 3404

Date: June 24, 1981

BORING LOG GRAPH - TEST HOLE NO. 1

Depth - Ft.	VISUAL DESCRIPTION	PENETRATION RESISTANCE Per Foot N	Per 6" or as Noted	Per Foot C	SAMPLER TYPE	MOISTURE CONTENT % M	DRY DENSITY P.C.F. D	PARTICLE SIZE DISTRIBUTION % GRAVEL	SAND	SILT & CLAY	ATTERBERG LIMITS % LIQUID LIMIT	PLASTIC LIMIT	P.I.	
0	Sand, dry, brown, silty (SM) Loose	9	3 4 5		S	3.1					Non-plastic			
	2'													
2½	Sand, dry, brown, silty to clayey (SM-SC)	18	5 7 11		C	14.9 -- 6.4	76 -- 104							
5	Medium Dense or Moderately Firm	14	8 7 7		S	10.3								
		15	6 7 8		S	6.9								
10	10'		8											
	Clay, brown, sandy dry (CL) Firm	20	10 10		S	10.6								
	13'													
15	Sand, brown, dry, silty to clayey (SM-SC) Firm	17	6 8 9		S	2.2	.	Cuttings Sample						

ALBUQUERQUE TESTING LABORATORY

PROJECT: Westwood Village

Lab No. 3404

Date: June 24, 1981

BORING LOG GRAPH - TEST HOLE NO. 2

Depth - Ft.	VISUAL DESCRIPTION	PENETRATION RESISTANCE Per Foot N	Per 6" or as Noted	Per Foot C	SAMPLER TYPE	MOISTURE CONTENT % M	DRY DENSITY P.C.F. D	PARTICLE SIZE DISTRIBUTION % GRAVEL	SAND	SILT & CLAY	ATTERBERG LIMITS % LIQUID LIMIT	PLASTIC LIMIT	P.I.
0	Sand, dry, brown, silty (SM) Loose	9	4 5 4		S	3.0		0	78	22			
2½	2' Clay, brown, dry sandy (CL) Moderately Firm to Firm with depth.	13	5 7 6		S	10.8		0	35	65	29	15	14
5		19	5 9 10		S	8.1		0	45	55			
7½	7' Sand, brown, dry, clayey (SC) Firm	18	6 8 10		S	7.5		0	57	43			
10		23	10 12 11		S	8.1		0	58	42			
15	13' Sand, brown, dry, silty (SM) Medium Dense	17	8 8 9		S	4.7		0	70	30			

ALBUQUERQUE TESTING LABORATORY

PROJECT: Westwood Village

Lab No. 3404

Date: June 24, 1981

BORING LOG GRAPH - TEST HOLE NO. 3

Depth - Ft.	VISUAL DESCRIPTION	PENETRATION RESISTANCE Per Foot N	Per 6" or as Noted	Per Foot C	SAMPLER TYPE	MOISTURE CONTENT% M	DRY DENSITY P.C.F. D	PARTICLE SIZE DISTRIBUTION % GRAVEL	SAND	SILT & CLAY	ATTERBERG LIMITS % LIQUID LIMIT	PLASTIC LIMIT	P.I.
0	Sand, dry, brown, silty to "clean" (SM-SP) Loose	10	3 4 6		S	1.6							
2½	2' Sand, brown, clayey (SC) Firm	17	7 8 9		C	13.0 -- 13.8	83 -- 87						
5	5' Silt, dry, brown, sandy (ML)	18	10 9 9		S	6.8							
7½	Firm	19	9 9 10		S	4.6							
10		22	14 11 11		S	5.5							
15	13' Sand, dry, brown, clayey (SC) Moderately Firm	13	3 4 9		S	6.5							

ALBUQUERQUE TESTING LABORATORY

Page 1

PROJECT: Westwood Village

Lab No. 3404

Date: June 24, 1981

BORING LOG GRAPH - TEST HOLE NO. 4

Depth - Ft.	VISUAL DESCRIPTION	PENETRATION RESISTANCE Per Foot N	Per 6" or as Noted	Per Foot C	SAMPLER TYPE	MOISTURE CONTENT % M	DRY DENSITY P.C.F. D	PARTICLE SIZE DISTRIBUTION % GRAVEL	SAND	SILT & CLAY	ATTERBERG LIMITS % LIQUID LIMIT	PLASTIC LIMIT	P.I.
0	Sand, dry, brown, silty (SM)	8	2 3 5		S	4.2		0	74	26			
	Loose												
	2'												
2½	Clay, dry, brown, silty, sandy (CL, some ML)	22	7 11 11		C	6.3 -- 6.0	-- -- 90	0	42	58	27	16	11
	Firm												
5	5'		6										
	Sand, dry, brown, silty (SM)	24	9 15		S	3.4		0	74	26			
7½	Medium Dense	11	3 4 7		S	2.3		0	85	15			
10	10'		5										
	Sand, brown "clean", fine to medium grained (SP)	13	5 8		S	2.0		0	93	7			
	Medium Dense												
15		17	5 8 9		S	1.1		2	96	2			

ALBUQUERQUE TESTING LABORATORY

PROJECT: Westwood Village

Lab No. 3404

Date: June 24, 1981

BORING LOG GRAPH - TEST HOLE NO. 5

Depth - Ft.	VISUAL DESCRIPTION	PENETRATION RESISTANCE Per Foot N	Per 6" or as Noted	Per Foot C	SAMPLER TYPE	MOISTURE CONTENT % M	DRY DENSITY P.C.F. D	PARTICLE SIZE DISTRIBUTION % GRAVEL	SAND	SILT & CLAY	ATTERBERG LIMITS % LIQUID LIMIT	PLASTIC LIMIT	P.I.
0	Sand, dry, brown, silty (SM)	19	4 7 12		S	2.9							
2½	Medium Dense	35	8 15 20		C	3.0	--						
5		23	10 10 13		S	2.8							
7½		14	4 6 8		S	3.0							
10	10' Sand, brown, "clean", fine to medium grained (SP) Medium Dense to Dense with depth.	25	7 10 15		S	1.7							
15		35	7 13 22		S	1.2							

NOTES AND DEFINITIONS

1. **Penetration Resistance** – Blows per foot using "A" rod, 140 lb. hammer with 30-inch guided free fall unless otherwise noted.
   - N – Standard Penetration Resistance (ASTM: D-1586), 2" O.D. split barrel sampler
   - C – Continuous Penetration Resistance, 2½" O.D., conical, steel drive point
   - R – Penetration Resistance, 3" O.D. Modified Dames & Moore Split Ring Sampler

2. **Sample Type**
   - S – Standard Split barrel; 2" O.D. x 1-3/8" I.D.
   - C – California Sampler; 2-3/8" O.D. equipped with 2" I.D. x 4" high brass liners
   - R – Modified Dames & Moore Sampler; 3" O.D. equipped with 2.42" I.D. x 1" high brass liners
   - T – Shelby Tube

3. **Soil Index Properties**
   - M – Moisture Content, % of dry soil weight
   - D – Density, lbs per cubic foot computed either by volumetric or displacement methods. Soils Classifications are visual unless accompanied by grain size analysis and Atterberg Limits.

4. **Water Table** – If encountered is noted on Log Graphs as ⏚.

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM: D2487

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	Description	Major Divisions
	GW	Well-graded gravels or gravel sand mixtures, less than 5% - 200 fines	Gravels More than half of coarse fraction is larger than No. 4 sieve size.
	GP	Poorly graded gravels or gravel sand mixtures, less than 5% - 200 fines	
	GM	Silty gravels, gravel-sand silt mixtures, more than 12% - 200 fines	
	GC	Clayey gravels, gravel-sand clay mixtures, more than 12% - 200 fines	
	SW	Well-graded sands or gravelly sands, less than 5% - 200 fines	Sands More than half of coarse fraction is smaller than No. 4 sieve size.
	SP	Poorly-graded sands or gravelly sands, less than 5% - 200 fines	
	SM	Silty sands, sand-silt mixtures more than 12% - 200 fines	
	SC	Clayey sands, sand-clay mixtures more than 12% - 200 fines	

NOTE – Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols.

FINE-GRAINED SOIL

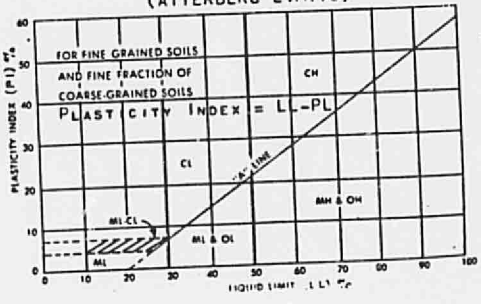
MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	Description	Major Divisions
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Silts and Clays Liquid limit less than 50
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
	OL	Organic silts and organic silt-clays of low plasticity	
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Silts and Clays Liquid limit greater than 50
	CH	Inorganic clays of high plasticity, fat clays	
	OH	Organic clays of medium to high plasticity, organic silts	
	Pt	Peat and other highly organic soils	

SOIL FRACTIONS

Component			Size Range
Boulders			Above 12 in.
Cobbles			3 in. to 12 in.
Gravel			5 in. to No. 4 sieve
Coarse Gravel			3 in. to ¾ in.
Fine gravel	G		¾ in. to No. 4 sieve
Sand			No. 4 to No. 200
Coarse	CS	TS	No. 4 to No. 10
Medium	MS		No. 10 to No. 40
Fine	FS		No. 40 to No. 200
Fines (silt or clay)	S/C		Below No. 200 sieve

PLASTICITY CHART (ATTERBERG LIMITS)



CONCLUSIONS AND RECOMMENDATIONS

Based on the conditions of the surface and subsurface soil existing at the test locations; standard penetration tests (A.S.T.M. D-1586) made at the time of drilling; the results of the laboratory tests performed on soil samples obtained from the site; and a visual inspection of the proposed site, we submit the following opinions and recommendations concerning the design of the foundations for the proposed Westwood Village Development in Albuquerque, New Mexico:

A. SITE CONDITIONS

The proposed site lies north of Glenrio Road and west of the proposed 68th Street. The ground surface is uneven with shallow, wide depressions and low mounds. Several locations show evidence of man-made excavations; the ground surface is covered with scattered rubble and sparse native vegetation. Surface and subsurface soils, as depicted on the "Boring Log Graphs", consist of dry, brown fine to medium grained silty sands (SM), with clayey sands (SC) and sandy clays (CL) in the north portion of the site. Brown sandy silts (ML) were encountered at Test Locations 3 and 4; "clean" brown sands (SP) were encountered below the 10 foot depth at Test Locations 4 and 5. At the test locations, surface soils are loose, becoming generally medium dense or moderately firm to firm below the 2 foot depth. No water table or water bearing stratum was encountered and all recovered soil samples exhibited low to moderate moisture content.

B. PROPOSED CONSTRUCTION

It is our understanding that the proposed structures will be one to two story residential apartment buildings. The ground floor will be a reinforced concrete slab on grade with turned down edges acting as foundations. Areas around the buildings will be paved for parking.

C. FOUNDATIONS

Soils at and below foundation depths may consolidate if saturated or wetted to various degrees (See Condolidation Test results in the Appendix); resulting

foundation settlements, if sufficient and differential in nature could cause structural distress. It is therefore recommended that for the most trouble free foundation system, the bottom of the turned down slabs and any individual spot footings be based on properly compacted engineered backfill, at a minimum depth of 2 feet below the nearest adjacent exterior finished grade. The compacted thickness of fill beneath the footings should be at least one-half the least dimension of the footing but not less than 1 foot. The engineered fill should also extend laterally from the edges of the footings a distance equal to the depth of fill beneath the foootings.

"On-site" soils removed from excavations or imported soils may be used as engineered, compacted fill for support of foundations. These soils should be thoroughly mixed with optimum moisture (±2%) outside of excavations. Prior to placement of fill soils, the exposed subgrade soils or bottoms of over-excavated foundation trenches should be scarified to a depth of 8 inches, moistened with optimum moisture (±2%), to as deep as practicable, and compacted to a minimum of 90 percent of Modified Proctor (A.S.T.M. D-1557-70). Fill soils should then be placed in thin, horizontal lifts (8 inches maximum loose depth), compacted to a minimum of 95 percent of Modified Proctor Density, and brought up to the desired grade beneath footings.

For foundations based as recommended entirely on engineered, compacted fill soils, a soil bearing pressure of 2000 lbs./sq. ft. may be used. Full dead plus the maximum reasonable live loads that can act at any one time should be used to design the foundations. This bearing pressure may be increased by 30 percent of the combination of dead plus full live loads plus seismic effects.

D. "ON-GRADE" FLOOR SLABS

All "on-grade" reinforced floor slabs should be based on a minimum 6 inch compacted thickness of either imported, select fill soils consisting of a pit-run sand and gravel, crushed rock, or similar material having a Plasticity

Index not exceeding 6, or "on-site soils approved by the Soils Engineer. In addition, the compacted slab fill should be underlain by at least one (1) foot of compacted "on-site" soils. Prior to placement of fill soils, the building areas should be completely stripped of vegetation and the exposed ground overcut a vertical depth of at least one (1) foot. The excavated soils should be thoroughly mixed "off-site" with optimum moisture (±2%), then placed and compacted to a minimum of 90 percent of Modified Proctor Density and brought up so that the minimum compacted thickness is 12 inches. Slab fill soils should then be placed and compacted to a minimum of 90 percent of Modified Proctor Density.

E. PAVEMENTS

Support for asphaltic concrete pavement may be provided by a minimum of 4 inches of a well graded crushed gravel and fines base course fill, placed and compacted on a prepared subgrade as outlined in the specification in Paragraph C.

The following minimum pavement sections are suggested for "on-site" traffic conditions:

Traffic Conditions	Minimum Total Pavement Thickness (inches)
Light (passenger cars, general parking areas)	1½

In addition, the asphalt pavement should conform to the following specifications:

Stability (Marshall - 75 blow briquette)	1500 minimum
Flow (Marshall)	16 maximum
Percent of Voids in Compacted Mix	3 to 7
Percent of Voids Filled with Asphalt	75 to 85
Percent Asphalt Cement Content by Weight of Total Mix	5 to 7
Sand Equivalent	40 minimum
Compaction	96% of Laboratory Molded Specimen

Additional specifications for asphaltic concrete and select gravel base course may be taken from the "New Mexico Standard Specifications for Public Works Construction, 1979 Edition", Sections 115 and 302 respectively.

F. SITE DRAINAGE AND PROTECTION OF FOUNDATION SOILS

It will be very important at this site to keep the soils at and below foundation depths protected from moisture intrusions.

In order to help prevent moisture intrusions into the foundation strata, we advise that the following precautions be taken:

1. Final site grading should be designed such that positive surface water drainage is provided and maintained away from all foundations and exterior walls.
2. All foundation excavations should be kept dry, with concreting operations to follow as soon as is practical. The Contractor shall have equipment available to remove any surface water which may collect in the excavations for any reason.
3. Properly compact all backfill around foundations, exterior walls and in utility trenches to a minimum of 90 percent of Modified Proctor Density. A select fill with approximately 30 percent fines, will provide a less permeable soil adjacent to foundations and exterior walls.
4. Discourage the planting of vegetation adjacent to exterior walls unless underdrains are provided beneath the planted areas to lead irrigation waters away from the foundations.
5. If ponding areas are required the edges of the ponds should be a minimum of 15 feet from any building.

Any changes or deviations from the recommendations given in this report in structure loads, foundation depths or any other factors which could affect or alter the recommendations covered herein, should be brought to our attention before finalization of plans and prior to construction.

Your attention is directed to the fact that only a very small, fractional part of the proposed site area was "opened" and subsurface soils exposed and tested through the test borings. Subsurface soils and their in-situ properties which can materially affect design considerations may be different in areas not covered by the test borings. Therefore, if during construction and when excavations for footings are opened, soil foundation conditions differ from those encountered by the test borings of this report, our laboratory should be notified immediately for possible revision of our recommendations.

Professional opinions and recommendations presented in this report are based on our evaluations of the subsurface soil conditions at the site, our understanding of the proposed construction and our experience in the geotechnical field. Our only guarantee concerning the project is that our engineering and geological work and judgments given herein meet the standards of our profession at this time.

Respectfully submitted,

ATL ENGINEERING SERVICES

Nicholas T. Korecki

Nicholas T. Korecki, E.I.T.

Reviewed by:

Robert K. Lloyd

Robert K. Lloyd, P.E.

ATL ENGINEERING SERVICES

Project Westwood Village
Location Albuquerque, New Mexico
Sample Source Test Hole 4, Depth 2½ feet
Material cemented silty clay with pinholes; weathering
Undisturbed [X] Calif Remolded [ ]

CONSOLIDATION TEST

Date	Time	Load T/sf	Elasped Time(min)	Dial Reading
6/18/81	11:33	1/4	0	0.0000
			1/4	0.0034
			1/2	0.0035
			1	0.0035
			2	0.0036
			4	0.0036
	12:37			0.0042
	2:30			0.0049
	3:30	1/2	0	0.0050
			1/4	0.0068
			1/2	0.0069
			1	0.0069
			2	0.0070
			4	0.0071
	4:30			0.0078
6/19/81	9:06			0.0094
	10:19	1	0	0.0095
			1/4	0.0123
			1/2	0.0124
			1	0.0125
			2	0.0126
			4	0.0127
	11:40			0.0137
	12:41			0.0139
	12:44	1*	0	0.0139
			1/4	0.0200
			1/2	0.0300
			1	0.0495
			2	0.0615
			4	0.0631
	2:33			0.0662
	3:30	2*	0	0.0660
			1/4	0.0909
			1/2	0.0920
			1	0.0934
			2	0.0945
			4	0.0956
	4:35			0.0995
6/20/81	8:06am			0.1017
6/22/81	8:05			0.1026
	11:16			0.1026

Wet Wt. Soil + Ring 101.7 gm.
Ring Wt. 25.0 gm.
Wet Soil 76.7 gm.
Dry Soil 73.6 gm.
Assumed Sp. Gr. 2.65

CONSOLIDATION RING #3
Dia. 1.9424 in. Area 2.9632 sq.in.
Ht. 1.000 in. Vol. 0.00171 cu.ft.

Percent Moisture 4.2 Dry Density 94.9 pcf

$V_s = \frac{\text{Dry Density}}{(62.4)\text{Sp.Gr.}} = 0.5739$

$V_v = 1 - V_s = 0.4261$

Init.Void Ratio $(e_o) = \frac{V_v}{V_s} = 0.7425$

$e = \frac{\Delta - V_s}{V_s}$

Load T/sf	Dial Reading	1-Dial Reading (Δ)	e	Percent Consolidation
0	0.0000	1.0000	0.7425	--
¼	0.0050	0.9950	0.7338	0.50
½	0.0095	0.9905	0.7259	0.95
1	0.0139	0.9861	0.7182	1.39
1*	0.0660	0.9340	0.6275	6.60
2*	0.1026	0.8974	0.5637	10.26
4*				
8*				
12*				
16*				

*Saturated

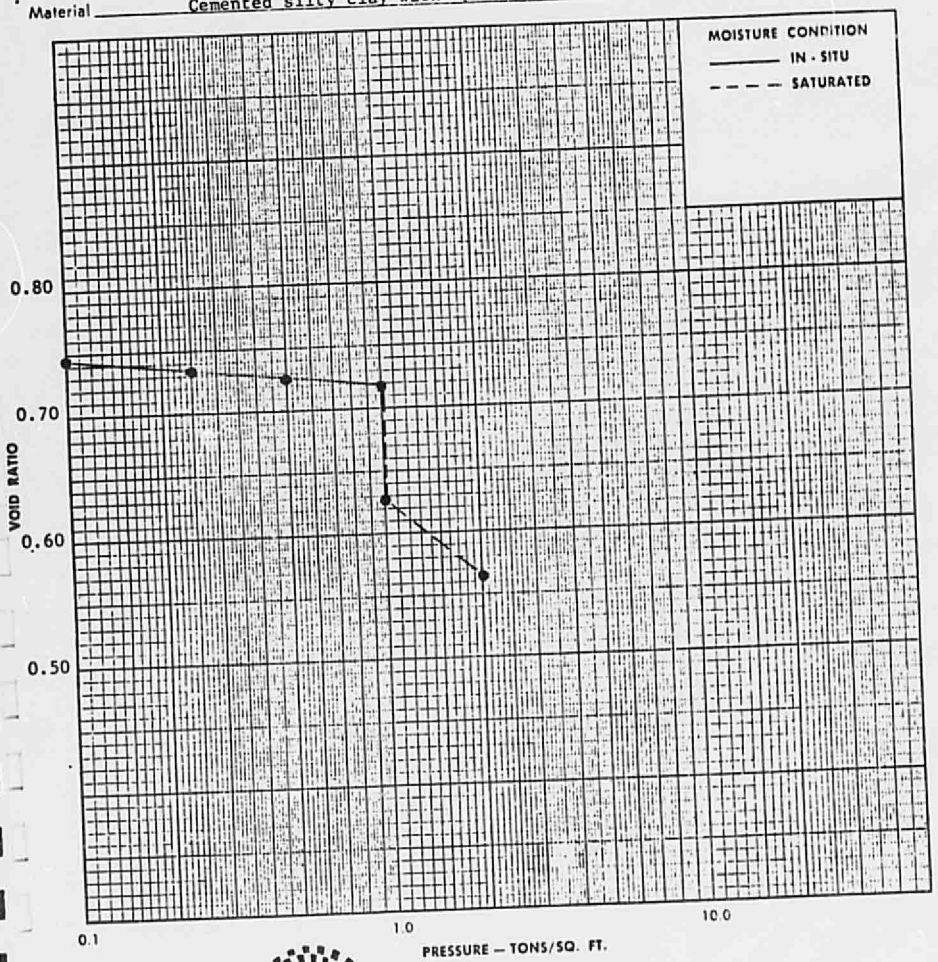
CONSOLIDATION TEST DATA

Lab. No. 3404

Project Westwood Village Location Albuquerque, New Mexico

Source of Sample Test Hole No. 4, Depth 2½ feet

Material Cemented silty clay with "pinholes"



ATL ENGINEERING SERVICES

Lab. No. 3404

SUGGESTED GUIDELINE SPECIFICATIONS
FOR EARTH FILLING AND/OR CUTTING OPERATIONS

(1) Prior to fill placement and grading operations, all areas to receive compacted fill for support of foundations, floor slabs or pavement at the site shall be thoroughly cleared of any trash, any loose fill soils and vegetation that may exist. An inspection or inspections as required will be made by the Soils Engineer and his approval will be given to commence grading and filling operations when the site has been properly cleared.

(2) All building pads where STRUCTURES are planned shall be composed either entirely of natural ground or of compacted, controlled fill. In the building areas where both fill and cut are encountered, the natural ground shall be overcut for a vertical distance of at least 1 foot below finished pad grade. Both the fill and overcut natural ground sections shall be compacted as hereinafter specified.

(3) Prior to placement of compacted fill soils the existing surface of natural ground in filled areas or overcut natural ground sections shall be proof rolled with a 10 ton roller to "seek out" any loose areas; if encountered, loose soil zones should be replaced as engineered compacted as hereinafter specified. The cut ground surface or natural ground shall then be scarified and properly moistened and compacted to a minimum of 90 percent of Modified Proctor Density by A.S.T.M. Method D-1557-70, and for a vertical depth of at least 8 inches. This may require processing of as much as 12 inches to 14 inches of the existing ground and/or cut ground soils.

Ground slopes which are to receive fill and which are steeper than 5 horizontal to 1 vertical shall be stepped or benched prior to fill placement.

(4) Approved fill soils with a Plasticity Index not exceeding 12 shall be those soils available at the site or from a source approved by the Soils Engineer. These soils shall be processed and thoroughly mixed with water outside of areas to be filled until they are within 2% of optimum moisture. They shall then be

spread in horizontal layers not to exceed 8 inches in loose thickness and compacted, using suitable equipment, to a minimum of 95 percent of Modified Proctor Density as determined by A.S.T.M. D-1557-70 (Moisture-Density Relations of Soils Using 10 pound hammer and 18-inch drop).

(5) During construction, low areas shall be protected from excessive water intrusions and the contractor shall have adequate equipment on the project site to promptly remove surface water that might accumulate in areas due to any cause.

(6) The Soils Engineer will provide adequate trained personnel during the construction period to continuously supervise and test all fills as they are placed. This will include "Densities of Soil in Place by the Sand Cone Method" or by Nuclear Methods (A.S.T.M. D-2922). A sufficient number of tests will be made during each day's operation on each lift of fill to insure the Soils Engineer that specification requirements are being adhered to. At least one (1) field density test should be made in each compacted "pad" or controlled fill area beneath "on-grade" floor slab construction. In addition, tests of fill soils should be made at the following rates:

(a) one field density test per each 2000 square yards of subgrade prior to fill placement.

(b) one field density test for each 350 cubic yards of fill placed or each layer of fill for each work area, whichever is greater.

When tests indicate that the density of any layer of fill or portion thereof is below the required density, the particular layer or portion shall be reworked until the required density is obtained.

(7) No fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions. If the work is interrupted by surface water intrusions, fill operations shall not be resumed until the Soils Engineer accepts the moisture content and density of the natural ground or previously placed filled soils.

Lab. No. 3404

(8) The owner shall employ the services of a registered, licensed Soils Engineer to supervise all controlled earthwork. The Soils Engineer shall provide continuous on-site inspection by experienced personnel during construction of controlled earthwork. The Contractor shall notify the Federal Housing Administration at least 2 working days in advance of any field operations on the controlled earthwork, or of any resumption of operations after stoppages. Costs of all tests and inspection(s) shall be the responsibility of the Contractor.

(9) Upon satisfactory completion of grading, the Soils Engineer shall certify that the site was graded and filled with acceptable material in accordance with these specifications and give his professional opinion regarding remaining shrinkage or settlements, the expansive characteristics, slope stability, load bearing qualities, saline or alkaline conditions or any other condition pertinent to construction upon the completed cut or fill.