HYDROLOGY

F22/D18

F22/D18

ACADEMY SQUARE

UNIT 1 PHASE A

1 PLAN

RECEIVED
JUN 17 1980
CITY ENGINEER

DeVILLE, INC.
11109 Towner, N.E.
Albuquerque, New Mexico 87112

June 16, 1980

E21-D8
F21-D10

Mr. Richard Heller
City Engineer
City of Albuquerque
Post Office Box 1293
Albuquerque, New Mexico 87103

RE: Academy Square, Unit 1

Dear Mr. Heller:

This will confirm our recent conference with you in your office at which time we showed you the proposed Amended Development Plan to the referenced property and the proposed Summary Plat dividing the property into Tracts "A", "B", "C", and "D". As you know, the EPC has already approved the proposed Amendment; and you indicated you had no objection to the Summary Plat, however, you wanted it understood that a drainage plan must be prepared and submitted prior to commencement of construction. As we explained, the property is being sold, and the new owners intend to develop this property in accordance with the plan approved by the EPC.

This will confirm that your approval of the Summary Plat is given with the understanding that we will provide to the City a drainage plan prior to commencement of any construction. A copy of this letter is being provided to the purchasers of the property so that they will be aware of this commitment. Please do not hesitate to call me if you have any questions.

Sincerely yours,

Glen Luttrell

GLEN LUTTRELL
President

GL/mf
cc: Rymar Enterprises, Inc.
Mr. Jim Creeden

RSH RSA	ADM
BRO	SUR
CDS	COUN
DES	SEC
INSP	FILE
HYDRO	RETURN

Consultants terrasol inc.

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

August 6, 1980

F21-D10

E21-D8

Mr. Richard Heller, P. E.
City Engineer
Municipal Development Department
Engineering Division
P. O. Box 1293
Albuquerque, New Mexico 87103

RECEIVED
AUG 13 1980
CITY ENGINEER

RE: Academy Square by DeVille, Inc.

Dear Mr. Heller:

In past discussions with you about the above referenced project, you requested that a master drainage concept be prepared to provide overall development harmony between the four tracts of the site, should these tracts be sold to different investors. We are therefore submitting the attached report to serve as a general guideline for future grading and drainage plans. We stress that the submitted report is general in nature in that the actual building details, as to type, size, locations, and parking and landscaping details, will not become fixed entities until the respective developers submit the required SU Site Development Plans to the City for approval. Once that step is taken, final construction details can be prepared following the guidelines established by this report.

We therefore respectfully request that your department review and approve this report as the master guideline for the proposal of Academy Square by DeVille, Inc.

Sincerely,

Christopher L. Weiss

Christopher L. Weiss, P. E.
President

CLW/vw

cc: Glen Luttrell

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

F22 - D18

November 19, 1981

Mr. Chris Weiss
Consultants Terra-Sol
P.O. Box 142
Sandia Park, N.M. 87047

RE: ACADEMY SQUARE PHASE A DRAINAGE REPORT

Dear Chris:

Based on a review of additional drainage information for the referenced site, this office feels that the concerns expressed in the EPC Hydrology Staff Comments have now been adequately addressed. Therefore, we have no objections to approval of the plan.

Very truly yours,

Brian G. Burnett
Civil Engineer/Hydrology

CE/tsl

DRAINAGE REPORT & GRADING PLAN

ACADEMY SQUARE, PHASE A

SEPTEMBER 1981

CHRISTOPHER L. FELLOWS
NEW MEXICO
6053
REGISTERED PROFESSIONAL ENGINEER

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

October 15, 1981

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

RE: Academy Square, Phase A

Dear Mr. Easterling:

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

Thank you.

Respectfully,

Christopher L. Weiss

Christopher L. Weiss, P.E.
President

CLW/vw

Enclosures

DRAINAGE REPORT & GRADING PLAN SEPTEMBER 1981

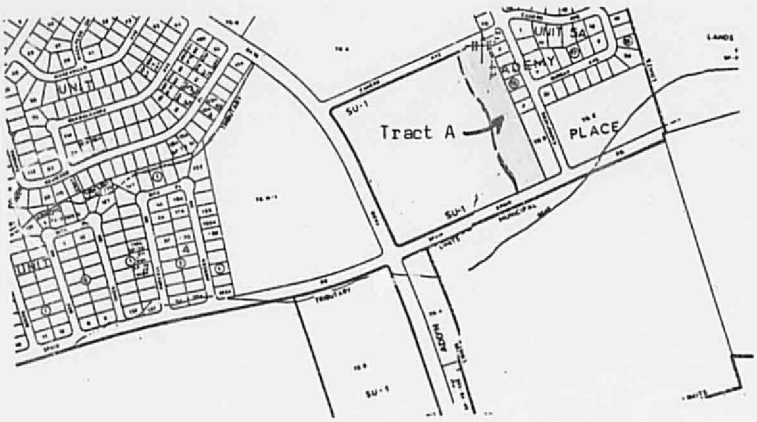
ACADEMY SQUARE, PHASE A

INTRODUCTION

At the request of E. Pike and C. Padilla, a Partnership, Consultants/Terra-Sol, Inc. has investigated the storm drainage for the proposed townhouse complex, known as Academy Square Townhouses, Tract A. This investigation follows the criteria set forth by the City for developments in the NE heights and sets forth recommendations for the developer to follow in order for the site to meet City criteria.

SITE LOCATION

The proposed development (3.5 Acres) is located in the Northeast quadrant of the City at the NE corner of Juan Tabo and Spain Road. It is bounded on the north by Camero Ave. and on the east by an R-1 development, the south by Spain Road and the west by the remaining undeveloped portion of Academy Square, Unit 1.

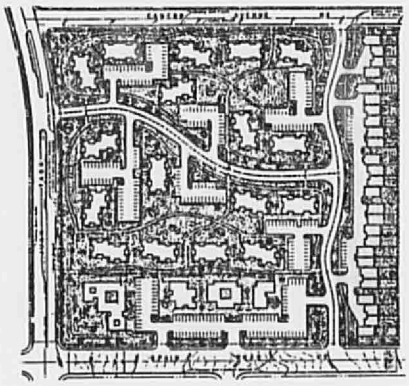


Zone Atlas Page F-21, 22

PROPOSED DEVELOPMENT

Academy Square, Unit 1, is an overall 19 Acre tract that had previously been approved by the EPC for a four tract combination involving townhouses, condominiums and office uses under the SU procedure.

Tract A is the only tract scheduled for development at this time. The development of this tract can be considered Phase 1 and will consist of 26 townhouse units, related street and storm drainage improvements. Lot depths will vary from 130' to 175', with lot widths varying from 30' to 49.25'. Typical structure size will range from 1800 ft.^{2} to 2000 ft.^{2}. Building setbacks will be staggered according to an approved SU site plan.



TOPOGRAPHIC MAP

The topographic map used as a basis for the grading plan is the result of a field survey conducted by Ron Forstbaurer Surveying Co. in August, 1981. This plan represents the site topography as it now exists.

SOILS REPORT

The soil-type from ground surface to limit of borings consist of silty with some slightly clayey sands (SM, some SC) containing pea sized

to somewhat larger, predominantly granitic gravel. Subsoils were generally of a medium dense state with loose to very loose zones at the surface. Specific drainage requires positive surface water drainage around and away from any building, with ponded waters held a minimum of 15' from the foundations.

DRAINAGE/GRADING EXHIBIT

The drainage/grading plan located in the back of this report shows the location of the proposed drainage improvements and the proposed final grades for the site.

EXISTING DRAINAGE

Minor offsite flow from the east is prevented from entering the site by the presence of an R-1 development adjoining the east side of the site. This R-1 area is comprised of Academy Place, Unit 5, which is completed, and Luttrell Subdivision, which presently is in various stages of completion.

In the original Academy Square Unit 1 Drainage Report, by Andrews, Asbury, Roberts, Inc., specific recommendations were made to provide 100 year storm runoff protection from the east. These include 1) the construction of a diversion structure 0.9 miles east of Tramway Blvd. to divert the Bear Arroyo Canyon flows into the Bear Arroyo, 2) the extension of Spain Road (partially completed) to the easterly limits of Academy Place Unit 5 to collect the flows generated by the area east of said subdivision. In conjunction with the Spain Road extension, a temporary diversion ditch was to be completed adjacent to the east boundary of the Luttrell Subdivision to insure that the diverted flows reach Spain Road, rather than draining through the southeast corner of the Academy Square site. When all of these improvements are completed, the Academy Square tract will be completely isolated from offsite flows from the east.

D E V E L O P E D D R A I N A G E

Developed drainage from the Tract A townhouse construction will be routed to three defined detention ponds, with controlled outlets draining these ponds onto London Street, an internal street which will be constructed with this project. This street, in turn, slopes to a low point in the center of the site to discharge its flows at the street intersection of London Street with Paris Street. Paris Street will be completed with the future development of Tracts B and C and will complete the drainage connection between London Street and Juan Tabo Blvd. In the interim, flows from London Street will exit onto the undeveloped portion of Academy Square Unit 1 and will follow its natural drainage patterns to Juan Tabo Blvd.

Other features of drainage pertinent to the Tract A construction are as follows:

1. The structures will not use roof ponding, with all flows draining to the front of each unit for discharge onto the pavement for routing to a pond.

2. Each townhouse backyard will be sloped to the east to provide positive drainage away fom the unit. The rear yard area will be self-ponding and will account for only the rainfall falling directly into the yard.

3. The defined pond areas in the front of the site will be held to a maximum 18" depth and will be incorporated into the landscaped open areas, with maximum side slopes of 2:1, varying to flatter slopes of 5:1 in some areas.

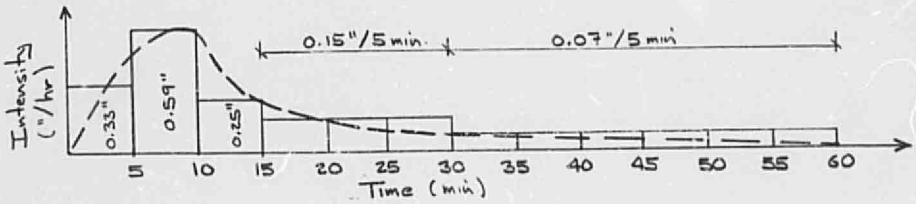
ACADEMY SQUARE, PHASE A SEPTEMBER 1981

D R A I N A G E P O N D C A L C S

Area Pond

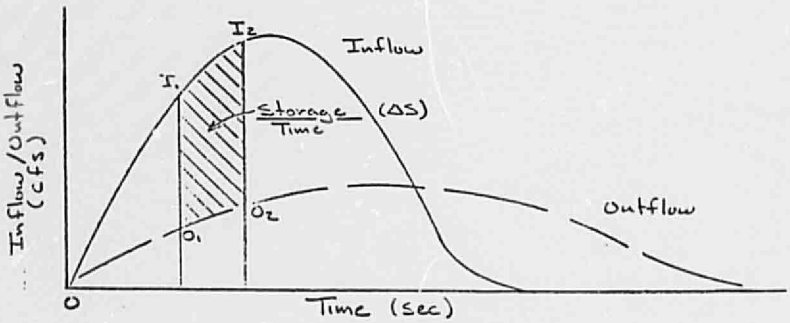
The inflow-outflow hydrograph method used for this report is based on data supplied by the City Engineer's office for new development, using the Rational Method as the model for the rainfall-runoff process.

In particular, the 6 hr.-100 yr. storm of 2.4" was used to form a precipitation profile for a one hour period of the 6 hr.-100 yr. average storm of total "P" for the one hour of 2.05". (This storm was adjusted for the site area of 2.6").



The rationale is that every conceivable storm which results in a total precipitation of 2.05" in one hour is by definition a 100 yr. storm event. This is a sound procedure for designing detention basins capable of intercepting the entire 100 yrs. developed runoff volume, with a Q5 release rate, irregardless of whether the peak intensity occurs at the beginning or toward the end of the storm period. The net result is a more effective detention basin design and use of the affected land.

General Data



Typical Inflow/Outflow Hydrograph

Equations Used

$$\Delta S = \frac{I_1+I_2}{2}\Delta t - \frac{O_1+O_2}{2}\Delta t = S_2 - S_1$$

$$\Delta S = S_2\Delta t - Si\Delta t$$

$$I_1+I_2+A_1 = R_2; \quad \text{where } A_1 = \frac{2S_1}{\Delta t} - O_1$$

$$R_2 = \frac{2S_2}{\Delta t} + O_2$$

$$I = S/\Delta t = \left[\frac{C_1 x P x A_2 x 43,560/12}{\Delta t}\right]$$

Where C_1 = Runoff Coefficient

P = Local Area Precipitation (Inches) = (SE/2.40) Po

Ar = Drainage Basin (Acres)

SE = Local 6 hr.-100 yr. storm event

Po = 1 hr. (hr.-100 yr. average storm) precipitation (Inches)

Runoff to Pond - Area 1/Pond 1

Base Data

Onsite Area = 0.43 Acres

Runoff Coefficient before development = 0.40

Runoff Coefficient after development = 0.81

Q100 Runoff = (0.81)(5.4)(0.43) = 1.9 cfs

Q5 Runoff = (0.40)(2.43)(0.43) = 0.4 cfs (outlet pipe design)

Local Area Precipitation = 2.6"

Total Onsite Developed Volume to be routed through pond =

(2.6/12)(0.81)(0.43) = 3300 $ft.^3$

Pipe Data

Available head = 0.86', maximum Q discharge for head available = 0.39 cfs.

These results obtained by using a 3 1/2" diameter pipe.

Equivalent Area = 9.6 $in.^2$ (Eq. $Q = CAV\overline{2gh}$)

Results (See data sheets in back of report)

Peak Volume stored while outflowing Q5 of 0.39 cfs (maximum achieved for pipe size and head available) = 1603 $ft.^3$ at time interval of 35-50 minutes at a depth in the pond of 0.86 ft.

Outlet Facilities

The pond perimeter will be defined by a landscaped berm, as shown on the grading plan. The pond outlet will consist of 1-3 1/2" diameter pipe with its flowline and elevation 5778.7 to release the entire ponded volume from the area at a peak controlled rate of 0.39 cfs. The maximum volume to be stored temporarily in the pond would equal 1603 $ft.^3$ with a high water elevation of 5779.56 ft.

A 30 ft. section of the pond perimeter berm will act as the spillway area and should a pipe blockage occur during the storm cycle, the erosion of this area will be held to a minimum by the proposed landscaping ground cover, as dictated by the approved SU site plan. The top of this section of the berm will correspond to the depth of the peak volume stored, or elevation 5779.6.

Incorporated into the pond area will be a 20' square by 2' deep gravel sub-basin in the area of the pipe outlet. This basin will capture a volume of 260 $ft.^3$ to help control runoff from landscape watering.

Page # 1

```
*****************************************
*                                       *
*   STORMWATER DETENTION POND DESIGN    *
*          SMALL DRAINAGE AREA          *
*                                       *
*****************************************
```

PROGRAM PARAMETERS

A2 = DRAINAGE BASIN SIZE(ACRES)..... .43
C1 = RUNOFF COEFFICIENT..... .81
C2 = FIRST GEOMETRIC VOLUME COEFFICIENT..... 1374
C3 = SECOND GEOMETRIC VOLUME COEFFICIENT..... 570
C4 = HEAD LOSS COEFFICIENT..... .8
C5 = PRECIPITATION COEFFICIENT..... 1.083
D = DISCHARGE PIPE DIAMETER(FT) in..... 3.5 SK-40
J = INCREMENTAL DEPTH SIZE(FT)..... .1
K = NUMBER OF ROUTING TIME PERIODS..... 15
T = ROUTING TIME(SECS)..... 300
X = DEPTH OF DETENTION POND(FT)..... 1
Z = DRAIN PIPE ELEVATION-EXIT TO ENTRANCE(FT).... 0

PART TWO

CALCULATE ROUTING EQUATION ELEMENTS

T (MIN)	I2 (CFS)	SV (CF)	A1 (CFS)	R2 (CFS)	Q2 (CFS)	WL (FT)
5	0	0	0	0	0	0
10	1.5	143	1	1	.13	.1
15	2.69	714	4	5	.28	.44
20	1.14	1155	8	8	.34	.66
25	.68	1306	9	9	.36	.73
30	.68	1463	9	10	.38	.8
35	.68	1603	10	11	.39	.859999
40	.16	1603	10	11	.39	.859999
45	.31	1603	10	11	.39	.859999
50	.31	1603	10	11	.39	.859999
55	.31	1463	10	10	.38	.8
60	.31	1463	10	10	.38	.8
65	.31	1463	9	10	.38	.8
70	0	1463	9	10	.38	.8
75	0	1306	8	9	.36	.73

POND STORAGE VOLUME @ 1.0' = 1944 ft^3

Runoff to Pond - Area 2/Pond 2

Base Data

Onsite Area = 1.44 Acres

Runoff Coefficient before development = 0.40

Runoff Coefficient after development = 0.80

Q100 Runoff = (0.80)(5.4)(1.44) = 6.2 cfs

Q5 Runoff = (0.40)(2.43)(1.44) = 1.4 cfs (outlet pipe design)

Local Area Precipitation = 2.6'

Total Onsite Developed Volume to be routed through pond =

(2.6/12)(0.80)(1.44) = 10,900 ft.^{3}

Pipe Data

Available head = 1.06', maximum Q discharge for head available = 1.29 cfs. These results obtained by using a 6" diameter pipe.

Equivalent Area = 28.3 in.^{2} (Eq. $Q = CAV\overline{2gh}$)

Results (See data sheets in back of report)

Peak Volume stored while outflowing less than Q5 of 1.29 cfs (maximum achieved for pipe size and head available) = 2527 ft.^{3} at a time interval of 46 minutes at a depth in the pond of 1.06 ft. These results include a sub-basin with a volume of 1782 ft.^{3} which will infiltrate into the ground.

Total Peak Volume stored = 4309 ft.^{3}.

Outlet Facilities

The pond perimeter will be defined by a concrete wall adjacent to the street side of the pond, as shown on the grading plan. The pond outlet will consist of 1-6" diameter pipe with its flowline at elevation 5777.0 to release the entire ponded volume from the area at a peak controlled rate of 1.29 cfs. The maximum volume to be stored temporarily in the pond would equal 2527 ft.^{3} in the surface portion at a high water elevation of 5778.06 ft. for a maximum pond depth of 1.06 ft.

The sub-surface portion of the pond will hold a volume of 1782 ft.^{3} following a geometric configuration of 162'x11'x3' deep, filled with gravel with an effective void ratio of 0.33%. The sub-surface portion of the pond was necessary to account for the total peak volume of 4309 ft.^{3}. Additionally, this sub-basin will also help control runoff from landscape watering and minor storms without releasing flows onto London Street.

The wall along the street side of the pond will act as a spillway along its entire 260' length should a pipe blockage occur during the storm cycle. The top of this wall will correspond to the depth of the peak volume stored, or elevation 5778.06.

POND #2
3rd ITTERATION

```
*****************************************
*                                       *
*   STORMWATER DETENTION POND DESIGN    *
*          SMALL DRAINAGE AREA          *
*                                       *
*****************************************
```

PROGRAM PARAMETERS

A2 = DRAINAGE BASIN SIZE(ACRES).....	1.17	
C1 = RUNOFF COEFFICIENT.....	.8	
C2 = FIRST GEOMETRIC VOLUME COEFFICIENT.....	2228	
C3 = SECOND GEOMETRIC VOLUME COEFFICIENT.....	148	
C4 = HEAD LOSS COEFFICIENT.....	.8	
C5 = PRECIPITATION COEFFICIENT.....	1.083	
D = DISCHARGE PIPE DIAMETER(FT). in.....	6	SIC-40
J = INCREMENTAL DEPTH SIZE(FT).....	.1	
K = NUMBER OF ROUTING TIME PERIODS.....	15	
T = ROUTING TIME(SECS).....	300	
X = DEPTH OF DETENTION POND(FT).....	1.5	
Z = DRAIN PIPE ELEVATION-EXIT TO ENTRANCE(FT)....	0	

PART TWO

CALCULATE ROUTING EQUATION ELEMENTS

T (MIN)		I2 (CFS)	SV (CF)	A1 (CFS)	R2 (CFS)	Q2 (CFS)	WL (FT)
6	11	0	0	0	0	0	0
11	16	0	224	-1	0	.39	.1
16	21	5.76	520	3	4	.6	.23
21	26	3.06	1656	10	12	1.06	.71
26	31	1.83	2075	13	15	1.18	.879999
31	36	1.83	2225	14	16	1.22	.939999
36	41	1.83	2375	15	17	1.26	.999999
41	46	.98	2527	15	18	1.29	1.06
46	51	.85	2375	14	17	1.26	.999999
51	56	.85	2225	14	16	1.22	.939999
56	61	.85	2075	13	15	1.18	.879999
61	66	.85	2075	12	15	1.18	.879999
66	71	.85	1951	12	14	1.14	.83
71	76	0	1803	10	13	1.1	.77
76	81	0	1366	9	10	.96	.59

POND STORAGE VOLUME @ 1.5' = 3675 ft³

SUB-POND STORAGE VOLUME @ -2.0' = 1782 ft³

Runoff to Pond - Area 3/Pond 3

Base Data

Onsite Area = 0.61 Acres

Runoff Coefficient before development = 0.40

Runoff Coefficient after development = 0.81

Q100 Runoff = (0.81)(5.4)(0.61) = 2.7 cfs

Q5 Runoff = (0.40)(2.43)(0.61) = 0.6 cfs (outlet pipe design)

Local Area Precipitation = 2.6

Total Onsite Developed Volume to be routed through pond =

(2.6/12)(0.81)(0.61) = 4700 $ft.^3$

Pipe Data

Available head = 0.98', maximum Q discharge for head available = 0.55 cfs.

These results obtained by using a 4" diameter pipe.

Equivalent Area = 12.6 $in.^2$ (Eq. $Q = CA\sqrt{2gh}$)

Results (See data sheets in back of report)

Peak Volume stored while outflowing less than Q5 of 0.55 cfs (maximum achieved for pipe size and head available) = 2338 $ft.^3$ at time interval of 40-45 minutes at a depth in the pond of 0.98 ft.

Outlet Facilities

The pond perimeter will be defined by a landscaped berm, as shown on the grading plan. The pond outlet will consist of 1-4" diameter pipe with its flowline at elevation 5777.5 to release the entire ponded volume from the area at a peak controlled rate of 0.55 cfs. The maximum volume to be stored temporarily in the pond would equal 2338 $ft.^3$ at a high water elevation of 5778.48 ft.

A 40' section of the pond perimeter berm will act as the spillway area should a pipe blockage occur during the storm cycle. The erosion of this area will be held to a minimum by the proposed landscaping ground cover, as dictated by the approved SU Site Plan. The top of this section of the berm will correspond to the depth of the peak volume stored, or elevation 5778.50.

Incorporated into the pond area will be a 15'x40'x2' deep gravel sub-basin in the area of the pipe outlet. This basin will capture a volume of 400 $ft.^3$ to help control runoff from landscape watering.

POND #5

```
*****************************************
*                                       *
*   STORMWATER DETENTION POND DESIGN    *
*          SMALL DRAINAGE AREA          *
*                                       *
*****************************************
```

PROGRAM PARAMETERS

```
A2 = DRAINAGE BASIN SIZE(ACRES)..................  .61
C1 = RUNOFF COEFFICIENT.                            .81
C2 = FIRST GEOMETRIC VOLUME COEFFICIENT..........  2033
C3 = SECOND GEOMETRIC VOLUME COEFFICIENT.........  360
C4 = HEAD LOSS COEFFICIENT.                         .8
C5 = PRECIPITATION COEFFICIENT...................  1.083
 D = DISCHARGE PIPE DIAMETER(~~FT~~ in ...........  4        SK-40
 J = INCREMENTAL DEPTH SIZE(FT).                    .1
 K = NUMBER OF ROUTING TIME PERIODS...............  15
 T = ROUTING TIME(SECS)...........................  300
 X = DEPTH OF DETENTION POND(FT).                   1.5
 Z = DRAIN PIPE ELEVATION-EXIT TO ENTRANCE(FT)....  0
```

PART TWO

CALCULATE ROUTING EQUATION ELEMENTS

T (MIN)	I2 (CFS)	SV (CF)	A1 (CFS)	R2 (CFS)	Q2 (CFS)	WL (FT)
5	0	0	0	0	0	0
10	2.13	270	1	2	.2	.13
15	3.82	1011	6	7	.37	.46
20	1.61	1727	11	12	.48	.75
25	.97	1882	12	13	.5	.81
30	.97	2041	13	14	.52	.87
35	.97	2175	14	15	.53	.919999
40	.51	2338	15	16	.55	.979999
45	.45	2338	14	16	.55	.979999
50	.45	2175	14	15	.53	.919999
55	.45	2175	14	15	.53	.919999
60	.45	2175	14	15	.53	.919999
65	.45	2175	14	15	.53	.919999
70	0	2041	13	14	.52	.87
75	0	1882	12	13	.5	.81

POND STORAGE VOLUME @ 1.5' = 3859 ft^3

ACADEMY SQUARE, PHASE A SEPTEMBER 1981

RECOMMENDATIONS TO DEVELOPER

1. Grade around each townhouse to provide a positive slope away from the foundation to carry drainage to a) the rear of the back yards, b) discharge/pond points.

2. Scarify the rear yard areas to a minimum 18" depth prior to landscaping to increase the infiltration capabilities of the soil. Keep all scarifying operations a minimum of 15' away from proposed house pads.

3. Construct detention ponds at locations shown on grading plan. Additionally, for:

Area 1: Install 1-3 1/2" pipe at flowline invert 5778.70 for a controlled release point of the pond.

Area 2: Install 1-6" pipe at flowline invert 5777.0 for a controlled release point of the pond.

Area 3: Install 1-4" pipe at flowline invert 5777.5 for a controlled release point of the pond.

4. Landscape pond areas without any plastic liners.

5. Establish a common home owners association as part of the lot sale to be responsible for and provide maintenance of these pond/landscape areas.

6. Provide the City with a drainage covenant agreement for maintenance of the storm drainage facilities, based on City format.

7. Provide the City with completed copies of Special Order #19 for each outlet facility within the public right-of-way.

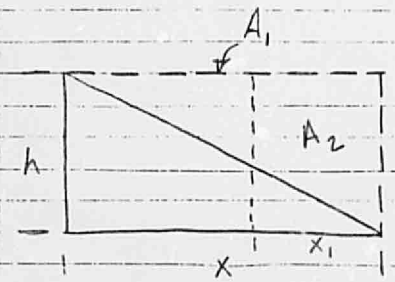
8. Provide a temporary erosion control pad at the intersection of the outlet of Paris Street with London Street to protect the street improvements at the limits of construction. This protection can take the form of broken concrete, angular stone rip-rap, or a concrete pavement surface. An agreement will have to be established between the developer and the City for the developer to provide maintenance of this erosion protection area until the Paris Street improvements are completed to Juan Tabo.

9. Construct gravel sub-basins in each pond area to capture nuisance run-off from landscape watering, to dimensions shown on plan.

C O N C L U S I O N

The proposed drainage plan sets forth requirements to be followed by the developer, E. Pike and C. Padilla, a Partnership, in order to meet the City drainage requirements for the area.

The following pages contain the inflow-outflow data sheets and the soils report.



$A_1 = \frac{1}{2} x h$

$A_2 = x_1 h$

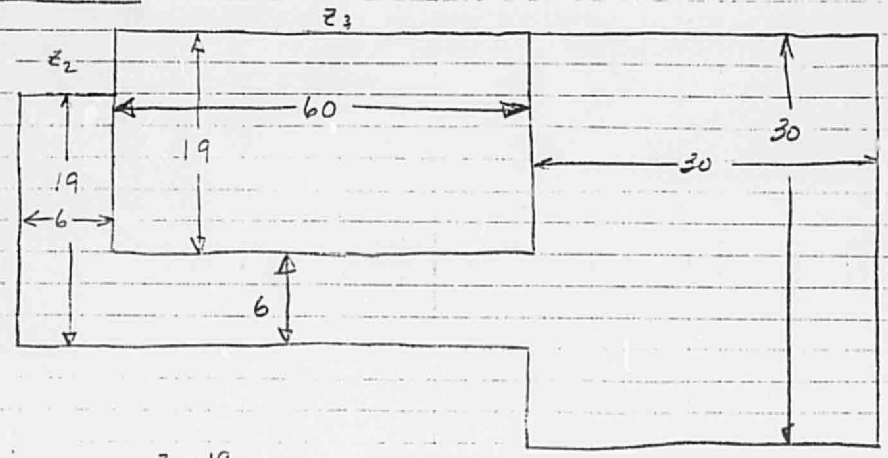
$\frac{x}{h} = z \Rightarrow x = zh \therefore$

$A_1 = \frac{1}{2} z h^2 = A_2 = x_1 h \therefore$

$\frac{1}{2} z h^2 = x_1 h \Rightarrow$

$x_1 = \frac{1}{2} z h$

AREA I POLG



$z_1 = 12 \therefore$
$x_1 = 6h$
$h = 1 \Rightarrow x_1 = 6$

$z_3 = 19$
$x = 19h$

$z_2 = 8$
$x_1 = 4h$
$h = 1 \Rightarrow x_1 = 4$

$$\text{VOLUME} = (6 \cdot 19)h + (6 \cdot 60)h + (30 \cdot 30)h + \tfrac{1}{2}(60 \cdot 19)h^2$$

$$= 1374h + 570h^2$$

Pond "1

$$Q = CA\sqrt{2gh} \quad : \quad h = 1.0,\ C = 0.8,\ Q = 0.4$$

$$A = \frac{Q}{C\sqrt{2gh}} = \frac{0.4}{0.8(64.4)^{1/2}} = 0.06231$$

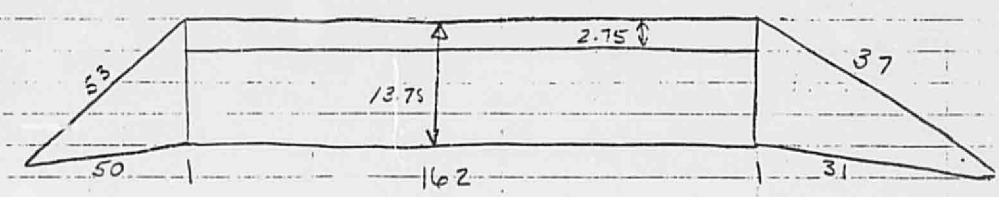
$$= \pi R^2 : \quad R(\text{inches}) = R(\text{ft})\,12\left(\frac{\text{in}}{\text{ft}}\right) \Rightarrow$$

$$D(\text{inches}) = 2R(\text{inches}) = 2 \cdot 12 \cdot R = 24R$$

$$D = 24R = 24\left(\frac{A}{\pi}\right)^{1/2} = 24\left(\frac{0.06231}{\pi}\right)^{1/2} = 3.38 \text{ in}$$

use $3\frac{1}{2}$ pipe.

AREA 2. POND



$$z = \frac{x}{h} = \frac{2.75}{1.50} = 1.83 \quad \therefore \quad x = 1.83h \quad V = \frac{1}{2}xh = \frac{1}{2}(1.83)(162)h^2$$

$$\text{Vol} = (162 \cdot 11)h + \frac{1}{2}(50 \cdot 11)h + \frac{1}{2}(31 \cdot 11)h + \frac{1}{2}(1.83)(162)h^2$$

$$= (1782 + 275 + 171)h + 148h^2$$

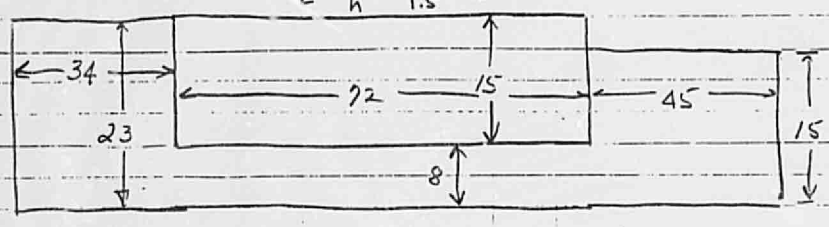
$$= 2228h + 148h^2$$

$$D = 24\left\{\frac{1.4}{.8\pi(64.4 \times 1.5)^{1/2}}\right\}^{1/2} = 5.714$$

try 6.0 inch diameter pipe

AREA 3 POND

$z = \frac{x}{h} = \frac{15}{1.5} = 10$



$$V = (23 \cdot 34)h + (8 \cdot 72)h + (15 \cdot 45)h + \tfrac{1}{2}(10)(72)h^2$$

$$= (782 + 576 + 675)h + 360h^2$$

$$= 2033h + 360h^2$$

Pond #3: $h = 1.5$, $Q = 0.6$, $C = 0.8$

$$D = 24\left\{\frac{0.6}{0.8\pi(64.4 \times 1.5)^{1/2}}\right\}^{1/2} \cong 3.740$$

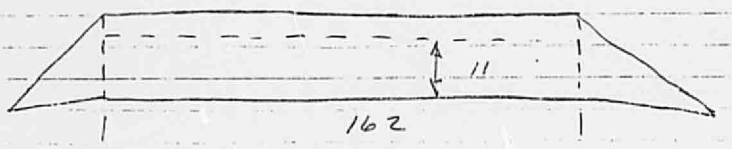
try 4.0 in diameter pipe

Pond #2 undersized

Storage Volume at 1.5' = 3675 ft³
Computer calculations predict
SV = 4711 ft³ @ 1.72 cfs with head of 1.88.

∴ Try a sub-pond storage of 3 times excess + 10%:

1. EXCESS = 4711 − 3675 = 1036 ft³
EXCESS +10% = 1036 + 104 = 1140
3x (EXCESS +10%) = 1140 x 3 = 3420 ft³.



A = 162 x 11 = 1782

V/A = d (sub-pond depth) = 3420/1782 ~ 1.92 ft

Pond #2

```
*****************************************
*                                       *
*   STORMWATER DETENTION POND DESIGN    *
*          SMALL DRAINAGE AREA          *
*                                       *
*****************************************
```

PROGRAM PARAMETERS

A2 = DRAINAGE BASIN SIZE(ACRES)..... 1.44
C1 = RUNOFF COEFFICIENT..... .8
C2 = FIRST GEOMETRIC VOLUME COEFFICIENT..... 2228
C3 = SECOND GEOMETRIC VOLUME COEFFICIENT..... 148
C4 = HEAD LOSS COEFFICIENT..... .8
C5 = PRECIPITATION COEFFICIENT..... 1.083
D = DISCHARGE PIPE DIAMETER(~~FT~~ in)..... 6 SK-40
J = INCREMENTAL DEPTH SIZE(FT)..... .1
K = NUMBER OF ROUTING TIME PERIODS..... 15
T = ROUTING TIME(SECS)..... 300
X = DEPTH OF DETENTION POND(FT)..... 1.5
Z = DRAIN PIPE ELEVATION-EXIT TO ENTRANCE(FT).... 0

PART TWO

CALCULATE ROUTING EQUATION ELEMENTS

T (MIN)	I2 (CFS)	SV (CF)	A1 (CFS)	R2 (CFS)	Q2 (CFS)	WL (FT)
5	0	0	0	0	0	0
10	4.98	520	3	4	.6	.23
15	8.9	2375	15	17	1.26	.999999
20	3.77	3835	24	27	1.57	1.56
25	2.26	4270	27	30	1.65	1.72
30	2.26	4407	28	31	1.67	1.77
35	2.26	4711	29	33	1.72	1.88
40	1.2	4711	29	33	1.72	1.88
45	1.05	4407	28	31	1.67	1.77
50	1.05	4270	27	30	1.65	1.72
55	1.05	4133	26	29	1.62	1.67
60	1.05	3970	25	28	1.59	1.61
65	1.05	3835	24	27	1.57	1.56
70	0	3541	22	25	1.51	1.45
75	0	3094	19	22	1.42	1.28

Pond Storage Volume @ 1.5 ft = 3675 ft^3

FIRST ITERATION

$V = CPA_c\, 43560/12$

$= \{(0.81)(2.05)(1.083)(43560)/12\}\, A_c$

$\doteq 6528\, A_c$

BUT $V = 6528(1.44)$

$= 9400\ ft^3$

$V_1 = V - EXCESS = 9400 - 1036 = 8364$

$V_1 = 6528\, A_c \Rightarrow A_c = \frac{V_1}{6528} = \frac{8364}{6528} = 1.28$

TIME

In each 5 min increment

$V = CPA_c\, 43560/12$
$= (0.81)P_\phi(1.083)(1.44)(43560)/12$
$= 4585\, P_\phi$

1st 5 min $V = 4585(0.33) = 1513\ ft^3$

$\therefore$ Time $= \frac{\text{Excess Volume}}{\text{Volume/5 min}} = \frac{1036}{1513}(5\ min) \doteq 0.68 \Rightarrow$

Time of above sub-storage volume stud $= 0.68 \times 5$
$\doteq 3.4$ mins $\therefore$ use 3 min.

SECOND ITERATION

EXCESS = 3970 − 3675 = 295
3 × EXCESS = 3 × 295 = 885
PLUS 10% = 885 + 89 = 974

depth = $\frac{974}{1782}$ = 0.55

depth, Sub-Pond = 1.92 + 0.55 = 2.47'

VOLUME = 9400 − 1036 − 295
= 8069

$V1 = 6528\,A_c \Rightarrow A_c = \frac{8069}{6528} = 1.24$

TIME = $\frac{1036 - 295}{1518}$ = 0.88

T = 0.88 × 5 = 4.4 t_{rec} 4 mins

A_c = 1.24
N = 4

POL = $\frac{1}{5} \times 0.33 \sim .07$

THIRD ITERATION

Use 3' sub-pond depth

$V = 1782 \times 3 = 5346\ ft^3$

$V/3 = 1782\ ft^3 = V$

$V_1 = 9400 - 1782 = 7618$

$A_c = \frac{7618}{6528} = 1.17$

$T = \frac{1782}{1513} \times 5 = 5.9 \simeq 6$ mins

$A_c = 1.17$
$N = 6$

$P\phi Z = \frac{4}{5} \times .59 = 0.47$ — $\boxed{\text{use this data}}$

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED
ACADEMY SQUARE, UNIT ONE DEVELOPMENT
ALBUQUERQUE, NEW MEXICO
ATL ENGINEERING SERVICES LAB. NO. 3829
JULY 30, 1981

ATL ENGINEERING SERVICES

July 30, 1981

Consultants Terra Sol, Inc.
P. O. Box 142
Sandia Park, New Mexico 87047

Attention: Mr. Chris Weiss

Re: ATL Engineering Services Lab. No. 3829. Geotechnical Investigation for the Proposed Academy Square, Unit One Development in Albuquerque, New Mexico

Gentlemen:

Enclosed is our report for the referenced project. It includes a description of the procedures utilized, the results of field and laboratory tests and recommendations concerning foundation design, concrete slab support and asphaltic concrete for parking areas.

We appreciate the opportunity of working with you on this project. If any questions should arise concerning the report or if we can be of further assistance to you, please contact our office.

Respectfully,

ATL ENGINEERING SERVICES

Nicholas T. Korecki

Nicholas T. Korecki, E.I.T.
Reviewed by:

Robert K. Lloyd

Robert K. Lloyd, P.E.

NTK/ksc

ACADEMY SQUARE, UNIT ONE

INTRODUCTION

The five (5) test borings were drilled on July 27 and 28, 1981 using a Mobile B-56 rotary drill, powered by a Ford Industrial Engine and mounted on a 1969 Dodge 4 x 4 truck. The test holes were advanced "dry" using 6-5/8" O.D. by 3-1/4" I.D. continuous flight, 5-foot sectional hollow stem augers. Standard penetration tests (A.S.T.M. D-1586) 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 standard penetration test provides a measure of the relative density or consistency of the subsurface soils encountered while obtaining samples of the soils for visual inspection and laboratory testing.

LABORATORY TESTING

Soil samples were sealed at the site in watertight containers and returned to the laboratory where they were visually classified according to the Unified Soils Classification System (A.S.T.M. D-2487) by either a Geologist or a Geotechnical Engineer. Representative soil samples were further tested to aid in classification and to determine the engineering properties of the soil. Laboratory tests included moisture content, dry density, grain size classifications and Atterberg Limits Tests. Results of the tests are shown on the Boring Log Graphs in the Appendix.

SITE CONDITIONS

The proposed site lies east of Juan Tabo, N.E. and between Spain Road and Camero Avenue. The ground surface is very uneven and it is anticipated that site preparation will require extensive cutting and/or filling. The site is lower along Spain Road and it appears that the top soil layers have been excavated from this area. In the vicinity of Test Borings 3 and 4 there are two arroyos. The arroyos have been filled "upstream" with the construction of residential units on Carruthers Road. The site is covered with native grass and shrubs and some rubble is scattered throughout, especially in the lower areas.

Soils encountered at the test locations consist of silty with some slightly clayey sands (SM, some SC) containing pea sized to somewhat larger, predominantly granitic

gravel. Boring Log Graphs are shown on Pages A-2 through A-6 in the Appendix. Recovered soil samples were dry and no water bearing stratum was encountered. Subsoils are in a generally medium dense state of relative density with loose to very loose zones at the surface and at the 2½' depth of Test Hole No. 2, the 15' depth of Test Hole No. 1, and between the 5' and 10' depth of Test Hole No. 4. Dense soil conditions were encountered at the 15' depth of Test Hole No. 3. An approximately 4 foot thick mantle of probable man-made fill was encountered at Test Location No. 1.

PROPOSED CONSTRUCTION

It is our understanding that the proposed structures will be one to two story townhouses, without basements, of frame construction and with reinforced concrete slabs on grade. Areas around the units will be paved for parking; the proposed London Street will be paved in accordance with City specifications.

FOUNDATIONS

Due to the loose to very loose soil strata and some man-made fill encountered at several locations and the probable large extent of earth cutting and/or filling to be accomplished at the site, we recommend that all continuous reinforced concrete footings, isolated spot footings, or bottoms of turned down slabs be based on engineered compacted fill. The thickness of fill beneath the footings and lateral distance extending from all footing perimeters should be equal to one half the least dimension of the footing but not less than 1½ feet. Foundations should be based at a minimum depth of 2 feet below the adjacent exterior finished grade. Minimum width of continuous footings should be 1'-4"; least dimension of spot footings should be 2'-0". If turned down slab edges are used as foundations, the design should be such that wall loads are distributed over a sufficient portion of the slab area. Engineered fill should be placed and compacted according to the specifications outlined in the Appendix of this report. Soils for the support of foundations should be compacted to a minimum of 95 percent of Modified Proctor Density. For foundations based as recommended a soil bearing pressure of 2000 pounds per square foot may be used. Full dead plus live loads should be considered when designing the foundations. The soil bearing pressure value may be increased by 30 percent for the combination of dead and live loads plus the effects of seismic and transitory loads.

"ON-GRADE" FLOOR SLABS

All "on-grade" reinforced concrete floor slabs should be based on a minimum 6 inch compacted thickness of either approved on-site cohesionless sands or imported, select fill soils consisting of a pit-run sand and gravel, crushed rock, or similar material having a Plasticity Index not exceeding 6. Prior to placement of select slab fill soils, each building area should be completely stripped of vegetation and the exposed ground scarified to at least 8 inches in depth. Both scarified subgrade and slab fill should be placed and compacted as set forth in the Suggested Guideline Specifications given in the Appendix.

PAVEMENTS

Support for asphaltic concrete pavement may be provided by a well graded crushed gravel and fines base course fill, placed and compacted on a prepared subgrade as outlined in the "Guideline Specifications for Earth Filling and/or Cutting Operations" in the Appendix. Base course fill beneath paving should be compacted to a minimum of 95 percent of Modified Proctor Density.

Pavement sections should conform to the requirements set forth by the City of Albuquerque for residential streets; the following minimum pavement sections, however, are suggested for varying traffic conditions within the development:

Traffic Conditions	Minimum Base Course Thickness	Minimum Total Pavement Thickness (inches)
Light (passenger cars, general parking areas)	4	2
Heavy (medium to heavy duty trucks)	6	3

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

Stability (Marshall - 75 blow briquette)	1500 minimum
Flow (Marshall)	10 to 16
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.

SITE DRAINAGE AND PROTECTION OF FOUNDATION SOILS

It will be important at this site to keep the soils at and below foundation depths protected from moisture intrusions. Some consolidation of the subsurface soils is possible should these soils become wetted or saturated to various degrees. In order to help prevent moisture intrusions into and below foundation soils, 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.
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. Ponding areas, if required, should be established at least 15 feet from structures.

Any changes or deviations from the proposed construction as stated 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. Therfore, 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 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 this 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.

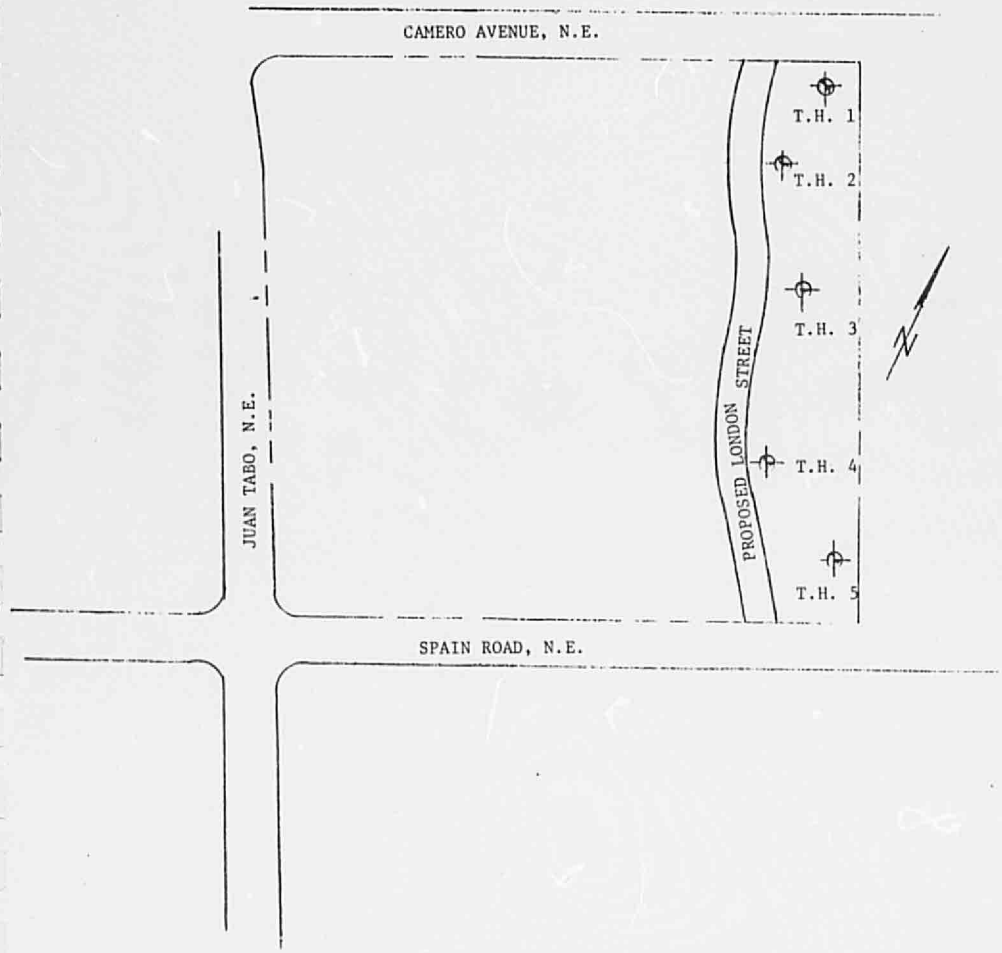
Respectfully submitted,
ATL ENGINEERING SERVICES
Nicholas T. Korecki
Nicholas T. Korecki, E.I.T.
Reviewed by:
Robert K. Lloyd
Robert K. Lloyd, P.E.

APPENDIX

TEST LOCATIONS

ACADEMY SQUARE, UNIT ONE

SCALE: 1"=200'



ENGINEERING SERVICES

PROJECT: Academy Square, Unit One

PAGE: A-2

LAB NO.: 3829

DATE: July 30, 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, silty, brown, with granitic gravel (SM); with concrete pieces. Probable Fill Dense	52	16 26 26		S	4.4							
2½		44	30 19 25		C	2.8	107						
	4'												
5	Sand, brown, silty, with decomposed granite gravel (SM).	48	18 22 26		C	3.8	103						
7½	Dense with a	35	14 13 22		S	4.3							
10	Loose zone at 15' depth.	34	41 20 14		S	4.3							
15		9	6 5 4		S	3.4							
20	Some clayey sand (SM) below 20' depth.	34	10 13 21		S	8.9							

ENGINEERING SERVICES

PROJECT: Academy Square, Unit One

PAGE: A-3

LAB NO.: 3829

DATE: July 30, 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, brown, silty, predominantly fine to medium grained; more coarse grained at 2½' depth; (SM); with pea sized granitic gravel.	12	4 6 6		S	3.6		4	54	42			
2½		7	5 3 4		C	2.4	--	15	58	27	27	19	8
5		34	8 17 17		S	2.2	109	18	74	8			
7½	Medium Dense Very Loose at 2½ depth.	12	8 6 6		S	4.2		6	63	31			
10		20	8 10 10		S	2.6		8	60	32			
15		22	8 9 13		S	4.0		7	63	30			

ENGINEERING SERVICES

PROJECT: Academy Square, Unit One

PAGE: A-4

LAB NO.: 3829

DATE: July 30, 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, brown, silty (SM)	9	3 4 5		S	2.6							
2½	with decomposed granite gravel. Loose at the surface to Medium Dense with depth.	29	4 8 21		C	1.9	--						
5		20	9 9 11		S	3.2							
7½		26	11 13 13		S	4.2							
10		21	10 11 10		S	4.5							
	Dense at 15' depth.												
15		35	12 17 18		S	2.2							

ENGINEERING SERVICES

PROJECT: Academy Square, Unit One

PAGE: A-5

LAB NO.: 3829

DATE: July 30, 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, brown, silty, (SM).	15	5 8 7		S	4.7		4	51	45			
2½	Predominantly fine to medium grained; more coarse grained at 15' depth; with pea sized granitic gravel.	25	8 11 14		S	4.4		3	63	34			
5		3	3 1 2		C	4.1	96	6	73	21			
7½	Generally Medium Dense with a very loose to loose zone between the 5' and 10' depths.	5	7 2 3		S	5.8		7	59	34			
10		9	5 4 5		S	3.1		11	70	19			
15		32	12 18 14		S	2.4		10	80	10			

ENGINEERING SERVICES

PROJECT: Academy Square, Unit One

PAGE: A-6

LAB NO.: 3829

DATE: July 30, 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, brown,	18	8 9 9		S	5.0							
	silty, slightly												
2½	clayey at the	11	11 5 6		C	3.0	109						
	surface (SM, some												
5	SC); with	10	3 4 6		S	2.3							
	pea sized												
7½	granitic gravel.	18	8 8 10		S	4.5							
10	Medium	10	3 4 6		S	2.3							
	Dense												
15		16	9 5 11		S	1.6							

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	

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	

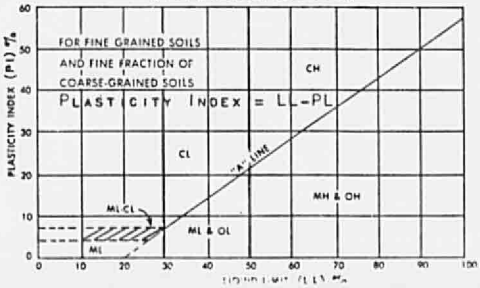
NOTE – Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols.

SOIL FRACTIONS

Component		Size Range
Boulders		Above 12 in.
Cobbles		3 in. to 12 in.
Gravel		3 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	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

(CS, MS, FS: TS)

PLASTICITY CHART
(ATTERBERG LIMITS)



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% 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% of Modified Proctor Density as determined by A.S.T.M. D-1557-70 (Moisture-Density Relations of Soils Usingal0 lb. 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:

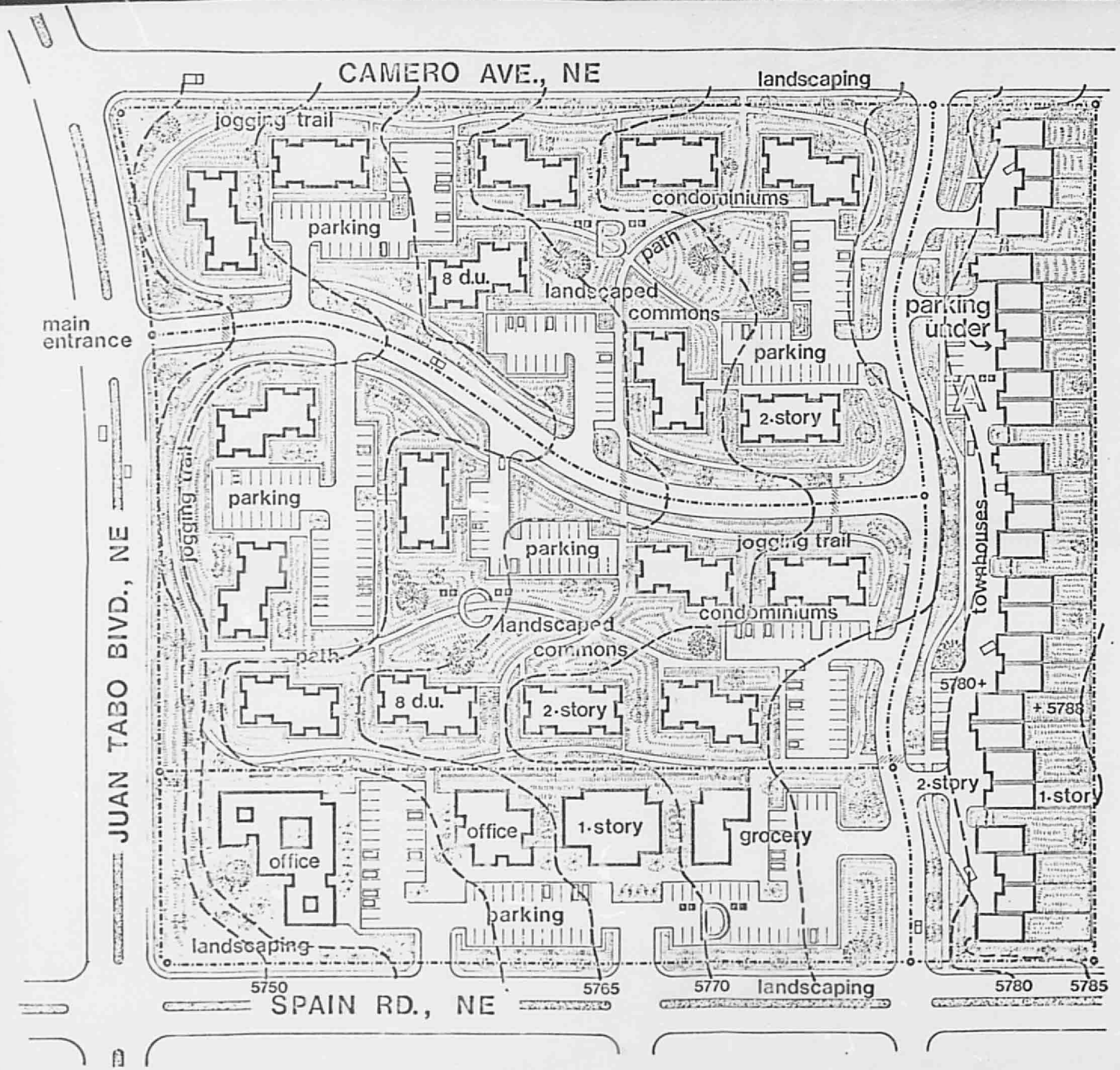
(a) one field density test per each 2000 square yards of subgrade prior to fill placement.

(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 or 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 fill soils.

(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.



ACADEMY SQUARE

DE VILLE, INC.

PROPOSED PLAN

TRACT "A"
26 townhouses - 3.5 acres

TRACT "B"
64 condo units - 6.4 acres

TRACT "C"
72 condo units - 6.5 acres

TOTAL: - 162 d.u., 16.4 acs.
DENSITY: - 9.88 d.u. / acre
PARKING: - 272 spaces

TRACT "D"
professional offices & convenience grocery 3.5 acs.

50 25 0 50 100
scale feet

Berent Groth, architect-planner

F22/D18

THIS MICROIMAGE IS THE BEST POSSIBLE REPRODUCTION DUE TO THE POOR QUALITY OF THE ORIGINAL DOCUMENT

1019