HYDROLOGY E19/D15A TWO PLAN

E 19-D 15A

2 PLANS

Boyle Engineering Corporation

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

ENGINEERING OFFICE
RECEIVED
MAR 20 1980
RECEIVED
INSPECTOR

March 17, 1980

Mr. Fred Aguirre
Assistant City Hydrology Engineer
City of Albuquerque
PO Box 1293
Albuquerque, New Mexico 87103

E19-D15a

RE: NORTH TOWNE OFFICE PARK
DRAINAGE REPORT (MASTER PLAN)
JOB NO. K-D02-109-51

Dear Mr. Aguirre:

As per our conversation this morning, transmitted herewith are three (3) copies each of the amended grading plan and drainage plan for subject project. Please replace the grading and drainage plans contained in the three copies previously submitted (logged into your office March 10, 1980) with the amended copies of this submittal.

If you have any questions, please do not hesitate to call.

Yours truly,

BOYLE ENGINEERING CORPORATION

John A Segotta

John A. Segotta
Assistant Civil Engineer

JAS:pdn
Enclosures: a/s

Boyle Engineering Corporation

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

April 7, 1980

E19-015a

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

RE: Drainage Report for North Towne Office Park
Job Number K-D02-109-51

Dear Mr. Aguirre,

In response to your comments by letter of March 28, 1980, the following information is submitted in order to clarify problem areas noted for the above project:

1. Although t_c's determined from the nomographs do not agree exactly, I submit that they are of sufficient accuracy for design.

2. Attached are calculations which indicate that the outflow from the 3" drains is less than Q_5 undeveloped, thus complying with the "Interim Drainage Guidelines" November 1979.

3. Attached is the revised grading plan with spot elevations shown along the east side of the buildings at the curb line. These spot elevations show that runoff will drain out of parking areas and not pond against the curbs.

4. Combined ponding area 4A and 4C is shown incorrectly. On the attached revised grading plan it is shown correctly. The pond has a sodded sideslope of 3:1 from the property line with no vertical drop as indicated in your comment # 4.

5. Flow through the curb cuts into the ponding areas will not create erosion problems as all ponding areas will be completely sodded.

By this submittal it is anticipated that the referenced drainage report will meet with your approval. Your immediate response to this material will be appreciated.

BOYLE ENGINEERING CORPORATION

John A. Segotta

John A. Segotta
Assistant Civil Engineer

JAS:crm
encl:

Calculations to determine outflow from 3" drains provided from ponding areas

1. According to "Interim Drainage Guidelines" November 1979, the outflow to a street or public storm system shall be at the rate of Q_5 undeveloped.

2. Determination of Concentration Time (t_c) and Intensity (I), from: Figure H - Overland Flow Time and Figure J - Values of I, Rainfall Intensity - Duration - Page 18-01
Data Book For Civil Engineers: Design, by Elwyn Seelye.

3. From Hydrologic Data for City of Albuquerque, the 6-hour rainfall to be expected once in 5 years is 1.25 inches.

DRAINAGE AREA # 1

Area = 1.42 Acres
C = 0.4 (Undeveloped)
t_c = 16.8 minutes (from report)
I = 2.9 in./hr.

Rate of Flow, Q_5 = CIA

$Q_5 = 0.40\ (2.90)\ (1.42) = 1.65$ cfs

Capacity of 3" Drain:

$A = \pi r^2 = \pi(\frac{1.5}{12})^2 = 0.0491\ ft^2$

$S = \frac{98.50 - 96.23}{26} = 0.0873\ \ s^{\frac{1}{2}} = 0.2955$

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

$Q = \frac{1.486}{0.013}\ (0.0491)\ (\frac{0.0491}{0.7854})^{2/3}\ \ (0.2955)$

$= 1.6585\ (0.1575)$

Q = 0.26 cfs less than 1.65 cfs ok

DRAINAGE AREA # 2

Area = 1.70 Acres
C = 0.4 (Undeveloped)
t_c = 15.0 minutes (from report)
I = 3.2 in./hr.
Q_5 = 0.40 (3.20) (1.70) = 2.18 cfs

Capacity of 3" Drain:

$A = 0.0491 \text{ ft.}^2$

$S = \frac{7.0-6.3}{26} = 0.0269 \qquad S^{\frac{1}{2}} = 0.1640$

$Q = \frac{1.486}{0.013} (0.0491) (0.1575) (0.1640)$

Q = 0.15 cfs less than 2.18 cfs ok

DRAINAGE AREA #3

Area = 0.96 Acres
C = 0.4 (Undeveloped)
t_c = 13.8 minutes (from report)

I = 3.25 in./hr.
$Q_5 = 0.40 (3.25) (0.96) = 1.25$ cfs

Capacity of 3" Drain(Pond 3C):

$A = 0.0491 \text{ ft.}^2$

$S = \frac{9.5-9.3}{10} = 0.0200 \qquad S^{\frac{1}{2}} = 0.1414$

$Q = \frac{1.486}{0.013} (0.0491) (0.1575) (0.1414)$

Q = 0.13 cfs less than 1.25 cfs ok

Capacity of 3" Drain (pond 3D):

$\text{Area} = 0.0491 \text{ ft}^2$

$S = \frac{8.5-8.3}{10} = 0.0200$

Q = 0.13 cfs less than 1.25 cfs ok

DRAINAGE AREA #4

Area = 0.78 Acres
C = 0.4 (Undeveloped)
t_c = 13.3 minutes (from report)
I = 3.35 in./hr.
$Q_5 = 0.40 (3.35) (0.78) = 1.05$ cfs

Capacity of 3" Drain (Pond 4A & C):

$\text{Area} = 0.0491 \text{ ft}^2$

$S = \frac{99.5-98.2}{18} = 0.0722$

$S^{\frac{1}{2}} = 0.2687$

$Q = \frac{1.486}{0.013}$ (0.0491) (0.1575) (0.2687)

Q = 0.24 cfs less than 1.05 cfs ok

Capacity of 3" Drain (Pond 4B):

Area = 0.0491 ft^2

$S = \frac{99.5-98.6}{18} = 0.0500$

$S^{\frac{1}{2}} = 0.2236$

$Q = \frac{1.486}{0.013}$ (0.0491) (0.1575) (0.2236)

Q = 0.20 cfs less than 1.05 cfs ok

DRAINAGE AREA # 5

Area = 1.18 acres
C = 0.4 (Undeveloped)
t_c = 15.0 minutes (from report)
I = 3.2 in./hr.
Q_5 = 0.40 (3.20) (1.18) = 1.51 cfs

Capacity of 3" Drain

A = 0.0491 ft^2

$S = \frac{5400.5-5400.0}{25} = 0.0200$

$S^{\frac{1}{2}} = 0.1414$

$Q = \frac{1.486}{0.013}$ (0.0491) (0.1575) (0.1414)

Q = 0.13 cfs less than 1.51 cfs ok

City of • Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 29, 1980

John A. Segotta
Boyle Engineering Corp.
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

Reference: North Towne Office Park

Dear Mr. Segotta:

I have reviewed the revised plan for the referenced project, and the drainage plan submitted is approved in concept.

The construction plan for each individual site will have to contain a detailed grading plan with an acceptable configuration of the ponding areas, a clear indication of the conveyance of the flow from the buildings to the ponding areas and from the ponding areas to the street.

The temporary means required to control the outside flows before the adjacent parcels are developed must also be indicated. This approval is contingent upon concurrence by Mr. Heller, of the treatment and the timing for the construction of Cuebro Dr. adjacent to this parcel.

Very truly yours,

Bruno Conegliano
Assistant City Engineer/Hydrology

BC/lc
xc: Richard Leonard, AMAFCA
Richard Heller, City Engineer

C29-201 — C29-201

E19-15a

CHAVEZ GRIEVES / CONSULTING ENGINEERS, INC.
6121 INDIAN SCHOOL RD., N.E. SUITE 120
ALBUQUERQUE, N.M. 87110
PH. (505) 881-7376

RECEIVED
OCT 26 1981
CITY ENGINEER

LETTER OF TRANSMITTAL

TO: Mr. Brian Burnett
City Engineer's Office
P. O. Box 1293
Albuquerque, N.M. 87103

DATE: October 23, 1981
JOB NO. D01-107-50
RE: North Towne Plaza
Bldg. #3 Drainage

GENTLEMEN:

We are sending you X ATTACHED ___ UNDER SEPARATE COVER the following items:

__ SHOP DRAWINGS __ CHANGE ORDER __ SPECIFICATIONS
X COPY OF LETTER __ PLANS __ _____
__ PRINTS __ SAMPLES

COPIES	DATE	NO.	DESCRIPTION
1	10/20/81		Letter from Sergent, Hauskins & Beckwith

THESE ARE TRANSMITTED as checked below:

__ FOR APPROVAL
__ FOR YOUR USE
__ AS REQUESTED
__ FOR REVIEW AND COMMENT
__ APPROVED AS SUBMITTED
__ APPROVED AS NOTED
__ RETURNED FOR CORRECTIONS
__ RESUBMIT ___ COPIES FOR APPROVAL
__ SUBMIT ___ COPIES FOR DISTRIBUTION
__ RETURN ___ CORRECTED PRINTS
__ PRINTS RETURNED AFTER LOAN TO US
__ FOR BIDS DUE _____ 19___
X Addition to our 10/9/81 Letter.

REMARKS:

COPY TO: _____

SIGNED: Victor J Chavez

If enclosures are not as noted, kindly notify us at once.

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E. NORMAN H. WETZ, P.E. WAYNE A. ERICSON P.E. JOHN B. HAUSKINS, P.E. DALE V. BEDENKOP, P.E. ROBERT L. FREW GEORGE H. BECKWITH, P.E. ROBERT R. KOONS, P.E. DONALD G. METZGER, P.G. ROBERT D. BOOTH, P.E. ROBERT W. CROSBLEY, P.E. RALPH E. WEEKS, P.G.

October 20, 1981

Dale Bellamah Corporation
6400 Uptown Boulevard, N.E.
Albuquerque, New Mexico 87110

SHB Job No. E77-1013
Addendum No. 2

Attention: Mr. George Rainhart

Re: North Town Plaza
Academy & Wyoming, N.E.
Albuquerque, New Mexico

Gentlemen:

In accordance with the request of Mr. Victor J. Chavez, P.E., with Chavez-Grieves Engineers, we have reviewed our original soil and foundation investigation report on the referenced project relative to ponding in the vicinity of the structures. It is understood that site grading for the North Town Professional Park, Building No. 3, will be such that small ponding areas will be located on the north and west of the structure, approximately 15 and 5 feet from its perimeter, respectively. These ponding areas will primarily impound runoff from the roof of the structure. In addition, the ponding areas are designed to drain in a relatively short period of time.

It was recommended in our original report that positive drainage away from the structures be provided and maintained. However, in view of the relatively small quantity

REPLY TO: 4700 LINCOLN ROAD, N.E., ALBUQUERQUE, NEW MEXICO 87109

PHOENIX (602) 272-6848 ALBUQUERQUE (505) 884-0950 SANTA FE (505) 471-7836

of water involved and short retention time, it is our opinion that the structure will perform satisfactorily with the ponding areas as designed.

This addendum should be attached to the original report and made a part thereof. Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Robert D. Booth
Robert D. Booth

ROBERT D. BOOTH NEW MEXICO 5711 REGISTERED PROFESSIONAL ENGINEER

Copies: Addressee (1)
North Town Development Company (1)
De La Torre-Rainhart, P.A., Architects (2)
Chavez-Grieves Engineers (1)

ACADEMY CLINIC SITE, NORTH TOWNE OFFICE PARK

(LOVELACE MEDICAL CENTER, 7901-2 ACADEMY BLVD., N.E.)

DRAINAGE BALANCE CALCULATIONS

January 15, 1982

$V = C A P$

P = 6-hr. precipitation for 100-yr. storm
= 2.5 in

C = coefficient of runoff
= 0.4 undeveloped
= 0.9 developed

Areas Draining to North Pond

Designation	Area (ft^2)	C	V (ft^3)	
I	11,140	0.9	2,089	
II	14,540	0.4	1,211	
SUBTOTAL			3,300	
Capacity of North Pond			2,336	
				964 ft^3 overflow

Area draining to South Pond

III	32,400	0.9	6,075	
Capacity of South Pond			3,050	
				3,025 ft^3 overflow

Areas not draining to either pond

IV	2,640	0.4	220
V	8,080	0.9	1,515
VI	5,280	0.4	440
SUBTOTAL			2,175

TCTAL Unponded flow from developed site: 6,164 ft^3

Existing runoff from undeveloped site: 6,171 ft^3
(Ref.: March 1980, Master Drainage Report)



Boyle Engineering Corporation

consulting engineers

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

505 / 883-7700

January 18, 1982

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

Attn: Mr. Fred Aguirre, Hydrology Engineer

RE: Academy Clinic Site, North Towne Office Park, Bldg., No. 2
(Lovelace Medical Center, 7901-2 Academy Blvd., N.E.)

Dear Mr. Aguirre:

The following items are discussed in response to your drainage comments on your CONSTRUCTION PLAN CHECKLIST dated 11/24/81. These items are furnished on behalf of our client, Stevens, Mallory, Pearl & Campbell.

Item 16 — Internal contributory drainage areas are outlined on the enclosed reduced site plan. These areas conform to the proposed grading plan. The two pond volumes are compared to total volume of flows entering these ponds from their respective areas. The enclosed calculations show that the ponds have sufficient capacity to limit the offsite drainage to a value less than the historic pre-development condition.

Item 28 — Pond volume calculations are provided for the "balance" investigation described above. In the case of free-form pond shapes, volumes are computed by the contour method using end areas measured by polar planimeter.

100-year water surface elevations are marked on the reduced site plan.

Item 22 — Calculations for the outflow from the 3" pond bottom drains were provided to your office on April 7, 1980, by our late collegue, John Segotta. A copy of his letter is attached for your information. Although there are slight differences in pipe slopes between the original Master Drainage Plan and the SMPC Site Plan, the capacity of the 3" pipes is still an order-of-magnitude below the Q5 undeveloped flow. Also the 3" pipes will drain the ponds in less than 24 hours as noted on pages 1 and 3 of our Master Plan.

Sincerely,

BOYLE ENGINEERING CORPORATION

Thornton D. Schwenk

Thornton D. Schwenk, P.E.
Senior Civil Engineer

TDS:cc



STEVENS, MALLORY, PEARL & CAMPBELL, P.A.
ARCHITECTS
115 AMHERST DRIVE, S.E. ALBUQUERQUE, NEW MEXICO 87106 505 255-8668

January 22, 1982

Mr. Fred Aguirre
City of Albuquerque
Code Administration Division - Hydrology
123 Central Avenue, N.W.
Albuquerque, N.W.

Subject: Academy Clinic
North Towne Office Park - Building No. 2
7801-2 Academy Blvd., N.E.
Albuquerque, New Mexico

Dear Fred:

Transmitted are two copies of Sheet A-1 for the subject project, revision 3, dated January 20, 1982; 1 copy of survey of Tract D-4 for subject project; and a letter from Thornton Schwenk, Boyle Engineers, dated January 18, 1982, with supporting information and calculations relating to Drainage Design for the subject project.

We trust this information will meet with your approval.

Sincerely,

R A Moraga

Robert A. Moraga

RAM/lk

Enclosure

DONALD P. STEVENS A.I.A.
ROBERT G. MALLORY A.I.A.
GEORGE CLAYTON PEARL F.A.I.A.
C. ROBERT CAMPBELL A.I.A.

Boyle Engineering Corporation
Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

LETTER OF TRANSMITTAL

TO: City of Albuquerque
Post Office Box 1293
Albuquerque, New Mexico 87103

DATE: February 9, 1982

RE: ACADEMY CLINIC POND DRAINAGE

ATTN: Fred Aguirre

B.E.C. PROJECT No. AL-S01-193-02

GENTLEMEN:
We are sending you: ☒ Attached ☐ Under separate cover via _____
the following items:

- ☐ Shop Drawings
- ☒ Design calculations
- ☐ Tracings
- ☐ Prints
- ☐ Details
- ☐ _____
- ☐ Addendum
- ☐ Copy of letter
- ☐ Specifications
- ☐ Schedules
- ☐ Descriptive Literature

copies	date	No.	description
1	2/9/82		Q_5 Discharge rates and pipe sizes

These are transmitted as checked below:

- ☐ For approval
- ☐ Approved as submitted
- ☐ Approved as noted
- ☐ Returned for corrections
- ☒ As Requested
- ☐ _____
- ☐ For Bids due _____ 19____
- ☐ Prints returned after loan to us
- ☐ Resubmit _____ copies for approval
- ☐ Return _____ corrected prints
- ☒ For your use
- ☒ For review and comment
- ☐ _____ copies for distribution

REMARKS: _____

Copies also sent to: Bob Moraga, SMPC

RECEIVED
FEB 17 1982
PARKS & RECREATION DEPARTMENT

From: Thorton Schwenk
Thorton Schwenk, P.E.
Senior Civil Engineer

ACADEMY CLINIC SITE, NORTH TOWNE OFFICE PARK
(LOVELACE MEDICAL CENTER, 7901-2 ACADEMY BLVD., N.E.)

PIPE SIZES FOR Q_5 POSITIVE DISCHARGE FROM PONDS

February 9, 1982

EXISTING CONDITIONS (At the time of March 1980, Master Drainage Plan)

Area, A = 74,052 sq. ft. = 1.70 Acres
Flow distance = 370 ft.

Average slope = (5022-5006) ÷ 370 = 0.0432 = 4.32%

Time of Concentration, t_c = 15 min

(Ref: Fig. H, p. 18-01, Data Book for Civil Engineers: Design, Elwyn Seele, for Poor Grass Surface (undeveloped))

Intensity, $I_5 = \frac{80}{t_c + 10} = 3.2$ in./hr.

$Q_5 = CIA = 0.4\ (3.2)(1.7) = 2.2$ cfs

DEVELOPED CONDITIONS

Determine Discharge Rates, Q_o, from North and South Detention Ponds and discharge pipe sizes.

(Ref. "A Simple Method for Retention Basin Design", Yrjanainen, G. and Warren, A. W., Water and Sewage Works, Dec. 1973)

Determine a value of Q_o in the following equations such that $V_s \leq$ Volume of detention pond.

$$T = -25 + \sqrt{7087\ \frac{CA}{Q_o}}$$

$$V_s = 11{,}340\ \frac{CAT}{T+25} - 40Q_oT \leq V \text{ pond}$$

Areas Draining to North Pond

Designation	A	C	CA
I	11,140	0.9	10,026
II	14,540	0.4	5,816
	25,680 sq. ft. = 0.59 Acres		15,842

$$C_{avg} = \frac{15{,}842}{25{,}680} = 0.617$$

For Q_o = 0.26 cfs, (determined by iteration)

$$T = -25 + \sqrt{7087(0.617)(0.59)/\ 0.26} = 74.6 \text{ min}$$

$$V_s = \frac{11{,}340\ (0.617)(0.59)(74.6)}{(74.6 + 25)} - 40(0.26)(74.6) = 2316 \text{ cu. ft.} < 2336 \text{ cu. ft.}$$

for 18" water depth in North Pond

Select a drainage pipe from the orifice formula which will yield Q_o = 0.26 under a head of 1.5 ft., with a coefficient of discharge C = 0.80 (Ref. p.21-30, Standard Handbook for Civil Engineers, 2nd Ed., Merritt, 1976)

$$A = \frac{Q}{c\sqrt{2gh}} = \frac{0.26}{0.8\sqrt{(2)(32.2)(1.5)}} = 0.033 \text{ sq. ft.} = 4.75 \text{ sq. in.}$$

D = 2.46 in Use D = 3-in diameter pipe

Area Draining to South Pond

A = 32,400 sq. ft. = 0.744 Acres

C = 0.9

For Q_o = 1.05 cfs, (determined by iteration)

$$T = -25 + \sqrt{7085(0.9)(0.744)/1.05} = 42.2 \text{ min}$$

$$V_s = \frac{11{,}340(0.9)(0.744)(42.2)}{(42.2 + 25)} - 40(1.05)(42.2) = 2996 \text{ cu. ft.} < 3050 \text{ cu. ft.}$$

for 18" water depth in South Pond

$$A = \frac{1.05}{0.8\sqrt{(2)(32.2)(1.5)}} = 0.134 \text{ sq. ft.} = 19.3 \text{ sq. in.}$$

D = 4.96 in Use D = 6-in diameter pipe



For Q_o = 0.26 cfs, (determined by iteration)

$T = -25 + \sqrt{7087(0.617)(0.59)/\ 0.26}$ = 74.6 min

$V_s = \frac{11{,}340\ (0.617)(0.59)(74.6)}{(74.6 + 25)} - 40(0.26)(74.6) = 2316$ cu. ft. < 2336 cu. ft.

for 18" water depth in North Pond

Select a drainage pipe from the orifice formula which will yield Q_o = 0.26 under a head of 1.5 ft., with a coefficient of discharge C = 0.80 (Ref. p.21-30, Standard Handbook for Civil Engineers, 2nd Ed., Merritt, 1976)

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D = 2.46 in Use D = 3-in diameter pipe

Area Draining to South Pond

A = 32,400 sq. ft. = 0.744 Acres

C = 0.9

For Q_o = 1.05 cfs, (determined by iteration)

$T = -25 + \sqrt{7085(0.9)(0.744)/1.05}$ = 42.2 min

$V_s = \frac{11{,}340(0.9)(0.744)(42.2)}{(42.2 + 25)} - 40(1.05)(42.2) = 2996$ cu. ft. < 3050 cu. ft.

for 18" water depth in South Pond

$A = \frac{1.05}{0.8\sqrt{(2)(32.2)(1.5)}}$ = 0.134 sq. ft. = 19.3 sq. in.

D = 4.96 in Use D = 6-in diameter pipe

REGISTERED PROFESSIONAL ENGINEER STATE OF NEW MEXICO No. 4739 THORNTON D. SCHWENK

For Q_o = 0.26 cfs, (determined by iteration)

$$T = -25 + \sqrt{7087(0.617)(0.59)/\ 0.26} = 74.6 \text{ min}$$

$$V_s = \frac{11{,}340\ (0.617)(0.59)(74.6)}{(74.6 + 25)} - 40(0.26)(74.6) = 2316 \text{ cu. ft.} < 2336 \text{ cu. ft.}$$

for 18" water depth in North Pond

Select a drainage pipe from the orifice formula which will yield Q_o = 0.26 under a head of 1.5 ft., with a coefficient of discharge C = 0.80 (Ref. p.21-30, Standard Handbook for Civil Engineers, 2nd Ed., Merritt, 1976)

$$A = \frac{Q}{c\sqrt{2gh}} = \frac{0.26}{0.8\sqrt{(2)(32.2)(1.5)}} = 0.033 \text{ sq. ft.} = 4.75 \text{ sq. in.}$$

D = 2.46 in Use D = 3-in diameter pipe

Area Draining to South Pond

A = 32,400 sq. ft. = 0.744 Acres

C = 0.9

For Q_o = 1.05 cfs, (determined by iteration)

$$T = -25 + \sqrt{7085(0.9)(0.744)/1.05} = 42.2 \text{ min}$$

$$V_s = \frac{11{,}340(0.9)(0.744)(42.2)}{(42.2 + 25)} - 40(1.05)(42.2) = 2996 \text{ cu. ft.} < 3050 \text{ cu. ft.}$$

for 18" water depth in South Pond

$$A = \frac{1.05}{0.8\sqrt{(2)(32.2)(1.5)}} = 0.134 \text{ sq. ft.} = 19.3 \text{ sq. in.}$$

D = 4.96 in Use D = 6-in diameter pipe



NORTH TOWNE OFFICE PARK

DRAINAGE REPORT (MASTER PLAN)

RECEIVED
MAR 10 1980
CITY ENGINEER

I. PURPOSE:

This report presents data relating to storm runoff from a 6.04 acre tract of land located at the Northeast Intersection of Academy Road and Cubero Drive. This tract is being developed for use as an office park by the Dale Bellamah Corporation in Albuquerque, New Mexico (See Vicinity Map in the Appendix).

II. SCOPE:

The analysis presented herein deals with the determination of the amount of runoff from the proposed development prior to and subsequent to development based on a 2.5" (100 year) rainfall. The peak off-site runoff of the developed site shall not be in excess of the pre-development peak runoff rates. Excess runoff created by the proposed development will be ponded on-site. These ponds will be designed to drain over a 24 hour period to Cubero Drive and Academy Road.

III. LOCATION:

The area to be developed is a 6.04 acre portion of Parcel 5, Tract B of the North Towne Shopping Center. The property is bounded on the North by the remaining undeveloped 1.38 acres of Parcel 5, on the West by Cubero Drive, on the East by the developed portion of the North Towne Shopping Center, and faces South on Academy Road (See Location Map in Appendix).

IV. EXISTING DRAINAGE CONDITIONS:

The site is composed of decomposed granite soils, sparsely vegetated with native grasses. The present drainage is characterized by overland sheet flow east to west into Cubero Drive. The drainage on Cubero Drive follows

the grade of the street to Academy Road.

The elevation of the site is 5422 at the high point and 5398 at the low point. The slope is east to west at approximately 4.08%.

No offsite drainage will enter onto the proposed development. Drainage from the developed portion of the North Towne Shopping Center (East side) is prevented from entering the property by a 6-inch header curb abutting the east property line. The grade of the private drive running parallel with the header curb also directs drainage away from the property. Drainage from the undeveloped parcel to the North follows natural drainage patterns West to Cubero Drive and away from the development. Drainage on Cubero Drive and Academy Road is prevented from entering onto the property by standard curb and gutter and/or the design grade of the respective areas.

V. PROPOSED DRAINAGE PLANS:

A. CRITERIA

1) General: Standards and Policies being followed by the City of Albuquerque, New Mexico.

2) Project Storm: 100 year intensity; frequency duration as shown by the curves of Chart 1, "1963 Master Plan of Drainage for the City of Albuquerque and Environs" as prepared by Gordon Herkenhoff and Associates, Inc., Consulting Engineers.

B. FLOOD PROTECTION

1) Existing Condition: Flow from contiguous properties is minimal to non-existent. The site is not in danger of flooding during a 100-year storm.

2) Future Conditions: There will be five office buildings (proposed) covering approximately 17% of the entire site, paved parking - 60%, and landscaped area - 23% (See attached Site Layout and Grading Plan).

C. SITE DRAINAGE

As shown on the attached site plan, the general pattern of the existing topography will not have to be altered significantly in order to

achieve the desirable development. The historic drainage pattern will remain the same as before development. The site will be divided into five separate drainage areas. The intent is to make the drainage plan compatible with the developers plan to develop the site in phases. Each phase will consist of the construction of an office building and its related site. Periods of time will elapse between phases of construction, thereby creating the need for separate drainage plans for each phase of the development.

Onsite ponds will be provided in each drainage area and will reduce offsite drainage below the historic pre-development condition. The ponded water will be disposed of over a 24 hour period onto Cubero Drive and Academy Road and also by evaporation and percolation. Roof drains will be required to drain by downspouts or internal piping into areas designated as shown on the attached plot of drainage areas. (See Drainage Area Plan in Appendix.)

VI. SUMMARY:

Prior to the development of this site, 21,925 cubic feet of runoff was released as offsite drainage to Cubero Drive and then following grade to Academy Road. Subsequent to development and implementation of the proposed drainage plan, the volume of runoff released as offsite drainage to Cubero Drive and Academy Road will be 21,130 cubic feet. Drainage conditions will be improved after development by reducing runoff released offsite by 795 cubic feet.

VII. CONCLUSIONS AND RECOMMENDATIONS

On the basis of the study performed herein, the following recommendations are proposed:

1) Maintain the historic drainage pattern.
2) Provide ponding areas as shown on the attached Drainage Plan.
3) Provide roof drainage, to drain the total roof areas into the designated drainage areas and ponding areas. (See Drainage Plan)

4) Grade the site as shown on the attached Grading Plan.

5) Provide 3" drains from Ponding Areas onto Cubero Drive and Academy Road as shown in detail on the Drainage Plan.

6) Provide interim drainage improvements (if required) during phase construction. The first phase of construction will consist of Drainage Area 1 only.

Provided the above listed recommendations are implemented prior to or concurrent with the development of the property, it is concluded that the proposed development will not create a flood hazard to surrounding properties, nor will the property itself be in danger of flooding.

Respectfully submitted,
BOYLE ENGINEERING CORPORATION

Theodore C. Hogsett, PE
Senior Civil Engineer

TCH:pdn

APPENDIX

DRAINAGE REPORT

I. DRAINAGE AREA #1

AREA = 1.42 Acres = 61,855 sq. ft.

LENGTH = 365 ft.

AVERAGE SLOPE = $\frac{106 - 98}{365}$ = 0.0219 2.19%

A. EXISTING CONDITIONS

1) Determination of Concentration Time, tc

Undeveloped Ground - Poor Grass

From: Figure H - Overland Flow Time - Page 18-01
Data Book for Civil Engineers: Design, by Elwyn Seelye

tc = 16.8 minutes

2) Determination of Intensity:

For 100-year storm - from Master Plan of Drainage, City of Albuquerque, New Mexico - 1963 Chart I, by Herkenhoff & Associates.

Intensity, $I = \frac{189}{tc + 25} = \frac{189}{16.8 + 25} = 4.52$ in./hr.

3) Determination of Runoff for 100-Year Storm:

Rate of Flow, $Q_{100} = CIA$

Where C = Coefficient of Runoff
A = Area in Acres
I = Intensity

$Q_{100} = 0.4\ (4.52)\ (1.42) = 2.57$ cfs

Volume of Runoff, V_{100} = (A, sq. ft.) (C) (Rainfall in inches)

(61,855) (0.4) (2.5/12) = 5,155 cu.ft.

B. CONDITION AFTER DEVELOPMENT

1) Runoff For Proposed Development:

Rate of Flow = CIA

Q_{100} = [(0.9) (5.96) (1.10)] + [(0.4) (4.02) (.31)] = 6.40cfs

Volume of Runoff

$V_{100} = [0.9 \times \frac{2.5}{12} \times 48{,}114] + [0.4 \times \frac{2.5}{12} \times 13{,}741] = 10{,}166$cu.ft.

Change in Runoff Due to Development

	Proposed		Existing		
Change Q =	6.40	-	2.57	=	3.83 cfs
Change V =	10,166	-	5,155	=	5,011 cu.ft.

2) Pond Characteristics

Pond	Volume	Surface Area
1A	5,437 cu.ft.	5,000 sq. ft.
TOTAL	5,437 cu.ft.	5,000 sq. ft.

3) Areas Draining Into Ponds

Volume Runoff From Roof = 1,763 cu. ft.

Pond 1A has a total volume greater than V_{100} from roof.

Therefore, all runoff from the roof is ponded.

Volume Runoff from Paved and Landscaped Areas = 8,403 cu. ft.

Pond 1A 3,674 cu. ft. (partially filled)

3,674 cu. ft.

100-Year storm runoff exceeds pond capacity by 8,403 - 3674 = 4,729 cu. ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
5,155 cu. ft.	4,729 cu. ft.

Developed Condition less than existing condition, therefore all right.

II. DRAINAGE AREA #2

AREA = 1.70 Acres = 74,052 sq. ft.

LENGTH = 370 ft.

AVERAGE SLOPE = $\frac{22 - 6}{370}$ = 0.0432 4.32%

A. Existing Condition

1) Determination of Concentration:

tc = 15.0 min. (reference Area #1)

2) Determination of Intensity:

$$I = \frac{189}{tc + 25} = \frac{189}{115 + 25} = 4.72 \text{ in./hr.}$$

3) Determination of Runoff for 100-Year Storm

Rate of Flow, Q_{100} = CIA

= (0.4) (4.72) (1.70) = 3.21 cfs

Volume of Runoff - =

$$V_{100} = (74,052)\ (0.4)\ \left(\frac{2.5}{12}\right) = 6,171 \text{ cu. ft.}$$

B. Condition After Development

1) Runoff For Proposed Development

Rate of Flow = CIA

$$Q_{100} = [\ (0.9)\ (6.09)\ (1.24)] + [(0.4)(4.23)(0.46)] = 7.58 \text{ cfs}$$

Volume of Runoff

$$V_{100} = \left[0.9 \times \frac{2.5}{12} \times 54,128\right] + \left[0.4 \times \frac{2.5}{12} \times 19,924\right] = 11,809 \text{ cu. ft.}$$

Change in Runoff due to Development

	Proposed		Existing	
Change Q =	7.58	-	3.21	= 4.37 cfs
Change V =	11,809	-	6,171	= 5,638 cu. ft.

2) Pond Characteristics

Pond	Volume	Surface Area
2A	1,883 cu. ft.	1,575 sq. ft.
2B	3,485 cu. ft.	2,800 sq. ft.
2C	302 cu. ft.	450 sq. ft.
Total	5,660 cu. ft.	4,825 sq. ft.

3) Areas Draining Into Ponds

Volume Runoff from Roof = 2,067 cu. ft.

Ponds 2A & 2C have total volume greater than V_{100} from roof.

Therefore, all runoff from the roof is ponded.

Volume runoff from paved and landscaped areas = 9,742 cu. ft.

Pond 2A	118 cu. ft. (partially filled)
Pond 2B	3,485 cu. ft.
Pond 2C	Filled
	3,603 cu. ft.

100 Year storm runoff exceeds pond capacity by

9,742 - 3,603 = 6,139 cu. ft. to offsite drainage

4) Runoff From Site After Development

Existing Condition	Developed Condition
6,171 cu. ft.	6,139 cu. ft.

Developed condition less than existing condition, therefore, all right.

III. DRAINAGE AREA #3

AREA = 0.96 Acres = 41,818 sq. ft.

LENGTH = 275 ft.

AVERAGE SLOPE = $\frac{18 - 8}{275}$ = 0.364 3.64%

A. Existing Condition

1) Determination of Concentration Time, tc:

tc = 13.8 minutes (reference - Area #1)

2) Determination of Intensity:

$I = \frac{189}{tc + 25} = \frac{189}{13.8 + 25} = 4.87$ in./hr.

3) Determination of Runoff for 100-Year Storm:

Rate of Flow, Q_{100} = (0.4) (4.87) (0.96) = 1.87 cfs

Volume of Runoff -

$V_{100} = (41,818)\ (0.4)\ \left(\frac{2.5}{12}\right) = 3,485$ cu. ft.

B. Condition After Development

1) Runoff for Proposed Development

Rate of Flow = CIA

Q_{100} = [(0.9)(6.19)(0.73)] + [(0.4)(4.44)(0.23)] = 4.47 cfs

Volume of Runoff

V_{100} = [0.9 x $\frac{2.5}{12}$ x 31,982] + [0.4 x $\frac{2.5}{12}$ x 9836] = 6,816 cu.ft.

Change in Runoff Due to Development

	Proposed		Existing		
Change Q =	4.47	-	1.87	=	2.60 cfs
Change V =	6,816	-	3,485	=	3,331 cu. ft.

2) Pond Characteristics

Pond	Volume	Surface Area
3A	500 cu.ft.	430 sq. ft.
3B	764 cu.ft.	650 sq. ft.
3C	983 cu.ft.	1200 sq. ft.
3D	1,2o4 cu.ft.	864 sq. ft.
TOTAL	3,511 cu.ft.	3,144 sq. ft.

3) Areas Draining Into Pond

Volume Runoff From Roof = 1,574 cu.ft.

Ponds 3A, 3B & 3D have total volume greater than V_{100} from roof (2528 $ft.^3$ 1574 $ft.^3$), therefore, all runoff from the roof is ponded.

Volume of runoff from paved and landscaped areas = 5,242 cu.ft.

Pond 3C	983 cu. ft.
Pond 3D	954 cu. ft. (Partially filled)
	1,937 cu. ft.

100 Year storm runoff exceeds pond capacity by 5242-1937 = 3305 cu.ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
3,485 cu.ft.	3,305 cu.ft.

Developed condition less than existing condition, therefore, all right.

IV. DRAINAGE AREA #4

AREA = 0.78 Acres = 33,977 sq. ft.

LENGTH = 280 ft.

AVERAGE SLOPE = $\frac{10 - 0}{280}$ = 0.0357 3.57%

A. Existing Condition

1) Determination of Concentration Time, tc:

tc = 13.3 minutes (reference - Area #1)

2) Determination of Intensity:

$$I = \frac{189}{tc + 25} = \frac{189}{13.3 + 25} = 4.93 \text{ in./hr.}$$

3) Determination of Runoff For 100-Year Storm

Rate of Flow; Q_{100} = (0.4)(4.93)(0.78) = 1.54 cfs

Volume of Runoff

$$V_{100} = (0.4)\left(\frac{2.5}{12}\right)(33,977) = 2,831 \text{ cu.ft.}$$

B. Condition After Development

1) Runoff For Proposed Development

Rate of Flow = ICA

$$Q_{100} = [(0.9)(6.09)(0.67)] + [(0.4)(4.41)(0.11)] = 3.87 \text{ cfs}$$

Volume of Runoff

$$V_{100} = [0.9 \times \frac{2.5}{12} \times 29,185] + [0.4 \times \frac{2.5}{12} \times 4,792] = 5,872 \text{ cu.ft.}$$

Change in Runoff Due to Development

		Proposed		Existing	
Change Q	=	3.87	-	1.54	= 2.33 cfs
Change V	=	5,872	-	2,831	= 3,041 cu.ft.

2) Pond Characteristics

Pond	Volume	Surface Area
4A	1,219 cu.ft.	1,200 sq.ft.
4B	1,220 cu.ft.	870 sq.ft.
4C	644 cu.ft.	550 sq.ft.
TOTAL	3,083 cu.ft.	2,620 sq.ft.

3) Areas Draining Into Pond:

Volume Runoff From Roof = 1,485 cu.ft.

Ponds 4A & 4C have total volume greater than V_{100} from roof.

Therefore, all runoff from the roof is ponded.

Volume of Runoff From Paved and Landscaped Areas = 4,387 cu.ft.

Pond 4A	Filled
Pond 4B	1,220 cu.ft.
Pond 4C	378 cu.ft. (partially filled)
	1,598 cu.ft.

100 Year Storm runoff exceeds pond capacity by 4,387-1,598=2,789 cu.ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
2,831 cu. ft.	2,789 cu. ft.

Developed Condition less than Existing Condition, therefore, all right.

V. DRAINAGE AREA #5

AREA = 1.18 Acres = 51,400 sq. ft.

LENGTH = 370 ft.

AVERAGE SLOPE = $\frac{16 - 1}{370}$ = 0.0405 4.05%

A. Existing Condition

1) Determination of Concentration Time, tc:

tc = 15.0 minutes (reference - Area #1)

2) Determination of Intensity:

$I = \frac{189}{tc + 25} = \frac{189}{15 + 25} = 4.72$ in./hr.

3) Determination of Runoff For 100 Year Storm:

Rate of Flow, Q_{100} = (0.4)(4.72)(1.18) = 2.23 cfs

Volume of Runoff

$$V_{100} = (0.4)\left(\frac{2.5}{12}\right)(51,400) = 4,283 \text{ cu.ft.}$$

B. Condition After Development

1) Runoff For Proposed Development

Rate of Flow = CIA

$$Q_{100} = [(0.9)(6.10)(0.88)] + [(0.4)(4.30)(0.30)] = 5.35 \text{ cfs}$$

Volume of Runoff

$$V_{100} = [0.9 \times \frac{2.5}{12} \times 38{,}194] + [0.4 \times \frac{2.5}{12} \times 13{,}207] = 8{,}262 \text{ cu.ft.}$$

Change in Runoff Due to Development

		Proposed		Existing		
Change Q	=	5.35	-	2.23	=	3.12 cfs
Change V	=	8,262	-	4,283	=	3,979 cu.ft.

2) Pond Characteristics

Pond	Volume	Surface Area
5A	355 cu.ft.	390 sq. ft.
5B	3,739 cu.ft.	2,850 sq. ft.
TOTAL	4,094 cu.ft.	3,240 sq. ft.

3) Areas Draining Into Ponds

Volume Runoff From Roof = 1,582 cu.ft.

Ponds 5A & 5B have volume greater than V_{100} from roof. Therefore, all runoff from the roof is ponded.

Volume of Runoff From Paved & landscaped areas = 6,680 cu.ft.

Pond 5A	Filled
Pond 5B	2,512 (partially filled)
	2,512 cu. ft.

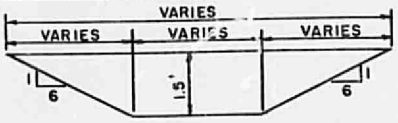
100-Year Storm Runoff exceeds pond capacity by 6,680-2,512= 4,168 cu.ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
4,283 cu.ft.	4,168 cu.ft.

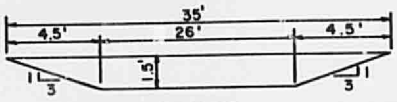
Developed condition less than existing condition, therefore, all right.

DRAINAGE AREA 1

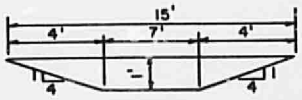


POND 1A L=140'
V=5437ft.^{3}

DRAINAGE AREA 2

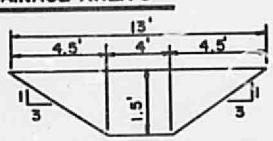


POND 2A & 2B 2A: L=45'
V=1883 ft.^{3}
2B: L=80'
V=3485ft.^{3}

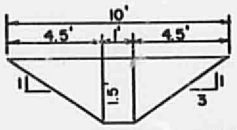


POND 2C L=30'
V=302ft.^{3}

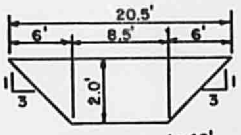
DRAINAGE AREA 3



POND 3A & 3B 3A: L=43'
V=500ft.^{3}
3B: L=65'
V=764ft.^{3}

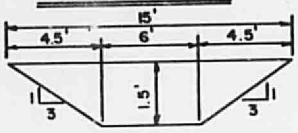


POND 3C L=120'
V=983ft.^{3}

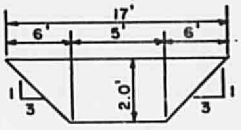


POND 3D L=48'
V=1264ft.^{3}

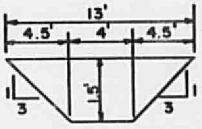
DRAINAGE AREA 4



POND 4A L=80'
V=1219ft.^{3}

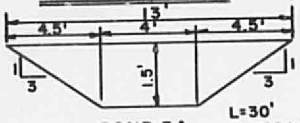


POND 4B L=58'
V=1220ft.^{3}

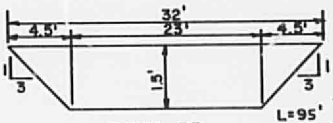


POND 4C. L=55'
V=644ft.^{3}

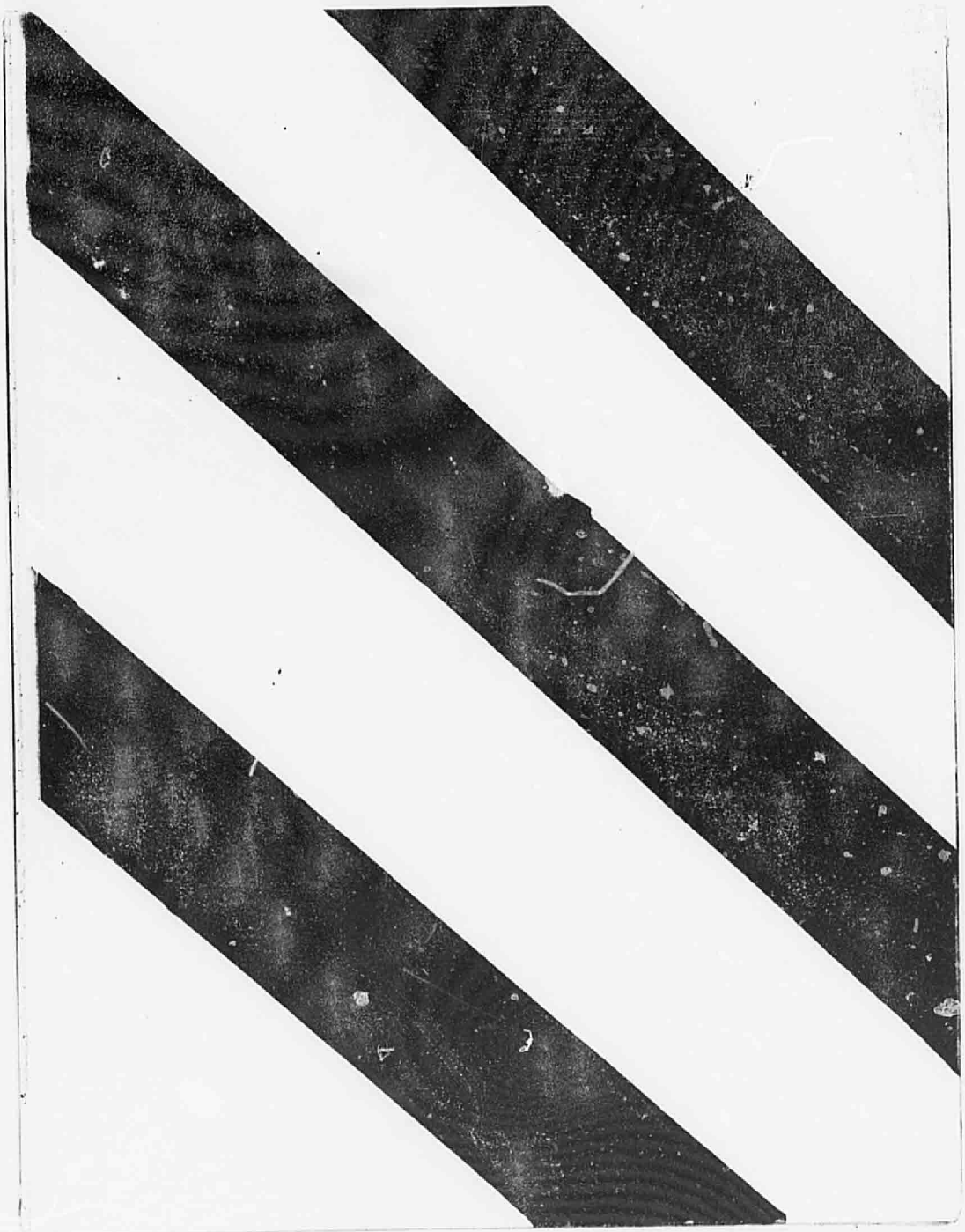
DRAINAGE AREA 5



POND 5A L=30'
V=355ft.^{3}



POND 5B L=95'
V=3739ft.^{3}



HYDROLOGY E19/D16 1 of 2 5 PLANS

E19/D15

5 Plans

eh ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

SUBJECT OFFSITE CALCS

SPANOS

SHEET 1 OF ___ BY BL
DATE 2-29 CK BY ___

RECEIVED
DEC 17 1986
HYDROLOGY SECTION

DOWNSTREAM CAPACITY:

1. DRAINAGE BASIN AREA = 317 Ac^t
   OVERLAND FLOW VIA STREETS TO TRANSVERSE INLET w/ 84" RCP TO BEAR, WITH OVERFLOW AND RUNDOWN.

2. DETERMINE t_c

   $\Delta H = 310'$

   $L = 11{,}200'$

   $S = 0.0277$

   $$t_c = 0.0078 \frac{(11200)^{0.77}}{(0.0277)^{.385}} = 40.7 \Rightarrow 41 \text{ min.}$$

3. CHECK VELOCITY

   $$V = \frac{L}{t_c(60)} = \frac{11200}{41(60)} = 4.6 \text{ FPS}$$

   ACCEPTABLE RANGE, t_c ok

4. INTENSITY

   $P_{100} = 2.3"$ $\quad i_{100} = 2.37"/hr.$

   $P_{10} = 1.5"$ $\quad i_{10} = 1.56"/hr.$

5. SOILS

TYPE	% TOTAL	GROUP
EtC	85	B
TgB	10	B
EmB	5	B

6. LAND USE

TYPE	% IMP	'C'	% TOTAL
UNDEV.	0	~~0.54~~ 0.65	23
GOLF COURSE	0	~~0.54~~ 0.25	22
RESIDENTIAL	45	0.55	51
COMMERCIAL	90	0.86	4

7. 'C' FACTOR

(0.25)(22)+(0.65)(23)

COMPOSITE 'C' = $[(.3\cancel{4})45 + (.55)51 + (.86)4]/100$

$= \cancel{0.47}$

$C = 0.52$

8. DISCHARGE

$Q_{100} = \cancel{0.47}\ 0.52\,(2.37)(317) = \cancel{353}\ 391$ CFS

$Q_{10} = \cancel{272}\ 257$ CFS

ESPEY, HUSTON & ASSOCIATES INC.
Engineering & Environmental Consultants

SUBJECT OFFSITE CAPACITY

SPANOS

SHEET 3 OF ____ BY ____
DATE ____ CK BY ____

9. STREET CAPACITY (ACADEMY)

S = 0.02

WIDTH = 86'

PLATE 22.3 D-4

LET d = 0.67' (TOP CURB)

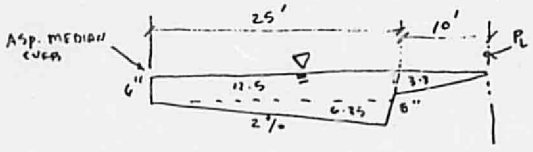
Q_{MAY} = 95 CFS

d = 0.87'

Q = 210 CFS

d = 1.0' (PL)

Q = BY MANNING



A = 22.05 SF
P = 36.17'
R = 0.61
n = 0.017
Q = 196 CFS (½ ST.)

Q_T = 392 CFS
Q_{100} = ~~383~~ 391 CFS
Q_{10} = ~~282~~ 257 CFS

⇒ WATER WILL STAY WITHIN R.O.W.

d_{100} > 0.87'
d_{10} > 0.50'
} VIOLATES DRAINAGE ORDINANCE

HYDROGRAPH COMPUTATION WORKSHEET

DATE 12/10/86
COMPUTED BY JSM
CHECK BY _____

"OFF SITE" DEVELOPED CONDITION

PROJECT Northtown Shopping Ctr.

LOCATION Academy & Inlets

ANALYSIS POINT # 1

(DR. AREA) A = 317-24 = 293 ACRES

T_c 41 MIN

POINT RAINFALL 2.3 IN. FROM PLATE 22.2 D-1

CN = ~ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ~ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ~ MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{45.4A}{T_p}$ = ~ CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = _____ CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

i = 2.37
A = 293
C = 0.52
Q = 361 cfs

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1	4.1	.03	10.8
3	.2	8.2	.10	36.1
4	.3	12.3	.190	68.6
5	.4	16.4	.310	111.9
6	.5	20.2	.470	169.7
7	.6	24.6	.660	238.3
8	.7	28.7	.820	296.0
9	.8	32.8	.930	335.7
10	.9	36.9	.990	357.4
11	1.0	41.0	1.00	361.0
12	1.1	45.1	.990	357.4
13	1.2	49.2	.930	335.7
14	1.3	53.3	.860	310.5
15	1.4	57.4	.780	281.6
16	1.5	61.5	.680	245.5
17	1.6	65.6	.560	202.2
18	1.7	69.7	.460	166.1
19	1.8	73.8	.390	140.8
20	1.9	77.9	.330	119.1
21	2.0	82.0	.280	101.1
22	2.2	90.2	.207	74.7
23	2.4	98.4	.147	53.1
24	2.6	106.6	.107	38.6
25	2.8	114.8	.077	27.8
26	3.0	123.0	.055	19.9
27	3.2	131.2	.040	14.4
28	3.4	139.4	.029	10.5
29	3.6	147.6	.021	7.6
30	3.8	155.8	.015	5.4
31	4.0	164.0	.011	4.0
32	4.5	184.5	.005	1.8
33	5.0	205.0	.000	0

RECEIVED
DEC 19 1986
HYDROLOGY SECTION

PLATE 22.2 F-1

HYDROGRAPH COMPUTATION WORKSHEET

DATE 12/10/86
COMPUTED BY JWH
CHECK BY

EXISTING ON-SITE CONDITION (POND)

PROJECT Northtown Shopping Center

LOCATION Academy & Inlets

ANALYSIS POINT # 1

(DR. AREA) A = 24 ACRES

T_c 21.5 MIN

POINT RAINFALL 2.3 IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF 59.7

(R X q_p) = Q_{peak} = 9.6 controlled CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)	t	Q
1	0	0	0	0		
2	.1	2.2	.03	1.8	4.1	5.6
3	.2	4.3	.10	6.0		
4	.3	6.5	.190	9.6	8.2	9.6
5	.4	8.6	.310	9.6		
6	.5	10.8	.470	9.6	12.3	9.6
7	.6	12.9	.660	9.6		
8	.7	15.1	.820	9.6	16.4	9.6
9	.8	17.2	.930	9.6		
10	.9	19.4	.990	9.6	20.2	9.6
11	1.0	21.5	1.00	9.6		
12	1.1	23.7	.990	9.6	24.6	9.6
13	1.2	25.8	.930	9.6		
14	1.3	28.0	.860	9.6	28.9	9.6
15	1.4	30.1	.780	9.6		
16	1.5	32.3	.680	9.6	32.8	9.6
17	1.6	34.4	.560	9.6		
18	1.7	36.6	.460	9.6	36.9	9.6
19	1.8	38.7	.390	9.6		
20	1.9	40.9	.330	9.6	41.0	9.6
21	2.0	43.0	.280	9.6	45.1	9.6
22	2.2	47.3	.207	9.6	49.2	9.6
23	2.4	51.6	.147	9.6	53.3	9.6
24	2.6	55.9	.107	9.6	57.4	9.6
25	2.8	60.2	.077	9.6	61.5	9.6
26	3.0	64.5	.055	9.6	65.6	9.6
27	3.2	68.8	.040	9.6	69.7	9.6
28	3.4	73.1	.029	9.6	73.8	9.6
29	3.6	77.4	.021	9.6	77.9	9.6
30	3.8	81.7	.015	9.6	82.0	9.6
31	4.0	86.0	.011	9.6	90.2	9.6
32	4.5	96.8	.005	9.6	98.4	9.6
33	5.0	107.5	.000	9.6	1060	9.6

E-H $V = 4.6$ f/s

$T_c \Rightarrow 4.6 \frac{ft}{sec} \times \frac{60 sec}{min} \times \frac{1}{5928 ft}$

$T_c = 21.5$ min

Time to drain pond:

$9.6 \frac{ft^3}{sec} \times \frac{1}{200376 ft^3} \times \frac{60 sec}{min} \Rightarrow 347.9 min = 5.8 hrs.$

PLATE 22.2 F-1

HYDROGRAPH COMPUTATION WORKSHEET

DATE 12/10/86
COMPUTED BY SJH
CHECK BY

PROPOSED ON-SITE CONDITION

PROJECT Hackettstown Shopping Center

LOCATION Academy & Inlets

ANALYSIS POINT # 1

(DR. AREA) A = 24 ACRES

T_c 21.5 MIN

POINT RAINFALL 2.3 IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 59.7 CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

Vol = (2.3)(24)(43560)/12 = 200376 cu.ft.

	(t/T_p)	t (min.)	y	Q (cfs)	t	Q
1	0	0	0	0		
2	.1	2.2	.03	1.8	4.1	5.6
3	.2	4.3	.10	6.0		
4	.3	6.5	.190	11.3	8.2	17.1
5	.4	8.6	.310	18.5		
6	.5	10.8	.470	28.1	12.3	36.2
7	.6	12.9	.660	39.4		
8	.7	15.1	.820	49.0	16.4	53.0
9	.8	17.2	.930	55.5		
10	.9	19.4	.990	59.1	20.2	59.3
11	1.0	21.5	1.00	59.7		
12	1.1	23.7	.990	59.1	24.6	57.5
13	1.2	25.8	.930	55.5		
14	1.3	28.0	.860	51.3	28.7	49.7
15	1.4	30.1	.780	46.6		
16	1.5	32.3	.680	40.6	32.8	38.9
17	1.6	34.4	.560	33.4		
18	1.7	36.6	.460	27.5	36.9	26.9
19	1.8	38.7	.390	23.3		
20	1.9	40.9	.330	19.7	41.0	19.6
21	2.0	43.0	.280	16.7	45.1	14.6
22	2.2	47.3	.207	12.4	49.2	10.8
23	2.4	51.6	.147	8.8	53.3	7.9
24	2.6	55.9	.107	6.4	57.4	5.8
25	2.8	60.2	.077	4.6	61.5	4.2
26	3.0	64.5	.055	3.3	65.6	3.1
27	3.2	68.8	.040	2.4	69.7	2.3
28	3.4	73.1	.029	1.7	73.8	1.6
29	3.6	77.4	.021	1.3	77.9	1.3
30	3.8	81.7	.015	0.9	82.0	0.9
31	4.0	86.0	.011	0.7	90.2	0.5
32	4.5	96.8	.005	0.3	98.4	0.3
33	5.0	107.5	.000	0	106.6	0

PLATE 22.2 F-1

HYDROGRAPH COMPUTATION WORKSHEET

DATE 12/11/86
COMPUTED BY JSM
CHECK BY

Composite Hydrograph - Existing

PROJECT Northtown Shopping Center

LOCATION Academy & Inlets

ANALYSIS POINT # 1

(DR. AREA) A = 317 ACRES

T_c 41.0 MIN

POINT RAINFALL 2.3 IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. ($T_p = T_c$ Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 370.6 CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1	4.1	.03	10.4
3	.2	8.2	.10	35.7
4	.3	12.3	.190	70.2
5	.4	16.4	.310	121.5
6	.5	20.2	.470	179.3
7	.6	24.6	.660	247.9
8	.7	28.7	.820	305.6
9	.8	32.8	.930	345.3
10	.9	36.9	.990	367.0
11	1.0	41.0	1.00	370.6 ←
12	1.1	45.1	.990	367.0
13	1.2	49.2	.930	345.3
14	1.3	53.3	.860	320.1
15	1.4	57.4	.780	291.2
16	1.5	61.5	.680	255.1
17	1.6	65.6	.560	211.8
18	1.7	69.7	.460	175.7
19	1.8	73.8	.390	150.4
20	1.9	77.9	.330	128.7
21	2.0	82.0	.280	110.7
22	2.2	90.2	.207	84.3
23	2.4	98.4	.147	62.7
24	2.6	106.6	.107	48.2
25	2.8	114.8	.077	37.4
26	3.0	123.0	.055	29.5
27	3.2	131.2	.040	24.0
28	3.4	139.4	.029	20.1
29	3.6	147.6	.021	17.2
30	3.8	155.8	.015	15.0
31	4.0	164.0	.011	13.6
32	4.5	184.5	.005	11.4
33	5.0	205.0	.000	9.6

PLATE 22.2 F-1

HYDROGRAPH COMPUTATION WORKSHEET

DATE 12/11/86
COMPUTED BY OSM
CHECK BY

Composite Hydrograph - Proposed

PROJECT Northtown Shopping Center

LOCATION Academy & Inlets

ANALYSIS POINT # 1

(DR. AREA) A = 317 ACRES

T_c 36.9 MIN

POINT RAINFALL 2.3 IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. $T_p = T_c$
(Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 384.3 CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

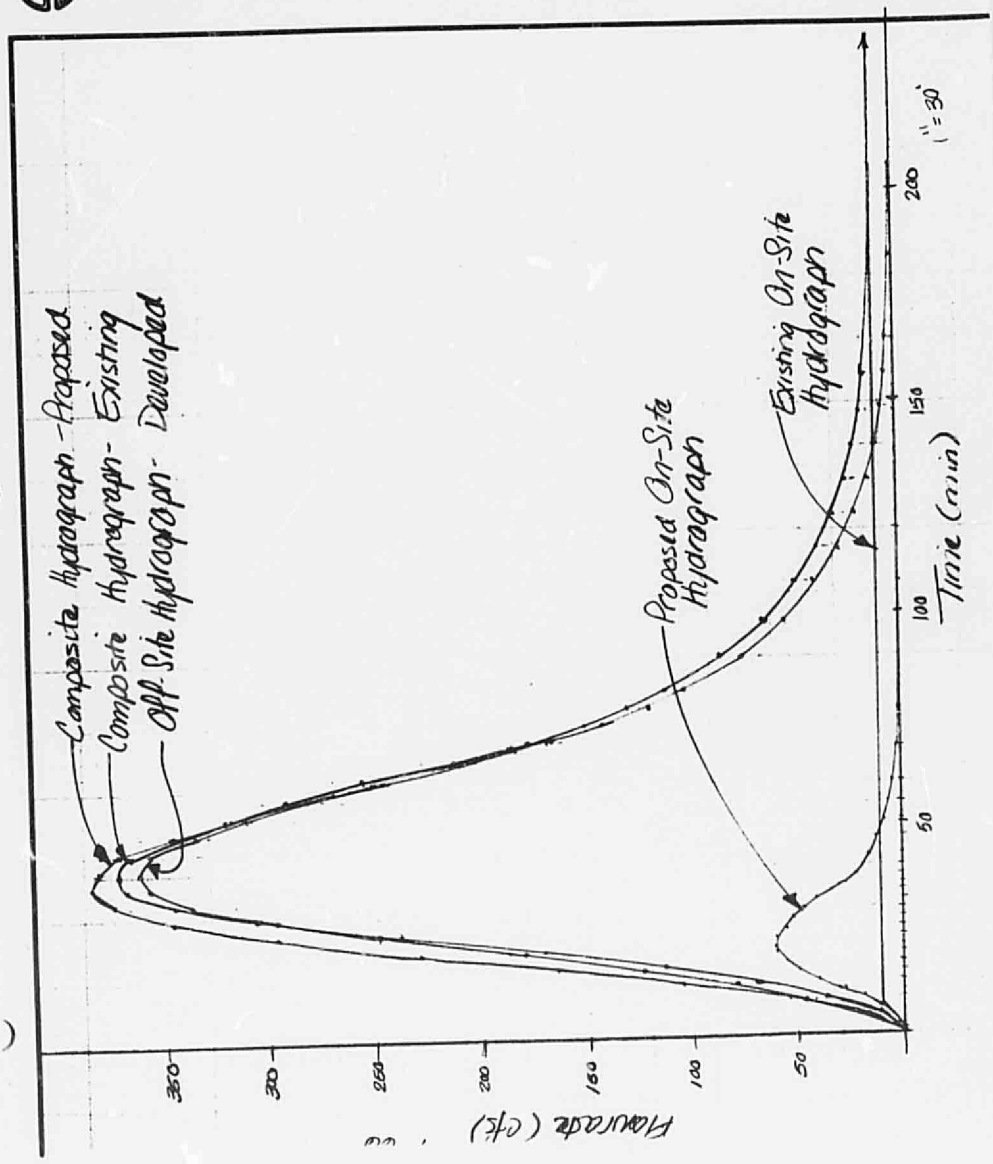
	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1	4.1	.03	16.4
3	.2	8.2	.10	53.2
4	.3	12.3	.190	104.8
5	.4	16.4	.310	169.9
6	.5	20.2	.470	224.0
7	.6	24.6	.660	295.8
8	.7	28.7	.820	345.7
9	.8	32.8	.930	374.6
10	.9	36.9	.990	384.3
11	1.0	41.0	1.00	390.6
12	1.1	45.1	.990	372.0
13	1.2	49.2	.930	346.5
14	1.3	53.3	.860	318.4
15	1.4	57.4	.780	287.4
16	1.5	61.5	.680	249.7
17	1.6	65.6	.560	205.3
18	1.7	69.7	.460	168.4
19	1.8	73.8	.390	142.4
20	1.9	77.9	.330	120.4
21	2.0	82.0	.280	102.0
22	2.2	90.2	.207	75.2
23	2.4	98.4	.147	53.4
24	2.6	106.6	.107	38.6
25	2.8	114.8	.077	27.8
26	3.0	123.0	.055	19.9
27	3.2	131.2	.040	14.4
28	3.4	139.4	.029	10.5
29	3.6	147.6	.021	7.6
30	3.8	155.8	.015	5.4
31	4.0	164.0	.011	4.0
32	4.5	184.5	.005	1.8
33	5.0	205.0	.000	0

PLATE 22.2 F-1

Job Northtown Shopping Center
Subject Graph
Client DeLuTorre/Rainhart

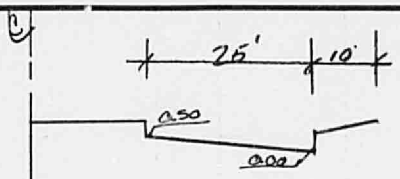
Sheet No. 1 of 2
Job. No.
By JSM Date 12/11/86

CHAVEZ - GRIEVES / CONSULTING ENGINEERS, Inc. Albuquerque, NM



Job Northtown Shopping Center — Sheet No. 2 of 2
Subject Capacity at Academy - 10-year — Job. No.
Client de la Torre/Kaibart — By DSM Date 12/18/86

CHAVEZ - GRIEVES / CONSULTING ENGINEERS, Inc. — Albuquerque, NM



$Q = 1.486 A^{2/3} S^{1/2} / n P^{2/3}$

$S = 0.0215$

$n = 0.017$

$\frac{1}{2}A = (0.50)(25)(\frac{1}{2}) = 6.25$

$\frac{1}{2}P = 25.5$

$\frac{1}{2}Q = 31.37$

$Q = 62.75$ cfs

Q_{10} (from site) $= 59.7(0.657) = 39.22 < 62.75$

E-18/B17

22.2

RECEIVED
DEC 17 1985
HYDROLOGY SECTION

HYDROGRAPH COMPUTATION WORKSHEET

DATE 9/85
COMPUTED BY JJB
CHECK BY

PROJECT ACADEMY ACRES UNIT 10

BASIN ~~LOCATION~~ 3+2+1

ANALYSIS POINT # ACADEMY @ INLET

(DR. AREA) A = _____ ACRES

T_c 14 MIN

POINT RAINFALL — IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = 14 MIN. ($T_p = T_c$)
(Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 37.2 CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	Basin t (min.)	y	Q (cfs)	Inlet t (min)
1	0	0	0	0	7
2	.1	1	.03	1.1	8
3	.2	3	.10	3.7	10
4	.3	4	.190	7.1	11
5	.4	6	.310	11.5	13
6	.5	7	.470	17.5	14
7	.6	8	.660	24.6	15
8	.7	10	.820	30.5	17
9	.8	11	.930	34.6	18
10	.9	13	.990	36.8	20
11	1.0	14	1.00	37.2	21
12	1.1	15	.990	36.8	22
13	1.2	17	.930	34.6	24
14	1.3	18	.860	32.0	25
15	1.4	20	.780	29.0	27
16	1.5	21	.680	25.3	28
17	1.6	22	.560	20.8	29
18	1.7	24	.460	17.1	31
19	1.8	25	.390	14.5	32
20	1.9	27	.330	12.3	34
21	2.0	28	.280	10.4	35
22	2.2	31	.207	7.7	38
23	2.4	34	.147	5.5	41
24	2.6	36	.107	4.0	43
25	2.8	39	.077	2.9	46
26	3.0	42	.055	2.0	49
27	3.2	45	.040	1.5	52
28	3.4	48	.029	1.1	55
29	3.6	50	.021	0.8	57
30	3.8	53	.015	0.6	60
31	4.0	56	.011	0.4	63
32	4.5	63	.005	0.2	70
33	5.0	70	.000	0.0	77

T_c = TIME OF CONCENTRATION

14 min from R-3 of these computations

LAG TIME (for site runoff to traverse Academy to Inlet)

distance = 1765 ft
slope = 0.022%
velocity = 4.0 fps from DPM 22.2 B-2
lag time = distance/velocity
= 7 min.

PLATE 22.2 F-1

HYDROGRAPH COMPUTATION WORKSHEET

DATE 9/85
COMPUTED BY JJB
CHECK BY

PROJECT ACADEMY ACRES UNIT 10

BASIN ~~LOCATION~~ A+B

ANALYSIS POINT # ACADEMY RD @ INLET

(DR. AREA) A = 6.5 ACRES

T_c 10 MIN

POINT RAINFALL — IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 21.2 CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	Basin t (min.)	y	Q (cfs)	Inlet t (min.)
1	0	0	0	0	9
2	.1	1.0	.03	.6	10.0
3	.2	2.0	.10	2.1	11.0
4	.3	3.0	.190	4.0	12.0
5	.4	4.0	.310	6.6	13.0
6	.5	5.0	.470	10.0	14.0
7	.6	6.0	.660	14.0	15.0
8	.7	7.0	.820	17.4	16.0
9	.8	8.0	.930	19.7	17.0
10	.9	9.0	.990	21.0	18.0
11	1.0	10	1.00	21.2	19.0
12	1.1	11.0	.990	21.0	20.0
13	1.2	12.0	.930	19.7	21.0
14	1.3	13.0	.860	18.2	22.0
15	1.4	14.0	.780	16.5	23.0
16	1.5	15.0	.680	14.4	24.0
17	1.6	16.0	.560	11.9	25.0
18	1.7	17.0	.460	9.8	26.0
19	1.8	18.0	.390	8.3	27.0
20	1.9	19.0	.330	7.0	28.0
21	2.0	20.0	.280	5.9	29.0
22	2.2	22.0	.207	4.4	31.0
23	2.4	24.0	.147	3.1	33.0
24	2.6	26.0	.107	2.3	35.0
25	2.8	28.0	.077	1.6	37.0
26	3.0	30.0	.055	1.2	39.0
27	3.2	32.0	.040	.9	41.0
28	3.4	34.0	.029	.6	43.0
29	3.6	36.0	.021	.5	45.0
30	3.8	38.0	.015	.3	47.0
31	4.0	40.0	.011	.2	49.0
32	4.5	45.0	.005	.1	54.0
33	5.0	50.0	.000	.0	59.0

T_c = Time of Concentration
= 10 min from O1 & O2 of these computations

LAG TIME (for site runoff to traverse Academy to inlet)

distance = 2073 ft.
slope = 0.22 %
velocity = 4.0 fps from DPM 22.2B-2 PLATE 22.2 F-1
lagtime = distance/velocity
= 8.6 min.

HYDROGRAPH COMPUTATION WORKSHEET

DATE 9/85
COMPUTED BY JJB
CHECK BY

PROJECT Academy Acres Unit 10

BASIN ~~LOCATION~~ C

ANALYSIS POINT # Academy Rd @ Inlet

(DR. AREA) A = 3.3 ACRES

T_c 10 MIN

POINT RAINFALL — IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 11.7 CFS

t(COLUMN)=(t/T_p) $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	Basin t (min.)	y	Q (cfs)	Inlet t (min.)
1	0	0	0	0	10
2	.1	1.0	.03	.4	11.0
3	.2	2.0	.10	1.2	12.0
4	.3	3.0	.190	2.2	13.0
5	.4	4.0	.310	3.6	14.0
6	.5	5.0	.470	5.5	15.0
7	.6	6.0	.660	7.7	16.0
8	.7	7.0	.820	9.6	17.0
9	.8	8.0	.930	10.9	18.0
10	.9	9.0	.990	11.9	19.0
11	1.0	10	1.00	11.7	20.0
12	1.1	11.0	.990	11.9	21.0
13	1.2	12.0	.930	10.9	22.0
14	1.3	13.0	.860	10.1	23.0
15	1.4	14.0	.780	9.1	24.0
16	1.5	15.0	.680	8.0	25.0
17	1.6	16.0	.560	6.6	26.0
18	1.7	17.0	.460	5.4	27.0
19	1.8	18.0	.390	4.6	28.0
20	1.9	19.0	.330	3.9	29.0
21	2.0	20.0	.280	3.3	30.0
22	2.2	22.0	.207	2.4	32.0
23	2.4	24.0	.147	1.7	34.0
24	2.6	26.0	.107	1.3	36.0
25	2.8	28.0	.077	.9	38.0
26	3.0	30.0	.055	.6	40.0
27	3.2	32.0	.040	.5	42.0
28	3.4	34.0	.029	.3	44.0
29	3.6	36.0	.021	.3	46.0
30	3.8	38.0	.015	.2	48.0
31	4.0	40.0	.011	.1	50.0
32	4.5	45.0	.005	.1	55.0
33	5.0	50.0	.000	.0	60.0

T_c = Time of Concentration
= 10 min from page 03 of these computations

LAG TIME (for site runoff to traverse Academy to inlet)

distance = 2320 ft
slope = 0.022 %
velocity = 4.0 fps from DPM 22.2B-2 PLATE 22.2 F-1
lagtime = distance/velocity
= 9.6 min.

HYDROGRAPH COMPUTATION WORKSHEET

DATE 9/85
COMPUTED BY JJB
CHECK BY

PROJECT ACADEMY ACRES UNIT 10

~~LOCATION~~ BASIN D+E

ANALYSIS POINT # ACADEMY RD @ INLET

(DR. AREA) A = 5.8 ACRES

T_c 10 MIN

POINT RAINFALL — IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{45.4A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 21.4 CFS

t(COLUMN)=(t/T_p) $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	Basin t (min.)	y	Q (cfs)	Inlet t (min.)
1	0	0	0	0	12
2	.1	1.0	.03	.6	13.0
3	.2	2.0	.10	2.1	14.0
4	.3	3.0	.190	4.1	15.0
5	.4	4.0	.310	6.6	16.0
6	.5	5.0	.470	10.1	17.0
7	.6	6.0	.660	14.1	18.0
8	.7	7.0	.820	17.6	19.0
9	.8	8.0	.930	20.0	20.0
10	.9	9.0	.990	21.2	21.0
11	1.0	10.0	1.00	21.4	22.0
12	1.1	11.0	.990	21.2	23.0
13	1.2	12.0	.930	20.0	24.0
14	1.3	13.0	.860	18.4	25.0
15	1.4	14.0	.780	16.7	26.0
16	1.5	15.0	.680	14.6	27.0
17	1.6	16.0	.560	12.0	28.0
18	1.7	17.0	.460	9.8	29.0
19	1.8	18.0	.390	8.4	30.0
20	1.9	19.0	.330	7.1	31.0
21	2.0	20.0	.280	6.0	32.0
22	2.2	22.0	.207	4.4	34.0
23	2.4	24.0	.147	3.2	36.0
24	2.6	26.0	.107	2.3	38.0
25	2.8	28.0	.077	1.7	40.0
26	3.0	30.0	.055	1.2	42.0
27	3.2	32.0	.040	.9	44.0
28	3.4	34.0	.029	.6	46.0
29	3.6	36.0	.021	.5	48.0
30	3.8	38.0	.015	.3	50.0
31	4.0	40.0	.011	.2	52.0
32	4.5	45.0	.005	.1	57.0
33	5.0	50.0	.000	.0	62.0

T_c = Time of Concentration
= 10 min from page 03 of these computations

LAG TIME (for site runoff to traverse Academy to inlet)

distance = 2790 ft
slope = 0.022%
velocity = 4.0 fps from DPM 22.2B-2 PLATE 22.2 F-1
lagtime = distance/velocity
= 11.6 min.

HYDROGRAPH COMPUTATION WORKSHEET

DATE 9/85
COMPUTED BY JJB
CHECK BY

PROJECT Academy Acres Unit 10

BASIN ~~LOCATION~~ F+G

ANALYSIS POINT # Academy Rd @ Inlet

(DR. AREA) A = 3.1 ACRES

T_c 10 MIN

POINT RAINFALL — IN. FROM PLATE 22.2 D-1

CN = — FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = — IN. FROM PLATE 22.2 C-4

COMPUTED T_p = — MIN. (Rounded to even minute) $T_p = T_c$

$q_p = \frac{484A}{T_p}$ = — CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 10.4 CFS

t (COLUMN) = (t/T_p) $\times T_p$ = t/T_p

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	Basin t (min.)	y	Q (cfs)	Inlet t (min.)
1	0	0	0	0	15
2	.1	1.0	.03	.3	16.0
3	.2	2.0	.10	1.0	17.0
4	.3	3.0	.190	2.0	18.0
5	.4	4.0	.310	3.2	19.0
6	.5	5.0	.470	4.9	20.0
7	.6	6.0	.660	6.9	21.0
8	.7	7.0	.820	8.5	22.0
9	.8	8.0	.930	9.7	23.0
10	.9	9.0	.990	10.3	24.0
11	1.0	10.0	1.00	10.4	25.0
12	1.1	11.0	.990	10.3	26.0
13	1.2	12.0	.930	9.7	27.0
14	1.3	13.0	.860	8.9	28.0
15	1.4	14.0	.780	8.1	29.0
16	1.5	15.0	.680	7.0	30.0
17	1.6	16.0	.560	5.8	31.0
18	1.7	17.0	.460	4.8	32.0
19	1.8	18.0	.390	4.1	33.0
20	1.9	19.0	.330	3.4	34.0
21	2.0	20.0	.280	2.9	35.0
22	2.2	22.0	.207	2.2	37.2
23	2.4	24.0	.147	1.5	39.0
24	2.6	26.0	.107	1.1	41.0
25	2.8	28.0	.077	.8	43.0
26	3.0	30.0	.055	.6	45.0
27	3.2	32.0	.040	.4	47.0
28	3.4	34.0	.029	.3	49.0
29	3.6	36.0	.021	.2	51.0
30	3.8	38.0	.015	.2	53.0
31	4.0	40.0	.011	.1	55.0
32	4.2	42.0	.008	.1	57.0
33	4.4	44.0	.006	.0	59.0

T_c = Time of Concentration
= 10 min from page 04 of these computations

LAG TIME (for site runoff to traverse Academy to inlet)

distance = 3480 ft
slope = 2.022%
velocity = 40 fps from DPM 22.2B-7. PLATE 22.2 E-
lag time = distance / velocity
= 145 min

HYDROGRAPH COMPUTATION WORKSHEET

DATE 9/85
COMPUTED BY JJB
CHECK BY

PROJECT ACADEMY ACRES UNIT 10

~~LOCATION~~ BASIN EXISTING ONSITE

ANALYSIS POINT # ACADEMY RD @ INLET

(DR. AREA) A = 22.1 ACRES

T_c 20 MIN

POINT RAINFALL 2.3 IN. FROM PLATE 22.2 D-1

CN = 70 FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = 0.4 IN. FROM PLATE 22.2 C-4

COMPUTED T_p = 20 MIN. ($T_p = T_c$) (Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = 50.2 CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 20.1 CFS

t(COLUMN)=(t/T_p) $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	Basin t (min.)	y	Q (cfs)	Inlet t (min.)
1	0	0	0	0	9
2	.1	2	.03	0.6	11
3	.2	4	.10	2.0	13
4	.3	6	.190	3.8	15
5	.4	8	.310	6.2	17
6	.5	10	.470	9.4	19
7	.6	12	.660	13.3	21
8	.7	14	.820	16.5	23
9	.8	16	.930	18.7	25
10	.9	18	.990	19.9	27
11	1.0	20	1.00	20.1	29
12	1.1	22	.990	19.9	31
13	1.2	24	.930	18.7	33
14	1.3	26	.860	17.3	35
15	1.4	28	.780	15.7	37
16	1.5	30	.680	13.7	39
17	1.6	32	.560	11.3	41
18	1.7	34	.460	9.2	43
19	1.8	36	.390	7.8	45
20	1.9	38	.330	6.6	47
21	2.0	40	.280	5.6	49
22	2.2	44	.207	4.2	53
23	2.4	48	.147	3.0	57
24	2.6	52	.107	2.2	61
25	2.8	56	.077	1.5	65
26	3.0	60	.055	1.1	69
27	3.2	64	.040	0.8	73
28	3.4	68	.029	0.6	77
29	3.6	72	.021	0.4	81
30	3.8	76	.015	0.3	85
31	4.0	80	.011	0.2	89
32	4.5	90	.005	0.1	99
33	5.0	100	.000	0	109

T_c = Time of Concentration
= 20 min from DPM 22.2 B-1

distance = 1300 ft, slope = 0.029 ft/ft, velocity = 1.1 fps

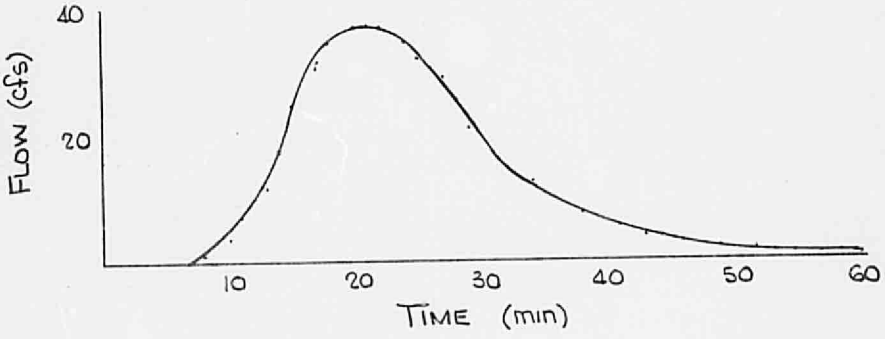
LAG TIME (for site runoff to traverse Academy to inlet)

distance = 2165 ft
slope = 0.022 ft/ft
velocity = 4.0 fps from DPM 22.2B-2 PLATE 22.2 F-1
lagtime = distance/velocity
= 9 min.

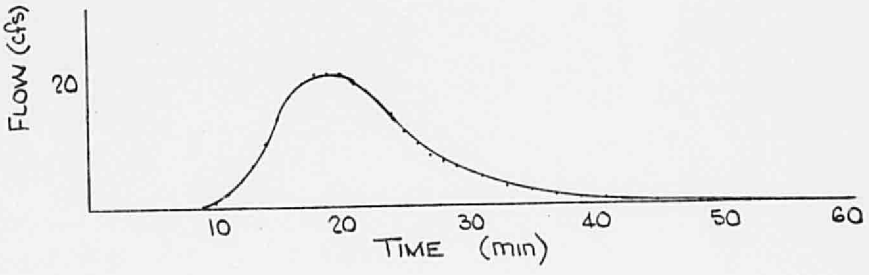
DMJM/AHA ALBUQUERQUE	PROJECT: Academy Acres Unit 10	PROJECT NO: 4668-02-01	PAGE
		BY: JB / DATE: 9/85	

SUBJECT: Academy Road

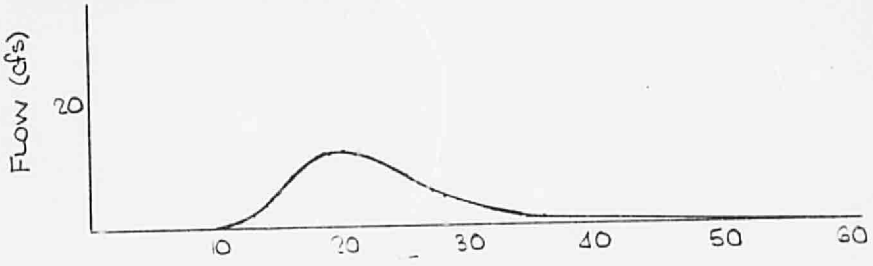
HYDROGRAPH 3+2+1 @ INLET



HYDROGRAPH A+B @ INLET



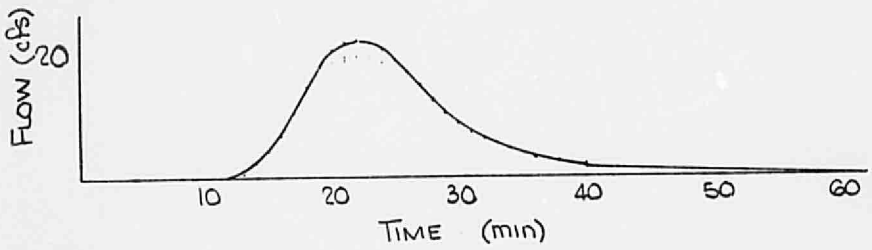
HYDROGRAPH C @ INLET



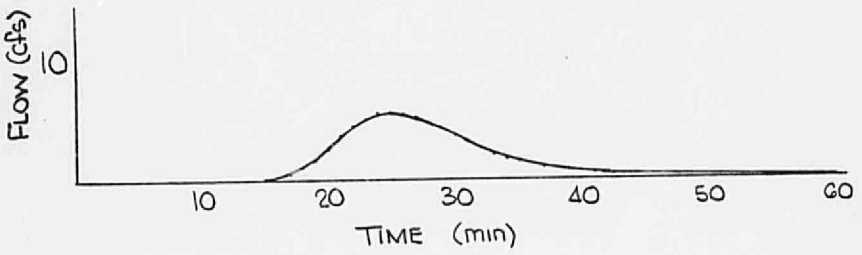
DMJM / AHA ALBUQUERQUE	PROJECT: ACADEMY ACRES UNIT 10	PROJECT NO: 4668-02-01	PAGE
		BY: JJB DATE: 9/85	

SUBJECT: Academy Road

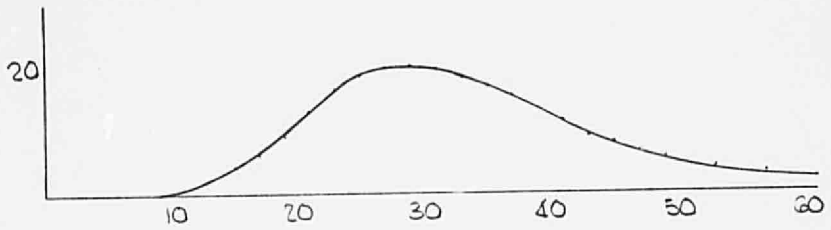
HYDROGRAPH D+E @ INLET



HYDROGRAPH F+G @ INLET



HYDROGRAPH EXISTING ONSITE



DMJM / AHA ALBUQUERQUE	PROJECT: Academy Acres Unit 10	PROJECT NO: 4668-02-01	PAGE
		BY: JB DATE: 9/85	

SUBJECT: Academy Road

Hydrograph @ Inlet - Existing

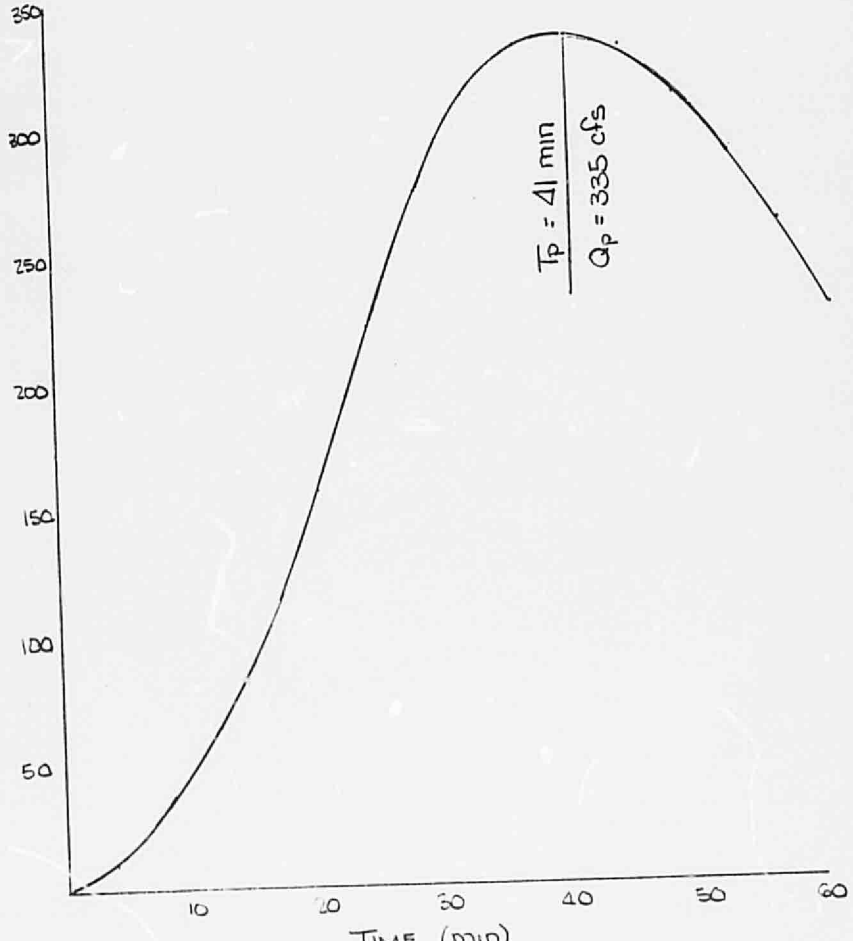
Time (min)	Basin Flows (cfs)		
	Offsite*	Onsite	TOTAL
2	5	0	5
4	10	0	10
6	20	0	20
8	32	0	32
10	46	0	46
12	62	1	63
14	78	3	81
16	98	5	103
18	123	8	131
20	152	11	163
22	182	14	196
24	212	18	230
26	242	19	261
28	267	20	287
30	290	20	310
32	308	19	327
34	320	18	338
36	328	16	344
38	333	14	347
40	335	12	347
42	335	10	345
44	331	9	340
46	326	7	333
48	319	6	325
50	309	5	314

* Data prepared by Espey, Huston & Assoc., Inc. Mar. 2, 1984. Approved by City of Albuquerque Mar. 13, 1984.

DMJM/AHA ALBUQUERQUE	PROJECT: ACADEMY ACRES UNIT 10	PROJECT NO. 4668-02-01	PAGE
		BY: JJB	DATE: 9/85

SUBJECT: Academy Acres

HYDROGRAPH @ INLET - EXISTING *



* Data Prepared by Espey, Huston & Assoc., Inc
Mar 2 1984 Approved [illegible]

DMJM / AHA ALBUQUERQUE	PROJECT: Academy Acres Unit 10	PROJECT NO: 4668-02-01	PAGE
		BY: JB	DATE: 9/85

SUBJECT: Academy Road

HYDROGRAPH @ INLET - PROPOSED

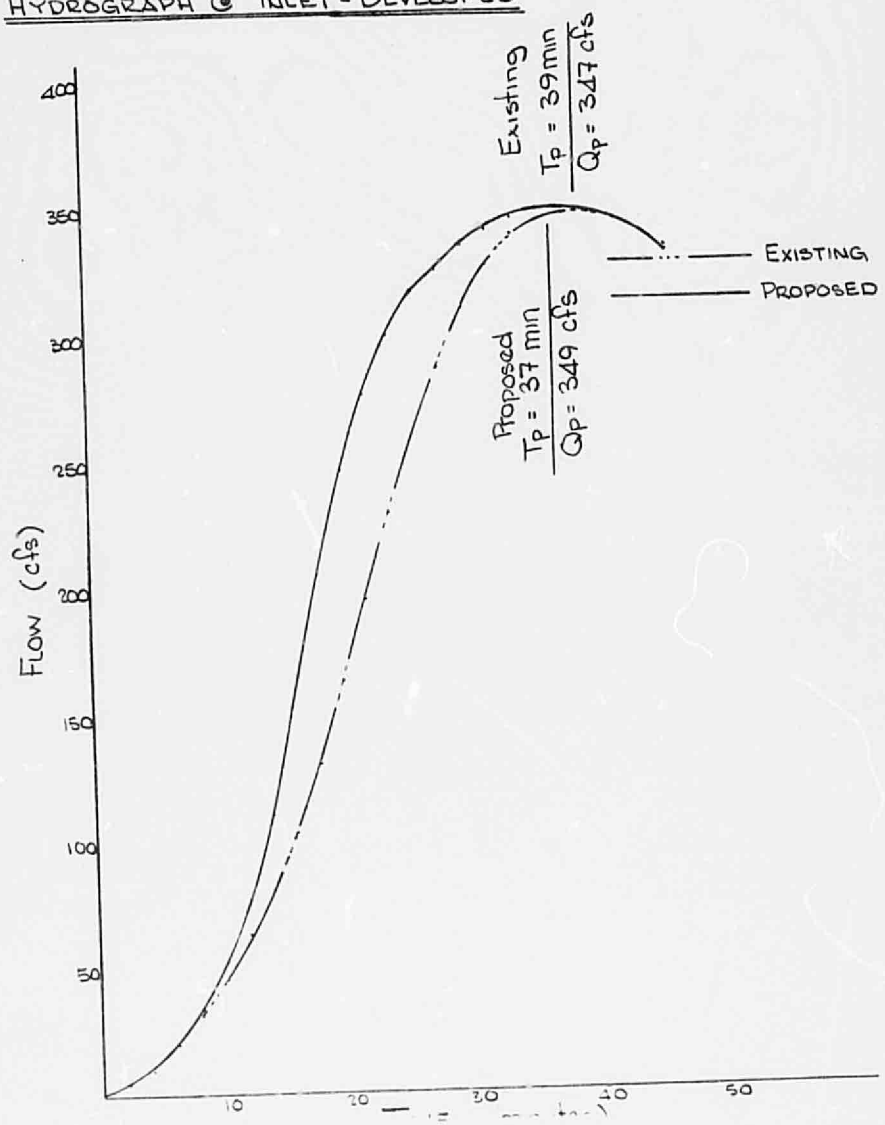
TIME (min)	BASIN FLOWS (cfs)						
	Offsite*	3+2+1	A+B	C	D+E	F+G	Total
2	5	0	0	0	0	0	5
4	10	0	0	0	0	0	10
6	20	0	0	0	0	0	20
8	32	2	0	0	0	0	34
10	46	5	1	0	0	0	52
12	62	10	4	1	0	0	77
14	78	11	10	4	2	0	111
16	98	29	17	8	7	0	159
18	123	35	21	11	14	2	206
20	152	37	21	12	20	5	247
22	182	37	18	11	21	8	277
24	212	35	14	9	20	10	300
26	242	31	10	7	17	10	317
28	267	25	7	5	12	9	325
30	290	20	5	4	9	7	335
32	308	15	4	3	6	5	341
34	320	12	3	2	4	4	345
36	328	10	2	2	3	3	348
38	333	8	2	1	2	2	348
40	335	6	1	1	2	2	347
42	335	5	1	1	1	1	344
44	331	4	1	1	1	1	339
46	326	3	1	0	1	1	332
48	319	2	0	0	1	1	323
50	309	2	0	0	0	0	311

* Data prepared by Espey, Huston & Assoc., Inc Mar. 2, 1984. Approved by City of Albuquerque Mar. 13, 1984.

DMJM/AHA ALBUQUERQUE	PROJECT: ACADEMY ACRES UNIT 10	PROJECT NO: 1668-02-01	PAGE
		BY: JB	DATE: 9/85

SUBJECT: Academy Road

HYDROGRAPH @ INLET - DEVELOPED



FILE COPY

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

January 6, 1987

Jackie McDowell
Chavez-Grieves Consulting Engineers, Inc.
4600 Montgomery Blvd., NE Bldg. C #101
Albuquerque, New Mexico 87109

RE: HYDROLOGY CALCULATIONS FOR NORTHTOWN SHOPPING CENTER
RECEIVED DECEMBER 12, 1986 FOR REVIEW AND COMMENT FOR PENDING
SITE DEVELOPMENT PLAN (E-19/D15)

Dear Jackie:

I have reviewed the above referenced submittal, memo dated December 11, 1986. I concur with your conclusion that elimination of the existing detention pond will increase the peak runoff rate flowing in Academy. My own computer modeling analysis showed an increase of 39 cfs versus your 13.7 cfs, although our peak flow rates without the pond were identical.

Therefore, any Grading and Drainage Reports submitted showing elimination of the existing detention pond will not be approved. It may be possible to reduce the size of the existing pond, but detailed hydrologic analysis would be required. As I discussed with you previously, the pond could be reduced in size to the point where peak flows in Academy are not increased, using the hydrograph of the entire watershed.

If you have any questions, call me at 768-2650.

Cordially,

Roger A. Green, PE

Roger A. Green, P.E.
C.E./Hydrology Section

cc: Jorge de la Torre

RAG/bsj

CHAVEZ—GRIEVES / CONSULTING ENGINEERS, INC.
4600 MONTGOMERY N.E., BUILDING C, #101
ALBUQUERQUE, NEW MEXICO 87109
(505) 881-7376

December 11, 1986

RECEIVED
DEC 12 1986
HYDROLOGY SECTION

Mr. Roger Green
City of Albuquerque
Public Works Dept./Hydrology Section
P.O. Box 1293
Albuquerque, N.M. 87103

RE: HYDROLOGY CALCULATION FOR NORTHTOWN SHOPPING CENTER
(E-19/D15)

Dear Roger:

In response to your comments dated November 26, 1986 and our meeting on December 9, 1986, I offer the following:

1. The peak runoff rate for the analysis point in Academy has been taken from Espey-Huston calculations for Academy Acres and modified with more realistic "C" values, see attached calculations.

2. The flows in Academy Road violate both the 0.87 foot and 0.50 foot requirements in the drainage ordinance as mentioned in the Espey-Huston study. Runoff directly from the site in question does not violate this requirement when analyzing it independently from the rest of the system - see attached calculations.

3. The number of existing catchbasins are not adequate to handle the existing flows. Approximately 23 single inlet catchbasins are required for developed runoff from the watershed.

4. Assuming a street slope of 2 percent and a flow depth of 0.87 feet, the capacity of a single Type A or Type C catchbasin is approximately 16 cfs.

5. As per our meeting of December 9, the Rational Method was used to determine the peak runoff rate.

In addition to the comments above the following items are included in this analysis to determine the amount of runoff added to the peak by the elimination of the pond in Northtown Shopping Center.

A. The hydrograph computation worksheet for the "Offsite" Existing Conditions was redone using the above modifications for developed conditions.

B. A hydrograph computation worksheet was completed for the existing on-site condition with ponding.

C. A hydrograph computation worksheet was completed for the proposed on-site condition without ponding.

D. A hydrograph computation worksheet was completed for the Composite of developed off-site and existing on-site runoff.

E. A hydrograph computation worksheet was completed for the composite of developed off-site and proposed on-site runoff.

F. A graph was made including all of the hydrographs computed.

The above results conclude that by eliminating the pond an additional 13.7 c.f.s. will be added to the peak runoff for the watershed. This will be an increase in water depth of approximately 0.082 feet.

We would appreciate your timely response and/or recommendations to the above analysis.

Cordially,

CHAVEZ-GRIEVES CONSULTING ENGINEERS, INC.

Jackie S. McDowell

Jackie S. McDowell

JSM:kk

Encl.

Copy of Comment Letter
Copy of Conference Recap
Marked-up calculation sheets taken from Espey-Huston Report (3)
Hydrograph Computation Work Sheets (5)
Graph of all Hydrographs above (1)
10-year street capacity for Academy Road

CC: Jorge de la Torre
Bob Fosnaugh/Dave Harman-Traffic Engineering

CHAVEZ—GRIEVES / CONSULTING ENGINEERS, INC.
4600 MONTGOMERY N.E., BUILDING C, #101
ALBUQUERQUE, NEW MEXICO 87109
(505) 881-7376

LETTER OF TRANSMITTAL

TO: Public Works Dept
Hydrology Section
Attn: Roger Green

DATE: 12/12/86
JOB NO.
RE: Northtown Shopping Center

GENTLEMEN:
We are sending you X ATTACHED ___ UNDER SEPARATE COVER the following items:

___ SHOP DRAWINGS ___ CHANGE ORDER ___ SPECIFICATIONS
~~X~~ ~~COPY OF~~ LETTER ___ PLANS ___
X PRINTS ___ SAMPLES

RECEIVED
DEC 17 1986
HYDROLOGY SECTION

COPIES	DATE	NO.	DESCRIPTION
1			Hydrology Calcs for Northtown Shopping Center

THESE ARE TRANSMITTED as checked below:

X FOR APPROVAL
___ FOR YOUR USE
___ AS REQUESTED
___ FOR REVIEW AND COMMENT
___ APPROVED AS SUBMITTED
___ APPROVED AS NOTED
___

___ RETURNED FOR CORRECTIONS
___ RESUBMIT ___ COPIES FOR APPROVAL
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REMARKS:

COPY TO: File
de la Torre/Reinhart
Traffic Engineering/Dave Harman

SIGNED: Debbie S. McDavid

If enclosures are not as noted, kindly notify us at once.

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION/DESIGN HYDROLOGY SECTION

1:30 pm

CONFERENCE RECAP

DRAINAGE FILE/ZONE ATLAS PAGE NO.: _____ DATE: 12/1/86

PLANNING DIVISION NOS: EPC: _____ DRB: _____

SUBJECT: Nurton

STREET ADDRESS (IF KNOWN): _____

SUBDIVISION NAME: _____

APPROVAL REQUESTED:

_____ PRELIMINARY PLAT
_____ SITE DEVELOPMENT PLAN
_____ OTHER

_____ FINAL PLAT
_____ BUILDING PERMIT
_____ ROUGH GRADING

	WHO	REPRESENTING
ATTENDANCE:	Jerry McDonald	Charles Graves
	Ken Green	Hydrology Section

FINDINGS:

(1) Recheck drainage area from golf course existing Pending Condo (SIA on copy Lista vs 234 Ac's)

(2) Provide hydrographs for Dyke Wing for entire watershed proposed Lake and proposed Hydrograph to show effect of the discharging

(3) Will free discharge be at peak of the watershed hydrograph peak or should the proposed discharge has not been considered is appropriate.

(4) If the outfall system or [illegible] and make a recommendation for [illegible]

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

SIGNED: _____ SIGNED: _____
TITLE: _____ TITLE: _____
DATE: _____ DATE: _____

NOTE PLEASE PROVIDE A COPY OF THIS RECAP WITH THE DRAINAGE SUBMITTAL

COPY

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

November 26, 1986

Jackie McDowell
Chavez-Grieves Consulting Engineers, Inc.
4600 Montgomery Blvd., NE Bldg. C #101
Albuquerque, New Mexico 87109

RE: HYDROLOGY CALCULATIONS FOR NORTHTOWN SHOPPING CENTER
RECEIVED NOVEMBER 10, 1986 FOR REVIEW AND COMMENT (E-19/D15)

Dear Jackie:

I have reviewed the above referenced submittal dated November 10, 1986, and have the following comments:

1. The peak runoff rate you have calculated for the analysis point in Academy differs greatly from that previously calculated by Espey-Huston and used for the Hydrologic analysis of Academy Acres. Keep in mind that your analysis must assume a fully developed watershed. The "C" value of 0.40 seems very low for developed conditions, please show how the composite "C" value was determined.

2. Since Academy Road is an arterial street, check its capacity with a Q_{10} storm, since the Drainage Ordinance requires that all arterials have one driving lane free of water, and a flow depth less than 0.5.

3. To determine the number of additional catch basins required, you must first determine if the existing number are adequate for the existing flows, not just increase capacity for your proposed additional flows. Your development will not be responsible for providing additional inlet capacity above that of your discharge, but any construction drawings must include all required improvements to meet current design requirements.

4. Provide design data assumptions made to determine that each additional catch basin has 16 cfs capacity.

5. I feel that use of the Rational Formula and the Kirpich equation is not the correct method to determine the peak runoff rate at a specific analysis point. A unit hydrograph method and travel time or lag method to determine T_c are appropriate methods.

If you have any questions, call me at 768-2650.

Cordially,

Roger A. Green, PE

Roger A. Green, P.E.
C.E./Hydrology Section

RAG/bsj

CHAVEZ—GRIEVES / CONSULTING ENGINEERS, INC.

4600 MONTGOMERY N.E., BUILDING C, #101
ALBUQUERQUE, NEW MEXICO 87109
(505) 881-7376

November 10, 1986

RECEIVED
NOV 10 1986
HYDROLOGY SECTION

Mr. Billy Goolsby
The City of Albuquerque
Public Works Department
Engineering Group/Hydrology Section
P.O. Box 1293
Albuquerque, New Mexico 87102

RE: NORTHTOWN SHOPPING CENTER POND

Dear Billy:

After analyzing the drainage conditions on Academy Road from Wyoming Boulevard to Marohetal Avenue, it seems feasible to eliminate the pond in Northtown Shopping Center located on the northwest corner of the intersection of Wyoming Boulevard and Academy Road. Four additional catch basins will be required just west of Marohetal Avenue to tie to the 84" RCP storm sewer (Capacity = 950 cfs). These catch basins will be added to the storm sewer system to pick up the additional runoff from Northtown Shopping Center due to elimination of the pond.

The area does not contribute to a 100-year flood zone according to the Floodway Flood Boundary and Floodway Map - Panel 17 of 50. Enclosed are conceptual calculations for the design.

I am seeking conceptual approval of the design in order to continue with construction drawings for the additional catch basins and pond removal.

Your timely assistance in this matter is appreciated.

Cordially,

CHAVEZ-GRIEVES CONSULTING ENGINEERS, INC.

Jackie S. McDowell

Jackie S. McDowell

JSM:mf

CC: Jorge de La Torre

CALCULATIONS:

Watershed area contributing to the system west of the intersection of Academy Road and Marohetal Avenue = 234 acres.
80% of the area is residential. what is other 20%?
~~Rational~~ Method : Q = CiA
C = 0.40

$$Tc = (0.0078)(9125)^{0.77} / (0.0278)^{0.385} = 34.7 \text{ min.}$$

V = 9125/(34.7)(60) = 4.38 - o.k.
I = 1.13 Plate 22.2 D-1
i = (2.4)(1.13) = 2.71
Q (100) = (0.40)(2.71)(234) = 254 cfs

CAPACTIY OF ACADEMY ROAD (100-YEAR): Principle Arterial check Q10 for free driving lane.

$$Q = 1.486\, A^{5/3}\, S^{1/2} / np$$

1/2 A = (0.37)(25)+(1/2)(0.50)(25) = 15.50
1/2 P = 26.24
n = 0.017
S = 0.0215 (min.)
1/2 Q = 139.86
Q (100) = 280 cfs

EXISTING ON-SITE CONDITIONS FROM NORTHTOWN SHOPPING CENTER:
Q (100) = 9.6 cfs (controlled discharge from pond).

PROPOSED ON-SITE CONDITIONS FROM NORTHTOWN SHOPPING CENTER:
A (100) = (0.89)(5.28)(12.7) = 59.7 cfs
Q_{4c}
FLOW RATE ADDED TO ACADEMY ROAD DUE TO ELIMINATION OF POND:
59.7 - 9.6 = 50.1 cfs ✓

NUMBER OF CATCH BASINS TO BE ADDED TO SYSTEM DUE TO INCREASED RUNOFF: at what slope? & depth?

50.1/16 = 3.13
Add 4 catch basins to system. what is capacity of existing C.B's?

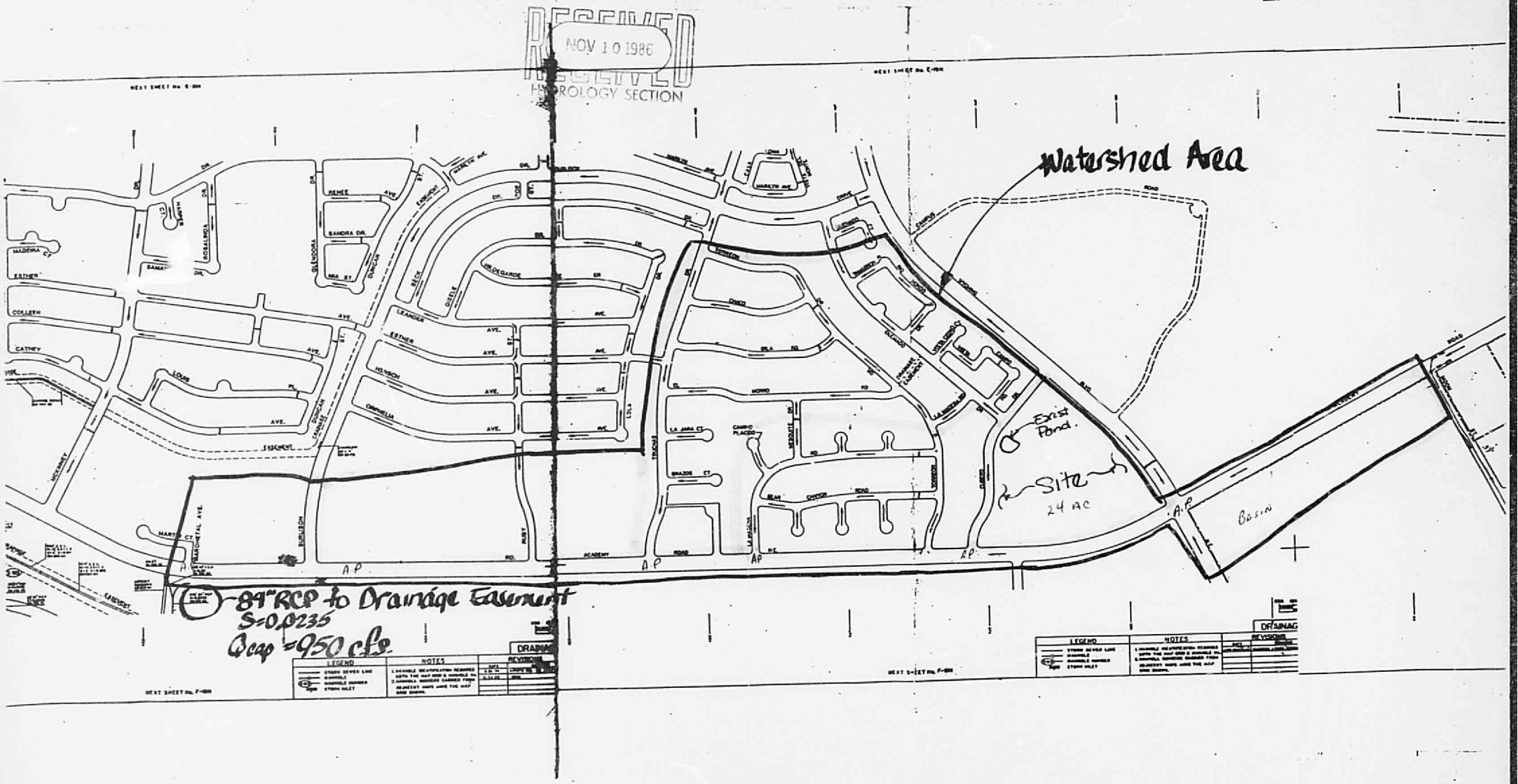
CAPACITY OF CUBERO DRIVE (100-YEAR):

$$Q = 1.486\, A^{5/3}\, S^{1/2} / np$$

A = (.47)(40) + (0.40)(20) = 26.80
P = 41.74
n = 0.017
S = 0.00706 (min.)
Q (100) = 146 cfs

PROPOSED RUNOFF TO CUBERO DRIVE (100-YEAR):

Q (100) = 59.7 cfs < 146 cfs


RECEIVED
NOV 10 1986
HYDROLOGY SECTION
Watershed Area
Exist Pond.
Site
24 AC
A.P.
Basin
84" RCP to Drainage Easement
S=0.0235
Qcap=950 cfs
LEGEND
NOTES
REVISIONS

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Northtown Shopping Ctr. ZONE ATLAS/DRNG. FILE #: ~~E,F 18~~ E19/D

LEGAL DESCRIPTION:

CITY ADDRESS:

ENGINEERING FIRM: Chavez-Grieve CONTACT: Jackie McDowell

ADDRESS: 4600C Montgomery PHONE: 881-7376

OWNER: ~~City of Albuq.~~ CONTACT: ~~Sandy Zaccheo~~

ADDRESS: PHONE:

ARCHITECT: de la Torre/Reinhart CONTACT: Jorge de la Torre

ADDRESS: Jorge de la Torre PHONE:

SURVEYOR: ~~Albuq. Surveying~~ CONTACT: ~~Fred Sanchez~~

ADDRESS: PHONE:

CONTRACTOR: CONTACT:

ADDRESS: PHONE:

RECEIVED
NOV 10 1986
HYDROLOGY SECTION

PRE-DESIGN MEETING:

___ YES
✓ NO
___ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO. _____
EPC NO. _____
PROJ. NO. _____

TYPE OF SUBMITTAL:

___ DRAINAGE REPORT
___ DRAINAGE PLAN
___ CONCEPTUAL GRADING & DRAINAGE PLAN
___ GRADING PLAN
___ EROSION CONTROL PLAN
___ ENGINEER'S CERTIFICATION
x Calcs

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL
___ PRELIMINARY PLAT APPROVAL
___ SITE DEVELOPMENT PLAN APPROVAL
___ FINAL PLAT APPROVAL
___ BUILDING PERMIT APPROVAL
___ FOUNDATION PERMIT APPROVAL
___ CERTIFICATE OF OCCUPANCY APPROVAL
___ ROUGH GRADING PERMIT APPROVAL
___ GRADING/PAVING PERMIT APPROVAL
X OTHER tent. bldg. permit (SPECIFY)

DATE SUBMITTED: 11/10/86

BY: Jackie S. McDowell

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

DESIGN HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

July 6, 1984

Mr. Thornton Schwenk
Boyle Engineering Corporation
3939 D San Pedro NE
Albuquerque, NM 87110

REF: UPDATE TO DRAINAGE REPORT FOR THE LOVELACE ACADEMY CLINIC ADDITION (E19-D15A) RECEIVED JULY 2, 1984

Dear Thornton:

The above referenced information is in compliance with the request of this department. Therefore, the drainage report is approved.

Please attach a copy of the approved plan, dated April 1984, to the construction set prior to release of the building permit.

For future reference all plans pertaining to this department's approval must have the engineer's stamp, signature and date of release.

If I can be of further assistance, please contact me at 766-7644.

Sincerely yours,

Billy J. Goolsby

Billy J. Goolsby, PE
City/County Flood Plain Admin.

BJG:mrk

Boyle Engineering Corporation

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

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

June 29, 1984
AL-S01-193-04

Attn: Billy J. Goolsby, P.E.
City/County Flood Plain Administration

RE: REVISIONS TO DRAINAGE REPORT FOR THE LOVELACE ACADEMY CLINIC ADDITION, 7901-2 ACADEMY BLVD., N.E. E19-D15a

Dear Billy:

The attached sheets are to update the calculations sent to Fred Aguirre on January 18, 1982, which were furnished to substantiate the March 1980 Master Drainage Plan prepared by our office.

Our present conclusion is that the ponding available on the site is still adequate to limit the net developed discharge to the approved 6,171 cu. ft. limit, in spite of the larger building addition being planned for the clinic.

On behalf of our clients, Stevens, Mallory, Pearl & Campbell, we therefore solicit your approval of the drainage requirements as part of the Building Permit application process.

Please call if you have any questions.

Sincerely,

BOYLE ENGINEERING CORPORATION

Thornton D. Schwenk

Thornton D. Schwenk, P.E.
Senior Civil Engineer

cc: David Hassard, SMPC
Don Stevens, SMPC

APPROVED FOR DRAINAGE

7/5/84
DATE

Billy J. Goolsby
SIGNATURE TITLE

ADVISE DRANAGE INSPECTOR WHEN GRADING EXECUTED

RECEIVED
JUL 02 1984
HYDROLOGY SECTION

INFORMATION SHEET

PROJECT TITLE Lovelace Academy Clinic Add'n TYPE OF SUBMITTAL Update to E19-D15a

ZONE ATLAS PAGE NO. E19 D15A CITY ADDRESS 7901-2 Academy Blvd. N.E.

LEGAL DESCRIPTION Tract D.4 of the replat of Tract D, North Towne Plaza

ENGINEERING FIRM Boyle Engineering Corporation CONTACT Thornton D. Schwenk

ADDRESS 3939-D San Pedro, N.E. PHONE (505) 883-7700

OWNER Lovelace Medical Center CONTACT Lars Jacobson

ADDRESS 5400 Gibson Blvd. S.E. PHONE 262-7325

ARCHITECT Stevens Mallory Pearl & Campbell CONTACT David Hassard

ADDRESS 115 Amherst Dr. S.E. PHONE 255-8668

SURVEYOR D.T. Morrison CONTACT D.T. Morrison

ADDRESS 1020 Texas, N.E. PHONE 256-7364

CONTRACTOR Chant Corporation Contractors CONTACT Ralph Spangeman

ADDRESS P.O. Box 30028, 87190 PHONE 345-2641

APPROVED FOR DRAINAGE
7/5/84
Billy J. Goolsby

PRE-DESIGN MEETING:

____ YES
____ NO
____ COPY OF CONFERENCE RECAP SHEET PROVIDED

PLEASE CHECK TYPE OF APPROVAL EXPECTED WITH THIS SUBMITTAL:

____ SKETCH PLAT APPROVAL
____ PRELIMINARY PLAT APPROVAL
____ SITE DEVELOPMENT PLAN APPROVAL
____ FINAL PLAT APPROVAL
_X_ BUILDING PERMIT APPROVAL
____ CERTIFICATE OF OCCUPANCY APPROVAL
____ ROUGH GRADING PERMIT APPROVAL
____ GRADING/PAVING PERMIT APPROVAL
____ OTHER. _____ (SPECIFY)
Master Plan Report dated March 1980

DATE SUBMITTED: _____

UPDATE SUBMITTED: June 29, 1984

RECEIVED
JUN 29 1984
STEVENS, MALLORY, PEARL & CAMPBELL

RECEIVED
JUL 02 1984
HYDROLOGY SECTION

BY: Thornton D. Schwenk

DR file

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

October 4, 1982 E19-D15a

Mr. Jack Fullerton
Bellamah Corporation
6121 Indian School Rd. N.E.
Albuquerque, N.M. 87110

RE: NORTHTOWNE SHOPPING CENTER POND RENOVATION

Dear Mr. Fullerton:

I have reviewed the details submitted by Chavez-Grieves Consulting Engineers and concur with the design. Therefore, this letter serves as a "go-a-head" for the work.

We request that the pond bottom be positively sloped toward the outlet pipes.

Thank you for your cooperation on this project. We look forward to having the problem rectified.

Very truly yours,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BGB/tsl

CHAVEZ GRIEVES / CONSULTING ENGINEERS, INC.

6121 INDIAN SCHOOL RD., N.E. SUITE 220
ALBUQUERQUE, N.M. 87110
PH. (505) 881-7376

September 30, 1982

Mr. Brian Burnett
Hydrology Department
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

RE: Northtowne Detention Pond

Mr. Burnett,

Attached are the revised details and site plan for the Northtowne Detention Drain.

Please advise me if there are any changes to be made.

Sincerely,

Yvonne M. Villescas

Yvonne M. Villescas

YV/dlk

cc. Jack Fullerton, Bellaash

CHAVEZ GRIEVES / CONSULTING ENGINEERS, INC.

6121 INDIAN SCHOOL RD., N.E. SUITE 220
ALBUQUERQUE, N.M. 87110
PH. (505) 881-7376

September 29, 1982

Mr. Brian Burnett
Hydrology Department
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Mr. Burnett,

Attached are the proposed drain details and site plan for the Northtowne Detention Drain. All elevations and dimensions are to be field verified.

Your prompt attention in this matter will be greatly appreciated.

Sincerely,

Yvonne M. Villescas

Yvonne M. Villescas

Encl.
YMV/dlk

cc. Jack Fullerton

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

September 22, 1982

Mr. Victor Chavez
Chavez-Grieves & Associates
6121 Indian School Rd. N.E.
Suite 220
Albuquerque, N.M. 87110

RE: YOUR LETTER OF SEPTEMBER 14, 1982 - NORTH TOWNE SHOPPING CENTER DRAINAGE MODIFICATION

Dear Vic:

I have reviewed your submittal regarding the North Towne pond modifications and concur that the pond bottom may be raised without drastically affecting the capacity of the facility. Since we have suggested this solution several times to the developer of the property, we now need to work out details such as:

1. Who will prepare the construction details for the work?

2. Who will pay for this work and when will it be constructed?

We are quite anxious to see this "project" brought to a conclusion since the facility has been a constant source of complaints for several years. Please contact me to discuss the details of the project.

Thanks for your help.

Very truly yours,

Brian G. Burnett
Civil Engineer/Hydrology

BGB/tsl

CHAVEZ GRIEVES / CONSULTING ENGINEERS, INC.

6121 INDIAN SCHOOL RD., N.E. SUITE 220
ALBUQUERQUE, N.M. 87110
PH. (505) 881-7376

September 14, 1982

RECEIVED

SEP 14 1982

ENGINEERING

Mr. Chuck Easterling
Assistant City Engineer/Hydrology
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Re: North Towne Shopping Center
Drainage Pond Modification

Dear Chuck,

The drainage pond for the North Towne Shopping Center was constructed in accordance with "Storm Drainage Study Relative to Development of Tract "A" and a Portion of Tract "B" Bear Canyon Village for the North Towne Shopping Center, Albuquerque, New Mexico, March, 1977" as prepared by Boyle Engineering Corporation. Subsequent to the construction of the pond, Cubero Drive was designed and built with a gutter flow line higher than the outlet of the drainage pond. This has caused standing water to stagnate in the pond, creating offensive odors and providing a breeding ground for misquitoes. As a result of complaints from nearby residential areas, the shopping center owners were requested to investigate potential solutions.

A review of the original report indicates that the relatively conservative approach required in 1977 will allow some changes while still conforming to today's standards. The original report assumed a three inch rainfall and provided for 100% retention. Design criteria contained in the recently published Development Process Manual provides for a total rainfall of two and a half inches and allows for routing storms through the ponds to effectively reduce the required volumes. The effect of these changes is shown in the attached calculations. A reduction in the required ponding volume will allow raising of the pond outlet from an elevation of 5402.2 to 5404.0 feet. Installation of two 10 inch drains with outlets adjacent to Cubero Drive will eliminate the present problem with stagnant water.

We hereby request approval of this proposed change. Your assistance in this matter is appreciated.

Sincerely,

Victor J. Chavez

Victor J. Chavez, P.E.

VJC/rc
encl.

Boyle Engineering Corporation
Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

LETTER OF TRANSMITTAL

TO: Samples, Mallory, Pearl, and Campbell
115 Amherst, S.E.
Albuquerque, New Mexico 87106

DATE: February 9, 1982

RE: ACADEMIC CLINIC POND DRAINAGE
PIPES

ATTN: Bob Monagan

B.E.C. PROJECT No. AL-501-198-02

GENTLEMEN:
We are sending you: ☒ Attached ☐ Under separate cover via _____
the following items:

- ☐ Shop Drawings
- ☒ Design calculations
- ☐ Tracings
- ☐ Prints
- ☐ Details
- ☐ Addendum
- ☐ Copy of letter
- ☐ Specifications
- ☐ Schedules
- ☐ Descriptive Literature
- ☐ _____

copies	date	No.	description
1	2/9/82		Q_6 Discharge rates and pipe sizes

These are transmitted as checked below:

- ☐ For approval
- ☐ Approved as submitted
- ☐ Approved as noted
- ☐ Returned for corrections
- ☐ As Requested
- ☐ _____
- ☐ For Bids due _____ 19____
- ☐ Prints returned after loan to us
- ☐ Resubmit _____ copies for approval
- ☐ Return _____ corrected prints
- ☒ For your use
- ☐ For review and comment
- ☐ _____ copies for distribution

REMARKS: Note that while a 3" pipe will work to drain the North pond a 6" pipe is needed for the South pond.

Copies also sent to: Fred Aguirre, City

RECEIVED
JUL 02 1984
HYDROLOGY SECT.

From: Thorton D. Schwenk
Thorton Schwenk, P.E.
Senior Civil Engineer

Boyle Engineering Corporation

consulting engineers

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

505 / 883-7700

January 18, 1982

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

Attn: Mr. Fred Aguirre, Hydrology Engineer

RE: Academy Clinic Site, North Towne Office Park, Bldg., No. 2
(Lovelace Medical Center, 7901-2 Academy Blvd., N.E.)

Dear Mr. Aguirre:

The following items are discussed in response to your drainage comments on your CONSTRUCTION PLAN CHECKLIST dated 11/24/81. These items are furnished on behalf of our client, Stevens, Mallory, Pearl & Campbell.

Item 16 — Internal contributory drainage areas are outlined on the enclosed reduced site plan. These areas conform to the proposed grading plan. The two pond volumes are compared to total volume of flows entering these ponds from their respective areas. The enclosed calculations show that the ponds have sufficient capacity to limit the offsite drainage to a value less than the historic pre-development condition.

Item 28 — Pond volume calculations are provided for the "balance" investigation described above. In the case of free-form pond shapes, volumes are computed by the contour method using end areas measured by polar planimeter.

100-year water surface elevations are marked on the reduced site plan.

Item 22 — Calculations for the outflow from the 3" pond bottom drains were provided to your office on April 7, 1980, by our late collegue, John Segotta. A copy of his letter is attached for your information. Although there are slight differences in pipe slopes between the original Master Drainage Plan and the SMPC Site Plan, the capacity of the 3" pipes is still an order-of-magnitude below the Q5 undeveloped flow. Also the 3" pipes will drain the ponds in less than 24 hours as noted on pages 1 and 3 of our Master Plan.

Sincerely,

BOYLE ENGINEERING CORPORATION

Thornton D. Schwenk

Thornton D. Schwenk, P.E.
Senior Civil Engineer

TDS:cc

ACADEMY CLINIC SITE, NORTH TOWNE OFFICE PARK

(LOVELACE MEDICAL CENTER, 7901-2 ACADEMY BLVD., N.E.)

DRAINAGE BALANCE CALCULATIONS

January 15, 1982

$V = C A P$

P = 6-hr. precipitation for 100-yr. storm
= 2.5 in

C = coefficient of runoff
= 0.4 undeveloped
= 0.9 developed

Areas Draining to North Pond

Designation	Area (ft^2)	C	V (ft^3)	
I	11,140	0.9	2,089	
II	14,540	0.4	1,211	
	SUBTOTAL		3,300	
	Capacity of North Pond		2,336	
				964 ft^3 overflow

Area draining to South Pond

III	32,400	0.9	6,075	
	Capacity of South Pond		3,050	
				3,025 ft^3 overflow

Areas not draining to either pond

IV	2,640	0.4	220
V	8,080	0.9	1,515
VI	5,280	0.4	440
	SUBTOTAL		2,175

TOTAL Unponded flow from developed site: 6,164 ft^3

Existing runoff from undeveloped site: 6,171 ft^3
(Ref.: March 1980, Master Drainage Report)



Boyle Engineering Corporation
Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

LETTER OF TRANSMITTAL

TO: SMPC

DATE: JANUARY 18, 1982

RE: ACADEMY CLINLIC

ATTN: BOB MORAGA

B.E.C. PROJECT No. AL-S01-193-02

GENTLEMEN:
We are sending you:

☐ Attached ☐ Under separate cover via _____

the following items:

☐ Shop Drawings
☒ Design calculations
☐ Tracings
☐ Prints
☒ Details
☐ _____

☐ Addendum
☒ Copy of letter
☐ Specifications
☐ Schedules
☐ Descriptive Literature

copies	date	No.	description
1	1/18/82	1	LETTER FROM B.E.C. TO FRED AGUIRRE, W/CALCS.
1	4/7/80	1	LETTER FROM B.E.C. TO FRED AGUIRRE
1	1/15/82		SKETCH OF SOUTH POND

These are transmitted as checked below:

☐ For approval
☐ Approved as submitted
☐ Approved as noted
☐ Returned for corrections
☐ As Requested
☐ _____
☐ For Bids due _____ 19____
☐ Prints returned after loan to us

☐ Resubmit _____ copies for approval
☐ Return _____ corrected prints
☒ For your use
☐ For review and comment
☐ _____ copies for distribution

REMARKS: The South Pond which you redrafted as part of A contains 2300 ft^3 vs 2790 ft^3 originally (a decrease, instead of the desired increase?) because the side slopes are too shallow (about 10:1). I have sketched the necessary dimensions with .3:1 side slopes to give you a 3050 ft^3 pond. This is less than the 3485 ft^3 called for on the Master Report but is sufficient for the adjusted runoff from your proposed development.

Copies also sent to: _____

From: Thornton D. Schwenk, P.E.
Senior Civil Engineer

Boyle Engineering Corporation

consulting engineers

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

505 / 883-7700

December 30, 1981

Stevens, Mallory, Pearl & Campbell
115 Amherst S.E.
Albuquerque, New Mexico 87102

Attn: Mr. Bob Moraga

RE: ACADEMY CLINIC DETENTION POND NORTH TOWNE OFFICE PARK, BLDG. NO.2

Dear Bob:

Attached is a partial grading plan revision for the enlarged detention pond north of the sidewalk for the above-referenced project. The pond should now conform to the requirements of the Boyle Master Drainage Report approved by the City on May 14, 1980.

We lowered the enclosing berm from elevation 5410 to 5409 and widened the pond toward the west so as to increase its capacity from 1450 ft^3 on your original Site Plan to 2336 ft^3 at an 18-inch water depth. With this capacity, the pond will experience an overflow of 800 ft^3, which when combined with the design overflow of 3759 ft^3 from pond 2B and the 1429 ft^3 of unponded flow adjacent to the driveway, will not exceed the permitted site runoff of 6171 ft^3.

Summarizing the applicable data from the Master Drainage Report, we note that ponds 2C and 2A have a combined volume of 302+1883 = 2185 ft^3. Flow to these ponds consists of 2067 ft^3 from the roof and 1069 ft^3 from the landscaped area north of your parking lot. The overflow, which you are now planning to route to the west, was thus 3136 - 2185 = 951 ft^3.

Please let us know if we can be of further assistance.

Sincerely yours,

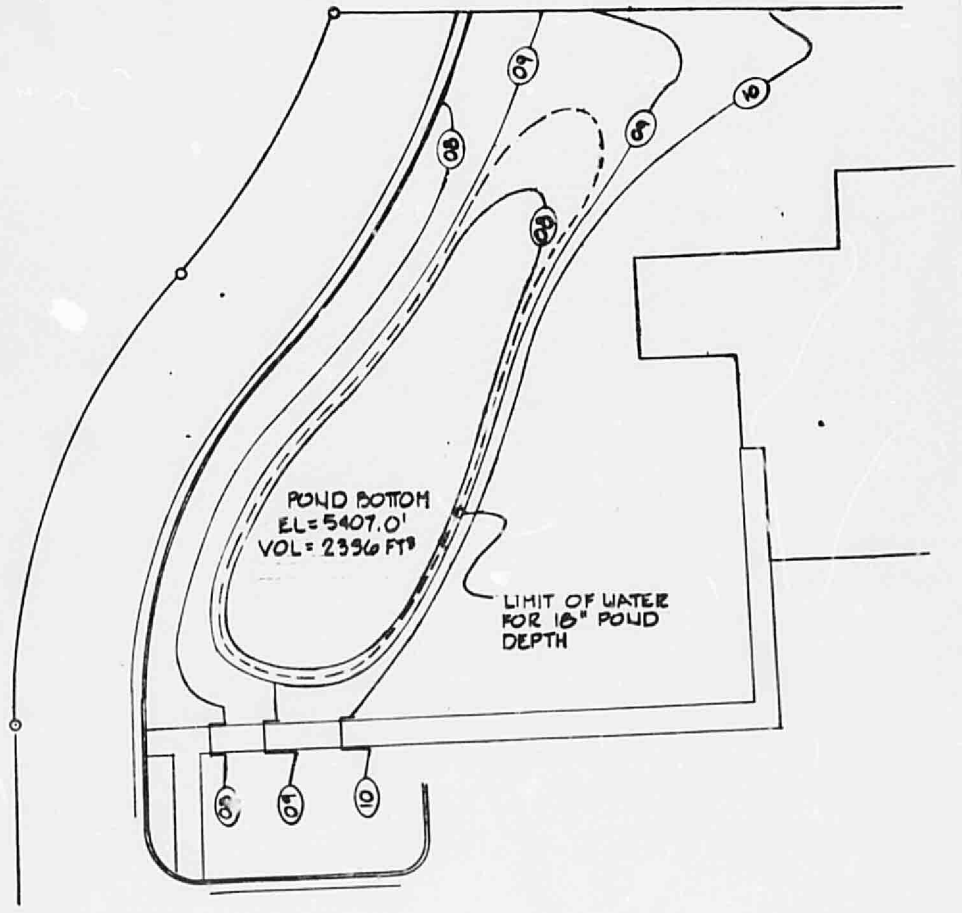
BOYLE ENGINEERING CORPORATION

Thornton

Thornton D. Schwenk, P.E.
Senior Civil Engineer

w/attachment

TDS:cc



1"=20'

DEC 30, 1981

ACADEMY CLINIC - NORTH TOWNE
OFFICE PARK BLDG Nº 2

Boyle Engineering Corporation
3939 San Pedro Dr. NE
ALBUQUERQUE, NEW MEXICO 87110

7801 Academy

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E.
NORMAN H. WETZ, P.E.
WAYNE A. ERICSON P.E.
JOHN B. HAUSKINS, P.E.
DALE V. BEDENKOP, P.E.
ROBERT L. FREW
GEORGE H. BECKWITH, P.E.
ROBERT R. KOONS, P.E.
DONALD G. METZGER, P.G.
ROBERT D. BOOTH, P.E.
ROBERT W. CROSSLEY, P.E.
RALPH E. WEEKS, P.G.

October 20, 1981

Dale Bellamah Corporation
6400 Uptown Boulevard, N.E.
Albuquerque, New Mexico 87110

SHB Job No. E77-1013
Addendum No. 2

Attention: Mr. George Rainhart

Re: North Town Plaza
Academy & Wyoming, N.E.
Albuquerque, New Mexico

Gentlemen:

In accordance with the request of Mr. Victor J. Chavez, P.E., with Chavez-Grieves Engineers, we have reviewed our original soil and foundation investigation report on the referenced project relative to ponding in the vicinity of the structures. It is understood that site grading for the North Town Professional Park, Building No. 3, will be such that small ponding areas will be located on the north and west of the structure, approximately 15 and 5 feet from its perimeter, respectively. These ponding areas will primarily impound runoff from the roof of the structure. In addition, the ponding areas are designed to drain in a relatively short period of time.

RECEIVED
OCT 21 1981

It was recommended in our original report that positive drainage away from the structures be provided and maintained. However, in view of the relatively small quantity

REPLY TO: 4700 LINCOLN ROAD, N.E., ALBUQUERQUE, NEW MEXICO 87109

PHOENIX (602) 272-6848
ALBUQUERQUE (505) 884-0950
SANTA FE (505) 471-7836

of water involved and short retention time, it is our opinion that the structure will perform satisfactorily with the ponding areas as designed.

This addendum should be attached to the original report and made a part thereof. Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By _____
Robert D. Booth, P.E.

ROBERT D. BOOTH NEW MEXICO 5711 REGISTERED PROFESSIONAL ENGINEER

Copies: Addressee (1)
North Town Development Company (1)
De La Torre-Rainhart, P.A., Architects (2)
Chavez-Grieves Engineers (1)

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

E19-D15

Mr. Victor Chavez
Chavez-Grieves Consulting Engineers
6121 Indian School Rd. N.E. Suite 120
Albuquerque, New Mexico 87110

Re: NORTHTOWNE OFFICE COMPLEX BUILDING THREE DRAINAGE REPORT

Dear Vic:

This letter is in response to your submittal of October 9, 1981. Approval of the referenced report will be granted by this office upon receipt of the letter from Mr. Booth.

I appreciate you supplying the requested information. If I can be of further help, please call.

Very truly yours,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BGB/fs

CHAVEZ GRIEVES / CONSULTING ENGINEERS, INC.

6121 INDIAN SCHOOL RD., N.E. SUITE 120
ALBUQUERQUE, N.M. 87110
PH. (505) 881-7376

October 9, 1981

RECEIVED

OCT 09 1981

ENGINEERING

Mr. Brian Burnett
Civil Engineer/Hydrology
P. O. Box 1293
Albuquerque, New Mexico 87103

Re: Northtowne Office Complex
Building Three Drainage Report

Dear Brian:

In response to your letter dated September 30, 1981 with regard to the referenced project, I offer the following:

1. A soils report was prepared by Sergent, Hauskins and Beckwith in in February of 1977. The report states "In no case should long-term ponding of water be allowed around the perimeter of the structure." Mr. Bob Booth of S.H.& B. was contacted to determine what constituted long-term ponding. It is his opinion that moisture migration from a ponding area used to temporarily detain water for periods less than twelve hours would not have a significant impact on the building foundation. Ponding areas "B" and "C" will be drained in approximately 1.65 hours. I have requested that this be confirmed in writing by Mr. Booth. Written confirmation will be forwarded upon receipt.

2. The proposed Building #3 is located on Tract D-3-A as shown on the attached plat. Revised grading on Tract D-4 reflects plans being prepared by others and is shown on our plan only to reflect compatibility between the two proposed structures. Grading on Tract A of Northtowne Plaza will not be affected. Grading on Tract D-3-B is required only to keep water from running back on Tract D-3-A. Tracts D-3-A, D-3-B and D-4 are all owned by Northtowne Office Plaza, a Partnership. See attached Replat.

3. The architects statement regarding buildings 4 and 5 was intended only as a point of clarification in that the original building plans have been revised requiring revisions in the original drainage master plan. The calculations submitted on September 21, 1981

reflected the changes made in the area of Building 3 only. They were intended as a supplement to the original Master Plan to avoid repeating the effects of upstream areas on the site development which are negligible.

4. Your revised Vol. calculations for Pond "C" show a required volume of 513 ft.^{3} Volume provided is 510 ft.^{3} Your statement that flows from Pond "B" had not been included is correct. Rather than increase the ponding area of "C", we would rather increase the outlet size to pass the routed flows from both "B" and "C" at rates equivalent to undeveloped conditions. Your calculations have been revised to reflect this change. (See attached.) The required ponding volume will be 453 ft.^{3} which is less than the 510 ft.^{3} provided. The site plan has been changed to reflect this.

5. a. See Attached.

   b. See Attached.

6. See Attached.

Thank you for your assistance in this matter and your timely response.

Very truly yours,

Victor J. Chavez

Victor J. Chavez

Attachments
cc: George Rainhart

RECEIVED
OCT 09 1981
ENGINEERING

Ponding Area C - Building 3 Northtowne (E19-D5)
BGB 9.29.81

Time	Rainfall (in)	V (in) (ft^3)	ΔV (ft^3)	V to Pond (ft^3)	V_{out} (ft^3)	$V_{in\ pond}$ (ft^3)
5	.33	186	186	186	~~23~~ 56	163
10	.92	526 ~~496~~	340 ~~310~~	503 ~~473~~	~~46~~ 106	397 ~~429~~
15	1.17	735 ~~645~~	209 ~~149~~	606 ~~575~~	~~69~~ 159	447 ~~507~~
20	1.32	896 ~~776~~	161 ~~71~~	608 ~~578~~	~~69~~ 159	449 ~~509~~
25	1.47	1057 ~~787~~	161 ~~71~~	610 ~~580~~	~~69~~ 159	451 ~~511~~
30	1.62	1218 ~~858~~	161 ~~71~~	612 ~~582~~	~~69~~ 159	453 ~~513~~
35	1.69	1341 ~~841~~	123 ~~33~~	576 ~~546~~	~~69~~ 159	417 ~~477~~

Note: "Volume in" must include contribution from "Pond B"

Required Volume in Pond C. is 513 cuft

RECEIVED
OCT 09 1981
ENGINEERING

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

E19-D15

September 30, 1981

Mr. Vic Chavez
Chavez-Grieves/Consulting Engineers
6121 Indian School Rd. N.E., Suite 120
Albuquerque, New Mexico 87110

Re: NORTHTOWNE OFFICE COMPLEX - BUILDING THREE DRAINAGE REPORT

Dear Vic:

A review of the submitted material for the referenced drainage report has resulted in the covenants listed below. The numbers refer to the Drainage Report (DR) and Construction Plan (CP) Checklists.

1. DR #6 - Ponding is proposed within 15 ft. of the structure. A soils report is required for plans of this type.

2. DR #10 - Approval of the proposed off-site grading must be obtained from the adjacent property owners. A statement addressing how the grading will affect off-site flows and the existing developments should be included.

3. Please clarify the statement on the plans submitted by the architect that states "For information - possible modification to the original plan combines buildings 4 and 5." How will this change affect the approved master plan?

4. DR #15B1 - The pond volume for Sub Area "C" does not appear adequate since the contribution from Pond "B" is included in the calculations (See enclosed sheet).

5. Please supply the following information

   a. DR #15B3 - Emergency spillways with supporting calculations.

   b. Copy of zone atlas page and legal description placed on the grading and detail plan (DP#18-CP#4).

6. A completed drainage covenant will be required before approval can be granted.

It should be pointed out that the proposed site plan differs significantly from the approved master plan and therefore requires the investigation of the above items.

If I can answer any questions, please call.

Very truly yours,

Brian G. Burnett
Civil Engineer/Hydrology

BGB/fs
Enclosure

CHAVEZ GRIEVES / CONSULTING ENGINEERS, INC.

6121 INDIAN SCHOOL RD., N.E. SUITE 120
ALBUQUERQUE, N.M. 87110
PH. (505) 881-7376

September 21, 1981

Mr. Chuck Easterling
Assistant City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

RECEIVED
SEP 21 1981
ENGINEERING

Re: Northtowne Office Park
Revised Drainage Report

Dear Mr. Easterling:

Attached are the revised calculations for a portion of the "Northtowne Office Park - Drainage Report (Master Plan)" dated March, 1980 as prepared by Boyle Engineering Corporation. The revised areas include drainage area 3 and portions of drainage areas 4 and 5.

Offsite conditions are identical to those oulined in the referenced report. On site ponding has been revised to reflect the benefits of routing flows through the ponds to minimize required volumes.

Included in the attached information are the pond volume calculations and a marked-up grading plan showing the sub-drainage areas.

Please call if you require any additional information or have any questions.

Sincerely,

Victor J. Chavez

Victor J. Chavez, P. E.

cc: Jorge de La Torre

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

June 4, 1981

Mr. Ed Pennybacker
On Your Behalf
KOAT-TV/P. O. Box 25982
Comanche & Carlisle N.E.
Albuquerque, New Mexico 87125

Dear Mr. Pennybacker:

First of all, I want to apologize for the delay in responding to your letter of May 6, 1981.

I contacted the owner of the development (Bellamah Corporation) and was assured in a letter to me (attached) that the problem would be corrected by June 1, 1981.

Also, Mr. Fullerton informed me that these corrective measures are temporary and a permanent solution will be forthcoming when construction plans are submitted for future development.

If you have any further questions, please feel free to contact me.

Very truly yours,

Fred J. Aguirre, PE
Civil Engineer

FJA/cc

xc: Check Easterling, PACE/Hydrology
Jack D. Fullerton, Mgr., New Mexico Income Properties

Bellamah Development Corp.

May 27, 1981

Mr. Fred Aguirre
City Engineer Department
123 Central Avenue, NW
Hydrology Section
Albuquerque, NM

Dear Mr. Aguirre:

Please allow this letter to act as a follow-up to our conversations on Tuesday, May 26, 1981, concerning the ponding area at North Towne Shopping Center. As I mentioned to you at that time, the reason that the ponding area had standing water in it was due to the fact that our maintenance man has been on vacation and has not been able to pump the water out. Be assured that this matter will be corrected by Monday, June 1, 1981.

If you should have any questions regarding this matter, please contact me.

Sincerely,
BELLAMAH DEVELOPMENT CORP.

Jack D. Fullerton

Jack D. Fullerton, Manager
New Mexico Income Properties

JDF:vmd

RECEIVED
JUN 01 1981
RECEIVED

6121 Indian School Road, NE / PO Box 3325 / Albuquerque, New Mexico 87190 / (505) 883-3000

RECEIVED
MAY 12 1981
RECEIVED

ON YOUR BEHALF
Ed Pennybacker

May 6, 1981

Mr. Fred Aguirre
Flood Control
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Dear Mr. Aguirre,

Enclosed please find a letter from Dr. Gordon Scott which is self-explanatory. Would you please be kind enough to review your records on this matter to determine what, if anything, might be done? Or if there are additional factors of which I am not aware, please let me know.

Thank you for your time and attention. I am looking forward to your reply.

Sincerely,

ED PENNYBACKER
On Your Behalf

EP:

Enclosures

KOAT-TV / P.O. Box 25982 / Comanche & Carlisle N.E. / Albuquerque, New Mexico 87125 / (505)884-7777

HYDROLOGY E19/D16 2 of 2 5 PLANS

GORDON W. SCOTT, M.D., P.A.
EL CAMINO MEDICAL CENTER
SUITE 3000
8100 CONSTITUTION PL. NE
ALBUQUERQUE, NEW MEXICO 87110

TELEPHONE 299-9049

May 1, 1981

RECEIVED
MAY 12 1981
RECEIVED

Mr. Ed Pennybacker
KOAT-TV Station
On Your Behalf
P. O. Box 25982
Albuquerque, New Mexico 87125

Dear Mr. Pennybacker:

There is a recessed basin on the North side of the North Town Shopping Center which is located at the corner of Wyoming and Academy. The purpose of this large basin is to collect the water runoff from the shopping center area. At the East end of this basin is a connection with the sewer to allow the water to run off as it collects. So far, it sounds good.

The only trouble is that the bottom of the basin is not properly sloped and so all during the summer months, there is stagnant water standing in the bottom of this. This provides a place where mosquitos may breed and as the weather becomes warmer, the stagnant water has a definite odor, made worse by garbage and trash which blows in and stays there.

Last summer, I brought this problem to the attention of the management corporation for the shopping center and they refused to take any action. I then spent half an hour on the telephone contacting various city offices, each of which assured me that it was not their job to attend to things like this.

As the warm weather approaches, I would appreciate your looking into this source of odor pollution which I think is also a health hazard. It would seem like a simple thing to put more gravel on the bottom of the area and with a proper slope so that the water would run off as it collects.

Thank you for your help.

Sincerely yours,

Gordon W. Scott M.D.

Gordon W. Scott, M. D.

GWS:*

Boyle Engineering Corporation

consulting engineers

Suite D
3509 San Pedro N.E.
Albuquerque, New Mexico 87110

505 / 883-7900

May 5, 1980

Jorge de la Torre, Architect
6121 Indian School Road NE
Suite 141
Albuquerque, New Mexico 87110

Attention: Mr. Bob McCabe

RE: North Towne Office
Park Drainage Report
Job No. K-002-109-51

Dear Mr. McCabe:

Transmitted herewith is a copy of the letter of approval for subject project for your use and files.

I do not foresee any problems in the complying with the guidelines Mr. Conegliano outlined in his letter of approval for the first phase of construction insofar as the drainage plan and grading plan are concerned. It is my understanding that the timing and construction of Cubero Drive will be concurrent with the construction of Building No. 1.

I you have any problems or require any further assistance please do not hesitate to call.

Sincerely,
BOYLE ENGINEERING CORPORATION

John A. Segotta
Assistant Civil Engineer

JAS/cc

K-602-104-37

Rec'd. 5/2/80 JAL

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 29, 1980

John A. Segotta
Boyle Engineering Corp.
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

Reference: North Towne Office Park

Dear Mr. Segotta:

I have reviewed the revised plan for the referenced project, and the drainage plan submitted is approved in concept.

The construction plan for each individual site will have to contain a detailed grading plan with an acceptable configuration of the ponding areas, a clear indication of the conveyance of the flow from the buildings to the ponding areas and from the ponding areas to the street.

The temporary means required to control the outside flows before the adjacent parcels are developed must also be indicated. This approval is contingent upon concurrence by Mr. Heller, of the treatment and the timing for the construction of Cuebro Dr. adjacent to this parcel.

Very truly yours,

Bruno Conegliano
Assistant City Engineer/Hydrology

BC/lc
xc: Richard Leonard, AMAFCA
Richard Heller, City Engineer

Boyle Engineering Corporation

April 7, 1980

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

RE: Drainage Report for North Towne Office Park
Job Number K-002-109-51

Dear Mr. Aguirre,

In response to your comments by letter of March 28, 1980, the following information is submitted in order to clarify problem areas noted for the above project:

1. Although t_c's determined from the nomographs do not agree exactly, I submit that they are of sufficient accuracy for design.

2. Attached are calculations which indicate that the outflow from the 3" drains is less than Q_5 undeveloped, thus complying with the "Interim Drainage Guidelines" November 1979.

3. Attached is the revised grading plan with spot elevations shown along the east side of the buildings at the curb line. These spot elevations show that runoff will drain out of parking areas and not pond against the curbs.

4. Combined ponding area 4A and 4C is shown incorrectly. On the attached revised grading plan it is shown correctly. The pond has a sodded sideslope of 3:1 from the property line with no vertical drop as indicated in your comment # 4.

5. Flow through the curb cuts into the ponding areas will not create erosion problems as all ponding areas will be completely sodded.

By this submittal it is anticipated that the referenced drainage report will meet with your approval. Your immediate response to this material will be appreciated.

BOYLE ENGINEERING CORPORATION

Thornton Dobkowski, for

John A. Segotta
Assistant Civil Engineer

JAS:crm
encl:

Boyle Engineering Corporation

Suite D
3939 San Pedro N.E.
Albuquerque, New Mexico 87110

consulting engineers
505 / 883-7700

Mr. Richard Heller
City Engineer
The City of Albuquerque
PO Box 1293
Albuquerque, New Mexico 87103

March 7, 1980

E19-D15a

RECEIVED
MAR 10 1980
CITY ENGINEER

RE: DRAINAGE REPORT
NORTH TOWNE OFFICE PARK (MASTER PLAN)
JOB. NO. K-D02-109-51

Dear Mr. Heller:

Transmitted herewith are three (3) copies of the above referenced drainage report for your review and approval.

Your immediate attention to this matter will be appreciated. If you have any questions, please do not hesitate to call.

Yours truly,

BOYLE ENGINEERING CORPORATION

John A Segotta

John A. Segotta
Assistant Civil Engineer

JAS:pdn
Enclosures: a/s

TRSH	ADM
HRO	SUR
CDS	COUN
DES	SEC
INSP	FILE
HYDRO	RETURN

October 22, 1981

City of Albuquerque
Department of Hydrology
123 Central SW
Albuquerque, New Mexico 87103

Attention: Fred Aguirre

Dear Mr. Aguirre,

Enclosed herewith is a copy of the site plan of Northtowne Office Park, Building 3, 7801 Academy NE.

Sincerely,

George Rainhart

RECEIVED
OCT 23 1981
CITY ENGINEER

621 indian school road ne / suite 141 / albuquerque nm 87110/505 881 0550

NORTH TOWNE OFFICE PARK

DRAINAGE REPORT
(MASTER PLAN)

MARCH, 1980

Boyle Engineering Corporation
consulting engineers / architects

NORTH TOWNE OFFICE PARK

DRAINAGE REPORT (MASTER PLAN)

RECEIVED
MAR 10 1980
CITY ENGINEER

I. PURPOSE:

This report presents data relating to storm runoff from a 6.04 acre tract of land located at the Northeast Intersection of Academy Road and Cubero Drive. This tract is being developed for use as an office park by the Dale Bellamah Corporation in Albuquerque, New Mexico (See Vicinity Map in the Appendix).

II. SCOPE:

The analysis presented herein deals with the determination of the amount of runoff from the proposed development prior to and subsequent to development based on a 2.5" (100 year) rainfall. The peak off-site runoff of the developed site shall not be in excess of the pre-development peak runoff rates. Excess runoff created by the proposed development will be ponded on-site. These ponds will be designed to drain over a 24 hour period to Cubero Drive and Academy Road.

III. LOCATION:

The area to be developed is a 6.04 acre portion of Parcel 5, Tract B of the North Towne Shopping Center. The property is bounded on the North by the remaining undeveloped 1.38 acres of Parcel 5, on the West by Cubero Drive, on the East by the developed portion of the North Towne Shopping Center, and faces South on Academy Road (See Location Map in Appendix).

IV. EXISTING DRAINAGE CONDITIONS:

The site is composed of decomposed granite soils, sparsely vegetated with native grasses. The present drainage is characterized by overland sheet flow east to west into Cubero Drive. The drainage on Cubero Drive follows

the grade of the street to Academy Road.

The elevation of the site is 5422 at the high point and 5398 at the low point. The slope is east to west at approximately 4.08%.

No offsite drainage will enter onto the proposed development. Drainage from the developed portion of the North Towne Shopping Center (East side) is prevented from entering the property by a 6-inch header curb abutting the east property line. The grade of the private drive running parallel with the header curb also directs drainage away from the property. Drainage from the undeveloped parcel to the North follows natural drainage patterns West to Cubero Drive and away from the development. Drainage on Cubero Drive and Academy Road is prevented from entering onto the property by standard curb and gutter and/or the design grade of the respective areas.

V. PROPOSED DRAINAGE PLANS:

A. CRITERIA

1) General: Standards and Policies being followed by the City of Albuquerque, New Mexico.

2) Project Storm: 100 year intensity; frequency duration as shown by the curves of Chart 1, "1963 Master Plan of Drainage for the City of Albuquerque and Environs" as prepared by Gordon Herkenhoff and Associates, Inc., Consulting Engineers.

B. FLOOD PROTECTION

1) Existing Condition: Flow from contiguous properties is minimal to non-existent. The site is not in danger of flooding during a 100-year storm.

2) Future Conditions: There will be five office buildings (proposed) covering approximately 17% of the entire site, paved parking - 60%, and landscaped area 23% (See attached Site Layout and Grading Plan).

C. SITE DRAINAGE

As shown on the attached site plan, the general pattern of the existing topography will not have to be altered significantly in order to

achieve the desirable development. The historic drainage pattern will remain the same as before development. The site will be divided into five separate drainage areas. The intent is to make the drainage plan compatible with the developers plan to develop the site in phases. Each phase will consist of the construction of an office building and its related site. Periods of time will elapse between phases of construction, thereby creating the need for separate drainage plans for each phase of the development.

Onsite ponds will be provided in each drainage area and will reduce offsite drainage below the historic pre-development condition. The ponded water will be disposed of over a 24 hour period onto Cubero Drive and Academy Road and also by evaporation and percolation. Roof drains will be required to drain by downspouts or internal piping into areas designated as shown on the attached plot of drainage areas. (See Drainage Area Plan in Appendix.)

VI. SUMMARY:

Prior to the development of this site, 21,925 cubic feet of runoff was released as offsite drainage to Cubero Drive and then following grade to Academy Road. Subsequent to development and implementation of the proposed drainage plan, the volume of runoff released as offsite drainage to Cubero Drive and Academy Road will be 21,130 cubic feet. Drainage conditions will be improved after development by reducing runoff released offsite by 795 cubic feet.

VII. CONCLUSIONS AND RECOMMENDATIONS

On the basis of the study performed herein, the following recommendations are proposed:

1) Maintain the historic drainage pattern.
2) Provide ponding areas as shown on the attached Drainage Plan.
3) Provide roof drainage, to drain the total roof areas into the designated drainage areas and ponding areas. (See Drainage Plan)

4) Grade the site as shown on the attached Grading Plan.
5) Provide 3" drains from Ponding Areas onto Cubero Drive and Academy Road as shown in detail on the Drainage Plan.
6) Provide interim drainage improvements (if required) during phase construction. The first phase of construction will consist of Drainage Area 1 only.

Provided the above listed recommendations are implemented prior to or concurrent with the development of the property, it is concluded that the proposed development will not create a flood hazard to surrounding properties, nor will the property itself be in danger of flooding.

Respectfully submitted,
BOYLE ENGINEERING CORPORATION

Theodore C. Hogsett, PE
Senior Civil Engineer

TCH:pdn

APPENDIX

APPENDIX

DRAINAGE REPORT

I. DRAINAGE AREA #1

AREA = 1.42 Acres = 61,855 sq. ft.

LENGTH = 365 ft.

AVERAGE SLOPE = $\frac{106 - 98}{365}$ = 0.0219 2.19%

A. EXISTING CONDITIONS

1) Determination of Concentration Time, tc

Undeveloped Ground - Poor Grass

From: Figure H - Overland Flow Time - Page 18-01
Data Book for Civil Engineers: Design, by Elwyn Seelye

tc = 16.8 minutes

2) Determination of Intensity:

For 100-year storm - from Master Plan of Drainage, City of Albuquerque, New Mexico - 1963 Chart I, by Herkenhoff & Associates.

Intensity, $I = \frac{189}{tc + 25} = \frac{189}{16.8 + 25} = 4.52$ in./hr.

3) Determination of Runoff for 100-Year Storm:

Rate of Flow, $Q_{100} = CIA$

Where C = Coefficient of Runoff
A = Area in Acres
I = Intensity

$Q_{100} = 0.4\ (4.52)\ (1.42) = 2.57$ cfs

Volume of Runoff, V_{100} = (A, sq. ft.) (C) (Rainfall in inches)

= (61,855) (0.4) (2.5/12) = 5,155 cu.ft.

B. CONDITION AFTER DEVELOPMENT

1) Runoff For Proposed Development:

Rate of Flow = CIA

Q_{100} = [(0.9) (5.96) (1.10)] + [(0.4) (4.02) (.31)] = 6.40cfs

Volume of Runoff

$V_{100} = [0.9 \times \frac{2.5}{12} \times 48{,}114] + [0.4 \times \frac{2.5}{12} \times 13{,}741] = 10{,}166$cu.ft.

Change in Runoff Due to Development

	Proposed		Existing		
Change Q =	6.40	-	2.57	=	3.83 cfs
Change V =	10,166	-	5,155	=	5,011 cu.ft.

2) Pond Characteristics

Pond	Volume	Surface Area
1A	5,437 cu.ft.	5,000 sq. ft.
TOTAL	5,437 cu.ft.	5,000 sq. ft.

3) Areas Draining Into Ponds

Volume Runoff From Roof = 1,763 cu. ft.

Pond 1A has a total volume greater than V_{100} from roof.

Therefore, all runoff from the roof is ponded.

Volume Runoff from Paved and Landscaped Areas = 8,403 cu. ft.

Pond 1A 3,674 cu. ft. (partially filled)

3,674 cu. ft.

100-Year storm runoff exceeds pond capacity by 8,403 - 3674 = 4,729 cu. ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
5,155 cu. ft.	4,729 cu. ft.

Developed Condition less than existing condition, therefore all right.

II. DRAINAGE AREA #2

AREA = 1.70 Acres = 74,052 sq. ft.

LENGTH = 370 ft.

AVERAGE SLOPE = $\frac{22 - 6}{370}$ = 0.0432 4.32%

A. Existing Condition

1) Determination of Concentration:

tc = 15.0 min. (reference Area #1)

2) Determination of Intensity:

$$I = \frac{189}{tc + 25} = \frac{189}{115 + 25} = 4.72 \text{ in./hr.}$$

3) Determination of Runoff for 100-Year Storm

Rate of Flow, Q_{100} = CIA

= (0.4) (4.72) (1.70) = 3.21 cfs

Volume of Runoff -

$$V_{100} = (74,052)\ (0.4)\ \left(\frac{2.5}{12}\right) = 6,171 \text{ cu. ft.}$$

B. Condition After Development

1) Runoff For Proposed Development

Rate of Flow = CIA

$$Q_{100} = [\ (0.9)\ (6.09)\ (1.24)] + [(0.4)(4.23)(0.46)] =$$

7.58 cfs

Volume of Runoff

$$V_{100} = [0.9 \times \frac{2.5}{12} \times 54,128] + [0.4 \times \frac{2.5}{12} \times 19,924] =$$

11,809 cu. ft.

Change in Runoff due to Development

	Proposed		Existing		
Change Q =	7.58	-	3.21	=	4.37 cfs
Change V =	11,809	-	6,171	=	5,638 cu. ft.

2) Pond Characteristics

Pond	Volume	Surface Area
2A	1,883 cu. ft.	1,575 sq. ft.
2B	3,485 cu. ft.	2,800 sq. ft.
2C	302 cu. ft.	450 sq. ft.
Total	5,660 cu. ft.	4,825 sq. ft.

3) Areas Draining Into Ponds

Volume Runoff from Roof = 2,067 cu. ft.

Ponds 2A & 2C have total volume greater than V_{100} from roof. Therefore, all runoff from the roof is ponded.

Volume runoff from paved and landscaped areas = 9,742 cu. ft.

Pond 2A 118 cu. ft. (partially filled)

Pond 2B 3,485 cu. ft.

Pond 2C Filled

3,603 cu. ft.

100 Year storm runoff exceeds pond capacity by

9,742 - 3,603 = 6,139 cu. ft. to offsite drainage

4) Runoft From Site After Development

Existing Condition	Developed Condition
6,171 cu. ft.	6,139 cu. ft.

Developed condition less than existing condition, therefore, all right.

III. DRAINAGE AREA #3

AREA = 0.96 Acres = 41,818 sq. ft.

LENGTH = 275 ft.

AVERAGE SLOPE = $\frac{18 - 8}{275}$ = 0.364 3.64%

A. Existing Condition

1) Determination of Concentration Time, tc:

tc = 13.8 minutes (reference - Area #1)

2) Determination of Intensity:

$I = \frac{189}{tc + 25} = \frac{189}{13.8 + 25} = 4.87$ in./hr.

3) Determination of Runoff for 100-Year Storm:

Rate of Flow, Q_{100} = (0.4) (4.87) (0.96) = 1.87 cfs

Volume of Runoff -

$$V_{100} = (41,818)\ (0.4)\ \left(\frac{2.5}{12}\right) = 3,485 \text{ cu. ft.}$$

B. Condition After Development

1) Runoff for Proposed Development

Rate of Flow = CIA

$$Q_{100} = [(0.9)(6.19)(0.73)] + [(0.4)(4.44)(0.23)] = 4.47 \text{ cfs}$$

Volume of Runoff

$$V_{100} = [0.9 \times \frac{2.5}{12} \times 31{,}982] + [0.4 \times \frac{2.5}{12} \times 9836] = 6{,}816 \text{ cu.ft.}$$

Change in Runoff Due to Development

	Proposed		Existing		
Change Q =	4.47	-	1.87	=	2.60 cfs
Change V =	6,816	-	3,485	=	3,331 cu. ft.

2) Pond Characteristics

Pond	Volume	Surface Area
3A	500 cu.ft.	430 sq. ft.
3B	764 cu.ft.	650 sq. ft.
3C	983 cu.ft.	1200 sq. ft.
3D	1,264 cu.ft.	864 sq. ft.
TOTAL	3,511 cu.ft.	3,144 sq. ft.

3) Areas Draining Into Pond

Volume Runoff From Roof = 1,574 cu.ft.

Ponds 3A, 3B & 3D have total volume greater than V_{100} from roof (2528 ft.^3 1574 ft.^3), therefore, all runoff from the roof is ponded.

Volume of runoff from paved and landscaped areas = 5,242 cu.ft.

Pond 3C	983 cu. ft.
Pond 3D	954 cu. ft. (Partially filled)
	1,937 cu. ft.

100 Year storm runoff exceeds pond capacity by 5242-1937 = 3305 cu.ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
3,485 cu.ft.	3,305 cu.ft.

Developed condition less than existing condition, therefore, all right.

IV. DRAINAGE AREA #4

AREA = 0.78 Acres = 33,977 sq. ft.

LENGTH = 280 ft.

AVERAGE SLOPE = $\frac{10 - 0}{280}$ = 0.0357 3.57%

A. Existing Condition

1) Determination of Concentration Time, tc:

tc = 13.3 minutes (reference - Area #1)

2) Determination of Intensity:

$$I = \frac{189}{tc + 25} = \frac{189}{13.3 + 25} = 4.93 \text{ in./hr.}$$

3) Determination of Runoff For 100-Year Storm

Rate of Flow; $Q_{100} = (0.4)(4.93)(0.78) = 1.54$ cfs

Volume of Runoff

$$V_{100} = (0.4)\left(\frac{2.5}{12}\right)(33,977) = 2,831 \text{ cu.ft.}$$

B. Condition After Development

1) Runoff For Proposed Development

Rate of Flow = ICA

$$Q_{100} = [(0.9)(6.09)(0.67)] + [(0.4)(4.41)(0.11)] = 3.87 \text{ cfs}$$

Volume of Runoff

$$V_{100} = [0.9 \times \frac{2.5}{12} \times 29,185] + [0.4 \times \frac{2.5}{12} \times 4,792] = 5,872 \text{ cu.ft.}$$

Change in Runoff Due to Development

		Proposed		Existing	
Change Q	=	3.87	-	1.54	= 2.33 cfs
Change V	=	5,872	-	2,831	= 3,041 cu.ft.

2) Pond Characteristics

Pond	Volume	Surface Area
4A	1,219 cu.ft.	1,200 sq.ft.
4B	1,220 cu.ft.	870 sq.ft.
4C	644 cu.ft.	550 sq.ft.
TOTAL	3,083 cu.ft.	2,620 sq.ft.

3) Areas Draining Into Pond:

Volume Runoff From Roof = 1,485 cu.ft.

Ponds 4A & 4C have total volume greater than V_{100} from roof. Therefore, all runoff from the roof is ponded.

Volume of Runoff From Paved and Landscaped Areas = 4,387 cu.ft.

Pond 4A	Filled
Pond 4B	1,220 cu.ft.
Pond 4C	378 cu.ft. (partially filled)
	1,598 cu.ft.

100 Year Stomm runoff exceeds pond capacity by 4,387-1,598=2,789 cu.ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
2,831 cu. ft.	2,789 cu. ft.

Developed Condition less than Existing Condition, therefore, all right.

V. DRAINAGE AREA #5

AREA = 1.18 Acres = 51,400 sq. ft.

LENGTH = 370 ft.

AVERAGE SLOPE = $\frac{16 - 1}{370}$ = 0.0405 4.05%

A. Existing Condition

1) Determination of Concentration Time, tc:

tc = 15.0 minutes (reference - Area #1)

2) Determination of Intensity:

$I = \frac{189}{tc + 25} = \frac{189}{15 + 25} = 4.72$ in./hr.

3) Determination of Runoff For 100 Year Storm:

Rate of Flow, $Q_{100} = (0.4)(4.72)(1.18) = 2.23$ cfs

Volume of Runoff

$$V_{100} = (0.4)\left(\frac{2.5}{12}\right)(51,400) = 4,283 \text{ cu.ft.}$$

B. Condition After Development

1) Runoff For Proposed Development

Rate of Flow = CIA

$$Q_{100} = [(0.9)(0.10)(0.88)] + [(0.4)(4.30)(0.30)] = 5.35 \text{ cfs}$$

Volume of Runoff

$$V_{100} = [0.9 \times \frac{2.5}{12} \times 38{,}194] + [0.4 \times \frac{2.5}{12} \times 13{,}207] = 8{,}262 \text{ cu.ft.}$$

Change in Runoff Due to Development

		Proposed		Existing		
Change Q	=	5.35	-	2.23	=	3.12 cfs
Change V	=	8,262	-	4,283	=	3,979 cu.ft.

2) Pond Characteristics

Pond	Volume	Surface Area
5A	355 cu.ft.	390 sq. ft.
5B	3,739 cu.ft.	2,850 sq. ft.
TOTAL	4,094 cu.ft.	3,240 sq. ft.

3) Areas Draining Into Ponds

Volume Runoff From Roof = 1,582 cu.ft.

Ponds 5A & 5B have volume greater than V_{100} from roof. Therefore, all runoff from the roof is ponded.

Volume of Runoff From Paved & landscaped areas = 6,680 cu.ft.

Pond 5A	Filled
Pond 5B	2,512 (partially filled)
	2,512 cu. ft.

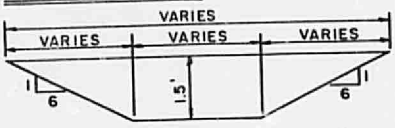
100-Year Storm Runoff exceeds pond capacity by 6,680-2,512= 4,168 cu.ft. to offsite drainage.

4) Runoff From Site After Development

Existing Condition	Developed Condition
4,283 cu.ft.	4,168 cu.ft.

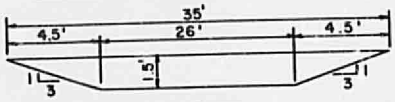
Developed condition less than existing condition, therefore, all right.

DRAINAGE AREA 1

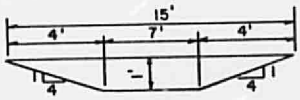


POND 1A L=140'
V=5437 ft.^{3}

DRAINAGE AREA 2

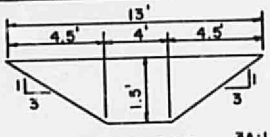


POND 2A & 2B 2A: L=45'
V=1883 ft.^{3}
2B: L=80'
V=3485 ft.^{3}

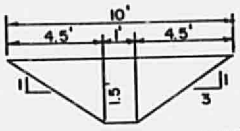


POND 2C L=30'
V=302 ft.^{3}

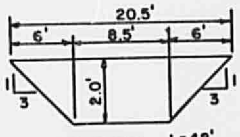
DRAINAGE AREA 3



POND 3A & 3B 3A: L=43'
V=500 ft.^{3}
3B: L=65'
V=764 ft.^{3}

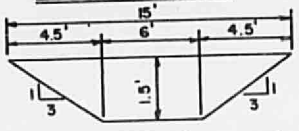


POND 3C L=120'
V=983 ft.^{3}

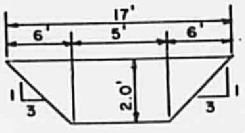


POND 3D L=48'
V=1264 ft.^{3}

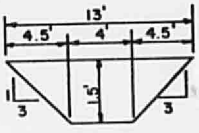
DRAINAGE AREA 4



POND 4A L=80'
V=1219 ft.^{3}

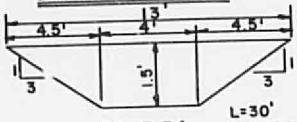


POND 4B L=58'
V=1220 ft.^{3}

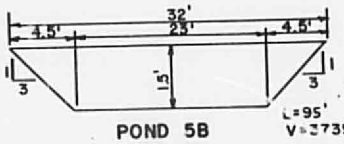


POND 4C. L=55'
V=644 ft.^{3}

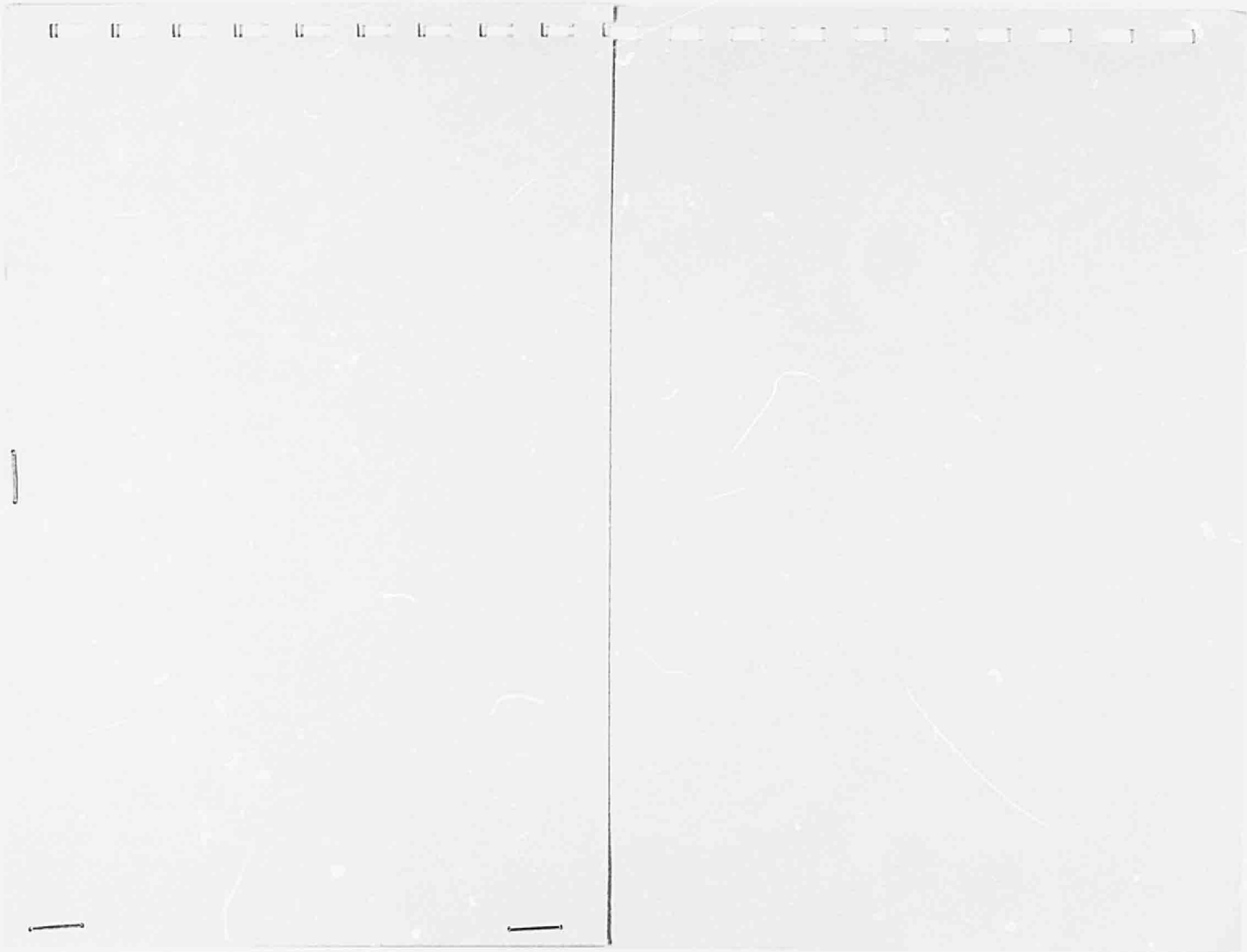
DRAINAGE AREA 5



POND 5A L=30'
V=355 ft.^{3}



POND 5B L=95'
V=2739 ft.^{3}



DRAINAGE REPORT

FOR

ARROYO VISTA APARTMENTS

ESPEY, HUSTON & ASSOCIATES, INC.

Engineering/Environmental Consultants

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DRAINAGE REPORT

E-18/D17

FOR

ARROYO VISTA APARTMENTS

Prepared for:

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April 1984