

1-82-612

1-82-612

ALBUQUERQUE ACADEMY CAMPUS⁸² 3121

BEING A REPLAT OF
A PORTION OF TRACT A
YORBA LINDA SUBDIVISION

(Filed April 27, 1978)

AND

A PORTION OF TRACT A
AND ALL OF TRACT B
ALBUQUERQUE ACADEMY CAMPUS

(Filed July 16, 1965)

Albuquerque, New Mexico
July 1981

SP-82-20

APPROVALS

Eugene Harce
Planning Director, City of Albuquerque, NM
Date: 1-18-82

Paul M. Eastley
AMAFCA
Date: 12/14/81

Richard S. Hahn
City Engineer, City of Albuquerque, NM
Date: 1/11/82

Thomas W. Kennedy
Traffic Engineer, City of Albuquerque, NM
Date: 10/11/81

John W. Kennedy
Director of Parks & Recreation, City of Albuquerque, NM
Date: 1/15/82

John W. Kennedy
Chief Surveyor, City of Albuquerque, NM
Date: 12/14/81

Arturo C. Lopez
Mountain States Telephone & Telegraph Co.
Date: 9-30-81

Ralph P. Malar
Public Service Company of New Mexico
Date: 9-16-81

Lee S. Searcy
Gas Company of New Mexico
Date: 9/15/81

Roy E. Elwell
Property Management
Date: 7/30/81

Mark H. Dickinson
Water Resources, City of Albuquerque, NM
Date: 1/6/82

NOTE:

DEDICATION TO THE ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY, ITS SUCCESSORS AND ASSIGNS, OF THE LANDS, RIGHT-OF-WAY, AND EASEMENTS DESIGNED HEREON IS WITH THE FULL AND FREE CONSENT AND IN ACCORDANCE WITH THE DESIRE OF THE UNDERSIGNED OWNER. THIS DEDICATION IS FOR DRAINAGE, FLOOD CONTROL, AND THE CONSTRUCTION, OPERATION, AND MAINTENANCE OF RELATED FACILITIES. ANY PORTION OF ANY LANDS, RIGHT-OF-WAY, OR EASEMENT DEDICATED OR GRANTED HEREIN SHALL REVERT TO THE OWNER, ITS SUCCESSORS AND ASSIGNS AS AND TO THE EXTENT SAID PORTION IS DECLARED UNNECESSARY FOR FLOOD CONTROL AND DRAINAGE BY THE BOARD OF DIRECTORS OF THE ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY.

NOTE:

Easements will be assigned to each Tract as that Tract is replatted and/or subdivided. This plat is for zoning purposes.

NR.	DISTANCE	BEARING
T1	146.00'	N18°10'22"E
T2	75.00'	N00°04'22"E
T3	136.94'	N00°04'22"E
T4	80.00'	S89°55'38"E
T5	67.92'	S88°33'22"W
T6	28.89'	N89°55'38"W
T7	58.84'	N89°55'38"W
T8	144.84'	S56°08'29"W
T9	155.54'	N48°01'59"W
T10	86.28'	N06°53'17"W
T11	212.66'	S58°19'16"W
T12	126.27'	N23°25'13"W
T13	229.40'	N73°14'14"W
T14	218.50'	N29°04'40"W
T15	95.17'	S82°10'22"W
T16	39.29'	S51°54'58"W
T17	144.28'	N72°07'24"W
T18	144.84'	S68°52'54"E
T19	166.53'	S21°19'57"E
T20	199.82'	S82°51'24"E
T21	286.11'	S50°32'18"E
T22	283.78'	S80°04'18"E
T23	64.46'	N63°06'59"E
T24	62.26'	S48°00'01"E
T25	262.48'	S76°34'39"E
T26	177.78'	N78°31'53"E
T27	274.59'	S73°58'09"E
T28	139.90'	N85°04'37"E
T29	77.37'	S57°33'52"E
T30	220.06'	S83°09'51"E
T31	322.85'	N84°40'25"E
T32	293.64'	N59°25'06"E
T33	28.97'	S85°58'38"E
T34	229.35'	S85°58'38"E
T35	108.59'	S71°03'53"E
T36	110.02'	N72°32'09"E
T37	56.08'	S46°23'49"E
T38	236.86'	N50°15'06"E
T39	94.11'	N87°29'34"E
T40	133.00'	N01°25'58"W
T41	145.83'	N01°25'58"W
T42	189.33'	N44°11'06"E
T43	137.00'	N21°28'22"E
T44	119.40'	N41°35'30"E
T45	164.33'	N44°11'06"E
T46	67.91'	S88°33'22"W
T47	53.00'	N01°26'38"W
T48	53.00'	S01°25'58"E
T49	100.39'	S01°25'58"E
T50	43.17'	S83°32'22"W
T51	6.60'	N89°55'38"W
T52	47.85'	N64°02'48"W
T53	143.35'	N64°02'48"W
T54	182.46'	S88°17'51"W
T55	36.58'	S47°57'57"W
T56	32.32'	S47°57'57"W

NR.	RADIUS	ARC	CHORD	DELTA	TANGENT
C1	2228.09'	648.18'	645.90'	16°40'05"	326.39'
C2	2228.09'	66.27'	66.26'	01°42'15"	33.14'
C3	2228.09'	102.18'	102.18'	02°37'40"	51.10'
C4	1447.00'	1682.40'	1588.22'	66°37'00"	950.80'
C5	1353.00'	226.68'	228.42'	09°35'58"	113.81'
C6	1353.00'	100.64'	100.62'	04°15'43"	50.35'
C7	1353.00'	100.09'	100.07'	04°14'19"	50.07'
C8	25.00'	39.27'	35.36'	90°00'00"	25.00'
C9	1807.00'	1024.89'	1011.30'	32°30'00"	526.69'
C10	1843.00'	835.80'	827.78'	29°10'53"	427.68'
C11	2083.00'	945.24'	937.15'	26°00'00"	480.90'
C12	2083.00'	747.39'	743.39'	20°33'29"	377.76'
C13	2083.00'	197.84'	197.77'	05°26'31"	99.00'
C14	24.92'	39.15'	35.25'	89°59'20"	24.92'
C15	365.44'	144.88'	143.92'	22°42'44"	73.39'
C16	748.83'	262.93'	261.60'	20°07'08"	132.84'
C17	394.51'	144.87'	144.05'	21°02'22"	73.26'
C18	25.00'	38.53'	34.83'	88°17'50"	24.27'
C19	407.44'	161.51'	160.46'	22°42'44"	81.83'
C20	706.83'	246.20'	246.93'	20°07'08"	125.39'
C21	436.51'	142.44'	141.81'	18°41'49"	71.86'
C22	1643.00'	425.88'	424.69'	14°51'06"	214.14'
C23	1643.00'	410.92'	409.85'	14°19'48"	206.54'
C24	2228.09'	816.64'	812.07'	21°00'00"	412.95'
C25	1353.00'	427.42'	425.64'	18°06'00"	215.51'

DESCRIPTION

A tract of land within Sections 28 and 30, in T11N, R4E, N.M.P.M., comprising a portion of Tract A, and all of Tract B as shown on the plat of Albuquerque Academy Campus filed in the office of the County Clerk of Bernalillo County, New Mexico on July 18, 1965 and a portion of Tract A, Yorba Linda Subdivision, filed in the office of the County Clerk of Bernalillo County, New Mexico on April 27, 1978, and being more particularly described by New Mexico State Plane Grid bearings and ground distances as follows:

BEGINNING at a point on the northerly right-of-way line of Academy Road whence the Albuquerque Control Survey Monument 11-E18 (N.M. State Plane Grid Coordinates X = 406,394.98, Y = 1,808,867.36) bears N13°29'11"W, 29.82 feet; thence, 39.27 feet along the arc of a curve to the right having a radius of 25.00 feet and a chord bearing N72°28'38"W, 36.36 feet to a point on the easterly right-of-way of Wyoming Boulevard; thence 816.84 feet along the arc of a curve to the left having a radius of 2228.09 feet and a chord bearing N37°56'38"W, 812.07 feet; thence N48°26'38"W, 1840.16 feet; thence 1882.40 feet along the arc of a curve to the right having a radius of 1447.00 feet and a chord bearing N18°08'06"W, 1580.22 feet; thence N18°10'22"E, 717.17 feet; thence 427.42 feet along the arc of a curve to the left having a radius of 1353.00 feet and a chord bearing N09°07'22"E, 425.84 feet; thence, N00°04'22"E, 211.94 feet; thence 39.27 feet along the arc of a curve to the right having a radius of 25.00 feet and a chord bearing N45°04'22"E, 38.36 feet; thence along the southerly right-of-way of Harper Road, S89°56'38"E, 80.00 feet; thence, 1024.89 feet along the arc of a curve to the right having a radius of 1807.00 feet and a chord bearing S73°40'38"E, 1011.30 feet; thence S67°26'38"E, 1343.19 feet; thence 836.80 feet along the arc of a curve to the left having a radius of 1843.00 feet and a chord bearing S72°01'05"E, 827.78 feet; thence along the westerly line of Tract B, Yorba Linda Subdivision (filed January 10, 1980), S03°23'34"W, 626.36 feet; thence along the southerly boundary of said Tract A, Yorba Linda Subdivision, S84°27'38"E, 1623.33 feet; thence N83°32'22"E, 1326.98 feet; thence leaving said southerly boundary S01°26'58"E, 838.44 feet; thence S86°33'22"W, 87.81 feet; thence N01°26'38"W, 53.00 feet to a point on the northerly right-of-way line of Academy Road, thence along said northerly right-of-way line, N45.24 feet along the arc of a curve to the left having a radius of 2083.00 feet and a chord bearing S75°33'22"W, 837.18 feet; thence S62°33'22"W, 3535.00 feet to the point of beginning. Tract contains 318.8878 acres, more or less.

DEDICATION

The subdivision of the land herein described is with free consent and in accordance with the desires of the undersigned owner and proprietor thereof, and said owner and proprietor does hereby dedicate the public rights-of-way shown herein, together with all easements shown on this plat, to the public for drainage, flood control, and the construction, operation, and maintenance of related facilities, as noted, including the right of ingress and egress and the right to trim interfering trees.

ALBUQUERQUE ACADEMY, INC.

BY: *Richard G. Elkins*
Richard G. Elkins, President
Board of Trustees

STATE OF NEW MEXICO

COUNTY OF BERNALILLO

On this 7th day of July, 1982, the foregoing instrument was acknowledged before me by Richard G. Elkins, President, Board of Trustees, Albuquerque Academy, Inc., a New Mexico non-profit corporation, on behalf of said corporation.

My commission expires: 7/9/84

Notary Public: *Francis J. Gonzalez*

NOTES:

- Bearings are N.M. State Plane Grid Bearings (Central Zone).
- Distances are ground distances.
- Elevations are field elevations (City of Albuquerque Datum).
- Record bearings and distances are shown in parentheses.
- Zone Atlas No. E-19, E-20.
- Number 6 rebar with plastic survey cap stamped PE&LS 2456 were set on corners designated by a small solid circle.

I, under the laws of New Mexico, certify that I am a Registered Land Surveyor and that this plat was prepared by me or under my supervision and meets the minimum requirements for monumentation and surveys of the Albuquerque Subdivision Ordinance and shows all easements of record and is true and accurate to the best of my knowledge and belief.

A. Dwin Weaver
A. Dwin Weaver, N.M.P.S. No. 8844



10860

SHEET 1 of 2

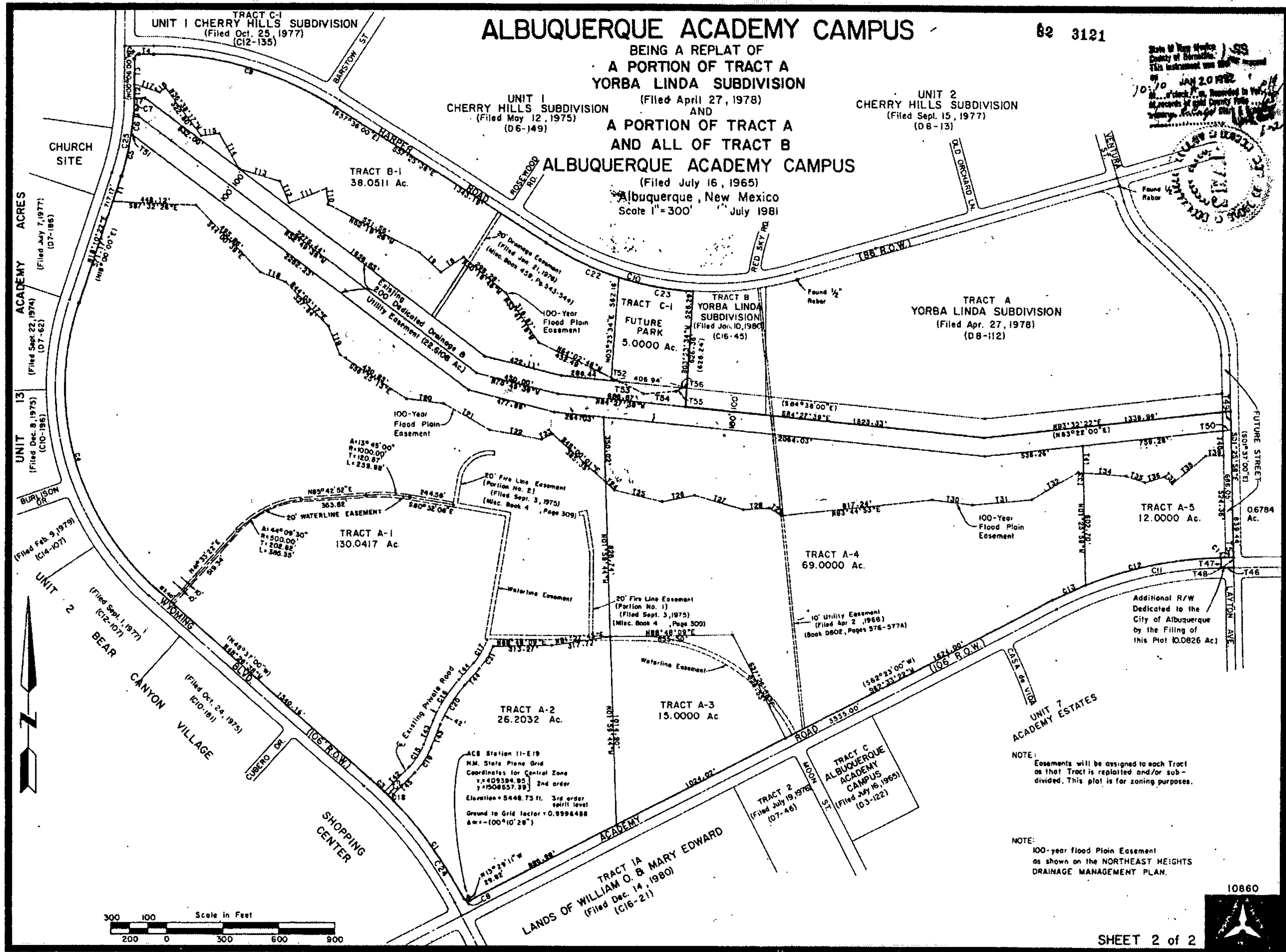


C19-68-1

C19-68-1

2-89610

2-89610





2600 Prospect Ave. NE
Albuquerque, NM 87107
Ph: (505) 884-2215
Fax: (505) 884-0214

MEMORANDUM

To: Abiel Carrillo

From: Lynn Mazur *LM*

Subject: South Pino Arroyo thru Albuquerque Academy

Date: March 10, 2016

The purpose of this memo is to provide you with information regarding the maintenance and encroachment issues on the South Pino Arroyo between Wyoming Boulevard and Ventura Street. Both the City and AMAFCA hold drainage easements on the arroyo, and the Academy has been providing some maintenance. However, there has never been a formal agreement for maintenance, and through the years, the Academy has constructed structures in the easements without licenses from the City or AMAFCA. More history and information is provided in the attached memo from 2009. I also made copies of the agreement between the City and AMAFCA for improvements at Wyoming and Ventura, as well as a rundown from the Hoffmantown Church parking lot.

There will be a meeting at the Academy tomorrow, March 11, to discuss a maintenance agreement and licenses. John Christensen, Physical Plant Director at the Academy, knows a lot of the history and will be retiring soon. Kevin Daggett, City DMD, and Kurt Wagener, AMAFCA Field Engineer, will also attend. You are welcome to attend, too.

MEMO

Item xx

Never presented to the Board.

To: Board of Directors

From: Lynn Mazur, P.E., C.F.M., Development Review Engineer

Date: , 2009

Re: Briefing on Pino Arroyo Between Ventura and Wyoming – History and Maintenance Issues

Over the past several months, staff has attended meetings with representatives from the City of Albuquerque, Albuquerque Academy, Hoffmantown Church and La Vida Llena Retirement Community to discuss drainage and maintenance issues on the Pino Arroyo (Arroyo) between Ventura Boulevard and Wyoming Boulevard. The meetings were prompted by an Environmental Planning Commission case submitted by La Vida Llena Retirement Community for a new facility west of Hoffmantown Church. The concern is that the additional developed runoff from the site will contribute to the erosion that already occurs in the Arroyo.

This stretch of the Arroyo is unlined and receives 1900 cfs of 100-year storm water runoff from a mostly developed upstream watershed. There is a FEMA floodplain along the Arroyo corridor. There is also a 200-foot wide Drainage and Utility Easement that was granted by plat in 1965. Since it was not granted specifically to AMAFCA, we assume that it is a City easement. The Albuquerque Academy Campus plat granted a 100-year Floodplain Easement to AMAFCA in 1982 to the FEMA floodplain limit. It did not dedicate easement on Tract A, which later became Hoffmantown Church. The plat for Hoffmantown Church granted a Temporary Drainage Easement to AMAFCA to the FEMA floodplain limit that partially encumbers the existing 200-foot easement. Neither the City nor AMAFCA maintains this portion of the Arroyo between Ventura and Wyoming.

Over the years, the natural arroyo function of degradation and aggradation has caused erosion (degradation) at the Ventura crossing and through the Academy and Hoffmantown properties and sediment deposition (aggradation) at the Wyoming crossing. The City constructed improvements at the Ventura crossing in 2003 to control the velocity and scour potential of the clean water flows. The City maintains the improvements, and they have worked well to protect the crossing.

The Wyoming crossing served as a deposition zone for the sediment picked up through the upstream reach of the Arroyo. In 19__, a Letter of Map Revision was submitted for the Arroyo improvements from Wyoming to Interstate 25. FEMA responded that Wyoming was in danger of being overtopped, so a desedimentation basin was

constructed on the upstream side on Academy property. There is an informal agreement between the City and the Academy for the Academy to periodically transport sediment from the Wyoming crossing upstream to the Ventura crossing to maintain the natural arroyo function.

The stretch of the Arroyo between the two roadway crossings has been maintained by the Academy. The Academy considers the natural arroyo to be an asset to the school, and the staff use it as a teaching tool. They are not interested in hard-lining the Arroyo at this time. However, they are interested in a maintenance agreement. A separate agreement among the adjacent property owners would address cost-sharing for certain maintenance activities.

Many people who know the history of the Arroyo are retiring or have already retired, and that history and informal agreements are being lost. Staff feels that the time is right for a formal agreement among the property owners, the City and AMAFCA to spell out maintenance responsibilities. It will be structured similarly to the High Desert agreement where the owners will be responsible for low level maintenance, such as trash cleanup and minor grading, and the public entities will be responsible for higher level maintenance, such as damage to the Arroyo that may occur from scouring in a large storm event.

Request: Board input on AMAFCA's participation in a maintenance agreement for the Pino Arroyo between Ventura and Wyoming.

F. Lee
3/2016

RECITALS:

- Page 1

3. **WHEREAS**, BHI completed the preliminary design and submitted the CLOMR to FEMA;
and
4. **WHEREAS**, FEMA's review agent made numerous comments on the CLOMR, requiring BHI to make several successive submittals; and
5. **WHEREAS**, in a letter dated May 14, 2002, FEMA finally approved the CLOMR; and
6. **WHEREAS**, in order to expedite construction, the CITY requested BHI to split the PROJECT plans into two separate projects, requiring BHI to perform additional tasks; and
7. **WHEREAS**, as a result of Items 4 and 6, BHI will exceed the amount of the ON-CALL CONTRACT; and
8. **WHEREAS**, AMAFCA and the CITY agree that BHI is due just compensation for the additional work as requested;

NOW THEREFORE, IN CONSIDERATION OF THE PROMISES AND COVENANTS CONTAINED HEREIN, THE PARTIES HERETO AGREE TO AMEND THE ORIGINAL AGREEMENT TO AS FOLLOWS:

SECTION TWO PAGE 4 OF ORIGINAL AGREEMENT: THE CITY AGREES TO

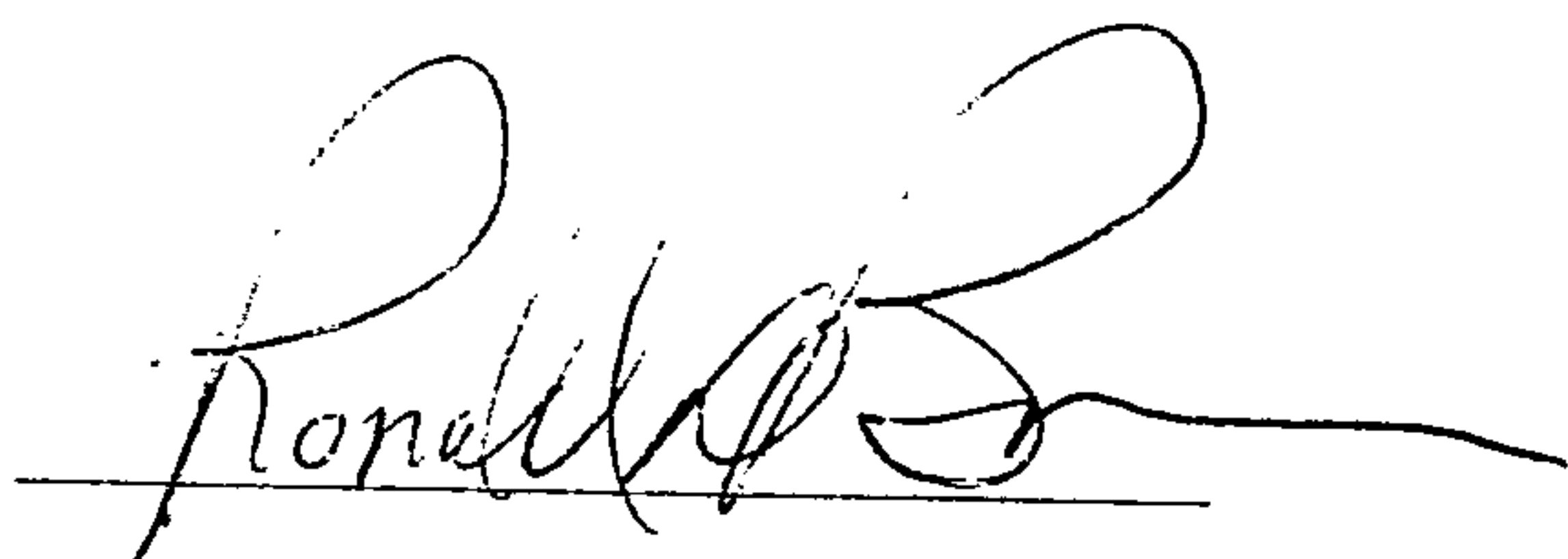
Add a new paragraph 2.7. as follows:

- 2.7. Reimburse AMAFCA for additional engineering services and FEMA review fees in the amount of \$13,632.00 (Thirteen Thousand Six Hundred Thirty Two Dollars) to complete the PROJECT ("CITY's Contribution"). The CITY's Contribution shall be paid within 45 days after invoicing by AMAFCA.

IN WITNESS WHEREOF, the undersigned have caused this Agreement to be executed as of the day and year set forth above.

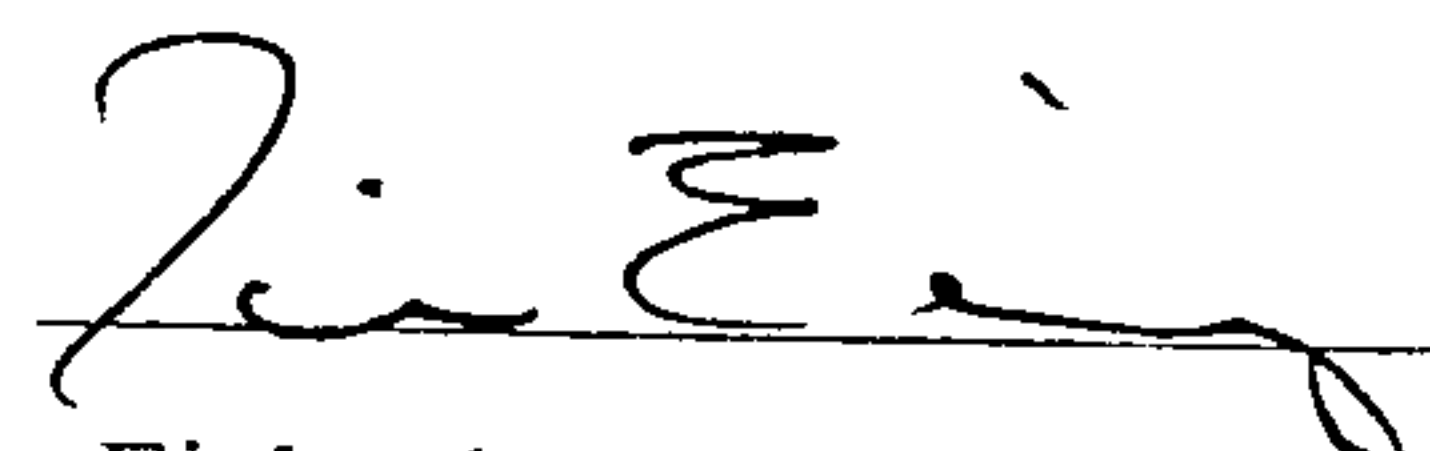
**Albuquerque Metropolitan Arroyo
Flood Control Authority**

Attest:

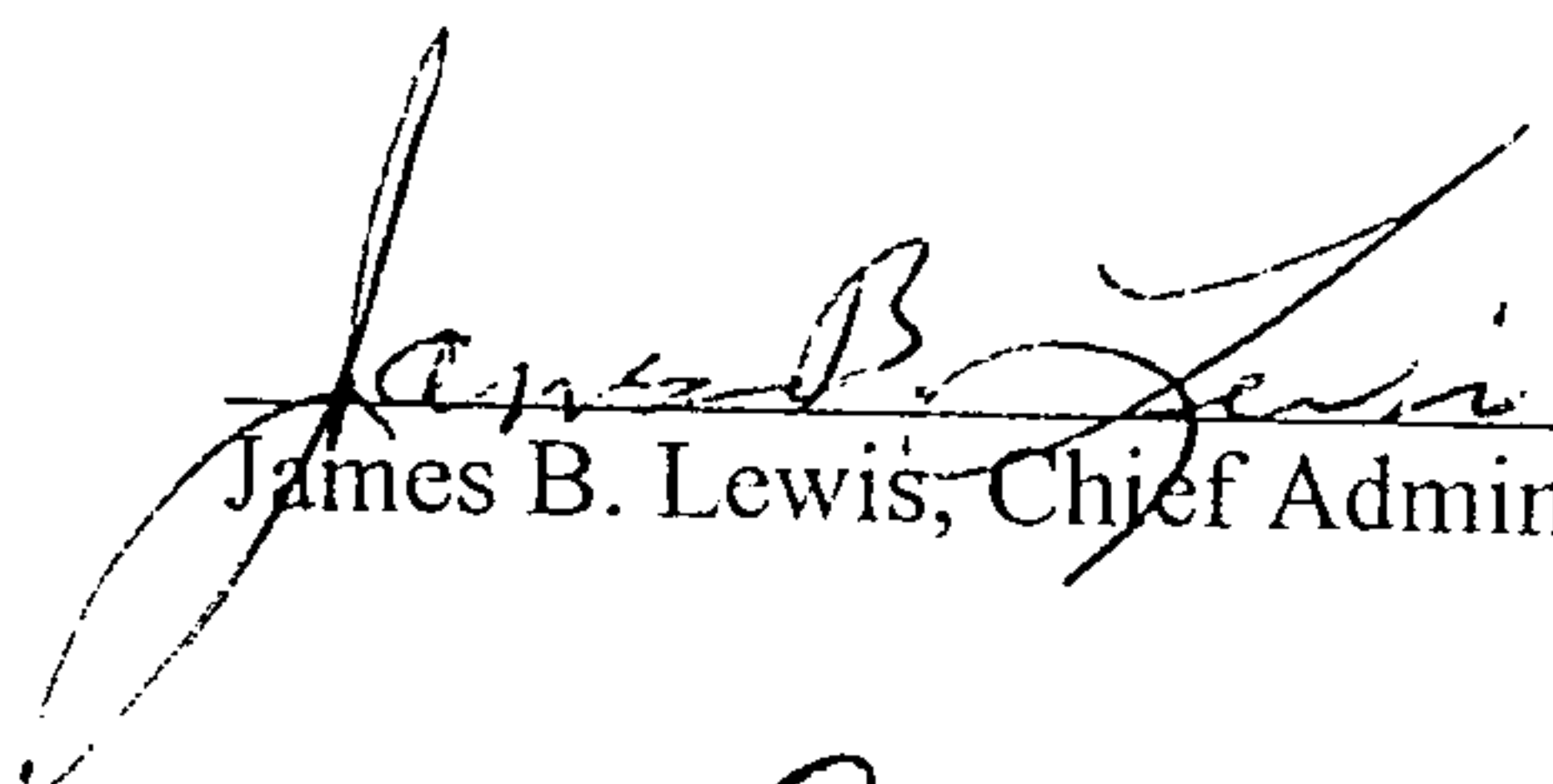


Ronald D. Brown

Secretary Treasurer

by:  10/29/04
Tim Eichenberg, Chair Date
Board of Directors

City of Albuquerque

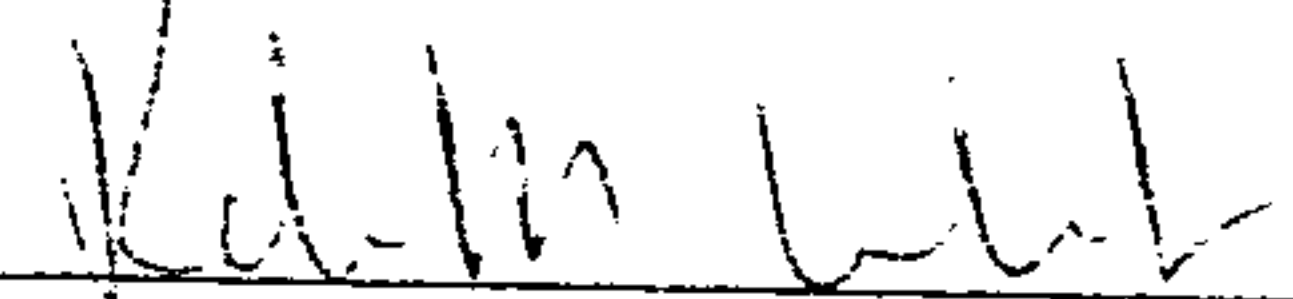

James B. Lewis, Chief Administrative Officer

10/22/04
Date


Ed Adams, P.E., Director
Department of Municipal Development

10-22-04
Date

Reviewed by City Legal Department:

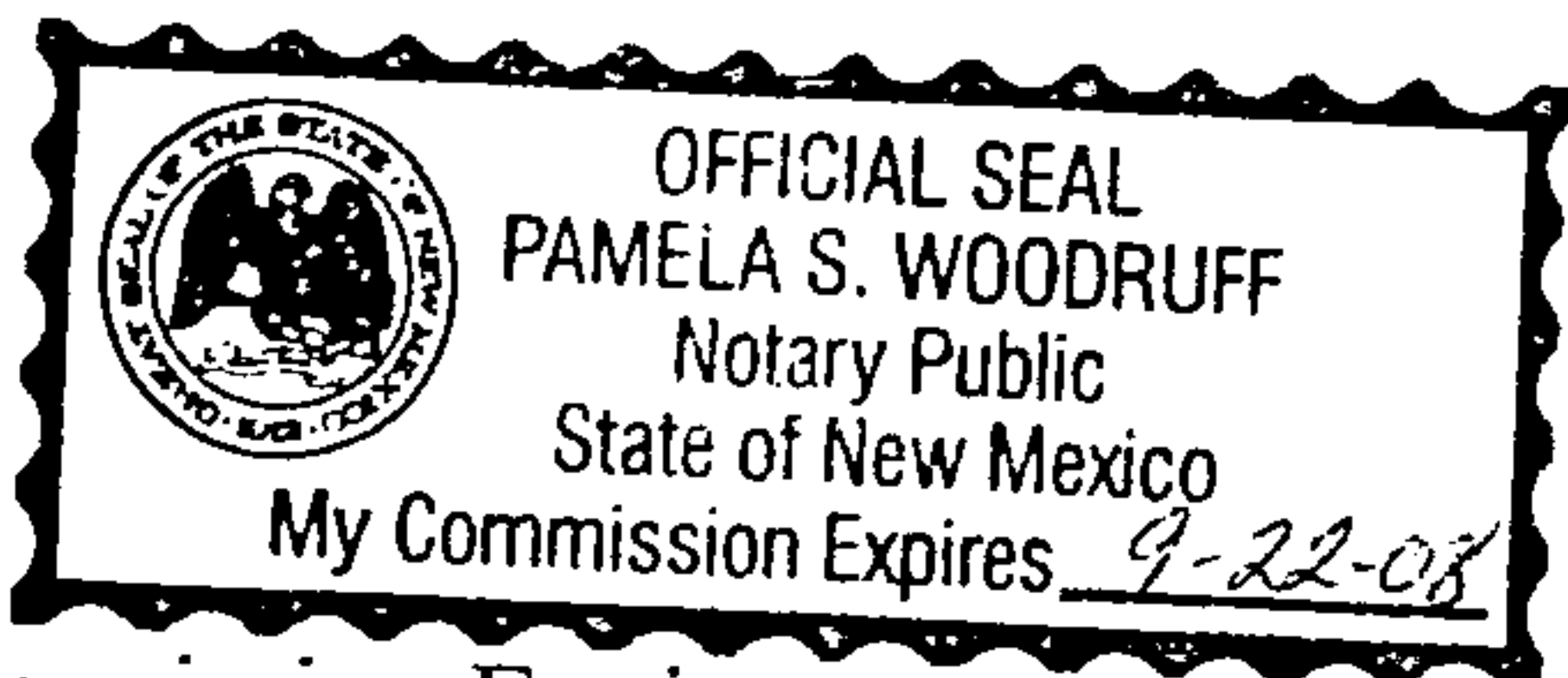

City Legal Department

10-21-04
Date

ACKNOWLEDGMENTS

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on October 29, 2004
by Tim Eichenburg, Chair of the Board of Directors, Albuquerque Metropolitan Arroyo Flood
Control Authority (AMAFCA), a political subdivision of the State of New Mexico.



Pamela S. Woodruff
Notary Public

My Commission Expires:

9-22-08

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on October 25, 2004
by James B. Lewis, Chief Administrative Officer for the City of Albuquerque, a New Mexico
municipal corporation.

Salvador Leon
Notary Public

My Commission Expires:

1-27-06

CITY OF ALBUQUERQUE

PURCHASE ORDER OFFICE

P.O. Box 1293 • Albuquerque, New Mexico 87103

PURCHASE ORDER

000679390

PAGE

1

E1

CONFIRMING
DO NOT
DUPLICATEORDER FROM
THIS PO

TO

ALBUQUERQUE METROPOLITAN
ARROYO FLOOD CONTROL AUTHORITY
2000 PROSPECT NE
ALBUQUERQUE NM 87107SHIP
TOSEE BODY OF PURCHASE ORDER FOR
SHIP TO ADDRESS AND CONTACT
PERSON

505-768-3320

DATE OF ORDER

TERMS OF SALE

VENDOR NUMBER

DEPT. REQUESTING

06/12/2000

NET

850171475

PWD PUBLIC WORKS DEPT

SHIP VIA

F.O.B.

REQ. #

DATE WORKS REQUIRED

BEST WAY

DESTINATION

089996

07/30/2006

ITEM #

QUANTITY

DESCRIPTION

UNIT PRICE

EXTENSION

001

1

FUNDING FOR PREPARATION OF CONSTRUCTION

29000.0000

0305 0527500 7216091

DOCUMENTS FOR IMPROVEMENT ON THE
PINO ARROYO AND DOCUMENTATION FOR A
CLEAR FOR THE PINO ARROYO AT WYOMING,
PER THE TERMS & CONDITIONS OF THE
ATTACHED AGREEMENT.TOTAL CONTRACT NOT TO EXCEED \$29000.00
WHICH AMOUNT INCLUDES ANY APPLICABLE
TAXES. TO BE PAID AT THE RATES STATED
IN THE ATTACHED AGREEMENT.

001 0000000000

TO: PUBLIC WORKS
ATTN: NANCY EVANS
ONE CIVIC PLAZA, 5TH FLOOR
ALBUQUERQUE, NM 87102

RECEIVED

MAY 22 2000

AMAFCA

PLEASE SEE BACK OF PURCHASE ORDER FOR VENDOR INSTRUCTIONS

TOTAL ► \$ 29000.00

CONF / SIGNED J. VESCOVI

BUYER

PURCHASING OFFICER

VENDOR COPY

CONTROL NO. 87592

RECEIVED

JUN 13 2003

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.kline.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

June 13, 2003

Mr. Joseph A. Martinenza
PBS&J
12101 Indian Creek Court
Beltsville, MD 20705**RE: Request for a Letter of Map Revision for the South Pino Arroyo, City of Albuquerque, New Mexico, Community No. 350002, FIRM panel 35001C0137D & 35001C0141D, FEMA CASE No. 01-06-881R**

Dear Mr. Martinenza:

This letter is in response to the Conditional Letter of Map Revision from FEMA dated May 14, 2002. The purpose of this submittal is to request a Letter of Map Revision due to the construction of berms at the Wyoming Desiltation Pond along South Pino Arroyo.

Enclosed with this submittal in accordance with the items outlined in FEMA's letter dated May 14, 2002 are the following items:

1. A Revision Requester and Community Official form from the City.
2. Certified as-built plans for the relevant project elements are included in the LOMR submittal as Figure 2. Digital copies of the as-builts are not available.
3. Since the project was built as proposed we are not resubmitting hydrologic and hydraulic analyses for as-built conditions of the 1% annual chance flood for the Arroyo Del Pino.
4. Certified topographic mapping delineating the 1% annual chance floodplain for Arroyo Del Pino was included in the CLOMR request. Since the construction associated with the LOMR only increased the height of the berms at the desiltation pond to provide additional freeboard and did not in any way alter the water surface elevation at the pond or downstream, it is not necessary to resubmit this information.
5. Similar to the response for Item number 4, the annotated FIRMs provided in the CLOMR are not being changed with the LOMR request. However, for your convenience we are resubmitting the annotated FIRMs.
6. A copy of the maintenance agreement and plan is enclosed.
7. The 1% annual chance floodplain is not being widened or shifted as a result of this construction project and its associated LOMR, therefore it is not necessary to notify any property owners.
8. Documentation regarding the fill placement for the berms is enclosed.

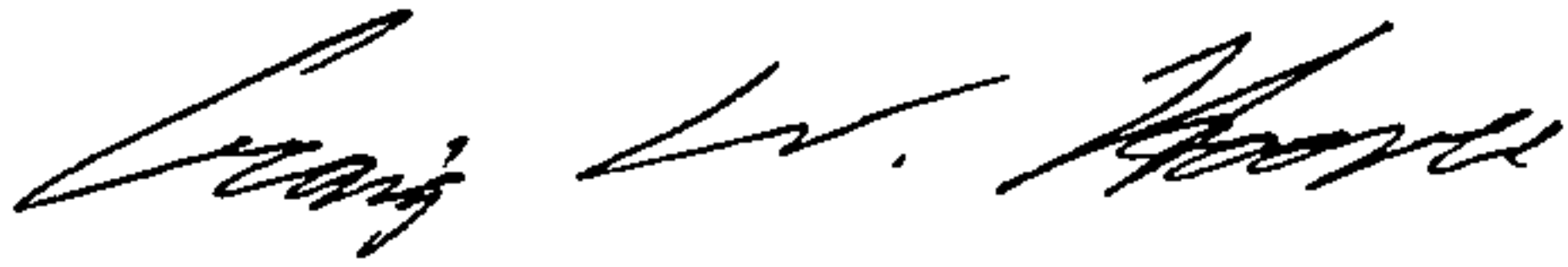
William R. Blanton, Jr.

June 11, 2003

Page 2

The City of Albuquerque has reviewed and approved the plans provided with this submittal. If you have any questions in regards to this submittal, please call me at (505) 823-1000.

Sincerely,



Craig W. Hoover, P.E.
Senior Vice President and Group Manager
Water Resources Group

CWH/cc
Enclosures

Cc: Dan Hogan, City of Albuquerque
Carlos Montoya, City of Albuquerque
Lynn Mazur, AMAFCA



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

June 6, 2003

Joseph A. Martinenza
PBS&J
12101 Indian Creek Court
Beltsville, Maryland 20705

RE: Request for a Letter of Map Revision for South Pino Arroyo

**City of Albuquerque, New Mexico, Community No. 350002, FIRM Panel
35001C0137 E and 141 E Effective Date April 2, 2002**

Dear Mr. Martinenza,

The purpose of this submittal is to convey the documents in order to request a Letter of Map Revision based on desiltation pond construction and previous concrete channel construction to revise the 100-year floodplain.

Enclosed with this letter are the Record Drawings, Sediment Issues in the Pino Basin Report, Geotechnical Investigation Report, and a check in the amount of \$3,800.00.

As the City Floodplain Administrator, I have reviewed the response provided with this submittal. Our Community would greatly appreciate your prompt response and approval for this Letter of Map Revision.

If you have any questions, you can contact me at (505) 924-3982.

Sincerely,

Carlos A. Montoya
City Floodplain Administrator

C: Bill Blanton, Federal Emergency Management Agency Headquarters
Jack Quarles, FEMA Region VI
Craig Hoover, Bohannon Huston
Lynn Mazur, AMAFCA

2000001437
2000-17

**AGREEMENT FOR FUNDING FOR
PREPARATION OF CONSTRUCTION DOCUMENTS FOR
IMPROVEMENTS ON THE PINO ARROYO AND DOCUMENTATION
FOR A CLOMR FOR THE PINO ARROYO AT WYOMING BOULEVARD**

THIS AGREEMENT is made and entered into this 11th day of May, 2000, by and between the Albuquerque Metropolitan Arroyo Flood Control Authority, a political subdivision of the State of New Mexico ("AMAFCA"), and the City of Albuquerque, a municipal corporation ("CITY").

RECITALS:

WHEREAS, in 1989 the CITY completed construction of concrete channel lining for the Pino Arroyo from I-25 to immediately east of Wyoming Blvd. as part of City Projects #2151 and #3532;

WHEREAS, the City made several attempts between 1991 and 1993 to obtain a Letter Of Map Revision ("LOMR") from the Federal Emergency Management Agency ("FEMA") to designate this reach of the Pino Arroyo floodplain as being confined to the constructed channel based on the improvements made as part of Projects #2151 and #3532;

WHEREAS, the CITY was not successful in their attempts to obtain a LOMR;

WHEREAS, failure to obtain a LOMR has resulted in numerous residents being required to have flood insurance who, in the CITY's opinion, are clearly outside the 100 year floodplain;

WHEREAS, an existing Agreement, dated June 9, 1998 and a Supplement to that Agreement dated March 22, 1999 stipulate a cost sharing arrangement between the CITY and AMAFCA for the preparation of documentation for a LOMR for the Pino Arroyo at Wyoming Boulevard;

**AGREEMENT FOR FUNDING FOR
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WHEREAS, the CITY and AMAFCA, wish to submit additional documentation to FEMA in support of a request for a Conditional Letter of Map Revision ("CLOMR") to the Pino Arroyo from San Pedro Boulevard to immediately east of Wyoming Boulevard;

WHEREAS, there is presently a 200 ft. wide drainage and utility easement within Albuquerque Academy property dedicated by a plat of the Albuquerque Academy Campus, recorded at the Bernalillo County Clerk's Office in Vol. D3 Folio 122A on July 16, 1965 and a plat of the Yorba Linda Subdivision, recorded at the Bernalillo County Clerk's Office in Vol. D8 Folio 112 on April 27, 1978; there is also a 100 Year Flood Plain Easement dedicated to AMAFCA, it's successors and assigns, by a plat of the Albuquerque Academy Campus, recorded at the Bernalillo County Clerk's Office in Vol. C19 Folio 68 on January 20, 1982 (collectively the "EASEMENTS"); on which a portion of the IMPROVEMENTS (hereinafter defined) are planned to be constructed;

WHEREAS, the Albuquerque Academy owns property where drainage easements do not presently exist on which property a portion of the IMPROVEMENTS are planned to be constructed and the Academy has agreed upon certain conditions to grant easements ("FUTURE EASEMENTS"), in addition to the EASEMENTS that already exist, to AMAFCA its successors and assigns for the construction and maintenance of the IMPROVEMENTS.

**NOW THEREFORE, IN CONSIDERATION OF THE PROMISES AND COVENANTS
CONTAINED HEREIN, THE PARTIES HERETO AGREE AS FOLLOWS:**

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1.1 Provide for the sharing of costs between the CITY and AMAFCA, for the preparation of the design drawings and contract documents ("PROJECT DESIGN") for 1) construction of a drop structure at Ventura Street and the Pino Arroyo; 2) construction of an outfall from the Hoffmantown Church parking lot to the Pino Arroyo; 3) construction of engineered berms at Wyoming Blvd.; and 4) application to FEMA for a CLOMR for the Pino Arroyo at Wyoming Blvd.

2.1 Reimburse AMAFCA for the PROJECT DESIGN for an amount not to exceed \$29,000.00 (Twenty Nine Thousand Dollars) plus any fees charged by FEMA in processing the CLOMR ("CITY's Contribution"). The CITY's Contribution shall be paid within 45 days after invoicing by AMAFCA which may occur anytime after the effective date of this Agreement and in increments as may be charged by AMAFCA or FEMA;

2.2 Approve the scoping letter of instructions prior to AMAFCA contracting for the PROJECT DESIGN;

2.3 Provide technical review of the PROJECT DESIGN and the CLOMR submittal prior to delivery to FEMA;

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- SECTION THREE: AMAFCA agrees:**

- Final: April 20, 2000

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- SECTION FOUR: BOTH PARTIES Agree:**

- Final: April 20, 2000

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- 4.6 The parties understand and agree the obligation of each party under this Agreement shall be performed in compliance with all applicable laws, statutes and ordinances. Nothing herein is intended to constitute any agreement for the parties to perform any activity in violation of the Constitution or Laws of the State of New Mexico, or the Ordinances of the City of Albuquerque;
- 4.7 If any clause or provision in this Agreement is illegal, invalid or unenforceable, under present or future laws effective during the term of this Agreement, then and in that event, it is the intention of the parties hereto that the remainder of this Agreement shall not be affected thereby;
- 4.8 It is specifically agreed between the parties executing this Agreement that this Agreement does not and is not intended to create in the public, or any member thereof, any rights whatsoever, such as, but not limited to, the rights of a third party beneficiary, or to authorize anyone not a party to the Agreement to maintain a suit(s) for wrongful death(s) and/or any other claim(s) whatsoever pursuant to any provision of this Agreement;
- 4.9 Each party shall be solely responsible for any and all liability arising from personal injury including death(s) or damage to property arising from an act or failure to act of the respective party, its officials, agents, contractors and employees pursuant to this Agreement. Liabilities of each party shall be subject to the immunities and limitations of the Tort Claims Act, Section 41-4-1, et seq., N.M.S.A. 1978 and any amendments thereto;

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- 4.10 This Agreement is subject to approval by the AMAFCA Board of Directors, and the Chief Administrative Officer ("CAO") of the CITY and shall not be binding upon the parties until so approved. Upon approval, the covenants, terms and conditions of this Agreement shall be binding upon and inure the benefit of the parties hereto, their successors and assigns. The effective date of this Agreement shall be the date of the last party to execute this Agreement;
- 4.11 This Agreement constitutes the entire agreement and understanding of the Parties. This Agreement supercedes and replaces all prior or contemporaneous negotiations, promises, agreements, discussions or proposals, whether written or oral, concerning the subject matter; except for the "Agreement for Funding for Preparation of Documentation for a LOMR for the Pino Arroyo at Wyoming," dated June 9, 1998 between the CITY and AMAFCA and a Supplement to that Agreement dated March 22, 1999.

IN WITNESS WHEREOF, the undersigned have caused this Agreement to be executed as of the day and year set forth above.

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Lawrence Rael, Chief Administrative Officer

Date _____

Date:

City Attorney

Date _____

[illegible]

Municipal Corporation. OFFICIAL SEAL



Roberta Duran

NOTARY PUBLIC
STATE OF NEW MEXICO

My Commission Expires:

Notary Public

Final: April 20, 2000

Revised Drainage Management Plan
Albuquerque Academy Campus
June 1996

I, Craig W. Hoover, state that I am a Registered Professional Engineer, qualified in Civil Engineering, and that the accompanying plans and specifications were prepared by me, or under my direction, and are true and correct to the best of my knowledge and belief.


Craig W. Hoover, P.E.
N.M.P.E. No. 11848



1. Statement of Purpose

The purpose of this plan is to update the existing Master Drainage Plan for the Albuquerque Academy Campus (MDPAA; BHI, 1989), recognizing improvements made to the site since 1989 affecting drainage management, and to:

- Satisfy the Academy's commitment to the City of Albuquerque Hydrology Division regarding the interception of on-site flows bound for Wyoming Blvd. and diversion of these flows north to the Pino Arroyo
- Provide an improvement concept for the Wyoming Desiltation Basin Berm in exchange for the City's commitment to remedy the Academy's concerns regarding the erosion at the Pino Arroyo outfall at Ventura Blvd. in conjunction with them constructing the improvements to the basin.
- Include the proposed Natatorium in the drainage model (Basin 90) to determine the drainage impacts, specifically concerning the downstream capacity of the revised Pond 100 to accommodate the increased flow from Basin 90.
- Provide the necessary drainage management provisions so that the permitting process for proposed future building sites and parking lots can proceed in a forthwith manner

The revised drainage management plan updates the MDPAA using current hydrologic criteria. Drainage improvements (as identified in the MDPAA) necessary for development of the remaining targeted sites have changed due to alterations in flow pathways resulting from interim site modifications. The updated analysis incorporates these changes, and the proposed Natatorium, so that the drainage management plan will accommodate the increased flows resulting from future development of the site. The revised plan also includes three options and cost estimates for the diversion of

Academy flows bound for Wyoming Blvd. and routing these flows to the Pino Arroyo. The Academy plans to complete construction of the diversion structures in concert with the construction of the proposed Natatorium by October 1997. All proposed improvements included in the revised Drainage Management Plan (DMP) conforms to the conditions and criteria previously adopted in the MDPAA.

2. Project Description

The Albuquerque Academy Campus is located on approximately 320 acres in the Northeast Heights (Figure 1). The Campus is bordered by Wyoming Blvd. to the west, Harper Rd to the north, Ventura Blvd. to the east, and Academy Road to the south (Zone Atlas Maps E-19 and E-20). The Academy site is located in the alluvial fan formation of the Sandia Mountains. This type of formation typically consists of systems of smaller branched arroyos which collect into larger arroyos. The site slopes from east to west at approximately 2% to 4%.

The soils on the site are classified by the "Soil Survey of Bernalillo County" as Tijeras gravely fine sandy loam, Embudo gravely fine sandy loam, and Embudo-Tijeras Complex. Each of these types is listed as hydrologic soil type B. Sparse native vegetation covers the site not occupied by the campus improvements.

3. Background

A Site Development Plan was submitted to the City of Albuquerque (COA) Environmental Planning Commission in September of 1989 (Exhibit 1; all Exhibits are contained in packets in the back of the report). As a condition of approval, the COA Hydrology Section required a master drainage plan for the site. In response, the Academy submitted the "Master Drainage Plan for the Albuquerque Academy" in November 1989 (MDPAA. Bohannon-Huston). Since the adoption of the MDPAA several modifications to the Academy have been completed. The following paragraphs summarize the 1989 MDPAA and subsequent Campus improvements.

Master Drainage Plan for the Albuquerque Academy, 1989

The MDPAA presented a hydrologic analysis of the site under existing and proposed conditions, based on a number of site improvements either in progress or proposed at the time. The MDPAA addressed the following key issues:

- Preservation of Academy lands outside Tract A-1
- Analysis of the Pino Arroyo floodplain as part of the effort to relocate the tennis courts
- Identification of drainage improvements required to accommodate increased runoff from proposed site improvements
- Development of an agreement between the Academy and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) for the future management of the Pino Arroyo
- Diversion of Campus runoff bound for Wyoming Blvd

The MDPAA summarized drainage improvements (Improvement Summary Table, MDPAA) necessary for the development of future building and parking sites identified in the Site Development Plan. Since 1989, site #1 (tennis courts), site #2 (Library and Science Buildings) and site #7 (Music Building) have been developed (discussed further in section entitled, *Improvements to the Campus*, pg. 7). Recommendations for proposed drainage modifications necessary for the development of the remaining sites generally addressed improvements to downstream detention facilities (e.g., Ponds 90, 100 and 140) which would occur at the time of development.

The MDPAA also recognized the need to intercept and divert flows from the Academy Campus bound for Wyoming Blvd. Two improvement alternatives were included in the plan, namely construction of a channel to convey flows from Basin 80 (including flows from Basins 20, 10, 30 and 70) north to the Pino (Improvement Alternative One), or installation of a detention pond in Basin 80 to detain these flows (Improvement Option Two).

The following list summarizes the conditions and criteria which were adopted in the 1989 Master Drainage Plan:

- All basins to remain undeveloped except within Tract A-1. Specific improvements were identified in the General Site Plan and include the Library and Science Buildings, new athletic fields, and relocation of the tennis courts.
- Separate detailed grading/drainage reports to be submitted for each future improvement as development occurs within Tract A-1
- Improvements to the Pino Arroyo should be consistent with the plan to be developed with the Academy and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA). The improvements will strive to maintain the arroyo in its historic condition.

- Free discharge of developed runoff to the Pino Arroyo to be allowed for all basins unless material damage constraints preclude such action.

Improvements to the Pino Arroyo and Academy Campus that have been completed or proposed since the submittal of the 1989 MDPAA are discussed below.

Wyoming Desilting Basin, 1991

A desilting basin for the Pino Arroyo (located immediately east of Wyoming Blvd.), was constructed in 1991 to capture upstream sediments originating between the Pino Dam at Tramway Blvd. and Wyoming Blvd. Sediment management issues were refined in an informal agreement between the Academy and AMAFCA, which defined the future roles of each party in the monitoring and relocation of sediment within the arroyo stretch located on the Academy site.

Later in 1991, in an effort to revise the Pino Arroyo floodplain west of Wyoming Blvd., two reports were prepared as supplements to a Letter of Map Revision (LOMR) by Andrews, Asbury and Roberts, Inc. and Dr. Richard Heggen (Report on Flood Map Revision South Pino Arroyo East of Interstate 25 to Wyoming Blvd., Andrews, Asbury & Roberts, Inc.; Sediment Issues in the Pino Basin, R. Heggen). The purpose of these reports was to revise both the hydrologic and hydraulic analysis of the Lower Pino (between Tramway Blvd. and Interstate 25). Updated hydrologic criteria were applied to previously defined basins to determine 100 year flood frequency discharges for the entire Pino watershed below the Pino Dam. Revised criteria increased flows entering the Wyoming Desilting basin from 1,500 cfs (original design flow) to 2,352 cfs. The increased flow exceeded the existing capacity of the basin, resulting in inadequate freeboard according to criteria established by the Federal Emergency Management Agency (FEMA) and adopted by the City of Albuquerque. Section 7, entitled *Desilting Basin Improvement Concept*, provides a more detailed discussion of potential strategies to rectify the problem.

Pino Arroyo Bank Stabilization, 1995

In 1995, four reaches of the Pino Arroyo between Ventura Blvd. and the desilting basin required erosion control measures. Portions of each reach were stabilized with gabion mats (BHI, Pino Arroyo Bank Stabilization, 1995).

Improvements to the Campus, 1995-1996

In 1995 the City of Albuquerque Hydrology Division approved a site specific drainage plan for a new Music Building. The City of Albuquerque agreed to allow construction of the Music Building to proceed with the following provisions: (1) the Academy commits to construct a drainage diversion along Wyoming Blvd. to intercept off-site flows and routing the flows north to the Pino Arroyo, and (2) the Academy commits to update the drainage management plan for the Academy Campus property. A letter of commitment from the Academy to the City is included in Appendix A. The Music Building is scheduled for completion mid-summer 1996.

4. Hydrologic Parameters

This section presents the hydrologic analysis completed to update the 1989 MDPAA. Drainage basins were reviewed and updated for existing and proposed conditions. In general, basin boundaries described in the MDPAA remain unchanged. In some cases drainage basin boundaries were amended to reflect site improvements completed since 1989 (e.g., relocation of the tennis courts, construction of the Music Building), or subdivided to enable a more detailed flow analysis for proposed improvements adjacent to Wyoming Blvd.

Criteria used for the updated hydrologic analysis were taken from the Design Process Manual (DPM), Section 22.2, Volume 2, Design Criteria for the City of Albuquerque, January 1993. For each drainage basin, land use was classified using DPM Land Treatment Types A - D, ranging from undisturbed vacant land (type A) to paved impervious surfaces (type D). Rainfall values for the 100 year, 24 hour storm were obtained from the DPM, which utilizes rainfall isopluvials from the National Oceanic and Atmospheric Administration (NOAA) Atlas 2 to determine rainfall amounts for various return periods. The time of concentration (T_c) for each basin was calculated based on the characteristics of each basin using a spreadsheet which uses formulas from the DPM. A copy of the spreadsheet output is included in Appendix B.

The AHYMO computer model (Albuquerque HYdrologic MOdel) used the referenced input data to determine storm water runoff from each of the drainage basins. Hydrologic criteria for upstream Pino Arroyo drainage basins (east of Ventura Blvd.) were obtained from the referenced LOMR prepared by Andrews, Asbury & Roberts, Inc. (AAR) for the South Pino Arroyo. A copy of the drainage basin map developed by AAR is included in Appendix F.

5. Existing Conditions

On-site and off-site drainage basins for existing conditions are shown on Exhibit 2. The following discussion describes the management of drainage currently entering and leaving the site.

Off-site flows

The Academy receives off-site flows from three areas at five distinct locations: Harper Road at Barstow, Rosewood, and Redsky via street flow and storm drains to the Pino Arroyo, the Hoffmantown Baptist Church, and the Ventura outfall. Runoff at Rosewood and Redsky discharge into unimproved channels draining to the Pino

Does this flow enter the Pino or does it travel through the campus prior to reaching the Pino

Arroyo. Runoff from the Hoffmantown Church flows from an improved drainage ditch to the Pino Arroyo. Runoff from the upstream Pino Arroyo (the largest off-site flow) enters the site at the Ventura outfall. *? is Pino considered an AMAFCA easement*

Concerns over erosion and scouring at the Ventura outfall and Hoffmantown Church southern property boundary have not, to date, been addressed to the satisfaction of the Academy as proposed by the City of Albuquerque.

Outfall Locations

The site currently discharges at three locations: the Pino Arroyo at Wyoming Blvd., Academy Blvd. from Basin #5 and Basin #7, and Wyoming Blvd. from southwest and west on-site drainage basins.

Runoff to the Pino Arroyo is uncontrolled free discharge. Under present conditions, the unlined channel is adequate to accommodate the flows. Under an informal agreement between the Academy and AMAFCA, the arroyo is monitored, and sediment is taken from the desiltation basin and transported upstream to the Ventura Blvd. outfall as needed. Bank stabilization is performed in response to erosion problems.

Basins discharging to Wyoming Blvd. either freely discharge directly to the roadway, or are routed through one of six existing detention ponds (Exhibit 2).

Runoff from Basin 5 flows south into Basin A1 (northside of Academy Blvd.) where the combined flows continue southwest along Academy Blvd. Runoff from Basin 7 joins runoff from Basins 5 and A1 in Basin A2, east of the Academy Blvd./Wyoming Blvd. intersection (flow is partially reduced through a drop inlet located east of Moon St.). At the Academy/Wyoming intersection, these flows are diverted to Wyoming Blvd. Basin 85, where they continue north through Basins 165 and 185, reaching the Pino Arroyo through drop inlets in Basin 190. Under existing conditions,

additional flow from Academy Campus basins adjacent to Wyoming Blvd. (and their upstream contributing basins) enters Basins 85, 165, and 185 along Wyoming Blvd. between Academy Blvd. and Harper Road. Table 1 shows a summary of flows at key analysis points identified in Exhibit 2.

TABLE 1 - FLOWS AT KEY ANALYSIS POINTS' (CFS)

Analysis Point ID	100 yr. Pre-developed ²	100 yr Existing	100 yr. Improved	AAR LOMR
AP 4	-----	214 ³	24 ⁴	-----
AP 5	-----	198 ³	23 ⁴	-----
AP 6	250 ³	221 ³	22 ⁴	-----
AP 8	-----	2192	2090 ⁵	2350

1. See Exhibit 2 for location of analysis points
2. Assumes Campus property in undeveloped natural state
3. Full roadway cross section flow
4. Half roadway cross section flow (eastside half of Wyoming Blvd.)
5. Reduction of flow with existing condition results from drainage management improvements (e.g. detention ponds)

Under pre-developed conditions, the estimated 100-year storm runoff at AP6 is about 250 cfs. Development of the site to existing conditions resulted in a reduction of flow to 221 cfs, due to the construction of the campus storm management infrastructure.

A Special Assessment District (SAD) was established prior to 1985 for infrastructure improvements in the vicinity of the Academy during the construction of Wyoming Blvd. between Harper Rd. and Academy Blvd. At that time, communication between City Departments was less sophisticated, and an apparent oversight resulted in a lack of drainage facilities. In 1987, two storm sewers were built on Wyoming Blvd. close to the Pino Arroyo. One sewer conveys storm flows from Harper Road to the Pino Arroyo crossing. The second sewer intercepts Wyoming Blvd. roadway flow

through inlets located south of the Pino crossing. The capacity of the inlets is approximately 25 cfs on either side of the roadway.

A hydrologic and hydraulic analysis of Wyoming Blvd. ,excluding all contributions from Academy property, was performed during the current revision to the MDPAA to determine the susceptibility of Wyoming Blvd. to flooding solely from contributing roadway drainage basins.

Table 2 shows the results of the roadway flow analyses. Under existing conditions, the 10 year DPM criteria is violated at AP4 and AP5. Storm flow are within 100-year criteria at all three analysis points.

TABLE 2 - ROADWAY FLOWS AT KEY ANALYSIS POINTS ON WYOMING BLVD.' (CFS)

Analysis Point ID	100 yr. Existing	100 yr Capacity DPM Criteria ²	10 yr. Existing	100 yr Capacity DPM Criteria ²
AP 4	18.6	29.2	10.4	2.8
AP 5	18.6	29.2	10.1	2.3
AP 6	18.3 ³	29.2	9.6 ³	2.3

1. Runoff from roadway ROW only (includes Wyoming Blvd. Basins and contributing Academy Blvd. Basins)
Refer to Appendix D for additional analysis of Wyoming Blvd. Drainage.
2. DPM criteria listed in Appendix D
3. Storm sewer inlets located upstream of AP6 will fully intercept this flow.

6. Proposed Improvements

Proposed improvements to the Academy Campus included in this revised Drainage Management Plan include construction of the Wyoming Blvd. Diversion, the Natatorium, and drainage provisions for other future buildings and parking areas targeted for development in the 1989 MDPAA, (and as further revised in this plan). A discussion of the proposed improvements is presented below.

Proposed Wyoming Boulevard Diversion

Hydrologic analysis of the Academy Campus using 1996 criteria show that under existing conditions, runoff from the campus results in an additional flow of approximately 200 cfs to the roadway flow on Wyoming Blvd. south of Harper Rd. However, based on results from hydrologic and hydraulic analysis of the existing roadway, runoff generated solely from roadway ROW results in storm flows on Wyoming Blvd. which violate City of Albuquerque storm management criteria (Table 2 and Appendix D). In order to achieve compliance with the City criteria, both flows must be reduced. Therefore, it is reasonable that both the City and the Academy contribute to a long-term solution to the existing drainage problems. ~~What if COA contributed~~

Three options were evaluated for the capture and diversion of runoff from the Academy Campus, bound for Wyoming Blvd., on Academy property. The options are described with the least visual impact, most costly (Option 1), to the highest visual impact, least cost alternative (Option 3). With the exception of Pond 90 (which is located in an area designated as a future parking lot) all existing drainage structures are incorporated into the proposed drainage management options.

While all the options are capable of the capture and diversion of Campus flows before reaching Wyoming Blvd., they do not reduce flows generated within the Academy Blvd. and Wyoming Blvd. ROW's which currently overburden the roadway during the 10 year storm event. A better alternative would address both the Academy and roadway flows, namely a storm sewer along Wyoming Blvd. Placement of a storm drain within the roadway ROW would preserve the pristine nature of the Academy perimeter, consistent with long-term land use criteria adopted by the Academy in the MDPAA, and ensure the preservation of a valued neighborhood retreat in an otherwise urbanized area. It would be up to the City and Academy to negotiate the shared expense for construction of a City storm sewer with sufficient capacity to eliminate both drainage problems.

It appears that there will still be a problem in Wyoming Blvd. w/ any of these options. Why should City contribute?

Is Academy also a public park?

Option 1 includes detention ponds, berms, and storm sewers to detain and convey storm flows north to the Pino Arroyo. Detention ponds and small diversion berms are proposed along Wyoming in the southwest corner of the Academy Campus (Ponds A, B, and C; Exhibit 3) to intercept and detain flows from drainage basins 60, 7, 145, 80C, and 80B. Outflow from Ponds A, B, and C are conveyed in a small storm sewer to Basin 80L, where they are combined with flows from Basins 20, 10, 30, 70, and 80U into a major storm sewer (60"), extending north along the western boundary of the Academy to the Pino Arroyo. In conjunction, a smaller pond is proposed in Basin 160 to detain the combined flows from Basin 160, and outflow from existing Ponds 140 and 50.

The capacity of the proposed ponds is based upon the assumption that upstream areas behind the pond berms are preserved in their natural state (i.e., no excavation upstream of the berm). The cost estimate for Option 1 is \$906,000.

Option 2 is similar to Option 1 except that additional detention ponds are proposed in Basins 80U and 80L (Exhibit 4). The added ponds in Basin 80U and 80L provide detention of the substantial storm flow entering Basin 80L allowing a reduction in size of the major storm sewer along the western boundary of the Academy from 60" to 36" and 42". South of Basin 80L, Option 2 is identical to Option 1. The cost estimate for Option 2 is \$623,900.

Option 3 replaces the major storm sewer (proposed in Options 1 and 2) with an earthen channel extending from Basin 80L north to the Wyoming Desilting Basin (Exhibit 5). Outflow from Pond D at Basin 80L is combined with flow from the smaller storm sewer serving Ponds A, B, and C, at the inlet to the proposed channel. Again, Ponds A, B, and C, their diversion berms, and storm sewer are the same as Option 1. The channel would have 3/1 side slopes, and a bottom width of 15 feet. The cost estimate for Option 3 is \$374,400.

Cost estimates for the proposed options are based on 1992 City of Albuquerque unit prices, plus 10% for inflation and 45% for contingencies and soft costs. The cost estimates presented in the text do not include acquisition of ROW which raises the cost estimates substantially. For example, the cost of ROW for Option 3 is estimated to be \$814,400, raising the total cost estimate for this Option to \$1,188,800. Cost estimates for each option are included in Appendix E.

The Natatorium

The proposed Natatorium is in the final stages of design. The 23,830 square foot building will be located adjacent to and contiguous with the existing Middle School Gymnasium. A separate site drainage and grading plan for the Natatorium is currently being prepared for approval by the COA and will be included in the building permit plan set.

Other Future Buildings and Parking Areas

Future building and parking sites (Exhibit 3) impact the drainage management for the Academy in three ways. First, the development of the sites will increase the runoff generated within the on-site drainage basins containing the targeted areas. Proposed conditions land treatment types have been revised in the hydrologic model to reflect the development of these sites.

Second, some of the proposed sites conflict with existing drainage management infrastructure which requires the modification of other structures, or construction of new structures to manage future flows. Notably the proposed future parking site in Basin 90 conflicts with Pond 90. Proposed improvements for this area includes the modification of Pond 100 to provide capacity to detain flows from both Basin 100 and routed flows from Basin 90.

Finally, one of the targeted sites for a future building is located atop an historic drainage pathway (Future Building site, Basin 140). Construction of a building on this site will require more rigorous drainage evaluation during site development.

7. Desilting Basin Improvements Concept

Basin Improvements

Revised hydrologic analysis using 1991 criteria resulted in increased flow entering the desilting basin from the original design flow of 1500 cfs to 2350 cfs (Pino Arroyo LOMR, AAR, 1991). The increased flows were verified by BHI using the 1996 Academy AHYMO with upstream Pino Arroyo hydrographs provided by AAR (Appendix F).

Hydraulic analysis of the desilting basin using the revised flows were included with the LOMR. The results indicated that the freeboard of the basin following the design event no longer meets the 3' minimum requirement set forth by FEMA and the City of Albuquerque DPM. Included in the referenced report was a recommendation to rectify the problem by removing the existing sill. According to the AAR and Dr. Richard Heggen, removal of the sill lowers the water surface elevation to provide adequate freeboard, and has minimal impact on sediment storage and sediment capture during the design event. Whereas fewer suspended fines would settle from annual storms following sill removal, the authors noted that fine sediments suspended during the design storm would not appreciably settle in the presence or absence of the sill. The strategy provides a relatively inexpensive solution to the problem.

The City of Albuquerque Hydrology Division prefers a more conservative strategy in which the sill remains, and a berm is constructed to provide adequate freeboard. Based on the referenced analysis, the top-of-berm elevation required to satisfy FEMA requirements would be 5404.5 feet (existing surface elevation adjacent to basin is

approximately 5400 feet). The western slope of the berm, adjacent to the desilting pond outlet structure, provides additional freeboard to the transition structure between the basin outlet and Wyoming Blvd. to meet COA freeboard criteria for trapezoidal channels.

The cost estimate for construction of a berm of sufficient height to satisfy FEMA requirements is \$104,000, which includes construction of the berm, and acquisition of right-of-way (Appendix E). In contrast, the cost estimate for removal of the existing sill is \$16,800. Bohannon-Huston Inc. strongly recommends following the recommendation of Dr. Heggen. Removal of the sill represents the least cost, least impact solution.

Will FEMA accept this?

The Academy and the City of Albuquerque Hydrology Division have agreed that the Academy will allow the City to construct aesthetically pleasing berms along the downstream edge of the desilting basin (located on Academy property), to achieve freeboard requirements, in exchange for a commitment by the City to remedy the erosion problems at the Ventura Blvd. outfall of the Pino. A conceptual layout for the addition of a berm of sufficient height to meet freeboard requirements is shown in Exhibit 6.

Sediment Management

Responsibility for monitoring and relocation of sediments in the Pino reach within the Academy Campus were presented in the MDPAA, and further refined by the Academy and AMAFCA. Modifications to the basin are not anticipated to effect this agreement.

ALBUQUERQUE ACADEMY

6400 WYOMING BOULEVARD, N.E.

ALBUQUERQUE, NEW MEXICO 87109

September 15, 1995

Mr. Dan Hogan
Hydrology Division
Public Works Department
CITY OF ALBUQUERQUE
P.O. Box 1293
Albuquerque, New Mexico 87103

Re: Letter of Commitment concerning the Drainage/Diversion east
and adjacent to Wyoming Blvd., adjacent to the Albuquerque
Academy Campus

Dear Dan:

This correspondence shall serve as a Letter of Commitment between the Albuquerque Academy and the City of Albuquerque for the construction of the drainage/diversion east of and along Wyoming Blvd. to intercept flows from the Albuquerque Academy campus. This drainage/diversion, along with other options for handling drainage from the Albuquerque Academy campus, has appeared in various drainage master plans for the campus since 1984. It is the City's desire that this drainage/diversion be constructed to convey flows from the campus to the north and into the Pino Arroyo to prevent the aggravation of flooding in Wyoming Blvd., which are exacerbated by flows from the Academy campus. The following is our understanding of the commitment by the Albuquerque Academy to the City of Albuquerque.

1. The drainage/diversion along Wyoming Blvd. will be constructed to City standards and budgeted along with Albuquerque Academy's plans for the construction of a Natatorium on the campus. It is envisioned that planning for the Natatorium will begin in October 1995 and that the project will be completed by October 1997, to include the construction of the drainage/diversion along Wyoming Blvd. to handle the increased flow rates from the campus. Therefore, the drainage/diversion will be substantially completed by October 1997. Should unforeseen occurrences disrupt the schedule for the Natatorium, the construction of the drainage/diversion will proceed on its own, maintaining the time schedule above.

Mr. Dan Hogan
9/15/95
Page 2

2. With the planning for the Natatorium and in preparation for the construction of the drainage/diversion, an updated drainage management plan for the entire Academy campus property bounded by Wyoming, Academy, Ventura and Harper, will be prepared and submitted to the City of Albuquerque for their review and approval. The updated drainage management plan will include the construction plans for the drainage/diversion along Wyoming Blvd.
3. Based upon this Commitment to construct the drainage/diversion along Wyoming Blvd. and recognizing that alternative drainage management schemes were set forth in previous drainage management plans for the Albuquerque Academy campus property, the Music Building site specific drainage plan which has already been approved by the Hydrology Division, may proceed immediately to construction, assuming all other requirements are met.
4. Once the drainage/diversion along Wyoming Blvd. is constructed to City standards and functional, and an updated drainage management plan for the Academy campus property is approved by the Hydrology Division, it is anticipated that drainage reviews will be greatly simplified which will help to expedite future plans through the normal review process.

The above reflects Albuquerque Academy's understanding of the commitment to the City. If you should have any questions concerning these matters, please feel free to call.

Sincerely,



Richard G. Elkins
Chief Business & Financial Officer

RGE/sat

WYOMING BLVD. FLOW CAPACITY ANALYSIS

1. CITY CRITERIA FOR ARTERIAL:

The City of Albuquerque street hydraulic criteria are detailed as follows (COA DPM):

- a. Mannings roughness coefficient is 0.017
- b. Flow depths for the 100 year storm event shall be less than 0.67' at all locations
- c. Flow depths for the 10 year storm event many not exceed 0.5' in any collector or arterial street. One lane must be free of flowing or standing water in each traffic direction on arterial streets
- d. The product of depth times velocity shall not exceed 6.5 in any location in any street for the 10 year storm event

2. RESULTS OF HYDROLOGIC AND HYDRAULIC ANALYSIS:

Storm runoff from Wyoming Blvd drainage basins, and Academy Blvd basins contributing to Wyoming, were modeled using AHYMO as described in Section 4. Runoff from Basins A1 and A2 (north side of Academy Blvd) was combined with runoff from the east side of Wyoming Blvd Basins 85, 165, 185 and 190 (Wyoming Blvd) to determine the required capacity of Wyoming Blvd. The analysis assumed no contribution of storm flows from the Academy Campus.

AHYMO analysis (AHYMO summary sheets are included in Appendix D) for the 100 year storm flow at AP6 (northern boundary of Basin 185, Exhibit 2) determined the maximum flow at this location to be about 18.3 cfs. A series of five inlet structures are located in the north end of Basin 185 from 80 feet south of the boundary of Basins 185/190 extending into Basin 190. The capacity of the inlets is adequate to intercept roadway flows. However, south of the inlet structures, in the reach between AP5 and AP6 there are no drainage structures to reduce roadway storm flows. The AHYMO analysis determined the storm flows at AP5 to be 10.1 cfs and 18.6 cfs for the 10 year and 100 year storm events, respectively.

The 100 year storm event criteria limits the depth of flow to 0.67' at all locations. Flow depth was determined using a typical roadway cross section for Wyoming Blvd based on one side of the roadway (see attached sheet entitled "WYOMING FLOW CAPACITY"). Flow depth for 18.6 cfs was determined to be 0.55' and therefore within the COA 100 year criteria.

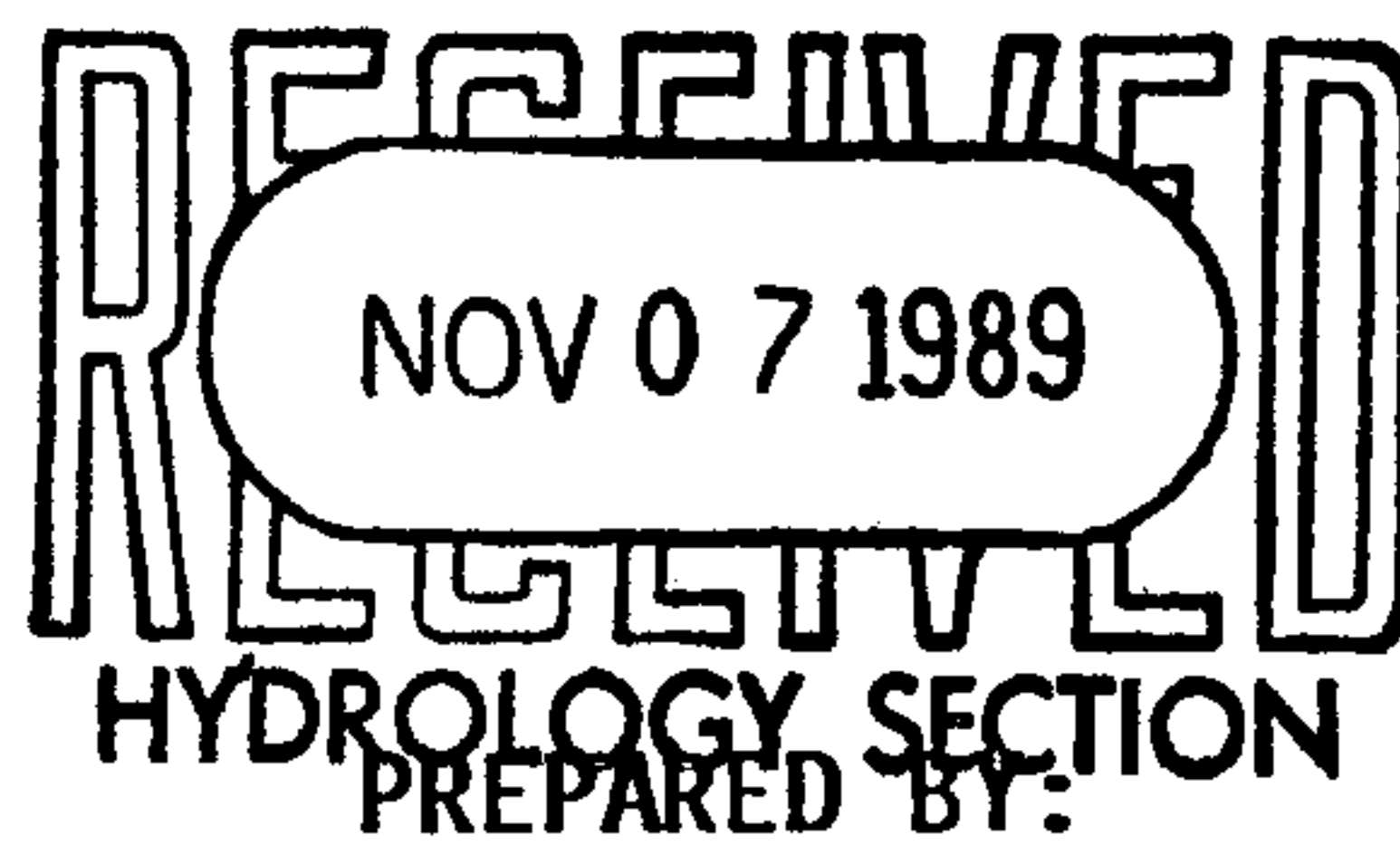
The 10 year storm event criteria requires that one lane must be free of flowing or standing water in each traffic direction. Based on a 2% roadway cross slope, the flowdepth for 10.1 cfs is approximately 0.44', extending about 22 feet towards the median from the curb. Since this section of Wyoming Blvd has two lanes of traffic in either direction, the flow depth generated in the 10 year storm would not allow one lane free of flowing or standing water. Therefore, flows generated in the roadway ROW, as a result of the 10 year storm event, exceed City street hydraulic criteria under existing conditions.

MASTER
DRAINAGE PLAN
FOR
ALBUQUERQUE ACADEMY

NOVEMBER, 1989

PREPARED FOR:

ALBUQUERQUE ACADEMY
6400 Wyoming Blvd., NE
Albuquerque, NM 87109



BOHANNAN-HUSTON, INC.
7500 Jefferson St., NE
Courtyard I
Albuquerque, NM 87109



JOB NO. 89155.02

A. PURPOSE AND SCOPE

On May 26, 1989, the Albuquerque Academy submitted a site development plan to the City of Albuquerque (COA) Environmental Planning Commission (EPC). The submittal consisted of two parts, a General Site Plan for the entire 320 acre campus, and a Site Specific Plan for the new Library and Science Buildings. A Master Drainage Plan was required by the City of Albuquerque Hydrology Section as a condition of approval.

This report presents a drainage management plan which serves the existing Albuquerque Academy Campus and future improvements as defined by the General Site Development Plan. A copy of the Site Plan is provided as Plate 1.

Information found in this Master Plan is conceptual only and is not intended to function as a detailed drainage management plan. Detailed grading and drainage plans will be required for each new project as ~~they~~^{IS} are implemented. 17

Two site specific areas are shown in this report as a part of future improvements. These are the tennis court relocation, and the new Library and Science Buildings. The tennis court relocation is close to completion at this time. The Library and Science Buildings are also shown as part of the Master Plan improvements. A separate grading and drainage plan has been submitted for the buildings. A copy of both the tennis court grading plan and the Library and science Building grading plan is provided for information. A section dedicated to the treatment of these areas is included within this report.

In addition to the proposed developments, a plan for management of the Pino Arroyo has become a major element in this report. AMAFCA maintains the primary jurisdiction over this section of the Pino Arroyo. Responsibilities of the Academy, and AMAFCA are defined, and a draft management plan for the channel is presented in the section titled "Pino Channel". This plan is currently being formulated with AMAFCA and will be a benefit to the entire community.

B. PROJECT DESCRIPTION

Located in the northeast heights, the Albuquerque Academy is bounded by Wyoming Blvd. to the west, Harper Rd. to the north, Ventura Blvd. to the east, and Academy Rd. to the south (Zone Atlas Maps E-19 and E-20). The campus is approximately 320 acres in area. Most of the site is bounded by City streets. The Hoffmantown Church site is located at the northeast corner of the Campus property.

The site is located in the alluvial fan formation of the Sandia Mountains. This type of formation typically consist of systems of smaller branched arroyos which collect into larger arroyos. A major arroyo known as the Pino Arroyo bisects the site.

The site slopes from east to west at approximately 2%-4%. The soils are classified by the "Soil Survey of Bernalillo County" as Tijeras gravely fine sandy loam, Embudo gravely fine sandy loam, and Embudo - Tijeras Complex. Each of these types is listed as hydrologic soil type B. Sparse native vegetation covers the site not occupied by the campus improvements.

Exhibit 1 shows the Soil Conservation Service map of soil types.

C. HYDROLOGIC ANALYSIS

Analysis and design criteria is taken from the COA Development Process Manual (DPM) in particular, Volume II, Design Process. Based on these criteria, the hydrologic and hydraulic analysis will be for a 100 year frequency, 6-hour duration rainfall.

Due to the size and complexity of the site, a computer-based hydrologic analysis was performed. This will allow the analysis and evaluation of stream routing, pond routing, and detailed hydrograph development. The most current version of HYMO as revised for the latest Albuquerque Master Drainage Study (AMDS) update as of April 1988, was used.

Basin parameters were defined by the latest revisions to the HYMO Program as proposed by the DPM Steering Committee, dated May 15, 1989. Development of HYMO input parameters are based on four dependent variables;

- Applied Rainfall
- Time of Concentration
- Soil Type
- Area

These variables are represented by several parameters.

The most important of these parameters is the curve number (CN) and conveyance factor (K). Slight adjustments in these parameters can result in large differences in the computed flow rates.

Three land uses treatments are given which are as follows:

- Treatment 1 - Soil Uncompacted by Human Activity
- Treatment 2 - Soil Compacted by Human Activity
- Treatment 3 - Impervious Areas

Computations and analysis used to develop these parameters are found in the appendix, Engineering Computations Section. Modeling of sod or landscaped areas requires dividing the basin into equal parts of treatment 1 and treatment 2. Because of the large area of sod, a fourth treatment was developed. A CN value and K value was developed for treatment 4. A volume method of computation is used to compute an equivalent CN.

The applied rainfall distribution is based on the latest proposed DPM revisions of May, 1989. The hyetograph distribution that was utilized is for Zone 3, a 100 year, 6 hour duration design storm. Separate hydrographs were developed for pervious and impervious areas then combined to create a composite hydrograph for each basin.

A hydrologic analysis of the Pino Channel from a previous study (South Pino Arroyo Stabilization Study, January, 1987, prepared by Bohannon-Huston, Inc.) defines the flow rate at the Ventura Blvd. crossing and the Wyoming Blvd. crossing. Because the Pino Channel is hard lined from Wyoming Blvd. to the North Diversion Channel, and is sized for fully developed conditions, free discharge to the channel will be allowed.

D. EXISTING CONDITIONS

1. OFFSITE FLOWS

Offsite flows to the site come from 3 sources; Hoffmantown Baptist Church, Harper Rd., and the Pino Arroyo at Ventura Blvd. Runoff from the Hoffmantown site affects the arroyo in several ways. Steep side slopes exist within this area, and have a high potential for erosion and ~~scoring~~. The close proximity to the Ventura crossing structure with associated high velocities also increases the erosion and scour potential. Future improvements planned for the church site must adequately protect the Pino Arroyo and be consistent with the Pino Arroyo management plan.

SCOURING

Flows coming off Harper Rd. discharge into unimproved channels which then drain to the Pino Arroyo. Improvements to these channels are not planned at this time.

Offsite flows at the Ventura crossing structure are approximately of 1200 cfs. Section F of this report concerning the Pino Arroyo discusses future treatment of the arroyo. Basin delineation, flowpaths, flow rates, and analysis points are shown on the Existing Condition Basin Map, Plate II. Both detailed HYMO computer printouts and a Basin Parameters Summary Table are found in the appendices.

2. OUTFALL LOCATIONS

Under present conditions the site discharges to three locations, the Pino Arroyo, Academy Road and Wyoming Blvd. Runoff which reaches Academy Blvd. is generated from Basins 5 and 7.

Runoff to the arroyo is uncontrolled free discharge. Under present conditions, the unlined channel is adequate to handle these flowrates. Future development will require the upgrading of the channel to accommodate increased flowrates and associated erosion and scouring. We are working with AMAFCA on the development of the management plan for the arroyo. It addresses these concerns and others. Section F of this report on the treatment of the Pino Channel addresses this in more detail.

Areas discharging to Wyoming Blvd. either free discharge directly to Wyoming or are routed through one of 6 existing ponds. The existing conditions analysis shows the flow rates reaching Wyoming Blvd. are on the order of 275 cfs. Several catch basins located on Wyoming Blvd. at the Pino Channel intercept the flow and discharge into the channel.

Wyoming Blvd. is under capacity and cannot carry the historic flow rates. The 10-year criteria is greatly exceeded. Maximum capacity for 100-year conditions is approximately 138 cfs versus the 245 reaching the Academy under existing conditions. Past improvements to the Academy have ~~served to~~ lessen the impacts of drainage.

SERVED TO

E. PROPOSED CONDITIONS

1. GENERAL PLAN IMPROVEMENTS

Drainage improvements presented in this report serve the existing Academy Campus and those buildings and facilities which are planned for future development as identified in the General Site Plan for subdivision. In summary, these improvements include the new Library and Science Building, relocation of tennis courts and the addition of five new buildings.

Future developments will require site specific grading and drainage reports. These reports will follow the concepts defined by this master plan.

The Albuquerque Academy has approved zoning for higher density developments than is currently being used, and has adopted a policy to restore the majority of the campus to its historic conditions. Land outside of the campus tract will remain undeveloped in the foreseeable future. A program has been started to restore the native vegetation, arroyo and wildlife to historic conditions. This Master Plan will treat those areas as undeveloped.

The following are conditions and criteria adopted by this report:

- o All basins remain undeveloped except within Tract A-1. Specific improvements are as identified in the General Site Plan.
- o Separate detailed grading/drainage reports will be submitted for each future improvement as development occurs within Tract A-1.
- o Improvements to the Pino Arroyo will be consistent with the plan presently being developed by the Academy and AMAFCA. These improvements will strive to maintain the arroyo in its historic condition.
- o Discharge of developed runoff to Pino Arroyo is allowed for all basins.

PARKING IN A2
ROAD ACROSS A2 & A3
TENNIS COURT IN A4

} SEE PLATE 1 SITE PLAN
WHICH DISAGREES W/ #3
PRO. COND.

2. OFFSITE FLOWS

Four areas of off-site flow reach the Academy site. The most important of these is the Pino Arroyo. As mentioned previously, section F in this report address the Pino Arroyo.

Two channels which convey flows from Harper Rd. are within dedicated easements. Treatment of the Pino Channel if any will recognize these facilities.

Hoffmantown properties will be allowed free discharge into the Pino Arroyo. Drainage improvements by Hoffmantown will need to adequately protect the arroyo and will need to follow or offer revisions to the Pino Arroyo Plan presently being developed. Such improvements are not addressed in this report.

Exhibit B contains a summary table of proposed improvements. Basin delineation, flow paths, conceptual grading and infrastructure improvements are shown on Plate III, Proposed Conditions. Detailed hydrologic data and hydraulic data can be found in Proposed Conditions, Basin Parameters Summary Table located in the appendices.

3. OUTFALL LOCATIONS

Onsite drainage basins outfall to three locations: the Pino Arroyo, Wyoming Blvd. and Academy Road. Flows to Wyoming Blvd. eventually drain into the Pino Arroyo at the Wyoming crossing structure.

Pino Arroyo

As stated in the conditions above, free discharge to the Pino Channel will be allowed by all basins. See section F for discussion of the Pino Arroyo.

Wyoming Blvd.

At one time a minor arroyo conveyed drainage from areas east of the Academy through Academy property to Wyoming Blvd. A large portion of the flow in this arroyo has been diverted directly to the Pino Arroyo due to the construction of Ventura Blvd.

As stated earlier in this report the amount of storm runoff reaching Wyoming Blvd. is greater than that allowed by City of Albuquerque criteria. Adequate drainage facilities needed to accommodate historic flows were not provided for when Wyoming Blvd. was constructed. It is not the responsibility of the Academy to solve or eliminate this situation. Past improvements to the campus have lessened runoff to Wyoming Blvd. Future improvements presented in this report further reduce the flow rates to Wyoming Blvd.

SEE WHO?

Several drainage improvements are required to support the future buildings identified on the General Site Plan. An improvements summary is provided which details drainage improvements required for each building. (See Exhibit B).

The most significant improvement are those within Basin 80. Two alternates are given for this basin:

- o Alternate One calls for the construction of a drainage channel which intercepts runoff at Basin 80 and conveys it north to the Pino Arroyo within an improved earthen channel. The vast majority of flow currently reaching Wyoming Blvd. from Tract A-1 of the Campus would be diverted to the Pino Arroyo thereby relieving, to some degree, the potential flooding in Wyoming Blvd.
- o Alternate Two calls for the installation of a pond within Basin 80. This pond would detain the runoff, reducing the amount of runoff reaching Wyoming Blvd. also reducing to some degree the potential flooding.

Alternatives 1 and 2 will be evaluated when improvements upstream of Basin 80 are developed. At that time further analysis will be conducted which determines the most beneficial and cost effective alternate.

4. SITE SPECIFIC IMPROVEMENTS

Library and Science Buildings

A detailed grading and drainage plan for the Library and Science Buildings has been submitted separately. The detailed drainage plan is consistent with this Master Plan. Basin limits, flow rates, and grading are shown on the Proposed Conditions Basin Map, Plate 3. The overall runoff is reduced because the existing tennis courts have been removed and relocated resulting in a lower impervious area. Modifications to improvements will not be necessary to downstream ponds due to the construction of the Science and Library buildings. A copy of the previously submitted grading and drainage plan is included in this report as plate IV.

Tennis Courts

Relocation of the tennis courts to the northeast side of the campus required several actions. One was the design of a berm which diverts flows around the courts. Analysis of the effects of the diversion on the channel floodplain were conducted using the Corps of Engineers (COE) Hec-2 surface profile computer program. Copies of the letter report and approval letters can be found in the correspondence section of the appendix.

Hydrology for Basin 200 addresses runoff from the tennis courts. A plan is submitted with this report which shows the detailed grading for the tennis courts and associated improvements. All runoff generated free discharges directly to the Pino Arroyo by surface drainage facilities.

F. PINO CHANNEL

Approximately 1200 cfs enters the site at the Pino Arroyo, Ventura Blvd. crossing structure. This is by far the most significant drainage feature on the site. Under existing conditions the Pino Arroyo has adequate capacity to carry the 1200 cfs. Upstream, to the east, the channel passes through the Tanoan Community and is improved from the Pino dam to the Academy property at Ventura Blvd. Downstream the channel is concrete lined from Wyoming Blvd. west to the North Diversion Channel. This creates a unique situation in that this segment of the channel can experience a significant loss in sediment. Signs of problems possibly relating to this condition are beginning to show in the form of erosion and scour. AMAFCA is concerned with the possibility of unacceptable quantities of sediment reaching the Wyoming crossing structure to the west.

As a result of these conditions, the Albuquerque Academy and AMAFCA have begun to develop a plan which addresses channel maintenance. An initial draft copy of this plan entitled "Letter of Understanding" is included in the correspondence section of the appendix. Currently, the Letter of Understanding is under review by AMAFCA and the Academy. Future definition of the monitoring program and the phased implementation are being developed.

The plan proposes to maintain the arroyo in its historic condition. Alternate methods of channel stabilization will be studied and implemented which adhere to the philosophy of preserving the historic condition of the arroyo. In order to reduce the amount of sediment reaching the lined channel at Wyoming Blvd., specific improvements are planned which consist of a sediment trap and a sediment injection area. Sediment will be collected in the trap upstream of Wyoming Blvd. and placed into the stream at the injection area west of Ventura Blvd.

As stated earlier a floodplain analysis for the Pino Arroyo has been conducted as a part of the tennis court diversion berm design. This analysis determined computed floodplain limits and was approved by the COA and AMAFCA. The analysis redefines the location of the 100 year floodplain limits. In all cases the new computed floodplain limits are contained within the existing platted easement. Both the computed floodplain limits and the FEMA limits are shown on the basin maps. Also included is a copy of the plat showing both the dedicated floodplain easement and the dedicated 200 ft. drainage easement.

As stated above the Pino plan is under review by AMAFCA. A final approved plan will be developed which defines the responsibilities of AMAFCA, the Albuquerque Academy and the City and which details and defines the future management of this section of the Pino Arroyo. This Master Plan adopts and follows the approved Pino Arroyo Plan.

G. CONCLUSIONS

Addressed in this report are the issues pertaining to drainage management relative to a general site development plan for subdivision for the Albuquerque Academy Campus. Both existing and proposed conditions are analyzed. Future improvements are presented in a conceptual fashion appropriate for the site plan approval. Below is a summary of conclusions determined in this report:

- o Improvements presented in this report will not directly address the problem of inadequate flow capacity of Wyoming Blvd. However, these improvements will, to some degree, reduce the flooding to Wyoming Blvd.
- o Free discharge to the Pino Arroyo is allowed from the new tennis courts by surface drainage.
- o Construction of the Library and Science Building will not require modifications or improvements to existing downstream ponds.
- o Future improvements in basins, 90, 140, and 170 will require re-evaluation and analysis to determine if modifications to downstream ponds would be necessary. This would be done on a case by case basis. Development of all improvements will require existing drainage facilities to be upgraded and improved to accommodate the increased runoff.
- o Building #7, located south of the Upper Campus will trigger the need for improvements in Basin 80. Improvements to the existing arroyo within Basin 80 will not be necessary. The two alternates which will be evaluated are:
 - Alternate 1 consists of an earthen channel which will divert flow north along Wyoming Blvd. to the Pino Arroyo.
 - Alternate 2 consists of a detention pond which would outfall to Wyoming Blvd. at a reduced, controlled flow rate.

Following in this report is Plate 2, and the Improvements Summary Table which show the future improvements in detail. Also included are all hydrologic and hydraulic analysis, computations maps and other information necessary for the requested approvals.

Following are exhibits which show hydrologic and hydraulic data for the drainage analysis as well as an improvements summary, vicinity map, and soils map. All necessary information is provided for the requested approvals.

Improvements proposed in this Master Plan reduces runoff to Wyoming Blvd. and controls developed runoff from the Academy Campus.

COMPUTE CN FOR TREATMENT 4

USE VOLUME METHOD TO COMPUTE EQUIVALENT CN. $P = 2.6 \text{ in}$

TREATMENT #1 $Q = 72.3$ for $P_{100} = 2.6 \text{ in}$

TREATMENT #2 $Q = 81.6$ for $P_{100} = 2.6 \text{ in}$

For parks and lawns $Q = \frac{1}{2} T_{\text{TREAT \#1}} + \frac{1}{2} T_{\text{TREAT \#2}}$

$$Q = \frac{0.60 + 1.05}{2} = 0.825$$

$$Q = \frac{(P - 0.25)^2}{P + 0.85}$$

WHERE $S = \frac{1000}{\text{CN}} - 10$

$$0.825 = \frac{(2.6 - 0.25)^2}{2.6 + 0.85}$$

$$2.145 + 0.66S = 6.76 - 1.045 + 0.04S^2$$

$$.04S^2 - 1.70S + 4.615 = 0$$

$$- \frac{(-1.70) \pm \sqrt{1.7^2 - (4 \times .04 \times 4.615)}}{2 \times .04}$$

$$S = \frac{1.70 \pm 1.4668}{.08} = 39.58, 2.915$$

$$(2.915, 39.58) = \frac{1000}{\text{CN}} - 10$$

$$\text{CN} = 20.16, 77.43$$

$$\underline{\underline{\text{CN} = 77.4}}$$



EC - ENGINEERING & ARCHITECTURE

118 ACADEMY

89155.02

MASTER DRAINAGE

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6/20/89

TIME OF CONCENTRATION COMPUTATIONS (T_c)

FOR LARGE BASINS (30 AC OR LARGER)
USE OVERLAND FLOW (UPLAND) METHOD.

$$T_c = L_1/V_1 + L_2/V_2 + L_3/V_3 + \dots$$

$$V = K\sqrt{S}$$

L = REACH LENGTH (FT)

V = VELOCITY (FT/SEC)

K = CONVEYANCE FACTOR
(DIMENSIONLESS)

S = SLOPE (FT/FT)

Table 13. Conveyance Factors

k	Factor
0.7	Grass and landscaped areas
1	Bare ground
2	Paved areas (sheet flow) and small upland gullies
3	Street flow and channels

TIME TO PEAK COMPUTATIONS (T_p)

$$T_p = 2/3 T_c \quad T_p \geq 10 \text{ min.}$$

K FACTOR

For evaluation of K 1 of three methods are used depending on BASIN SIZE.

- 30 acres or less
- 30 acres to 130 acres
- OVER 130 acres

K VALUES

$$\Delta < 30 \text{ acres} \Rightarrow t_{p30}$$

Table 14. K/t_{p30} Ratio

Zone	Treatment			
	1	2	3	4
1	0.574	0.386	0.283	
2	0.611	0.410	0.285	
3	0.608	0.388	0.286	0.498*
4	0.569	0.341	0.287	

Applicable for 100, 10 & 2 year storms

$$K/t_{p30} = \frac{K/t_{p30,1} A_1 + K/t_{p30,2} A_2}{A_1 + A_2}$$

$$K = K/t_{p30} * t_p$$

$$\Delta > 130 \text{ ac} \Rightarrow t_{p130}$$

$$K/t_{p130} = \frac{K/t_{p130,1} A_1 + K/t_{p130,2} A_2}{A_1 + A_2}$$

$$K = K/t_{p130} * t_p$$

$$* K/t_{p30} \text{ for TREAT. 4} = \frac{K/t_{p30} \text{ TREAT. 1} + K/t_{p30} \text{ TREAT. 2}}{2}$$

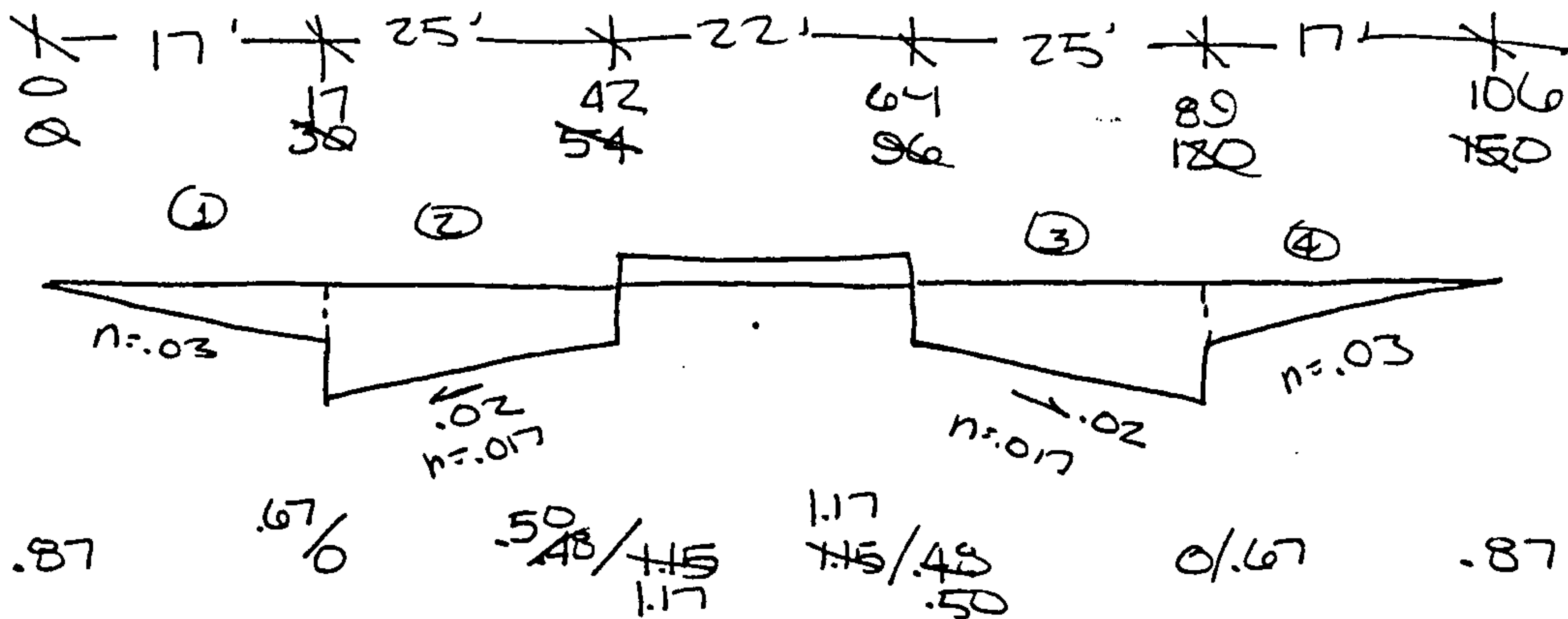
Average of values is used.

ALB ACADEMY
89155.02

2


3
6/20/89

100% ALLOWABLE



① ④ $Q = \frac{1.486}{.03} \left(\frac{17 \times .2}{2} \right) \left[\frac{\left(\frac{17 \times .2}{2} \right)^{2/3}}{17} \right]^{2/3} \cdot .0707 = 1.28 \text{ cfs}$

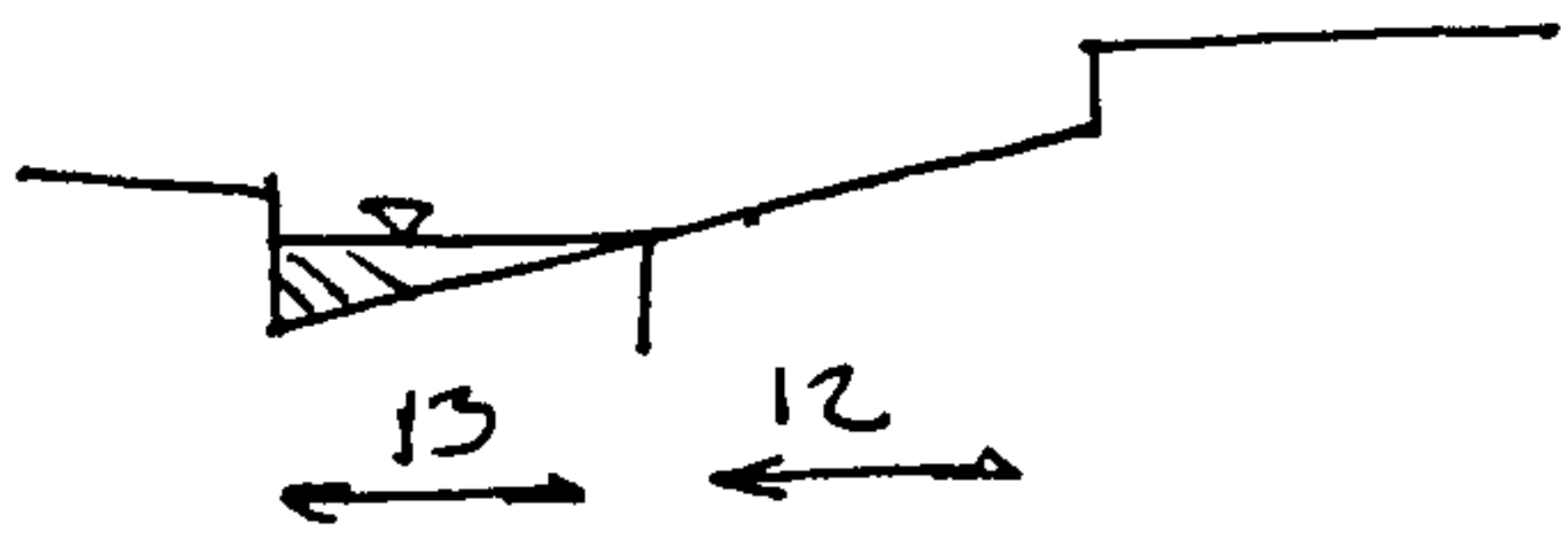
② ③ $Q = \frac{1.486}{.017} \left(\frac{37 \times .87}{2} \times 25 \right) \left[\frac{\left(\frac{37 \times .87}{2} \times 25 \right)^{2/3}}{(25 + .67 + .37)} \right]^{2/3} \cdot .0707 = 67.8$

$67.8 \times 2 + 1.3 \times 2 = \underline{\underline{138.2 \text{ cfs}}}$

Maximum capacity of Wyoming Blvd. = 138 cfs

10YR ANALYSIS ALLOWABLE DISCHARGE

CRITERIA ①



$$A = \frac{.02 \times 13 \times 13}{2} = 1.69 \text{ ft}^2$$

$$Q_{100} = \frac{1.4849}{.017} \cdot 1.69 \left[\frac{(1.69)}{(26+13)} \right]^{2/3} \cdot .0707 = 2.6 \text{ cfs}$$

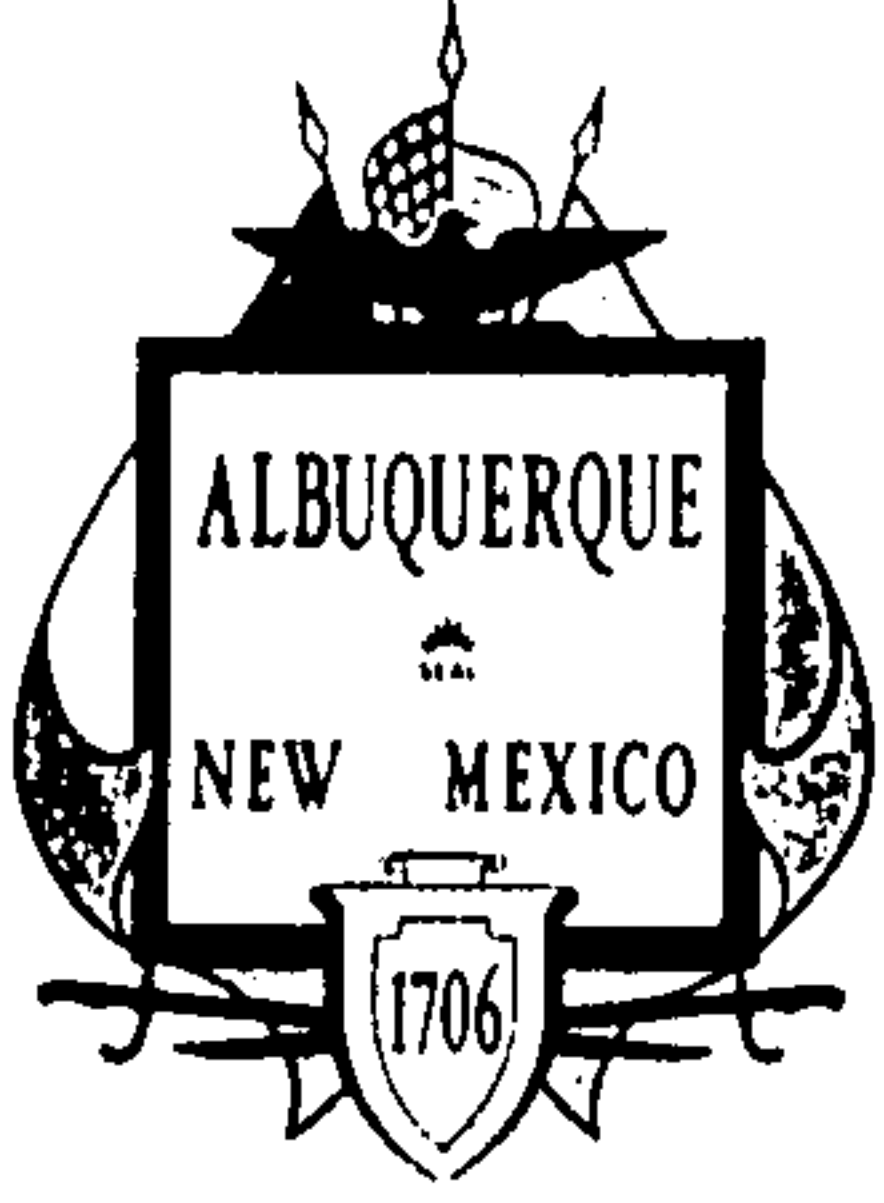
CRITERIA ②

$$V \times A < 6.5$$

$$Q/A = 2.6/1.69 = 1.53 \text{ fps}$$

$$V \times d = 0.4 < 6.5 \quad [OK] \quad d = .26'$$

30-1-100-10



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

December 10, 1997

Craig Hoover, P.E.
Bohannon-Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

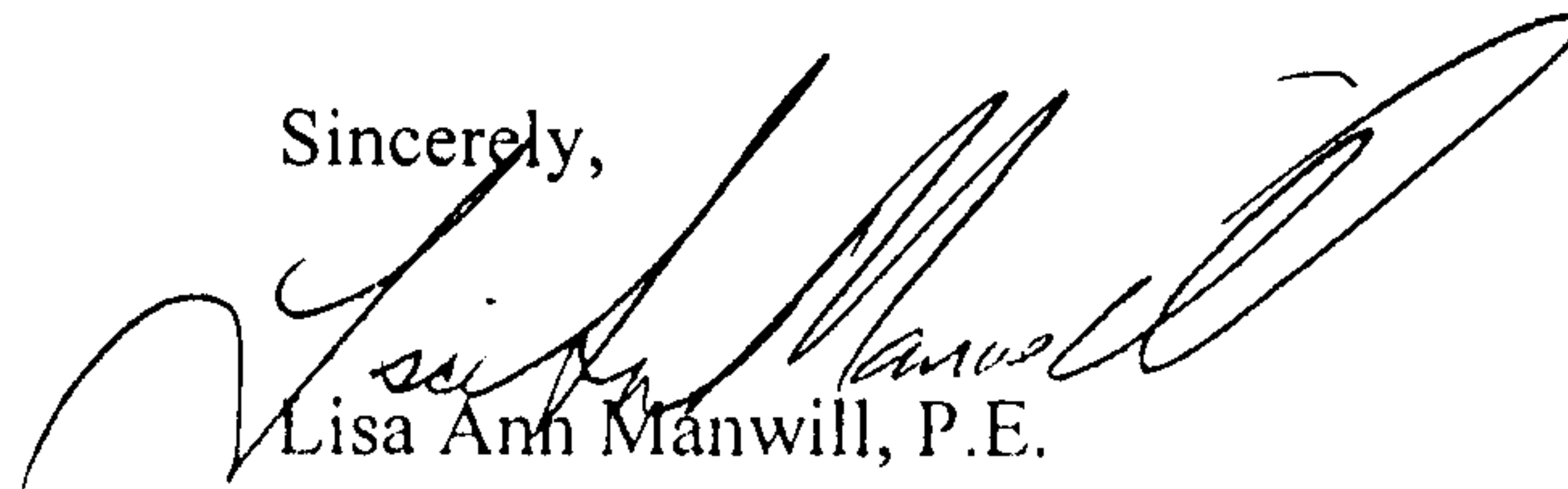
***RE: ALBUQUERQUE ACADEMY POND (E19-D29). ENGINEER'S CERTIFICATION
FOR DRAINAGE REQUIREMENTS. ENGINEER'S CERTIFICATION DATED
NOVEMBER 26, 1997.***

Dear Mr. Hoover:

Based on the information provided on your December 1, 1997 submittal, the above referenced project is acceptable to Hydrology.

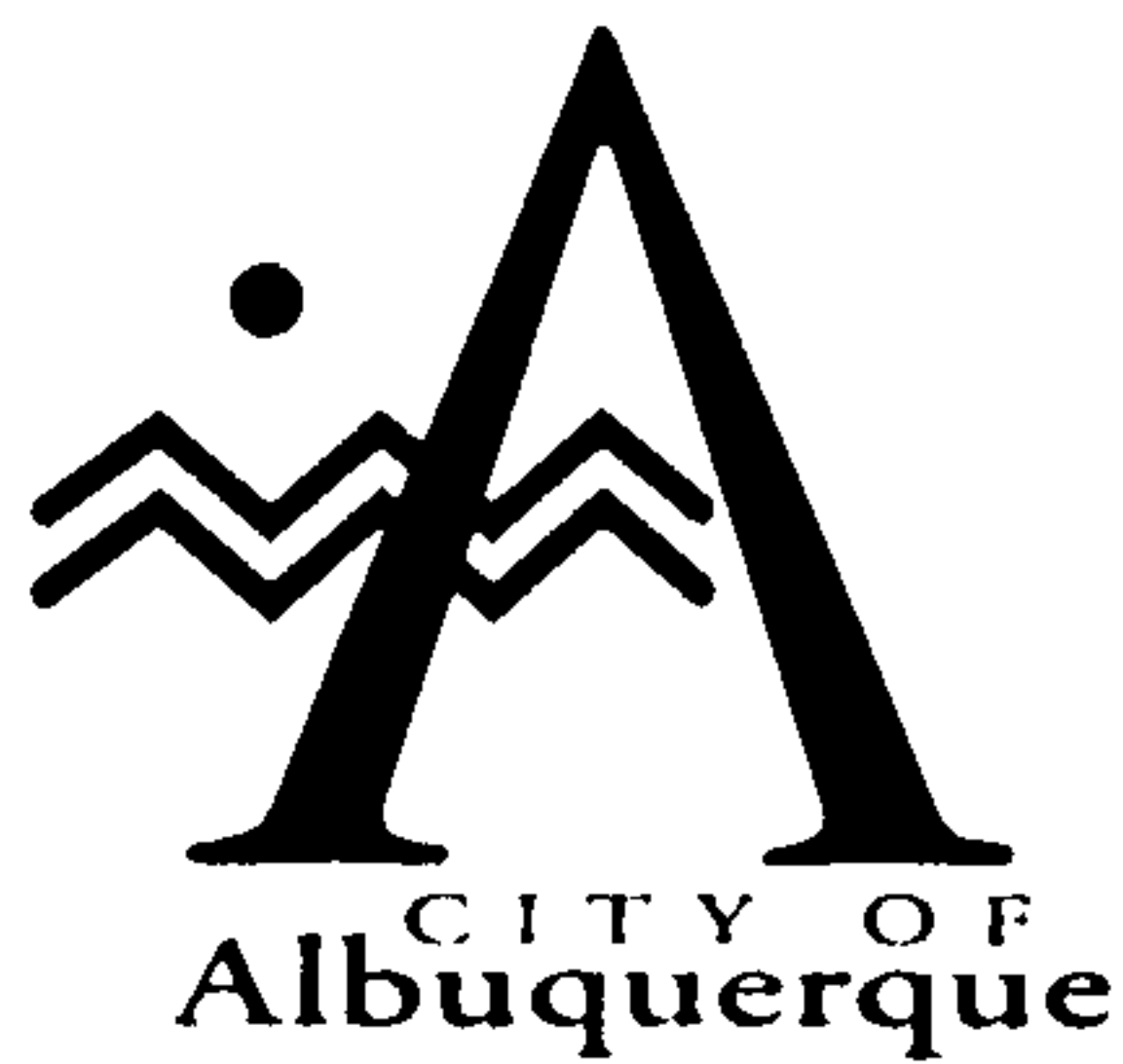
If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,



Lisa Ann Manwill, P.E.
Hydrology

c: Andrew Garcia
File



January 23, 1997

Martin J. Chávez, Mayor

Tamara Morgan, P.E.
Bohannon Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

**RE: ALBUQUERQUE ACADEMY NATATORIUM (E19-D11). DRAINAGE PLAN FOR
BUILDING PERMIT APPROVAL. ENGINEER'S STAMP DATED 9-13-96.**

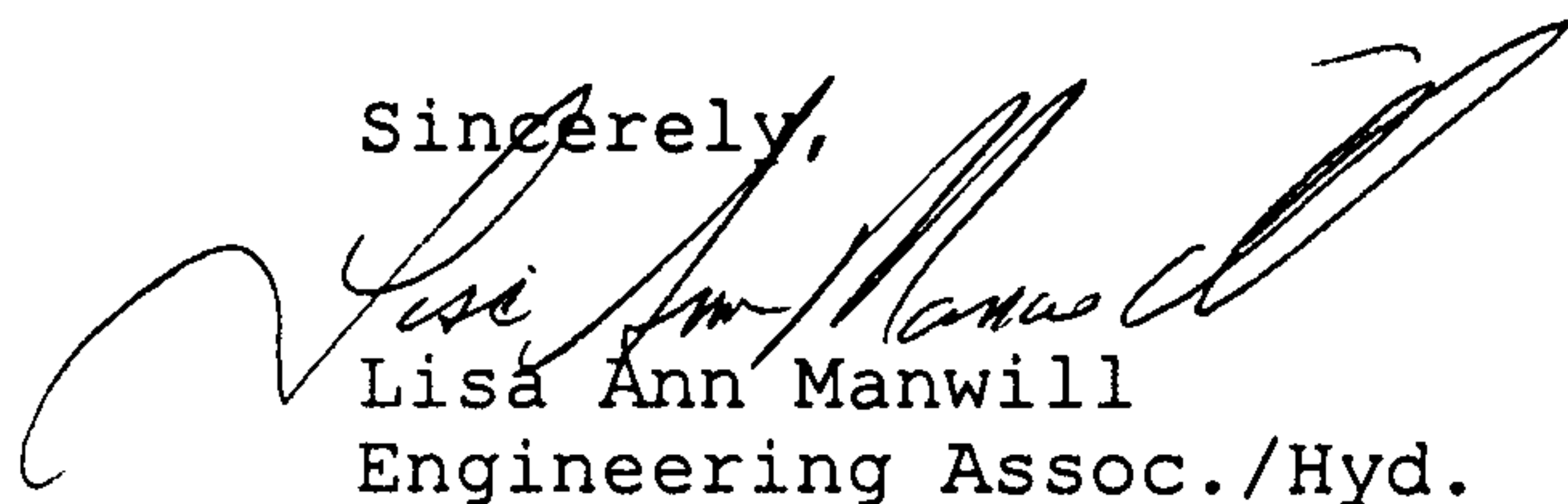
Dear Ms Morgan:

Based on the information provided on your August 2, 1996
submittal, the above referenced project is approved for Building
Permit.

An Engineer's Certification will be required prior to Certificate
of Occupancy.

If I can be of further assistance, please feel free to contact me
at 768-3622.

Sincerely,



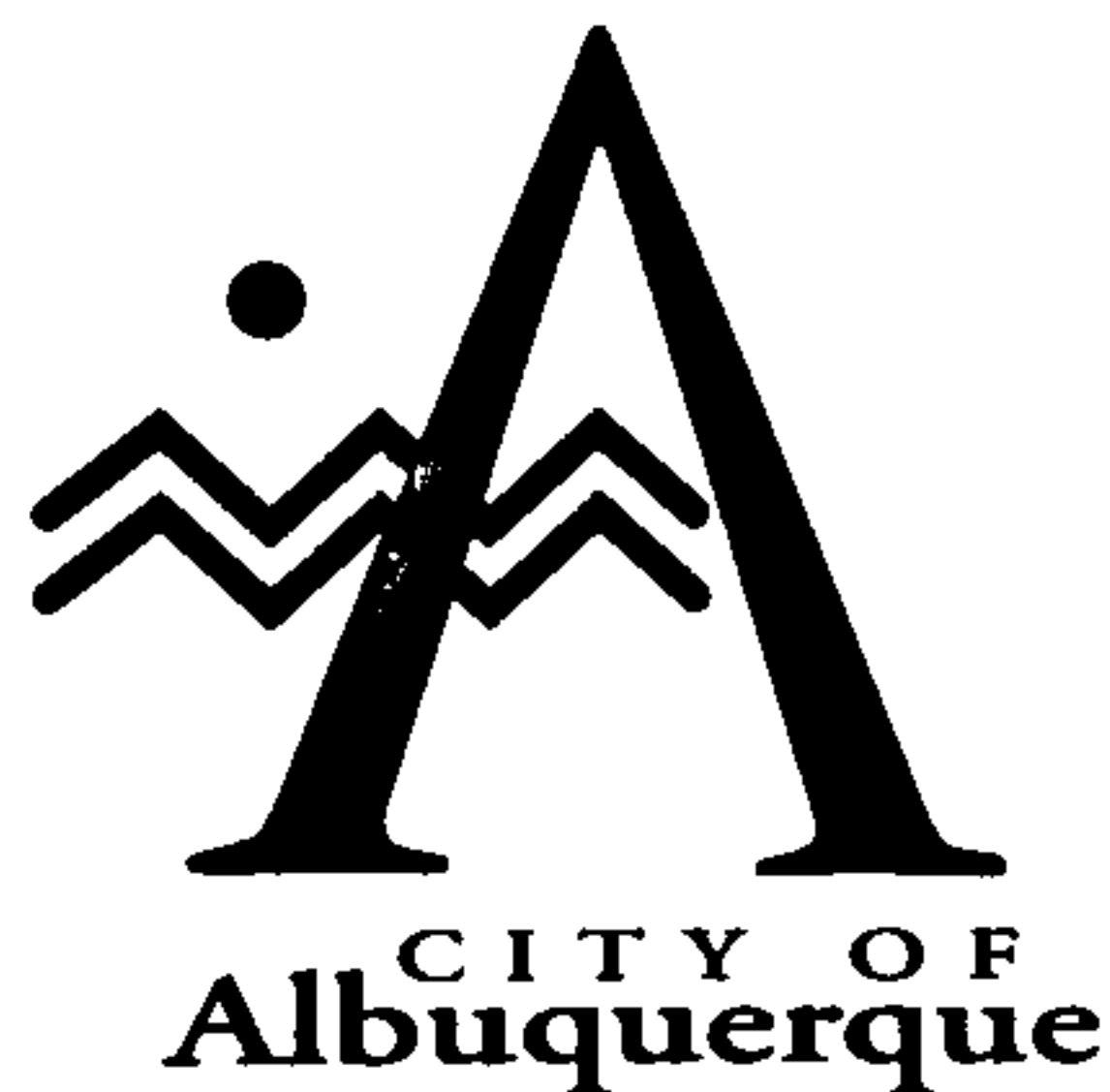
Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Dan Hogan
Andrew Garcia

~~File~~

Good for You, Albuquerque!





September 12, 1996

Martin J. Chávez, Mayor

Eruce Stidworthy
Bohannon Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

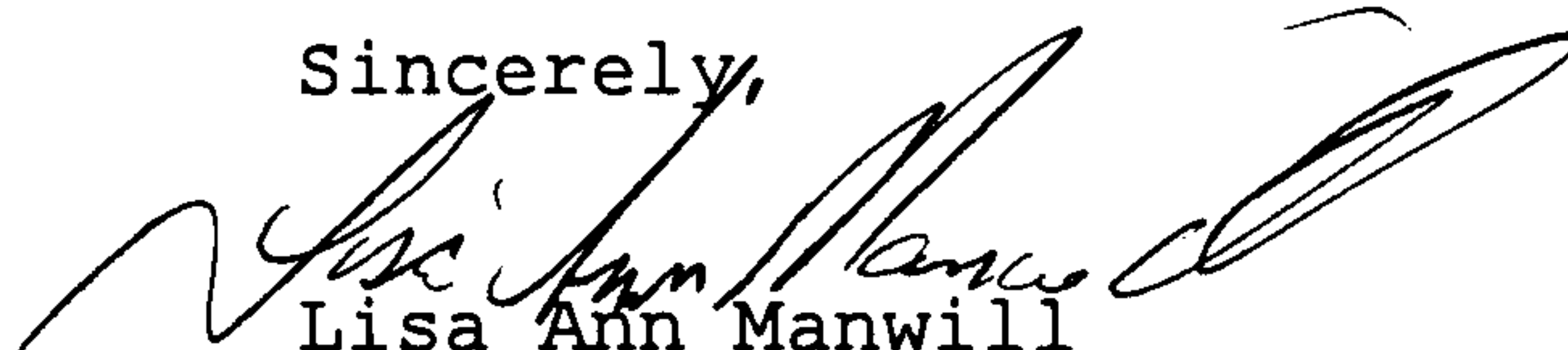
**RE: ALBUQUERQUE ACADEMY MUSIC BUILDING (E19-D29). ENGINEER'S
CERTIFICATION FOR CERTIFICATE OF OCCUPANCY APPROVAL.
ENGINEER'S CERTIFICATION DATED AUGUST 22, 1996.**

Dear Mr. Stidworthy:

Based on the information provided on your August 26, 1996
submittal, the above referenced project is approved for
Certificate of Occupancy.

If I can be of further assistance, please feel free to contact me
at 768-3622.

Sincerely,



Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Andrew Garcia
File

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.

Good for You, Albuquerque!



FILE COPY



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
KEN SCHULTZ

CHIEF
ADMINISTRATIVE OFFICER
GENE ROMO

DEPUTY CAO
DEVELOPMENT & ENTERPRISE SERVICES
LARRY LARRANAGA

DEPUTY CAO
PUBLIC SERVICES
DAN WEAKS

July 5, 1988

Michial M. Emery, P.E.
Bohannon-Huston, Inc.
7500 Jefferson Street, NE
Albuquerque, New Mexico 87109

RE: ALBUQUERQUE ACADEMY SENIOR SCHOOL CAFETERIA ADDITION
DRAINAGE PLAN DATED JUNE 24, 1988 (E-19/D11)

Dear Mr. Emery:

The referenced plan dated June 24, 1988, is approved for building permit with conditions outlined in your letter to me dated June 13, 1988, and my letter to you dated June 22, 1988.

For building permit sign-off by our section, please see that your client attaches copies of the referenced plan to the construction sets.

If you should have any questions regarding our understanding, please call me at 768-2650.

Cordially,

Fred J. Aguirre, P.E.
City Hydrologist

FJA/bsj

DRAINAGE PLAN
FOR THE
ALBUQUERQUE ACADEMY SENIOR SCHOOL
CAFETERIA ADDITION

PREPARED FOR

ALBUQUERQUE ACADEMY
6400 WYOMING BOULEVARD N.E.
ALBUQUERQUE, NM 87109

PREPARED BY

BOHANNAN-HUSTON, INC.
COURTYARD I
7500 JEFFERSON ST., N.E.
ALBUQUERQUE, NM 87109



JOB NO. 87249.01

PURPOSE

The purpose of this plan is to analyze the drainage patterns and flow rates for the site and to show that the area has been developed following the guidelines and restrictions described in the Albuquerque Academy Campus Conceptual Drainage Report of November, 1981

INTRODUCTION

Existing Conditions:

The site is located on the Albuquerque Academy Campus at the northwest corner of Tract A-1. The Pino Arroyo and Academy Campus Loop Road are on the north side of the site, a courtyard and school buildings are to the south, the west is bordered by a grass practice field, and undeveloped Tract A-4 is to the east.

Runoff from the buildings currently flows northward across the existing parking lot. A portion of the runoff ponds on Academy land west of the site and south of the loop road, the remaining runoff from the site discharges into the Pino Arroyo.

Under present conditions, the Pino Arroyo remains unimproved. An earthen berm borders the east side of the existing parking lot to divert flows from the undeveloped Tract A-4 into the Pino Arroyo. South and west of the site, runoff flows south westerly and discharges into Wyoming Boulevard. The Pino Arroyo intercepts flows from the north before they reach the site. Therefore, no off-site flows impact the site.

Proposed Conditions:

The proposed building addition is to the existing dining hall and will be constructed over an existing paved patio area. The extension will consist of two levels with the upper level having a balcony that extends over the patio area and will not increase the anticipated flow rate for the area. The runoff will continue to flow to the north end of the parking lot and leave the site through the existing curb cuts in the parking lot as shown on the enclosed drainage plan sheet.

A new restroom facility is being added to the south end of the building and has been shown on this plan in accordance with City Hydrology's request during building permit approval. The addition is also part of the dining hall but is being constructed under a separate permit.

The site is divided into six (6) drainage subbasins (see enclosed drainage plan) and flow rates for the subbasins computed as follows:

<u>Subbasin</u>	<u>A</u> <u>(Acres)</u>	<u>I</u>	<u>C</u>	<u>Q=CIA</u> <u>(cfs)</u>
#1	0.9374	5.073	0.90	4.3
#2	0.7415	5.073	0.95	3.6
#3	1.0847	5.073	0.81	4.5
#4	1.3333	5.073	0.72	4.9
#5	0.9866	5.073	0.95	4.8
#6	0.1263	5.073	0.95	0.6

Runoff from Subbasins No. 1 and No. 2 will discharge through the curb cut provided at the northwest corner of the parking lot to an informal ponding area on Albuquerque Academy land west of the site. A total of 14.8 cfs from Subbasins No. 3, 4, 5 and 6 will discharge freely into the Pino Arroyo. A small amount of erosion occurs downstream of the parking lot curb cuts but is maintained as required by the Albuquerque Academy. Runoff from the site is insignificant compared to the existing developed flows being experienced by the Pino Arroyo and will not contribute to erosion problems in the arroyo itself.

CONCLUSION

Since the proposed cafeteria addition does not affect existing drainage conditions, the site still conforms with the Albuquerque Academy Campus Conceptual Drainage Report of November, 1981. No improvements to the existing drainage facilities are felt to be needed at this time.

FILE COPY



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

KEN SCHULTZ
MAYOR

CLARENCE V. LITHGOW
CHIEF
ADMINISTRATIVE OFFICER

DAN WEAKS
DEPUTY CAO
PUBLIC SERVICES

FRED E. MONDRAGON
DEPUTY CAO
DEVELOPMENT & ENTERPRISE SERVICES

RAY R. BACA
DEPUTY CAO
PUBLIC SAFETY

June 9, 1989

Rick Beltramo, P.E.
Bohannon-Huston, Inc.
7500 Jefferson Street, NE
Albuquerque, New Mexico 87109

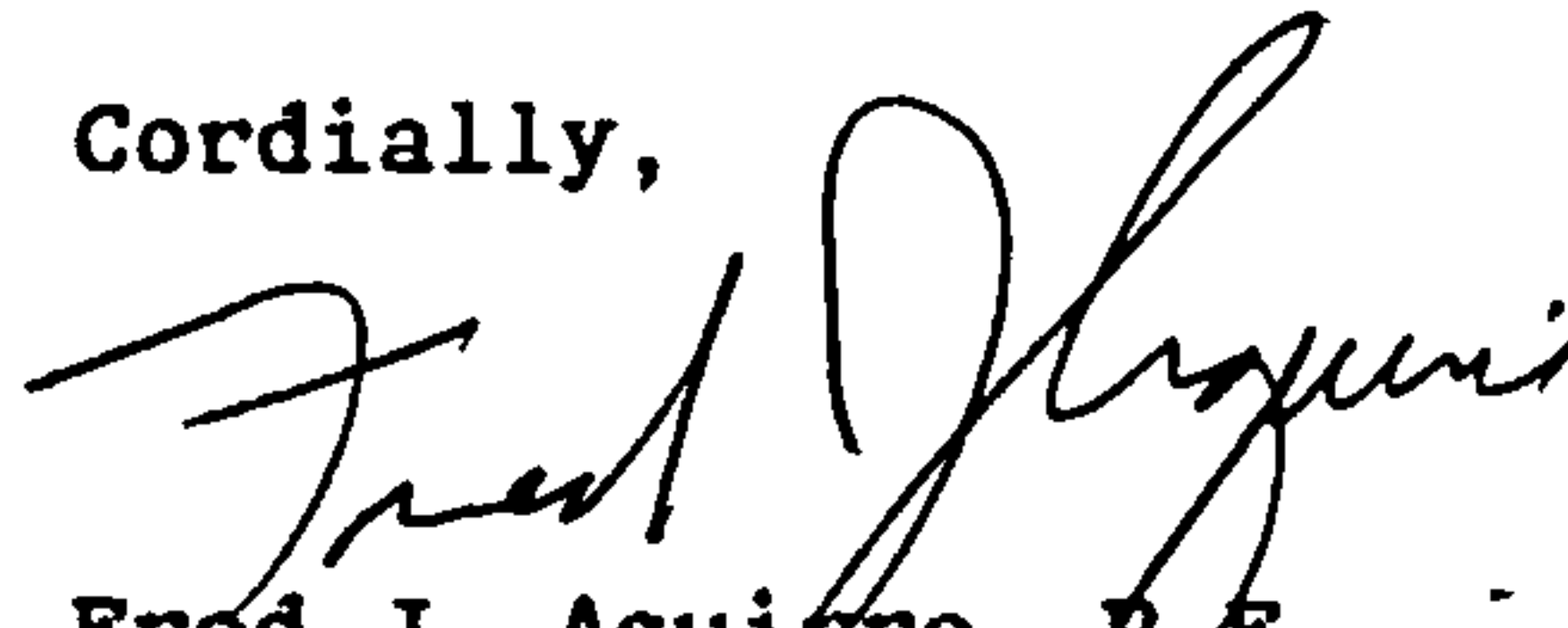
RE: ROUGH GRADING PERMIT FOR ALBUQUERQUE ACADEMY PLAYING FIELDS
RECEIVED MAY 3, 1989 - ENGINEERS STAMP DATED APRIL 28, 1989

Dear Mr. Beltramo:

For the record, the referenced plan is approved.

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

Cordially,



Fred J. Aguiar, P.E.
Hydrologist

xc: Larry Caudill, Env. Health

FJA/bsj
(WP+770)

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

NOV 15 1989

HYDROLOGY SECTION

KEN SCHULTZ
MAYOR

CLARENCE V. LITHGOW
CHIEF
ADMINISTRATIVE OFFICER

DAN WEAKS
DEPUTY CAO
PUBLIC SERVICES

FRED E. MONDRAGON
DEPUTY CAO
DEVELOPMENT & ENTERPRISE SERVICES

RAY R. BACA
DEPUTY CAO
PUBLIC SAFETY

November 13, 1989

CERTIFICATE OF COMPLETION AND ACCEPTANCE

Mr. James S. Kirkpatrick
Albuquerque Academy, Inc.
6400 Wyoming Blvd. N.E.
Albuquerque, NM 87109

RE: PROJECT NO. 3921, ALBUQUERQUE ACADEMY CAMPUS FIRELINE EXTENSION, (MAP NO. E-19 & 20)

Dear Mr. Kirkpatrick:

This is to certify that the City of Albuquerque accepts Project No. 3921 as being completed according to approved plans and construction specifications. If all required right-of-ways and/or easements have been dedicated, the City of Albuquerque will accept for continuous maintenance all public infrastructure improvements constructed as part of Project No. 3921. If the required right-of-ways and/or easements have not been dedicated, the City of Albuquerque cannot accept the project for continuous maintenance and said maintenance will be the responsibility of the developer. When a final plat has been filed it will be the developer's responsibility to provide the Construction Management Division with a copy, at which time the City will fully accept Project No. 3921.

The project is described as follows:

- Installed 530 LF of 8" PVC water line. Also installed one (1) 6" gate valve and removed and replaced one (1) fire hydrant as part of the Albuquerque Academy Campus fireline extension located at the northeast corner of Wyoming and Academy Blvd. N.E.
- The contractor's warranty begins the date of this letter and will be effective for a period of one (1) year.

Sincerely,

Brian L. Speicher, P.E.
Chief Construction Engineer
Design/Construction Division
Engineering Group
Public Works Department

BLS:kt

AN EQUAL OPPORTUNITY EMPLOYER

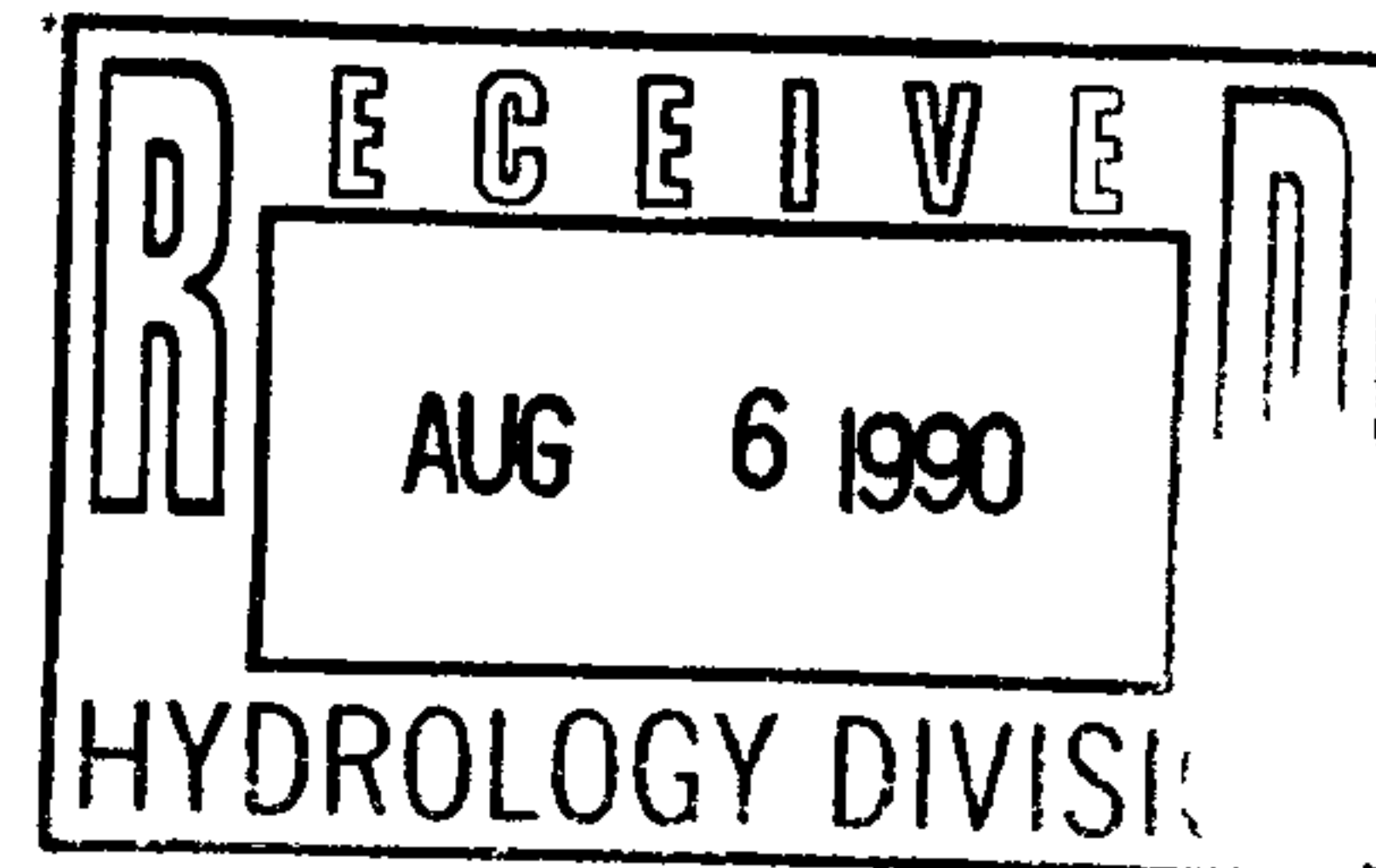
E19/D11



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

August 1, 1990



CERTIFICATE OF COMPLETION AND ACCEPTANCE

Mr. Steve Davis
Albuquerque Academy Campus
6400 Wyoming Blvd. N.E.
Albuquerque, NM 87109

RE: PROJECT NO. 3926, ALBUQUERQUE ACADEMY CAMPUS, (MAP NO. E-19, 20)

Dear Mr. Davis:

This is to certify that the City of Albuquerque accepts Project No. 3926 as being completed according to approved plans and construction specifications. The City of Albuquerque will accept for continuous maintenance all public infrastructure improvements constructed as part of Project No. 3926.

The project is described as follows:

- 10" water main tie-in at Harper Rd. and Campus Access Rd. traversing southerly for approximately 860 LF thence westerly approximately 65 LF thence along a 255' radius curve-right approximately 250 LF thence south approximately 1000 LF to tie into an existing 8" main.
- The 10" main had two (2) tie-ins to existing mains; 4 fire hydrant legs installed with one (1) fire hydrant. Four (4) services were installed for 3" meters along with five (5) 10" gate valves, four (4) 8" gate valves and three (3) 6" gate valves.

The contractor's correction period begins the date of this letter and will be effective for a period of one (1) year.

Sincerely,

Brian L. Speicher, P.E.
Chief Construction Engineer
Design/Construction Division
Engineering Group
Public Works Department

BLS:kt



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

June 29, 1993

Patrick McClernon, AIA
Patrick McClernon, ARCHITECTS
1401 Fifth Street NW
Albuquerque, N.M. 87102

RE: SITE PLAN FOR FINE ARTS ADD'N @ ALBUQ ACADEMY (E-19/D11)
RECEIVED JUNE 28, 1993 FOR BUILDING PERMIT APPROVAL
ARCHITECT'S STAMP DATED 6/25/93

Dear Mr. McClernon:

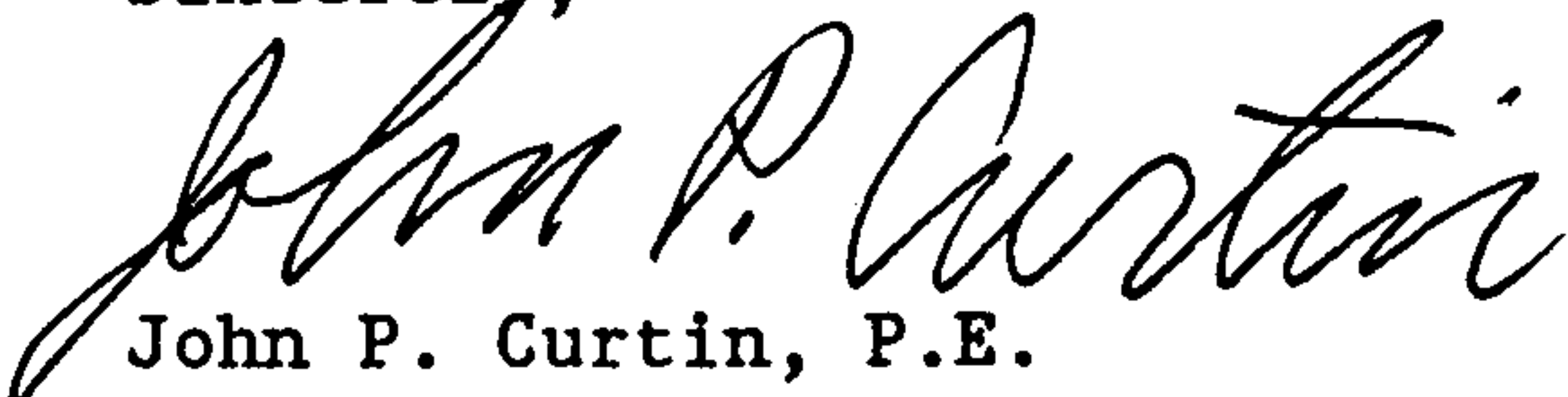
Based on the information included in the submittal referenced above, City Hydrology APPROVES this project for Building Permit.

Include a copy of the Site Plan in the set of construction documents submitted to One Stop for your Building Permit.

Engineer's Certification of Grading & Drainage will NOT be required for release of Certificate of Occupancy.

If I can be of further assistance, You may contact me at 768-2727.

Sincerely,


John P. Curtin, P.E.
Civil Engineer/Hydrology

xc: Alan Martinez

WPHYD+7815;jpc

PUBLIC WORKS DEPARTMENT

/95060707

5998

EASEMENT TO AMAFCA
AND EASEMENT TO OWNERS ASSOCIATION
IN TRACTS 15B AND 15C AT HIGH DESERT,
PROPOSED UNITS 2 AND 3 HIGHLANDS SUBDIVISION
(A Portion of Highlands Dendritic Arroyos)

ALBUQUERQUE ACADEMY, a New Mexico nonprofit corporation ("Grantor"), the ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY, a political subdivision of the State of New Mexico ("AMAFCA"), the HIGH DESERT RESIDENTIAL OWNERS ASSOCIATION, INC., a New Mexico nonprofit corporation (the "Owners Association"), and HIGH DESERT INVESTMENT CORPORATION, a New Mexico corporation ("High Desert"), agree:

1. Recitals

A. Grantor is the sole owner in fee simple of certain real property in Bernalillo County, New Mexico, more fully described in the attached Exhibits A through G (the "Property"). The Property is located within Tracts 15B and 15C at High Desert, to be the proposed Units 2 and 3 of the Highlands Subdivision.

B. By bulk land plat recorded February 9, 1995 in Map Book 95C, Folio 46, records of Bernalillo County, New Mexico, Grantor indicated that there would be future drainage easements dedicated to AMAFCA and Owners Association over the

6999

Property for surface storm water drainage. This easement constitutes such future drainage easements.

C. The Owners Association was established for the administration of certain obligations pertaining to homes to be located adjacent to and in the vicinity of the Property.

D. The Property possesses arroyos which are paths for storm water drainage, but also possesses open space values that are of great importance.

E. Grantor desires that to the extent possible, without restricting the rights of AMAFCA granted pursuant to this easement, the Property be preserved for drainage and open space and that the primary function of the arroyos, which is for drainage, be consistent, in as much as possible, with the natural open space nature of the Property.

2. Definitions. The following terms have the following meanings:

A. Level One Maintenance means:

- i. removal from the Property of garbage and debris including but not limited to paper, cans and bottles;
- ii. pruning of vegetation, removal of dead and dying plant material and thinning of vegetation to prevent choking or congestion of the arroyos situated on the Property;

iii. enhancement of vegetation through the addition of specimens native to the vicinity of the Property, provided however, that, the addition of such native specimens will not be in such a manner which reduces or restricts arroyo flows, or redirects arroyo flows to cause damage. In general, most specimens, especially woody varieties, will only be allowed along arroyo banks, or in vegetated "islands" in the middle of the arroyo which will not impair arroyo flows or induce bank erosion;

iv. the installation and maintenance of water harvesting devices in any situation or at any time the Owners Association determines necessary or desirable, subject to prior approval of AMAFCA, such approval not to be unreasonably withheld;

v. removal and control of pests and rodents; and

vi. other measures intended primarily to preserve or enhance the aesthetic values of the Property, without restricting arroyo flows.

B. Level Two Maintenance means:

STATE OF NEW MEXICO
COUNTY OF BERNALILLO
FILED FOR RECORD

1995 JUN 20 PM 2:01

95-14-1098-
JUDY D. WOODWARD
J. J. Jarama

7001

i. repair of minor erosion of arroyo banks
(generally three feet high or less) by hand or machine grading,
in order to:

a. fill in steep banks which are
enticements for digging by children or others;

b. correct hazardous bank conditions
which could lead to unexpected falls and injury; and

c. arrest the potential for a
significant change of course by the arroyo;

ii. cleaning of culverts and culvert
entrances;

iii. construction of minor erosion control
measures, using primarily native materials, along arroyo banks,
at drainage outfalls to the arroyo, at water harvesting
structures, below culverts and road crossings, at utility
crossings of arroyos, and at any other place where continued
neglect could or would lead to Level Three Maintenance or higher;

iv. reseeding of disturbed areas, using
native seed mix and/or native plants/bushes. Provided however,
that, plantings will not be made which obstruct arroyo flows or
direct arroyo flows in a manner or direction which can cause
harmful erosion or damage; and

v. other measures intended to preserve the capacity and flow path of the Property's arroyos, and to correct safety hazards.

C. Level Three Maintenance means:

i. repair of major erosion of arroyo banks (over three feet high) by machine grading or filling, including the hauling in and placing of fill against the banks and including the temporary (180 days or less) storage of sediment within the limits of the Prudent Lines (defined below) or in other areas as may be approved by the Owners Association;

ii. stabilization of arroyo horizontal or vertical migration by installation of permanent grade control structures or permanent bank stabilization structures (Permanent Improvements) (defined below), in particular in situations in which the Prudent Line (defined below) is threatened,

iii. installation of permanent scour protection below culverts, dip crossings, or other points where flow has been concentrated;

iv. emergency protection of utility crossings of arroyos as AMAFCA deems necessary pending installation of permanent erosion protection by the responsible utility or entity;

v. other measures intended to preserve and protect the 100 Year Design Storm Capacity (defined below) of the arroyos and/or any of its improvements.

D. Level Four Maintenance means:

i. measures taken to protect public safety and prevent property damage, generally immediately after a significant flood event, when such measures clearly dominate over such considerations as aesthetics and preservation of flora and fauna. This includes the temporary storage of sediment within the limits of the Prudent Lines, and if necessary, in such areas outside the Prudent Lines as would be mutually agreeable to AMAFCA and the Owners Association;

ii. restoration or preservation of the Prudent Line, both by short term or permanent measures using Permanent Improvements;

iii. restoration or repair of any Permanent Improvements; and

iv. any measures deemed by AMAFCA to be urgent or an emergency, intended to restore the 100 Year Design Storm (defined below) capacity of the arroyo and which, if not performed, are likely to lead to threats to life or property.

E. The physical limits of the Drainage Easement have been set at the Prudent Line for each of the arroyos covered by this Drainage Easement. The Prudent Line (or Erosion Limit Line) is that line which will not be disturbed by erosion, scour, or meandering of a natural (unlined) arroyo, channel or watercourse over a period of thirty (30) years and which will not be disturbed by a 100 Year Design Storm (defined below) occurring at any time during the 30-year period. The Prudent Line was located as to include all free board required to contain the wave action of the 100 Year Design Storm. It is understood that AMAFCA's maintenance responsibilities extend to the limits of the Prudent Lines and not beyond.

F. Permanent Improvement is defined as a flood control facility which has been analyzed and designed by a competent engineer using acceptable engineering standards and the 100 Year Design Storm criteria, and which is constructed of materials expected to have a design life of 50 years or more before replacement or major rehabilitation is required. Within this Drainage Easement, any Permanent Improvement will, to the extent possible, be constructed of soil cement, concrete, rip rap, or other materials of equivalent durability, stability, and longevity. Rip rap will be covered with an earth layer

sufficient to sustain plant growth and discourage rodents. Other materials will be covered, to the extent possible, with a similar earth layer. Structural concrete, if exposed, will be treated to make its color similar to the surrounding earth, either by concrete additives, or by appropriate surface treatment. Texturing of the structural concrete will also be considered. The construction of reinforced concrete channels will be permitted only when other permanent measures have been tried and have failed, or are deemed unacceptable to AMAFCA for reasons of high maintenance or poor performance.

G. It is understood that AMAFCA's obligations to perform Level Three and Level Four Maintenance and/or to construct Permanent Improvements are subject to availability of funds, and in the case of capital improvements, a favorable vote on a public bond issue, sale of bonds, and approval of expenditures by the AMAFCA Board of Directors.

3. Grant of Drainage Easement; Purpose; Reserved Rights. Grantor grants to AMAFCA and to its successors and assigns, a drainage easement over the Property for the primary purpose of surface storm drainage and gives AMAFCA the right to construct, operate, maintain, reconstruct, temporarily store sediment and perform other functions necessary for drainage and

flood control as specified herein (the "Drainage Easement").

Grantor reserves to itself, and to its personal representatives, heirs, successors and assigns, all rights accruing from the ownership of the Property, including the right to engage in or permit or invite others to engage in all uses of and activities at the Property that are not expressly prohibited by or inconsistent with the purpose of the Drainage Easement, as such purposes are defined herein. Without limiting the foregoing, the Grantor will have and expressly reserves the following rights and easements to be exercised at the discretion of the Grantor, except as otherwise provided:

A. The right to grant subservient easements over portions of the Property to the appropriate parties as necessary for underground utilities including but not limited to water, sewer, gas, electricity and cable t.v., subject to prior approval from AMAFCA, such approval not to be unreasonably withheld, and issuance of an encroachment license by AMAFCA;

B. The right to use and maintain, and grant subservient easements to use and maintain, the Property consistent with the purpose of the Drainage Easement and permitted uses within the scope of the Drainage Easement, subject to prior approval from AMAFCA, such approval not to be

unreasonably withheld, and issuance of an encroachment license by AMAFCA;

C. The right to establish hiking, biking and equestrian trails, the right to maintain such trails, and the right to grant trail and other path easements, all subject to prior approval from AMAFCA, such approval not to be unreasonably withheld, and issuance of an encroachment license by AMAFCA;

D. The right to dedicate to the City of Albuquerque portions of the Property as rights-of-way for public streets, subject to prior approval from AMAFCA, such approval not to be unreasonably withheld;

E. The right to install and maintain water harvesting devices; and

F. The right to plat lots over this Drainage Easement.

4. Term of Drainage Easement. The Drainage Easement will remain in effect so long as AMAFCA continues to use the Drainage Easement for the designated purpose. Whenever AMAFCA abandons, vacates or ceases to use the Drainage Easement, then ownership of the Drainage Easement will revert to and revest in Grantor, and its successors and assigns, without any action on the part of Grantor, as fully and completely as if the grant of

the Drainage Easement had never been executed by Grantor and the Drainage Easement will then become void. Abandonment action will occur by the AMAFCA Board of Directors, conveying the Drainage Easement to Grantor by quitclaim deed.

5. Maintenance Obligations of AMAFCA. Level Three and Level Four Maintenance for the Drainage Easement will be the responsibility of AMAFCA. AMAFCA will bear all costs, responsibilities and liabilities related to such maintenance, except as otherwise stated herein. These obligations to maintain will remain in full force and effect as long as this Drainage Easement exists and may only be assigned to and assumed by a person or entity capable of performing such obligations. Such assignment will not be made without prior approval of the Owners Association, such approval not to be unreasonably withheld. Grantor will have no responsibility whatsoever relating to such maintenance of the Drainage Easement.

6. Easement; Maintenance Obligations of the Owners Association. Grantor grants to the Owners Association an easement for, and the Owners Association will be responsible for, Level One and Level Two Maintenance for the Drainage Easement. The Owners Association will bear all costs, responsibilities and liabilities related to such maintenance. Should the Owners

Association desire to undertake measures outlined under Level Three or Level Four Maintenance, it may do so at its own expense, subject to prior written approval from AMAFCA of both the engineering aspects and the financial ability to finance such measures, such approval not to be unreasonably withheld. During the Class "B" Control Period (as defined in the Declaration of Covenants, Conditions, and Restrictions for High Desert Residential Properties recorded December 22, 1993 in the records of Bernalillo County, New Mexico in Book MS 93-36, pages 1-87), as amended, High Desert will either (i) perform all of the maintenance obligations of the Owners Association under this Drainage Easement or (ii) ensure that the Owners Association has the financial ability to perform all of its maintenance obligations under this Drainage Easement. Grantor will have no responsibility whatsoever relating to maintenance of the Drainage Easement.

7. Default in Maintenance Obligations.

A. Non-Emergency Situation Defaults. If AMAFCA or the Owners Association believes the other has defaulted in its obligations to maintain the Drainage Easement, except in flood emergency situations as set forth in Section 7(B), the "non-defaulting party" will give the "defaulting party" written

notice of such default. Within 10 working days of such notice the "defaulting party" will respond, in writing, setting forth its intended action to cure the default. If the intended action is not satisfactory to the "non-defaulting party", it will appeal to the AMAFCA Board of Directors. If the nature of the default is of a technical nature, either party may, as an intermediate step before appeal to the AMAFCA Board, appeal to the Technical Standards Committee of AMAFCA (the "Technical Standards Committee"). If the decision of the Technical Standards Committee is not satisfactory to either party, either party may appeal to the AMAFCA Board of Directors. If the decision of the AMAFCA Board of Directors is not satisfactory to either party, either party may proceed to arbitration under the provisions of the New Mexico Uniform Arbitration Act, provided that matters within the discretionary authority of the AMAFCA Board of Directors, including, but not limited to the prioritization of repairs or improvements, are not arbitrable, unless the Board's decision is arbitrary or capricious. If a claim of default in maintenance obligations is arbitrated, the prevailing party will be entitled to reasonable attorney fees and costs.

B. Emergency Situation Defaults. During or immediately following a flood emergency, if AMAFCA or the Owners

Association believes the other is in default of its maintenance obligations, the "non-defaulting party" has the option of seeking immediate judicial relief in the form of an injunction, or it can unilaterally, without notice, take whatever reasonable steps it believes are necessary to mitigate damage from the emergency situation. Following such mitigation efforts, the party taking such steps may seek reimbursement of its reasonable expenses from the "defaulting party" through arbitration under the procedures of the New Mexico Uniform Arbitration Act. If such a claim for reimbursement is arbitrated, the prevailing party will be entitled to reasonable attorney fees and costs.

C. Liens. If AMAFCA is awarded monetary compensation (including attorney fees and costs) against the Owners Association through arbitration, AMAFCA may take whatever steps are necessary to enforce and collect such monetary award, including the placing of a lien against the assets of the Owners Association. The Owners Association agrees to enforce the provisions of all documents governing the Owners Association and its members regarding members' financial obligations or assessments to the Owners Association (the "Assessment Rights"), so that sufficient funds and other assets are available to satisfy any arbitration or judicial award. The Owners

Association hereby assigns to AMAFCA and grants AMAFCA a security interest in the Assessment Rights. Such assignment will become absolute, and AMAFCA may exercise such Assessment Rights, in the event that the Owners Association (i) has ceased to exist or function or (ii) has filed a voluntary or involuntary petition under any chapter of the Federal Bankruptcy Code.

8. Operation, Maintenance and Inspection:
Procedures and Records.

A. An operation, maintenance and inspection file (the "File") will be created and maintained by AMAFCA, but will be available for review by the Owners Association at any time. The Owners Association will cooperate with AMAFCA in the creation and maintenance of the File. The File will be the result of the joint efforts of AMAFCA and the Owners Association. The File will include, at a minimum, the following:

- i. copy of this Drainage Easement and any modification;
- ii. copy of any easement documents;
- iii. photographs of the Property's arroyos in their condition contemporaneous with the date of this Drainage Easement, such photographs to be taken by AMAFCA. These photographs will comprise a visual baseline for evaluating

appropriateness of planned maintenance measures, and for ensuring the flood-carrying capacity of the arroyos are not diminished;

iv. operation, maintenance and inspection records, as outlined below;

v. correspondence; and

vi. other records deemed appropriate or necessary.

B. Operation records of the Property's arroyos will be kept as follows:

i. operation records of flood events, that may have any degree of formality, and that may include such records as telephonic reports of rainfall, floods and visual observations, photographs, video recordings, measurements of depth and width of flows, and engineering estimates of flow will be maintained.

ii. Owners Association will notify AMAFCA during or after significant storm events that create a need for Level Two Maintenance or higher, and will provide as much information as possible for purposes of maintaining operating records.

iii. Any engineering analyses regarding flow events will be the responsibility of AMAFCA.

C. Maintenance records of the Property's arroyos will be maintained as follows:

i. Reports of maintenance performed, with an associated estimate of costs, will be maintained, including a breakdown of each level of maintenance (Levels One through Four) performed and an estimate of the cost of each level of maintenance performed.

ii. Both AMAFCA and the Owners Association will provide reports to the AMAFCA file, immediately after maintenance is performed.

iii. Reports will include information on what maintenance was performed, location of maintenance activities, and estimated costs. Photographs and sketches may be added, as appropriate.

D. Inspection records of the Property's arroyos will be maintained as follows:

i. The Owners Association will cause the arroyos to be inspected at least once annually, during the period October 1 to March 31, and after each significant storm event which creates a need for Level Two Maintenance or higher. The primary purposes of the inspection are to identify problems needing correction and to serve as a work order for maintenance.

ii. Inspections will be performed by a person or team with sufficient knowledge and experience to determine when and what maintenance is required, which team will include a registered professional engineer competent in hydrology and hydraulics selected by the Owners Association. AMAFCA will, to the extent possible, participate in the inspection, at mutually agreed upon times.

iii. Reports of each inspection will be made on a form developed by AMAFCA, in consultation with the Owners Association.

iv. Inspection personnel, including AMAFCA personnel, will be permitted to walk across (on foot only) the private property adjacent to the Property in order to gain access to the Property for inspections. Provided, however, that such crossing will be done in a manner to limit and minimize any damage to the private property and will not be excessive.

9. Liability and Responsibility; Insurance;
Contingency Reserve.

A. Each party will be responsible and liable for its actions, according to New Mexico state law.

B. Owners Association will carry general liability insurance in the amount of not less than \$500,000,

naming AMAFCA as additional named insured and with a copy of the policy provided to AMAFCA annually, or upon each renewal.

C. Owners Association will, within ten years of the date of this Drainage Easement, establish a contingency reserve (the "Reserve"), dedicated solely to extraordinary drainage maintenance and repair.

i. The Reserve will be funded to an amount equal to the costs incurred for Levels One and Two Maintenance, for the five years during the first ten years after the date of this Drainage Easement in which such costs were the highest, or \$50,000, whichever is greater. The Reserve will be the single reserve that will apply to this Drainage Easement and the other dendritic arroyos drainage easements located or to be located in the High Desert development including those dendritic arroyos drainage easements set forth in to the Modification to Easement to AMAFCA and Easement to Owners Association in Proposed Unit 1, Highlands Subdivision (A Portion of Highlands Dendritic Arroyos) recorded March 8, 1995, in book 95-6, pages 2335-2370, as document number 95023421, records of Bernalillo County, New Mexico.

ii. The Reserve will be maintained in a financial institution selected by the Owners Association.

iii. The Reserve will be used by the Owners Association solely for (i) Level One or Level Two Maintenance types of activities, following Level Three or Level Four Maintenance activities by AMAFCA, (ii) extraordinary amounts of Level One or Level Two Maintenance activities at any time when mutually agreed upon by AMAFCA and the Owners Association, or (iii) Level Three or Level Four Maintenance activities performed by the Owners Association when mutually agreed upon by AMAFCA and the Owners Association. The Reserve may not be used for other purposes without the prior written approval of AMAFCA. If the Reserve is depleted, it will be restored within an amount of time proportional to the amount of depletion up to a five year period (e.g., 20% depletion replaced in one year; 100% depletion replaced in five years).

iv. The amount of the reserve may be modified after the tenth year by mutual agreement, based upon accumulated experience.

10. Other Easements. AMAFCA accepts the Drainage Easement subject to other easements of record to which the Property is subject.

11. Recordation. Grantor will timely record this Drainage Easement in the real estate records of Bernalillo

County, New Mexico and any other place of recordation AMAFCA or the Owners Association deems is necessary to preserve its rights.

12. Notice. Any notice required under this Drainage Easement will be sent by first class mail, postage prepaid:

If to Grantor: Albuquerque Academy
6400 Wyoming Boulevard, N.E.
Albuquerque, New Mexico 87109

If to AMAFCA: Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect Avenue, N.E.
Albuquerque, New Mexico 87107

If to Owners
Association: High Desert Residential Owners
Association, Inc.
1607 Calle del Ranchero, N.E.
Albuquerque, New Mexico 87106

If to High Desert: High Desert Investment Corporation
13000 Academy Boulevard, N.E.
Albuquerque, New Mexico 87111

13. Binding Effect. This Drainage Easement will inure to the benefit of and bind the heirs, devisees, personal representative, mortgagees, lessees, tenants, successors and assigns of Grantor, AMAFCA, the Owners Association and High Desert and will continue as a servitude running in perpetuity with the Property.

14. Governing Law. This Drainage Easement will be governed by and interpreted in accordance with the laws of the State of New Mexico.

15. Amendment. This Drainage Easement may be amended or modified by the mutual agreement in writing of Grantor, AMAFCA, the Owners Association and High Desert or their successors or assigns. Such writing will be filed for public record with reference to this Drainage Easement and previous amendments thereto, if any.

16. Liberal Construction and Interpretation. This Drainage Easement will be liberally construed. If any provision of this Drainage Easement is found to be ambiguous, an interpretation consistent with the purpose of this Drainage Easement that would render the provision valid will be favored over an interpretation that would render it invalid. If any provision of this Drainage Easement is determined by a court of competent jurisdiction to be void, invalid, illegal or unenforceable, that portion will be severed from this Drainage Easement and the remaining parts will remain in full force as though the invalid, illegal, or unenforceable portion had never been a part of this Drainage Easement.

17. Integration. This Drainage Easement contains or expressly incorporates by reference the entire agreement of the parties with respect to the matters contemplated by this Drainage Easement and supersedes all prior negotiations.

18. No Forfeiture. Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

19. No Rights Granted or Conferred. This Drainage Easement is not intended to and does not grant or confer rights to any utilities or the general public for unauthorized use except those rights specifically granted and conferred herein.

20. Flood Control Standards; Future Easements. It is understood and the parties agree that:

A. the community standard in Albuquerque, New Mexico for flood protection is the 100 Year Design Storm as defined in the City of Albuquerque and Bernalillo County Drainage Ordinances as of the date of this Easement and that damage resulting from a storm exceeding the 100 Year Design Storm will not be attributed to any party to this Drainage Easement, nor will any such party be liable for such damage;

B. this Drainage Easement granted is based on the Prudent Line which is defined by reference to the erosion

caused by a single 100 Year Design Storm and 30 years of average annual flow. All parties will work to preserve and protect the ability of the easement area to convey the 100 Year Design Storm; and

C. Permanent Improvements will be designed and built to withstand the 100 Year Design Storm, unless otherwise approved by AMAFCA.

21. Resolution of Disputes and Appeals.

A. Matters of a technical nature may be appealed by any party to the Technical Standards Committee, under provisions of AMAFCA Resolution 1980-15.

B. Except as otherwise provided herein, non-technical decisions made by the AMAFCA staff may be appealed to the AMAFCA Board of Directors. If satisfactory resolution is not achieved, any party will refer the matter to arbitration under the provisions of the New Mexico Uniform Arbitration Act, except as otherwise provided herein.

C. The sole remedy for all disputes arising under this Drainage Easement, with the exception of injunctive relief as set forth in Section 7(B), will be arbitration under the provisions of the New Mexico Uniform Arbitration Act.

22. Albuquerque Academy. The obligations and

liabilities of Albuquerque Academy as Grantor or otherwise under this document or the Drainage Easement will cease upon the transfer or conveyance of the Property by Albuquerque Academy to a subsequent owner. Upon such transfer or conveyance, Albuquerque Academy is and will be released and discharged from any obligation or liability under the Drainage Easement.

23. Miscellaneous. The headings used in this Drainage Easement are for convenience only and will be disregarded in interpreting the substantive provisions of this Drainage Easement. Time is of the essence of each term of this Drainage Easement.

Dated June 16, 1995.

ALBUQUERQUE ACADEMY, a New Mexico
nonprofit corporation

By [Signature]
Its President

By [Signature]
Its Chair, Board of Trustees

HIGH DESERT RESIDENTIAL OWNERS
ASSOCIATION, INC., a New Mexico
nonprofit corporation

By Samela A. Scanlon
Its PRESIDENT

ALBUQUERQUE METROPOLITAN ARROYO
FLOOD CONTROL AUTHORITY

By Samuel M. Mestas
Its Chair

By Ronald W. Brown
Its Secretary

HIGH DESERT INVESTMENT
CORPORATION, a New Mexico profit
corporation

By Daryl H. Hellyer
Its President

By Richard G. Ellman
Its Treasurer

STATE OF NEW MEXICO)
) ss.
 COUNTY OF BERNALILLO)

This instrument was acknowledged before me on 30th
May, 1995, by ROBERT L. BOVINETTE, PRESIDENT
 of Albuquerque Academy, a New Mexico nonprofit corporation, on
 behalf of the corporation.

Sandra A. Taylor
 Notary Public

My commission expires:

April 17, 1998

STATE OF NEW MEXICO)
) ss.
 COUNTY OF BERNALILLO)

This instrument was acknowledged before me on 31st
May, 1995, by CYNTHIA B. STEINER, Chair, Board
of Trustees
 of Albuquerque Academy, a New Mexico nonprofit corporation, on
 behalf of the corporation.

Sandra A. Taylor
 Notary Public

My commission expires:

April 17, 1998

STATE OF NEW MEXICO)
) ss.
 COUNTY OF BERNALILLO)

This instrument was acknowledged before me on 30th
May, 1995, by DAMELA G. SCANLON, PRESIDENT
 of High Desert Residential Owners Association, Inc., a New Mexico
 nonprofit corporation, on behalf of the corporation.

Sandra A. Taylor
 Notary Public

My commission expires:

April 17, 1998

STATE OF NEW MEXICO)
) ss.
 COUNTY OF BERNALILLO)

This instrument was acknowledged before me on 16
June, 1995, by Leneira Mueker, Chair of the
 Albuquerque Metropolitan Arroyo Flood Control Authority, a
 political subdivision of the State of New Mexico, on behalf of
 the subdivision.

Irene Jeffries
 Notary Public

My commission expires:

June 1, 1999

7026

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on 16
June, 1995, by Ronald D. Brown, Secretary of the
Albuquerque Metropolitan Arroyo Flood Control Authority, a
political subdivision of the State of New Mexico, on behalf of
the subdivision.

Deanne Jeffries
Notary Public

My commission expires:

June 1, 1999

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on June 5th
 , 1995, by Douglas H. Collister President
of High Desert Investment Corporation, a New Mexico profit
corporation, on behalf of the corporation.

Linda J. Miles
Notary Public

My commission expires:

7-14-98

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

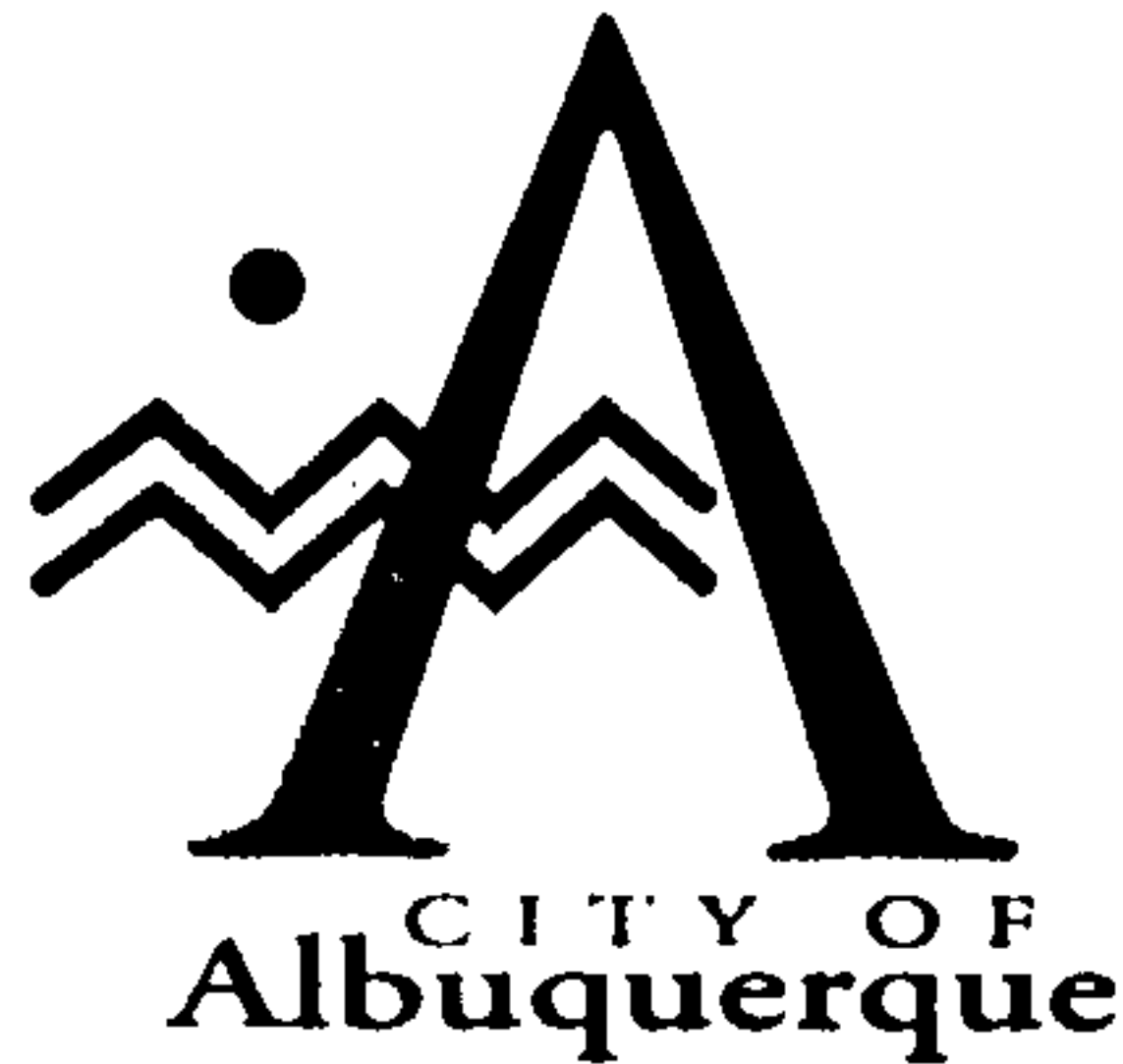
This instrument was acknowledged before me on June 5th
 , 1995, by Richard M. Elkins, Treasurer
of High Desert Investment Corporation, a New Mexico profit
corporation, on behalf of the corporation.

Linda J. M. [Signature]
Notary Public

My commission expires:

7-14-98

115256



March 25, 1997

Martin J. Chávez, Mayor

Craig W. Hoover, P.E.
Bohannon Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

**RE: Design Analysis Report and Drainage Improvements Construction Drawings for
Albuquerque Academy Drainage Improvements (E19/D11) Submitted for Grading
Permit Approval, Engineer's Stamp Dated 3/3/97.**

Dear Mr. Hoover:

Based on the information provided in the submittal of March 5, 1997, the above referenced plans and report seem to be in compliance with the approved Master Drainage Plan and are, therefore, approved.

Prior to commencement of the actual construction, however, the agreement between Albuquerque Academy and the City must be complete. With this agreement, all required easements must be in place.

If you should have any questions, or if I may be of further assistance to you, please do not hesitate to call me at 924-3982.

Sincerely,

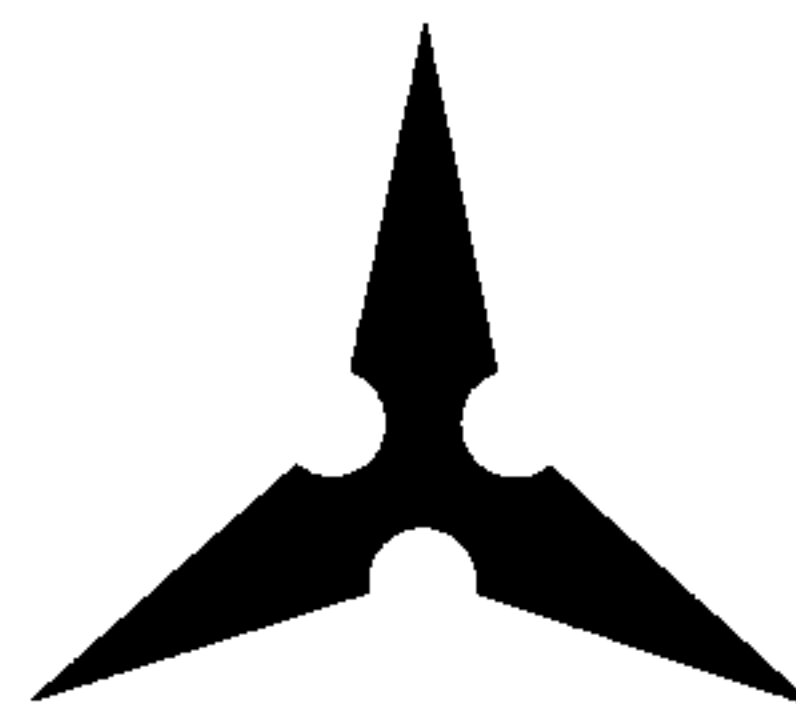
Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Dan Hogan, City Hydrology
Michial Emery, Bohannon-Huston
Larry Blair, AMAFCA
File

Good for You, Albuquerque!

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





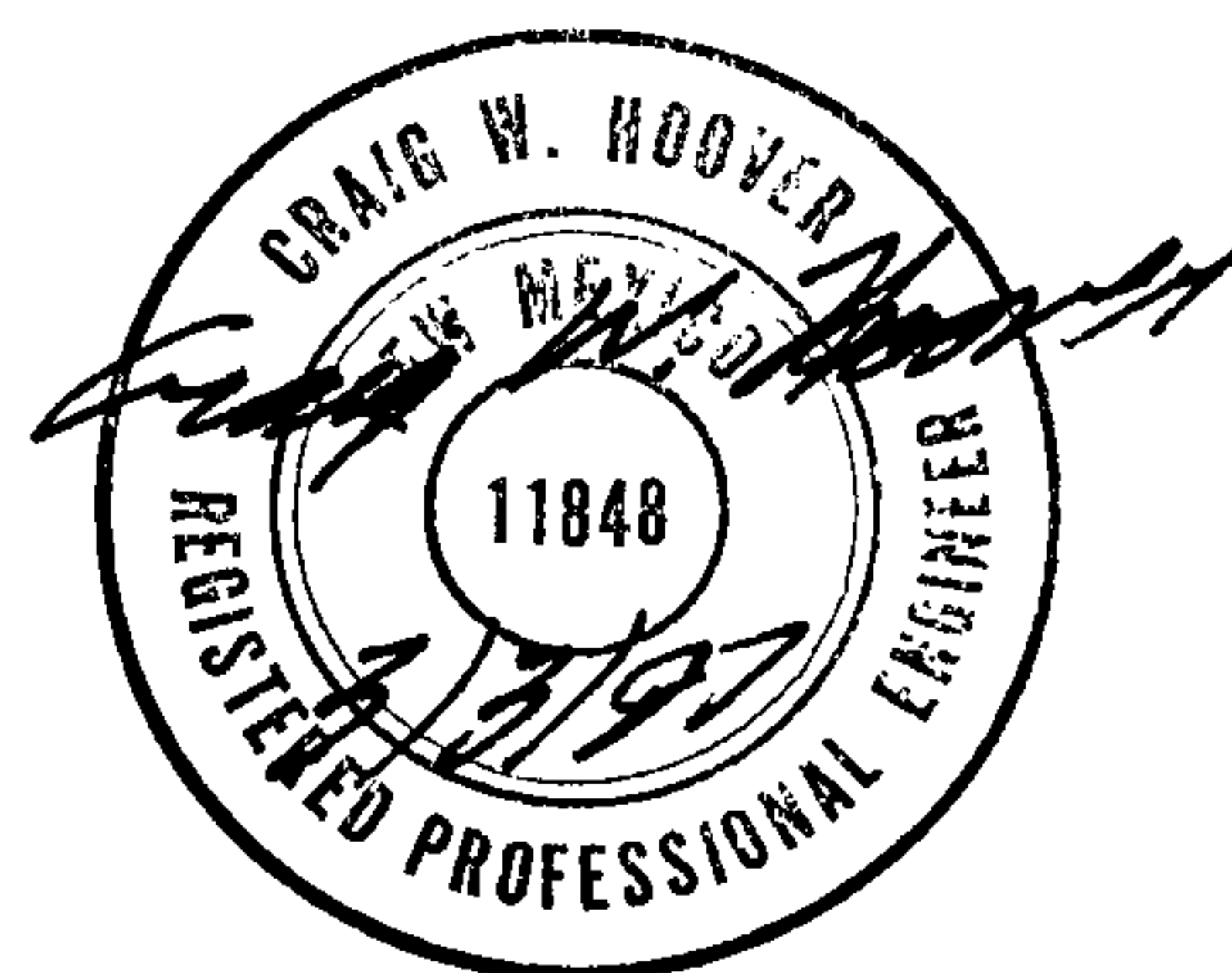
Draft Design Analysis Report
for
Albuquerque Academy Campus
Drainage Improvements

February 1997

DRAFT DESIGN ANALYSIS REPORT FOR ALBUQUERQUE ACADEMY CAMPUS DRAINAGE IMPROVEMENTS

Prepared for:

Albuquerque Academy
6400 Wyoming Blvd. NE
Albuquerque, NM 87109



BOHANNAN-HUSTON INC.

ENGINEERS • PLANNERS • PHOTOGRAMMETRISTS • SURVEYORS • LANDSCAPE ARCHITECTS

COURTYARD I, 7500 JEFFERSON NE, ALBUQUERQUE, NM 87109 TEL (505) 823-1000 FAX (505) 821-0892

ALBUQUERQUE

LAS CRUCES

SANTA FE

1.0 PURPOSE

This design analysis report, prepared for the Albuquerque Academy, presents a description of and supporting calculations for the Construction Plans for the Albuquerque Academy Campus Drainage Improvements. The design plans are based on Option 3 of The Albuquerque Academy Campus Revised Drainage Management Plan - June 24, 1996 (AACRDMP), as modified by this report.

2.0 INTRODUCTION

Option three of the AACRDMP describes the use of four detention ponds and small diversion berms along the southwest corner of the Academy Campus to intercept, capture and attenuate the flows from the southeast corner of the Academy Campus into an earthen channel. The purpose of these ponds and berms is to intercept runoff from the campus upstream of Wyoming Boulevard. The earthen channel with 3:1 side slopes and a 15' bottom width then carries the flow into the existing Pino Arroyo Desiltation Basin just east of the Wyoming Boulevard. The four detention ponds, as described by the AACRDMP, are paralleled by a single outfall pipe starting at Pond A and increasing in size until at Pond D where the outfall pipe discharges into the earthen channel.

Changes to the detention ponds, outfall pipes, and earthen channel have been made to reduce construction cost and minimize the visual impact to the pristine nature of the Academy perimeter. The modifications to Option 3 as proposed in the AACRDMP are as follows:

- First, Pond B and C have been combined into one detention pond (Pond B-C).
- Second all ponds have been given a sinusoidal alignment with varying top elevation to achieve aesthetically pleasing detention ponds.
- Third the single outfall pipe has been replaced with three separate outfall pipes that discharge from one pond to the next pond and then finally into the earthen channel.
- Fourth, the earthen channel has also been given a sinusoidal alignment to achieve the same aesthetically pleasing affect as the detention ponds.
- Finally the bottom width of the earthen channel has been reduced to 10'. The channel side slopes remain unchanged at 3:1.

3.0 HYDROLOGY

The overall drainage pattern of the Campus has not been changed by any of the improvements described in the introduction. All of the flowrates, however, have increased because a sediment bulking factor has been included in the latest AHYMO model. The AACRDMP AHYMO model did not include any bulking factors. The AHYMO model for this design analysis report uses two bulking factors; 5.0% for undeveloped areas and 2.5% for developed areas (See Appendix A).

The only other substantial change to the hydrology model pertains to Basin 70 and Pond D. The AACRDMP routed runoff from Basin 70 into Pond D. Basin 70 is no longer routed into Pond D, but is routed directly to the earthen channel. Consequently, the discharge rate from Pond D into the earthen channel has decreased slightly from 60 cubic feet per second (cfs) to 47 cfs. However, since Basin 70 bypasses Pond D, the peak flowrate in the earthen channel has increased to 84 cfs south and 96 cfs north of Burlison Road respectively.

Furthermore, Pond 80U has been removed from the AHYMO model. The pond does not provide significant attenuation of the flow from the east so it does not appreciably reduce the size of Pond D and was hence eliminated. The outfall pipe from Pond 100 has been changed from a 12" diameter pipe to a 24" diameter pipe to minimize Pond 100 storage volume required.

4.0 HYDRAULICS

The volume calculations and discharge rating curves for the three detention ponds and Pond 100 are included in Appendix B - Detention Pond Calculations. All ponds have a minimum of 3.0' of freeboard. Flows greater than the 100 year event are conveyed between Ponds through the small channels cut in the existing ground.

The new pond outfall configuration increased the flowrate into the earthen channel as described in Section 3.0. This increase in flowrate is contained in the new earthen channel as described in Section 2.0 (See Appendix C). It is important that the water velocity in the channel remain low so soil erosion does not occur. A rule of thumb of 3 feet per second (fps) for maximum velocities was used. The stability of the resulting channel section and slope was checked using an equilibrium slope analysis from the AMAFCA Design Guide (See Appendix D). From the equilibrium slope analysis, the design slopes which achieved a maximum velocity of 3 fps were found to be less than or equal to the maximum stable slope.

5.0 ESTIMATED COST SAVINGS

As mentioned in Section 2.0, Option 3 as proposed in the AACRDMP has been revised to reduce the construction cost. The two major components of this cost savings are:

- The replacement of the single outfall pipe with three separate outfall pipes.
- The replacement of the gabion drop structures with soil cement drop structures.

The first component removes 555 feet of 30" RCP pipe and three manholes from the project. The second component replaces the more expensive gabion drop structures with the soil cement drop structures. These two revisions save approximately \$54,000.00 (See Appendix E).

POND VOLUMES BASED ON FINAL CONTOURS

POND A

ELEV.	AREA (FT^2)	VOLUME (FT^3)	AC - FT
5438	864.11	0	0
5439	4040.46	2452.285	0.056297
5440 → 39.80 - 100 YR WSEL	8882.66	8913.845	0.204634
5441	16758.96	21734.66	0.498959
5442 → 42.80 (43.0) TOP	27312.26	43770.27	1.004827
5443			
5444		TOP	

OUT PIPE = 448' of 18" PIPE

PIPE INV. = 5435.5 (IN)

PIPE INV. = 5429.0 (OUT)

POND B & C

ELEV.	AREA (FT^2)	VOLUME (FT^3)	AC - FT
5424	432.97	0	0
5425	2916.33	1674.65	0.038445
5426	7836.62	7051.125	0.161872
5427 → 27.39 - 100 YR.	17863.28	19901.08	0.456866
5428 WSEL	29794.42	43729.93	1.003901
5429	42647.08	79950.68	1.835415
5430			
5431 → TOP		TOP	

OUT PIPE - 208' of 18" PIPE

PIPE INV. = 5421.5 (IN)

PIPE INV. = 5418.36 (OUT)

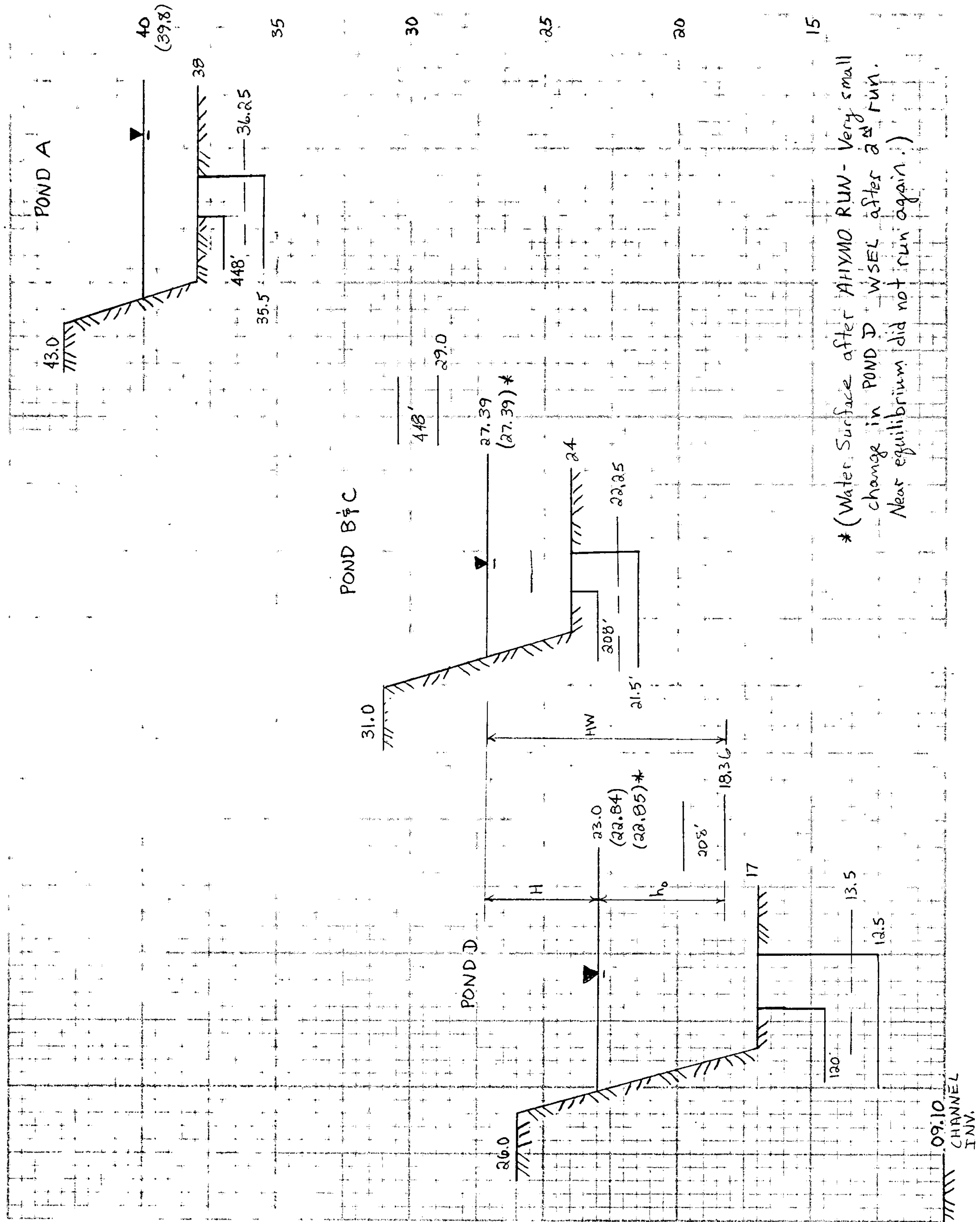
POND D

ELEV.	AREA (FT^2)	VOLUME (FT^3)	AC - FT
5417	2131.4	0	0
5418	5568.34	3849.87	0.088381
5419	9093.45	11180.77	0.256675
5420	13137.77	22296.38	0.511854
5421	21273.86	39502.19	0.906846
5422 → 22.85 - 100 YR.	30695.05	65486.65	1.503367
5423 WSEL	38493.68	100081	2.297544
5423.5	42916.82	140786.3	3.232008
5424	48116.2	186302.8	4.276923
5425	55808.92	238265.3	5.469819
5426 → TOP		TOP	

OUTPIPE - 112' of 24"

PIPE INV. = 5412.5 (IN)

PIPE INV. = 5409.10 (OUT)



*(Water Surface after AHYMO RUN - Very small change in POND D WSEL after 2nd run. Near equilibrium did not run again.)



PROJECT NAME Academy Diversion SHEET _____ OF _____
 PROJECT NO. 96465 A01 BY DEB DATE _____
 SUBJECT POND ELEVATION CH'D _____ DATE _____

ELEVATION (FT)

DISCHARGE (CFS)

POND A
18" RCP

5436.50000	4.25266
5436.75000	6.01417
5437.00000	7.36583
5437.25000	8.50532
5437.50000	9.50924
5437.75000	10.41685
5438.00000	11.25149
5438.25000	12.02835
5438.50000	12.75799
5438.75000	13.44810
5439.00000	14.10448
5439.25000	14.73165
5439.50000	15.33319
5439.75000	15.91200
5440.00000	16.47049
5440.25000	17.01065
5440.50000	17.53418
5440.75000	18.04252
5441.00000	18.53692
5441.25000	19.01848
5441.50000	19.48814
5441.75000	19.94675
5442.00000	20.39505
5442.25000	20.83370
5442.50000	21.26331
5442.75000	21.68441
5443.00000	22.09748
5443.25000	22.50297
5443.50000	22.90129
5443.75000	23.29279

DISCHARGE AT TOP

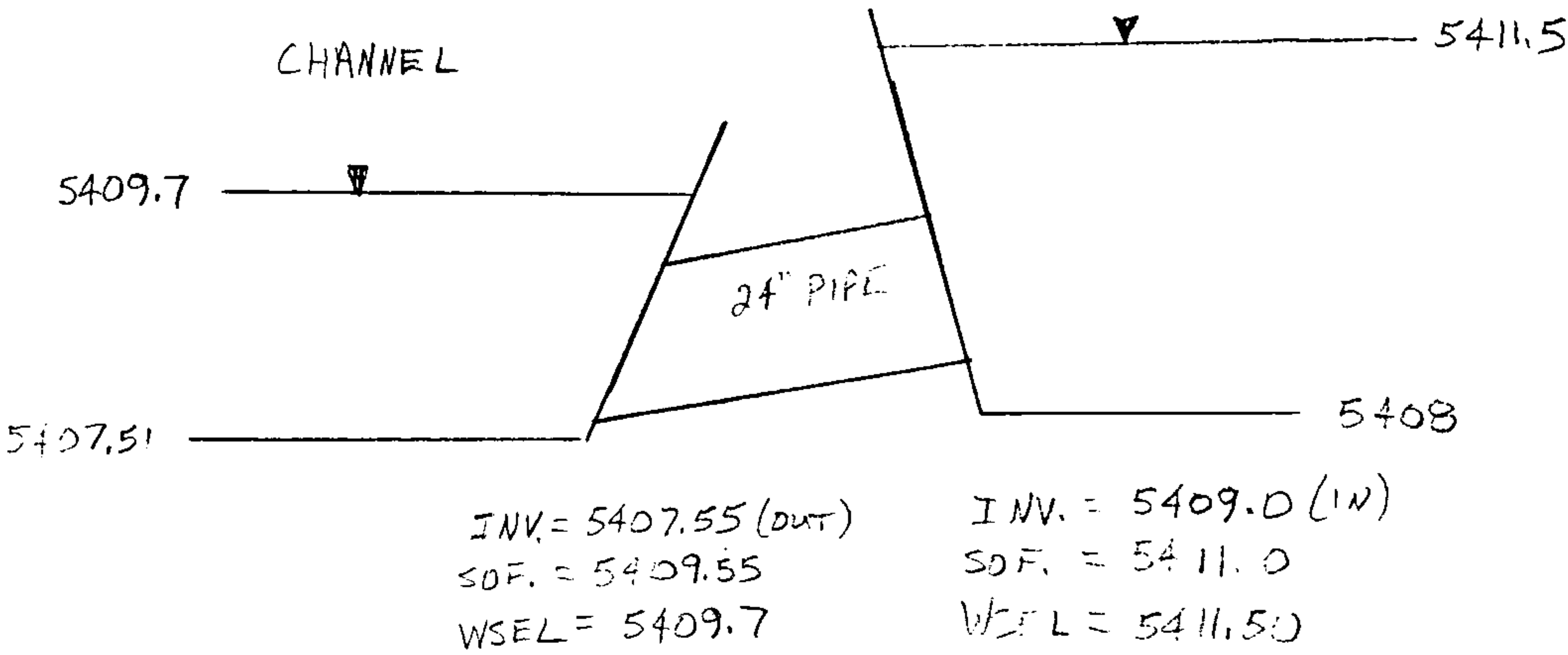
23.67782

ELEVATION (FT)	DISCHARGE (CFS)	POND D
5414.00000	10.69186	24"
5414.50000	15.12058	
5415.00000	18.51885	
5415.50000	21.38372	
5416.00000	23.90773	
5416.50000	26.18960	
5417.00000	28.28801	
5417.50000	30.24115	
5418.00000	32.07558	
5418.50000	33.81063	
5419.00000	35.46089	
5419.50000	37.03769	
5420.00000	38.55005	
5420.50000	40.00528	
5421.00000	41.40940	
5421.50000	42.76744	
5422.00000	44.08367	
5422.50000	45.36173	
5423.00000	46.60474	
5423.50000	47.81546	
5424.00000	48.99626	
5424.50000	50.14927	
5425.00000	51.27636	
5425.50000	52.37921	
DISCHARGE AT TOP	53.45930	

POND 100 VOLUME BASED ON FINAL CONTOURS

POND 100

ELEV.	AREA (FT^2)	VOLUME (FT^3)	AC - FT
5407	0	0	0
5408	11304.04	0	0
5409	13987.6	12645.82	0.290308
5410	16807.69	28043.47	0.643789
5411	19764.55	46329.59	1.063581
5412	22863.76	67643.74	1.552887
5413		79075.62	1.815326
5414		79075.62	1.815326
5415		79075.62	1.815326



ELEV.	DISCHARGE (CFS)
5408	0
5409	0
5410	10.0
5410.5	18.0
5411.0	20.5
5411.5	24.0
5412	26.60
5413	32.0

ALBUQUERQUE ACADEMY - DRAINAGE IMPROVEMENTS
 JOB NO. 96465A01

ARROYO STABILIZATION WORKSHEET

Based on AMAFCA Sediment and Erosion Design Guide, March 1994; Section 3.4.3 page 3-49

Q FROM HYD NO	ARROYO	Flow Rate (cfs)	Depth (ft)	Width (ft)	Width/Depth Ratio	Mannings n	Froude Number Fr	C	Maximum Stable Slope Ss (ft/ft)
5 Year INFLOWCUL	South of Burlison	30.2	1.05	16.3	15.52	0.03	0.43	0.003916	0.0025
CH6.180B	North of Burlison	32.5	1.15	16.9	14.70	0.03	0.39	0.003156	0.0020
10 Year INFLOWCUL	South of Burlison	53.2	1.43	18.6	13.01	0.03	0.45	0.004214	0.0025
CH6.180B	North of Burlison	56.7	1.58	19.5	12.34	0.03	0.39	0.003084	0.0020

E19/D011

PERMANENT EASEMENT

594481

Grant of Permanent Easement, between ALBUQUERQUE ACADEMY ("Grantor"), whose address is 6400 WYOMING N.E. 87109 and the City of Albuquerque, a New Mexico municipal corporation ("City"), whose address is P.O. Box 1293, Albuquerque, New Mexico, 87103.

Grantor grants to the City an exclusive, permanent easement ("Easement") in, over, upon and across the real property described on Exhibit "A" attached hereto ("Property") for the construction, installation, maintenance, repair, modification, replacement and operation of DRAINAGE EASEMENT, together with the right to remove trees, bushes, undergrowth and any other obstacles upon the Property if the City determines they interfere with the appropriate use of this Easement.

In the event Grantor constructs any improvements within the easement, the City has the right to enter upon Grantors property at any time and perform whatever inspection, installation, maintenance, repair, modification or removal ("Work") it deems appropriate without liability to the City. If the work effects any Improvements or Encroachments made by the Grantor, the City will not be financially or otherwise responsible for rebuilding or repairing of Improvements or Encroachments. If in the opinion of the City, the Work to be performed by the City could endanger the structural integrity or otherwise damage the Improvements or Encroachments, the Grantor shall, at its own expense, take whatever protective measures are required to safeguard the Improvements or Encroachments.

Grantor covenants and warrants that Grantor is the owner in fee simple of the Property, that Grantor has a good lawful right to convey the Property or any part thereof and that Grantor will forever warrant and defend the title to the Property against all claims from all persons or entities.

The grant and other provisions of this Easement constitute covenants running with the land for the benefit of the City and its successors and assigns until terminated.

WITNESS my hand and seal this 13 day of August, 1998.

GRANTOR:

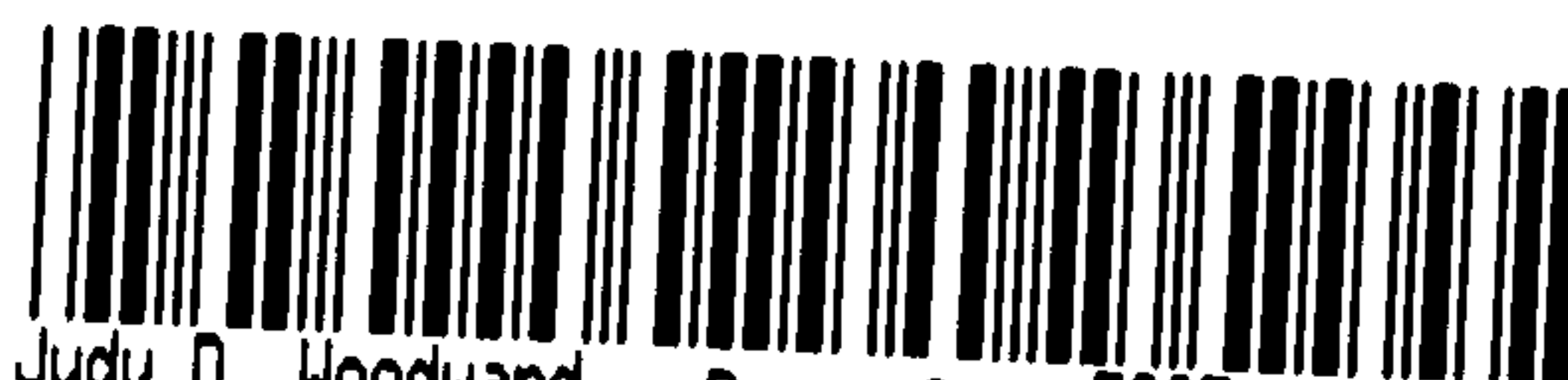
(Individual)

GRANTOR: ALBUQUERQUE ACADEMY

By: Richard S. Ellison

Its: CBO

(Corporation or Partnership)



Judy D. Woodward

Bern. Co.

EASE

R 13.00

1998126688

5116678

Page: 1 of 4

10/02/1998 09:47A

Bk-9816 Pg-4856

INDIVIDUAL

STATE OF _____)
)ss
COUNTY OF _____)

This instrument was acknowledged before me on _____ day of _____, 19____, by
_____.

Notary Public

My Commission Expires:

CORPORATION

STATE OF N.M.)
)ss
COUNTY OF BERN.)

This instrument was acknowledged before me on 13 day of August, 1998, by
Richard G. Elkins
Of ALBUQUERQUE ACADEMY, a New Mexico corporation, on behalf of the corporation.

Noella M. Gonzales
Notary Public

My Commission Expires:

Nov. 18, 2001

PARTNERSHIP

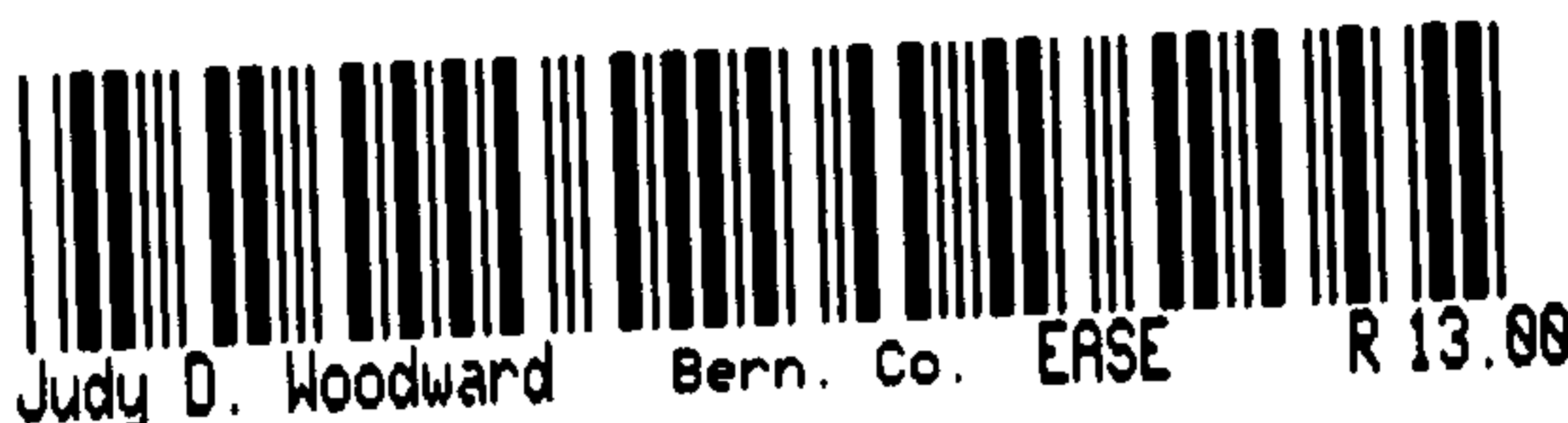
STATE OF _____)
)
COUNTY OF _____)

This instrument was acknowledged before me on _____ day of _____, 19____, by
_____, partner(s), on behalf of _____, a partnership.

Notary Public

My Commission Expires:

(EXHIBIT "A" ATTACHED)



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Page: 2 of 4
10/02/1998 09:47A
BX-9816 Pg-4856

DESCRIPTION "A"

A certain tract of land situate being Thirty (30) feet in width and being within the Elena Gallegos Grant, within projected Section 35, Township 11 North, Range 4 East, New Mexico Principal Meridian, Bernalillo County, Albuquerque, New Mexico, being and comprising a southwesterly portion of Tract OS-2 of the PLAT OF HIGH DESERT, Albuquerque, New Mexico as the same is shown and designated on the plat thereof, recorded in the office of the County Clerk of Bernalillo County, New Mexico on November 23, 1993 in Volume 93C, folio 325 as Document No. 93133004 and being more particularly described by New Mexico State Plane Grid Bearings (Central Zone NAD 1927 Datum) and ground distances as follows:

BEGINNING at the southwest corner of said Tract OS-2, said corner also being the southeast corner of Lot 36 of the CORRECTED PLAT OF TIERRA DEL OSO SUBDIVISION AT HIGH DESERT, Albuquerque, New Mexico as the same is shown and designated on the plat thereof, recorded in the office of the County Clerk of Bernalillo County, New Mexico on May 23, 1996 in Volume 96C, folio 215 as Document No. 96057884 and from said point of beginning running thence along the lot line common to said Tract OS-2 and said Lot 36,

N27°39'34"E, a distance of 33.24 feet to the northwest corner of the tract herein described, thence leaving the westerly boundary line of said Tract OS-2 and also the easterly boundary line of said Lot 36 and running thence along the northerly boundary line of the tract herein described,

S87°50'00"E, a distance of 110.18 feet to a point; thence,

N56°52'21"E, a distance of 436.22 feet to the most northerly corner of the tract herein described; thence,

S33°07'39"E, a distance of 30.00 feet to the most easterly corner of the tract herein described; thence,

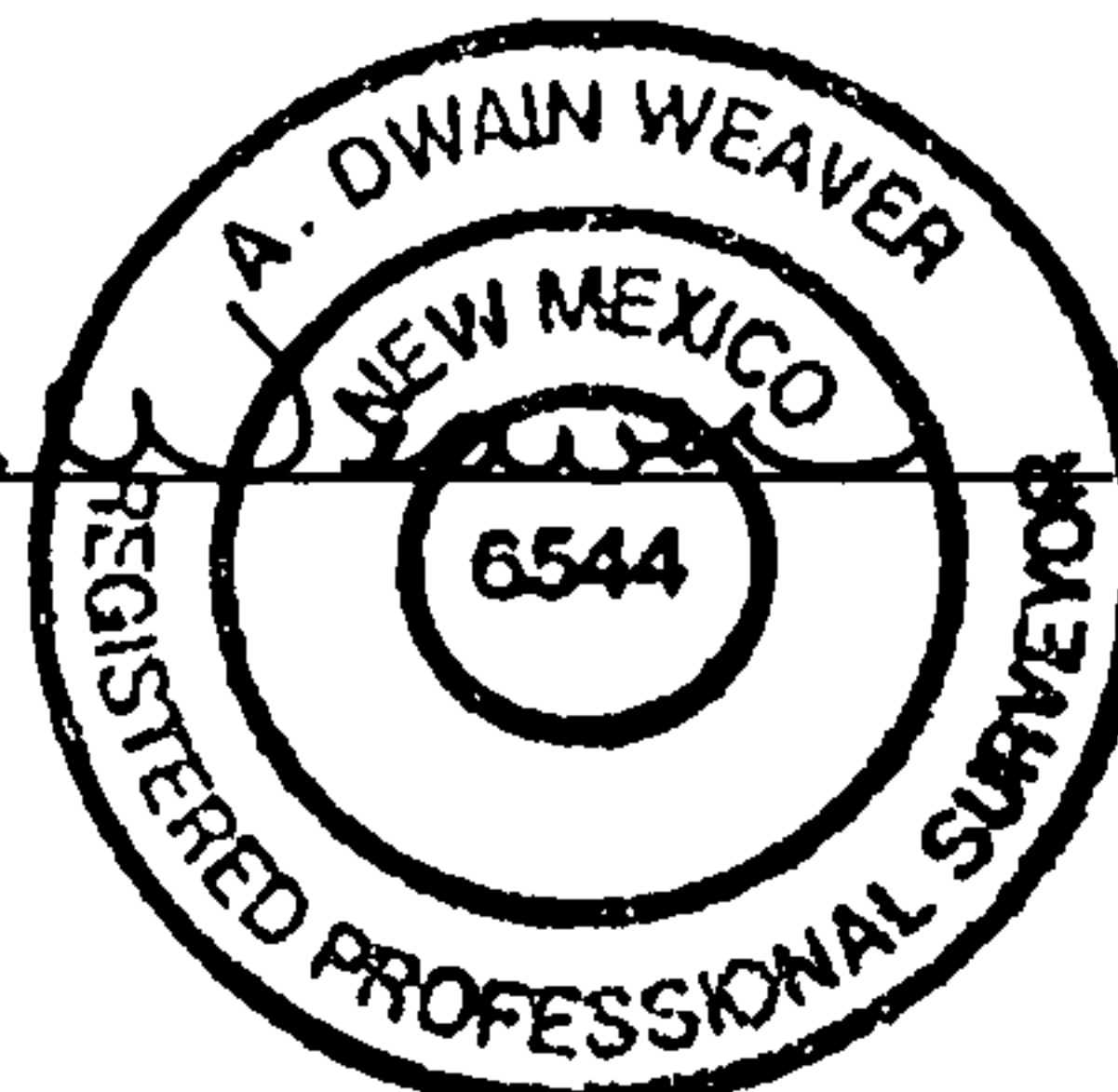
S56°52'21"W, a distance of 445.76 feet to a point on the southerly boundary line of said Tract OS-2, thence running along the southerly boundary line of said Tract OS-2,

N87°50'00"W, a distance of 134.03 feet to the point and place of beginning.

Tract contains 16,893 square feet or 0.3878 acre, more or less.

Bohannon Huston
Courtyard I
7500 Jefferson Street NE
Albuquerque, NM 87109

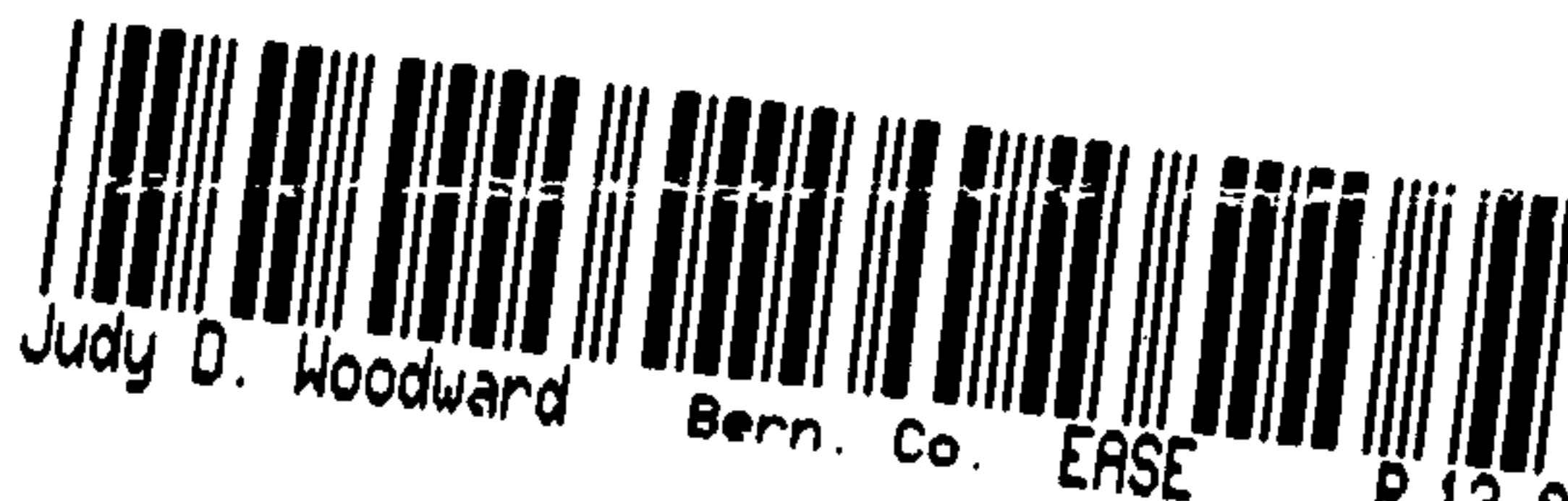
A. Dwain Weaver
A. Dwain Weaver
N.M.P.S. No. 6544



AUGUST 5, 1998

DATE

EXHIBIT "A"



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Page: 3 of 4
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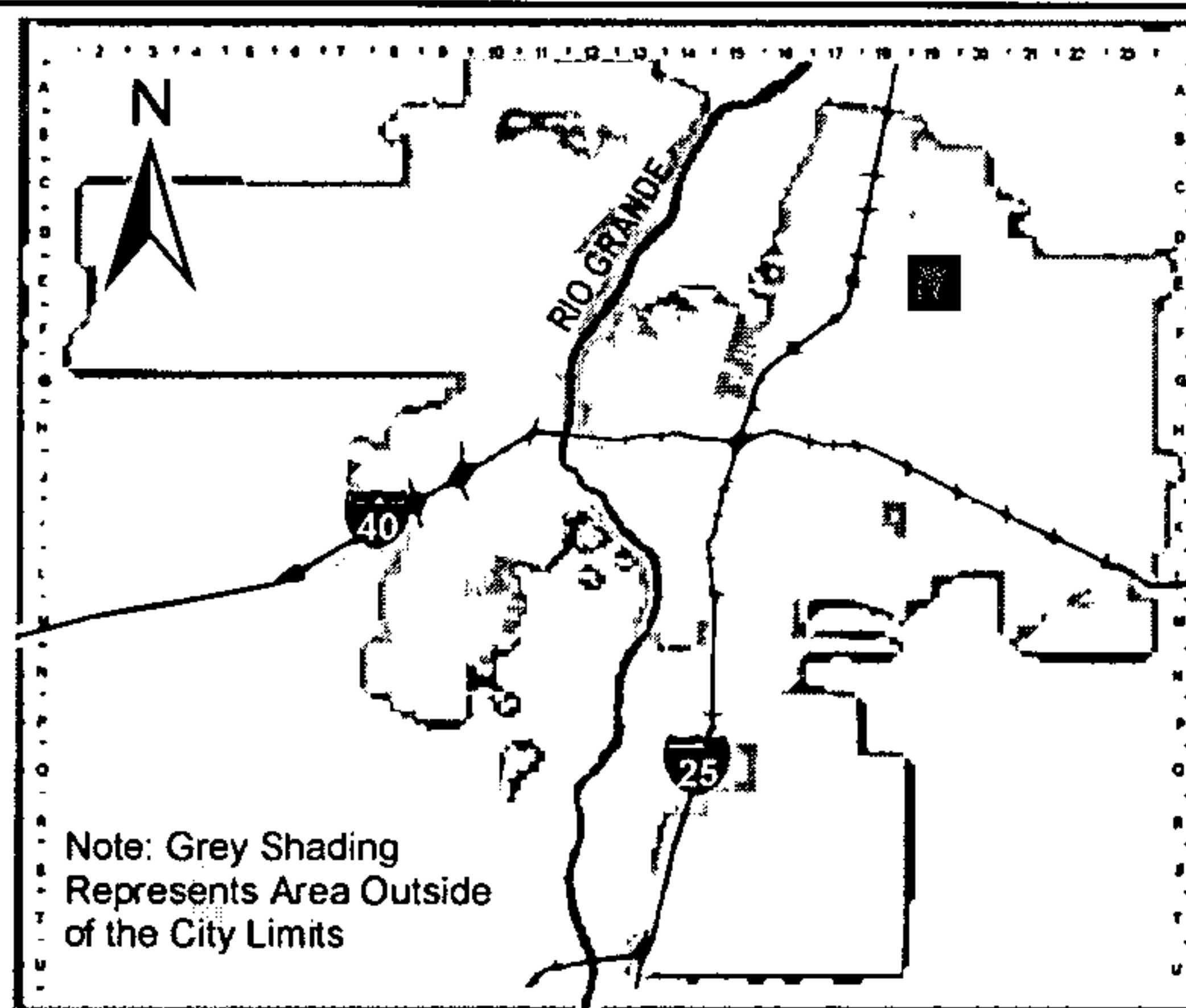
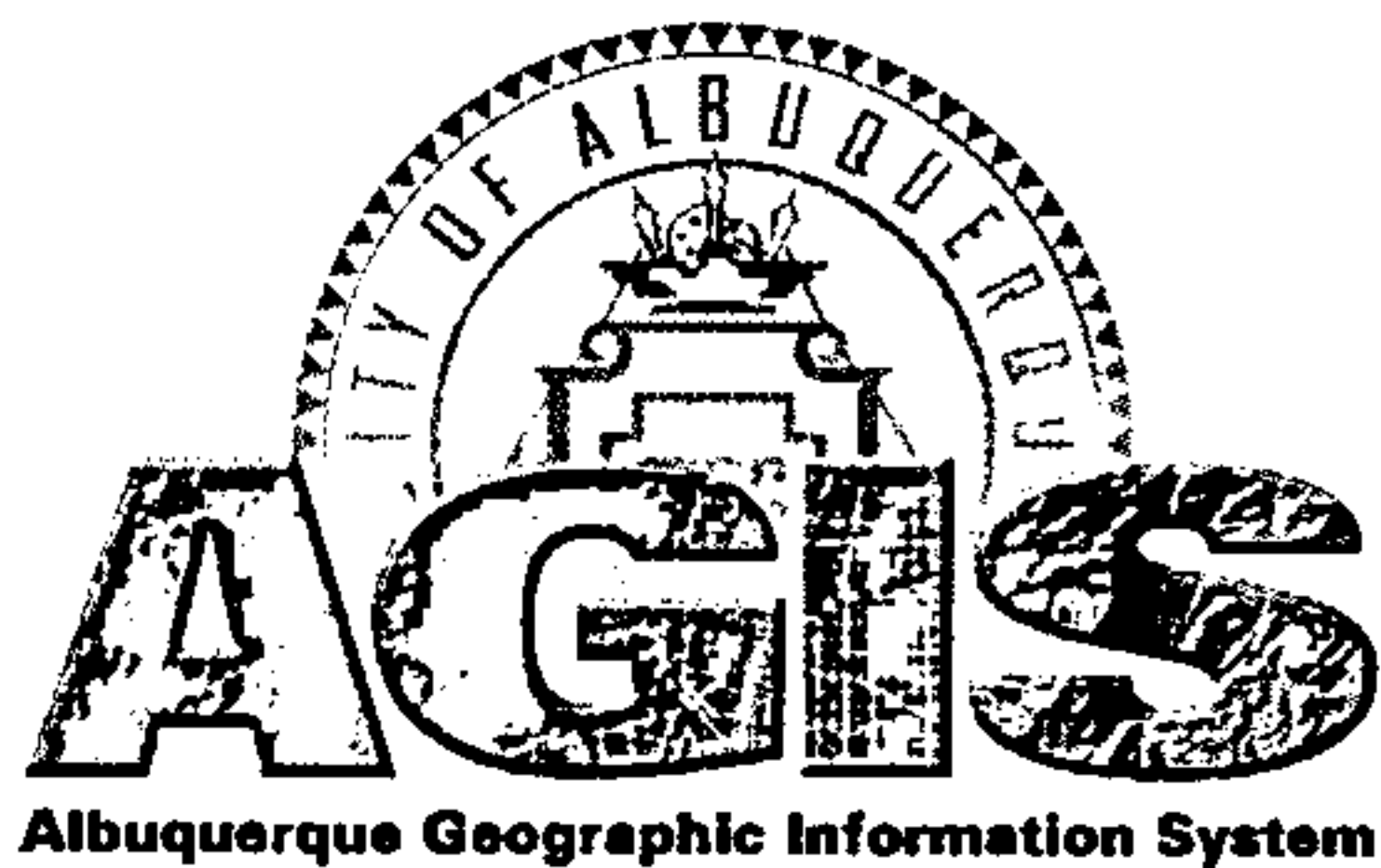
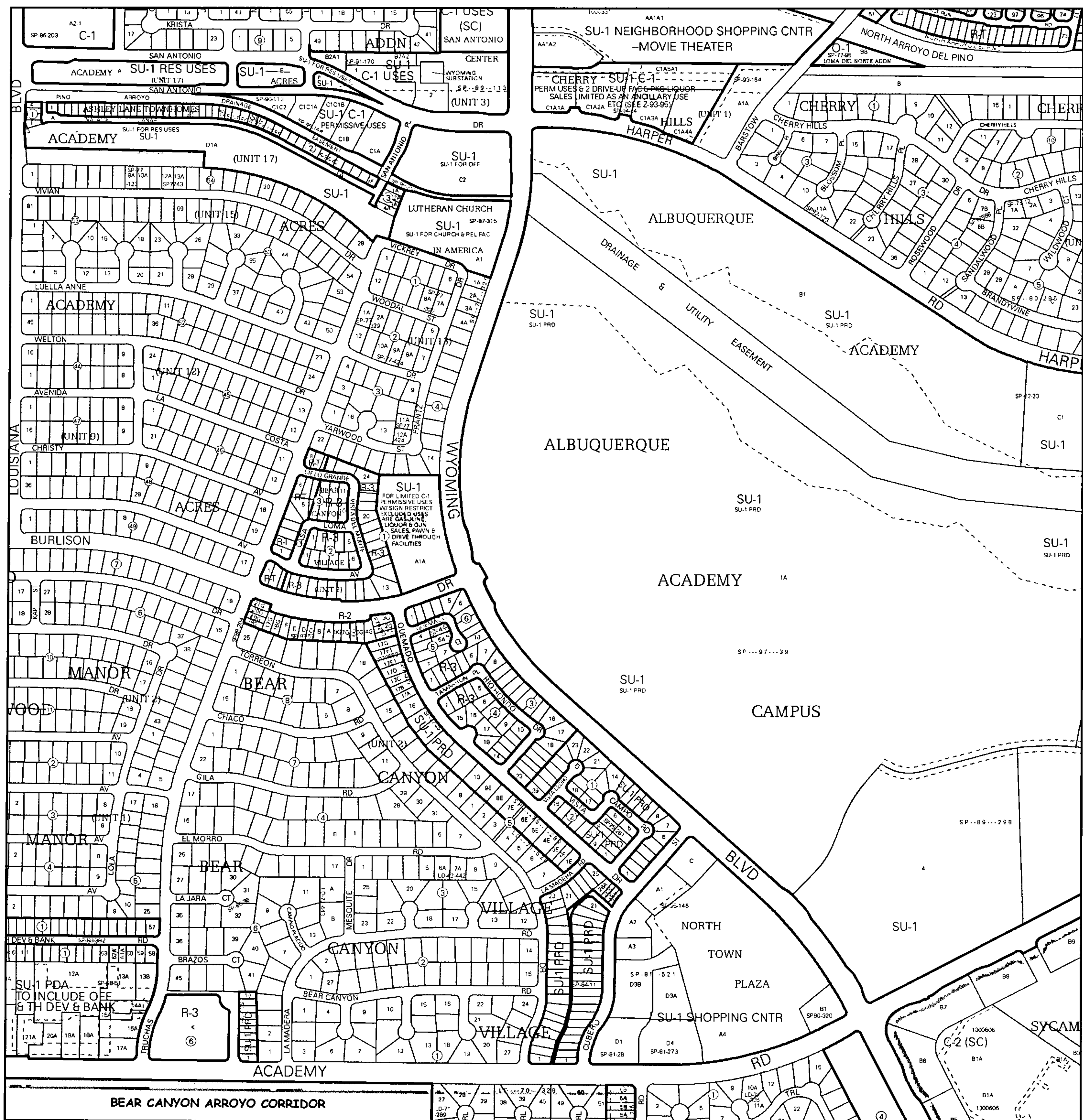
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Bohannon Huston



Courtyard One 7500 JEFFERSON NE Albuquerque NEW MEXICO 87109

ENGINEERS PLANNERS PHOTOGRAMMETRISTS SURVEYORS SOFTWARE DEVELOPERS

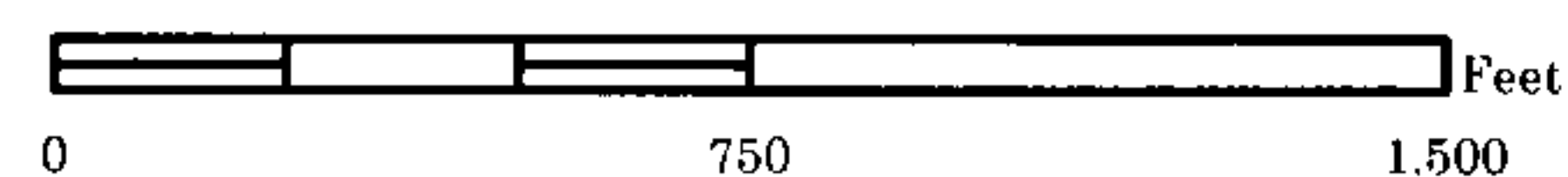


Zone Atlas Page:

E-19-Z

Selected Symbols

- SECTOR PLANS**
- Design Overlay Zones
- City Historic Zones
- H-1 Buffer Zone
- Petroglyph Mon.
- Escarpment
- 2 Mile Airport Zone
- Airport Noise Contours
- Wall Overlay Zone



**SOUTH PINO ARROYO
STABILIZATION STUDY**

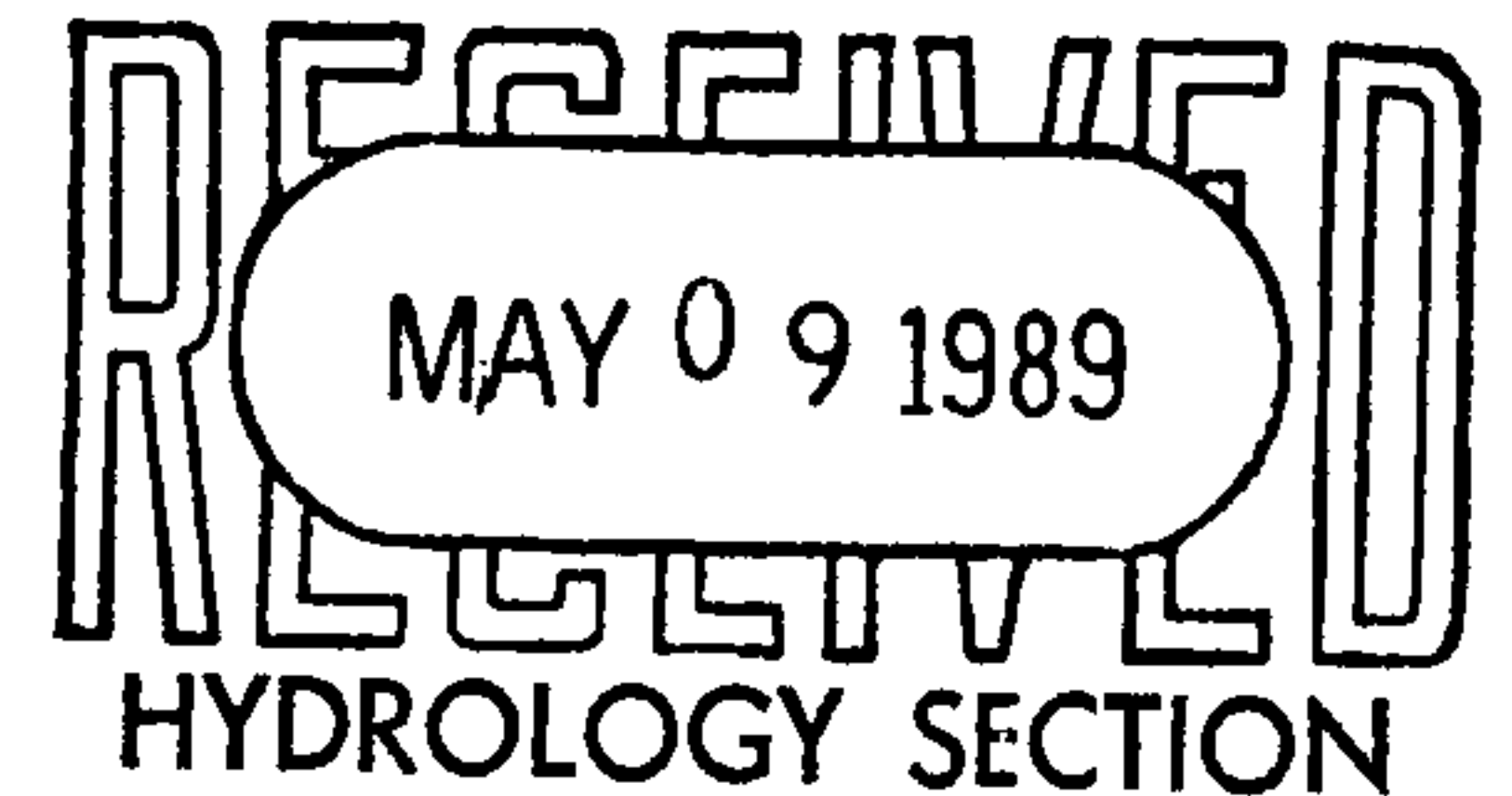
JANUARY, 1987

PREPARED FOR

**ALBUQUERQUE ACADEMY
6400 WYOMING, N.E.
ALBUQUERQUE, NM 87109**

PREPARED BY

**BOHANNAN-HUSTON INC.
COURTYARD I
7500 JEFFERSON ST., N.E.
ALBUQUERQUE, NM 87109
505/823-1000**



JOB NO. 6 412 0

INTRODUCTION

The South Pino Arroyo runs through the Albuquerque Academy property bounded by Ventura Street on the east, Academy Road on the south, Wyoming Boulevard on the west and Harper Road and the Hoffmantown Baptist Church property on the north (see Site Map, Figure 1).

The arroyo passes under the Ventura Street bridge and continues westward for approximately 6400 feet, where it crosses Wyoming Boulevard through a low flow or "dip" section in the roadway. A City of Albuquerque construction project, due to begin in February, 1987 will replace the dip section with a bridge.

This mile and a quarter stretch of the arroyo currently has no flood protection structures, and can be characterized as a wide and ill-defined floodplain with a sandy low flow channel and sloping banks hosting native vegetation such as chamisa, sage, salt bush and cactus. The 100-year storm for this reach of the arroyo would fill a typical section of the natural channel to a depth of 2.25 feet with a width of 58 feet.

Upstream of Ventura, the arroyo is hardly distinguishable, as the floodway lies within the Tanoan Golf Course. Downstream of Wyoming, the earth channel will soon be concrete lined by the City of Albuquerque. Construction is scheduled to begin in February, 1987.

The Academy land, through which the arroyo runs, is surrounded by rapidly developing residential and commercial areas. One consequence of this development is a deterioration of the ambiance of the site by unauthorized vehicular intrusion and vandalism. A second result is an increased discharge of highly erosive water into the arroyo, threatening the stability of the South Pino Arroyo in this reach.

PURPOSE

In November of 1986, the Albuquerque Academy authorized Bohannon-Huston Inc. to investigate means of stabilizing the arroyo in its natural state. This report discusses the causes of instability and recommends mitigating actions.

HISTORICAL IMPACTS ON THE ARROYO

The expansion of the City of Albuquerque into the South Pino Arroyo watershed has had a major impact on the stability of the arroyo. A chronological list of the developmental actions impacting the arroyo section flowing through the Academy property follows:

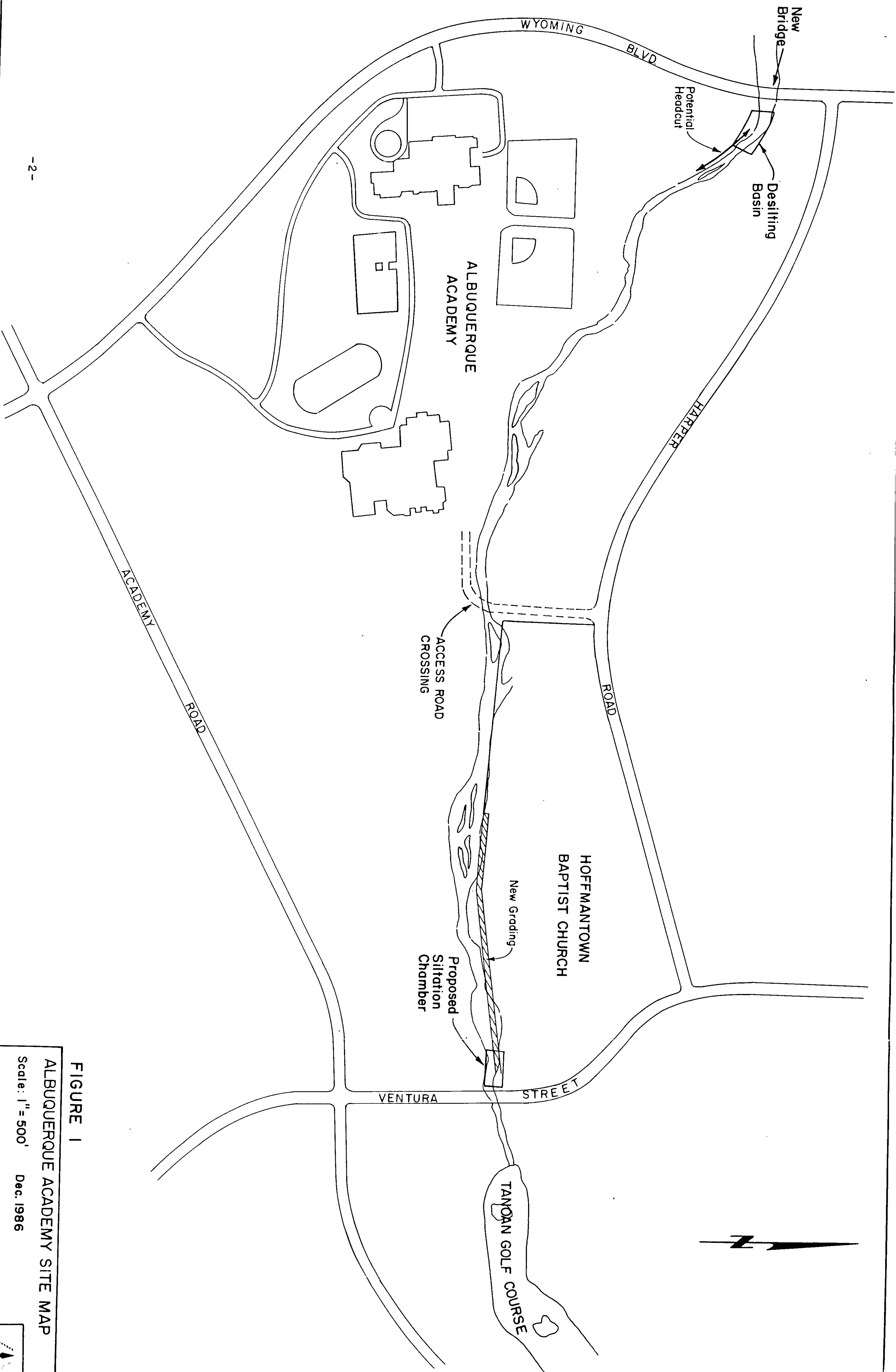


FIGURE 1

ALBUQUERQUE ACADEMY SITE MAP

Scale: 1" = 500' Dec. 1986

1. The major hydraulic impact on the South Pino Arroyo was the construction of the new Pino Detention Reservoir just west of Tramway Boulevard in approximately 1978, reducing the discharge from nearly 6000 cfs to 180 cfs. The old Pino Dam, located on the present alignment of the Ventura Street bridge, was subsequently removed in 1982 and replaced by the Ventura Street bridge over the South Pino Arroyo.
2. The continuing development of residential areas around the Tanoan Golf Course has increased the runoff and decreased the sediment load carried in the runoff. Similarly, discharge into the Academy reach of the South Pino Arroyo from the north has increased.
3. In 1978, the Albuquerque Metropolitan Flood Control Authority (AMAFCA) was granted a 200 foot wide easement along the South Pino Arroyo through the Academy property.
4. In 1981, the Federal Emergency Management Agency published the Albuquerque Floodplain Maps which establish limitations on building within the floodplains. Flooding boundaries for the Pino Arroyo through the Academy property are included on the maps. In January of 1982, these floodplains were granted as easements to AMAFCA with the filing of the plat entitled Albuquerque Academy Campus.
5. The City of Albuquerque in the past had committed to contribute \$200,000 toward the concrete lining of the Pino Arroyo from Ventura to Wyoming upon completion of a suitable design.
6. In May of 1985, the Albuquerque Academy retained Bohannan-Huston, Inc. to design a concrete channel with a park section through the property. In October of 1985, Bohannan-Huston Inc. had finished preliminary designs for this channel.
7. The construction of the new Hoffmantown Baptist Church includes recently completed grading which encroaches slightly upon the arroyo floodplain. The design of the grading calls for installation of a buried cutoff wall paralleling the arroyo to provide bank stabilization and arroyo meander protection. This wall is a temporary measure, and should not be construed as long-term protection of the arroyo bank on the Church property.

While the recent construction at the Church site did not encroach upon the 200' AMAFCA easement and only slightly affects the arroyo floodplain, the Church master plan calls for future expansion into the 200' easement after construction of a concrete channel to carry the arroyo flow.

8. The City of Albuquerque has designed a bridge over the South Pino Arroyo at Wyoming Boulevard. Construction is to begin early in 1987.
9. The Academy recently has proposed a change in concept, abandoning the previously proposed concrete lining and park section. Instead, investigation of a means of stabilizing the arroyo in its current natural state is the desired course of action. The planned Moon Street extension is to be abandoned and a crossing for a private drive investigated.

CONSEQUENCES TO THE ARROYO

The construction and planning presented in the previous section have direct consequences to the South Pino Arroyo running through Academy land. These consequences are listed below:

Increased Runoff.

The construction of residences and businesses in the watershed means an increase in impervious surfaces. Rain can no longer infiltrate into land now covered with rooftops, sidewalks, pavement and patios. The result is an increase in runoff carried by the arroyo. Not only is the flow passing under Ventura Avenue increased, but drainage entering the South Pino Arroyo on the north bank has been increased (see Site Map, Figure 1). The increased frequency and rate of runoff adds to channel instability and scour potential.

"Hungry" Water.

An important concept in the prediction of scour is the effect of "hungry water". Natural arroyos normally carry a large amount of sediment when flowing through any given stream reach. For a given set of conditions, the stream can carry only a certain (maximum) amount of sediment. There is a continual exchange of material between the water and the stream bed. The stream may drop some of its sediment load, but will shortly pick up more sediment by scouring the bed or banks. Sediment-laden water is less likely to cause scour than clean water, as it is already carrying near its capacity of sediment. However, since "clean" water carries very little sediment, it has a large capacity to scour and suspend sediment. This clean flow is referred to as "hungry water".

Developed areas with their lawns, landscaping and impervious surfaces tend to release relatively clean, "hungry" water to the arroyos draining the watershed. This is true of the development taking place in the South Pino watershed. Furthermore, the Pino Detention Dam also releases "hungry" water, as the sediment settles in the calm waters behind the reservoir. Finally, the

sod fairways of the Tanoan Golf Course tend to filter out the sediment, releasing even cleaner water below Ventura Street. The result is "hungry", erosive water flowing down the South Pino Arroyo through the Academy property. Thus, even small flows can cause extensive damage to the stream bed.

This scouring is already evident just below the Ventura bridge. The channel has degraded 5 to 6 feet in this area. The trend will continue as long as "hungry" water flows through the arroyo.

Bridge at Wyoming.

The existing channel crosses over Wyoming at an elevation of 5390. The design of the new bridge calls for lowering of the channel by 4 feet to an elevation of 5386. Such a sudden drop of the grade in a natural channel causes immediate instability. The channel, therefore, seeks a new and stable grade by eroding in an upstream direction. This phenomenon is known as "head cutting". The "head cut" will erode in an upstream direction until a stable slope is achieved. Such a head cut is almost inevitable without structural intervention, and could lower the stream bed by as much as 4 feet throughout the entire length of the Academy property.

"Private Drive" Crossing for Access to Harper.

The Academy is presently interested in building an access road connecting the campus with Harper Road in the vicinity of Red Sky Road, rather than the previously planned extension of Moon Street (see Site Map). Any crossing of a natural arroyo can impact the stability of the arroyo both upstream and downstream. Alternatives need to be found which would minimize the impact and retain the stability of the arroyo.

Grading on the Hoffmantown Baptist Church Property.

Although the grading performed in conjunction with the church construction does not intrude into the 200' AMAFCA easement, the grading does encroach upon the floodplain easement. Thus, during larger flows, the floodway will be pushed to the south, affecting more Academy land than in the past. This alteration in the flow path, however, should not be significant, as the intrusion into the floodway is slight. This study found the effect of the grading on the 100-year storm water surface to be less than 0.1 foot.

Of more serious impact to the arroyo are the Church's future expansion plans into the 200' AMAFCA easement. At the time the master plan for the Church was prepared, both the Church and the Academy were envisioning construction of concrete lining to carry the arroyo. This restriction of the arroyo would free land on both sides of the concrete canal for development.

However, if the Church were to encroach further into the floodplain without the construction of the lined channel, the flowpath would be pushed southward into Academy land that was previously outside of the floodplain, severely impacting the natural arroyo.

Discharge from the North.

Storm runoff draining the developing properties bordering the Academy property on the north is increasing along with development. The outfall of a 30" storm drain pipe from the Hoffmantown Church property has recently been constructed. Similar outfalls already exist along the north bank. These outfalls were constructed or upgraded during the recent improvements to Harper Road.

PROBLEMS AND RECOMMENDATIONS

The previous section discussed the consequences of development around the Academy property. Five major problems were defined:

1. Channel instability due to increased runoff and "hungry water".
2. Head cutting above the new Wyoming Boulevard bridge.
3. Arroyo crossing for the access road to Harper.
4. Existing and proposed intrusive grading at the Hoffmantown Baptist Church site.
5. Discharge entering the arroyo from the north.

In this section, these problems will be analyzed, and a solution or alternative solutions presented.

Problem 1--Channel Instability.

Hydrology. Before analysis of channel stability can begin, the expected flowrates must be determined. The prediction of the amounts of rainfall and subsequent surface runoff to be expected during the life of a project is referred to as "hydrology". The accepted approach of hydrologic studies is to review previous studies of the watershed, then check these results with an independent assessment. Bohannon-Huston Inc. followed this approach with the South Pino Arroyo watershed.

The City of Albuquerque requires major channel structures to safely carry the runoff from the 100-year storm, the storm of a magnitude expected to occur once every 100-years. Various studies of the 100-year fully-developed flowrate for the South Pino Arroyo at Wyoming Boulevard are presented below:

Study	100-Year Flowrate (cfs)
"Proposed Revision to the Northeast Heights Drainage Management Plan for the Arroyo del Pino with Pino Dam Removed", Gordon Herkenhoff & Associates, September 1978.	1209
Directive from Richard Heller, City Engineer, to Andrews, Asbury & Robert, Inc., May 2, 1979.	1300
"Preliminary Design Analysis, Pino Arroyo Corridor Improvements", Andrew, Asbury & Robert, Inc., May 13, 1983	1253
Design Drawings, Pino Arroyo Corridor Improvements, City Project #2151, Preliminary review on November 7, 1986.	1500

The Albuquerque Metropolitan Flood Control Authority (AMAFCA) accepts the 1209 cfs discharge presented by Herkenhoff in the September 1978 report.

Bohannon-Huston Inc. used the Agricultural Research Service's computer program HYMO (HYdraulic MOdeling) to model the South Pino Arroyo watershed. The 100-year flowrate at Wyoming was found to be 1131 cfs.

In order to resolve the disparity between the Bohannon-Huston Inc. discharge of 1131 and the City design flowrate of 1500 cfs, Bohannon-Huston Inc. contacted James A. Fink, Principal Hydrologist, Public Works Division, Planning, for the City of Albuquerque. Since no study substantiating the 1500 cfs discharge is known, Mr. Fink agreed that a 100-year flowrate of 1300 cfs at Wyoming would be acceptable to the City for design purposes.

Based on the above discussions, Bohannon-Huston Inc. recommends the following discharges for the South Arroyo del Pino:

	Ventura Street (cfs)	Wyoming Boulevard (cfs)
1-year storm	288	286
2-year storm	393	399
5-year storm	503	521
10-year storm	625	660
100-year storm	1157	1300

Sediment Transport. Having established the flowrates for various storms of interest, the next task is to estimate the expected scour during these storms. The flow in any given reach of channel will pick up sediment by scouring until its carrying capacity is reached. In general, higher discharges and velocities correspond to higher sediment transport. Should the velo-

city decrease as the flow continues downstream, the transport capacity also decreases, and sediment will settle out until the amount of sediment being transported equals the new (lower) carrying capacity.

Typically, scour will occur in the upper reaches of a watershed where the slope is steep and velocities high. Then, deposition (settling out of sediment) will occur in the lower reaches where the slope is milder and velocities lower. Engineers often encourage transport by increasing slopes and, thus, velocities.

Scores of equations to predict sediment transport are available, some theoretical, some site-specific, but all with a large margin of error. Two such equations were investigated in this study, resulting in a large variance in prediction.

In order to more accurately estimate the sediment transport in the South Pino, Bohannon-Huston Inc. measured the actual scour/deposition that has occurred in recent years. Detailed topographic mapping of the arroyo reach through the Academy property was available from a March, 1983 aerial photograph. For comparison, the same reach was surveyed in October of 1986. The channel profiles and an upstream cross-section for both dates are shown on Figures 2 and 3. The upstream reach, Station 3+50 to 32+00, shows scour, as the 1986 ground surface is lower than the 1983 profile. From Station 32+00 to 49+20, no significant change is apparent. From Station 49+20 to 57+60, deposition has occurred, as the 1986 profile is higher than the 1983 ground surface. Figure 3 shows the 1983 and 1986 ground surfaces for a cross-section at Station 7+80, further demonstrating the scour in this upstream reach. The sharp rise on the left side of the 1986 cross-section is the new fill of the Hoffmantown Baptist Church property.

From the cross-sections and profiles, the total amount of scour for the 3-year period was calculated to be 8000 cubic yards (C.Y.) yielding a yearly average of 2670 C.Y. per year.

This yearly average, however, is meaningful only if the rainfall in those three years was typical. U.S. Geological Survey (USGS) rainfall records for the Academy area are available up through December, 1985. From March, 1983 to December, 1986, the area experienced a 2-year frequency storm (1.43 inches on 10/15/84), a 1-year storm (1.04 inches on 4/28/85) and twelve smaller storms ranging from .5 inches to .82 inches. These storms closely represent the predicted rainfall for any 2-year period in Albuquerque, and justify the use of 2670 C.Y. per year as an average sediment yield for the South Pino Arroyo in the Academy reach.

Of equal interest is the sediment transport during large, individual storms. For these individual events, it is convenient to quantify sediment transport by applying a "bulking factor." The bulking factor is the ratio of sediment volume transported to

water volume. If 10 cubic yards of sediment are transported by 100 cubic yards of runoff, the bulking factor is 10 percent. By comparing the surveyed sediment transport with the typical 2-year frequency storm, the bulking factor for the 2-year storm in the reach was calculated¹ to be .9%.

For comparison purposes, test results from actual sediment laden water samples from the Tijeras Arroyo were obtained. For small storms (1-year frequency and smaller), the bulking factor for the Tijeras Arroyo storms was approximately .7%.

It is believed that bulking factors increase with larger storms. Using this concept and the findings from Tijeras Arroyo and the South Pino, this report projects the following sediment transport for storms of interest. Additionally, this transported sediment is translated into scour depth, assuming scour takes place in the upstream 2000 feet of the reach.

SEDIMENT TRANSPORT AND SCOUR

Frequency Storm	Bulking Factor	Transport (C.Y.)	Scour Depth* (Ft.)
1-year	1%	775	.25
2-year	1%	870	.30
5-year	2%	2130	.70
10-year	5%	6050	2.0
100-year	10%	19000	6.4
yearly average		2670	.90

* Assumes 40' channel scour width.

THIS MAY BE LOW —
THE EMBUDO'S BLK. FCTR. WAS EST. AT
25% DURING THE JULY '88 STORM w/

¹ Assume that of the 2670 C.Y. of estimated scour in 1984, approximately 30% was transported during the October 15, 1984 storm, a 2-year frequency event. Then, $30\% \times 2670 = 800$ C.Y. of scour during the storm. The typical 2-year storm runoff generates about 91,800 C.Y. of water in the watershed. The ratio of sediment volume to water volume is then: $800/91600 = 0.009$ or .9%. WHEN THE

ACADEMY STUDENTS BEGIN TO
MONITOR THIS ARROYO, WE NEED
TO LOOK @ THE DATA.

GSR
12/89

Recommendation 1.

Mitigation of Channel Instability. Three possible solutions for stabilizing the arroyo are presented below along with preliminary cost estimates for each. The first two, concrete and riprap lining, are proven methods for complete stabilization, but are not in keeping with the Academy philosophy of maintaining a natural environment for the campus. The third alternative proposes construction of a "siltation chamber" to inject sacrificial sediment into the "hungry" flows before they begin scouring the channel. This proposal will mitigate instability, but not completely stabilize the channel reach.

Concrete Lining. Concrete lining has, in similar situations, provided a solution to the problems presented above. The cost of lining the 6400-foot stretch is roughly \$1,500,000.00, of which approximately one quarter would fall to the Hoffmantown Baptist Church. However, concrete lining is not compatible with the Academy's vision of retaining a natural environment. The situation is complicated by the varied spheres of interest in the arroyo. AMAFCA retains the easement through the property. The City of Albuquerque has approval authority over any arroyo improvements and has tentatively committed \$200,000.00 towards concrete lining of the reach between Ventura and Wyoming. While these two entities have agreed to consider a naturalistic approach for the short term, they may well consider concrete lining inevitable in the future. While Bohannon-Huston Inc. acknowledges this possibility, our study indicates that the installation of the preferred solution (see Siltation Chamber below) can extend the life of the natural arroyo 20 to 40 years. \$ 235 PLF

Riprap Lining. The use of riprap for lining is an aesthetic compromise between no lining and concrete lining. Its drawback is its relatively large cost. Riprap lining of 6400 feet of channel would cost approximately \$2,750,000.00, or about \$1,250,000 more than the concrete option. \$ 430 PLF

Siltation Chamber. In order to address the problem of hungry water entering the earth channel at Ventura and at the same time maintain a natural environment throughout the Academy reach, this study proposes an innovative approach. We propose the construction of a siltation chamber immediately downstream of the Ventura bridge to mix sediment with the "hungry" water entering the Academy grounds. Sacrificial sediment would be dumped in the chamber to be washed away instead of allowing the "hungry" water to scour the channel bed and banks. The sediment would then be collected just upstream of the Wyoming bridge in the City-designed sediment trap for recycling (see Problem 2, Head Cut at Wyoming).

Similar injection schemes have been used for years in Pakistan to protect scour-prone irrigation canals. In Pakistan, large augers are used to mechanically inject sediment into the "clean"

mountain water entering the irrigation canals. This study proposes to direct the natural flow at a high velocity over and through the sacrificial sediment, allowing the fast flowing "hungry" water to pick up sediment to its capacity.

Figure 4 displays a sketch of the proposed "siltation chamber". It consists of wire-enclosed riprap floor and walls to ensure stability of the slope during high velocity flows and encourages spreading of the water over the entire width of the sacrificial silt. A ramp is provided for truck access.

Several considerations are involved in sizing the structure. It must be capable of storing enough sediment to feed the flows between restocking intervals. It should be roughly the same volume as the sediment trap at Wyoming which can trap approximately 1500 C.Y. Economic considerations call for the minimal size that will still be functional. After investigating these factors, this study recommends a sacrificial sediment volume of 1500 C.Y. The initial restocking interval is estimated to be twice a year, but monitoring is required to determine the interval. In order to contain the 1500 C.Y. of sacrificial sediment, the siltation chamber dimensions must be roughly 60' wide by 300' long.

The cost for the siltation chamber is estimated to be \$110,000.00. The transfer of 1500 C.Y. of material from the sediment trap to the siltation basin twice each year is estimated at \$10,000.00. The restocking interval will, of course, determine the average yearly cost. \$ 17 PLF

Problem 2--Head Cut at Wyoming.

In its Design Drawings, "Pino Arroyo Corridor Improvements," City Project #2151, the City of Albuquerque has designed a sediment trap just upstream of the Wyoming bridge to prevent large quantities of sediment from leaving the Academy grounds and entering the soon-to-be-built concrete channel downstream of Wyoming. Figure 5A shows this desilting basin.

The potential head cut has been described previously in the CONSEQUENCES TO THE ARROYO section of this report. The problem develops at the upstream end of the desilting basin (Figure 5A) where the City design calls for a 7.5% slope upstream, much steeper than the 2.4% slope of the existing channel. This is where the head cut will develop.

Recommendation 2.

Drop Structure. To prevent this cutting, a drop structure is needed to safely lower the water from the existing stream bed level to the floor of the sediment trap, a distance of about 11 vertical feet. Although various materials can be used to construct such a drop structure, the most widely used in the Albuquerque area are concrete and gabion baskets. A sketch of such a

drop structure using reinforced concrete is shown on Figure 6. A modification of the City's sediment trap incorporating a gabion drop structure is shown on Figure 5B. Photos of gabion drop structures installed on Albuquerque's West Mesa are shown on page 19. While concrete drops are usually less expensive, the gabion structures are more natural and aesthetically pleasing.

This study estimates an appropriate concrete structure to cost \$90,000.00, while an equivalent gabion structure would cost \$120,000.00.

\$19 PLF
17
\$36 PLF

\$14 PLF
+ 17
\$31 PLF

Problem 3--Arroyo Crossing for the Access Road to Harper.

The least expensive alternative for a private drive accessing the campus from Harper Road is the use of a low-flow crossing of the arroyo. The street pavement would dip down at the arroyo and cross at the existing level of the stream bed. During low flows or no flows, traffic could cross the arroyo. During larger flows, traffic would be temporarily impaired. During each flow, a certain amount of debris would accumulate on the dip section, requiring maintenance after the flow. However, the cost savings compared to the construction of a bridge are considerable. A sketch of cutoff walls and riprap needed to protect the crossing is shown on Figure 7.

Recommendation 3.

Crossing Structure. Several options are available when considering a bridge-type crossing. An aesthetically pleasing alternative would be the construction of a wooden bridge similar to the sketch on Figure 8. Such a spanning structure would not restrict flow or cause sediment to drop out above the bridge. A culvert crossing would be more economical, but the required constriction causes sediment to drop out from the slower moving water upstream of the culvert and scour to occur just downstream of the culvert. A culvert crossing is depicted on Figure 9.

Cost estimates for construction and maintenance of each type of crossing structure are presented below:

<u>Crossing Structure</u>	<u>Construction Cost</u>	<u>Maintenance</u>
Low-Flow Crossing	\$38,000	\$4000/year
Concrete Box Culvert	\$145,000	\$600/year
Wooden Span Bridge	\$320,000	\$1000/year

Considering aesthetics, maintenance and flow hydraulics, the span bridge is easily the preferred solution. This must, however, be weighed against the comparatively high cost of construction.

Problem 4--Grading at Hoffmantown Baptist Church.

The change in flood plain resulting from the Hoffmantown Church grading is expected to be slight. The potential for scouring of this new grading is, of course, the responsibility of the Church and not of the Academy. However, further encroachment into the floodplain by the Church would result in a severe impact to the Academy land across the arroyo. This encroachment has an additional influence. The ideal location of the Academy perimeter fence in the vicinity is the north bank of the arroyo. This would allow the fence to cross the arroyo on the Ventura Bridge.

In order to workout a mutually beneficial plan for both the fence location and the arroyo treatment, immediate negotiations between the Academy and the Church are needed.

Problem 5--Discharge from the North.

It is difficult to gage the future impact of the drainage outfalling into the South Pino Arroyo from the north. It is the recommendation of this report that these outfalls be monitored periodically for early signs of damage. At such times as action is required, the City of Albuquerque should be notified and included in the solution.

MONITORING

Because little is known about sediment injection in this country, the proposed channel stabilization scheme presented in this report should be closely monitored. Horizontal and vertical movements of the channel should be recorded and analyzed. The amount of sacrificial sediment moved by the flows should be measured periodically, and adjustments made in the restocking interval when required.

Two interesting opportunities are presented in this innovative project. First, the monitoring and analysis of the arroyo would make an excellent study for the Academy's Outdoor Classroom. With appropriate guidance and survey help when needed, the students could observe the intricacies of a dynamic natural waterway.

Secondly, the uniqueness of the project and its potential application to other projects where a natural approach to arroyo stabilization is desired lead to the conclusion that wider exposure is deserved. Should the Academy choose this approach, detailed documentation of the project and subsequent monitored results could well lead to a publishable study. The involvement of Academy students in the study would be an attractive addition.

SUMMARY

The mitigation of instability of a natural arroyo in an urban environment is a difficult and seldom attempted task. The approach presented in this report has been successfully implemented overseas in a slightly different form. This approach, while initially less expensive than conventional lining of the arroyo, is less proven and potentially more expensive in the long run, should maintenance in the future prove extensive.

The concept of recycling the sediment involves periodic trucking of silt from the sediment trap to the siltation chamber. With each storm, some sediment will evade the trap and be carried downstream. Eventual degradation is inevitable in the upper reaches, but scouring will be mitigated by the sediment injection approach. Our study predicts scour of around one foot every five years if the siltation chamber is installed. However, a large storm, such as the 10-year or 100-year event, though statistically rare, could occur at any time. Scour from these large storms could quickly deplete the sacrificial sediment and eat into the banks and bed of the arroyo. The naturalistic approach, while aesthetically and environmentally pleasing, carries risks. The costs of the alternative approaches can be likened to the deductible of an insurance policy. The siltation chamber approach has low payments but a high deductible. The conventional lining approach carries a high initial payment but the deductible--and the risk--is negligible.

The problem of the potential head cut moving upstream from Wyoming needs to be addressed in the near future. If the proposed Wyoming bridge is completed before the 1987 rainy season (July through September), the unprotected arroyo will begin to show erosion by winter. The Academy is left to express its preference between the gabion or concrete drop structure. Preferences for the road crossing structure accessing Harper also need to be determined.

The problem of vehicular and pedestrian intrusion into the Academy property has not been addressed in the Drainage Study portion of this report, but will be investigated in the Access/Circulation Analysis. Bohannon-Huston Inc. is coordinating with Walt Weaver in planning the fencing of the property perimeter. In regards to drainage, it would be highly preferable to avoid an arroyo crossing by the fence, as such a crossing would be expensive and require frequent maintenance.

We recommend approaching the Hoffmantown Baptist Church immediately to coordinate a mutually beneficial fence located on the south bank of their property and a mutually acceptable arroyo treatment along the reach shared by both.

CONSTRUCTION RECOMMENDATIONS

While the hydrology and sediment transport characteristics of the arroyo have been studied in detail, the structures required are presented in concept with very preliminary estimates of costs. Detailed designs for the drop structure, the siltation chamber and the arroyo crossing of the access road to Harper need to be prepared. A monitoring plan is required. In specific, the following tasks are now appropriate:

1. Design of the drop structure above the proposed Wyoming bridge and modification of the sediment trap as needed to insure adequate volume and access for sediment removal.
2. Design of the siltation chamber just below the Ventura bridge.
3. Design of the crossing structure for the access road from the campus to Harper Road.
4. Preparation of a monitoring plan for the arroyo, incorporating student involvement if appropriate.
5. Arrangement for construction inspection and survey for construction staking to insure compliance with the plans and specifications.
6. Negotiation with the City of Albuquerque and AMAFCA whenever necessary to insure acceptance of the designed solutions and an equitable and appropriate cost sharing.