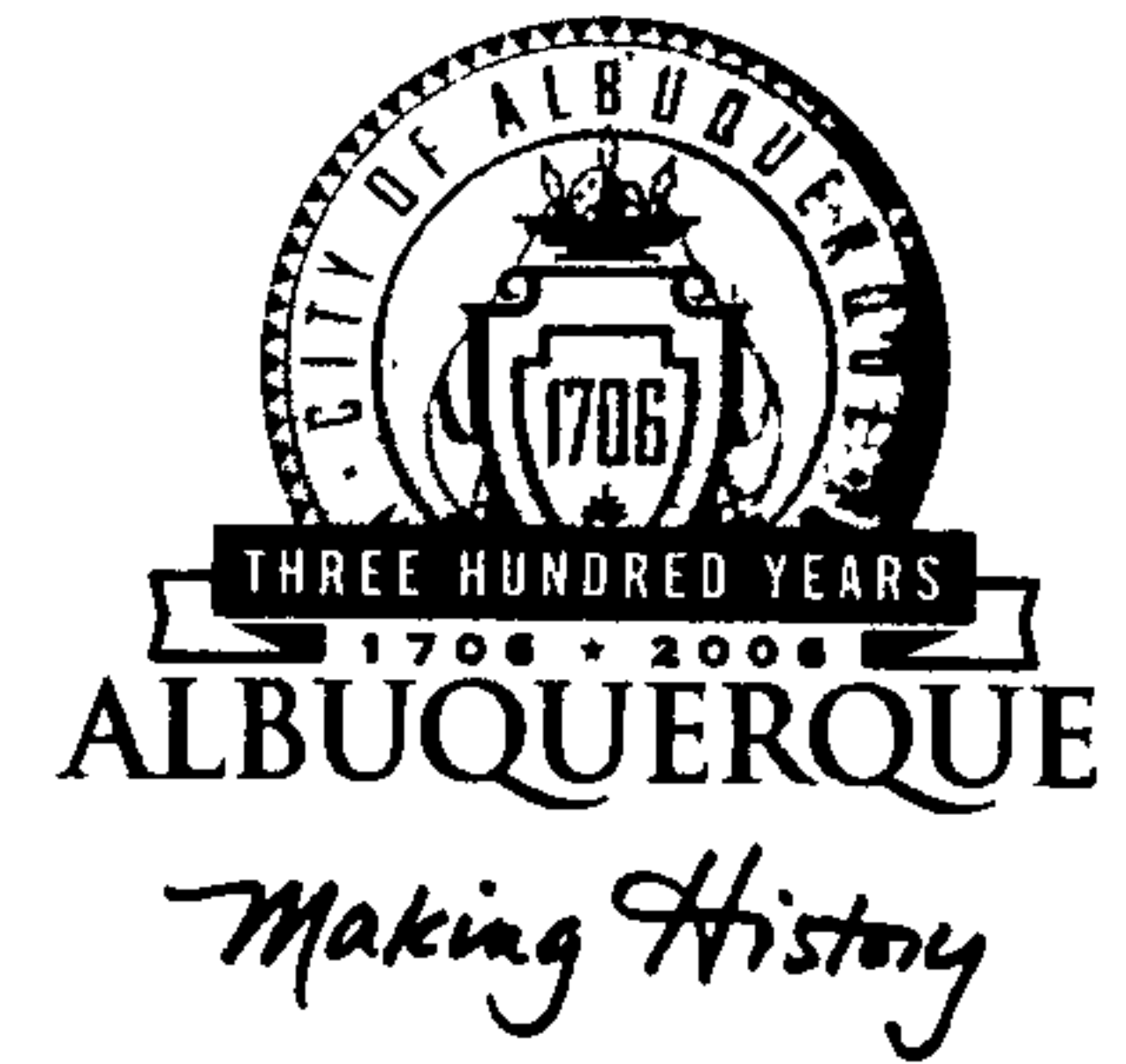


CITY OF ALBUQUERQUE



April 1, 2005

David A. Aube, P.E.
T.H.E. Group
4001 Juan Tabo NE - Suite A
Albuquerque, NM 87111

Re: Principios Medical Office, 1625 University Boulevard NE
Grading and Drainage Plan - Engineer's Stamp dated 02-08-05 (H15-D8)

Dear Mr. Aube,

Based upon the information provided in your submittal dated 03-25-05, the above referenced plan is approved for Building Permit. Please attach a copy of this approved plan to the construction sets prior to sign-off by Hydrology and prior to release of Certificate of Occupancy an Engineer's Certification of the grading plan per the DPM checklist will be required.

Additionally, this project requires a National Pollutant Discharge Elimination System (NPDES) Permit. Refer to the attachment that is provided with this letter for details. If you have any questions please feel free to call the Municipal Development Department, Hydrology section at 768-3654 (Charles Caruso).

If you have any other questions, you can contact me at 924-3990.

Sincerely,

Phillip J. Lovato, E.I.

Associate Engineer, Planning Department
Development and Building Services

C: Chuck Caruso, DMD
file

P.O. Box 1293

Albuquerque

New Mexico 87103

www.cabq.gov

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/28/2003rd)

H-15/D8

PROJECT TITLE: Principios Medical Office

DRB #: _____

EPC#: _____

ZONE MAP/DRG. FILE #: H-15-Z

WORK ORDER#: _____

LEGAL DESCRIPTION: Lot 2A1, Block 0000, ABQ Board of Realtors

CITY ADDRESS: 1625 University Boulevard

ENGINEERING FIRM: THE Group

ADDRESS: 4001 Juan Tabo N.E. Suite A

CITY, STATE: Albuquerque, NM

CONTACT: David Aube

PHONE: 292-3202

ZIP CODE: 87111

OWNER: Principios Medical

ADDRESS: _____

CITY, STATE: Albuquerque, NM

CONTACT: _____

PHONE: _____

ZIP CODE: 87111

ARCHITECT: The Design Group

ADDRESS: 202 Central Avenue Suite 200

CITY, STATE: Albuquerque, NM

CONTACT: Doug Majewski

PHONE: 242-6880

ZIP CODE: 87106

SURVEYOR: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

CONTRACTOR: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
- ☐ DRAINAGE PLAN 1st SUBMITTAL, **REQUIRES TCL or equal**
- ☐ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL GRADING & DRAINAGE PLAN
- ☒ GRADING PLAN
- ☐ EROSION CONTROL PLAN
- ☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEERS CERTIFICATION (TCL)
- ☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ☐ OTHER

CHECK TYPE OF APPROVAL SOUGHT:

- ☐ SIA / FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
- ☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ FOUNDATION PERMIT APPROVAL
- ☒ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM.)
- ☐ CERTIFICATE OF OCCUPANCY (TEMP.)
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ OTHER (SPECIFY)

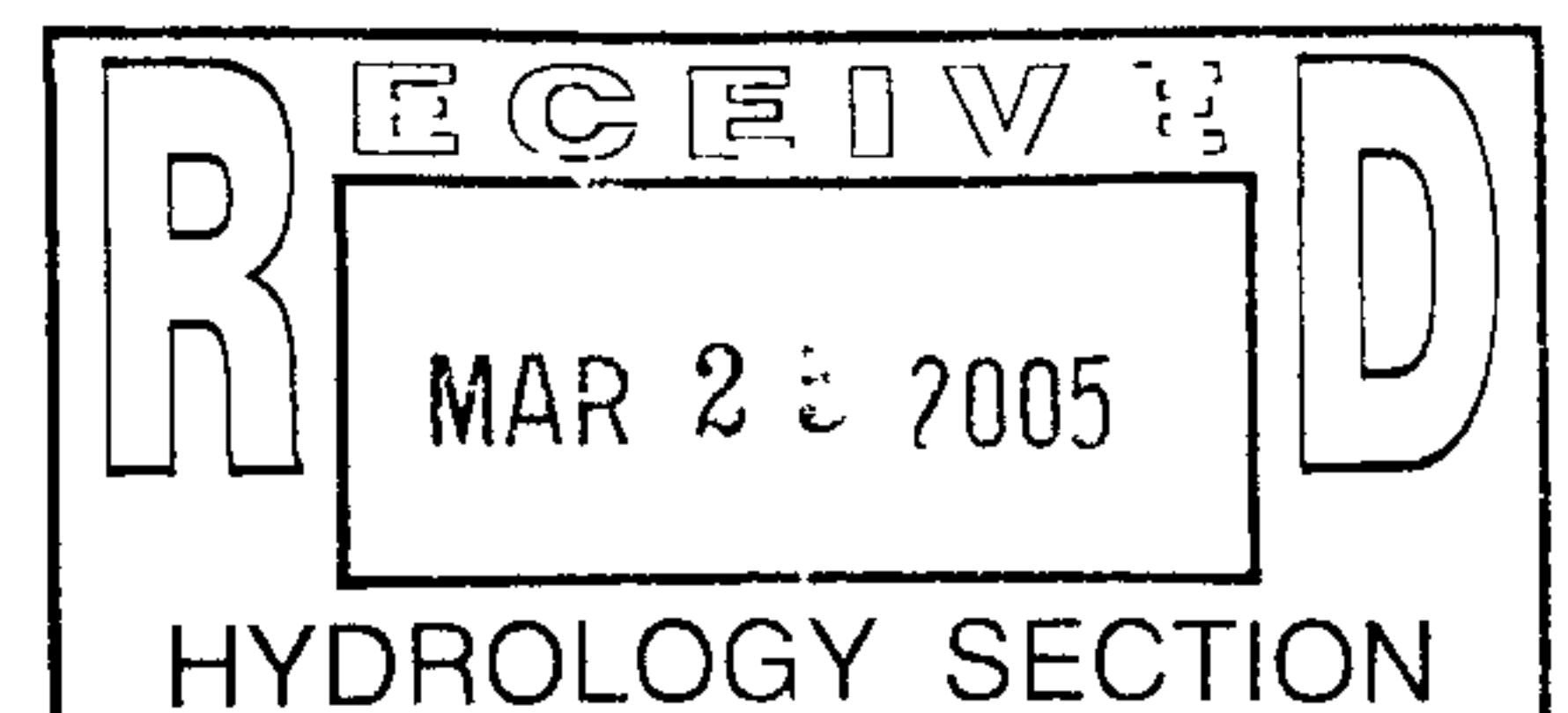
WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
- ☐ NO
- ☐ COPY PROVIDED

<Resub>

DATE SUBMITTED: 3-25-05

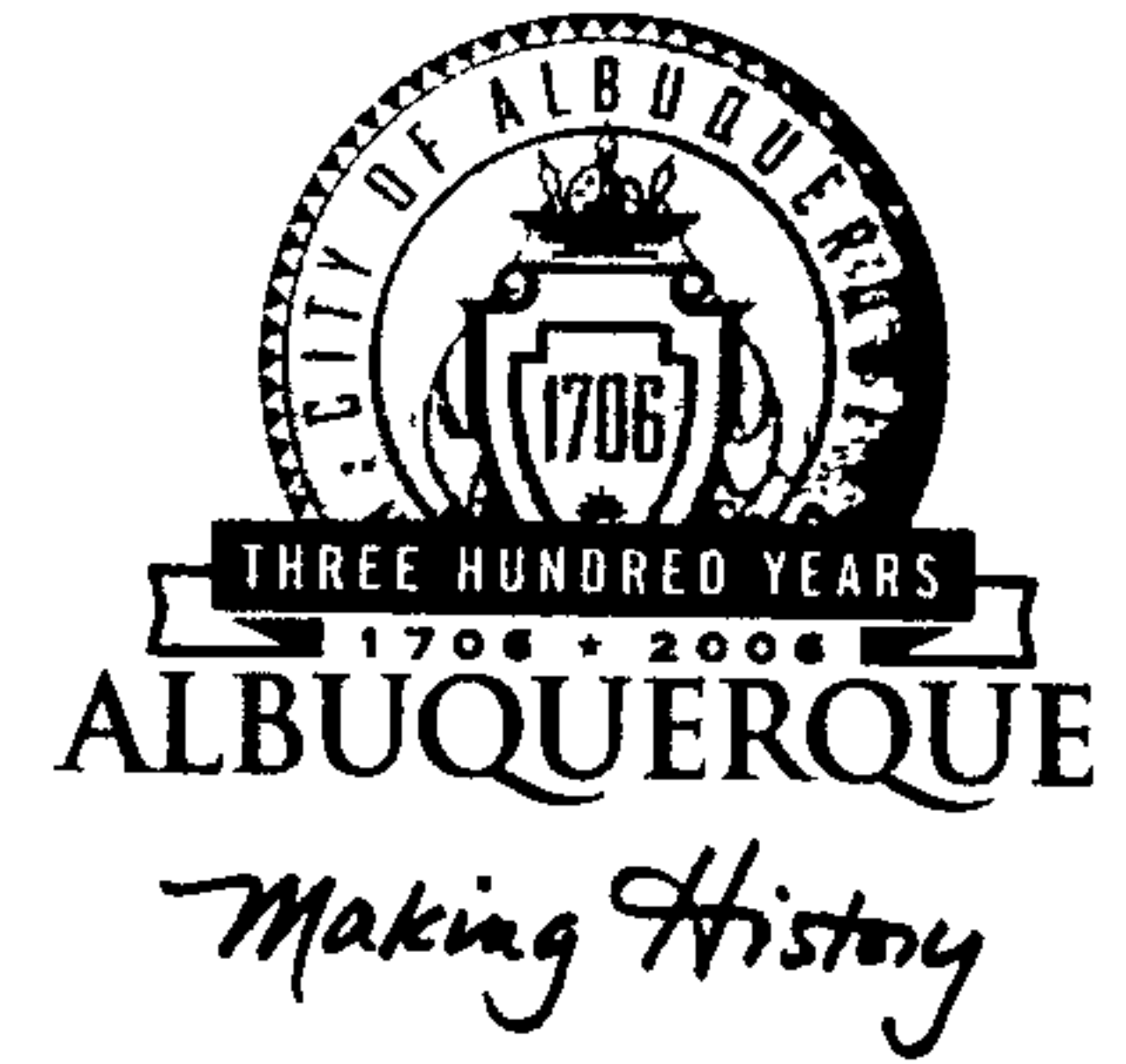
BY: David Aube P.E.



Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location and scope of the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

CITY OF ALBUQUERQUE



March 17, 2005

David A. Aube, P.E.
T.H.E. Group
4001 Juan Tabo NE, Suite A
Albuquerque, NM 87111

**Re: Principios Medical Office, 1625 University Boulevard NE
Drainage Report • Engineer's Stamp dated 01-18-05 (H15-D8)**

Dear Mr. Aube,

Based upon the information provided in your submittal dated 01-18-05, the above referenced report is approved in concept. However, prior to Building Permit approval please provide a Grading and Drainage Plan for our review.

P.O. Box 1293

If you have any questions, you can contact me at 924-3986.

Albuquerque

Sincerely,

Bradley L. Bingham, PE
Principal Engineer, Planning Dept.
Development and Building Services

New Mexico 87103

C: file

www.cabq.gov

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/28/2003rd)

PROJECT TITLE: Principios Medical Office
DRB #: _____ EPC#: _____

ZONE MAP/DRG. FILE #: H-15-118
WORK ORDER#: _____

LEGAL DESCRIPTION: Lot 2A1, Block 0000, ABQ Board of Realtors
CITY ADDRESS: 1625 University Boulevard

ENGINEERING FIRM: THE Group
ADDRESS: 4001 Juan Tabo N.E. Suite A
CITY, STATE: Albuquerque, NM

CONTACT: David Aube
PHONE: 292-3202
ZIP CODE: 87111

OWNER: Principios Medical
ADDRESS: _____
CITY, STATE: Albuquerque, NM

CONTACT: _____
PHONE: _____
ZIP CODE: 87111

ARCHITECT: The Design Group
ADDRESS: 202 Central Avenue Suite 200
CITY, STATE: Albuquerque, NM

CONTACT: Doug Majewski
PHONE: 242-6880
ZIP CODE: 87106

SURVEYOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
- ☒ DRAINAGE PLAN 1st SUBMITTAL, **REQUIRES TCL or equal**
- ☐ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL GRADING & DRAINAGE PLAN
- ☐ GRADING PLAN
- ☐ EROSION CONTROL PLAN
- ☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEERS CERTIFICATION (TCL)
- ☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ☐ OTHER

CHECK TYPE OF APPROVAL SOUGHT:

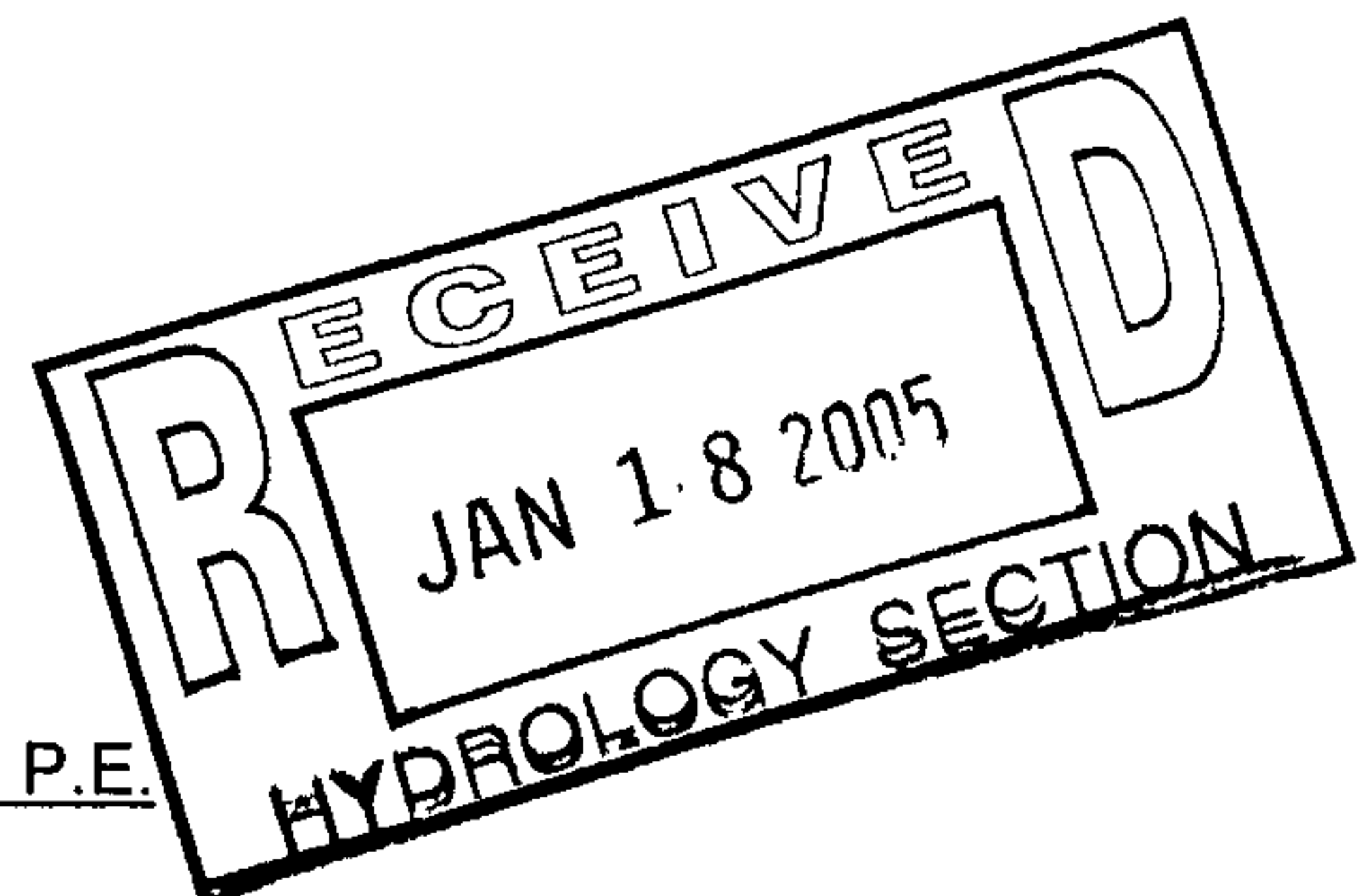
- ☐ SIA / FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
- ☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ FOUNDATION PERMIT APPROVAL
- ☒ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM.)
- ☐ CERTIFICATE OF OCCUPANCY (TEMP.)
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
- ☐ NO
- ☐ COPY PROVIDED

DATE SUBMITTED: 1-18-05

BY: David Aube P.E.

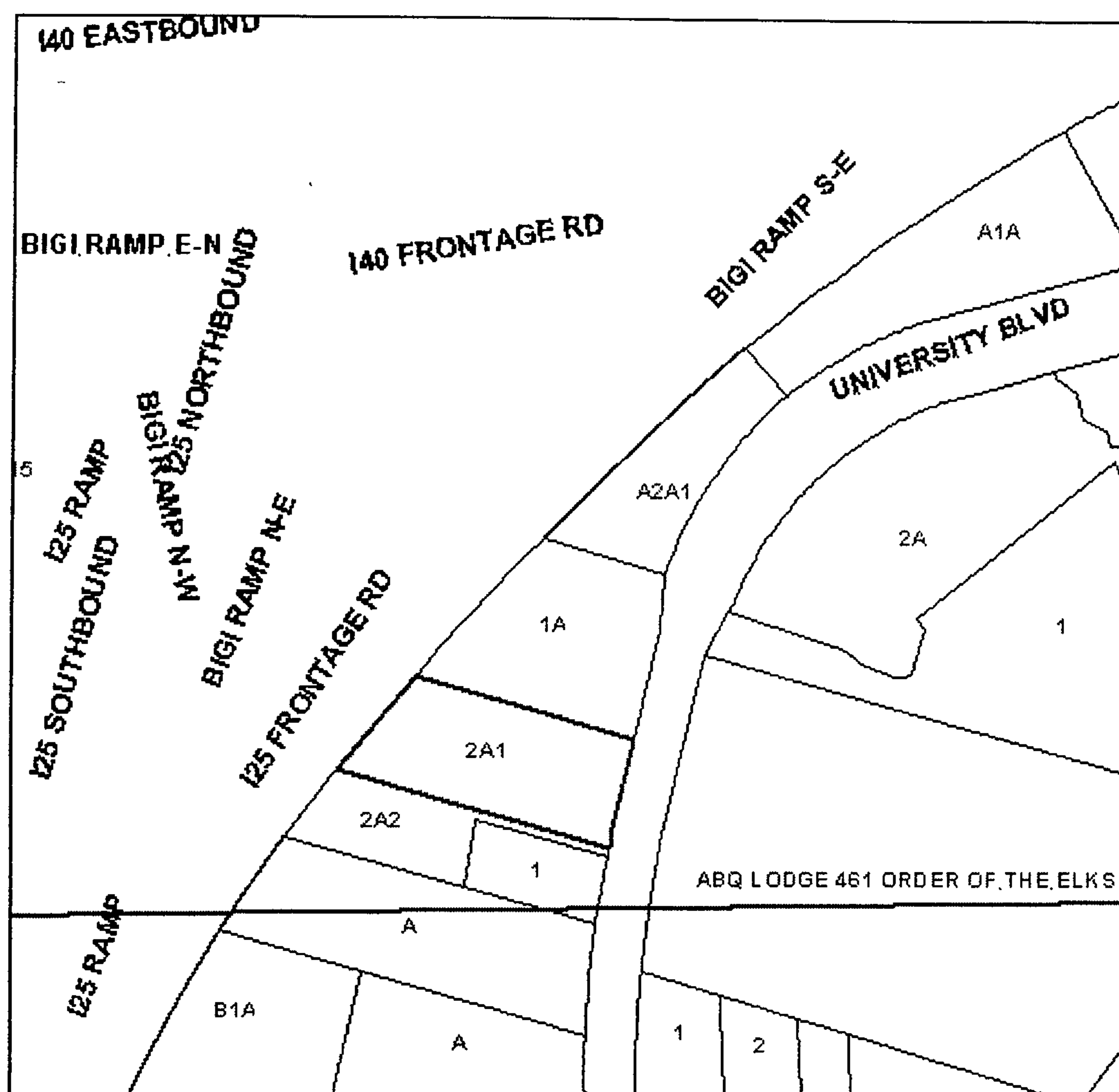


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1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
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ACTIVATE BUTTONS BY 'CLICKING' ON THE MAP

☐ Zoom In
 ☒ Id Address
 ☐ Id ZM
 ☐ Pan
 ☐ Zoom Out



ReDraw Screen

LAYER LEGEND

- ☒ STREET NAMES
☐ PARKS
☐ CITY LIMITS
☒ ZONE MAP GRID

☐ NBR BOUNDARY
☐ COMMUNITY PLAN
☐ WATER LINES
☐ SEWER LINES
☐ STORM DRAINS
☐ ZONING
☒ LOT NUMBERS
☐ ZIP CODES
☐ COUNCIL DISTRICT
☐ FLOOD ZONES (dis)
☒ PARCELS
☐ CONTROL STATION
☐ SENATE DIST.
☐ REPRESENTATIVE I
☐ COUNTY COMMISS
☐ PARCEL ADDRESS
☐ CRIMINAL ACTIVIT
☐ PUBLIC FACILITIES
☐ LAND USE
☐ 1960 CITY LIMITS
☐ LANDFILLS/BUFFE
☐ CRP LOCATIONS

SHOW LOCATION M

SHOW 1999 AERIAL

Selected Address: 99999 UNIVERSITY BLVD NE

Zoning: C-3 Lot/Block/Subd: 2A1, 0000, ABQ BOARD OF REALTORS

Council District/Name: THREE, GRIEGO County Commission: 3

Nbr Assoc: Nothing Selected Comp. Plan: Established Urban

Voter Pct: 345

High Sch District: ALBUQUERQUE Mid Sch District: JEFFERSON

ZoneMap Page: H15 Jurisdiction: CITY

Police Beat: 322/SOUTHEAST

Flood Zone: ZONE X

Comm Plan Area: NEAR HEIGHTS

UPC #: 101505931800840505

Owner Name: ALBUQUERQUE BOARD OF REALTORS

Owner Street Address: PO BOX 25605

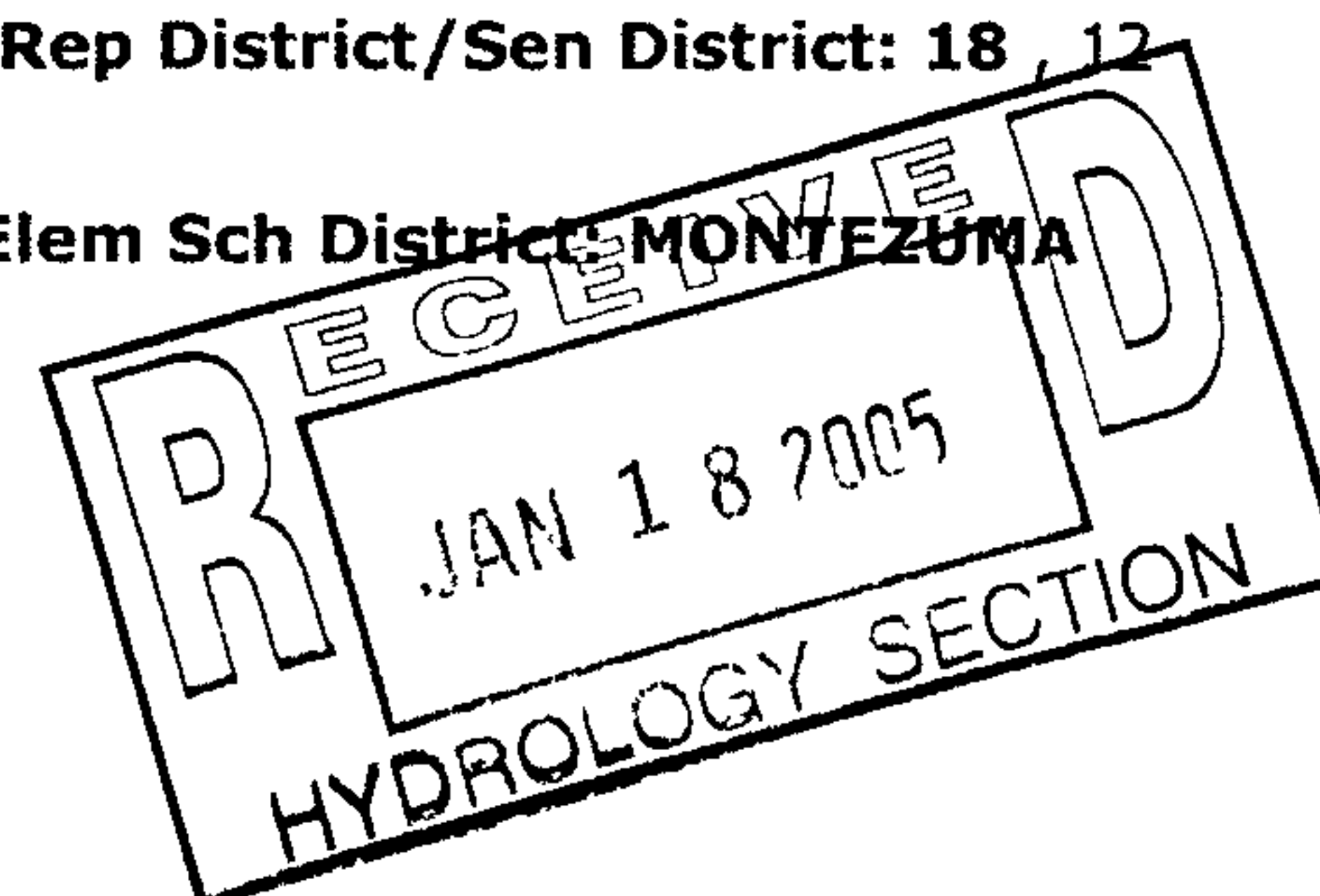
Owner City/State/Zip: ALBUQUERQUE / NM / 87125 0605 NM

Note: Accuracy for Owner info cannot be guaranteed correct.

Please check with the Bernalillo County Assessor for official data.

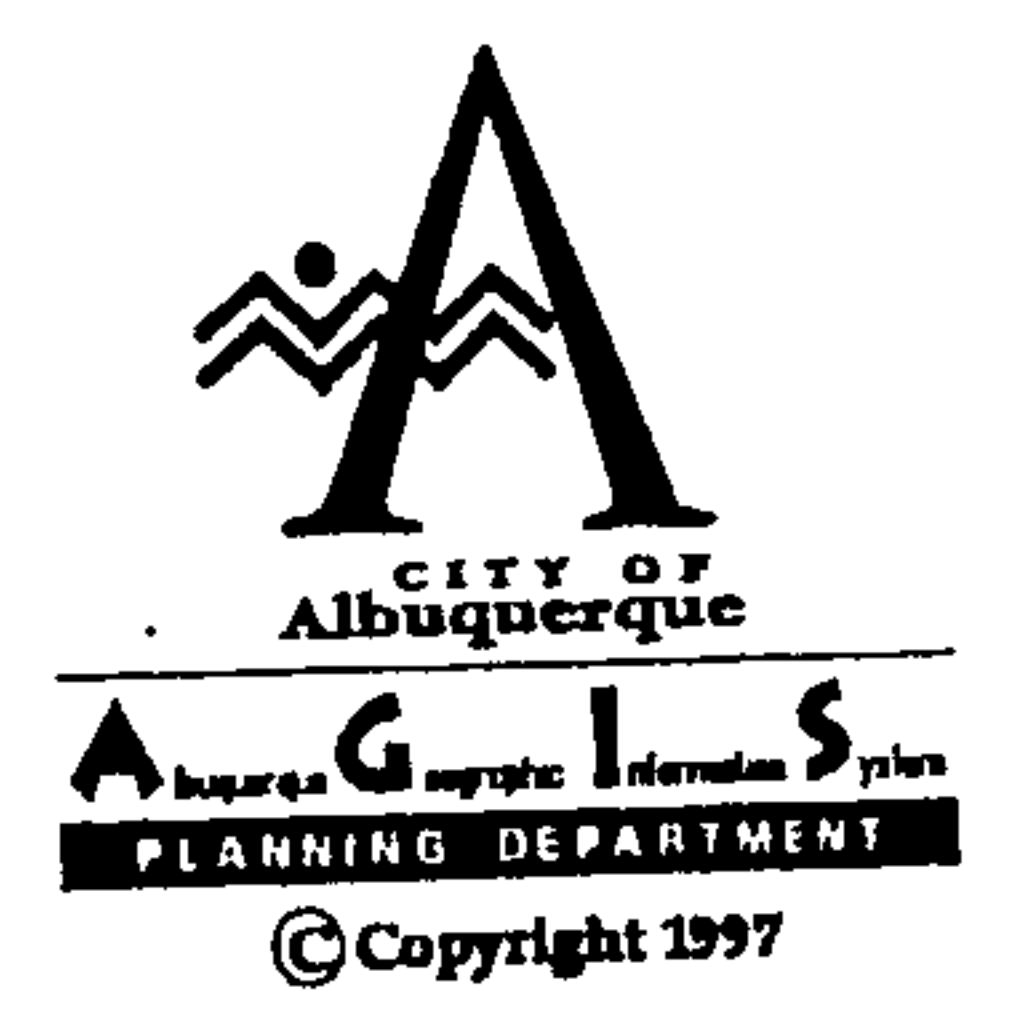
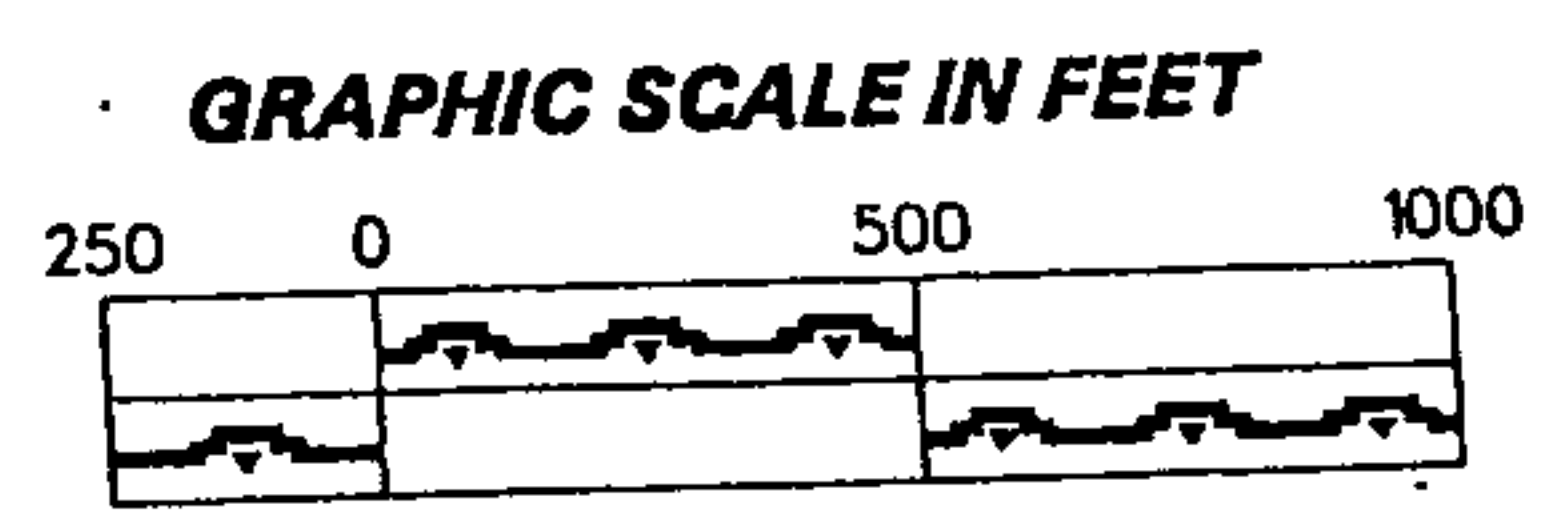
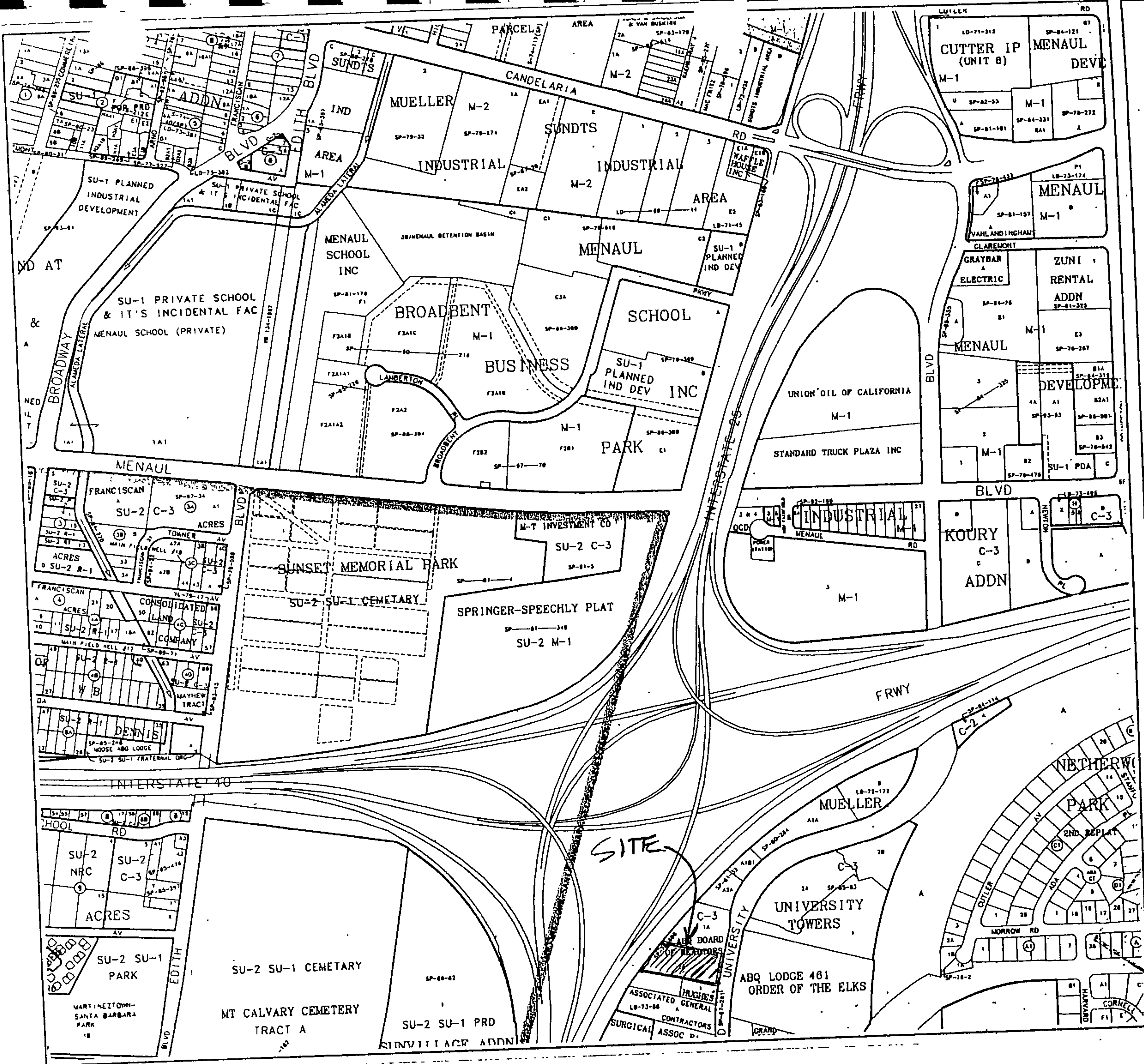
Rep District/Sen District: 18, 12

Elem Sch District: MONTEZUMA

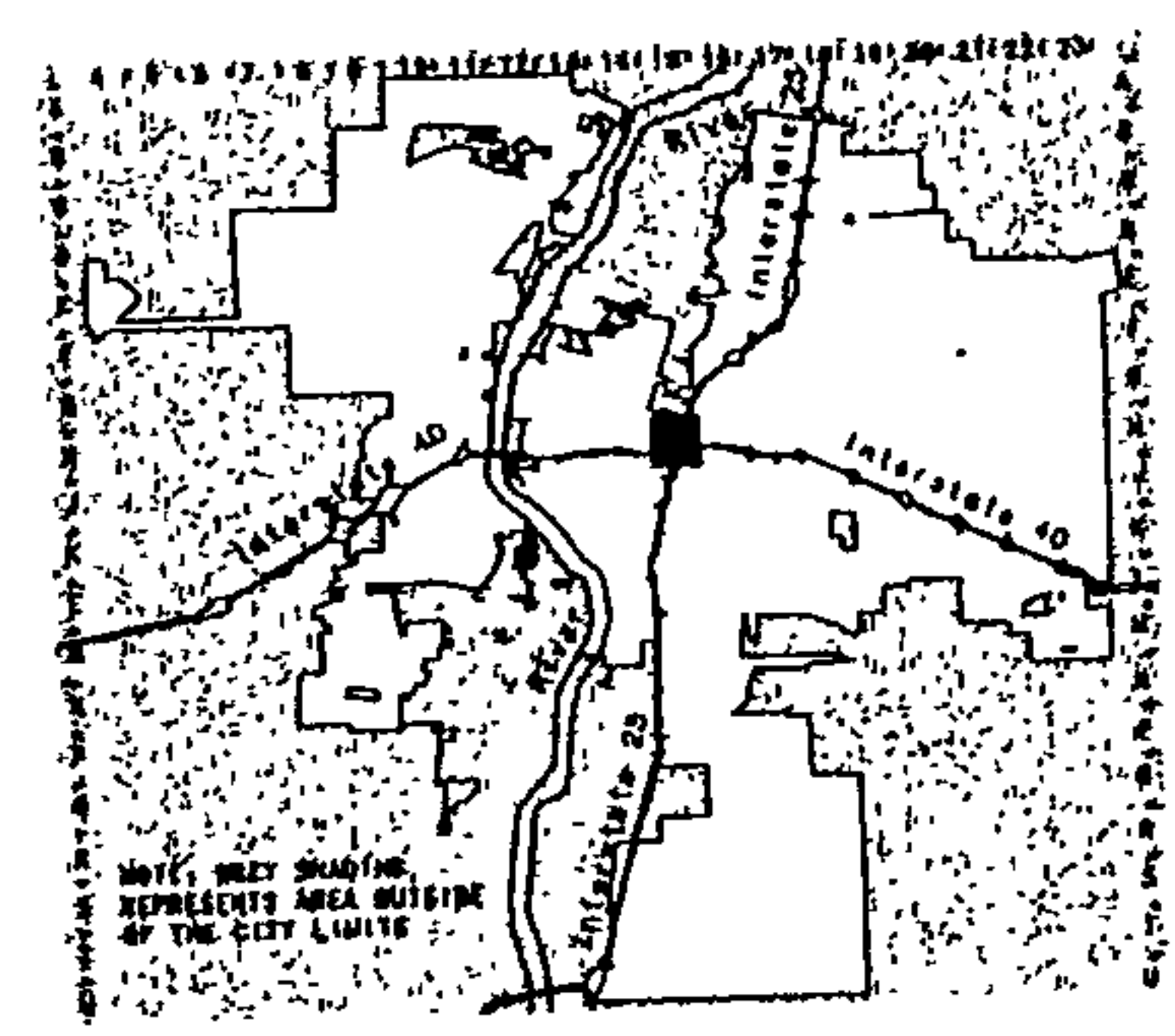


SEARCH FOR OTHER SERVICES AROUND THIS ADDRESS

ZOOM LEVEL MEDIUM ☐TEXT SIZE MEDIUM ☐

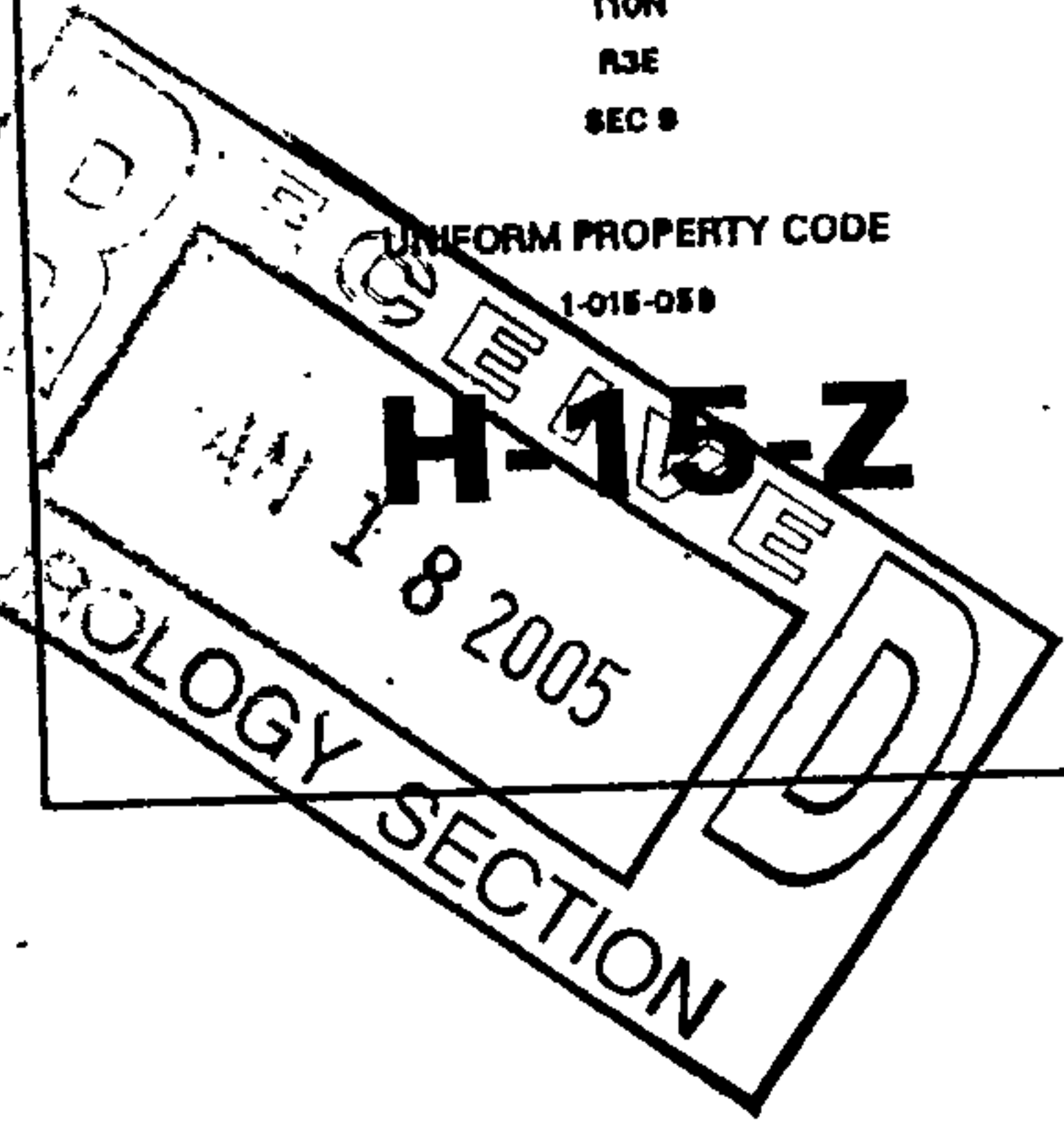


Map Amended through June 19, 1997



LEGAL DESCRIPTION
T10N
R3E
SEC 8

UNIFORM PROPERTY CODE
1-015-059



TOPOLOGY SECTION

Drainage Report

For

**Proposed
Principios Medical Office Center**

**Located on
University Boulevard**

Prepared for
The Hartman Majewski Design Group

Prepared by
T.H.E. Group
Telck Hensley Engineering Group

January 2005

Drainage Report

For

**Proposed
Principios Medical Office Center**

**Located on
University Boulevard**

Prepared for
The Hartman Majewski Design Group

Prepared by
T.H.E. Group
Telck Hensley Engineering Group



January 2005

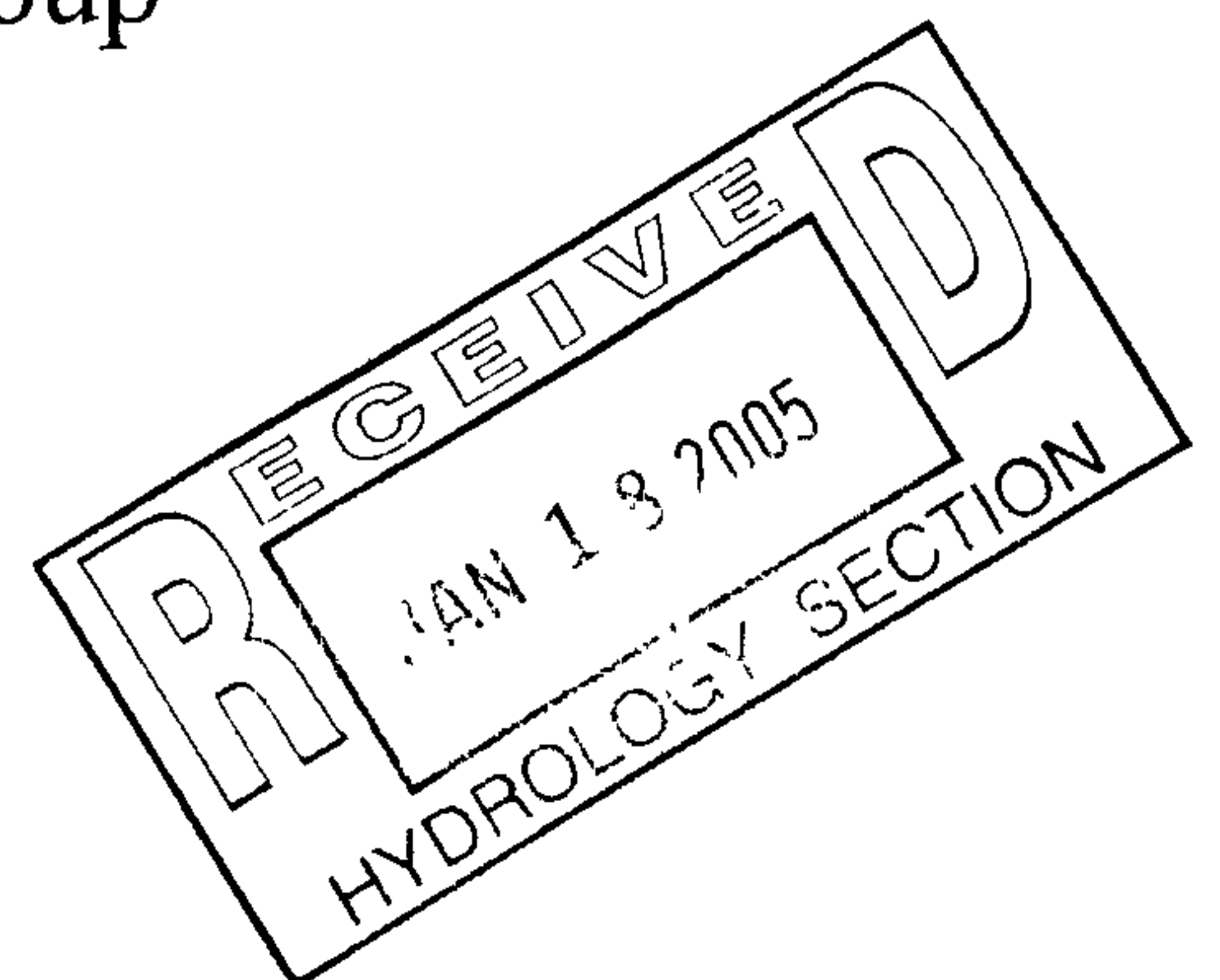


Table of Contents

- I. Purpose and Scope
- II. Site Description and History
- III. Computational Procedures
- IV. Precipitation
- V. Existing Drainage Conditions Overview
- VI. Drainage Management Plan
- VII. Conclusions

Appendices

- Appendix A Soil Survey
- Appendix B Flood Plain Data
- Appendix C Existing Conditions Hydrology Computations
- Appendix D Proposed Conditions Hydrology Computations
- Appendix E Basin Maps, and Analysis from URS on BIG I Project

Principios Medical Office Center

I. Purpose

The purpose of this report is to present a drainage management plan and a comprehensive analysis of the drainage control measures to be implemented with the construction of the Principios Medical Office Center to be constructed on Lot 2A1, ABC Board Of Realtors. The site is currently zoned C-3, and is part of the Established Urban Comprehensive plan.

II. Site Description and History

The site is currently vacant, and is bounded on the north by the Albuquerque Board of Realtors and on the south by Association of General Contractors. The site has a billboard located near University Boulevard and is bounded on the West by NMDOT ROW for I25.

III. Computation Procedures

Hydrologic analysis was performed utilizing the design criteria found in the City of Albuquerque DPM Section 22.2 released in June 1997.

IV. Precipitation

The 100year 6-hour duration storm was used as the design storm for this analysis. This site is within Zone 2 as identified in the DPM Section 22.2. Tables within the section were used to establish the 6-hour precipitation, excess precipitation volume and peak discharge.

V. Existing Drainage Conditions

The 1.4027 acre site, located within Zone Atlas H15Z is currently undeveloped. The site generally slopes from the South East toward the Northwest. The site appears to have been used for a laydown yard for another construction project because the surface is well compacted and gravelly. There is an existing drive pad located at the middle of the site for access to and from University Boulevard.

The site was included in the drainage analysis performed by URS for the Big I Project. Copies of the Existing and Proposed conditions have been included for easy reference. The site and those surrounding it were assumed to be 44% B

and 56% Soil treatment, for the analysis performed by URS. There is a concrete rundown channel that begins at the Southwest corner of the project site that drains North along the ROW boundary. A copy of this channel is enclosed for quick reference. NMDOT District Three has been contacted to request concentrated discharge points from the project site into the channel. They had no objections and simply requested that it be designed to reduce erosion between our parking area and the existing channel.

The existing runoff peak flowrate from the site at AP3 and AP6 combined, into the NMDOT ROW is ~~6.95~~^{7.17}cfs.

VI. **Proposed Drainage Conditions**

The proposed improvements include construction of a 14,000 sf. Office building and associated parking. The site and parking areas have been designed to harvest as much storm runoff into landscaping islands and buffers as possible. There will be 15% of the site that is dedicated to landscaping.

Overflows from the landscape buffers and islands will flow into rundowns that discharge into the existing concrete trench in the NMDOT ROW. The proposed peak runoff into NMDOT ROW through the two rip rap rundown channels will be less than 6.23. Flows from offsite basins 3 and 4 will flow directly into NMDOT channel at historic rates ~~1.11~~^{.17}cfs. This indicates that without any water harvesting there is an increase of ~~.39~~^{.17}cfs.

VII. **Conclusion**

The increase in flow rate is ~~0.39~~^{.17}cfs for the developed site. This increase is only 6% of the historic discharge and should have a minimal effect on downstream facilities.

Appendix A

1. Pages from Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico.

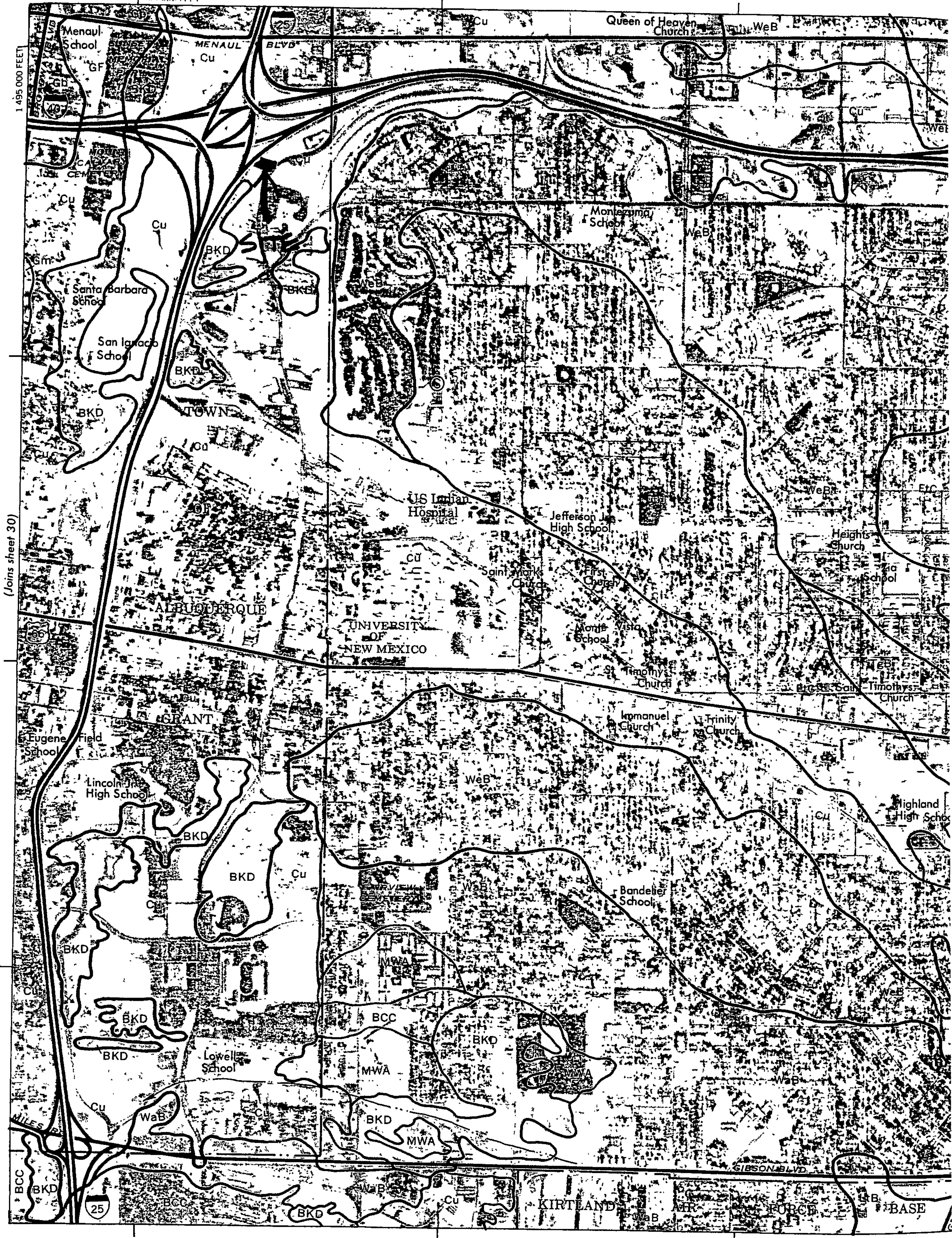
USDA, SCS and FS.

SOIL SURVEY OF
Bernalillo County and Parts of Sandoval
and Valencia Counties, New Mexico



United States Department of Agriculture
Soil Conservation Service and Forest Service
and
United States Department of the Interior
Bureau of Indian Affairs and Bureau of Land Management
in cooperation with
New Mexico Agricultural Experiment Station

385 000 1111



from above horizon; strongly calcareous with disseminated lime; moderately alkaline.

The A horizon has chroma of 3 or 4. It is stony loam or stony clay loam. The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5 dry, and chroma of 3 or 4 moist. It is clay or silty clay. The B3 and C horizons range from noncalcareous to strongly calcareous. They are mildly alkaline or moderately alkaline.

CAF—Carlito complex, 15 to 80 percent slopes. This mapping unit is about 55 percent Carlito stony loam and 30 percent a soil that is similar to the Carlito soil but is extremely stony.

This mapping unit is on the sides of canyons in the Manzanita Mountains in the Cibola National Forest where runoff is rapid and the hazard of water erosion is severe. Stones are about 5 to 30 feet apart on the surface of the Carlito stony loam, and sandstone fragments are on 25 to 90 percent of the surface on the other soil. Slopes are mainly 50 to 80 percent.

Included in this unit in mapping are areas of Seis soils, which make up 15 percent of the unit.

This mapping unit is used for range, wildlife habitat, recreation, and watershed. Dryland capability subclass VIIe; native plant community 7.

Cut and Fill Land

Cu—Cut and fill land consists of sandy loam and very gravelly sand that has been mixed by filling for residential, industrial, and business developments. It is on high terrace breaks of the Rio Grande Valley mainly in the city of Albuquerque. It is nearly level to moderately steep; slopes are 1 to 25 percent. Elevations range from 4,900 to 6,000 feet. The mean annual precipitation is 7 to 10 inches, the mean annual air temperature is 58° to 60° F, and the frost-free season is 165 to 195 days.

Included in this unit in mapping are a few areas of Bluepoint, Kokan, and Wink soils.

Runoff is slow to very rapid, and the hazard of erosion is slight to severe.

Cut and fill land is used for community development and watershed. Dryland capability subclass VIIe.

Embudo Series

The Embudo series consists of deep, well drained soils that formed in alluvium derived from decomposed, coarse grained, granitic rocks on old alluvial fans. Slopes are 0 to 5 percent. The native vegetation is principally mesa dropseed, blue grama, black grama, and some cholla cactus. Elevations range from 5,000 to 6,500 feet. The mean annual precipitation is 7 to 10 inches, the mean annual air temperature is 58° to 60° F, and the frost-free season is 170 to 195 days. Embudo soils are associated with Tijeras and Wink soils.

In a representative profile, the surface layer is brown gravelly fine sandy loam about 4 inches thick (fig. 4). Next is about 16 inches of brown and light brownish gray gravelly sandy loam. Below this to a depth of 60 inches or more is stratified, pale brown gravelly loamy coarse sand. The soil is moderately alkaline.

Permeability is moderate in the upper 20 inches and very rapid below. Available water capacity is 3 or 4 inches. Effective rooting depth is 60 inches or more.

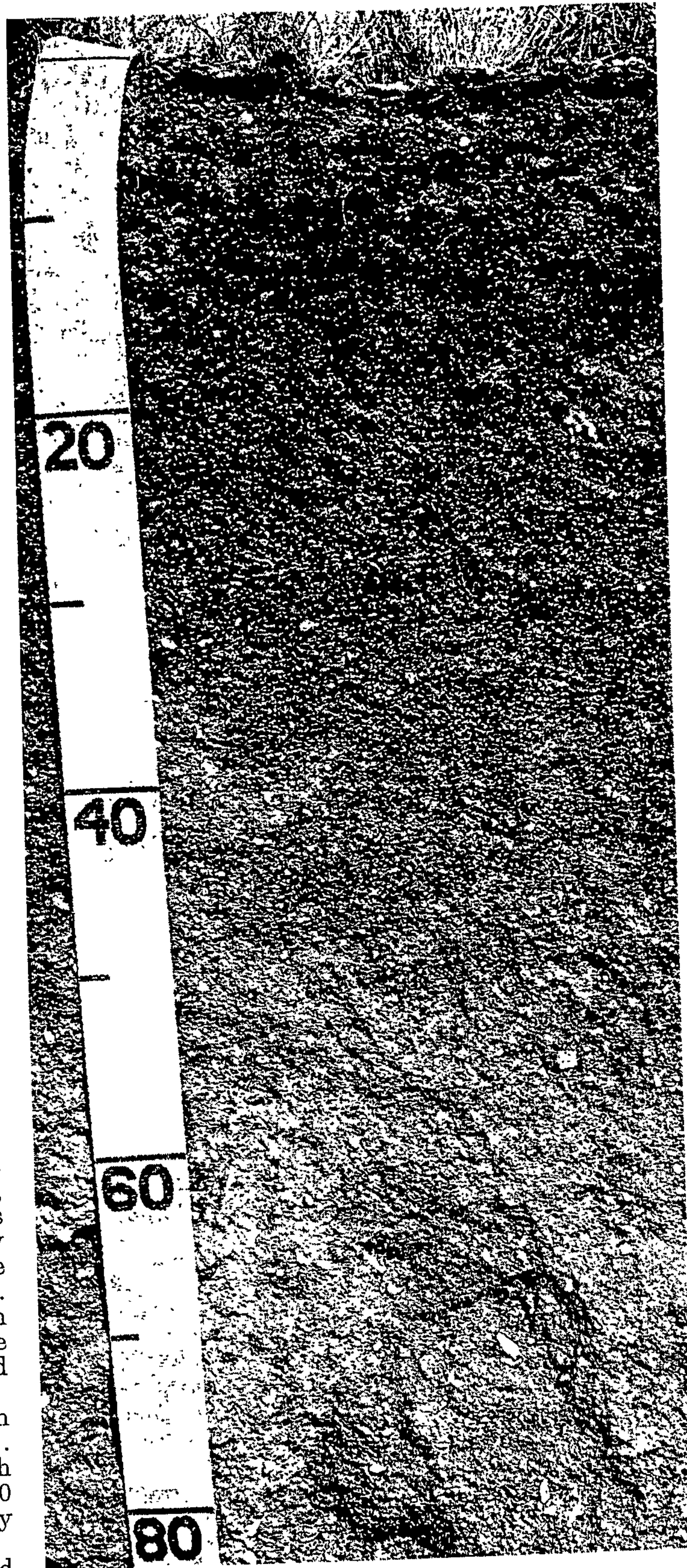


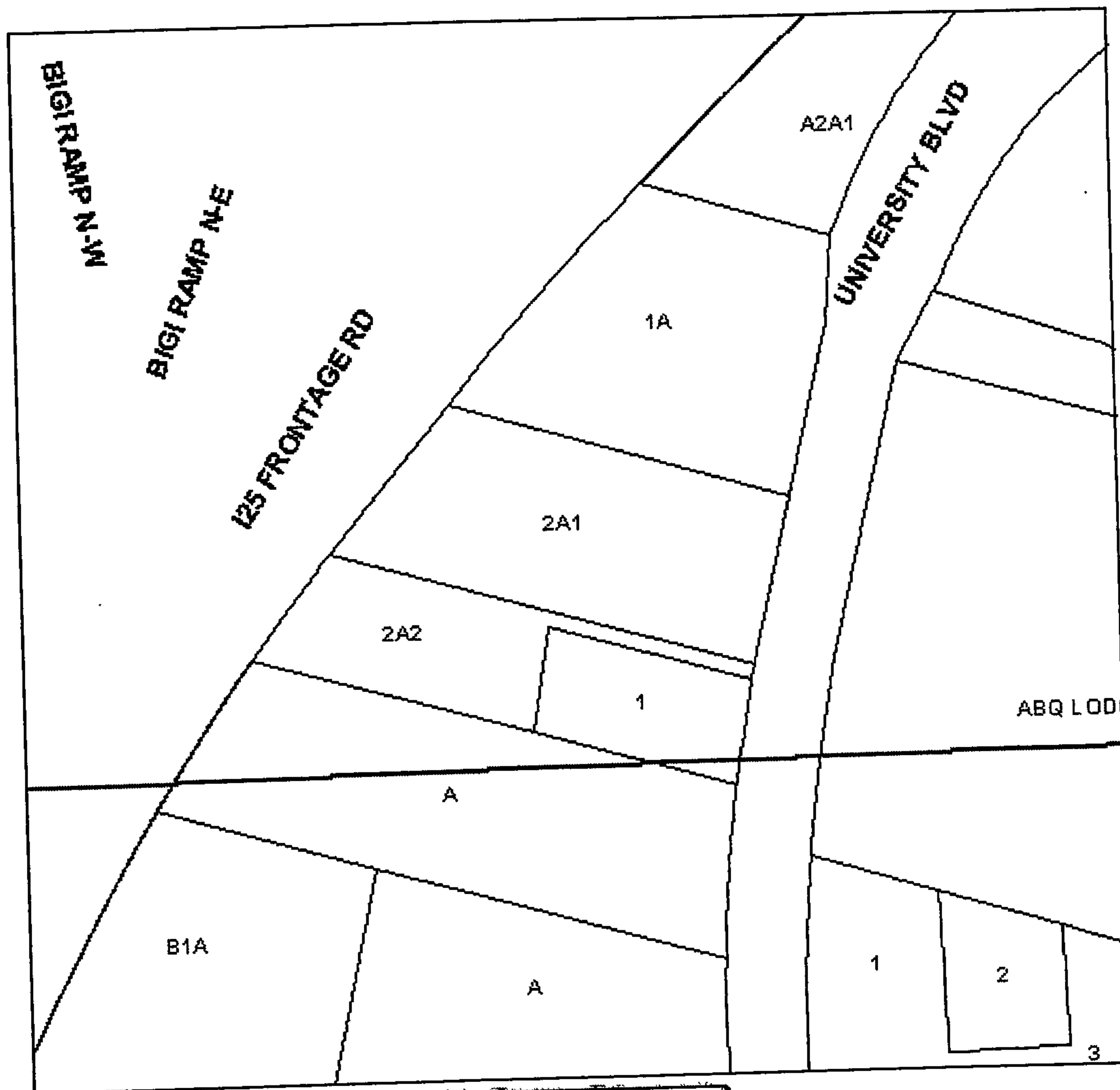
Figure 4.—Profile of Embudo gravelly fine sandy loam, 0 to 5 percent slopes.

Appendix B

1. Flood Plain Map from Albuquerque GIS.
2. C20 Zone Atlas Page
3. Aerial Photo of Site

ACTIVATE BUTTONS BY 'CLICKING' ON THE MAP

☒ Zoom In
 ☒ Id Address
 ☐ Id ZM
 ☒ Pan
 ☐ Zoom Out



ReDraw Screen

Flood Zones

☒ Zone A
 ☐ Zone AO
 ☒ Zone AH
 ☐ Zone AE

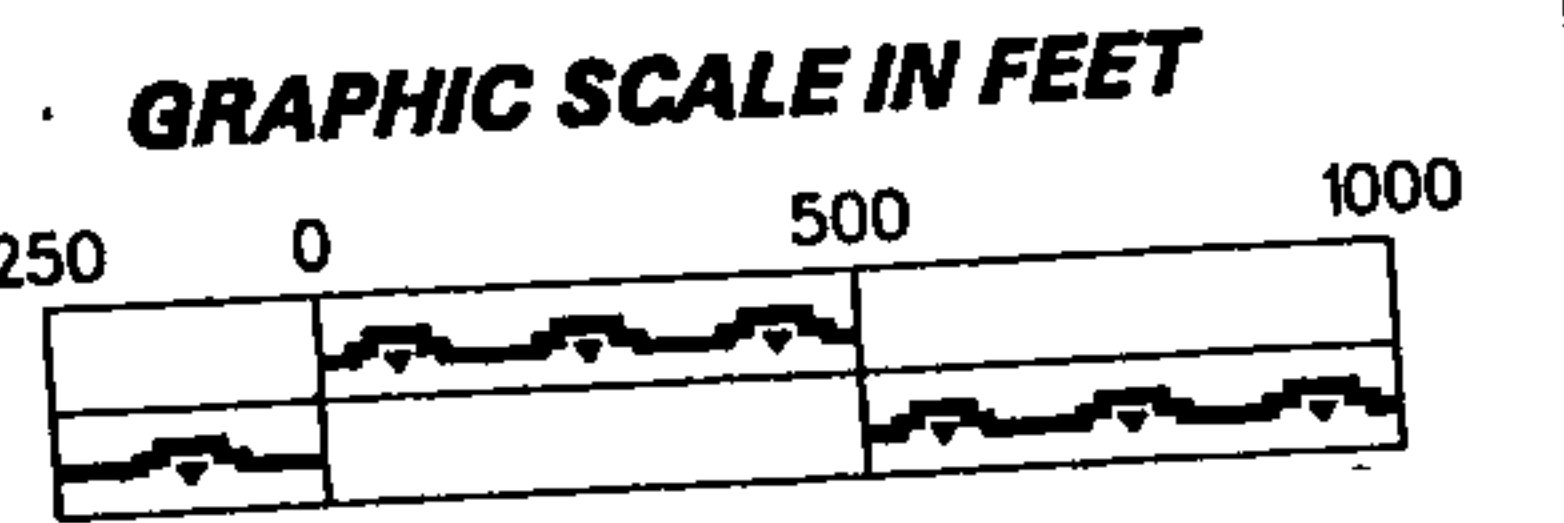
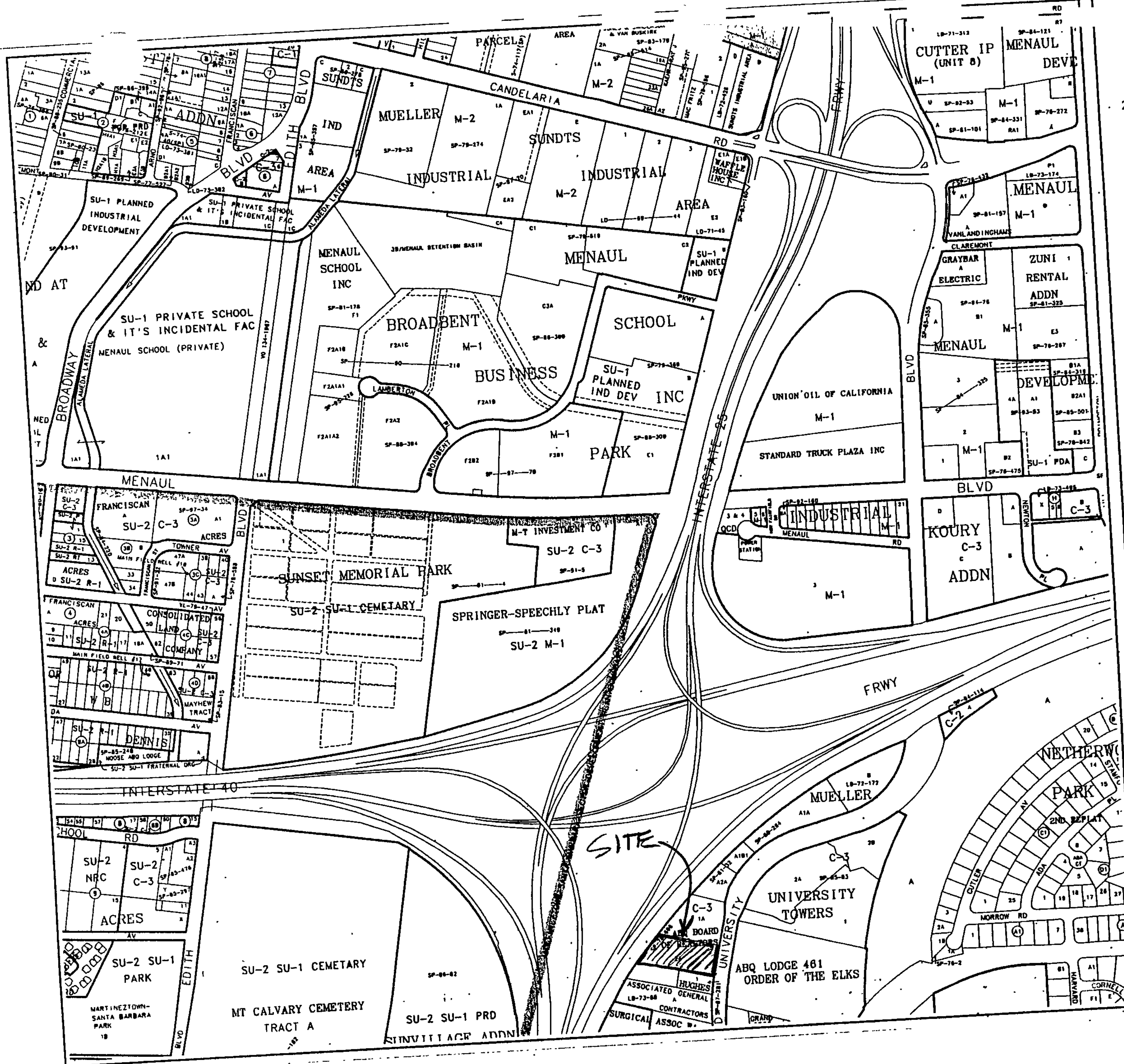
ZOOM LEVEL MEDIUM ☐
 TEXT SIZE MEDIUM ☐
 NEW GIS QUERY

LAYER LEGEND

- ☒ STREET NAMES
- ☐ PARKS
- ☐ CITY LIMITS
- ☒ ZONE MAP GRID
- 
- ☐ NBR BOUNDARY
- ☐ COMMUNITY PLAN
- ☐ WATER LINES
- ☐ SEWER LINES
- ☐ STORM DRAINS
- ☐ ZONING
- ☒ LOT NUMBERS
- ☐ ZIP CODES
- ☐ COUNCIL DISTRICT
- ☒ FLOOD ZONES (display)
- ☒ PARCELS
- ☐ CONTROL STATION
- ☐ SENATE DIST.
- ☐ REPRESENTATIVE DISTRICT
- ☐ COUNTY COMMISSION
- ☐ PARCEL ADDRESS
- ☐ CRIMINAL ACTIVITY
- ☐ PUBLIC FACILITIES
- ☐ LAND USE
- ☐ 1960 CITY LIMITS
- ☐ LANDFILLS/BUFFER
- ☐ CRP LOCATIONS

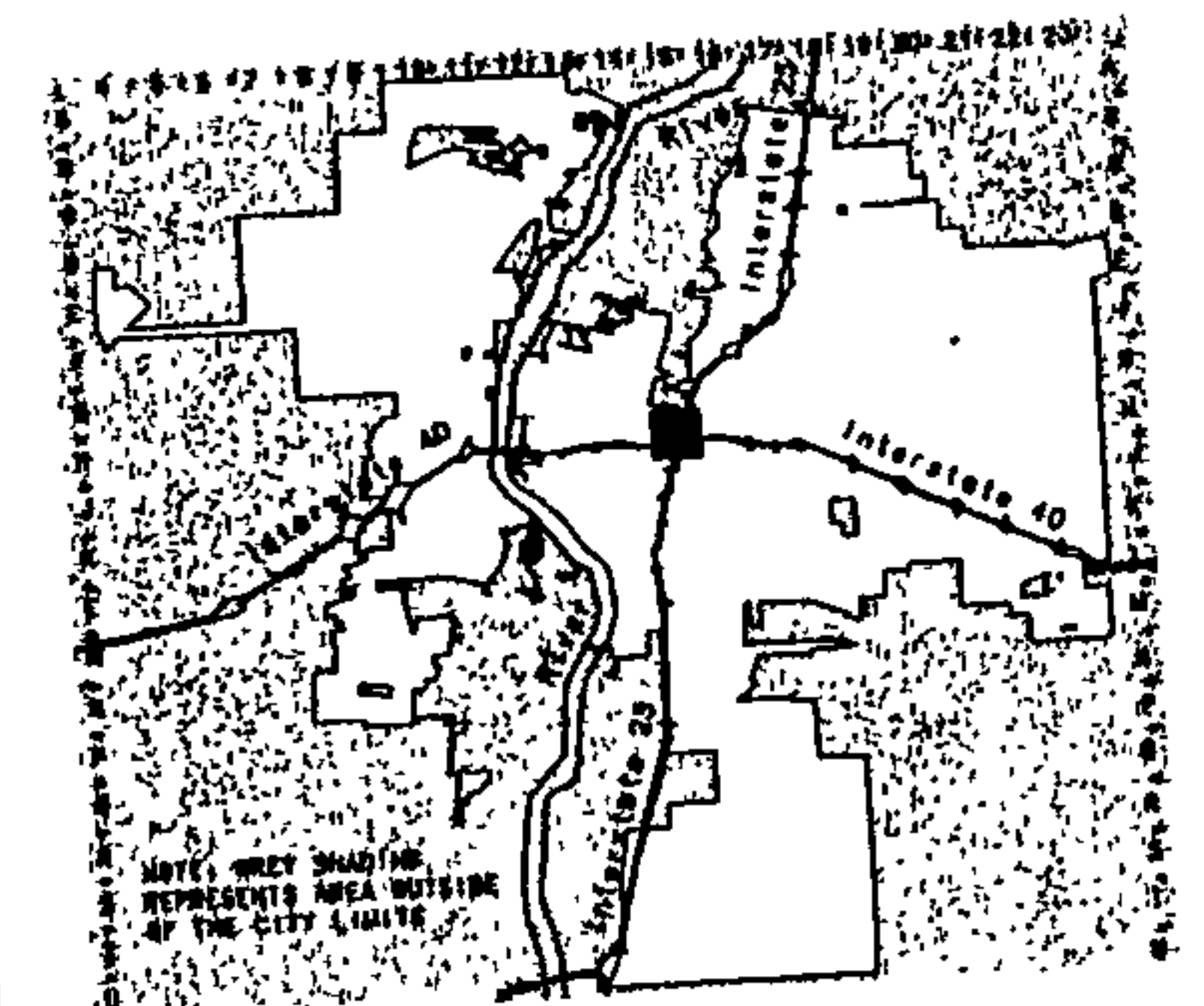
SHOW LOCATION MAP

SHOW 1999 AERIAL



CITY OF
Albuquerque
AUGGIS
PLANNING DEPARTMENT
© Copyright 1997

Map Amended through June 19, 1997

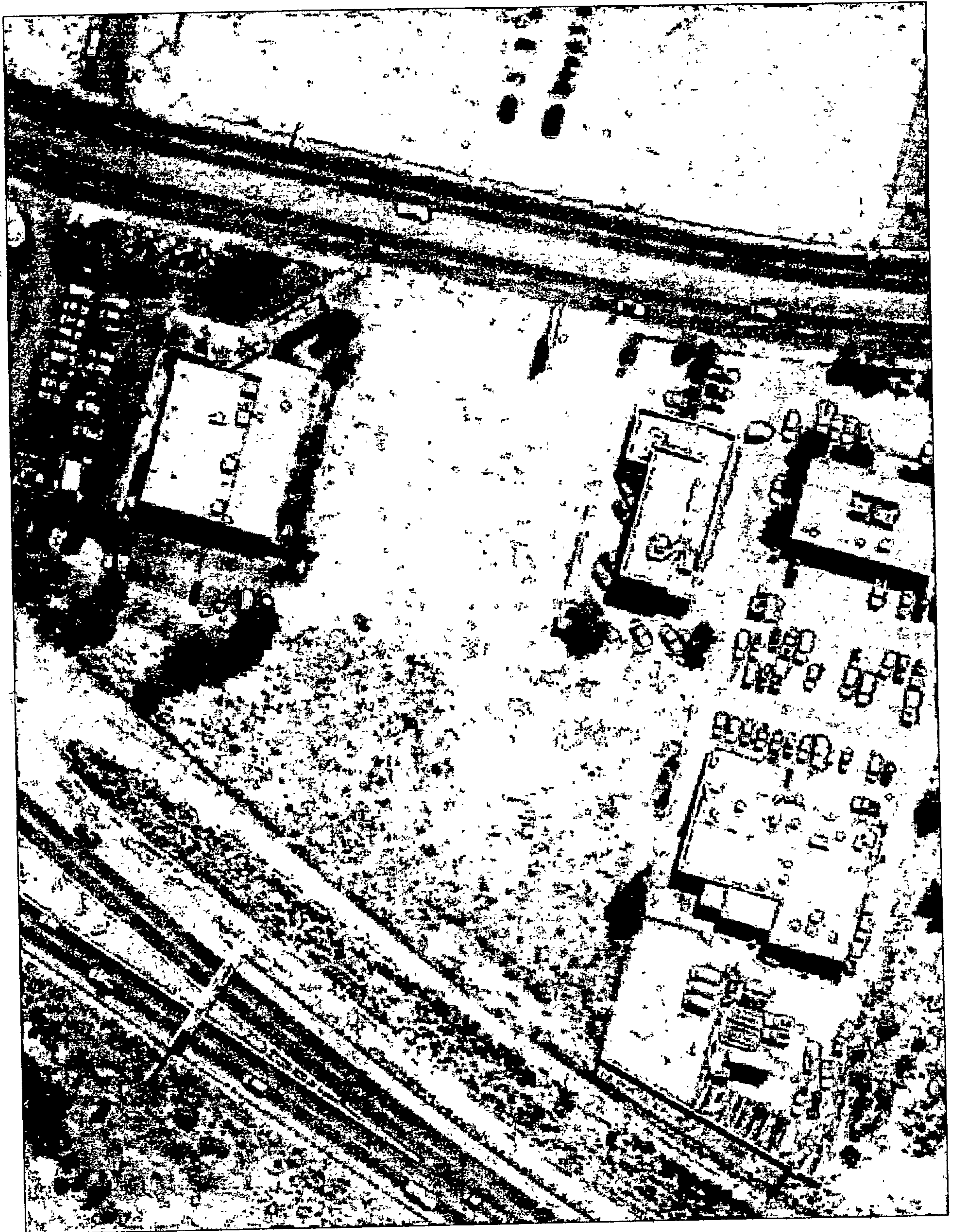


LEGAL DESCRIPTION
TION
R3E
SEC 9

UNIFORM PROPERTY CODE
1-015-059

H-15-Z





Appendix C

Existing Conditions Hydrology Computations

Appendix C

Existing Conditions Hydrology Computations

Drainage Summary

Project: Principios Medical (Design Group)
 Project Numbe: 04-163
 Date: 11/10/04
 By: Dave A

Site Location**Precipitaion Zone**

2 Per Table A-1 COA DPM Section 22.2

Existing summary

Basin Name	Ex 1	Ex2	Off Ex #1	Off Ex #2	Off Ex #3	Off Ex #4
Area (acres)	0.7897	0.6438	0.0326	0.0454	0.1921	0.0847
%A Land treatment						
%B Land treatment						
%C Land treatment	44	44	44	44	44	44
%D Land treatment	56	56	56	56	56	56
Soil Treatment (acres)						
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.00	0.00	0.00	0.00	0.00	0.00
Area "C"	0.35	0.28	0.01	0.02	0.08	0.04
Area "D"	0.44	0.36	0.02	0.03	0.11	0.05
Excess Runoff (acre-feet)						
100yr. 6hr.	0.11	0.09	0.00	0.01	0.03	0.01
10yr. 6hr.	0.06	0.05	0.00	0.00	0.0157	0.0069
2yr. 6hr.	0.03	0.03	0.00	0.00	0.0081	0.0036
100yr. 24hr.	0.13 ✓	0.10	0.01	0.01	0.03	0.01
Peak Discharge (cfs)						
100 yr.	3.17	2.58	0.13	0.18	0.77	0.34
10yr.	1.98	1.62	0.08	0.11	0.48	0.21
2yr.	1.03	0.84	0.04	0.06	0.25	0.11

7.17

Proposed summary

Basin Name	Pro 1	Pro 2	Off Ex #1	Off Ex #2	Off Ex #3	Off Ex #4
Square Feet	37846	24705				
Area (acres)	0.8688	0.5671	0.0326	0.0454	0.1921	0.0847
%A Land treatment						
%B Land treatment	15	15				
%C Land treatment			44	44	44	44
%D Land treatment	85	85	56	56	56	56
Soil Treatment (acres)						
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.13	0.09	0.00	0.00	0.00	~~0.04~~
Area "C"	0.00	0.00	0.01	0.02	0.08	0.04
Area "D"	0.74	0.48	0.02	0.03	0.11	0.05
Excess Runoff (acre-feet)						
100yr. 6hr.	0.14	0.09	0.00	0.01	0.03	0.01
10yr. 6hr.	0.09	0.06	0.00	0.00	0.02	0.01
2yr. 6hr.	0.05	0.03	0.00	0.00	0.01	0.00
100yr. 24hr.	0.16	0.11	0.01	0.01	0.03	0.02
Peak Discharge (cfs)						
100 yr.	3.77 ✓	2.46 ✓	0.13	0.18	0.77	~~0.42~~ 0.34
10yr.	2.44	1.59	0.08	0.11	0.48	~~0.25~~ 0.21
2yr.	1.38	0.90	0.04	0.06	0.25	0.11

THE Group

Mechanical, Electrical and Civil Engineers

PROJECT **Principios Medical (Design Group)**
 PROJECT NO. **04-163**
 DATE **11/10/04**
 BY **Dave A**

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
 January, 1993

INSTRUCTIONS

- * Spread sheet requires three input areas (dark cells):
 - Location
 - >A.1 Precipitation Zone
 - >A.3 Land Treaments
- * Values from the tables are automatically placed using "if" statements.
- * Table values should be checked for correctness for each use.

SUMMARY

Location	Pro 1		
Precipitation Zone		2	
Land Area		1.33	acres
Excess Precipitation Volume			
>>> 100-year 6-hour (design)		0.20	acre-ft.
10-year 6-hour		0.12	acre-ft.
2-year 6-hour		0.07	acre-ft.
100-year 24-hour		0.23	acre-ft.
Peak Discharge Rates (DPM)			
>>> Q100 (design)		5.45	cfs
Q10		3.45	cfs
Q2		1.89	cfs
Peak Discharge Rates (DPM-Rational Method)			
>>> Q100 (design)		5.45	cfs
Q10		3.45	cfs
Q2		1.88	cfs

CALCULATIONS FOLLOW

INPUT AND CALCULATIONS

LOCATION		Pro 1	
>A.1 PRECIPITATION ZONE (from Table A-1)		2	
>A.2 DEPTHS (from Table A-2)			
100-YEAR STORM (P60)	2.01	inches	
100-YEAR STORM (P360)	2.35	inches	
100-YEAR STORM (P1440)	2.75	inches	
10-YEAR (P360) (Calculated: $P360 \cdot RPF10$)	1.57	inches	
2-YEAR (P360) (Calculated: $P360 \cdot RPF2$)	1.02	inches	
>A.3 LAND TREATMENTS (Ai)			
Treatment A	0.00	acres	
Treatment B	0.33	acres	
Treatment C	0.00	acres	
Treatment D	1.00	acres	
Total Area	1.33	acres	
		=====	
>A.4 ABSTRACTIONS		See A.5	

CALCULATIONS FOLLOW

INPUT AND CALCULATIONS (CONT)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)		
from Table A-8		
100-year 6-hour		
Treatment A	0.53	inches
Treatment B	0.78	inches
Treatment C	1.13	inches
Treatment D	2.12	inches
WEIGHTED E (Sum Ei*Ai/A)	1.79	inches
VOLUME V100:6h (E*A)	0.20	acre-ft.
	8,629.96	ft^3
=====		
10-year 6-hour		
Treatment A	0.13	inches
Treatment B	0.28	inches
Treatment C	0.52	inches
Treatment D	1.34	inches
WEIGHTED E (Sum Ei*Ai/A)	1.08	inches
VOLUME V10:6h (E*A)	0.12	acre-ft.
	5,199.61	ft^3
=====		
2-year 6-hour		
Treatment A	0.00	inches
Treatment B	0.02	inches
Treatment C	0.15	inches
Treatment D	0.79	inches
WEIGHTED E (Sum Ei*Ai/A)	0.60	inches
VOLUME V2:6h (E*A)	0.07	acre-ft.
	2,891.66	ft^3
=====		
100-year 24-hour		
VOLUME V100:24h		
(V100-6h+Ad*P1440-P360)/12)	0.23	acre-ft.
	10,081.96	ft^3
=====		

CALCULATIONS FOLLOW

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (Qi)			
from Table A-9			
100-year			
Treatment A	1.56	cfs/acre	
Treatment B	2.28	cfs/acre	
Treatment C	3.14	cfs/acre	
Treatment D	4.70	cfs/acre	
Q100 (Sum Qi*Ai)	5.45	cfs	
10-year			
Treatment A	0.38	cfs/acre	
Treatment B	0.95	cfs/acre	
Treatment C	1.71	cfs/acre	
Treatment D	3.14	cfs/acre	
Q10 (Sum Qi*Ai)	3.45	cfs	
2-year			
Treatment A	0.00	cfs/acre	
Treatment B	0.08	cfs/acre	
Treatment C	0.60	cfs/acre	
Treatment D	1.86	cfs/acre	
Q2 (Sum Qi*Ai)	1.89	cfs	

CALCULATIONS FOLLOW

RATIONAL METHOD

PEAK INTENSITY (in/hr at $t_c=0.2$ hour) from Table A-10		
Peak Intensity (I) 100-year	5.05	
Peak Intensity (I) 10-year	3.41	
Peak Intensity (I) 2-year	2.04	
RATIONAL METHOD COEFFICIENT, C from Table A-11		
100-year		
Treatment A	0.31	cfs/acre
Treatment B	0.45	cfs/acre
Treatment C	0.62	cfs/acre
Treatment D	0.93	cfs/acre
Q100 (Sum $Q_i \cdot I \cdot A_i$)	5.45	cfs
=====		
10-year		
Treatment A	0.11	cfs/acre
Treatment B	0.28	cfs/acre
Treatment C	0.50	cfs/acre
Treatment D	0.92	cfs/acre
Q10 (Sum $Q_i \cdot I \cdot A_i$)	3.45	cfs
=====		
2-year		
Treatment A	0.00	cfs/acre
Treatment B	0.04	cfs/acre
Treatment C	0.29	cfs/acre
Treatment D	0.91	cfs/acre
Q2 (Sum $Q_i \cdot I \cdot A_i$)	1.88	cfs
=====		

- A. See sheet C-G01 for complete list of general notes and symbol/linetype legend that apply to all sheets.
- B. Surface features associated with underground utilities shall be shown on plans for clarity. See applicable utility plans for construction notes and details.
- C. Contractor shall field verify site for existing conditions (spolia, borrow areas, etc.) prior to bidding earthwork quantities.
- D. See survey for actual existing ground contours and spot elevations for earthwork in project area.

BASIN #	% A	% B	% C	% D
EX. BASIN #1			44	56
EX. BASIN #2			44	56
OFFSITE #1			44	56
OFFSITE #2			44	56
OFFSITE #3			44	56
OFFSITE #4			44	56



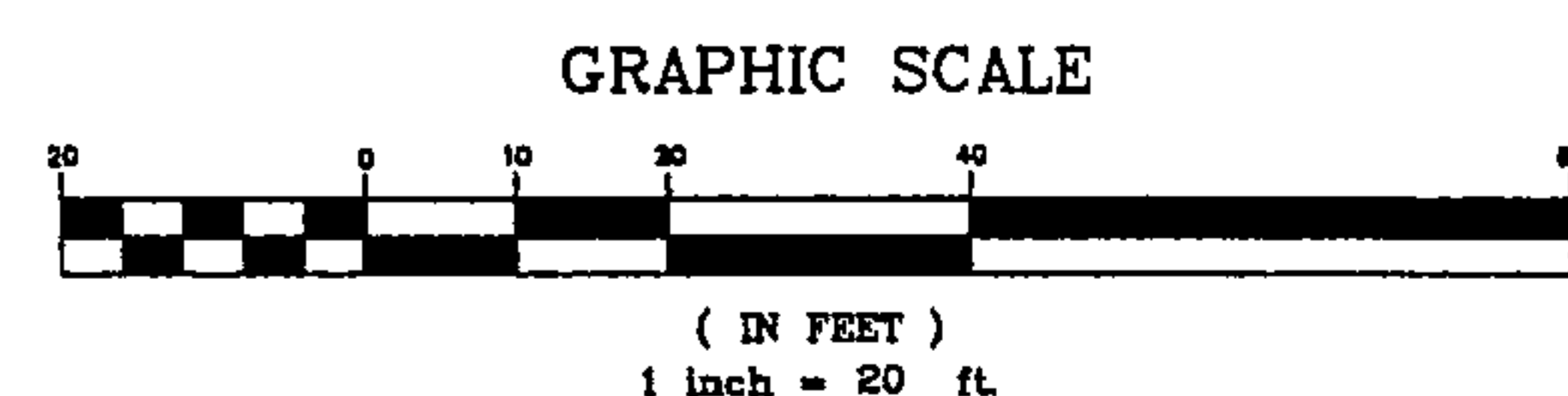
CDEX1

THE
group

**TELCK-HENSLEY
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4001 JUAN TABO NE, SUITE A
ALBUQUERQUE, NEW MEXICO 87111
Phone: (505)282-3202 FAX: (505)292-

A1 **EXISTING DRAINAGE PLAN**
SCALE: 1" = 20'-0"



Appendix D

Proposed Conditions Hydrology Computations

Drainage Summary

Project: Principios Medical (Design Group)
 Project Number: 04-163
 Date: 11/10/04
 By: Dave A

Site Location

Precipitation Zone

2 Per Table A-1 COA DPM Section 22.2

Existing summary

Basin Name	Ex 1	Ex2	Off Ex #1	Off Ex #2	Off Ex #3	Off Ex #4
Area (acres)	0.7897	0.6438	0.0326	0.0454	0.1921	0.0847
%A Land treatment						
%B Land treatment						
%C Land treatment	44	44	44	44	44	44
%D Land treatment	56	56	56	56	56	56
Soil Treatment (acres)						
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.00	0.00	0.00	0.00	0.00	0.00
Area "C"	0.35	0.28	0.01	0.02	0.08	0.04
Area "D"	0.44	0.36	0.02	0.03	0.11	0.05
Excess Runoff (acre-feet)						
100yr. 6hr.	0.11	0.09	0.00	0.01	0.03	0.01
10yr. 6hr.	0.06	0.05	0.00	0.00	0.0157	0.0069
2yr. 6hr.	0.03	0.03	0.00	0.00	0.0081	0.0036
100yr. 24hr.	0.13	0.10	0.01	0.01	0.03	0.01
Peak Discharge (cfs)						
100 yr.	3.17	2.58	0.13	0.18	0.77	0.34
10yr.	1.98	1.62	0.08	0.11	0.48	0.21
2yr.	1.03	0.84	0.04	0.06	0.25	0.11

Proposed summary

Basin Name	Pro 1	Pro 2	Off Ex #1	Off Ex #2	Off Ex #3	Off Ex #4
Square Feet	37846	24705				
Area (acres)	0.8688	0.5671	0.0326	0.0454	0.1921	0.0847
%A Land treatment						
%B Land treatment	15	15				
%C Land treatment			44	44	44	44
%D Land treatment	85	85	56	56	56	56
Soil Treatment (acres)						
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.13	0.09	0.00	0.00	0.00	0.04
Area "C"	0.00	0.00	0.01	0.02	0.08	0.04
Area "D"	0.74	0.48	0.02	0.03	0.11	0.05
Excess Runoff (acre-feet)						
100yr. 6hr.	0.14	0.09	0.00	0.01	0.03	0.01
10yr. 6hr.	0.09	0.06	0.00	0.00	0.02	0.01
2yr. 6hr.	0.05	0.03	0.00	0.00	0.01	0.00
100yr. 24hr.	0.16	0.11	0.01	0.01	0.03	0.02
Peak Discharge (cfs)						
100 yr.	3.77	2.46	0.13	0.18	0.77	~~0.42~~ 0.34
10yr.	2.44	1.59	0.08	0.11	0.48	~~0.25~~ 0.21
2yr.	1.38	0.90	0.04	0.06	0.25	0.11

THE Group

PROJECT Principios Medical (Design Group)
 PROJECT NO. 04-163
 DATE 11/10/04
 BY Dave A

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.

January, 1993

INSTRUCTIONS

- * Spread sheet requires three input areas (dark cells):
 Location
 >A.1 Precipitation Zone
 >A.3 Land Treatments
- * Values from the tables are automatically placed using "if" statements.
- * Table values should be checked for correctness for each use.

SUMMARY

Location	Ex5		
Precipitation Zone		2	
Land Area		1.33	acres
Excess Precipitation Volume			
>>> 100-year 6-hour (design)		0.06	acre-ft.
10-year 6-hour		0.01	acre-ft.
2-year 6-hour		0.00	acre-ft.
100-year 24-hour		0.06	acre-ft.
Peak Discharge Rates (DPM)			
>>> Q100 (design)		2.07	cfs
Q10		0.51	cfs
Q2		0.00	cfs
Peak Discharge Rates (DPM-Rational Method)			
>>> Q100 (design)		2.08	cfs
Q10		0.50	cfs
Q2		0.00	cfs

CALCULATIONS FOLLOW

INPUT AND CALCULATIONS

LOCATION		Ex5	
>A.1 PRECIPITATION ZONE (from Table A-1)		2	
>A.2 DEPTHS (from Table A-2)			
100-YEAR STORM (P60)	2.01	inches	
100-YEAR STORM (P360)	2.35	inches	
100-YEAR STORM (P1440)	2.75	inches	
10-YEAR (P360) (Calculated: $P360 \cdot RPF10$)	1.57	inches	
2-YEAR (P360) (Calculated: $P360 \cdot RPF2$)	1.02	inches	
>A.3 LAND TREATMENTS (Ai)			
Treatment A	1.33	acres	
Treatment B	0.00	acres	
Treatment C	0.00	acres	
Treatment D	0.00	acres	
Total Area	1.33	acres	
>A.4 ABSTRACTIONS		See A.5	

CALCULATIONS FOLLOW

Ex hyd.

INPUT AND CALCULATIONS (CONT)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei) from Table A-8			
100-year 6-hour			
Treatment A	0.53	inches	
Treatment B	0.78	inches	
Treatment C	1.13	inches	
Treatment D	2.12	inches	
WEIGHTED E (Sum Ei*Ai/A)	0.53	inches	
VOLUME V100:6h (E*A)	0.06	acre-ft.	
	2,558.79	ft^3	
=====			
10-year 6-hour			
Treatment A	0.13	inches	
Treatment B	0.28	inches	
Treatment C	0.52	inches	
Treatment D	1.34	inches	
WEIGHTED E (Sum Ei*Ai/A)	0.13	inches	
VOLUME V10:6h (E*A)	0.01	acre-ft.	
	627.63	ft^3	
=====			
2-year 6-hour			
Treatment A	0.00	inches	
Treatment B	0.02	inches	
Treatment C	0.15	inches	
Treatment D	0.79	inches	
WEIGHTED E (Sum Ei*Ai/A)	0.00	inches	
VOLUME V2:6h (E*A)	0.00	acre-ft.	
	0.00	ft^3	
=====			
100-year 24-hour			
VOLUME V100:24h			
(V100-6h+Ad*P1440-P360)/12	0.06	acre-ft.	
	2,558.79	ft^3	
=====			

CALCULATIONS FOLLOW

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (Qi)			
from Table A-9			
100-year			
Treatment A	1.56	cfs/acre	
Treatment B	2.28	cfs/acre	
Treatment C	3.14	cfs/acre	
Treatment D	4.70	cfs/acre	
Q100 (Sum Qi*Ai)	2.07	cfs	
10-year			
Treatment A	0.38	cfs/acre	
Treatment B	0.95	cfs/acre	
Treatment C	1.71	cfs/acre	
Treatment D	3.14	cfs/acre	
Q10 (Sum Qi*Ai)	0.51	cfs	
2-year			
Treatment A	0.00	cfs/acre	
Treatment B	0.08	cfs/acre	
Treatment C	0.60	cfs/acre	
Treatment D	1.86	cfs/acre	
Q2 (Sum Qi*Ai)	0.00	cfs	

CALCULATIONS FOLLOW

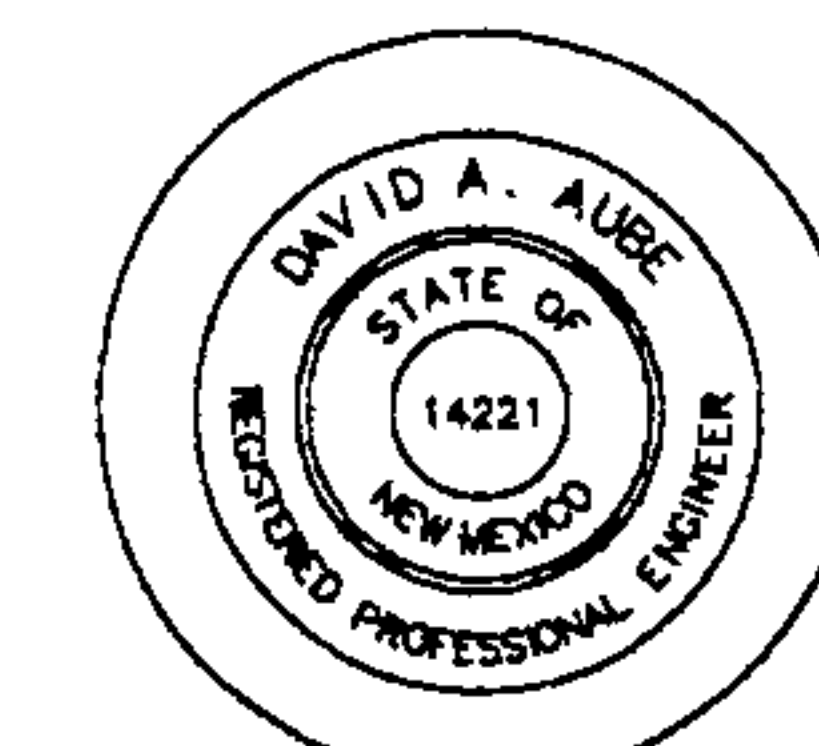
RATIONAL METHOD

PEAK INTENSITY (in/hr at $t_c=0.2$ hour) from Table A-10			
Peak Intensity (I) 100-year	5.05		
Peak Intensity (I) 10-year	3.41		
Peak Intensity (I) 2-year	2.04		
RATIONAL METHOD COEFFICIENT, C from Table A-11			
100-year			
Treatment A	0.31	cfs/acre	
Treatment B	0.45	cfs/acre	
Treatment C	0.62	cfs/acre	
Treatment D	0.93	cfs/acre	
Q100 (Sum $Q_i \cdot I \cdot A_i$)	2.08	cfs	
10-year			
Treatment A	0.11	cfs/acre	
Treatment B	0.28	cfs/acre	
Treatment C	0.50	cfs/acre	
Treatment D	0.92	cfs/acre	
Q10 (Sum $Q_i \cdot I \cdot A_i$)	0.50	cfs	
2-year			
Treatment A	0.00	cfs/acre	
Treatment B	0.04	cfs/acre	
Treatment C	0.29	cfs/acre	
Treatment D	0.91	cfs/acre	
Q2 (Sum $Q_i \cdot I \cdot A_i$)	0.00	cfs	



- A. See sheet C-G01 for complete list of general notes and symbol keynotes legend that apply to all sheets.
- B. Surface features associated with underground utilities are shown on existing plans for clarity. See applicable utility plans for construction notes and details.
- C. Contractor shall field verify site for existing conditions (spoils, borrow areas, etc.) prior to bidding earthwork quantities.
- D. See survey for actual existing ground contours and spot elevations for earthwork in project area.

BASIN #	% A	% B	% C	% D
PROPOSED BASIN #1		15		85
PROPOSED BASIN #2		15		85



CONFIDENTIAL

THE
group

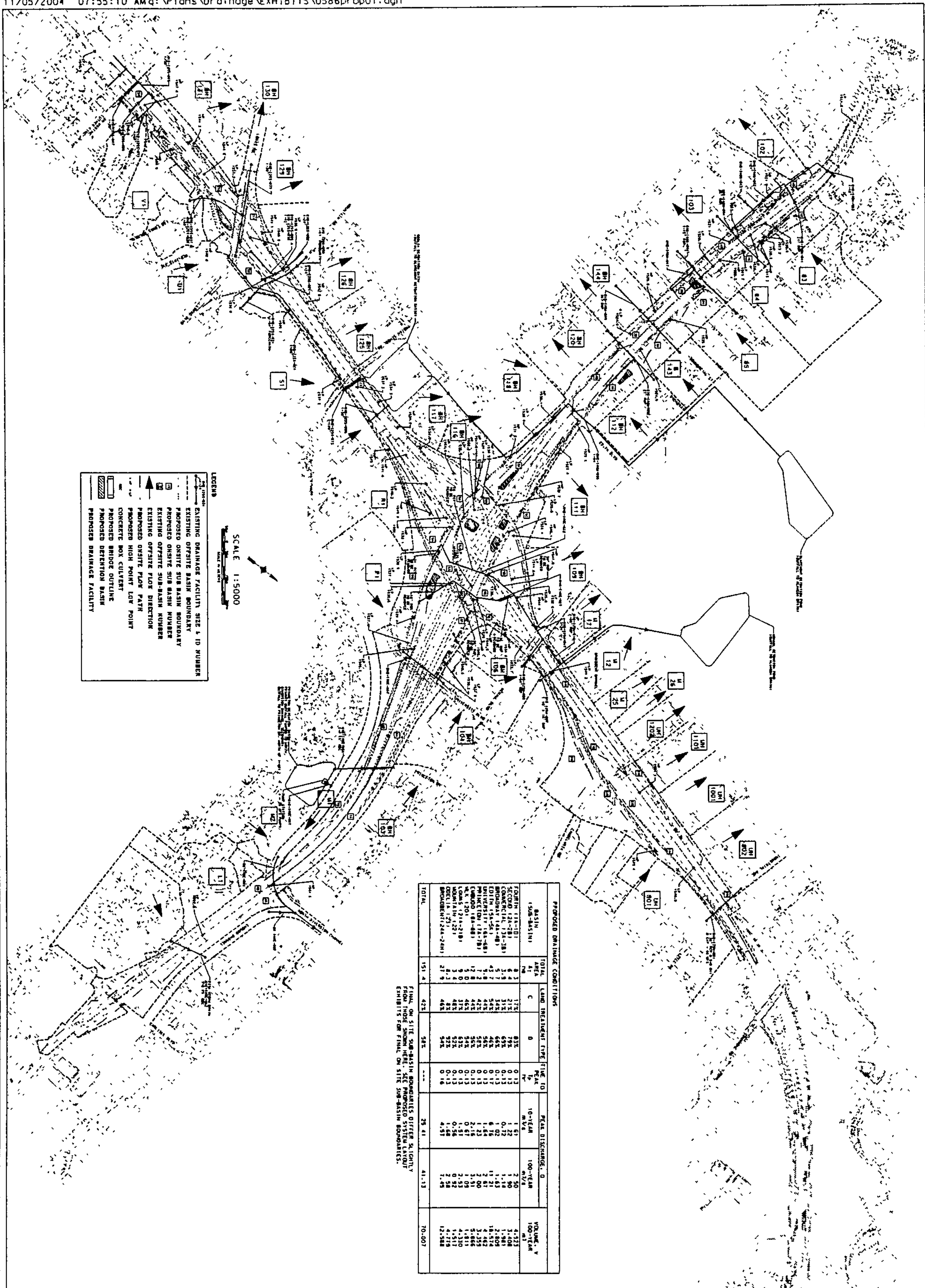
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Appendix E

1. Basin Maps,
2. Analysis from Big I Project

2-11-70 PRE-IRRIGATION CONDITIONS										
BASIN ISDN-BS(10)	TOTAL AREA Ht	LAND TREATMENT TYPE				TIME TO PEAK	PEAK DISCHARGE, Q			VOLUME, 100-YEAR
		C	D	E	F		10-YEAR Ht	100-YEAR Ht	100-YEAR Ht	
FOURTH (1-5)	8.7	24%	15%	0	0.86	1.18	1.49	1.82	3.26	
SECOND (6-7)	6.6	33%	10%	0	0.13	1.18	1.49	1.82	3.26	
THIRD (8-9)	3.4	36%	12%	0	0.13	0.41	0.81	1.22	1.62	
SEVENTH (10-11)	3.2	36%	12%	0	0.13	0.41	0.81	1.22	1.62	
EIGHTH (12-13)	22.6	71%	28%	0	0.17	2.61	4.90	8.19	13.19	
UNIVERSITY	10.5	71%	28%	0	0.13	1.49	2.56	3.62	5.62	
PARCEL (101)	8.1	61%	38%	0	0.13	1.32	2.08	3.26	5.62	
DEMO (102)	13.1	52%	48%	0	0.13	2.11	3.49	5.62	9.62	
DOES (124-130-31)	9.0	42%	58%	0	0.13	1.53	2.48	4.16	7.62	
JOHN (127)	2.6	72%	28%	0	0.13	0.40	0.81	1.05	1.62	
DOES (128-129)	40.2	65%	35%	0	0.35	5.16	9.10	15.62	25.62	
PROBUDER (132-13)	15	31-32	24%	62%	0.13	0.38	0.60	1.07	1.62	
INDUSTRIAL (122A)	2.2	38%	62%	0	0.13	0.38	0.60	1.07	1.62	
TOTAL	53.6	57%	43%	---	---	22.11	36.95	63.96	103.96	



URS	NEW MEXICO STATE HIGHWAY AND TRANSPORTATION DEPARTMENT		125/140 SYSTEM INTERCHANGE - THE BIG I	
	FHWA REGION NO 6 NEW MEXICO PROJECT NO CN 0586 AC-MIP-(IM)-(TPU)-025-4(78)227			
METRO	APPROVAL	DATE 03/01/00	DESIGN	DATE / /
	ENGINEER	DATE 03/01/00	DRAWN	DATE 03/01/00
PROPOSED DRAINAGE CONDITIONS MAP		REVISIONS (ON CHANGE NOTICES)		

ADDITIONAL REINFORCEMENT
#13 @ 150 (TYP)

A horizontal scale bar with markings at 10m, 0, 10m, 30m, and 50m. The text "SCALE IN METERS" is written vertically below the bar.

**Final Drainage Report
March 2000
The Big I Project
I25/I40 Interchange
AC-MIP-(IM)-(TPU)-025-4 (78) 227; CN 0586
Albuquerque, New Mexico**

Prepared for:

**New Mexico State Highway And
Transportation Department
Federal Highway Administration**

Prepared by:

**URS Greiner Woodward Clyde, Inc.
Carl Rogers, P.E.
Karen Stearns, P.E.
Phil Drazek, P.E.**



Karen M. Stearns

**Karen M. Stearns, P.E.
N.M.P.E. Registration No. 14085**

This report is based on data, site conditions and other information which is generally applicable as of March 2000. The conclusions herein are applicable only to this time frame. Background information design bases and other data have been furnished to URS Greiner Woodward Clyde by NMSHTD and third parties. URS Greiner Woodward Clyde has relied on this information as furnished, and is not responsible for and has not confirmed the accuracy of this information

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1. Introduction

This drainage report presents the hydrologic and hydraulic analyses performed on the I25/I40 system interchange, located in Albuquerque, New Mexico. Within the project limits, there are fourteen drainage basins and this report is broken down into corresponding sections. Each drainage basin is broken down into major topics of discussion corresponding to the various basin system analysis and basin facilities. These major topics of discussion are:

- Drainage Patterns – drainage basin site and system characteristics.
- Drainage Area Characteristics –runoff tributary area and land treatment percentages.
- Onsite Hydrology – tabular summary of existing and proposed six-hour 10-year runoff and six-hour 100-year runoff. The 24-hour 100-year runoff volume is provided for detention basin routing.
- Offsite runoff – summary of six-hour 10-year runoff and six-hour 100-year runoff.
- Storm Drains – discussion on proposed storm drain facilities.
- Detention Basin Design – discussion on proposed detention basin improvements.
- Special Issues –
- Coordination with Local Agencies – additional coordination to resolve issues of special interest to local agencies.

1.1. Project Location

The Big I Project is the I25/I40 Interchange located in Albuquerque, New Mexico at the junction of both interstate highways. Limits of improvements extend from Dr. Martin Luther King Jr. Avenue to Comanche Road along Interstate 25 and from 6th Street to Carlisle Boulevard along Interstate 40.

1.2. Description of Improvements

The proposed project improvements generally maintain the existing interstate and local cross street alignments. Specific changed features to the two interstate facilities include:

- Widening of I25 and I40 to three through lanes in each direction.
- Elimination of left-side exit and entrance ramps.
- Continuous frontage roads paralleling each side of I25 and I40.
- The frontage roads are depressed one level below existing grade within the interchange.

1.3. Existing Site Hydrology

Runoff within the existing I40 project limits outfalls to five facilities:

- Rio Grande – The area along I40 between 7th Street and the Burlington Northern Santa Fe Railroad. The outfalls are a 15-inch (375-mm) RCP in 2nd Street and a 36-inch (900-mm) RCP in 4th Street continuing south to the Rio Grande (See Appendix L – Existing Drainage Conditions Map).
- Broadway Pump Station – The area along I40 between the Burlington Northern Santa Fe railroad and Edith Boulevard. The outfalls are a 36-inch (900-mm) RCP in Commercial Street and a 27-inch (675-mm) RCP in Broadway Boulevard continuing south to the Broadway pump station.
- Claremont Detention Basin – The I25/I40 interchange area between Edith Boulevard and I25. The outfall is the 54-inch (1350-mm) RCP in Edith Boulevard continuing to the Claremont Detention Basin.
- Menaul Detention Basin – The area along I40 between I25 and the North Diversion Channel. The outfalls are:
 1. Princeton Detention Basin double 6-ft (1800-mm) by 6-ft (1800-mm) over flow CBC discharging as surface flow along Princeton Drive;
 2. 42-inch (1050-mm) RCP in University Boulevard continuing north to Menaul Boulevard.
- Embudo Channel and North Diversion Channel – The area along I40 between the North Diversion Channel and Carlisle Boulevard. The outfall is the Rita triple 8-ft (2400-mm) by 5-ft (1500-mm) CBC crossing I40 and connecting to the Embudo Channel.

Runoff within the existing I25 project limits outfalls to five major drainage facilities:

- Rio Grande – The area along I25 between Dr. Martin Luther King Jr. Avenue and Roma Avenue. The outfall is a 30-inch (750-mm) RCP on the west side of I25 running southwest to the Rio Grande.
- Broadway Pump Station – The area along I25 between Roma Avenue and Mountain Road. The outfalls are the 24-inch (600-mm) RCP in Mountain Road and the 30-inch (750-mm) RCP in Lomas Boulevard continuing west to the Broadway Pump Station.
- Odelia Dam Park – The area along Lomas Boulevard east of I25 and within NMSHTD right-of-way between Mountain Road and I40. The facilities draining to the Odelia Dam Park include:
 1. 60-inch (1500-mm) RCP east of I25 from Medical Arts Avenue to Indian School Road;
 2. Triple 120-inch (3000-mm) corrugated metal pipe (CMP) crossing I25 at Indian School Road; and

3. 30-inch (750-mm) CMP crossing I25 north of Indian School Road.
- Menaul Detention Basin – The area along I25 between I40 and Industrial Avenue/Aztec Road. The outfalls are the 199-inch (4975-mm) by 121-inch (3025-mm) arch culvert crossing I25 at the Broadbent Channel and the 60-inch (1500-mm) RCP entering the Broadbent Channel from the south. The Broadbent Channel empties into the Menaul Detention Basin.
- Alameda Lateral – A portion of southbound I25 and frontage road adjacent to Industrial Avenue and a portion of northbound frontage road and the offsite area east of I25 adjacent to Aztec Road. The outfall is a 36-inch (900-mm) RCP crossing I25 and continuing west on Industrial Avenue to a County detention pond, which drains to the Alameda Lateral.

1.4. Proposed Hydrology Concept

Drainage basins for the proposed I25/I40 project improvements have been established to correspond with the existing tributary basins (See Appendix M – Proposed Drainage Conditions Map). Existing routing was maintained for all basins with the exception of the area along I25 that drains to the 36-inch (900-mm) CMP within Industrial Avenue. Runoff within NMSHTD right-of-way and the offsite area to the east will be routed southward to the Broadbent Channel and the Menaul Detention Basin. The existing 36-inch (900-mm) RCP crossing I25 at Industrial Avenue will be abandoned in place, but the 36-inch (900-mm) CMP within Industrial Avenue will remain in place.

The project improvements will increase the percentage of impervious area relative to the existing conditions. Existing downstream drainage facilities are at or near maximum capacity. Onsite detention basins will be used to offset the increased flow prior to discharging to the existing facilities. Onsite detention basins are proposed for the following locations:

- I25 near Lomas Boulevard
- I40 between 2nd Street and 1st Street
- I40 near Broadway Boulevard
- I25/I40 Interchange

1.5. Drainage Investigations

Existing drainage facility records at the City of Albuquerque (City), Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), Middle Rio Grande Conservancy District (MRGCD), Bernalillo County (County) and the New Mexico State Highway and Transportation Department (NMSHTD) were investigated. Copies of record drawings and reports were obtained and reviewed. Drainage facilities within the project limits were assigned a utility tracking number and entered into an information-tracking log. Field designating of the existing drainage facilities

was performed and the information transferred to project utility maps along with the utility tracking number.

Field designate information, record drawing information and existing report documentation were used in conjunction with the Albuquerque Master Drainage Study (AMDS) to determine existing system capacity downstream of the project and existing offsite runoff entering the project. This information was combined with hydrologic analysis performed on the existing project facility and the proposed project improvements to determine onsite and offsite drainage improvements.

Hydrologic and hydraulic analyses were performed in accordance with the criteria identified in the Appendix A. The criteria was reviewed and approved by the NMSHTD in September 1998. Revisions to the criteria were approved by the NMSHTD in September 1999.

1.6. Existing System Capacity Analysis

In order to determine the impacts that proposed routing of flows had on existing drainage facilities it was necessary to examine the existing system capacities. Using as-built drawings, City of Albuquerque drainage facility maps, previous drainage reports and field investigations of the existing drainage facilities, storm drain size and slope were established. The full flow capacity of the storm drain was calculated using the Chezy-Manning equation and the existing runoff to the system. The calculated capacity was compared with other confluences downstream to determine the controlling system capacity. After looking at the difference between the flow entering the system and the full flow capacity of the system, the study was able to determine if there was surplus capacity available. Existing facility impacts resulting from the runoff generated by the proposed project improvements were then determined and mitigation measures developed. Existing system capacity analysis is contained in Appendix J.

2. Methodology

2.1. *Hydrologic Procedure*

Hydrologic analysis for the project consists of two components: onsite and offsite. For the offsite component, existing published reports and analyses were relied upon and supplemented with new analyses where needed for specific project issues. The primary source of offsite hydrologic information was the Albuquerque Master Drainage Study (AMDS) and the AMDS Restudy. These reports are over 10 years old and numerous recommendations contained within them have been implemented by the City. With each improvement implementation, the City prepared a separate detailed hydrologic analysis. These separate (new) analyses supersede the information in the AMDS reports. Additional studies and reference information are identified in the bibliography.

Onsite analysis was performed for both the existing and proposed project using the AHYMO computer program developed by C.E. Anderson. AHYMO is an Arid-lands Hydrologic Model that is accepted by the City of Albuquerque for large watersheds.

Input parameters for AHYMO are:

- Mass rainfall data
- Drainage area
- Land treatment type (A = flat undisturbed natural areas, B = steep undisturbed natural areas or irrigated lawns, parks and golf courses, C = compacted soil and minimal vegetation, D = impervious areas)
- Time to peak for the watershed

2.1.1. *Existing Onsite Hydrologic Analysis*

The project improvements lie within the Albuquerque metropolitan area, a heavily urbanized zone. The area is classified as Zone 2 and the land treatment types are predominantly C and D as defined in the “City of Albuquerque, Development Process Manual, Volume 2, Section 22.2, Hydrology” (DPM Section 22.2). Within the project limits, fourteen existing drainage basins and corresponding outfall facilities were identified. Each basin was further divided into sub-basins for which land treatment types, surface area and runoff time of concentration (with corresponding time to peak) were determined for use in the AHYMO hydrologic model. AHYMO output results consisted of peak discharge for the 10-year, 6-hour, 100-year, 6-hour storm event and total runoff volume for the 100-year, 24-hour storm event.

The existing onsite hydrology was developed to serve as a baseline to assess the changes in drainage basin boundaries, runoff volumes, onsite storm drain system layout and impacts to the offsite facilities due to the project improvements. From this assessment proposed facility improvement concepts were developed and evaluated. These concepts were first presented in the Preliminary Drainage Report (October 1998). The preliminary information has been expanded throughout the project design process (as more information has been developed), but the preliminary concept is essentially unchanged.

2.1.2. *Proposed Onsite Hydrology Analysis*

The proposed onsite hydrologic analysis was performed in two stages:

Stage 1 entailed reviewing the proposed roadway improvements and identifying the locations of high points, low points, retaining walls, grading and roadside barriers. These features would define the proposed drainage sub-basins. A storm drain routing concept was then developed to group the sub-basins into proposed drainage basins and convey the runoff to the existing outfall facilities. Peak discharge and total runoff volume were then computed and the results compared to the existing onsite hydrologic analysis. Additional adjustments were made to the sub-basin grouping to produce proposed peak discharges that equaled the existing condition peak discharge value to the downstream offsite drainage facilities. Where proposed peak discharge exceeded the existing peak discharge, onsite detention basins have been designed. Total runoff volumes were re-computed for the sub-basins requiring detention basins.

Stage 2 involved converting the AHYMO output data to a format useable by the HEC-12 pavement analysis, area drain analysis and drainage system hydraulic analysis. AHYMO computes a total runoff for the basin at the downstream end of the basin, but constraints on flooding and surface facility placement typically requires the runoff to be intercepted at intermediate points throughout the basin. The pavement and area drain analysis entails calculating interception values at the catch basins and culverts used to collect the surface runoff at the intermediate basin points. A summation of the interception values is used in the drainage system hydraulic analysis.

The final onsite drainage basin boundaries and system layout are shown on the "Proposed System Layout" exhibits in Appendix N. Sub-basin boundaries shown in Appendix N differ slightly from the "Proposed Drainage Conditions Map" due to adjustments during the design of the drainage facilities.

The individual interception values were determined using the "rational method" to prorate the total basin runoff and arrive at runoff values for the intermediate points while maintaining the same total runoff value for the basin. This maintains continuity between the AHYMO, HEC-12 and storm

drain hydraulic analyses. The rational method ($Q = CIA$) equates peak runoff (Q) to storm intensity (I), contributing area (A) and a runoff coefficient (C). Area and peak runoff are known entities from the AHYMO input/output. A weighted runoff coefficient was calculated by applying the land treatment type percentages to the rational method coefficient values listed in Table A-11 of DPM Section 22.2.

Land Treatment Type	DPM Section 22.2 Rational "C" Values		
	C _{10-year}	C _{50-year}	C _{100-year}
C	0.50	0.57	0.62
D	0.92	0.92	0.93

The remaining variable, storm intensity (weighted average), was then calculated.

Basin	Weighted Intensity (in/hr)		
	I _{10-year}	I _{50-year}	I _{100-year}
4 th , 2 nd , Commercial, Broadway, University, Princeton, Embudo, MLK, Mountain, Odelia	3.27	4.51	4.92
Edith	3.19	4.44	4.81
Lomas	3.05	4.22	4.60
Broadbent	3.22	4.47	4.85

2.2. *Pavement Drainage*

Inlet spacing was analyzed based on HEC-12 criteria for the 10-year and 50-year storm events (Appendix F). Flooded width and inlet clogging criteria for these storm events is contained in the project design criteria (Appendix A).

2.3. *Roadside and Median Channels*

Roadside and median channels were analyzed for the 50-year storm event. Freeboard criteria is contained in the project design criteria (Appendix A). Rip-rap channel lining was provided where the unlined channel velocities exceeded 0.76 m/s (2.5 fps). Rip-rap size was determined using the following equation developed by Smith and Murry (Smith, 1965) and Stevens (1981):

$$V = 3(d_{50})^{0.5}(Ss-1)S^{0.17}$$

Where, V = mean channel velocity (feet per second).

S = longitudinal channel slope (feet per foot).

Ss = specific gravity of rock (minimum $Ss = 2.50$).

d_{50} = rock size in feet for which 50% of the rip-rap by weight is smaller.

Minimum rip-rap blanket thickness is 1.5 times d_{50} .

2.4. Storm Drains

Drainage facility hydraulics were analyzed using the following methods:

- HEC-RAS water surface profiles and river system analysis software, Haestad Methods, Inc., Waterbury, Connecticut.
- StormCAD gravity flow pipe network analysis software, Haestad Methods, Inc., Waterbury, Connecticut.
- CulvertMaster culvert design and analysis software, Haestad Methods, Inc., Waterbury, Connecticut.
- FlowMasterPE civil engineering hydraulics software, Haestad Methods, Inc., Waterbury, Connecticut.
- Hydraulic Engineering Circular No. 12 (HEC-12) Drainage of Highway Pavements, National Technical Information Service, Springfield, Virginia.
- Hydraulic Engineering Circular No. 14 (HEC-14) Hydraulic design of Energy dissipators for Culvert and Channels, National Technical Information Service, Springfield, Virginia.
- Hydraulic Engineering Circular No. 15 (HEC-15) Design of Roadside Channels with Flexible Linings, National Technical Information Service, Springfield, Virginia.
- Hydraulic Engineering Circular No. 22 (HEC-22) Urban Drainage Design Manual, National Technical Information Service, Springfield, Virginia.

Storm drain facilities were sized based on a partially full flow condition for the 10-year storm event. Each storm drain trunk was then checked to ensure the 100-year storm event could be conveyed with the water surface elevation remaining below the roadway finished surface.

Pipe material selection was based on the following criteria:

- PC and SDPC where cover (unpaved) is greater than 0.3 m, cover (paved) is greater than 0.6 m and cover is less than less than 6.0 m.

- RCP where cover (unpaved) is less than 0.3 m, cover (paved) is less than 0.6 m and cover is greater than 6.0 m.
- RCP within City streets or AMAFCA right-of-way.
- SDPC (Manning's $n = 0.013$) and RCP (Manning's $n = 0.013$) where hydraulics do not allow PC (Manning's $n = 0.024$).
- PC is typically not used downstream of SDPC or RCP on storm drain trunk lines.

2.5. Detention Basins

Detention basin analysis was performed using AHYMO for the 100-year 24-hour storm event. Basin sizing parameters are contained in the project design criteria (Appendix A). Layout of the pond outlet facilities are based on the following:

- Minimum slope of pond bottom is 0.5% towards the primary outlet pipe.
- Primary outlet pipe invert is located 0.15 m above the pond bottom (0.000m for the 2nd Street pond, concrete lined).
- Secondary outlet is a minimum of 0.30 m below the lowest inlet (grate) contributing runoff to the pond.
- Emergency spillway is a minimum of 0.15 m above the lowest inlet (grate) contributing runoff to the pond.
- Top of pond is a minimum of 0.15 m above the emergency spillway.

3. Existing Conditions

3.1. 4th Street Basin

3.1.1. Drainage Patterns

The area along I40 between 7th Street and 4th Street drains to a 36-inch (900-mm) RCP within 4th Street. The 4th Street facility connects to a 48-inch (1200 mm) RCP in 3rd Street (2nd Street facility also connects here), which ultimately discharges to the Rio Grande south of the project. This is the westernmost basin within the project limits. A low capacity, interstate storm drain system consisting of 18-inch (450-mm) and 24-inch (600-mm) RCP, collects the runoff from the highway.

The Flood Insurance Rate Map (FIRM) designates two flood zones for this basin. The area west of 4th Street along I40 is designated as Zone X. Zone X is defined as areas of the 500-year flood, areas of the 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from the 100-year flood. Fourth Street under I40 and the westbound frontage road from 4th Street to 2nd Street are designated as Zone AO, Depth 1. Zone AO, Depth 1 is defined as special flood hazard areas inundated by the 100-year flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 1 foot average depths. All other areas are designated outside the 500-year floodplain.

3.1.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
1	1.3	34	68	0.13
2	1.1	0	100	0.13
3	2.4	18	82	0.26
4	2.5	32	68	0.13
5	1.4	32	68	0.13
Total	8.7	24	76	—

3.1.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
1	0.23	0.36	629
2	0.23	0.34	645
3	0.32	0.51	1300
4	0.45	0.71	1238
5	0.25	0.40	702
Total	1.48	2.33	4515

3.1.4. Offsite Runoff

Offsite tributary runoff originates to the north of I40. In the AMDS this tributary area is identified as basins 83 and 84. URS Greiner Woodward Clyde was not able to determine the volume of runoff for these basins using the AMDS. Therefore, an AHYMO analysis was performed to obtain this information. Results of this analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
		C	D			
6 TH Street (AMDS #83)	2.3	20	80	0.13	0.43	0.68
4 TH Street (AMDS #84)	17.1	30	70	0.33	1.86	3.00

3.2. 2nd Street Basin

3.2.1. Drainage Patterns

The area along I40 between 4th Street and the BNSF Railroad drains to a 15-inch (375-mm) RCP within 2nd Street. City GIS maps indicate the existing drainage facility in 2nd Street south of I40 is a 12-inch (305 mm) RCP that

connects to the 36-inch (914 mm) RCP in McKnight Road. The McKnight road facility connects with the 3rd Street storm drain at the same point as the 4th Street connection (3rd & McKnight). As discussed previously (see 4th Street basin), the 3rd Street system ultimately discharges to the Rio Grande.

The FIRM designates 2nd Street under I40 and the westbound frontage road from 4th Street to 2nd Street as Zone AO, Depth 1. Zone AO, Depth 1 is defined as special flood hazard areas inundated by the 100-year flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 1 foot average depths. All other areas are designated outside the 500-year floodplain.

3.2.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
6	4.6	35	65	0.13
7	2.0	28	72	0.13
Total	6.6	33	67	—

3.2.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
6	0.82	1.31	2255
7	0.37	0.58	1025
Total	1.19	1.89	3280

3.2.4. *Offsite Runoff*

Offsite tributary runoff originates to the north of I40. In the AMDS this tributary area is identified as basin 85. URS Greiner Woodward Clyde was not able to determine the volume of runoff for this basin using the AMDS. Therefore, an AHYMO analysis was performed to obtain this information. Results of this analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
		C	D			
2ND Street (AMDS #85)	11.2	40	60	0.20	1.53	2.50

3.3. Commercial Street Basin

3.3.1. Drainage Patterns

The area along I40 between the BNSF Railroad and Broadway Boulevard drains to a 36-inch (900-mm) RCP within Commercial Street, which ultimately discharges to the Broadway pump station.

The FIRM designates the area under I40 from the BNSF Railroad to Commercial Street as Zone AO, Depth 1. Zone AO, Depth 1 is defined as special flood hazard areas inundated by the 100-year flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 1 foot average depths. All other areas are designated outside the 500-year floodplain.

3.3.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
6A	3.2	66	34	0.13

3.3.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
6A	0.47	0.81	1242

3.3.4. Offsite Runoff

Offsite tributary runoff originates to the north of I40. In the AMDS this tributary area is identified as basin B143. URS Greiner Woodward Clyde was not able to determine the volume of runoff for this basin using the AMDS. Therefore, an AHYMO analysis was performed to obtain this information. Results of this analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
		C	D			
Commercial (AMDS B143)	4.1	70	30	0.13	0.59	1.02

3.4. Broadway Boulevard Basin

3.4.1. Drainage Patterns

The area along I40 between Broadway Boulevard and Edith Boulevard drains to a 27-inch (675-mm) RCP within Broadway Boulevard, which ultimately discharges to the Broadway pump station.

The FIRM designates the area outside the 500-year floodplain.

3.4.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
8	3.8	15	85	0.13
9	2.4	25	75	0.13
Total	6.2	35	65	—

3.4.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
8	0.75	1.16	2104
9	0.45	0.70	1243
Total	1.19	1.86	3348

3.4.4. Offsite Runoff

Offsite tributary runoff originates to the north of I40. In the AMDS this tributary area is identified as basin B112. URS Greiner Woodward Clyde was not able to determine the volume of runoff for this basin using the AMDS. Therefore, an AHYMO analysis was performed to obtain this information. Results of this analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
		C	D			
Broadway (AMDS B112)	6.2	70	30	0.13	0.89	1.52

3.5. Edith Boulevard Basin

3.5.1. Drainage Patterns

The area along I40 between Edith Boulevard and I25 (including a portion of the interchange) drains to a 54-inch (1350-mm) RCP in Edith Boulevard, which ultimately discharges to the Claremont Detention Basin.

The FIRM designates the area outside the 500-year floodplain.

3.5.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
10	5.1	66	34	0.13
11	17.5	72	28	0.14
Total	22.6	71	29	—

3.5.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
10	0.71	1.22	1956
11	2.11	3.68	6423
Total	2.83	4.90	8379

3.6. *University Boulevard Basin*

3.6.1. *Drainage Patterns*

The area along I40 between University Boulevard and Princeton Drive drains to a 42-inch (1050-mm) RCP in University Boulevard, which ultimately discharges to the Menaul Detention Basin via the Menaul Boulevard storm drain.

Discussions with the City Hydrology Division indicate that Menaul Boulevard experiences flooding for most rain storms. The City also expressed a desire to upgrade this facility if there were going to be any type of pavement work in Menaul Boulevard.

The Menaul/Mildred Report prepared for the City, determined that the storm drain in Menaul Boulevard was undersized and needed replacement. Recently, the City built a storm drain designed for the 100-year storm within University Boulevard and connected it to the storm drain system in Menaul Boulevard. Because the 54-inch storm drain in Menaul Boulevard is undersized, the City intended the University Boulevard storm drain system

to bypass the Menaul Boulevard system and directly connect to the junction box east of I25 at the Broadbent Culvert. However, the City encountered conflicts with existing utilities during construction and instead connected to the existing 54-inch (1350-mm) storm drain in Menaul Boulevard at the intersection of Menaul and University Boulevard.

The FIRM designates University Boulevard under I40 as Zone AO, Depth 1. Zone AO, Depth 1 is defined as special flood hazard areas inundated by the 100-year flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 1 foot average depths. All other areas are designated outside the 500-year floodplain.

3.6.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
14	2.1	71	29	0.13
16	1.4	72	28	0.13
17	1.9	62	38	0.13
18	5.1	75	25	0.13
Total	10.5	71	29	—

3.6.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
14	0.29	0.50	760
16	0.19	0.34	503
17	0.29	0.48	754
18	0.71	1.24	1835
Total	1.49	2.56	3852

3.6.4. *Offsite Runoff*

From the AMDS Vol. II Restudy, offsite sub-basin P1 contributes runoff to the University drainage basin. A portion of sub-basin P1 overlaps the existing onsite sub-basin 18.

3.7. *Princeton Drive Basin*

3.7.1. *Drainage Patterns*

The northern area along I40 between Princeton Drive and the North Diversion Channel drains to the Princeton Detention Basin double 6-ft (1800-mm) by 6-ft (1800-mm) overflow concrete box culvert (CBC). The double CBC outlets as surface flow along Princeton Drive to Menaul Boulevard and ultimately discharges to the Menaul Detention Basin. This basin primarily conveys runoff to the double CBC via earth ditches. The southern area along I40 between Princeton Drive and the North Diversion Channel drains to the double CBC.

The FIRM designates the area outside the 500-year floodplain.

3.7.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
19	8.1	61	39	0.13

3.7.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
19	1.24	2.08	3269

3.7.4. *Offsite Runoff*

The Princeton CBC serves as a secondary overflow for the Princeton detention basin located on the south side of I40. Primary outlet for the Princeton detention pond are 4 – 25 cfs (0.71 m³/s) pumps discharging to the North Diversion Channel.

3.8. Embudo Channel / North Diversion Channel / Rita Basin

3.8.1. Drainage Patterns

The area along I40 between the North Diversion Channel and Carlisle Boulevard drains to the Embudo Channel, upstream of its confluence with the North Diversion Channel. The North Diversion Channel ultimately discharges to the Rio Grande. Runoff from the Rita basin reaches the Embudo Channel by way of the existing triple 8-ft (2400-mm) by 5-ft (1500-mm) CBC. Currently, the onsite and offsite surface runoff reaches the box culvert by way of earth ditches and the Rita storm drain system.

The FIRM designates the North Diversion Channel as Zone A. Zone A is defined as special flood hazard areas inundated by the 100-year flood. All other areas are designated outside the 500-year floodplain.

3.8.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
20	13.1	52	48	0.13

3.8.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
20	2.11	3.49	5679

3.8.4. Offsite Runoff

Offsite tributary runoff originates to the south of I40. In the AMDS Restudy this tributary area is identified as basin L1. Results of a field investigation indicate that runoff from basin L1 enters the highway right-of-way at the following locations:

- Existing culvert from an inlet at the end of the McCoy Place cul-de-sac.
- Surface flow at the end of the Dartmouth Drive cul-de-sac.
- Surface flow at the end of the Bryn Mawr Drive cul-de-sac.

- Existing culvert from the City of Albuquerque Urban Forest Park detention basin near the end of Lafayette Drive.
- Rita 1800-mm storm drain.

All flows eventually confluence at the Rita CBC. The AMDS Restudy did not separate basin L1 into individual sub-basins. URS Greiner Woodward Clyde prepared an AHYMO analysis for the four sub-basins that entered the highway right-of-way separately from the Rita storm drain. Results of this analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
		C	D			
Dartmouth	0.8	46	54	0.13	0.13	0.21
McCoy	1.2	46	54	0.13	0.20	0.32
Bryn Mawr	8.9	46	54	0.14	1.42	2.33
Urban Forest	0.4	100	0	0.13	0.07	0.11

3.9. Dr. Martin Luther King Jr. Avenue Basin

3.9.1. Drainage Patterns

The current basin configuration conveys all flow to the south. The drainage system collects all the flow via earth ditches located in NMSHTD right-of-way between the I25 mainline and the frontage roads, as well as a series of inlets along the I25 mainline. The outfall for this system is a 30-inch (750-mm) storm drain crossing Dr. Martin Luther King Jr. Avenue on the west side of I25 and connecting to a 4-ft (1200-mm) by 4-ft (1200-mm) concrete box culvert in Copper Avenue. The runoff is conveyed to the Rio Grande.

The existing drainage basin border to the north is a high point north of Dr. Martin Luther King Jr. Avenue. The southern border is Dr. Martin Luther King Jr. Avenue. The eastern and western borders are at the NMSHTD right-of-way.

Analysis point (APV1) from the AMDS Vol. II restudy, located at I25 and Grand Avenue, indicates the 10 year runoff rate is 20 cfs (0.57 m³/s) and the 100 year runoff rate is 52 cfs (1.47 m³/s).

The FIRM designates the area outside the 500-year floodplain.

3.9.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
32	2.2	62	38	0.13
33	2.8	62	38	0.13
Total	5.0	62	38	---

3.9.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
32	0.33	0.55	865
33	0.42	0.70	1103
Total	0.75	1.26	1967

3.9.4. *Offsite Runoff*

Offsite runoff to this basin enters the highway right-of-way at Dr. Martin Luther King Jr. Avenue (MLK), Marquette Avenue, Roma Avenue, the under sidewalk drains from Parcel 3-2 (south of Las Lomas Rd.) and Las Lomas Road. Existing storm drain inlets intercept runoff at these locations.

3.10. *Lomas Boulevard Basin*

3.10.1. *Drainage Patterns*

The current system sends all the flow to the west along Lomas Boulevard and ultimately to the Broadway Pump Station. The drainage system collects all the flow using earth ditches, inlets located in NMSHTD right-of-way between the I25 mainline and the frontage roads, and a series of inlets along the I25 mainline. The outfall for this system is a 30-inch (750-mm) storm system located on Lomas Blvd west of I25.

The existing I40 drainage basin border to the north is Mountain Road. The southern border is a high point north of Dr. Martin Luther King Jr. Avenue. The eastern border is the northbound frontage road and NMSHTD right-of-

way. The western border is the southbound frontage road and NMSHTD right-of-way.

The FIRM designates the area outside the 500-year floodplain.

3.10.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
28	2.7	48	52	0.13
30	3.0	31	69	0.13
31	3.3	48	52	0.13
Total	9.0	42	58	—

3.10.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
28	0.45	0.74	1221
30	0.55	0.87	1509
31	0.54	0.88	1452
Total	1.53	2.48	4182

3.10.4. *Offsite Runoff*

Offsite runoff to the Lomas Basin consists of surface flow from the steep slopes east of the existing loop ramp and a 250 mm ACP pipe outlet from the hotel property adjacent to the existing loop ramp.

On the NE corner of the Las Lomas Road / Northbound Frontage Road intersection there is an existing inlet in the hotel parking lot. Runoff over-tops the parking lot curbing causing severe slope erosion. The inlet is approximately 300 mm deep with a 150-mm outlet pipe. This outlet pipe will connect to trunk 404 and be routed through the Lomas detention pond.

The approximate Las Lomas offsite boundary includes the area bounded by Medical Arts Avenue to the north, Encino Place to the east, Las Lomas Road to the south and the north bound frontage road (Oak Street) to the west.

An AHYMO analysis was performed for the Las Lomas offsite area to obtain runoff information. Results of this analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment		Time to Peak (hours)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
		C	D			
Las Lomas	4.1	15	85	0.13	0.80	1.24

3.11. Mountain Road Basin

3.11.1. Drainage Patterns

Currently, runoff on the east side of I25 travels overland to a raised inlet in the vacant field between Mountain Road and Lomas Boulevard. An existing 24-inch (600-mm) storm drain conveys the flow to the west side of I25. On the west side of I25 pavement runoff is intercepted by inlets and sent northward to Mountain Road and ultimately to the Broadway Pump Station in an existing 24-inch (600-mm) storm drain.

The existing drainage basin border to the north is Mountain Road. The eastern boundary is the existing 60-inch (1500-mm) storm drain located in the vacant field between Mountain Road and Lomas Boulevard. The southern border is Lomas Boulevard. The western border is the NMSHTD right of way west of I25.

There is an existing 54-inch (1350-mm) forcemain in Mountain Road that carries runoff from the Broadway Pump Station to the North Diversion Channel.

The FIRM designates the area outside the 500-year floodplain.

3.11.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
29	3.1	61	39	0.13

3.11.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
29	0.47	0.79	1237

3.11.4. Offsite Runoff

Runoff from residential and commercial sites within the area bordered by Lomas Boulevard, University Boulevard, Sigma Chi Road and Medical Arts Avenue is carried north in an existing 60-inch (1500 mm) storm drain to the existing 3-120 inch Indian School culverts. The 60-inch storm drain intercepts flow on both Mountain Road and Lomas Boulevard. The *Lomas Boulevard Storm Drain Design Analysis (1991)* indicates that the 100-year flow just north of Mountain Road at the I25 on-ramp is 6.40 m³/s (226 cfs).

3.12. Odelia Basin

3.12.1. Drainage Patterns

Runoff within and east of I25 (between Lomas Boulevard and I40) is discharged to the Odelia detention basin (also known as Odelia Dam Park and Vietnam Veterans Park). Area inlets and earth ditches collect the runoff between the I25 mainline and frontage roads. Mainline runoff is intercepted by roadway inlets.

The Odelia detention basin is located northwest of Indian School Road and I25. Runoff enters the Odelia detention basin via an existing 30-inch (750-mm) culvert crossing I25 and 3-120 inch (3000-mm) culverts crossing I25 at Indian School Road. A 60-inch (1500-mm) City storm drain from Lomas Boulevard paralleling the east side of I25 discharges additional runoff to the upstream end of the 3-120 inch culverts. From the detention basin, the stormwater is carried by gravity to the Claremont Detention Basin. The outfall for the Odelia detention basin is a 30-inch (750-mm) storm drain system located in the northwest corner of the detention basin.

The FIRM designates the existing 30-inch culvert crossing I25 and discharging to the Odelia detention basin as Zone AO, Depth 1. Zone AO, Depth 1 is defined as special flood hazard areas inundated by the 100-year flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 1 foot average depths. The triple 120-inch culverts crossing I25 at Indian School Road are designated as Zone AO, Depth 3. Zone AO, Depth 3 is defined as special flood hazard areas inundated by the 100-year flood with

depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 3 foot average depths. All other areas are designated outside the 500-year floodplain. The FIRM does not depict the Odelia detention basin.

3.12.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
25	2.7	55	45	0.13
26	3.9	44	56	0.13
27	8.9	59	41	0.31
Total	15.5	54	46	—

3.12.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
25	0.42	0.70	1132
26	0.66	1.07	1785
27	0.80	1.38	3628
Total	1.89	3.15	6545

3.12.4. *Offsite Runoff*

From the AMDS Vol. II Restudy, the following sub-basins make up the contributing offsite drainage basin: R1, S1 and U1 for a total of 284 acres (114.93 ha). The basin boundary to the south is Lomas Boulevard. To the north, the boundary is just southeast of the I25/I40 interchange. To the east, the boundary is the North Diversion Channel and University Boulevard. To the west, the boundary is the I25 mainline and the northbound frontage road.

As-built and field investigations indicate runoff from sub-basins R1, S1 and U1 enter or cross the highway right-of-way at the following locations:

- 1) Sub-basin U1 runoff is intercepted along Lomas Boulevard and at the intersection of Medical Arts Avenue / Lomas Boulevard by City storm

drainage facilities. The water collected is conveyed to the three Indian School road / I25 culverts via the 60-inch (1500 mm) City storm drain paralleling the east side of I25.

- 2) Sub-basin S1 runoff is intercepted by the three Indian School Road / I25 culverts.
- 3) Sub-basin R1 runoff enters the highway right-of-way at the following locations:
 - Existing 750 mm (30-inch) RCP storm drain on the south side of Indian School Road. Runoff south of Indian School Road and east of University Boulevard is collected by this facility and conveyed to the upstream end of the existing 3-120 inch culverts.
 - Parcel 7-2 (north of Indian School Road) runoff enters highway right-of-way as surface flow and is conveyed to area inlet near the NE corner of the Indian School Road bridge. An existing dirt berm prevents the runoff from reaching the I25 mainline and routes the water towards the existing inlet.
 - Parcel 7-3 (north of parcel 7-2) runoff enters highway right-of-way as surface runoff at the SW parcel corner and as discharge from a 200 mm culvert at mid parcel. Both runoff discharges flow northward to the existing 30-inch (750 mm) culvert crossing I25 and draining to the Odelia detention pond.
 - Parcel 7-4 (north of parcel 7-3) runoff enters the highway right-of-way as surface runoff, asphalt paved ditch, and discharge from three culverts. All flow travels southward to the existing 30-inch (750 mm) culvert crossing I25 and draining to the Odelia detention pond.

The surface runoff tributary areas consist of a steep slope between the highway right-of-way and the buildings on the property and an undeveloped area north of the buildings. The steep slope runoff consists of sheet flow. The undeveloped area runoff is collected by an asphalt paved ditch that also serves as a maintenance road within the highway right-of-way.

The first culvert exits through an existing retaining wall at the SW corner of the parcel. The other two culverts discharge west of the northern portion of the building.

- Parcel 8-2 (north of parcel 7-4) has an existing retaining wall on the west side. Surface runoff flows west and enters the highway property at the NW and SW corner of the parcel. Runoff is intercepted by the asphalt paved ditch. The highpoint in the asphalt ditch is at the SW corner of Parcel 8-2 (the ditch adjacent to this parcel flows northward to the interchange).

Runoff for parcels 7-2, 7-3, 7-4 and 8-2 was calculated by prorating total runoff for basin R1 (see Indian School Road basin) based on the ratio of parcel area to R1 area. Runoff summary for the parcels is shown below:

Sub-basin	Area (hectare)	Land Treatment (%)			Time to Peak (hours)	100-year (6 hour) Runoff Existing (m ³ /s)	100-year (6 hour) Runoff Future (m ³ /s)	10-year (6 hour) Runoff Future (m ³ /s)
		B	C	D				
R1	41.9	7	8	85	0.18	9.0	10.9	6.8
Indian Sch.	30.3	7	8	85	0.18	6.5	7.9	4.9
Parcel 7-2	0.61	7	8	85	0.18	0.13	0.16	0.10
Parcel 7-3	2.53	7	8	85	0.18	0.54	0.66	0.41
Parcel 7-4	5.67	7	8	85	0.18	1.22	1.48	0.92
Parcel 8-2	0.79	7	8	85	0.18	0.17	0.21	0.13

The Odelia detention basin was constructed in 1984. The design tributary drainage basin for Odelia detention basin from the as-built plans is 422 acres (170.77 ha). This contributing drainage area was subsequently reduced by the construction of drainage facilities diverting flow to the Campus Draw. The AMDS Restudy reflects this change.

In a meeting with the City Hydrology Department the City stated that the AMDS Vol. II Restudy analysis point for the Indian School Road triple 120-inch culvert crossing was suspect. In the original study, the SCS Unit Hydrograph method was used. The City did not concur with this method of analysis.

URS Greiner Woodward Clyde reanalyzed the offsite drainage basin for the existing condition and a future developed condition using AHYMO. The analysis of the existing conditions assumed the current developed offsite conditions. The analysis of future developed conditions assumed all areas to be 85% impervious and land treatment D, as requested by the City. The times of concentration and basin areas from the AMDS Vol. II Restudy were used for both reanalysis. As part of the AHYMO analysis a detention basin routing was performed on the Odelia Dam using pond parameters depicted on the as-built drawings.

To correlate as-built information (elevations) and hydraulic analysis with the Big I Project the following process was used:

- The outlet elevation for the existing 120" (3000-mm) CMP was taken from the Odelia detention basin as-built, converted to SI units and compared with the Big I Project field survey of the outlet. It was found that the elevation shown on the record drawing was 0.8 meters lower than the Big I Project field survey.
- The original as-built hydraulic information (stage, storage and discharge) was used to calculate the detention pond water surface elevations using AHYMO. The AHYMO hydraulic analysis results were converted to SI units and the Big I project datum correction factor applied

Using AHYMO, the 100 year storm event runoff for AMDS drainage basins R1, S1 and U1 was found to equal 25.1 m³/s (885 cfs) for the existing condition and 29.1 m³/s (1026 cfs) for the future developed condition. The corresponding water surface elevation in the Odelia detention basin for 25.1 m³/s (885 cfs) is 1532.47 meters (Big I Project Datum) and is contained in the detention basin. Results of the drainage basin analysis are shown below:

Sub-basin	Area (hectare)	Land Treatment (%)			Time to Peak (hours)	100-year (6 hour) Runoff Existing (m ³ /s)	100-year (6 hour) Runoff Future (m ³ /s)
		B	C	D			
R1	41.9	7	8	85	0.18	9.0	10.9
S1	33.1	7	8	85	0.19	6.2	8.2
U1	40.2	7	8	85	0.20	9.9	10.0
Total	115.2	7	8	85	—	25.1	29.1

Design capacity of the Odelia detention basin from the as-built plans is 504 cfs (14.27 m³/s) for the 100-yr. storm. The water surface elevation from the as-builts for 504 cfs (1427 m³/s) is approximately 5024.4 feet (1532.2 meters, Big I Project Datum). After converting the as-builts to SI units and applying a +0.8 meter vertical datum correction factor, the spillway elevation is 1533.3 meters (Big I Project Datum) and the top of the dam is 1534.3 (Big I Project Datum).

3.13. Broadbent Channel

3.13.1. Drainage Patterns

The present I25 drainage system conveys all runoff to the Menaul Detention Basin via the Broadbent Channel. The drainage system collects all the flow from just north of Industrial Avenue /Aztec Road to the northern part of the I25/I40 interchange. However, it does not include the Industrial Avenue Basin. The runoff is collected with earth ditches, inlets located in NMSHTD right-of-way between the I25 mainline and the north and southbound frontage roads, and a series of inlets along the I25 mainline. The system also conveys runoff from the I40 East leg to the Broadbent Channel. The contributing runoff area extends from the I25/I40 interchange to the North Diversion Channel along the I40 East leg. The flow is transported via the storm systems in University Boulevard, Princeton Drive and Menaul Boulevard and discharged into the Broadbent Channel.

URS Greiner Woodward Clyde had difficulty locating hydraulic information on the existing arch culverts crossing I25 at the Broadbent Channel. The City indicated that the as-built drawings for the existing 199-inch (4975-mm) by 121-inch (3025-mm) arch culvert were a reliable source for hydraulic information. The City also suggested that in lieu of as-built drawings, the Menaul Detention Basin Report was a dependable source for hydraulic information. Information obtained from these two sources is as follows:

- As-built drawings indicate the 100 year storm runoff in the channel at Broadbent Parkway (west of I25) is 1266 cfs (35.85 m³/s).
- As-built drawings indicate the 100 year storm runoff rate being conveyed through the arch culvert is 1056 cfs (29.91 m³/s).
- The Menaul Detention Basin Report indicates the offsite area contributing runoff to the arch culvert is 353 acres (142.85 ha).
- The Menaul Detention Basin Report indicates the 100-year storm runoff rate being conveyed through the existing 54-inch (1350-mm) storm drain in Menaul Boulevard is 148 cfs (4.19 m³/s). The contributing drainage basin area is 45 acres (18.21 ha). The 54-inch (1350-mm) storm drain connects to an existing 60-inch (1500-mm) storm line on the west side of I25.
- The Menaul Detention Basin Report indicates the drainage basin area contributing to the existing 60-inch (1500-mm) storm drain is 57 acres (23.07 ha) with a corresponding 100-year storm runoff rate of 75 cfs (2.12 m³/s). Combined with the 148 cfs (4.19 m³/s) from the 54-inch (1350-mm) storm line, the 60-inch (1500-mm) line carries 223 cfs (6.32 m³/s) to the Broadbent Channel. The 54-inch (1350-mm) and 60-inch (1500-mm) storm drains do not contribute to the flow being conveyed

through the arch culvert, but contribute to the Broadbent channel west of I40.

The FIRM designates the Broadbent Channel and Menaul Boulevard under I25 as Zone AO, Depth 1. Zone AO, Depth 1 is defined as special flood hazard areas inundated by the 100-year flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain) and 1 foot average depths. All other areas are designated outside the 500-year floodplain.

3.13.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
12	7.8	72	28	0.13
13	4.9	88	12	0.14
15	3.3	62	38	0.13
21	12.2	64	36	0.13
22	10.7	53	47	0.35
24	1.3	55	45	0.13
Total	40.2	65	35	---

3.13.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
12	1.10	1.90	2849
13	0.59	1.07	1552
15	0.51	0.85	1335
21	1.82	3.09	4800
22	0.94	1.59	4590
24	0.20	0.34	542
Total	5.16	8.84	15667

3.13.4. Offsite Runoff

The offsite drainage basin slopes west from the North Diversion Channel towards I25.

As-built and field investigations indicate offsite runoff enters or crosses the highway right-of-way at the following locations:

- 1) An existing 54-inch (1350-mm) storm drain in Menaul Boulevard carries runoff from upstream of the project limits ultimately to the Broadbent Channel. This system surcharges during minor storm events resulting in flooding along Menaul Boulevard.
- 2) Parcel 11-3 (north of Menaul Boulevard) runoff surface flows to two locations, Menaul Boulevard and an existing inlet in the NW corner of the parcel. The inlet connects to the junction structure on the east end of the 126-inch (3200 mm) culvert extension to the Broadbent Arch culvert.
- 3) University Boulevard Truck Stop (north of parcel 11-3) surface runoff flows to two locations:
 - An existing combination curb opening and triple grate inlet in the SW corner of the parcel. This inlet, parking lot asphalt pavement and curb and gutter encroach onto NMSHTD property (area occupied is approximately 90 m²). The inlet connects to the junction structure on the east end of the 126-inch (3200 mm) culvert extension to the Broadbent Arch culvert.
 - A 1200-mm grated access to the junction structure on the east end of the 126-inch (3200 mm) culvert extension to the Broadbent Arch culvert.
- 4) An existing 36-inch (900 mm) and 72-inch (1800 mm) storm drain connecting to the junction structure on the east end of the 126-inch (3200 mm) culvert extension to the Broadbent Arch culvert.
- 5) Culverts crossing the northbound Pan American Freeway at the following locations:
 - 25 meters north of Candelaria Road. Outfall for Candelaria road inlets and hotel parking lot inlet.
 - 170 meters north of Candelaria Road. Outfall for business parking lot.
 - 210 meters north of Candelaria Road. Outfall northbound frontage road inlet.

- 6) Culverts crossing the Pan American Freeway at the following locations drain an existing ditch on the east side of the frontage road. Culverts convey ditch flow across business access locations.
- 360 meters north of Candelaria Road. Outfall for business parking lot.
 - 500 meters north of Candelaria Road. Outfall for business parking lot.
 - 610 meters north of Candelaria Road. Outfall for business parking lot.
- 7) As-built and field investigations indicate runoff from AMDS sub-basins R1 and Q1 enter the highway right-of-way and are conveyed to the Broadbent channel by the existing interchange storm drain. Q1 runoff analysis has been included with the onsite analysis of sub-basins 15 and 18. R1 runoff consists of the following:
- Parcel 8-2 (north of parcel 7-4) has an existing retaining wall on the west side. Surface runoff flows west and enters the highway property at the NW and SW corner of the parcel. Runoff is intercepted by an asphalt paved ditch that also serves as a maintenance road. The highpoint in the asphalt ditch is at the SW corner of Parcel 8-2 (the ditch adjacent to this parcel flows northward to the interchange).
 - Parcel 8-3 (north of parcel 8-2) runoff flows west and enters the highway property as surface flow and is intercepted by the asphalt paved ditch / maintenance access road.
 - Parcel 49-1 (north of parcel 8-3) runoff enters the highway right-of-way through a curb cut in the asphalt parking lot.
 - Parcel 49-2 (north of parcel 49-1) runoff enters the highway right-of-way through multiple curb cuts in the asphalt parking lot. A shallow ditch within the highway right-of-way conveys the runoff to University Boulevard and enters the roadway as surface flow.

Runoff for parcels 8-2, 8-3, 49-1 and 49-2 was calculated by prorating total runoff for basin R1 (see Indian School Road basin) based on the ratio of parcel area to R1 area. A runoff summary for the parcels is shown below:

Sub-basin	Area (hectare)	Land Treatment (%)			Time to Peak (hours)	100-year (6 hour) Runoff Existing (m ³ /s)	100-year (6 hour) Runoff Future (m ³ /s)
		B	C	D			
R1	41.9	7	8	85	0.18	9.0	10.9
Parcel 8-2		7	8	85	0.18	0.17	0.21
Parcel 8-3		7	8	85	0.18	0.20	0.23
Parcel 49-1		7	8	85	0.18	0.13	0.16
Parcel 49-2		7	8	85	0.18	0.07	0.08

3.14. Aztec Road/Industrial Avenue Basin

3.14.1. Drainage Patterns

Currently, runoff from the east crosses I25 at Aztec Road and flows westward. At the intersection of Aztec Road and the northbound frontage road, there are batteries of inlets that intercept stormwater from the east. The inlets are connected to a 36-inch (900-mm) culvert crossing I25 and running west along Industrial Avenue. An inlet between the I25 mainline and the southbound frontage road also intercepts flow. The existing 36-inch (900-mm) pipe discharges to a detention pond near Edith Boulevard. The pond has a 36-inch (900-mm) outfall pipe to the Alameda Lateral.

The existing onsite drainage basin area includes only the area adjacent to the northbound and southbound frontage roads. The basin is bordered to the north by a high point north of Aztec Road/Industrial Avenue and to the east and west by NMSHTD right-of-way. The border to the south is a high point south of Aztec Road/Industrial Avenue. Runoff from the northbound and southbound frontage roads and southbound I25 contribute to the basin.

The FIRM designates the area outside the 500-year floodplain.

3.14.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
22A	2.2	38	62	0.13

3.14.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
22A	0.38	0.60	1027

3.14.4. Offsite Runoff

The offsite watershed is bounded roughly by the North Diversion Channel to the east, Comanche Road to the north and Candelaria Road to the south and the Pan American Freeway (northbound frontage road) to the west. Runoff collects at Aztec Road and flows west to the northbound frontage road. An existing 36-inch (900 mm) culvert crosses I25 at this location.

According to the Tinley Drainage Report, the 36-inch (900-mm) culvert has a capacity of 38 cfs (1.07 m³/s) under gravity-flow conditions. Under inlet control and an existing maximum headwater depth of six feet, its capacity is 65 cfs (1.84 m³/s). The Tinley Drainage Report indicates that the 10-year runoff from the contributing onsite and offsite drainage areas for the Aztec industrial area is approximately 185 cfs (5.24 m³/s). The 100-year runoff is approximately 291 cfs (8.24 m³/s) with a corresponding volume of 11.5 acre-ft (14185 m³).

Therefore, the culvert has insufficient capacity, and will flow under pressure during major rainstorms causing water to pond east of I25. A discussion with NMSHTD officials indicates that the I25 mainline near Candelaria Road floods for approximately 30 minutes during major storms. Should Aztec Road runoff overtop the northbound frontage curbs, existing topography along I25 would convey runoff from Aztec Road to Candelaria Road. The Aztec Road runoff could be contributing to the I25 flooding at Candelaria Road.

4. Proposed Conditions

4.1. 4th Street Storm Basin

4.1.1. Drainage Patterns

Although the amount of impervious area will increase with the proposed improvements, placement of new drainage facilities will result in a slight shift of the basin boundaries and a corresponding reduction in the basin area. This will result in a slightly smaller peak discharge rate and reduced runoff volume delivered to the existing storm drain in 4th Street.

4.1.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
1A	1.7	9	91	0.13
1B	2.4	21	79	0.13
1C	2.9	16	84	0.13
1D	1.3	24	76	0.13
Total	8.3	17	83	---

4.1.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
1A	0.35	0.54	987
1B	0.45	0.71	1267
1C	0.57	0.88	1594
1D	0.24	0.38	676
Total	1.61	2.50	4523

4.1.4. Storm Drains

The existing bridges at 6th and 4th Streets will remain and be widened. New ramps will be constructed to connect the widened I40 with the existing cross streets. The existing highway drainage facilities will be replaced with new 600 mm storm drain facilities to accommodate the new highway geometry. Existing highway drainage facilities connecting to the City drainage facilities in 6th Street, 4th Street and the cul-de-sac street (south of I40 between 6th & 4th) will be replaced with new facility connections to the exiting City facilities. Offsite improvements to the City storm drain have not been proposed for this project.

4.1.5. Special Issues

4th Street between Prospect Avenue (north of I40) and McKnight Avenue (south of I40) is designated as Zone AO (depth 1 foot) on the FIRM Panel 332 of 825.

This project does not increase the volume of runoff to the 4th Street drainage basin.

4.2. 2nd Street Storm Basin

4.2.1. Drainage Patterns

Proposed improvements will increase the amount of impervious area and basin acreage contributing runoff to this basin. This will result in an increase in the peak discharge rate and runoff volume. Five detention ponds are provided for mitigating the increased runoff and will be located under the I40 bridge between 2nd Street and 1st Street, within the NMSHTD right-of-way. These detention ponds will discharge at a rate equal to the historic peak discharge rate for this basin.

4.2.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
2A	4.4	23	77	0.13
2B	2	16	84	0.13
Total	6.4	21	79	—

4.2.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
2A	0.83	1.30	2324
2B	0.39	0.60	1084
Total	1.22	1.90	3408

4.2.4. Storm Drains

Roadway improvements for this basin are limited to I40 and the frontage roads east of 2nd Street. I40 runoff west of 2nd Street is conveyed to the proposed detention basins by a 600 mm storm drain. East of 2nd Street, bridge deck drains (bridges 6908 & 6910) discharge I40 runoff directly to the ground below. The storm water then travels as overland flow to the relocated culvert inlet at the NE quadrant of 1st Street and Indian School Road. Runoff from the frontage roads is collected by inlets at the roadway intersections with 1st Street. The WBFR runoff is conveyed to the detention basins and the EBFR runoff is conveyed to 2nd Street storm drain by a reconstructed inlet and lateral.

4.2.5. Detention Basin Design

Five concrete lined detention basins will be constructed between the existing bridge piers east of 2nd Street. The detention basins are concrete lined to prevent saturation of the soil. Saturation of the soil could result in additional settlement of the bridge pier spread footings.

Proposed storm drain facilities enter and exit the 1st (western) pond. The other four ponds are connected to the 1st pond by a trunk line with laterals and as the water level in the first pond rises so does the water level in the other ponds. Depth of storage varies from 1.4 meters to 0.81 meters from the western pond to the eastern pond. Total storage volume provide by the detention ponds is 1577 m³ (1.28 ac-ft). Existing highway facilities generate 3281 m³ (2.66 ac-ft) of runoff (100-year, 24-hour storm event) and project improvements will generate 136 m³ (0.11 ac-ft) of additional runoff volume.

4.2.6. Special Issues

2nd Street between Arvada Avenue (north of I40) and McKnight Avenue (south of I40) is designated as Zone AO (depth 1 foot) on the FIRM Panel 332 of 825. The existing City storm drain facility in 2nd Street south of the

detention pond is a 12-inch (305 mm) RCP. This facility and the City facilities further south are not sufficient to convey the existing City and highway runoff tributary to the 2nd Street watershed. The project improvements increase the amount of runoff in the 2nd Street watershed, but the increased volume (136 m³, 0.11 ac-ft) has been mitigated by the additional detention pond storage volume (1577 m³, 1.28 ac-ft).

4.2.7. *Coordination with Local Agencies*

URS Greiner Woodward Clyde met with the City on October 27 & 28, 1998; November 6, 1998; November 16, 1998; March 3, 1999; February 3, 2000 and February 4, 2000 to discuss City drainage issues. During the February 4, 2000 meeting the City indicated their policy concerning new development (Big-I reconstruction) and detention ponds is:

- Downstream drainage facility capacity dictates the allowable discharge from new development.
- New development is defined as involving grading in excess of 500 cubic yards. Pavement overlays are not considered new development.
- Ponds are required where there is no capacity or minimal capacity in the drainage system downstream of the development. Discharge from the pond is restricted to less than or equal to the downstream facility capacity.

Capacity for the existing 12-inch (914 mm) RCP in 2nd Street is 0.05 m³/s (1.9 cfs), assuming a friction slope equal to the slope of 2nd Street and pipe flowing full. Existing peak City runoff north of I40 (2.50 m³/s, 88.3 cfs, 100 year, 6 hour) and existing highway runoff (1.89 m³/s, 66.7 cfs, 100 year, 6 hour) exceed the existing storm drain capacity by a very large margin. This situation persists further southward. The southern drainage facilities increase, but peak runoff also increases. Enlarging the storm drain in 2nd Street immediately south of I40 would not eliminate the existing flooding issue and there is not sufficient right-of-way to detain all of the runoff from the highway. The City Hydrology Division suggested using the City park south of I40 between 3rd and 2nd Street as a detention pond. URSGWC had suggested this as early as October 1998, but it was rejected by the City and NMSHTD due to the potential 4F environmental issues.

4.3. *Commercial Street Basin*

4.3.1. *Drainage Patterns*

The proposed highway improvements will maintain and widen the existing I40 roadway and bridges. Frontage roads have been added to each side of I40. Existing inlets on I40 draining to the Commercial Street storm drain, will be replaced with a series of inlets and two 600 mm trunk lines along I40

and the frontage roads. Collected runoff will continue to be conveyed to the existing storm drain in Commercial Street.

4.3.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
3A	2.9	35	65	0.13
3B	1.1	19	81	0.13
Total	4.0	31	69	—

4.3.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
3A	0.51	0.81	1402
3B	0.21	0.32	579
Total	0.72	1.14	1981

4.3.4. *Storm Drains*

Two storm drains are proposed for this basin. A 600 mm storm drain will convey the WB I40 and WBFR runoff to the existing storm drain in Commercial Street. A 600 mm storm drain will convey the EB I40 and EBFR runoff to the existing storm drain in Indian School Road.

Capacity for the existing 36-inch (914 mm) RCP in Commercial Street is 1.02 m³/s (31 cfs), assuming a friction slope equal to the slope of Commercial Street and pipe flowing full. The upstream end of this facility is located at I40. Two existing inlets on I40 and two inlets at the intersection of Commercial Street and Indian School Road convey water to this facility. Capacity of the combined existing inlets in the intersection is 0.71 m³/s (25.2 cfs). The 100 year storm event runoff conveyed by the west bound highway storm drain is 0.23 m³/s (8.0 cfs). The 100 year storm event runoff conveyed by the east bound highway storm drain is 0.21 m³/s (7.3 cfs).

4.3.5. *Special Issues*

Runoff north of I40 is conveyed as surface flow along Commercial Street. Driveway curb cuts on the west side of Commercial Street at I40 enable the

surface runoff to travel west to the BNSF railroad right-of-way and then flow southward adjacent to the railroad tracks. Information on FIRM Panel 332 of 825 also indicates this situation.

4.4. *Broadway Boulevard Basin*

4.4.1. *Drainage Patterns*

Proposed highway improvements will widen the existing I40 and add frontage roads to each side. These improvements will increase the impervious area. Runoff from the highway and Parcel 26-3 (adjacent to the north side of I40, west of Edith Boulevard) will be routed through a detention basin located north of I40 and east of Broadway Boulevard.

4.4.2. *Drainage Area Characteristics*

Sub-basins 4A and 4B extend from Indian School Road to Arvada Avenue encompassing an area of 5.7 ha, but exclude Parcel 26-3. Sub-basins 4A and 4B have been further broken down to separate the highway from the adjacent private property. Sub-basins 4C and 4D represent the private property portions of sub-basins 4A and 4B respectively.

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
I40 R/W	3.5	11	89	0.13
Parcel 26-3	0.5	32	68	0.13
4C	1.4	64	36	0.13
4D	0.7	63	37	0.13
Total	6.1	31	69	—

4.4.3. *Onsite Hydrology*

Sub-basin 4	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
I40 R/W	3.4	11	89	0.13
Parcel 26-3	0.5	32	68	0.13
Total	3.9	14	86	—

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
4	0.78	1.21	2214

4.4.4. Offsite Runoff

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
4C	0.21	0.34
4D	0.11	0.18
Total	0.32	0.52

4.4.5. Storm Drains

Three storm drains are proposed for this basin. One system collects runoff from EB I40, EBFR, one half of WN I40 and one half of EBFR. Another system collects runoff from the remaining portion of WB I40 and WBFR. The third system collects offsite runoff from Parcel 26-3. All three systems are routed through the detention basin.

4.4.6. Detention Basin Design

Available storage depth and volume (below secondary outlet) of the detention pond are 1.34 m and 1052 m³ (0.86 ac-ft) respectively. Operating depth and peak discharge for the detention pond are 1.22 m and 0.38 m³/s (13.6 cfs). The detention pond reduces the sub-basin 4 peak runoff from 1.22 m³/s (43.1 cfs) to 0.38 m³/s (13.6 cfs).

Broadway Detention Pond	
Bottom of Pond	1516.00 m
Primary Outfall	1516.15 m (invert)
Secondary Outfall	1517.49 m (top of grate)
Emergency Spillway	1517.85 m
Top of Pond	1518.00 m
Water Surface Elevation	1517.37 m
100 Year Peak Discharge	0.33 m ³ /s (11.5 cfs)

4.5. Edith Boulevard Basin

4.5.1. Drainage Patterns

Currently, the interchange drains to the Menaul Detention Basin, Odelia Dam Park and the Edith Boulevard storm drain. The area within the interchange west of northbound I25 drains to a 54-inch (1350-mm) RCP in Edith Boulevard, which ultimately discharges to the Claremont Detention Basin. The proposed frontage roads cut below the existing ground within the interchange. This limits the amount of runoff that can discharge to the Menaul Detention Basin and Odelia Dam Park in a gravity system. Therefore, the majority of the interchange will need to discharge to the Edith Boulevard storm drain system. In addition, the proposed improvements increase the impervious area resulting in increased runoff from this basin.

The increase in runoff will be routed through six detention ponds located within the interchange. These detention ponds will discharge at the rate required to maintain the historic peak discharge rate for this basin.

4.5.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
5A	5.7	55	45	0.13
5B	3.1	62	38	0.17
5C	4.2	51	49	0.17
5D	4.1	68	32	0.13
5E	3.1	64	36	0.13
5F	3.8	58	42	0.13
5G	3.7	67	33	0.13
5H	3.8	48	52	0.14
5I	4.1	60	40	0.13
5J	4.8	36	64	0.13
5K	3.2	31	69	0.13
Total	43.7	54	46	---

4.5.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
5A	0.90	1.49	2402
5B	0.41	0.69	1252
5C	0.59	0.97	1826
5E	0.46	0.78	1206
5F	0.59	0.99	1576
5G	0.54	0.93	1423
5H	0.60	0.99	1690
5I	0.63	1.06	1679
5J	0.85	1.36	2329
5K	0.59	0.93	1626
Total	6.76	11.21	18574

4.5.4. Offsite Runoff

The parcels discussed below have historically contributed runoff to the storm drain facilities in Edith Boulevard.

Highway improvements will reduce the amount of Parcel 55-1 area that contributes surface runoff to Edith Boulevard. Parcel 55-1 runoff is included in sub-basin 5C. Approximately 2.3 ha (32%) of area will be routed through the northwest interchange pond as a result of the right-of-way acquisition for the NBFR.

The runoff value for Odelia Dam was obtained from the as-built record drawings and is shown below.

URS Greiner Woodward Clyde could not find existing published runoff data for Parcel 37-1. Paragraph A.6 of DPM Section 22.2 was used to generate the runoff values shown below.

Sub-basin	Area (hectare)	Land Treatment (%)		
		B	C	D
Parcel 37-1	6.7	7	8	85

Sub-basin	Area (ha)	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)
Parcel 55-1	4.9 + 2.3 = 7.2	Included with sub-basin 5C	
Odelia Dam	----	----	0.69
Parcel 37-1	6.7	1.35	2.07

4.5.5. Storm Drains

Two main outfall storm drains are proposed for the interchange. A 600-mm outfall in the WBRF will convey runoff from the northwest interchange detention pond. The 600-mm outfall also conveys runoff from offsite Parcel 55-1 (Springer Site) located adjacent to the NW quadrant of the interchange. A 1350-mm outfall in the EBFR conveys runoff from the west, central and east interchange ponds. The 1350-mm outfall also conveys runoff from the Odelia Dam park and the offsite Parcel 37-1 (Sun Village located adjacent to the SW quadrant of the interchange).

4.5.6. Detention Basin Design

The northwest, north central and northeast interchange ponds function as a single pond. Physical site features necessitated dividing a single pond into three. Connector culverts between the ponds have been sized to allow the free flow of water between ponds and the water surface elevation at any given time will be the same for all three ponds. Runoff tributary areas for these ponds include sub-basins 5A, 5B and 5C.

North Interchange Detention Ponds	
Bottom of Pond	1522.00 m
Primary Outfall	1522.15 m (invert)
Secondary Outfall	1524.54 m (top of grate)
Emergency Spillway	1525.82 m
Top of Pond	1526.00 m
Water Surface Elevation	1524.36 m
100 Year Peak Discharge	0.39 m ³ /s (13.9 cfs)

Runoff tributary area for the east interchange includes sub-basins 5E, 5F, 5G, 5H and 5I.

East Interchange Detention Pond	
Bottom of Pond	1524.00 m
Primary Outfall	1524.15 m (invert)
Secondary Outfall	1526.70 m (top of grate)
Emergency Spillway	1528.32 m
Top of Pond	1528.67 m
Water Surface Elevation	1526.59 m
100 Year Peak Discharge	0.64 m ³ /s (22.6 cfs)

Runoff tributary area for the central interchange pond is sub-basin 5J.

Central Interchange Detention Pond	
Bottom of Pond	1529.65 m
Primary Outfall	1529.00 m (invert)
Secondary Outfall	1531.55 m (top of grate)
Emergency Spillway	1531.85 m
Top of Pond	1532.00 m
Water Surface Elevation	1530.67 m
100 Year Peak Discharge	0.04 m ³ /s (1.5 cfs)

Runoff tributary area for the central interchange pond is sub-basin 5K.

West Interchange Detention Pond	
Bottom of Pond	1527.10 m
Primary Outfall	1527.25 m (invert)
Secondary Outfall	1529.55 m (top of grate)
Emergency Spillway	1529.85 m
Top of Pond	1530.00 m
Water Surface Elevation	1529.32 m
100 Year Peak Discharge	0.27 m ³ /s (9.5 cfs)

4.5.7. *Special Issues*

Currently, there is a considerable amount of erosion in the southeast quadrant of the interchange caused by a combination of steep cut slopes, soil conditions and offsite runoff. Proposed improvements will flatten these slopes and a concrete lined ditch at the top of slope will be provided to collect the large offsite flows.

4.6. *University Boulevard Basin*

4.6.1. *Drainage Patterns*

The University basin slopes from east to west with its eastern limit located at the Princeton box culvert. The highway begins its descent into the

interchange west of University Boulevard and limits the basin tributary area that can be routed back to the existing storm drain in University Boulevard.

4.6.2. *Drainage Area Characteristics*

The initial sub-basin boundary layout placed the western limit of 6A and 6B on the west side of University Boulevard. During final drainage, roadway grading and interchange detention pond design it was determined that a portion of sub-basins 5F and 5I would need to be routed to the Broadbent Channel and not through the interchange to the Edith Boulevard storm drain. This revised runoff routing is similar to the existing conditions. Calculation of the peak runoff for sub-basins 5F and 5I (contributing to the University Boulevard storm drain) was performed as a part of the pavement and ditch drainage analyses.

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
6A	3.9	41	59	0.13
6B	5.9	47	53	0.13
Total	9.8	44	56	—

4.6.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
6A	0.67	1.08	1821
6B	0.98	1.59	2641
Total	1.64	2.67	4462

4.6.4. *Offsite Runoff*

Improvements to the interchange will lower the existing grades. This necessitates removing the existing storm drain in the interchange that conveyed the runoff to the Broadbent channel (from AMDS sub-basins R1 and Q1). This flow and a portion sub-basin P1 runoff will now be picked up by a concrete lined channel within and adjacent to the NMSHTD right-of-

way and conveyed to a proposed storm drain (Trunk 8) west of University Boulevard. This new storm drain will convey both the offsite runoff and highway runoff to the existing drainage facility in University Boulevard. Offsite parcels contributing runoff to the concrete channel are 8-2, 8-3, 49-1, 49-2, 49-3, 49-4 and 50-1. Parcels 49-3, 49-4 and 50-1 are included with the onsite sub-basins 5G and 6B.

4.6.5. Storm Drains

Runoff will be collected by roadside ditches and roadway inlets. Storm drain facilities are provided in the EBFR, WBFR, Ramp WS, University ramps and I40 to convey the ditch and roadway runoff to the existing storm drain in University Boulevard. Highway runoff east of University Boulevard is conveyed to the existing University Boulevard storm drain by three 600 mm trunk facilities and two 600 mm laterals. West of University Boulevard the 600 mm storm drain along Ramp WS and the 900 mm storm drain in I40 buck grade to convey offsite runoff to the existing University Boulevard storm drain.

A new storm drain (Trunk 10) will connect to the existing University Boulevard storm drain at the WBFR and divert all flow west along the WBFR and north along the NBFR to the storm drain facility in Menaul Boulevard. The existing storm drain in Menaul Boulevard will be enlarged from the NBFR to the Broadbent channel as a part of the Trunk 10 storm drain improvements. Flow from I40 and further south of I40 will no longer be conveyed northward (in University Boulevard) to the existing Menaul storm drain.

4.6.6. Coordination with Local Agencies

Storm drain Trunk 10 west of University Boulevard was designed at the request of the City of Albuquerque to mitigate the existing flooding problems in University Boulevard and Menaul Boulevard. This facility carries both highway and City runoff and a cooperative agreement between the NMSHTD and City was prepared to facilitate cost sharing for the design and construction of this storm drain. See section 4.13.7 for additional discussion.

4.7. Princeton Drive Basin

4.7.1. Drainage Patterns

The proposed I40 profile shifted the roadway low and high points and resulted in a decrease in the contributing area of this basin. Consequently, the proposed peak discharge is lower than the existing and additional mitigating measures are not required for this basin. The eastern limit of this

drainage basin is the North Diversion Channel and the western limit is the Princeton box culvert.

4.7.2. *Drainage Area Characteristics*

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
7A	3.4	36	64	0.13
7B	3.8	48	52	0.13
Total	7.2	42	58	---

4.7.3. *Onsite Hydrology*

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
7A	0.60	0.96	1645
7B	0.63	1.04	1713
Total	1.23	2.00	3359

4.7.4. *Storm Drains*

The existing drop inlet over the Princeton box culvert on the south side of I40 has been relocated southward to pickup runoff from the new ditch. A new drop inlet over the Princeton box culvert was added to the center of I40 and a 600-mm storm drain in I40 connects to this inlet. The existing drop inlet over the Princeton box culvert on the north side of I40 has been relocated northward to pickup runoff from the ditch between the University off ramp and I40. An inlet and lateral from the off-ramp connect to ditch inlet.

4.7.5. *Box Culvert Extension*

Proposed improvements to Interstate 40 will not require the extension of the existing Princeton box culvert, but the north end of the existing box culvert will pass through the proposed MSE retaining wall adjacent to the north side of the University boulevard off ramp. Improvements along I40 will also increase the depth of fill over the existing box culvert, but this depth is still less than the depth of fill at the existing North Diversion Channel. The

structural capacity of the existing box culvert is adequate for the new highway fill.

4.8. Embudo Channel / North Diversion Channel / Rita Basin

4.8.1. Drainage Patterns

The proposed improvements will increase the contributing area and impervious area of this basin. Consequently, the proposed peak discharge rate will increase from the existing rate. However, the North Diversion Channel downstream of the Embudo Channel confluence was designed for 13,800 cfs (390.82 m³/s) for the 100-year storm. The maximum design capacity is 25,000 cfs (708 m³/s) for the project flood. The increased runoff from this basin is so minute compared to the design of the channel that its freeboard will not change from existing conditions.

The additional 16 cfs (0.45 m³/s) that will reach the box culvert is well within its excess capacity. Additional mitigating measures are not required; however, the box culvert will need to be extended to the south beyond the new pavement width limits.

4.8.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
8A	6.3	53	47	0.13
8B	6.5	36	64	0.13
Total	12.8	44	56	---

4.8.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
8A	1.01	1.67	2717
8B	1.15	1.83	3149
Total	2.16	3.51	5866

4.8.4. Offsite Runoff

Sound Wall 7 will be located along the NMSHTD right-of-way on the south side of I40 from the Princeton detention basin to Carlisle Boulevard. Storm drain facilities have been designed to convey offsite runoff through the sound wall and to the Rita box culvert.

The Dartmouth, McCoy and Bryn Mawr sub-basins currently drain to the Rita box culvert (triple 8-ft by 5-ft) via an interstate ditch (parallel to I40). This ditch is located within the alignment of the proposed I40 improvements. A new rip-rap lined ditch on the north side of Sound wall No. 7 will replace the existing ditch. Adjacent to the Bryn Mawr cul-de-sac the ditch flow and runoff from the cul-de-sac are collected and conveyed by a storm drain pipe to the Rita box culvert.

Dartmouth: A concrete rundown currently discharges offsite runoff from the Dartmouth cul-de-sac to the interstate ditch. An inlet (City Double Type "C" inlet) will be built at the end of the rundown and discharge to the new rip-rap ditch. The inlet interception capacity is designed for the 100-year storm event, with the water surface (WSE) below the top of curb. The City will continue to have access to this rundown and new inlet via the Dartmouth cul-de-sac.

McCoy: An inlet in the McCoy cul-de-sac discharges offsite runoff through an existing 18-inch (450 mm) culvert to the interstate ditch. This culvert will be extended to the new rip-rap ditch. The City will continue to have access to this storm drain from the inlet in the McCoy cul-de-sac.

Bryn Mawr: A concrete rundown currently discharges offsite runoff from the Bryn Mawr cul-de-sac to the interstate ditch. An inlet (City Triple Type "C" inlet) will be built at the end of the rundown and discharge to the proposed storm drain (Trunk 4). The inlet interception capacity is designed for the 100-year storm event, with the water surface (WSE) below the top of curb. The City will continue to have access to this rundown (and new inlet) from the Bryn Mawr cul-de-sac.

Urban Park: A Single Type "C" inlet will be built at the local low spot and discharge to the proposed storm drain. An existing 12-inch outfall for one of the detention ponds in the park is in conflict with the proposed sound wall. A new inlet (City Single Type "D" inlet) will be built on the 12-inch with a 600-mm (24-inch) pipe downstream used to convey the runoff to the Rita box and avoid the sound wall conflict. Since this Single "D" inlet is on higher ground, it will only intercept overflow from the Single "C" inlet or detention pond, if any. The inlet interception capacity is designed for the 100-year storm event. The City will continue to have access to these facilities from the Urban Park.

4.8.5. Storm Drains

The area west of the Rita box culvert will drain to two parallel 1200-mm storm drains connecting to the box culvert. The area east of the box culvert will continue to drain to the box culvert via earth ditches and a 600-mm storm drain in the Carlisle off ramp. The existing Carlisle off ramp storm drain constructed with the Carlisle interchange project will remain in place.

4.8.6. Channel Design

Improvements to I40 and will require modifications to the existing recreational trail in the located in North Diversion Channel. The existing recreational trail will be removed and the North Diversion Channel lining modified to incorporate the recreational trail. The proposed recreational trail will ramp down under the new bridge structures and become an integral part of the North Diversion Channel lining. This modification has the following benefits:

- Eliminates the existing cantilevered recreational trail and chain-link fence channel obstruction. (When the existing bike path was added to the channel, the U.S. Army Corps of Engineers required the analysis to assume the area occupied by the fenced recreational trail was not useable for channel hydraulics).
- Provides added channel capacity by providing a bench for the recreational trail adjacent to the existing channel.

A separate channel hydraulic analysis was prepared for the as-built (1965) channel, cantilevered recreational trail and proposed benched recreational trail to assess the impacts to the channel hydraulics resulting from the recreational trail and I40 bridge improvements. This report is contained in Appendix P.

4.8.7. Box Culvert Improvements

Runoff from the surrounding area and the existing 72-inch Rita storm drain currently discharges to an open, paved area at the upstream end of the existing Rita box culvert. The Rita box culvert crosses under I40 and drains to the Embudo Channel. The open area at the south end of the Rita box culvert will be removed and replaced with an extension of the box culvert and a closed transition structure. A manhole for access to the transition structure has been provided. The transition structure will connect the existing box culvert to the existing 72-inch (1800-mm) RCP. New storm drains facilities connecting to the transition structure and existing box culvert will convey roadway, ditch and offsite runoff.

The proposed roadway grade is at approximately the same elevation as the existing roadway. Structural capacity of the existing box culvert is adequate.

4.9. Dr. Martin Luther King Jr. Avenue Basin

4.9.1. Drainage Patterns

The proposed drainage basin boundary to the north is a high point north of Dr. Martin Luther King Jr. Avenue. The southern border is Dr. Martin Luther King Jr. Avenue. The eastern and western borders are the NMSHTD right-of-way.

Runoff will be intercepted with earth ditches located between the I25 mainline and the frontage roads as well as mainline and frontage road inlets. The new trunk systems will be placed in the I25 mainline and the northbound frontage road and convey the storm water south and west into an existing 30-inch (750-mm) trunk system in the southbound frontage road.

The proposed AHYMO analysis for the 100-year 6-hour storm equals 1.38 m³/s (48.8 cfs). This is an increase over the entire drainage basin of 0.12 m³/s (4.2 cfs), when compared with the existing AHYMO analysis for the 100-year 6-hour storm. This insignificant increase of runoff does not require onsite mitigation.

4.9.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
20	4.0	62	38	0.13

4.9.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
20	0.75	1.26	1967

4.9.4. Offsite Runoff

Offsite flow is intercepted by an existing system of inlets at the intersection of the northbound frontage road (Oak Street) and Roma / Marquette Avenue.

This system ties into trunk 403, a 750-mm storm drain, which crosses I25 at this location. The amount of offsite flow intercepted at this point is 1.32 m³/s (46.6 cfs) for the 100-year 6-hour event.

Runoff from Parcel 3-2 is intercepted with new inlets connected to trunk 403 (750-mm storm drain) in the northbound frontage road. The 100-year 6-hour runoff rate intercepted is 0.22 m³/s (7.8 cfs). At Las Lomas the 100 year 6-hour runoff rate intercepted is 0.37 m³/s (13.24 cfs)

4.9.5. Storm Drains

Runoff generated from mainline I25 and the northbound frontage road will be routed into three separate trunks. Trunk 400 (600-mm storm drain) will tie into an existing 30-inch (750-mm) system in the southbound frontage road. Trunk 403 is a 750-mm storm drain, which runs south along the northbound frontage road. At Encino Place and the northbound frontage road, trunk 403 heads west across I25 to the southbound frontage road where it ties into the existing 30-inch (750-mm) system.

Trunk 402, a 600-mm storm drain, collects I25 southbound drainage. Trunk 402 ties into trunk 403 as trunk 403 crosses I25. Pavement and ditch runoff within the eastside right-of-way of the interstate will be collected and conveyed under I25 to the west side in trunk 403. Runoff on the westside of I25 is intercepted by trunk 403 via ditch flow.

4.10. Lomas Boulevard Basin

4.10.1. Drainage Patterns

The northerly I40 drainage basin border is south of Mountain Road. The southerly border is a high point north of Dr. Martin Luther King Jr. Avenue. The easterly and westerly borders are NMSHTD right-of-way.

Increasing the impervious area of this basin resulted in an increase of the peak discharge for the Lomas Basin system. A detention basin located in NMSHTD right-of-way between the I25 mainline and the northbound frontage road, south of Lomas Boulevard will mitigate the additional runoff.

The sum of all the proposed onsite flow intercepted by the drainage system for the entire Lomas Basin is 2.1 m³/s (74.4 cfs) for the 100-year 6-hour storm.

4.10.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
21A	4.1	41	59	0.13
21B	4.9	34	66	0.13
Total	9.0	37	63	—

4.10.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
21A	0.70	1.14	1923
21B	0.87	1.39	2407
Total	1.58	2.53	4330

4.10.4. Storm Drains

Most runoff from I25 and the northbound frontage road will be routed through the new detention basin using a 900-mm storm drain (trunk 404). The proposed detention basin will outlet to an existing 30-inch (750-mm) RCP located in Lomas Boulevard.

Ditch flow on the east side of I25 in the right-of-way will be collected and conveyed to the detention basin. Storm water generated on the west side of I25 will be routed directly to the existing 30-inch storm drain in Lomas Boulevard via laterals and through trunk 406, a 600-mm storm drain.

4.10.5. Detention Basin Design

Sub-basin 21B, which includes most of I25 and the northbound frontage road was routed through the pond. The analysis determined that the proposed facility will detain 1.18 acre-ft (1457 m³). The depth of the pond at the 100-year water surface elevation is 0.9 m and the discharge is equal to 0.59 m³/s (20.86 cfs). The facility will be located on the east side of I25, west of the

northbound frontage road and south of Lomas Boulevard in NMSHTD right-of-way.

Lomas Detention Pond	
Bottom of Pond	1537.85 m
Primary Outfall	1538.00 m (invert)
Secondary Outfall	1538.88 m (top of grate)
Emergency Spillway	1539.18 m
Top of Pond	1539.35 m
Water Surface Elevation	1538.85 m
100 Year Peak Discharge	0.59 m ³ /s (20.9 cfs)

4.11. Mountain Road Basin

4.11.1. Drainage Patterns

The northern boundary for the basin is Mountain Road. The existing 60-inch (1500 mm) storm drain located in the vacant field between Mountain Road and Lomas Boulevard intercepts runoff along these two streets and acts as the eastern boundary for the basin. The southern boundary is Lomas Boulevard. The west boundary of the basin is NMSHTD right-of-way.

Earth ditches along the northbound frontage road intercept runoff and convey it to trunk 407 which ties into to the existing 24-inch (600-mm) storm drain in Mountain Road. Trunk 407 also collects runoff from I25. Trunk 407A intercepts pavement flow in the southbound frontage road and connects to the 24-inch (600-mm) in Mountain Road.

The 100-year 6-hour onsite runoff intercepted is 0.79 m³/s (28.0 cfs). This is equal to the AHYMO 100-year 6-hour result for the existing hydrology. Thus, existing and proposed conditions are the same.

4.11.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
22	3.4	48	52	0.13

4.11.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
22	0.56	0.92	1517

4.11.4. Offsite Runoff

The 60-inch storm drain to the east of the basin will remain to intercept runoff on both Mountain Road and Lomas Boulevard and to carry flow to the Odelia Detention Basin.

4.11.5. Storm Drains

Two trunk systems are proposed for this basin with both trunks tying into the existing 24-inch (600-mm) system in Mountain Road. Trunk 407, a 600 mm storm drain, will collect pavement runoff from I25, the northbound frontage road and the vacant field area. On the west side of the basin a 600 mm storm drain, trunk 407A will collect flow from the southbound frontage road.

4.12. Odelia Basin

4.12.1. Drainage Patterns

The proposed drainage basin borders include to the north, the southern part of the I25/I40 interchange and to the east and west the NMSHTD right-of-way. The border to the south is Mountain Road.

On and offsite runoff will continue to flow to the Odelia Dam Park, as well as the southernmost area within the interchange. Inlets along the I25 mainline and the frontage roads will tie to parallel storm drains between the I25 mainline and the north and southbound frontage roads. The project improvements will increase the overall runoff to the drainage basin, however the additional runoff will be detained in the existing Odelia detention basin.

4.12.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
23	8.3	8	92	0.13

4.12.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
23	1.68	2.58	4779

4.12.4. Offsite Runoff

Offsite runoff from the east side of I25 north of Indian School Road is intercepted by the highway improvements at the following locations:

- Parcel 7-2
An inlet (CB-1111) in the SW corner adjacent to the sound wall. This replaces an existing inlet.
- Parcel 7-3
An inlet (CB-1112) in the SW corner of the parking lot and a manhole connection (MH-020) to an existing 10-inch drain pipe at mid parcel.
- Parcel 7-4
A pipe and head wall (CV-009) at the base of the proposed retaining wall is provided at the base of the existing storm drain energy dissipator structure in the SW corner. The energy dissipator serves an existing storm drain paralleling the southern parcel property line.
A pipe and headwall (CV-010) is provided at mid parcel at the base of the proposed retaining wall. Overland runoff is collected from the existing erosion gully.
- Parcel 8-2
A ditch at the top of the MSE retaining wall conveys runoff south to the end of the wall and the runoff continues overland to CV-010 adjacent to Parcel 7-4.

Offsite flow from the east side of I25 south of Indian School Road will continue to be carried to the Odelia detention basin via the new Indian School Road culverts.

4.12.5. Storm Drains

The three 1800-mm culverts will be the primary outfall for the drainage basin to the Odelia Dam Park. All trunks for this basin tie into the 1800-mm culverts.

Along the southbound frontage road and I25 southbound, trunk 11 travels south and connects to the 1800-mm culverts just north of Indian School Road. Trunk 11 varies in size from 600-mm pipe culvert to 1050-mm RCP. Offsite runoff, as well as pavement flow from I25 NB, the NW ramp and the northbound frontage road is carried in trunk 12, which ties into the Indian School culverts along I25 NB. Trunk 12 varies in size from 600-mm pipe culvert to 1350-mm RCP. Stormwater from the southern part of the core is carried in Trunk 13, a 600-mm storm drain. Trunk 13 joins trunk 12 at the intersection of the NW and NE ramps. South of Indian School road, runoff from I25 is intercepted by laterals that tie to trunk 408 running north in the northbound frontage road shoulder. Trunk 408 is the replacement for the existing 60-inch RCP/concrete channel running northward from the Lomas Boulevard/Medical Arts Avenue area. Flowing north within the southbound frontage road is a 600-mm storm drain, trunk 409, which ties into the new culverts just north of Indian School Road.

The existing 30-inch (750-mm) culvert that crosses I25 and discharges into the Odelia Dam Park north of Indian School Road will be removed. The existing runoff will be routed to the three 1800-mm culverts.

4.12.6. Culvert Extension

Proposed improvements to Interstate 25 will lower the profile of the interstate and create conflicts with the existing triple 120-inch (3000-mm) CMP crossing under Indian School Road and I25. The three existing 120-inch (3000-mm) CMP are oversized for the runoff flowing to them.

Upstream drainage improvements built after the three 120-inch (3000-mm) CMP were constructed, have reduced the runoff tributary area. The existing three 120-inch (3000-mm) culverts will be replaced with three 1800-mm culverts. The concept for the I25 section of the culvert replacement is to insert the new culverts inside the existing 120-inch (3000-mm) culverts and remove the top portion of the existing culverts. . Where the culverts cross Indian School Road they will be replaced with three 1800-mm culverts at 0.3% slope to avoid conflicting with the NBFR and retaining wall.

Proposed improvements to Interstate 25 will widen the existing roadway. The northbound frontage road will be constructed over the existing concrete channel and 60-inch (1500-mm) RCP running northward from the Lomas Boulevard/Medical Arts Avenue area. The existing concrete channel and 60-inch (1500-mm) RCP will be removed and replaced with a new 1500-mm RCP. The 1500-mm pipe will be placed in the northbound frontage road shoulder. As the trunk approaches the upstream side of the 1800-mm

culverts it will curve eastward and penetrate the new headwall structure of the culverts.

4.12.7. Coordination with Local Agencies

Throughout the project URS Greiner Woodward Clyde coordinated with the City of Albuquerque regarding the Indian School culvert crossings.

The City wanted to carry the future developed condition flow of 1026 cfs ($29.1 \text{ m}^3/\text{s}$) under I25. Three 1800-mm culverts would convey the 1026 cfs ($29.1 \text{ m}^3/\text{s}$). The computed headwater for 1026 cfs equals 1537.36 meters. The headwater on the three 1800-mm culverts will be below the edge of shoulder/barrier on the northbound frontage road for the 100-year storm event for future developed conditions. The water surface elevation in the Odelia Dam Park for 1026 cfs ($29.1 \text{ m}^3/\text{s}$) is 1531.9 meters.

The following items were discussed with the City regarding the existing and proposed culverts at Indian School:

The Odelia Dam Park as-builts state that the headwater elevation for the existing culverts is 1537.29 m, assuming that Q_{100} is 504 cfs. The headwater for the existing culverts for Q_{100} equal to 885 cfs (from the URSGWC analysis of present conditions upstream for basins R1, S1, U1) is 1537.82 m.

The headwater for the proposed culverts, for Q_{100} equal to 1142 cfs (from the URSGWC analysis of future developed conditions for upstream basins R1, S1, U1) plus proposed onsite runoff from the Odelia basin is 1537.76 m.

The upstream headwater of 1537.76 m for the proposed condition, Q_{100} equal to 1142 cfs is less than the headwater of 1537.82 m for existing conditions for Q_{100} equal to 885. This is the case because the URSGWC design is using concrete culverts instead of CMP and the entrance configuration has changed from $k_e = 0.7$ (CMP mitered to slope) to $k_e = 0.5$ (concrete headwall with square-edges). In addition, the proposed entrance structure has been set 1.46 m lower than the existing culverts.

The upstream headwater of 1537.76 meters for the proposed conditions $Q_{100}=1142$ cfs is 0.5 meters more than the headwater for existing conditions for $Q_{100}=504$. However, the original hydrology for the Odelia Park Dam is suspect (the City of Albuquerque had URSGWC restudy the upstream hydrology of basins R1, S1, U1).

The URSGWC design for the Indian School culverts does not appear to impact the upstream basin for the 100-year storm. The FIRM (Flood Insurance Rate Map) currently shows the 100-year flood elevation as being confined to an existing constructed channel. The FIRM shows an upstream flood depth of three feet, which is approximately the depth of our upstream headwater. The FIRM does not show the Odelia Park Dam.

4.13. Broadbent Channel

4.13.1. Drainage Patterns

The drainage basin borders are defined by high points south of Comanche Road along I25 and the north and south bound frontage roads. To the east and west the NMSHTD right-of-way acts as the boundary. The border to the south is the northern part of the I25/I40 interchange.

The initial routing concept for this basin included the following:

The proposed routing would continue to carry the runoff to the Menaul Detention Basin via the Broadbent Channel. Earth ditches located in NMSHTD right-of-way between the I25 mainline and the north and southbound frontage roads plus a series of inlets along the frontage roads and I25 mainline will intercept runoff. At Aztec Road/Industrial Avenue the existing inlets along mainline I25 would be disconnected and rerouted to the south. This would eliminate NMSHTD right-of-way runoff from entering the existing 36-inch (900-mm) culvert crossing I25. The overall project improvements will decrease the runoff of the drainage basin. Interchange runoff that previously was conveyed to the Broadbent Channel will be routed through the detention ponds in the interchange and conveyed to Edith Boulevard.

Runoff to the Broadbent Channel from NMSHTD right-of-way will be reduced. However, the actual storm water volume entering the channel will be greatly increased because of offsite flows being diverted from the Aztec Road/Industrial Basin at the City of Albuquerque's request.

4.13.2. Drainage Area Characteristics

Sub-basin	Area (hectare)	Land Treatment (%)		Time to Peak (hours)
		C	D	
24A	4.9	28	72	0.13
24B	3.7	33	67	0.13
24C	5.7	74	26	0.13
24D	1.9	54	46	0.13
24E	2.6	66	34	0.13
24F	2.3	62	38	0.13
24G	2.6	14	86	0.14
24H	3.2	29	71	0.16
Total	27.9	46	54	—

4.13.3. Onsite Hydrology

Sub-basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
24A	0.89	1.41	2482
24B	0.66	1.05	1817
24C	0.80	1.39	2067
24D	0.31	0.51	819
24E	0.38	0.65	1005
24F	0.50	0.85	1331
24G	0.50	0.78	1458
24H	0.51	0.82	1608
Total	4.57	7.45	12588

4.13.4. Offsite Runoff

The City's Aztec Road offsite runoff will be intercepted at the intersection of Aztec Road and the northbound frontage road. The NMSHTD trunk / channel will carry the additional 100-year runoff of 8.24 m³/s (291 cfs) to the Broadbent Channel. The following table summarizes the additional Aztec Road runoff:

Offsite Basin	10-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (m ³ /s)	100-year (24 hour) Volume (m ³)
Aztec Avenue	5.24	8.24	14185

Additional offsite runoff from parcels along the Pan American Freeway (northbound frontage road) discharge to the proposed channel / trunk system. The contributing parcel(s), area and the 100-year 6-hour offsite flow are the following:

Parcels	Area (Ac)	100-year (6 hour) Runoff (m ³ /s)	100-year (6 hour) Runoff (ft ³ /s)
14-4, 15-2	3.169	0.40	14.3
14-3	7.065	0.90	31.9
14-3	5.82	0.74	26.3
14-1, 14-2	2.578	0.33	11.6

The Candelaria / Claremont Storm Drain plans indicate that the offsite flow for the 100-year flow is 6.09 m³/s (215 cfs).

4.13.5. Storm Drains

Along the southbound frontage road from south of Industrial Avenue to just north of the Broadbent Channel is the trunk 412 storm drain, varying in size from 600-mm to 900-mm. Trunk 412 carries flow from the southbound frontage road and I25 to an existing 54-inch (1350-mm) RCP that ties into the Broadbent Channel culvert. Trunk 413, a 600-mm storm drain, picks up flow along I25 then connects to trunk 412. Two 600-mm storm drains, trunks 411 and 416, receive flow from I25 and tie directly to the existing 199-inch (4975-mm) by 121-inch (3025-mm) arch culvert at the Broadbent Channel.

The drainage system on the east side of I25 includes trunks 414, 415, 417, culverts, a concrete channel and earth ditches. The system intercepts all the flow within the NMSHTD right-of-way as well as offsite runoff which includes Aztec Avenue, properties along Pan American freeway and the Candelaria / Claremont Storm Drain. Trunk 417 (an 1800-mm RCP) intercepts the offsite runoff from Aztec Avenue. Trunk 417 discharges the flow to a concrete-lined channel.

The channel has a bottom width of 2-meters, a top width that varies from 8-meters to 10-meters and side slopes equal to 1:4. The channel runs south between I25 and the northbound frontage road. Trunk 414 (a 600-mm storm drain) collects I25 runoff and ties into the channel north of Candelaria Road. NMSHTD runoff is picked-up with earth ditches and area inlets and discharges to the channel. Offsite runoff ties into the channel via culverts.

South of Candelaria Road the channel joins trunk 415, which varies in size from 1800-mm RCP to 2100-mm RCP. Trunk 415 carries upstream flow as well as intercepting NMSHTD overland runoff and offsite flow from the 54-inch RCP Candelaria / Claremont Storm Drain. Trunk 415 ties into a junction box to the east of the frontage road and west of the truck stop. From the junction box, the flow is discharged to the existing 199-inch (4975-mm) by 121-inch (3025-mm) arch culvert.

4.13.6. Culvert Extension

Proposed improvements to Interstate 25 will increase the depth of fill above the existing arch culverts and CMP. Structural adequacy of the existing 199-inch (4975-mm) by 121-inch (3025-mm) arch culvert and 126-inch (3150-mm) CMP culvert crossings has been verified.

4.13.7. Special Issues

The City Hydrology Division at the onset of the project was concerned with the storm drain in Menaul Boulevard and its existing undersized condition. The City proposed combining the NMSHTD and City runoff in the University Boulevard area and rerouting it to the Broadbent Channel. URS Greiner Woodward Clyde evaluated this request and determined that it was feasible. The City agreed to pay for the incremental construction cost to increase the size of the storm drain due to the University Boulevard runoff. The City also agreed to pay for the additional engineering cost.

The City also partnered with the NMSHTD to include the 54-inch (1350-mm) Candelaria/Claremont Storm Drain (City Project No. 4252.90) in the I25/I40 Interchange project. The Candelaria / Claremont Storm Drain begins at Princeton and Candelaria, travels south along Princeton, then west along Claremont and south along NMSHTD right-of-way until it ties into trunk 415 north of the junction box near the truck stop.

The Candelaria/Claremont Storm Drain system drains the area from north of Claremont Avenue, south of Candelaria Boulevard, west of the North Diversion Channel and east of University Boulevard. This storm drain was included in the analysis for the Menaul Detention Basin Report and the City had planned to construct this storm drain as part of the Menaul Detention Basin Project.

4.13.8. *Coordination with Local Agencies*

URS Greiner Woodward Clyde met with the City of Albuquerque in the fall of 1998 to coordinate the initial routing concept and the capacity issue of the existing 36-inch culvert at Aztec Road. Following discussions with the City of Albuquerque it was concluded that they wished to resolve the capacity issue of the existing 36-inch culvert at Aztec Road.

The agreed upon option for the Aztec basin was the to continue carrying the runoff to the Menaul Detention Basin via the Broadbent Channel. The City's Aztec Road offsite runoff would piggyback on the proposed NMSHTD trunk / channel and flow south along I25 and the northbound frontage road. This system would discharge directly into the Broadbent Channel without detention. The City agreed to pay for the incremental construction cost to increase the size of the storm drain facility due to the Aztec Road runoff.

It is not certain that the Menaul Detention Basin can handle the additional flow, or even drain under the 96-hour State criteria. Further analysis will be needed. The City stated they would perform the downstream capacity analysis for the Broadbent Channel and the Menaul Detention Basin. Dan Hogan from the City of Albuquerque Hydrology Department stated that the Big I Project does not need to analyze the downstream conditions. The City will analyze the downstream conditions and design any improvements necessary to facilitate the additional runoff from the Aztec Road offsite basin.

4.14. *Aztec Road/Industrial Avenue Basin*

4.14.1. *Drainage Patterns*

This drainage basin is included with the Broadbent Channel basin analysis.

4.14.2. *Special Issues*

URS Greiner Woodward Clyde met with MRGCD early in the project and it was discovered that a license is not on file for the existing 36-inch (900-mm) outfall facility from Aztec Road to Industrial Avenue. The Industrial Avenue storm drain facility outlets into a MRGCD detention pond. If improvements to the interstate increase the runoff draining to this pond, then a complete analysis of this system and possibly an MRGCD license and improvements

to the system would be required. This issue is moot because runoff from the NMSHTD right-of-way will be removed from this facility and routed to the Broadbent Channel.

4.14.3. *Coordination with Local Agencies*

See section 4.13.8.

5. North Diversion Channel Crossing

See Appendix P for hydraulic analysis of the recreational trail and I40 bridge improvements.

6. Construction Staging

URS Greiner Woodward Clyde prepared a three stage maintenance of traffic concept. This concept was referred to during the drainage design to locate the storm drain trunk lines. Permanent drainage facilities need to function for the portions of work completed and support subsequent phases of construction. Existing drainage facilities must also continue to operate during construction.

7. Maintenance and Limits of Responsibility

The following subsections delineate the maintenance responsibilities for all drainage facilities within the limits of the Big I Project. These maintenance designations have been reviewed and approved by the City, AMAFCA and NMSHTD.

7.1. NMSHTD Drainage Maintenance Responsibilities

All storm drains within NMSHTD right-of-way that serve the runoff produced within NMSHTD right-of-way.

Detention ponds within NMSHTD right-of-way.

Drainage facilities currently maintained by NMSHTD, including the culverts crossing I40 at Indian School Road.

That portion of drainage facilities within NMSHTD right-of-way, including those at the following locations: Broadbent Channel/Phoenix, Las Lomas Road, Princeton Drive and the Rita Storm Drain.

7.2. City of Albuquerque Drainage Maintenance Responsibilities

That portion of drainage facilities within City right-of-way, including those at the following locations: Broadbent Channel/Phoenix, Las Lomas Road, Princeton Drive and the Rita Storm Drain.

Detention ponds to be located within NMSHTD right-of-way between 2nd Street and Commercial Street, if and only if the City designates these ponds as dual-use facilities. If these ponds are not designated as dual-use facilities, then these ponds shall be maintained by NMSHTD.

All facilities situated within local streets, such as 6th Street, 4th Street, 2nd Street, Commercial Street, Broadway Boulevard, Edith Boulevard, University Boulevard, Dr. Martin Luther King Jr. Avenue, Lomas Boulevard, Mountain Road, Menaul Boulevard, Candelaria Road and Comanche Road.

All facilities parallel to NMSHTD right-of-way that serve runoff produced offsite, including (1) along I25 between Medical Arts Avenue and Indian School Road, (2) along I40 between 7th Street and 4th Street, and (3) along I40 between Edith Boulevard and Sun Village Apartments.

City of Albuquerque Project No. 4252.90 east of MH-431 shown on drawing 11DR-12 of the I25/I40 System Interchange - The Big I, Volume 3 Drainage and Utilities construction documents.

7.3. *AMAFCA Drainage Maintenance Responsibilities*

That portion of drainage facilities within AMAFCA right-of-way, including the outlet of the Rita Storm Drain.

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9. Appendix

- A. The Big I Project Drainage Design Criteria
- B. FIRM Panels
- C. Existing Onsite Hydrologic Calculations
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Appendix D

Proposed Onsite Hydrologic Calculations

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Proposed Onsite Hydrology Basin Areas

Basin	Sub-Basin	Total Area, A _T				Land Treatment Type			
		m ²	acre	mile ²	hectare	A _C m ²	%C	A _D m ²	%D
Fourth	1A	17,244	4.3	0.00666	1.7	1,573	9%	15,671	91%
	1B	23,787	5.9	0.00918	2.4	5,054	21%	18,733	79%
	1C	29,020	7.2	0.01120	2.9	4,586	16%	24,434	84%
	1D	12,920	3.2	0.00499	1.3	3,046	24%	9,874	76%
	Subtotal	82,971	20.5	0.03204	8.3	14,259	17%	68,712	83%
Second	2A	44,146	10.9	0.01704	4.4	9,972	23%	34,174	77%
	2B	19,741	4.9	0.00762	2.0	3,233	16%	16,508	84%
	Subtotal	63,887	15.8	0.02467	6.4	13,205	21%	50,682	79%
Commercial	3A	28,765	7.1	0.01111	2.9	10,066	35%	18,699	65%
	3B	10,710	2.6	0.00414	1.1	2,070	19%	8,640	81%
	Subtotal	39,475	9.8	0.01524	3.9	12,136	31%	27,339	69%
Broadway	4A	34,315	8.5	0.01325	3.4	12,187	36%	22,128	64%
	4B	23,086	5.7	0.00891	2.3	7,320	32%	15,766	68%
	Subtotal	57,401	14.2	0.02216	5.7	19,507	34%	37,894	66%
Edith	5A	56,881	14.1	0.02196	5.7	31,405	55%	25,476	45%
	5B	31,345	7.7	0.01210	3.1	19,390	62%	11,955	38%
	5C	41,922	10.4	0.01619	4.2	21,329	51%	20,593	49%
	5D	41,201	10.2	0.01591	4.1	27,819	68%	13,382	32%
	5E	30,694	7.6	0.01185	3.1	19,551	64%	11,143	36%
	5F	38,230	9.4	0.01476	3.8	22,115	58%	16,115	42%
	5G	37,136	9.2	0.01434	3.7	24,837	67%	12,299	33%
	5H	37,966	9.4	0.01466	3.8	18,135	48%	19,831	52%
	5I	41,352	10.2	0.01597	4.1	24,691	60%	16,661	40%
	5J	48,105	11.9	0.01857	4.8	17,331	36%	30,774	64%
	5K	32,473	8.0	0.01254	3.2	10,114	31%	22,359	69%
	Subtotal	437,305	108.1	0.16884	43.7	236,717	54%	200,588	46%
University	6A	38,923	9.6	0.01503	3.9	16,081	41%	22,842	59%
	6B	58,920	14.6	0.02275	5.9	27,437	47%	31,483	53%
	Subtotal	97,843	24.2	0.03778	9.8	43,518	44%	54,325	56%
Princeton	7A	33,993	8.4	0.01312	3.4	12,119	36%	21,874	64%
	7B	38,484	9.5	0.01486	3.8	18,609	48%	19,875	52%
	Subtotal	72,477	17.9	0.02798	7.2	30,728	42%	41,749	58%
Embudo	8A	63,375	15.7	0.02447	6.3	33,294	53%	30,081	47%
	8B	65,055	16.1	0.02512	6.5	23,402	36%	41,653	64%
	Subtotal	128,430	31.7	0.04959	12.8	56,696	44%	71,734	56%
MLK	20	40,096	9.9	0.01548	4.0	18,552	46%	21,544	54%
Lomas	21A	47,496	11.7	0.01834	4.7	15,820	33%	31,676	67%
	21B	52,827	13.1	0.02040	5.3	18,273	35%	34,554	65%
	Subtotal	100,323	24.8	0.03873	10.0	34,093	34%	66,230	66%
Mountain	22	50,008	12.4	0.01931	5.0	30,528	61%	19,480	39%
Odelia	23	83,056	20.5	0.03207	8.3	6,612	8%	76,444	92%
Broadbent	24A	48,653	12.0	0.01878	4.9	13,776	28%	34,877	72%
	24B	36,776	9.1	0.01420	3.7	12,226	33%	24,550	67%
	24C	57,369	14.2	0.02215	5.7	42,610	74%	14,759	26%
	24D	19,238	4.8	0.00743	1.9	10,418	54%	8,820	46%
	24E	26,005	6.4	0.01004	2.6	17,153	66%	8,852	34%
	24F	33,317	8.2	0.01286	3.3	20,523	62%	12,794	38%
	24G	26,235	6.5	0.01013	2.6	3,746	14%	22,489	86%
	24H	31,737	7.8	0.01225	3.2	9,314	29%	22,423	71%
	Subtotal	279,330	69.0	0.10785	27.9	129,766	46%	149,564	54%
Total		1,532,602	378.7	0.59174	153.3	646,317	42%	886,285	58%

Shaded cells indicate values calculated with a formula.

All areas (input data) are computed using MicroStation.

1 acre = 4046.873 m²

A_C + A_D = A_T

1 mile² = 640 acre

%C = A_C / A_T

1 hectare = 10,000 m²

%D = A_D / A_T

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Proposed Onsite Hydrology Time of Concentration

Basin	Sub-Basin	Length m	Conveyance Factor K	Elevation Change m	Slope %	Velocity m/sec	Computed t_c hrs	Use t_c hrs	Time to Peak t_p hrs
Fourth	1A	185	3	8.0	4.34%	1.9	0.03		
		40	3		0.30%	0.5	0.02	0.20	0.13
	1B	315	3	8.2	2.60%	1.5	0.06		
		56	3		0.30%	0.5	0.03	0.20	0.13
	1C	318	3	6.8	2.14%	1.3	0.07		
		59	3		0.30%	0.5	0.03	0.20	0.13
	1D	80	3	0.6	0.75%	0.8	0.03		
		79	3		0.30%	0.5	0.04	0.20	0.13
Second	2A	241	3	1.3	0.55%	0.7	0.10		
		125	3		0.30%	0.5	0.07	0.20	0.13
	2B	351	3	4.3	1.23%	1.0	0.10		
		110	3		0.50%	0.6	0.05	0.20	0.13
Commercial	3A	149	3	2.0	1.34%	1.1	0.04		
		45	3		0.50%	0.6	0.02	0.20	0.13
	3B	227	3		0.50%	0.6	0.10	0.20	0.13
Broadway	4A	325	3	5.0	1.54%	1.1	0.08		
		96	3		0.50%	0.6	0.04	0.20	0.13
	4B	322	3	5.0	1.55%	1.1	0.08		
		62	3		0.50%	0.6	0.03	0.20	0.13
Edith	5A	18	1		2.00%	0.4	0.01		
		192	2	6.5	3.39%	1.1	0.05		
		28	3		0.50%	0.6	0.01		
		144	3	8.0	5.53%	2.1	0.02		
		171	3		0.30%	0.5	0.09	0.20	0.13
	5B	73	2		0.50%	0.4	0.05		
		173	3	1.1	0.64%	0.7	0.07		
		288	3	1.0	0.35%	0.5	0.15	0.26	0.17
	5C	38	1		2.00%	0.4	0.02		
		143	3	2.3	1.61%	1.2	0.03		
		345	3		0.30%	0.5	0.19	0.25	0.17
	5D	28	0.7	9.9	35.36%	1.3	0.01		
		262	2	9.0	3.44%	1.1	0.06	0.20	0.13
	5E	20	2		2.00%	0.9	0.01		
		130	2		4.60%	1.3	0.03		
		125	3		0.30%	0.5	0.07	0.20	0.13
	5F	30	2		1.50%	0.7	0.01		
		266	2		5.00%	1.4	0.05	0.20	0.13
	5G	348	2	13.4	3.85%	1.2	0.08		
		18	3		0.30%	0.5	0.01	0.20	0.13
	5H	18	1		2.00%	0.4	0.01		
		522	2	10.9	2.09%	0.9	0.16		
		55	3		0.30%	0.5	0.03	0.21	0.14
	5I	242	2	19.3	7.98%	1.7	0.04	0.20	0.13
	5J	165	2	4.1	2.48%	1.0	0.05		
		216	3	8.1	3.75%	1.8	0.03	0.20	0.13
	5K	91	2	5.4	5.93%	1.5	0.02		
		280	3	3.3	1.18%	1.0	0.08	0.20	0.13

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Proposed Onsite Hydrology Time of Concentration

Basin	Sub-Basin	Length m	Conveyance Factor K	Elevation Change m	Slope %	Velocity m/sec	Computed t_c hrs	Use t_c hrs	Time to Peak t_p hrs
University	6A	248	3	3.4	1.37%	1.1	0.06		
		167	3	5.1	3.05%	1.6	0.03		
		180	3	0.5	0.28%	0.5	0.10	0.20	0.13
	6B	452	3	12.3	2.72%	1.5	0.08		
Princeton	7A	648	3	7.8	1.20%	1.0	0.18		
		69	4	0.7	1.01%	1.2	0.02	0.20	0.13
		604	3	9.0	1.49%	1.1	0.15		
	7B	52	4	0.5	0.96%	1.2	0.01	0.20	0.13
Embudo	8A	442	3	11.6	2.62%	1.5	0.08	0.20	0.13
	8B	675	3	14.4	2.13%	1.3	0.14	0.20	0.13
MLK	20	333	3	8.8	2.64%	1.5	0.06		
		200	3	4.8	2.40%	1.4	0.04	0.20	0.13
Lomas	21A	282	3	7.2	2.55%	1.5	0.05		
		115	4		0.50%	0.9	0.04	0.20	0.13
	21B	365	3	3.0	0.82%	0.8	0.12		
		303	3		0.50%	0.6	0.13	0.25	0.17
Mountain	22	389	3	17.3	4.45%	1.9	0.06	0.20	0.13
Odelia	23	649	3	9.4	1.45%	1.1	0.16		
		50	3	1.7	3.40%	1.7	0.01	0.20	0.13
Broadbent	24A	100	3	1.9	1.90%	1.3	0.02		
		420	3	8.3	1.98%	1.3	0.09		
		30	3	0.2	0.67%	0.7	0.01	0.20	0.13
	24B	95	3	1.9	2.00%	1.3	0.02		
		90	3	11.7	13.00%	3.3	0.01		
		337	3	3.3	0.98%	0.9	0.10	0.20	0.13
	24C	210	3	11.0	5.24%	2.1	0.03		
		451	3	11.1	2.46%	1.4	0.09	0.20	0.13
	24D	504	3	8.0	1.59%	1.2	0.12	0.20	0.13
	24E	319	3	9.4	2.95%	1.6	0.06	0.20	0.13
	24F	104	3	4.3	4.09%	1.8	0.02		
		253	3	3.0	1.17%	1.0	0.07	0.20	0.13
	24G	474	3	2.3	0.49%	0.6	0.21	0.21	0.14
	24H	568	3	2.8	0.49%	0.6	0.25	0.25	0.16

Shaded cells indicate values calculated with a formula.

$$\text{Velocity (m/sec)} = 0.3048006 \times 10 \times K \times s^{1/2}$$

$$t_c(\text{seconds}) = \text{Length} / \text{Velocity}$$

$$t_p(\text{hrs}) = 2/3 \times t_c$$

Total Length < 1220 m

Minimum t_c = 0.2 hours

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AHYMO Output for Proposed Onsite Drainage Conditions

Basin	Sub-Basin	Peak Discharge, Q						Volume, V	
		10-year, 6-hour		50-year, 6-hour		100-year, 6-hour		100-year, 24-hour	
		m ³ /s	cfs	m ³ /s	cfs	m ³ /s	cfs	m ³	acre-ft
Fourth	1A	0.35	12.3	0.48	16.9	0.54	18.9	987	0.800
	1B	0.45	16.0	0.63	22.3	0.71	25.0	1,267	1.027
	1C	0.57	20.0	0.79	27.7	0.88	31.0	1,594	1.292
	1D	0.24	8.6	0.34	12.0	0.38	13.5	676	0.548
	Subtotal	1.61	56.9	2.24	79.0	2.50	88.4	4,523	3.667
Second	2A	0.83	29.4	1.16	41.1	1.30	46.1	2,324	1.884
	2B	0.39	13.6	0.53	18.9	0.60	21.1	1,084	0.879
	Subtotal	1.22	43.0	1.70	60.0	1.90	67.2	3,408	2.763
Commercial	3A	0.51	18.0	0.73	25.6	0.81	28.8	1,402	1.137
	3B	0.21	7.3	0.29	10.2	0.32	11.4	579	0.469
	Subtotal	0.72	25.3	1.01	35.8	1.14	40.1	1,981	1.606
Broadway	4A	0.60	21.4	0.86	30.4	0.97	34.2	1,662	1.347
	4B	0.42	14.7	0.59	20.8	0.66	23.3	1,147	0.930
	Subtotal	1.02	36.0	1.45	51.2	1.63	57.5	2,809	2.277
Edith	5A	0.90	31.7	1.32	46.7	1.49	52.7	2,402	1.947
	5B	0.41	14.4	0.61	21.5	0.69	24.4	1,252	1.015
	5C	0.59	20.7	0.86	30.4	0.97	34.3	1,826	1.480
	5D	0.60	21.2	0.90	32.0	1.02	36.2	1,565	1.269
	5E	0.46	16.2	0.69	24.2	0.78	27.4	1,206	0.978
	5F	0.59	21.0	0.88	31.0	0.99	35.0	1,576	1.278
	5G	0.54	19.2	0.82	28.9	0.93	32.8	1,423	1.154
	5H	0.60	21.2	0.88	31.0	0.99	34.9	1,690	1.370
	5I	0.63	22.4	0.94	33.2	1.06	37.5	1,679	1.361
	5J	0.85	29.9	1.21	42.6	1.36	47.9	2,329	1.888
	5K	0.59	20.8	0.83	29.4	0.93	32.9	1,626	1.318
	Subtotal	6.76	238.7	9.93	350.8	11.21	395.9	18,574	15.058
University	6A	0.67	23.6	0.96	33.8	1.08	38.1	1,821	1.476
	6B	0.98	34.5	1.42	50.0	1.59	56.3	2,641	2.141
	Subtotal	1.64	58.0	2.37	83.8	2.67	94.3	4,462	3.617
Princeton	7A	0.60	21.1	0.85	30.1	0.96	33.8	1,645	1.334
	7B	0.63	22.4	0.92	32.5	1.04	36.6	1,713	1.389
	Subtotal	1.23	43.5	1.77	62.7	2.00	70.5	3,359	2.723
Embudo	8A	1.01	35.8	1.48	52.4	1.67	59.1	2,717	2.203
	8B	1.15	40.5	1.63	57.7	1.83	64.8	3,149	2.553
	Subtotal	2.16	76.3	3.12	110.1	3.51	123.9	5,866	4.756
MLK	20	0.67	23.6	0.97	34.2	1.09	38.5	1,811	1.468
Lomas	21A	0.85	30.0	1.21	42.6	1.35	47.8	2,346	1.902
	21B	0.82	28.8	1.16	41.1	1.31	46.2	2,576	2.088
	Subtotal	1.67	58.8	2.37	83.7	2.66	94.0	4,922	3.990
Mountain	22	0.76	26.9	1.13	40.0	1.28	45.2	2,014	1.633
Odelia	23	1.68	59.5	2.31	81.7	2.58	91.2	4,779	3.874
Broadbent	24A	0.89	31.6	1.26	44.5	1.41	49.9	2,482	2.012
	24B	0.66	23.3	0.93	33.0	1.05	37.0	1,817	1.473
	24C	0.80	28.3	1.23	43.3	1.39	49.1	2,067	1.676
	24D	0.31	10.8	0.45	15.9	0.51	17.9	819	0.664
	24E	0.38	13.6	0.58	20.4	0.65	23.0	1,005	0.815
	24F	0.50	17.8	0.75	26.5	0.85	30.0	1,331	1.079
	24G	0.50	17.7	0.70	24.6	0.78	27.5	1,458	1.182
	24H	0.51	18.2	0.73	25.7	0.82	28.8	1,608	1.304
	Subtotal	4.57	161.2	6.62	233.7	7.45	263.2	12,588	10.205
Total		25.70	907.7	37.00	1,306.7	41.62	1,469.9	71,095	57.637

Shaded cells indicate values calculated with a formula.

1 cfs = 0.02831685 m³/s

1 acre-ft = 1233.49 m³

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Proposed Adjusted Intensities for 100-year Return Period

Basin	Total Area acres	Land Treatment		Weighted Rational "C"			Peak Discharge			Adjusted Intensity		
		C %	D %	C ₁₀	C ₅₀	C ₁₀₀	Q ₁₀ cfs	Q ₅₀ cfs	Q ₁₀₀ cfs	I ₁₀ in/hr	I ₅₀ in/hr	I ₁₀₀ in/hr
Fourth	20.5	17%	83%	0.85	0.86	0.88	56.9	79.0	88.4	3.27	4.48	4.92
Second	15.8	21%	79%	0.83	0.85	0.87	43.0	60.0	67.2	3.27	4.48	4.91
Commercial	9.8	31%	69%	0.79	0.81	0.83	25.3	35.8	40.1	3.28	4.51	4.93
Broadway	14.2	34%	66%	0.78	0.80	0.82	36.0	51.2	57.5	3.27	4.51	4.91
University	24.2	44%	56%	0.73	0.76	0.79	58.0	83.8	94.3	3.27	4.54	4.93
Princeton	17.9	42%	58%	0.74	0.77	0.80	43.5	62.7	70.5	3.28	4.53	4.93
Embudo	31.7	44%	56%	0.73	0.77	0.79	76.3	110.1	123.9	3.27	4.53	4.92
MLK	9.9	46%	54%	0.73	0.76	0.79	23.6	34.2	38.5	3.28	4.55	4.93
Mountain	12.4	61%	39%	0.66	0.71	0.74	26.9	40.0	45.2	3.28	4.58	4.94
Odelia	20.5	8%	92%	0.89	0.89	0.91	59.5	81.7	91.2	3.27	4.46	4.91
Average	176.8	34%	66%	0.78	0.80	0.82	449.0	638.4	716.8	3.27	4.51	4.92

Edith	108.1	54%	46%	0.69	0.73	0.76	238.7	350.8	395.9	3.19	4.44	4.81
Lomas	24.8	34%	66%	0.78	0.80	0.82	58.8	83.7	94.0	3.05	4.22	4.60
Broadbent	69.0	46%	54%	0.72	0.76	0.79	161.2	233.7	263.2	3.22	4.47	4.85

Shaded cells indicate values calculated with a formula.

The Rational "C" values for the 10-year and 100-year storms are from the City of Albuquerque DPM. The Rational "C" values for the 50-year storm were calculated previously.

Land Treatment	C ₁₀	C ₅₀	C ₁₀₀
C	0.50	0.57	0.62
D	0.92	0.92	0.93

Appendix E
Existing Offsite Hydrologic Calculations

THE BIG I PROJECT
E301436.53
Existing Offsite Hydrology Basin Areas

Basin	Total Area, A _T				Land Treatment Type					
	m ²	acre	mile ²	hectare	A _B m ²	%B	A _C m ²	%C	A _D m ²	%D
Sixth (AMDS 83)	22,701	5.6	0.00876	2.3		0%		20%		80%
Fourth (AMDS 84)	171,264	42.3	0.06613	17.1		0%		30%		70%
Second (AMDS 85)	112,165	27.7	0.04331	11.2		0%		40%		60%
Commercial (AMDS B143)	41,337	10.2	0.01596	4.1		0%		70%		30%
Broadway (AMDS BH112)	61,635	15.2	0.02380	6.2		0%	43,144	70%	18,491	30%
Dartmouth (AMDS L1)	7,574	1.9	0.00292	0.8		0%		46%		54%
McCoy (AMDS L1)	11,740	2.9	0.00453	1.2		0%		46%		54%
Bryn Mawr (AMDS L1)	88,865	22.0	0.03431	8.9		0%		46%		54%
Urban Park (AMDS L1)	3,981	1.0	0.00154	0.4		0%		100%		0%
Lomas South (AMDS U1)	402,486	99.5	0.15540	40.2		7%		8%		85%
Indian School South (AMDS S1)	330,743	81.7	0.12770	33.1		7%		8%		85%
Indian School North (AMDS R1)	418,544	103.4	0.16160	41.9		7%		8%		85%

Shaded cells indicate values calculated with a formula.
All areas (input data) are computed using MicroStation.

1 acre = 4046.873 m²
1 mile² = 640 acre
1 hectare = 10,000 m²

$A_C + A_D = A_T$
 $\%C = A_C / A_T$
 $\%D = A_D / A_T$

THE BIG I PROJECT
E301436.53
Existing Offsite Hydrology Time of Concentration

Basin	Length m	Conveyance Factor K	Elevation Change m	Slope %	Velocity m/sec	Computed t_c hrs	Use t_c hrs	Time to Peak t_p hrs
Sixth (AMDS 83)	76 91	1 3	0.3 0.1	0.36% 0.13%	0.2 0.3	0.12 0.08	0.20	0.13
Fourth (AMDS 84)	91 577	1 3	0.6	0.67% 0.20%	0.2 0.4	0.10 0.39	0.49	0.33
Second (AMDS 85)	91 508	1 3	2.0	2.17% 0.40%	0.4 0.6	0.06 0.24	0.30	0.20
Commercial (AMDS B143)	157 104	1 3	3.0 0.4	1.91% 0.38%	0.4 0.6	0.10 0.05	0.20	0.13
Broadway (AMDS BH112)	102 254 106	1 3 3	1.5 3.6 0.6	1.42% 1.43% 0.52%	0.4 1.1 0.7	0.08 0.06 0.04	0.20	0.13
Dartmouth (AMDS L1)	82 68 33 16	2 2 2 2	1.5 0.6 0.4 1.4	1.83% 0.88% 1.20% 8.97%	0.8 0.6 0.7 1.8	0.03 0.03 0.01 0.00	0.20	0.13
McCoy (AMDS L1)	163 63	2 2	3.6 2.5	2.22% 4.00%	0.9 1.2	0.05 0.01	0.20	0.13
Bryn Mawr (AMDS L1)	610 22	2 3	11.8 0.2	1.93% 0.93%	0.8 0.9	0.20 0.01	0.21	0.14
Urban Park (AMDS L1)	125	2	2.3	1.83%	0.8	0.04	0.20	0.13
Lomas South (AMDS U1)								0.20
Indian School South (AMDS S1)								0.19
Indian School North (AMDS R1)								0.18

Shaded cells indicate values calculated with a formula.

$$\text{Velocity (m/sec)} = 0.3048006 \times 10 \times K \times s^{1/2}$$

$$t_c(\text{seconds}) = \text{Length} / \text{Velocity}$$

$$t_p(\text{hrs}) = 2/3 \times t_c$$

Total Length < 1220 m
Minimum t_c = 0.2 hours

THE BIG I PROJECT
E301436.53
AHYMO Output for Existing Offsite Drainage Conditions

Basin	Peak Discharge						Volume	
	10-year, 6-hour		50-year, 6-hour		100-year, 6-hour		100-year, 24-hour	
	m ³ /s	cfs	m ³ /s	cfs	m ³ /s	cfs	m ³	acre-ft
Sixth (AMDS 83)	0.43	15.3	0.61	21.4	0.68	23.9	1,216	0.986
Fourth (AMDS 84)	1.86	65.7	2.67	94.1	3.00	106.0	8,626	6.993
Second (AMDS 85)	1.53	54.1	2.22	78.3	2.50	88.2	5,284	4.284
Commercial (AMDS B143)	0.59	21.0	0.90	31.8	1.02	36.0	1,543	1.251
Broadway (AMDS BH112)	0.89	31.3	1.34	47.4	1.52	53.7	2,302	1.866
Dartmouth (AMDS L1)	0.13	4.5	0.18	6.5	0.21	7.3	342	0.277
McCoy (AMDS L1)	0.20	6.9	0.28	10.0	0.32	11.3	529	0.429
Bryn Mawr (AMDS L1)	1.42	50.3	2.07	73.1	2.33	82.3	4,013	3.253
Urban Park (AMDS L1)	0.05	1.6	0.08	2.7	0.09	3.0	110	0.089
Lomas South (AMDS U1)	6.19	218.5	8.82	311.4	9.94	350.9	21,968	17.810
Indian School South (AMDS S1)	5.17	182.4	7.31	258.3	8.23	290.6	18,052	14.635
Indian School North (AMDS R1)	6.80	240.1	9.66	341.2	10.88	384.3	22,844	18.520

Shaded cells indicate values calculated with a formula.

1 cfs = 0.02831685 m³/s

1 acre = 1233.49 m³

**I25/I40 Interchange
Fourth & Second Street Existing Hydrology
100 Year, 6 Hour Storm Event**

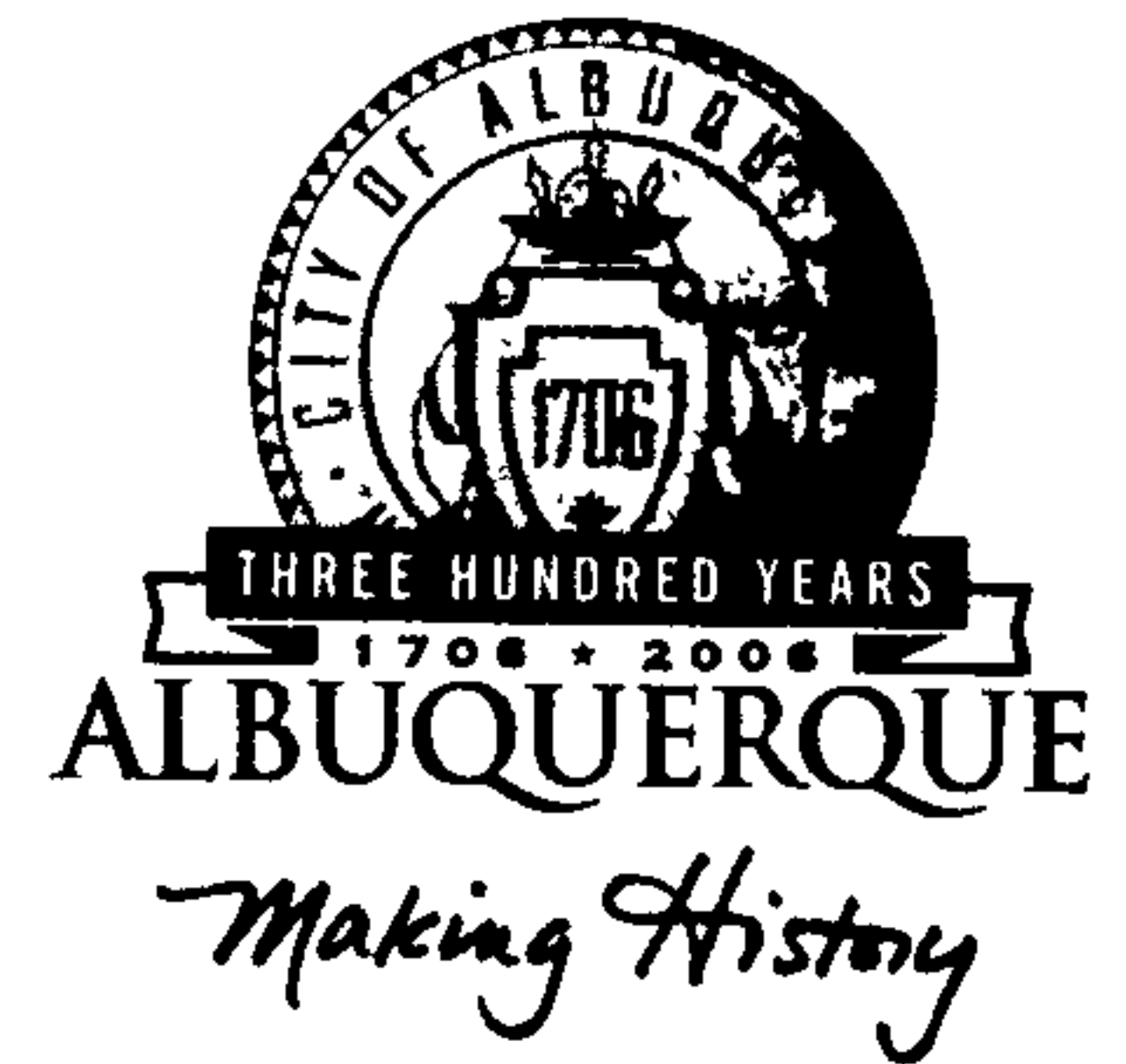
C. Rogers

3/14/00

Sub-basin	Area (ha)	Runoff per Unit Area (m ³ /s/ha)	Runoff	
			m ³ /s	cfs
North of I40				
6th (offsite # 83)	2.3	0.296	0.68	24.0
4th (offsite # 84)	17.1	0.175	3.00	105.9
2nd (offsite # 85)	11.2	0.223	2.50	88.3
Subtotal	30.6	0.202	6.18	218.2
South of I40				
4th (offsite)				
A1	1.0	0.202	0.19	6.8
A2	1.9	0.202	0.38	13.5
A3	2.3	0.202	0.46	16.2
A4	1.0	0.202	0.19	6.9
Subtotal	6.1		1.23	43.4
2nd (offsite)				
A5	0.96	0.202	0.19	6.9
A6	0.45	0.202	0.09	3.2
A7	1.72	0.202	0.35	12.2
Subtotal	3.1		0.63	22.3
I40				
6th & 4th (onsite)	8.7	0.268	2.33	82.3
2nd (onsite)	6.6	0.286	1.89	66.7
Subtotal	15.3	0.276	4.22	149.0
Total	55.1		12.26	432.9

4th Subtotal	34.18		7.24	255.6
2nd Subtotal	20.93		5.02	177.3
Total	55.1	0.222	12.26	432.9

CITY OF ALBUQUERQUE



February 4, 2005

David Aube, P.E.
Telck-Hensley Engineering Group
4001 Juan Tabo Blvd.
Albuquerque, NM 87111

Re: Principios Medical Office, 1625 University Blvd, Traffic Circulation Layout
Engineer's Stamp dated 2-01-05 (H15-D8)

Dear Mr. Aube,

The TCL submittal received 2-02-05 is approved for Building Permit. The plan is stamped and signed as approved. A copy of this plan will be needed for each of the building permit plans. Please keep the original to be used for certification of the site for final C.O. for Transportation.

If a temporary CO is needed, a copy of the original TCL that was stamped as approved by the City will be needed. This plan must include a statement that identifies the outstanding items that need to be constructed or the items that have not been built in "substantial compliance," as well as the signed and dated stamp of a NM registered architect or engineer. Submit this TCL with a completed Drainage and Transportation Information Sheet to Hydrology at the Development Services Center of Plaza Del Sol Building.

P.O. Box 1293

Albuquerque

New Mexico 87103

When the site is completed and a final C.O. is requested, use the original City stamped approved TCL for certification. A NM registered architect or engineer must stamp, sign, and date the certification TCL along with indicating that the development was built in "substantial compliance" with the TCL. Submit this certification TCL with a completed Drainage and Transportation Information Sheet to Hydrology at the Development Services Center of Plaza Del Sol Building.

www.cabq.gov

Once verification of certification is completed and approved, notification will be made to Building Safety to issue Final C.O. To confirm that a final C.O. has been issued, call Building Safety at 924-3306.

Sincerely,

Kristal D. Metro
Engineering Associate, Planning Dept.
Development and Building Services

cc: file

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/28/2003rd)

H-15/D8

PROJECT TITLE: Principios Medical Office

DRB #: _____

EPC#: _____

ZONE MAP/DRG. FILE #: H-15-Z

WORK ORDER#: _____

LEGAL DESCRIPTION: Lot 2A1, Block 0000, ABQ Board of Realtors

CITY ADDRESS: 1625 University Boulevard

ENGINEERING FIRM: THE Group

ADDRESS: 4001 Juan Tabo N.E. Suite A

CITY, STATE: Albuquerque, NM

CONTACT: David Aube

PHONE: 292-3202

ZIP CODE: 87111

OWNER: Principios Medical

ADDRESS: _____

CITY, STATE: Albuquerque, NM

CONTACT: _____

PHONE: _____

ZIP CODE: 87111

ARCHITECT: The Design Group

ADDRESS: 202 Central Avenue Suite 200

CITY, STATE: Albuquerque, NM

CONTACT: Doug Majewski

PHONE: 242-6880

ZIP CODE: 87106

SURVEYOR: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

CONTRACTOR: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

CHECK TYPE OF APPROVAL SOUGHT:

- ☐ DRAINAGE REPORT
- ☐ DRAINAGE PLAN 1st SUBMITTAL, **REQUIRES TCL or equal**
- ☐ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL GRADING & DRAINAGE PLAN
- ☐ GRADING PLAN
- ☐ EROSION CONTROL PLAN
- ☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☒ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEERS CERTIFICATION (TCL)
- ☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ☐ OTHER

- ☐ SIA / FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
- ☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ FOUNDATION PERMIT APPROVAL
- ☒ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM.)
- ☐ CERTIFICATE OF OCCUPANCY (TEMP.)
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
- ☐ NO
- ☐ COPY PROVIDED

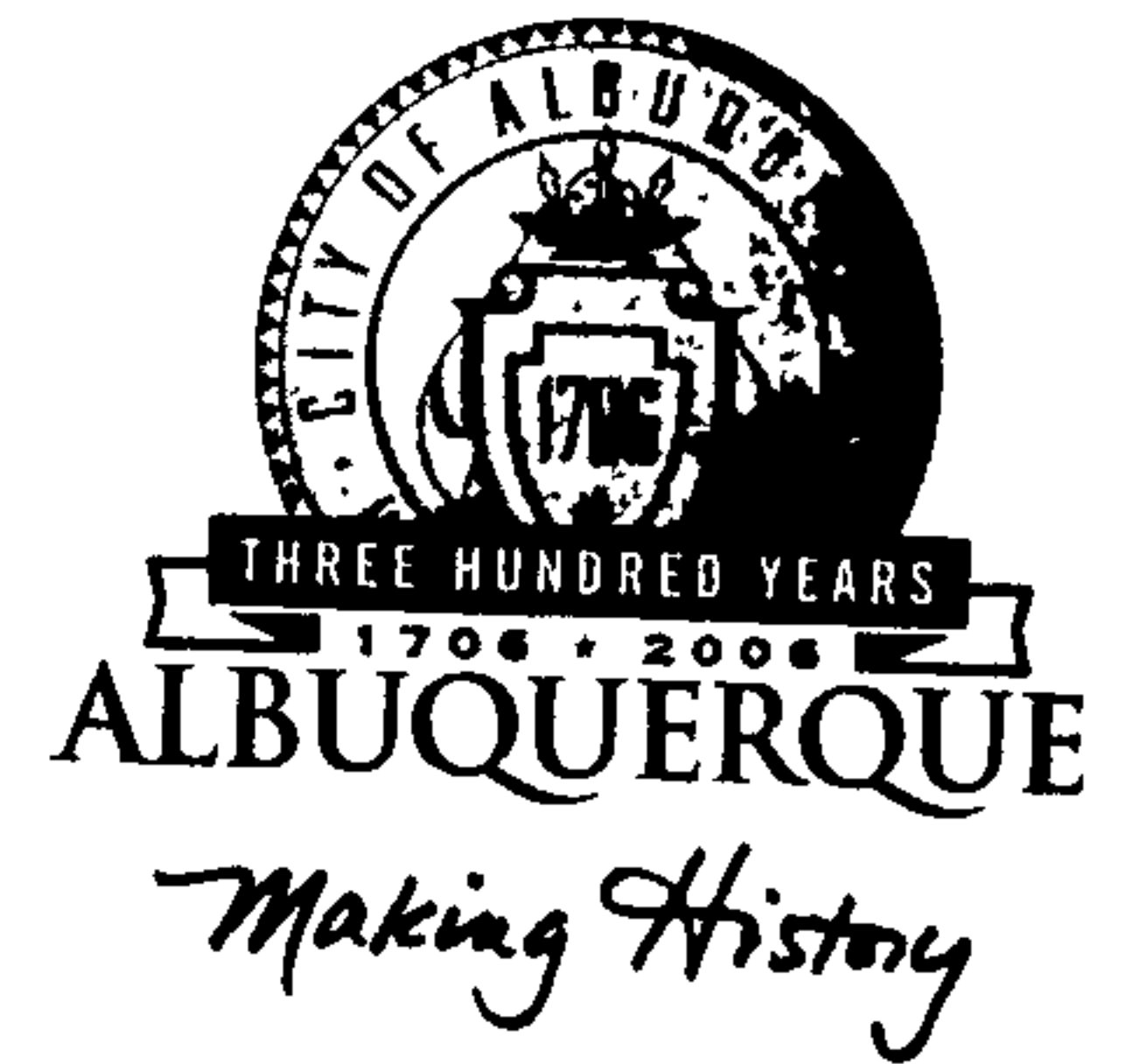
DATE SUBMITTED: 2-1-05

BY: David Aube P.E.

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location and scope of the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

CITY OF ALBUQUERQUE



January 24, 2005

David Aube, P.E.
Telck-Hensley Engineering Group
4001 Juan Tabo Blvd.
Albuquerque, NM 87111

Re: **Principios Medical Office, 1625 University Blvd, Traffic Circulation Layout**

Engineer's Stamp dated 1-18-05 (H15-D8)

Dear Mr. Aube,

*Add to plan:
6' prop sidewalk
City Std*

Based upon the information provided in your submittal received 1-18-05, the above referenced plan cannot be approved for Building Permit until the following comments are addressed:

P.O. Box 1293

Albuquerque

New Mexico 87103

- ✓ 1. List radii for all curves shown.
- ✓ 2. Is the sidewalk existing or proposed? If proposed, the sidewalk must be located against the property line.
- ✓ 3. For passenger vehicles, the minimum end island radius is 15 feet.
- ✓ 4. List the width for the handicapped spaces and all access aisles.
- ✓ 5. Is the curb cut new or existing? If proposed, please refer to all appropriate City Standards.

www.cabq.gov

If you have any questions, you can contact me at 924-3991.

Sincerely,

Wilfred A. Gallegos, P.E.
Traffic Engineer, Planning Dept.
Development and Building Services

*Any existing SW
to tie into?*

C: file *Yes*

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/28/2003rd)

H-15/D8

PROJECT TITLE: Principios Medical Office

DRB #: _____

EPC#: _____

ZONE MAP/DRG. FILE #: H-15-Z

WORK ORDER#: _____

LEGAL DESCRIPTION: Lot 2A1, Block 0000, ABQ Board of Realtors
CITY ADDRESS: 1625 University Boulevard

ENGINEERING FIRM: THE Group

ADDRESS: 4001 Juan Tabo N.E. Suite A

CITY, STATE: Albuquerque, NM

CONTACT: David Aube

PHONE: 292-3202

ZIP CODE: 87111

OWNER: Principios Medical

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PHONE: _____

ZIP CODE: 87111

ARCHITECT: The Design Group

ADDRESS: 202 Central Avenue Suite 200

CITY, STATE: Albuquerque, NM

CONTACT: Doug Majewski

PHONE: 242-6880

ZIP CODE: 87106

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ADDRESS: _____

CITY, STATE: _____

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PHONE: _____

ZIP CODE: _____

CONTRACTOR: _____

ADDRESS: _____

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CHECK TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
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- ☐ CLOMR/LOMR
- ☒ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEERS CERTIFICATION (TCL)
- ☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ☐ OTHER

fee paid

CHECK TYPE OF APPROVAL SOUGHT:

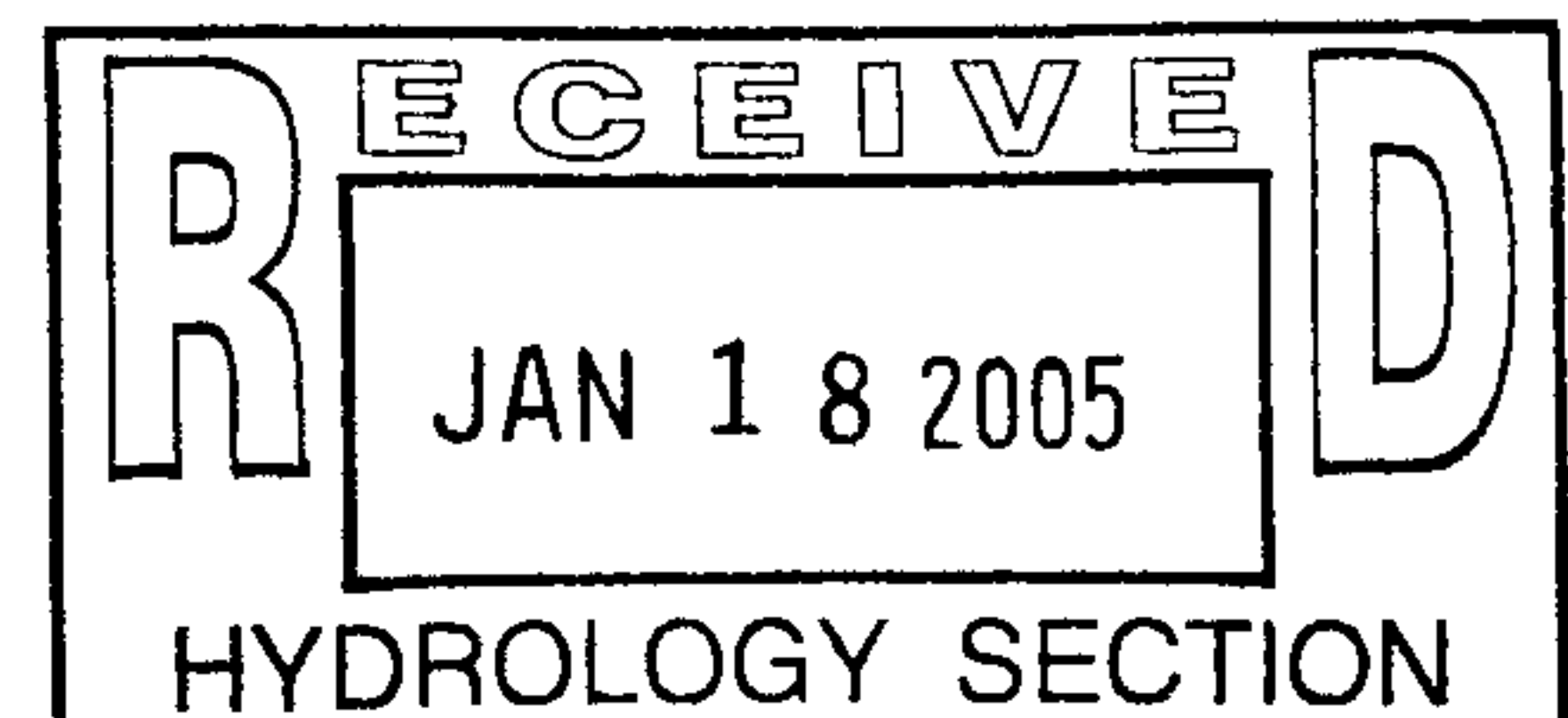
- ☐ SIA / FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
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- ☐ CERTIFICATE OF OCCUPANCY (TEMP.)
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
- ☐ NO
- ☐ COPY PROVIDED

DATE SUBMITTED: 1-18-05

BY: David Aube P.E.



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3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

HC Spaces / Aisles - width

Aisle width

Exist or prop side walks?

- if new, against prop line

Radius values

New curb cut?

if so, need ref City Std

Min curbed island radius

Pathways

