DESIGN ANALYSIS REPORT

for

AIRPORT DRIVE STORM DRAIN
LOS VOLCANES ROAD STORM DRAIN
AND
LOS VOLCANES ROAD
PAVING IMPROVEMENTS

FEBRUARY 1995

DESIGN ANALYSIS REPORT

for

AIRPORT DRIVE STORM DRAIN
LOS VOLCANES ROAD STORM DRAIN
AND
LOS VOLCANES ROAD PAVING IMPROVEMENTS

FEBRUARY 1995

PREPARED FOR:

SUNWEST BANK
SPECIAL ASSETS DEPARTMENT
303 Roma Avenue, N.W.
Albuquerque, New Mexico 87102

PREPARED BY:

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I, Ronald P. Bohannan, do hereby certify that this report was prepared by me or under my direction and that I am a duly registered Professional Engineer under the laws of the State of New Mexico.

R P Bohannan

Ronald P. Bohannan, P.E.
NMPE No. 9814

2/15/95

Date

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Design Analysis Report

for

Airport Drive Storm Drain
Los Volcanes Road Storm Drain
and
Los Volcanes Road Paving Improvements

February 1995

Purpose

To demonstrate the adequacy of the proposed storm drain and paving improvements.

Project Description

The project consists of approximately 2543 LF of collector street section, 48′ wide (typ.), flaring to 66′ wide at Unser Boulevard, and approximately 3520 LF of 24″ to 36″ diameter storm drain.

The construction of the proposed street section will complete Los Volcanes Road between Airport Drive and Unser Boulevard. The proposed storm drain will extend north from the future Airport/Bluewater Storm Drain [City of Albuquerque (COA) Project No. 4383.92] at the northwest quadrant of the intersection of Airport Drive and Bluewater Road in a proposed public drainage easement located adjacent to the west side of Airport Drive. The storm drain will cross under Los Volcanes Road then continue to the west in a proposed public drainage easement located along the north side of the Los Volcanes Road right–of–way. The proposed storm drain will terminate approximately 840 LF east of the intersection of Los Volcanes and Unser Boulevard.

The storm drain will serve as a low flow rate outfall for properties located adjacent to Airport Drive and Bluewater Road, as well as the northern portion of Tract S–1, Unit 2, Atrisco Business Park. The storm drain project will include only one inlet in the public right–of–way. This inlet will be located in the gutter along the north side of Los Volcanes Road at the intersection with Airport Drive. The purpose of this inlet is to intercept frequent minor nuisance flow, which collect in the standard gutter section, to prevent them from crossing the intersection. Because the existing Los Volcanes street section is superelevated in the intersection with cross fall from north to south, the major street flows will bypass this inlet.

Hydrology

The peak flow rates for the proposed storm drain were determined in the Master Drainage Plan for Atrisco Business Park, dated October 1993, and approved February 1994.

Discharge from the private property to be served by the storm drain is restricted to 0.1 cfs per acre. Runoff developed in the streets of the project area will be conveyed in the streets to inlets which will be constructed near the intersection of Airport Drive and Bluewater Road in the Airport/ Bluewater Storm Drain project.

Hydraulics

Hydraulic grade line calculations were performed for the proposed storm drain and the resultant hydraulic grade line is plotted on the plan and profile sheets. Calculations were performed in a spreadsheet utilizing equations published in the COA D.P.M., Chapter 22.3. In storm drain segments where the computed HGL is below the soffit of the pipe, the spreadsheet reports the soffit elevation as the HGL elevation. A summary of these calculations is included in Appendix "A."

The starting water surface elevation at the point of connection to the Airport Drive/Bluewater Road Storm Drain is 5096.09. This elevation corresponds to the HGL calculated for the connection point for the Airport Drive/Bluewater Road Storm Drain Project. (Refer to Design Analysis Report for COA Project 4383.92.)

Hydraulic grade line calculations performed for the main line of the storm drain system were based on peak 100–year flow rates in the main line. Lateral flow rates used to compute junction losses were determined as the differential between the main line flow out and flow in.

The peak flow rate assumed in the analysis of the proposed 24"-diameter Los Volcanes Storm Drain equals the total allowable discharge from Tract S-1. While it is highly unlikely this flow rate will be imposed on the full length of the storm drain, it is unknown at this time where flows from Tract S–1 will enter the storm drain. The calculations demonstrate that the Los Volcanes Storm Drain is adequately sized to allow interception of the design flows from Tract S–1 at any point along its length.

Flow characteristics were determined for sections of the street that have the potential for the greatest flow depths. Results of these calculations are included in Appendix "B." The calculations demonstrate the flow depths will not exceed 0.5′ depth in the 10–year storm or 0.87′ in the 100–year storm as required by COA drainage ordinance.

Pipe Class and Bedding Class

An analysis was performed to demonstrate the adequacy of the pipe and bedding classes specified for the project. A copy of this analysis is included in Appendix "C." The analysis was performed per the method presented in the "Concrete Pipe Design Manual" published by the American Concrete Pipe Association, June 1980 edition.

The analysis indicated that Class III RCP is adequate for the 36″ and 30″ diameter reaches. Class IV pipe is required for the 24″ diameter reach. Class "C" bedding is recommended for all reaches.

Paving Section

The proposed paving section is in accordance with the recommendations of the "Geotechnical Investigation and Pavement Section Design for Atrisco Business Park" by Vinyard and Associates, Inc. A copy of this report is included in Appendix "D."

Conclusions

The hydraulic calculations performed for this analysis demonstrate that the proposed storm drain will have capacity to convey the peak 100–year flow rates established in the October 1993 edition of the Atrisco Business Park Master Drainage Plan, as approved February 1994. It should be noted that it was the intent of the design to provide a limited amount of surplus capacity in the Airport Drive portion of the storm drain in order to provide conveyance for a limited amount of additional street runoff as provided for in the Master Drainage Plan. Any significant increase in the peak flows to be discharged to the storm drain should be analyzed to determine the effect on the HGL.

The calculations performed to check pipe class and bedding class indicate that the specified pipe and bedding are adequate for the project.

APPENDIX A

Hydraulic Grade Line Calculations

PROJECT: AIRPORT DRIVE STORM DRAIN BETWEEN BLUEWATER ROAD & LOS VOLCANES ROAD
JOB#: SUNWEST 3325
DATE: 6/19/1993
TIME: 02:47 PM

ANALYSIS BY VANCE FOSSINGER, EASTERLING & ASSOCIATES

STARTING CONDITONS:
TAILWATER ELEVATION = 5096.09
MANNING'S ROUGHNESS = 0.013
ASSUMED STARTING HGL ELEV. = 5096.09

STATION	STRUCTURE	MAINLINE FLOW RATE (cfs)	PIPE DIA. (inches)	LAY LENGTH (feet)	PIPE SLOPE (fpf)	INVERT (elev.)	FLOW VELOCITY (fps)	VELOCITY HEAD (feet)	FRICTION SLOPE (fpf)	FRICTION LOSS Hf	MANHOLE LOSS Hm	ANGLE PT. LOSS Hb	JUNCTION LOSS Hj	EXPANSION LOSS Hx	SUM OF LOSSES	ENERGY GRADE LINE ELEVATION	HYDRAULIC GRADE LINE ELEVATION	FINISHED GRADE ELEVATION
STORM DRAIN OUTFALL INITIAL CONDITIONS —→ @					OUTLET	5089.35										5096.09	5096.09	
28+02.91	M.H.	32.4	36	390.29	0.0050	5091.30	4.58	0.33	0.0024	0.921	0.016	0.000	0.000	0.326	1.264	5097.35	5097.03	5102.00
32+27.91	M.H.	32.4	36	425.00	0.0050	5093.43	4.58	0.33	0.0024	1.003	0.016	0.000	0.074	0.000	1.093	5098.45	5098.12	5104.00
36+77.91	M.H.	18.3	30	450.00	0.0050	5096.18	3.73	0.22	0.0020	0.896	0.011	0.000	0.000	0.013	0.919	5099.37	5099.15	5106.70
41+10.64	M.H.	18.3	30	432.73	0.0050	5098.34	3.73	0.22	0.0020	0.861	0.011	0.032	0.000	0.000	0.904	5101.06	5100.84	5108.29
41+10.64	DUMMY	18.3	30	0.01	0.0050	5098.34	3.73	0.22	0.0020	0.000	0.000	0.000	0.000	0.000	0.000	5101.06	5100.84	5108.29

PROJECT: LOS VOLCANES STORM DRAIN BETWEEN AIRPORT DRIVE & UNSER BOULEVARD
JOB#: SUNWEST 3325
DATE: 6/19/1993
TIME: 03:32 PM

ANALYSIS BY VANCE FOSSINGER, EASTERLING & ASSOCIATES
UPDATED BY MARTIN LEWIS, EASTERLING & ASSOCIATES, 2/6/95

STARTING CONDITONS:
TAILWATER ELEVATION = 5100.84
MANNING'S ROUGHNESS = 0.013
ASSUMED STARTING HGL ELEV. = 5100.95

STATION	STRUCTURE	MAINLINE FLOW RATE (cfs)	PIPE DIA. (inches)	LAY LENGTH (feet)	PIPE SLOPE (fpf)	INVERT (elev.)	FLOW VELOCITY (fps)	VELOCITY HEAD (feet)	FRICTION SLOPE (fpf)	FRICTION LOSS Hf	MANHOLE LOSS Hm	ANGLE PT. LOSS Hb	JUNCTION LOSS Hj	EXPANSION LOSS Hx	SUM OF LOSSES	ENERGY GRADE LINE ELEVATION	HYDRAULIC GRADE LINE ELEVATION	FINISHED GRADE ELEVATION
STORM DRAIN OUTFALL INITIAL CONDITIONS ⟶ @					OUTLET	5098.45										5100.95	5100.84	
36+51.93	M.H.	18.3	30	30.00	0.0050	5098.60	3.73	0.22	0.0020	0.060	0.011	0.032	0.000	0.216	0.318	5101.32	5101.10	5109.80
33+30.80	M.H.	13.3	24	321.13	0.0075	5101.02	4.23	0.28	0.0035	1.110	0.014	0.000	0.000	0.005	1.129	5103.30	5103.02	5113.00
30+30.46	M.H.	13.3	24	305.31	0.0087	5103.68	4.23	0.28	0.0035	1.055	0.014	0.000	0.000	0.000	1.069	5105.95	5105.68	5115.60
27+24.39	M.H.	13.3	24	311.05	0.0081	5106.20	4.23	0.28	0.0035	1.075	0.014	0.000	0.000	0.000	1.089	5108.47	5108.20	5118.00
23+84.40	M.H.	13.3	24	339.99	0.0082	5109.00	4.23	0.28	0.0035	1.175	0.014	0.000	0.000	0.000	1.189	5111.28	5111.00	5121.00
21+39.40	M.H.	13.3	24	245.00	0.0191	5113.65	4.23	0.28	0.0035	0.847	0.014	0.000	0.000	0.000	0.861	5115.93	5115.65	5125.70
18+94.39	M.H.	13.3	24	245.00	0.0191	5118.33	4.23	0.28	0.0035	0.847	0.014	0.000	0.000	0.000	0.861	5120.61	5120.33	5130.50

APPENDIX B

Street Flow Analysis

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: LOS VOLCANES FLOW

Comment: LOS VOLCANES 100YR.STRM FLOW) DEPTH STA 33+00

Solve For Depth

Given Input Data:

Left Side Slope..	0.00:1	(H:V)
Right Side Slope.	50.00:1	(H:V)
Manning's n.....	0.017	
Channel Slope....	0.0080	ft/ft
Discharge.....	14.17	cfs

Computed Results:

Depth.....	0.45	ft
Velocity.....	2.84	fps
Flow Area.....	4.99	sf
Flow Top Width....	22.34	ft
Wetted Perimeter.	22.79	ft
Critical Depth...	0.46	ft
Critical Slope...	0.0071	ft/ft
Froude Number....	1.06	(flow is Supercritical)

Discharge = ½ Atrisco Business Park M.D.P. Hyd 200.51
Total flow included in Hyd 200 51 assumed to be evenly distributed between sides of street
Cross Slope = 0.02 ft/ft

Open Channel Flow Module, Version 3.42 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: LOS VOLCANES FLOW

Comment: LOS VOLCANES 100YR.STRM FLOW DEPTH (STA_36+47)

Solve For Depth

Given Input Data:

Left Side Slope..	58.82:1 (H:V)
Right Side Slope.	0.00:1 (H:V)
Manning's n.....	0.017
Channel Slope....	0.0070 ft/ft
Discharge.....	(28.34 cfs)

Computed Results:

Depth.....	(0.56 ft)
Velocity.....	3.09 fps
Flow Area.....	9.17 sf
Flow Top Width...	(32.85 ft) >24'
Wetted Perimeter.	33.41 ft
Critical Depth...	0.57 ft
Critical Slope...	0.0066 ft/ft
Froude Number....	1.03 (flow is Supercritical)

Atf Accurate

Discharge = Atrisco Business Park M.D.P. HYD. 200.51

All flow is assumed to be on south side of street

Street cross slope = 0.017 ft/ft

Open Channel Flow Module, Version 3.42 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: LOS VOLCANES FLOW

Comment: LOS_VOLCANES 10_YR.STRM_FLOW DEPTH STA 33+00

Solve For Depth

Given Input Data:

Left Side Slope..	0.00:1 (H:V)
Right Side Slope.	50.00:1 (H:V)
Manning's n.....	0.017
Channel Slope....	0.0080 ft/ft
Discharge.....	8.37 cfs

does not accaunt for gutter l/p.

Computed Results:

Depth.....	0.37 ft
Velocity.....	2.49 fps
Flow Area.....	3.36 sf
Flow Top Width...	18.33 ft
Wetted Perimeter.	18.71 ft
Critical Depth...	0.37 ft
Critical Slope...	0.0076 ft/ft
Froude Number....	1.02 (flow is Supercritical)

Discharge = 1/2 Atrisco Business Park M.D.P. Hyd. 200.51
Total flow included in Hyd 200.51 assumed to be evenly distributed between sides of street
Cross Slope = 0.02 ft/ft

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: LOS VOLCANES FLOW

Comment: LOS VOLCANES 10 YR.STRM FLOW DEPTH STA 36+47

Solve For Depth

Given Input Data:

Left Side Slope..	58.82:1 (H:V)
Right Side Slope.	0.00:1 (H:V)
Manning's n.....	0.017
Channel Slope....	0.0070 ft/ft
Discharge.....	16.89 cfs

Computed Results:

Depth.....	0.46 ft
Velocity.....	2.71 fps
Flow Area.....	6.22 sf
Flow Top Width...	27.06 ft
Wetted Perimeter.	27.52 ft
Critical Depth...	0.46 ft
Critical Slope...	0.0070 ft/ft
Froude Number....	1.00 (flow is Critical)

Discharge = Atrisco Business Park M.D.P Hyd 200.51

All flow assumed to be on south side of street

Street cross slope = 0.017 ft/ft

Open Channel Flow Module, Version 3.42 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

APPENDIX C

Pipe and Bedding Class Analysis

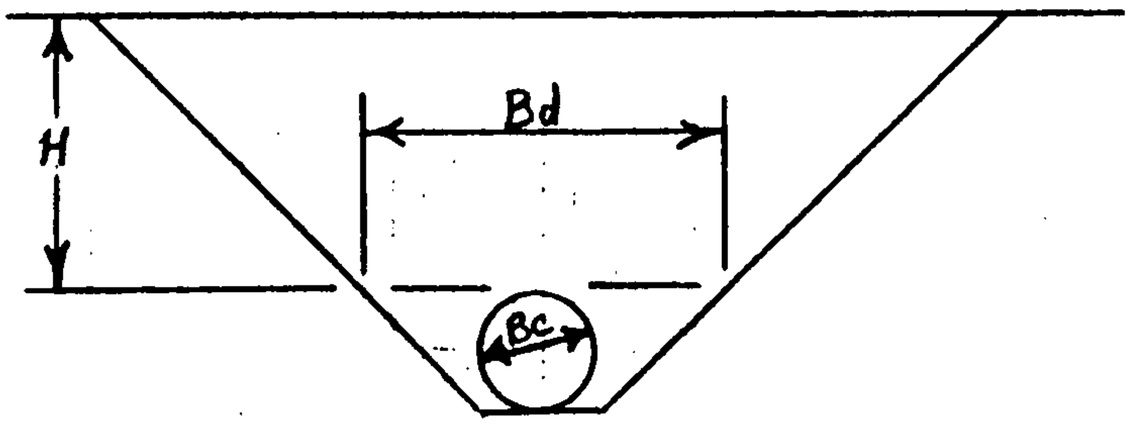
Easterling & Associates, Inc.
10131 Coors Rd., NW, Suite H-7
Albuquerque, New Mexico 87114
(505) 898-8021
FAX (505) 898-8501

Project Name Airport Dr./Los Volcanes S.D.
Project No. 3325 Date 6-22-93
Subject Pipe Class & Bedding Calcs
By VSF Sheet 1 of 2

Use the method presented in "Concrete Pipe Design Manual" by the American Concrete Pipe Association to check pipe and bedding class

Assumptions

1:1 Trench side slopes
Unit weight of backfill = 120 lb/cf
Class "C" Bedding Bf = 1.5



Check 36" dia. pipe Bc = 3.6'

Max. bury = 12' H = 12 - 3.6 = 8.4'

Bd = 3.6' + 3.6(2)(1) = 10.8'

- From table 24-A the transition width for H = 8.4 = 6'-8"
  Bd = 10.8 > 6.66' Use maximum backfill load for H = 8.4 = 4509 lb/LF
  Above load is for 100 lb/cf material - Adust for 120 lb/cf material
  4509 X 1.2 = 5,410.6 lb/cf

- From table 45 Live load = 360 lb/LF

- D-load = $D_{0.01} = \frac{W_L + W_E}{Bf \times D} \times F.S.$ For RCP F.S. = 1

- $D_{0.01} = \frac{360 + 5410.6}{1.5 \times 3} \times 1 = 1,282.3$ lb/Lf I.D.

- From ASTM C 76 For Class III Pipe $D_{0.01}$ = 1,350 lb/LF ID
  1282.3 < 1350

* Class III 36" RCP w/ Class "C" bedding is O.K.

Easterling & Associates, Inc.
10131 Coors Rd., NW, Suite H-7
Albuquerque, New Mexico 87114
(505) 898-8021
FAX (505) 898-8501

Project Name Airport Dr. / Los Volcanes S.D.
Project No. 3325 Date 6-22-93
Subject Pipe Class & Bedding Class
By USF Sheet 2 of 2

Check 30" dia Pipe Bc = 3.2'

Max. bury = 11.5' H = 11.5 - 3.2 = 8.3'

Bd = 3.2 + 3.2 (2)(1) = 9.6'

- From table 22-A the transition width for H = 8.3' = 5'-8"
- Bd = 9.6 > 5.66' Use Maximum backfill Load for H = 8.3'
- Backfill load = 3,759 lb/lf if backfill unit wt. = 100 lb/cf
- Adjust backfill load for 120 lb/cf material 3,759 X 1.2 = 4,511 lb/lf
- From table 45 live load = 315 lb/l.f.
- $D_{0.01} = \frac{315 + 4,511}{1.5 \times 2.5} = 1,286$ lb/lf. I.D.
- From ASTM C 76 For Class III Pipe $D_{0.01} = 1,350$ lb/LF ID

1286 < 1350

* Class III 30" RCP w/ Class "C" bedding is O.K.

Check 24" dia. pipe Bc = 2.5'

Max. bury = 13' H = 13 - 2.5 = 10.5'

Bd = 2.5 + 2.5(2)(1) = 7.5'

- From table 20-A the transition width for H = 10.5' = 5'-1"
- Bd = 7.5' > 5.1' use maximum backfill load for H = 10.5'
- Backfill load = 3,743 lb/LF if backfill unit wt = 100 lb/cf
- Adjust backfill load for 120 lb/cf mat. 3743 X 1.2 = 4,492 lb/LF
- Live load over 10' deep is insignificant
- $D_{0.01} = \frac{4492}{1.5 \times 2} = 1,497$ lb/lf of I.D.
- From ASTM C76 for Class III Pipe $D_{0.01} = 1350$ lb/LF ID

1497 > 1350 No Good

- From ASTM C76 for Class IV Pipe $D_{0.01} = 2,000$ lb/LF ID

1497 < 2000

* Class IV 24" RCP w/ Class "C" bedding is OK

APPENDIX D

Geotechnical Investigation and Pavement Section Design, Atrisco Business Park

Prepared by
Vinyard and Associates, Inc.

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

GEOTECHNICAL INVESTIGATION AND PAVEMENT SECTION DESIGN ATRISCO BUSINESS PARK

Prepared for:
Sunwest Bank

Project No.: 93-1-90
June 19, 1993

V & A

T A B L E O F C O N T E N T S

1.0 INTRODUCTION

This report presents the results of our geotechnical investigation and pavement section design for a portion of the streets within the Atrisco Business Park. Location of the streets investigated is indicated on Figure 1.

The investigation was performed to determine the subsurface conditions at selected points along the proposed roadways. Based upon the soil conditions observed, geotechnical recommendations were developed for:

Asphaltic Concrete Pavement;

Lateral Earth Pressures;

Site Grading; and

Earthwork Construction.

The conclusions and recommendations presented are based on information provided to us regarding the proposed construction, on laboratory testing, and upon the local standards of our profession at the time this report was prepared. This investigation was not performed to determine the presence of potentially hazardous waste. Determination of the presence of potentially hazardous materials requires the use of exploration techniques and analytic testing which were not appropriate for this investigation.

2.0 PROPOSED CONSTRUCTION AND SITE CONDITIONS

This study addresses a portion of the roads within the Atrisco Business Park. Proposed configuration of the roads is indicated on the Site Plan, Figure 1.

Based upon information obtained from personnel with Easterling & Associates, we anticipate the proposed roads will be either two or four lanes wide. The proposed roadways will be paved with asphaltic concrete. Very limited cut and fill earthwork is anticipated.

The site slopes slightly to the east. Vegetation on site consists of weeds, native grass and occasional cactus. The portion of Bluewater Road adjacent to the Honeywell Facility is presently paved with asphaltic concrete.

3.0 SUBSURFACE CONDITIONS

To evaluate subsurface conditions along the proposed roads fifteen test pits were excavated along the proposed roads. Test pit locations are indicated on the Site Plan, Figure 1. Test pits were excavated on May 24, 1993.

The test pits were excavated using a rubber tired backhoe equipped with a twenty-four inch wide bucket. The test pits were

logged by a qualified field engineer using the Unified Soil Classification System. The field engineer logged the cuttings during excavation and examined the cut faces. Logs of the test pits are presented on Figures 2 through 16.

The soil profile within the study area is relatively uniform. The majority of the soils encountered consisted of slightly silty to silty fine-grained sand. The sands are loose to medium dense and slightly moist to moist.

Very infrequent lenses of clayey sand were encountered in the test pits. To provide a more economical pavement section a sandy soil subgrade was assumed. If clayey sand is encountered at subgrade depth it should be removed as necessary to allow a minimum of eighteen inches of silty sand soil below the pavement.

Flowing groundwater or bedrock was not encountered in the test pits. However, groundwater conditions may change with time due to precipitation, variations in groundwater level, seepage from ponding areas or leaking utilities.

4.0 LABORATORY TESTING

A laboratory testing program was performed on soil samples obtained during the field investigation which appeared representative of the materials encountered. The laboratory

V&A

testing program was structured to determine the physical properties of the soils necessary for development of geotechnical recommendations.

The laboratory testing program included:

- o Soil Moisture Content;
- o Sieve Analysis;
- o Atterberg Limits; and
- o R-Value.

Laboratory Moisture Content tests were performed to evaluate the in-place soil moisture content. Test results are presented on the Logs of Test Pits and are summarized on Table 1.

Sieve Analysis and Atterberg Limits tests were performed on selected soil samples to confirm field soil classifications and to provide information on general physical soil properties. Test results are presented on Table 1.

Three R-Value tests were performed on representative soil samples. Test results are presented on Figures 18 through 20. The test results indicate the silty sands which were encountered over most of the alignment have an average R-Value of 72.

5.0 PAVEMENT RECOMMENDATIONS

The pavement recommendations presented are based upon City of Albuquerque design procedures. Default traffic projections specified by the City of Albuquerque were utilized. All of the streets were assumed to be "collectors" with an average weighted daily traffic (AWDT) of 3000 vehicles per day, per lane.

Traffic distribution as specified by the City of Albuquerque is tabulated below:

Automobile	Single Unit Truck	Single Trailer Truck	Multi-Trailer Truck
95%	3%	1%	1%

Calculations to determine equivalent single axle loads (ESAL's) (18 kip) are presented on Figure 21. The design nomograph to determine required structural number is presented on Figure 22.

To evaluate the required weighted structural number the following parameters were utilized.

Serviceability Index	2.5
Regional Factor	2.0
Design Life (years)	20
R-Value	55

An R-Value of 55 was utilized instead of the average test value of 72 based upon standard correlations of grain size distribution versus R-Value developed by the New Mexico State Highway and Transportation Department.

To evaluate the required pavement section for the proposed construction the following structural coefficients were utilized in our analysis:

Material	Structural Coefficient
Asphaltic Concrete	0.42
Aggregate Base Course	0.10

Based upon the above criteria we recommend the following asphaltic concrete pavement sections:

	Two Lane	Four Lane
Asphaltic Concrete	5"	4.5"
Aggregate Base Course	7"	8"

6.0 CONSTRUCTION METHODS AND MATERIALS

We anticipate the project will be constructed as detailed in the "City of Albuquerque Standard Specifications for Public Works

Construction". Supplemental earthwork recommendations for the project are presented below:

Project earthwork should be performed as detailed in Section 200 of the "City of Albuquerque Standard Specifications for Public Works Construction" except as modified herein. Prior to placing fill or pavement, all paved areas should be cleared and grubbed as detailed in Section 201 of the "City of Albuquerque Standard Specifications for Public Works Construction".

All fill below the proposed roadway should be placed and compacted as detailed in Section 204 of the "City of Albuquerque Standard Specifications for Public Works Construction" with the following exceptions:

- Subsequent to clearing and grubbing and prior to placing fill, the natural ground surface should be scarified to a depth of six inches and moisture conditioned to a near optimum (±3 percent) moisture content. The natural ground surface should then be compacted with a minimum of ten passes of a vibratory compactor. The vibratory compactor should exert a minimum dynamic force of 40,000 pounds. However, if vibratory compaction poses a threat to the structural integrity of nearby structures, an equivalent static compactor should be utilized. Special care should be utilized to minimize distress to existing

structures and utilities if vibratory soil or asphalt compactors are utilized in the vicinity of the existing structures and utilities.

- All fill below within 18" of subgrade elevation shall meet AASHTO Soil Classification A-2-4 or better.

Base course material shall conform to Section 302 of the "City of Albuquerque Standard Specifications for Public Works Construction". We suggest that base course be Class II material.

Plant mix bituminous pavement should conform to Section 116 of the "City of Albuquerque Standard Specifications for Public Works Construction".

7.0 TRENCHES AND EXCAVATIONS

All trenches greater than four feet in depth must be sloped, shored or braced or otherwise supported according to OSHA Construction and Safety Standards. Material excavated from the trench or spoil must be placed a minimum of two feet from the edge of the excavation. The spoil should be retained in an effective manner such that no loose material can fall into the excavation.

Fill in shallow utility line trenches below the pavement must be properly compacted to prevent localized pavement settlement. To

minimize settlement and maintenance of the pavement, all trenches should be backfilled as specified in the "City of Albuquerque Standard Specifications for Public Works Construction".

8.0 TEMPORARY AND PERMANENT SLOPES

Temporary construction slopes less than eight feet high should be sloped no steeper than 1-1/2:1 (horizontal:vertical). If deeper excavations are required, this office should be contacted for supplemental recommendations. Limited raveling of slopes will occur particularly as the exposed soils dry out. Heavy equipment and material stockpiles should be located a minimum of five feet from the top of slope.

Permanent cut and fill slopes less than eight feet in height should be sloped no steeper than 2:1 (horizontal:vertical). Permanent cut and fill slopes eight to twelve feet in height should be sloped no steeper than 2-1/2:1 (horizontal:vertical). If higher slopes are required this office should be contacted for supplemental recommendations.

9.0 RETAINING WALLS

Retaining walls constructed in conjunction with this project are not anticipated to exceed five feet in height. If higher walls or unusual loading conditions such as sloping backfill, slopes

below retaining wall footings or surcharges are anticipated, this office should be contacted for supplemental recommendations.

Foundations for retaining walls may be designed for a maximum toe bearing pressure of 1500 pounds per square foot. Retaining wall footings should be embedded a minimum of eighteen inches below lowest adjacent grade. Prior to placing footings, the exposed soils should be scarified to a depth of eight inches, moisture conditioned to a near optimum (±3%) moisture content and compacted to a minimum of 95% of maximum density as determined by ASTM D-1557.

We recommend that the following equivalent fluid pressures be utilized for design of retaining walls:

Loading Condition	Equivalent Fluid Pressure*
Active Earth Pressure	32 pcf
Passive Earth Pressure	
Undisturbed Natural Soils	300 pcf
Structural Fill	400 pcf
Earth Pressure at Rest	60 pcf

* Does not include a factor of safety.

The above earth pressures do not include hydrostatic pressure. If retaining walls are restrained against rotation the earth pressure at rest should be utilized for design.

Lateral retaining wall loads will be resisted by passive earth pressure at the toe and friction along the base of the wall. A coefficient of friction between soil and concrete of 0.4 may be used for design.

Backfill adjacent to retaining walls should be placed and compacted as detailed in Section 501 of the "City of Albuquerque Standard Specifications for Public Works Construction". Backfill adjacent to walls should be compacted with relatively light, hand operated equipment to prevent over stressing the wall and excessive lateral deflections.

To prevent staining of concrete, the back of retaining walls should be waterproofed prior to backfilling. Weep holes should be constructed near the base of exterior walls.

10.0 LANDSCAPING

Landscaping for the project should be designed and constructed to minimize the potential for saturation of soils supporting the proposed pavement. If subgrade soils become saturated, limited settlement and localized failure of the pavement may occur.

11.0 CLOSURE

This report completely supersedes our previous geotechnical report for the project. The recommendations presented in this report are based upon the subsurface conditions disclosed by the test pits. Soil and groundwater conditions may vary between test pits and with time.

Placement and compaction of structural fill should be observed and tested by a qualified Geotechnical Engineer or his representative. The purpose of the observation and testing is to confirm that the recommendations presented herein are followed and to provide supplemental recommendations if subsurface conditions differ from those anticipated. All asphaltic concrete should be tested by a qualified Geotechnical Engineer or his representative to confirm the recommendations presented herein are implemented.

If conditions are encountered during construction which differ from those presented herein, this office should be contacted for supplemental recommendations. The staff of Vinyard & Associates, Inc. is available for supplemental consultation as necessary.

This office would be pleased to review site grading and drainage plans to evaluate conformance with the recommendations presented herein. All site earthwork should be observed by a

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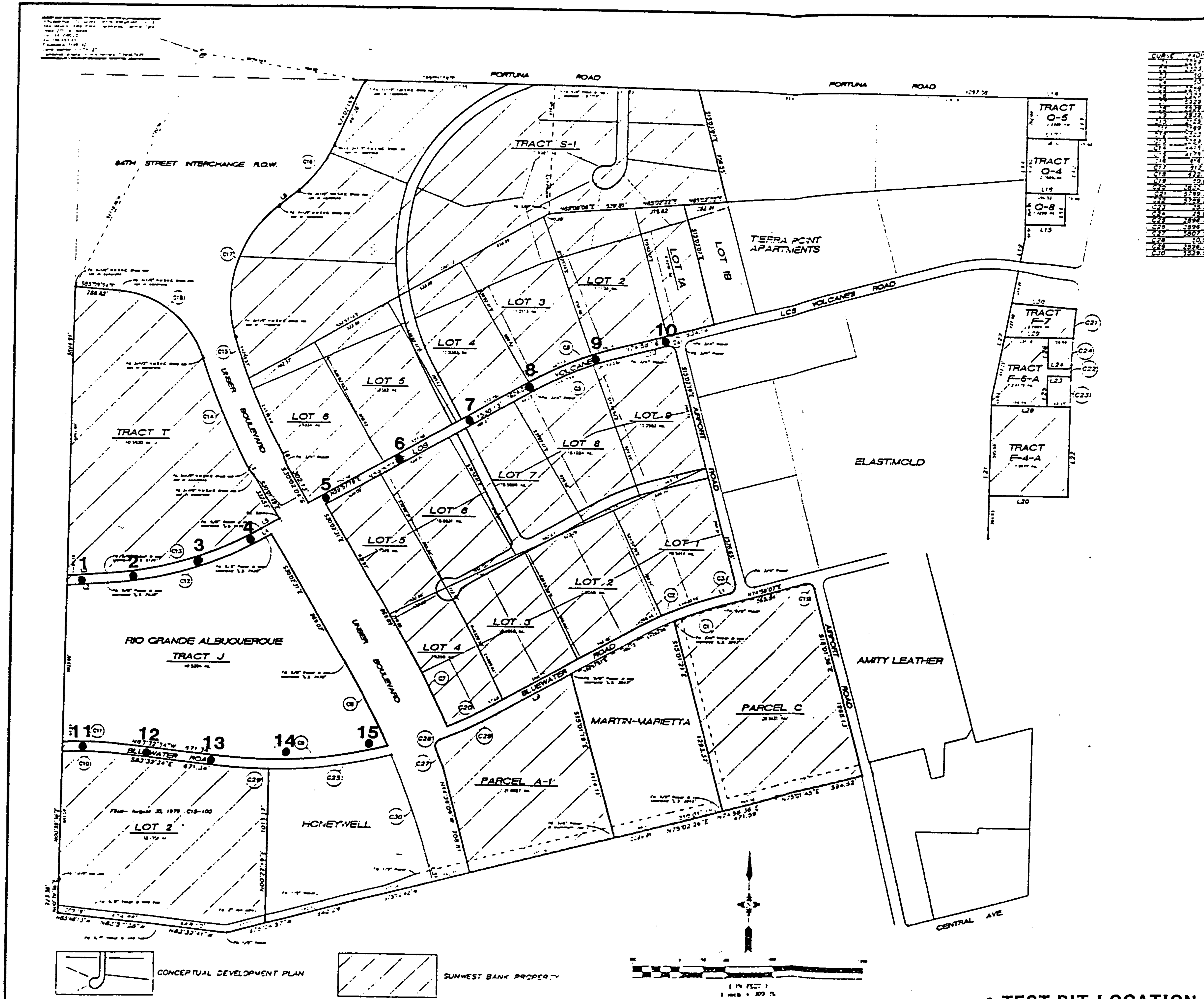
qualified Geotechnical Engineer or his representative. Vinyard & Associates, Inc. would be pleased to provide these services.

Vinyard & Associates, Inc.

Martin D. Vinyard, PE

File: 93-1-90



• TEST PIT LOCATION

CURVE TABLE

[illegible]

LINE TABLE

[illegible]

BOUNDARY RETRACEMENT BY SURV-TEK, INC.
CONCEPTUAL DEVELOPMENT PLAN BY CONSENSUS PLANNING

EASTERLING & ASSOCIATES, INC.
CONSULTING ENGINEERS

ATRISCO BUSINESS PARK

CITY OF ALBUQUERQUE
BERNALILLO COUNTY, NEW MEXICO

FIGURE NO.: 1

FEBRUARY, 1993

V & A

LOG OF TEST PIT NO. 1

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine-grained, poorly graded, moist to medium moist, brown
		B		6.2	1,2		
							Slightly moist
5							Very gravelly lens, fine to coarse, slightly silty
		B		1.9	1		
							Silty sand
							Weakly cemented
10							
							Bottom of pit at 10'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 2

V & A

LOG OF TEST PIT NO. 2

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine-grained, poorly graded, moist, light brown
		B		5.5	1,2		
5							Very silty, weakly cemented, slightly moist
		B		4.6			
		B		1.3			Slightly silty, fine to coarse-grained
10							Bottom of pit at 9-1/2'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 3

V & A

LOG OF TEST PIT NO. 3

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						GM	GRAVEL, silty, fine to coarse-grained, very sandy, slightly moist, brown
		B		4.7			
5		B					
						SM	SAND, silty, fine-grained
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 4

V & A

LOG OF TEST PIT NO. 4

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty to slightly silty, fine to medium-grained, poorly graded, slightly moist, light brown
		B		2.4	1,2,4		
5							Slightly silty, fine to coarse-grained, gravelly, fine to coarse
							Silty fine-grained
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 5

V & A

LOG OF TEST PIT NO. 5

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to medium-grained, poorly graded, slightly moist to moist, brown
		B		4.1	1,2		
5							Very silty, weakly cemented
							Silty
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 6

V
&
A

LOG OF TEST PIT NO. 6

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to medium-grained, poorly graded, slightly moist, brown
		B		2.2	1,2		Slightly silty
5							Fine to coarse-grained lens, slightly moist
		B		2.8			Very silty
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 7

V & A

LOG OF TEST PIT NO. 7

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, very silty to silty, fine to medium-grained, poorly graded, moist, brown
		B		6.9	1,2,4		
5		B					Slightly silty, fine to coarse-grained Gravelly
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 8

V & A

LOG OF TEST PIT NO. 8

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty to very silty, fine to medium-grained, poorly graded, moist, brown
		B		6.7	1,2		
5							silty
							Fine to coarse-grained
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 9

V & A

LOG OF TEST PIT NO. 9

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to medium-grained, poorly graded, moist, light brown
		B		4.7	1,2		
5							Very silty
							Silty to slightly silty, fine to coarse-grained
							Silty, fine-grained
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 10

V & A

LOG OF TEST PIT NO. 10

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to medium-grained, poorly graded, moist, light brown
		B		5.6	1,2		
5							Silty to slightly silty lens
		B					Very silty
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 11

V & A

LOG OF TEST PIT NO. 11

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty to very silty, fine-grained, poorly graded, moist, brown
		B		6.0	1,2		
							Silty, medium moist
5							Very silty
							Silty, slightly moist
		B					
10							Bottom of pit at 9-1/2'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 12

V & A

LOG OF TEST PIT NO. 12

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine-grained, poorly graded, moist, light brown
		B					
		B		12.5	1,2	SC	Clayey sand lens
5							
						SM	Slightly moist
		B		1.9			
							Fine to coarse-grained
10							Bottom of pit at 9-1/2'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 13

V & A

LOG OF TEST PIT NO. 13

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty, fine to coarse-grained, slight fine to coarse gravel, poorly graded, sli. moist, light brown
		B		2.1	1,2,4		Mostly fine-grained, medium moist
5		B		5.2	1		Very silty lenses
							Silty to slightly silty, fine to coarse-grained
10							Bottom of pit at 9-1/2'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 14

V & A

LOG OF TEST PIT NO. 14

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
		B		4.2	1,2	SM	SAND, silty, fine to medium-grained, poorly graded, moist, brown
5		B		2.5	1		Mostly medium-grained
		B		2.1			Mostly fine-grained, slightly moist
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 15

V & A

LOG OF TEST PIT NO. 15

Project: Atrisco Business Park — Project No. 93-1-90

Elevation - Top of Test Hole: n/a — Date Drilled: 5/24/93

Depth to Groundwater: not encountered — Drilling Method: 24" Backhoe

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
						SM	SAND, silty to slightly silty, fine to medium-grained, poorly graded, moist, light brown
		B		4.9	1,2		
5							
		B				SP-SM	SAND, slightly silty, fine to medium-grained, slight fine to coarse gravel, poorly graded, slightly moist, light brown
10							Bottom of pit at 9'
15							
20							
25							
30							

ADDITIONAL TESTS: 1 = Sieve Analysis 2 = Atterberg Limits 3 = Direct Shear 4 = R-Value 5 = Other

Figure 16

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NOTES - LOGS OF TEST PITS

Test pit locations were determined by compass bearing and pacing distances from known topographic points.

"Drilling Method" refers to the equipment utilized to advance the test pit. A rubber tired backhoe with a 24" bucket was utilized.

"S" under "Sample Type" indicates a Standard Penetration test (ASTM D-1586). The Standard Penetration sampler is 2 inches in outside diameter and 1 3/8 inches inside diameter.

"R" under "Sample Type" indicates a 3 inch outside diameter by 2.5 inch inside diameter sampler. The sampler is lined with 1 inch high brass rings.

"B" under "Sample Type" indicates a bulk sample.

"Blows Per Foot" indicates the number of blows of a 140 pound hammer falling 30 inches required to drive the indicated sampler 12 inches.

"NR" under "Blows/Foot" indicates that no sample was recovered.

"Dry Density PCF" indicates the laboratory determined soil dry density in pounds per cubic foot.

"Water Content %" indicates the laboratory determined soil moisture content in percent (ASTM D-2216).

"Unified Classification" indicates the field soil classification as per ASTM D-2488. When appropriate, the field classification is modified based upon subsequent laboratory tests.

Variations in soil profile, consistency, and moisture content may occur between test holes. Subsurface conditions may also vary between test holes and with time.

Figure 17

Vinyard & Associates, Inc.

R - Value Test Results

Project No.: 93-1-90
Client: SunWest Bank

Sample Location: Test Pit #4 @ 2'

Sample No.	A	B	C
Moisture Content (%)	11.5	11.9	11.1
Dry Density (PCF)	114	114	116.7
Expansion Pressure (PSI)	0.0	0.0	0.0
Exudation Pressure (PSI)	214	331	688
R - Value	71	73	75
R - Value at 300 PSI	72		

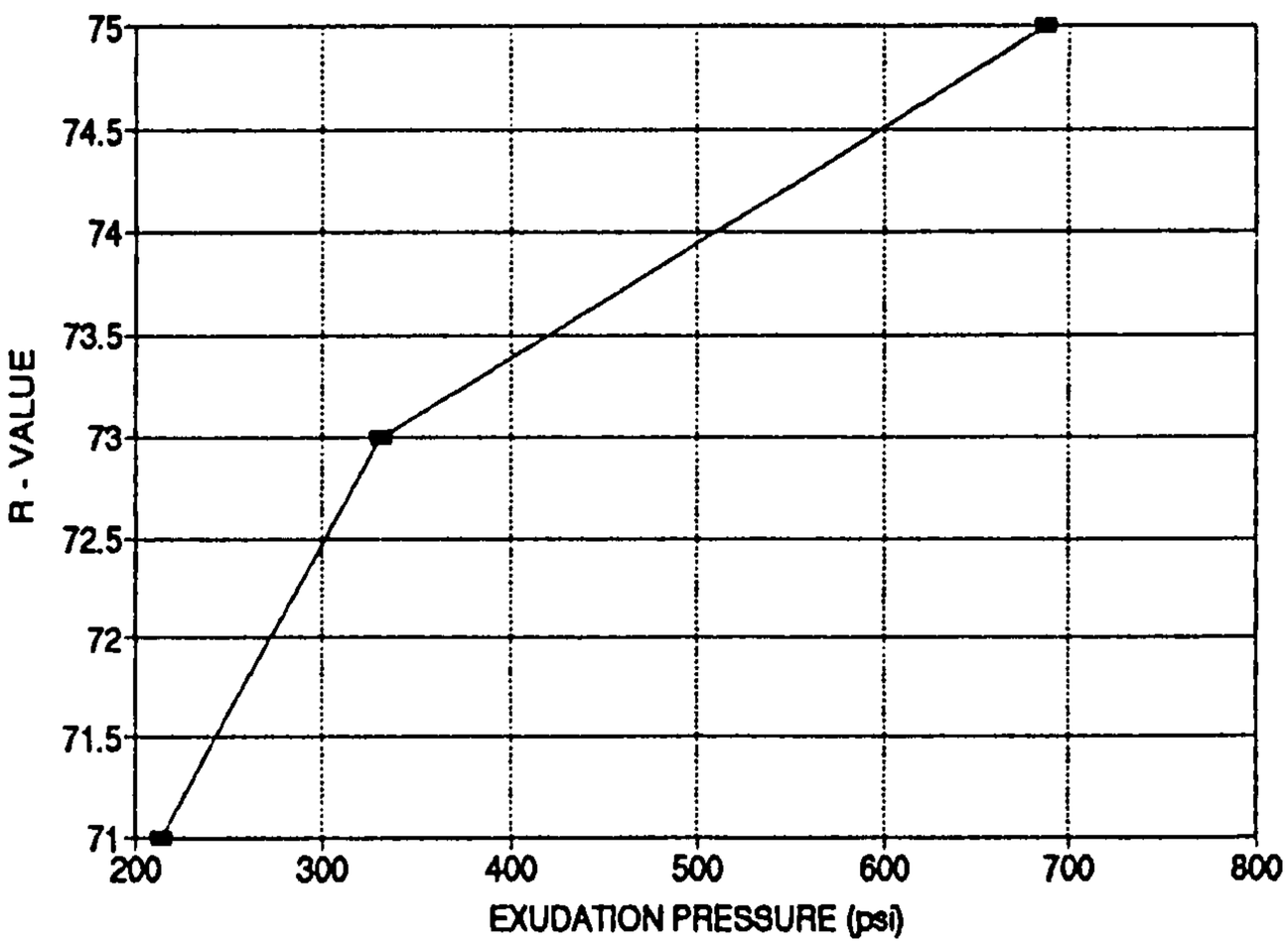


Figure No.: 18

Vinyard & Associates, Inc.

R - Value Test Results

Project No.: 93-1-90
Client: SunWest Bank

Sample Location: Test Pit #7 @ 2'

Sample No.	A	B	C
Moisture Content (%)	13.6	12.2	10.9
Dry Density (PCF)	116.2	122.2	124.2
Expansion Pressure (PSI)	0.0	0.0	0.0
Exudation Pressure (PSI)	91	295	463
R - Value	9	27	44
R - Value at 300 PSI	27		

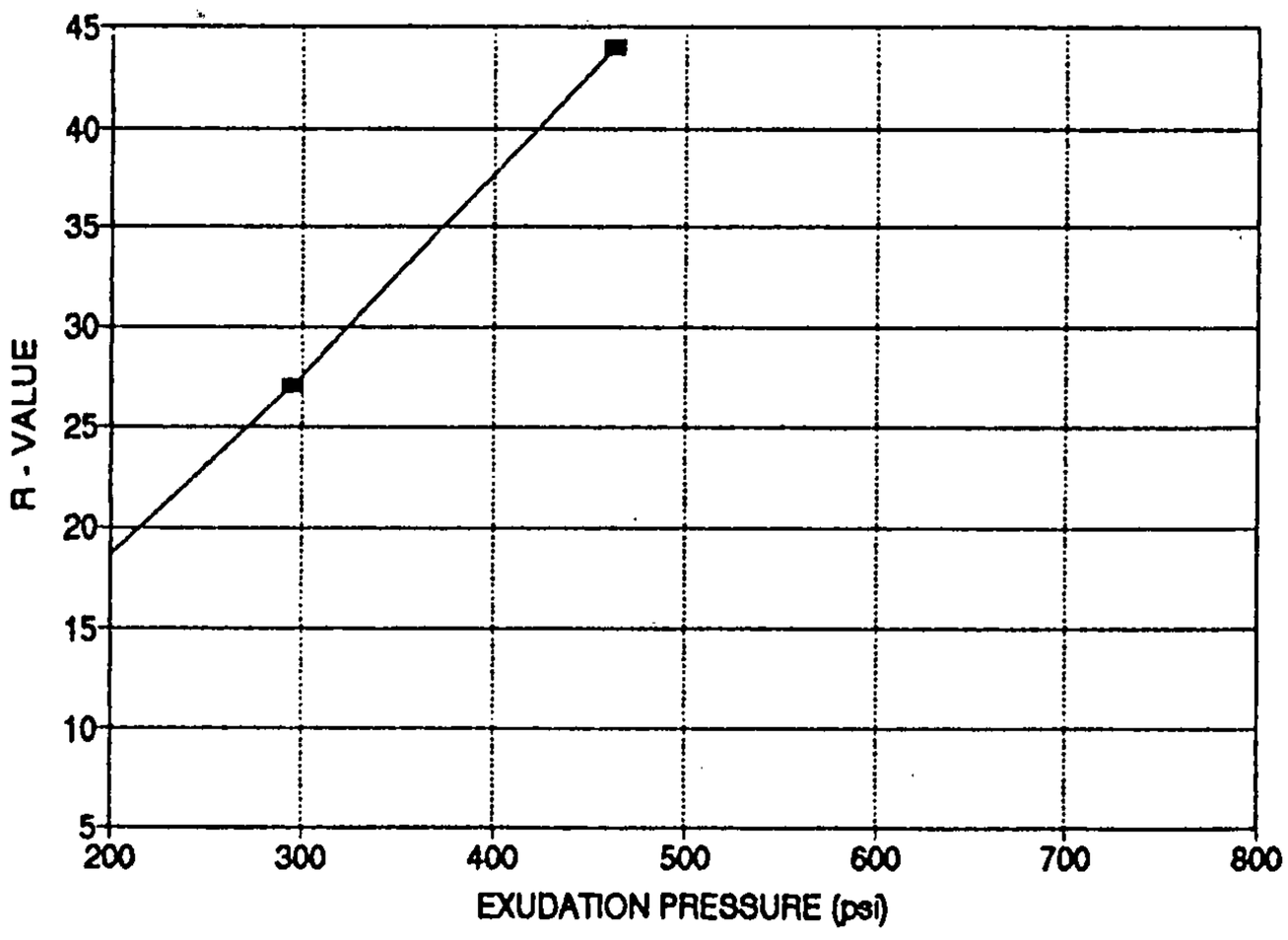


Figure No.: 19

Vinyard & Associates, Inc.

R - Value Test Results

Project No.: 93-1-90
Client: SunWest Bank

Sample Location: Test Pit #13 @ 2'

Sample No.	A	B	C
Moisture Content (%)	12.5	11.9	11.5
Dry Density (PCF)	113	114.7	114.5
Expansion Pressure (PSI)	0.0	0.0	0.0
Exudation Pressure (PSI)	248	487	687
R - Value	72	74	72
R - Value at 300 PSI	72		

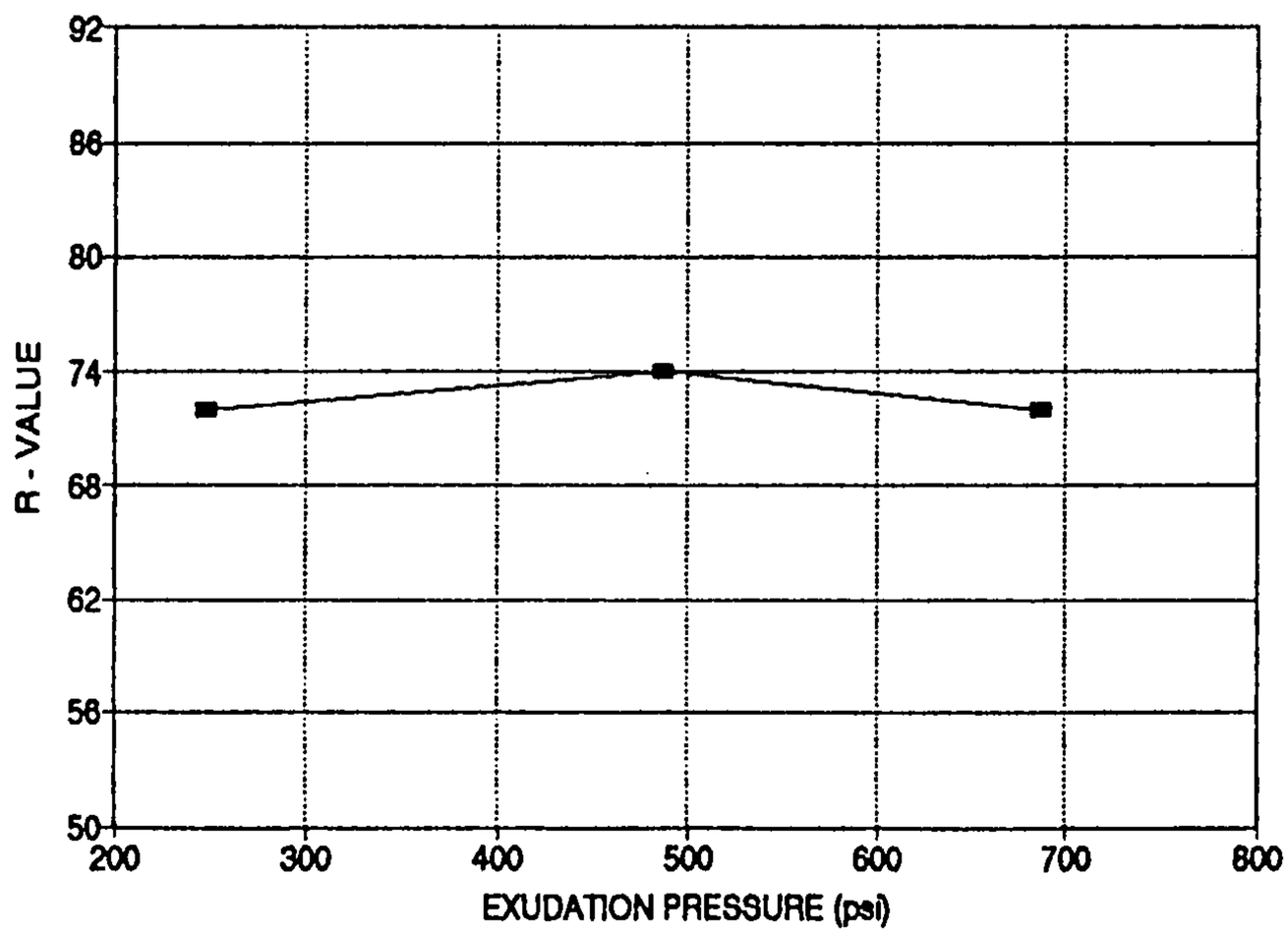


Figure No.: 20

PAVEMENT SECTION DESIGN

DESIGN R-VALUE = 55

SOIL SUPPORT VALUE = 6.920

CURRENT AWDT = 3000

TRAFFIC:		ESAL FACTOR
SUT	= 3%	.1890
STT	= 1%	2.3719
MTT	= 1%	2.3187
CAMS	= 95%	.0008

GROWTH FACTOR = 4%

$$ESAL = [(3000)(29.78)(365)][(.03)(.1890) + (.01)(2.3719) + (.01)(2.3187) + (.95)(.0008)]$$

$$ESAL = (32.6 \times 10^6)(.0533)$$

$$ESAL = 1.7 \times 10^6 \text{ (TWO LANE)}$$

WEIGHTED STRUCTURAL NUMBER = 2.78 (TWO LANE)

$$ESAL \text{ (FOUR LANE)} = (1.7 \times 10^6)(0.9) = 1.5 \times 10^6$$

WEIGHTED STRUCTURAL NUMBER = 2.70 (FOUR LANE)

Figure No.: 21

$$SN = \left[\left(\frac{1.0504 \cdot W_t^{0.10684} \cdot R^{0.10684}}{10^{0.039714(SS-3)} \cdot 10^{0.10684\, G_{t/\beta}}} \right) - 1 \right]$$

P_t = SERVICIBILITY INDEX = 2.5
R = REGIONAL FACTOR
USE 2.0 FOR CITY OF ALBUQUERQUE

Serviceability Index (P_t) = 2.5
Regional Factor (R) = 2.0 for City of Albuquerque

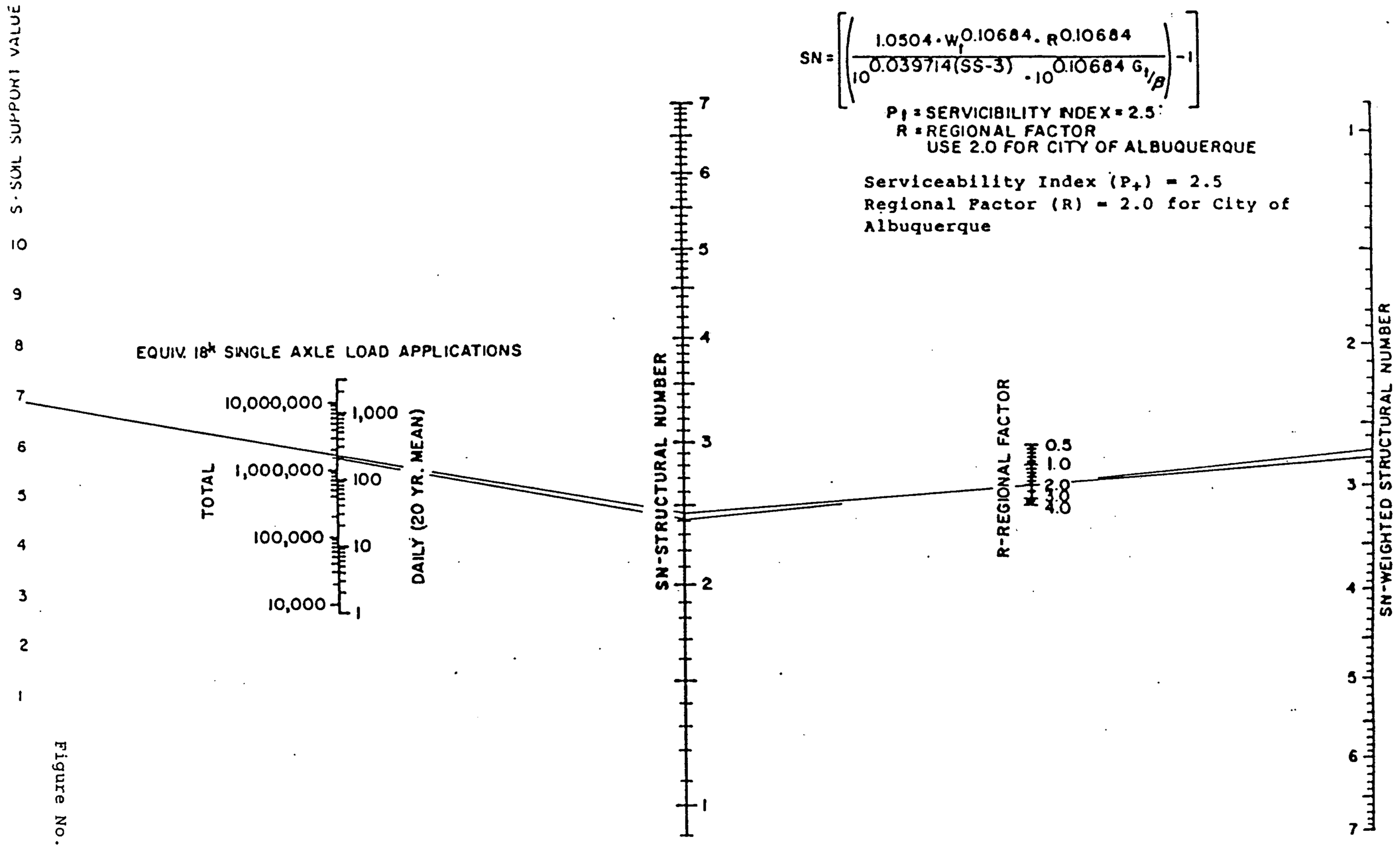


FIGURE 23.4.2

DESIGN CHART
FLEXIBLE PAVEMENTS
20-YEAR TRAFFIC ANALYSIS

FIGURE 23.4.3 - STRUCTURAL DESIGN COMPUTATION FORM

PROJECT NAME: ATRISCO BUSINESS PARK

PROJECT NO. : 93-1-90

STREET: _____

FROM: _____

TO: _____

COMPUTED BY: M.O.V.

DESIGN ADL _____

DESIGN SN 2.78 (TWO LANE)

Alternate	Subbase	CTB	BTB	ABC	AC	PMSC	SN
A	x(0.08)=	x(0.20)=	x(0.25)=	x(0.10)=	x(0.42)=	x(0.25)=	_____
B	_____	_____	_____	11(0.10)	(4)(.42)	_____	2.78
C	_____	_____	_____	7(0.10)	(5)(.42)	_____	2.80
D	_____	_____	_____	_____	_____	_____	_____
E	_____	_____	_____	_____	_____	_____	_____
F	_____	_____	_____	_____	_____	_____	_____

Design SN _____

Figure No.: 23

FIGURE 23.4.3 - STRUCTURAL DESIGN COMPUTATION FORM

PROJECT NAME: ATRISCO BUSINESS PARK

PROJECT NO. : 93-1-90

STREET: _____

FROM: _____

TO: _____

COMPUTED BY: MOV

DESIGN ADL _____

DESIGN SN 2.70 (FOUR LANE)

Alternate	Subbase	CTB	BTB	ABC	AC	PMSC	SN
A	x(0.08)=	x(0.20)=	x(0.25)=	x(0.10)=	x(0.42)=	x(0.25)=	
B				(10)(0.10)	4(.42)		2.68
C				(8)(0.10)	(4.5)(.42)		2.69
D							
E							
F							

Design SN _____

Figure No.: 24

V & A

SUMMARY OF LABORATORY TEST DATA

Test Hole No.	Depth (Feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS % PASSING BY WEIGHT										DESCRIPTION
					LL	PI	1½"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
1	2	SM	-	6.2	NV	NP	-	-	-	100	99	98	95	82	51	23.7	SAND, silty
1	5	SP-SM	-	1.9	-	-	100	94	88	80	72	63	53	41	22	9.3	SAND, slightly silty, gravelly
2	2	SM	-	5.5	NV	NP	-	-	100	99	98	95	87	70	41	19.2	SAND, silty
2	5	-	-	4.6	-	-	-	-	-	-	-	-	-	-	-	-	
2	8	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-	
3	2	-	-	4.7	-	-	-	-	-	-	-	-	-	-	-	-	
4	2	SP-SM	-	2.4	NV	NP	-	-	-	100	99	97	86	58	20	5.2	SAND, slightly silty
5	2	SM	-	4.1	NV	NP	-	-	-	100	99	98	93	76	39	17.8	SAND, silty
6	2	SP	-	2.2	NV	NP	-	100	98	94	87	73	56	36	13	4.0	SAND, trace silt, slightly gravelly
6	6	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-	-	
7	2	SM	-	6.9	18	3	-	-	-	-	100	99	95	82	53	28.7	SAND, silty, trace clay
8	2	SM	-	6.7	NV	NP	-	-	-	100	99	98	94	82	50	23.9	SAND, silty
9	2	SM	-	4.7	NV	NP	-	-	100	99	98	94	84	66	35	12.1	SAND, silty
10	2	SM	-	5.6	NV	NP	-	-	100	99	98	94	81	60	32	16.8	SAND, silty
11	1½	SC	-	6.0	22	12	-	-	-	100	99	98	94	78	49	30.1	SAND, silty, clayey
12	3	SC	-	12.5	30	17	-	-	-	100	99	98	93	81	59	43.8	SAND, very clayey
12	6	-	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	
13	2	SP-SM	-	2.1	NV	NP	-	-	-	-	100	99	97	79	35	9.4	SAND, slightly silty
13	5	SM	-	5.2	-	-	-	-	-	100	99	97	92	81	56	33.2	SAND, very silty

NV - indicates no value
NP - indicates non-plastic

Project No. 93-1-90
Table 1

V & A

SUMMARY OF LABORATORY TEST DATA

Test Hole No.	Depth (Feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS % PASSING BY WEIGHT										DESCRIPTION
					LL	PI	1½"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
14	2	SM	-	4.2	NV	NP	-	100	99	98	96	92	82	63	32	13.0	SAND, silty, trace gravel
14	4	SP	-	2.5	-	-	-	-	100	98	93	78	54	32	12	4.5	SAND, trace silt, trace gravel
14	8	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	
15	2	SM	-	4.9	NV	NP	-	-	-	100	99	98	91	77	43	15.0	SAND, silty

NV - indicates no value

NP - Indicates non-plastic

Project No. 93-1-90

Table 1 Cont.

PROJECT BENCHMARK
ALBUQUERQUE CONTROL STATION 10-K10
ELEVATION=5142.79

SCALE IN FEET
0 50 100 200
SCALE: 1"=100'

LOS VOLCANES ROAD N.W.

BOULEVARD N.W.

UNSER

STREET "A" MERIDIAN PL

STREET "B"

STREET "C"

AIRPORT DRIVE

BLUEWATER ROAD N.W.

TRACT L-1-(EXISTING) (NOT IN PROJECT)

Storm Sewer Manhole
Rim Elev.=5126.32
Inv. Elev.=5117.74 NW
Inv. Elev.=5117.72 N
Inv. Elev.=5114.42 E

2' Additional Right of Way to be dedicated to the City of Albuquerque per plat.

EX 16" WTR
EX 8" SAS
EX 10" WTR

PROPOSED WATER BLOCK

BASIN E1
BASIN A1
BASIN A2
BASIN A3
BASIN B
BASIN C
BASIN D
BASIN E2
BASIN OS1
BASIN OS2
BASIN OS3
BASIN OS4

LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
LOT 13
LOT 14
LOT 15
LOT 16
LOT 17
LOT 18
LOT 19
LOT 20
LOT 21
LOT 22
LOT 23

PROPOSED 16' PRIVATE DRAINAGE EASEMENT AND PRIVATE STORM DRAIN
PROPOSED 15' PRIVATE DRAINAGE EASEMENT AND PRIVATE STORM DRAIN
PROPOSED 15' PRIVATE DRAINAGE EASEMENT AND PRIVATE STORM DRAIN (TYP. LOTS 14,16,18,19)
PROPOSED 12" PRIVATE STORM DRAIN
PROPOSED 15' PRIVATE DRAINAGE EASEMENT

10' Public Utility Easement granted per plat. (typical)

Existing 22' Storm Drain Easement

PROPOSED VALLEY GUTTER

0.010 ft/ft (typ)
0.009 ft/ft
0.005 ft/ft

12" SD
24" SD
36"SD

0.22 cfs (TO STREET)
0.23 cfs (TO STREET)
0.28 cfs
0.35 cfs
0.47 cfs
0.58 cfs
0.67 cfs
17.26 cfs
0.29 cfs
1.47 cfs
20.44 cfs
0.15 cfs
4.48 cfs (max)
5.41 cfs
0.23 cfs
0.22 cfs
3.59 cfs (max)
0.21 cfs
0.14 cfs
0.48 cfs
0.42 cfs
0.86 cfs (max)
0.41 cfs
0.26 cfs
0.25 cfs
3.08 cfs (max)

PROPOSED PRIVATELY MAINTAINED PUBLIC DETENTION POND. (PUBLIC DRAINAGE EASEMENT PER SEPARATE DOCUMENT)
(POND SHAPE MAY CHANGE)

PROPOSED CONNECTION OF POND OUTLET PIPE TO EXISTING PUBLIC STORM DRAIN

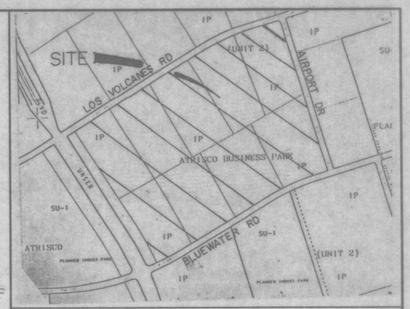
PROPOSED WATER BLOCK (8" NOM)

PROPOSED INLETS AT LOW POINT IN STREET (1-DOUBLE "C" PER SIDE) Q_{100}=10.22 cfs PER INLET

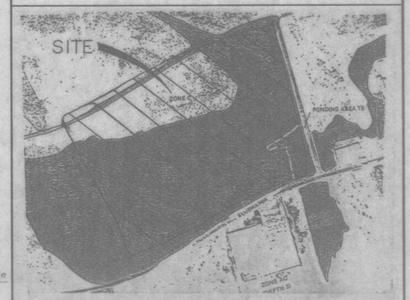
PROPOSED CONNECTION OF PRIVATE STORM DRAIN TO EXISTING PUBLIC STORM DRAIN

NOTE:
LOCATION OF BASIN DIVIDE IN LOTS 11,13,15,17 AND 20 MAY VARY (SEE SHEET 2 OF 2)

2' Additional Right of Way to be dedicated to the City of Albuquerque per plat.



VICINITY MAP
C.O.A. ZONE ATLAS No. J-10/K-10
1"=750'



FLOOD MAP
FEMA MAP No. 27 (OCTOBER 14, 1983)
NOTE: CLOMR APPROVED FOR SITE
1"=750'

LEGEND

DESCRIPTION	PROPOSED	EXISTING
CONTOURS (1 FT)		5210
CONTOURS (5 FT)		x 5214.3
SPOT ELEVATIONS	+ 15.50	
APPROXIMATE DRAINAGE BASIN BOUNDARY		
DRAINAGE DIVIDE / WATER BLOCK		
DIRECTION OF RUNOFF		
FLOWLINE		
OVERFLOW		
PROPERTY LINE		
STORM DRAIN M.H. & LINE	36"SD	24" SD
STORM INLET		
ALLOWABLE 100-YEAR DEVELOPED DISCHARGE	0.58 cfs	
100-YEAR STREET FLOW	20.44 cfs	
100-YEAR STORM DRAIN FLOW	3.59 cfs (max)	
ONSITE BASIN	BASIN A	
OFFSITE BASIN	BASIN OS4	

NOTES:
1. REFER TO MASTER DRAINAGE PLAN FOR ATRISCO BUSINESS PARK, (EASTERLING & ASSOCIATES INC., OCTOBER 1993, K-10/D23) FOR DESCRIPTION OF OVERALL DRAINAGE CONDITIONS IN ATRISCO BUSINESS PARK.
2. REFER TO SHEET 2 OF 2 OF THIS PLAN FOR DESCRIPTION OF PROPOSED CONDITIONS FOR TRACT M, AND FOR REPRESENTATIVE CALCULATIONS.

NO.	REVISIONS	BY	DATE

CONCEPTUAL MASTER GRADING AND DRAINAGE PLAN

LOTS 1-23, MERIDIAN BUSINESS PARK

(REPLAT OF LOTS 1-9, TRACT M, UNIT 2 ATRISCO BUSINESS PARK)

AUG 30 '96

NEW MEXICO 6411 REGISTERED PROFESSIONAL ENGINEER

Easterling & Associates, Inc.
CONSULTING ENGINEERS
10131 Coors Rd., NW, Suite H-7
Albuquerque, New Mexico 87114
(505) 898-8021 FAX (505) 898-8501

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SHEET 1
JML	JMM	CME	OF 2
JOB NO: 4320	DATE: 8/96		

DWG: T:\PROJECTS\4320\DWG\GEN\GEN-GD
TIME: 08-29-96 09:27:53

J10 -D20

DRAINAGE PLAN

Existing Conditions

The subject site is located in Atrisco Business Park, and consists of approximately 86.6 acres of undeveloped land. The site is bounded by paved streets on its north, east and south sides. A narrow undeveloped plot (Tract L-1, Atrisco Business Park), separates the site's west boundary from Unser Boulevard. Undeveloped offsite flows may currently enter the site from Tract L-1. Offsite flows do not appear to enter the site from the north, east or south.

The site drains generally from northwest to southeast over an average land slope of approximately 1.4%. A natural depression at the southeast corner of the site acts as a retention pond for existing flows. There are no improvements on the site other than an existing public storm drain (COA Project 4383.93) located along the east boundary adjacent to Airport Drive. There are currently no connections from the site to the storm drain. However, the storm drain was designed to accept controlled developed discharge from the site. The existing 24" storm drain on the north side of Los Volcanes Road was not planned to accept discharges from this site.

Proposed Conditions

It is proposed to re-subdivide the site in accordance with the established zoning (IP), and in conformance with the City-approved Master Development Plan for Atrisco Business Park, 1992 (EPC Z-92-57). The proposed lot and street layout for the site is depicted on Sheet 1 of 2 herein. The site will continue to drain to the south and east, and will discharge to the existing Airport Drive Storm Drain, between Bluewater Road and Los Volcanes Road. The existing Master Drainage Plan for Atrisco Business Park (*Easterling & Associates, Inc.*, October 1993) established criteria for the control of developed discharge from the site based on evaluation of downstream capacity. As such, all developed discharges within this site will be limited to 0.1 cfs/acre. Proposed internal streets (streets "A", "B" and "C") will drain to a proposed public detention pond on Lot 10. The pond will also accept runoff from Lot 10, and will itself drain via a proposed connection to the existing 36" RCP along Airport Drive. Individual developed lots will have onsite ponding to limit peak 100-year discharge to 0.1 cfs/acre and drain in 24 hours. Each lot development will be accompanied by a Site Development Plan and a detailed lot-specific Grading and Drainage Plan, which will provide details of onsite ponding designs and outfall connections. Individual lot grading and drainage plans shall conform to this plan and to the existing Master Drainage Plan. In particular, Plate 3 of the Master Drainage Plan provides guidelines for grading and drainage design for lots in the 2.5 acre to 10 acre range.

The drainage patterns indicated on Sheet 1 of 2 herein are intended as a general guide, and individual lot drainage patterns may vary. Lots 11, 13, 15, 17 and 20 are shown with a drainage divide approximately at their north-south midpoint. The actual location of this divide will be determined individually for each lot. The proposed storm drains along Street "A" and on the north side of Bluewater Road will be designed to accommodate such flexibility.

Construction Phasing

It is proposed to construct the basic public infrastructure improvements in a single phase. This will consist of Streets "A, "B" and "C", public water and sewer facilities, the 24" public storm drain in Street "A", and the public detention pond and appurtenances. In addition, minor grading will be performed on individual lots to accommodate new street construction. It is not intended to mass-grade the entire site. Proposed lots will then develop on an individual basis. Temporary retention or detention ponds and/or ditch/dikes may be graded on individual undeveloped lots upstream of developing lots to control interim drainage. Such facilities will be sized to limit discharge to 0.1 cfs/acre or less. Design of interim facilities will be accomplished with the Subdivision Infrastructure Improvement Plans, for approval by the City Design Review Committee. Final design of offsite permanent drainage facilities will be performed at that time. A conceptual design of the proposed public pond on Lot 10 is presented herein.

Offsite flows from Basin OS1 through OS3, the undeveloped Tract L-1, may continue to enter Lots 21 through 23, or be prevented from entering thee lots by means of ditch/dikes along their western property line. If such undeveloped offsite flows are accepted, they will be ponded and released at 0.1 cfs/acre of tributary offsite drainage area. Upon development of Tract L-1 (by others), Tract L-1 will be responsible for onsite control of its developed runoff to 0.1 cfs/acre. Tract L-1's outfall for developed discharge from Basins OS1 through OS4 will be at its southeast corner, discharging to Bluewater Road.

Private storm drains indicated on Sheet 1 of 2 herein will be constructed to serve individual lots as they develop. Each developing lot which drains to a private storm drain will be responsible for constructing the storm drain across its frontage and across adjacent lots to the point of connection to a public storm drain downstream, as indicated on Sheet 1 of 2 herein.

Floodplain Issues

The 1983 FEMA Floodway map indicates that a substantial portion of the site lies in a designated flood hazard area. The proposed Unser Diversion, to be built by AMAFCA west of the site, is the physical means by which this floodplain will be eliminated. Right-of-way and funding are in place for the Unser Diversion, and an approved design is complete. A CLOMR has been approved by FEMA, and a LOMR is to be issued upon completion of the Unser Diversion project. Construction has not yet begun, but it is expected that work may commence in 1996. The plan shown on Sheet 1 of 2 hereon depicts conditions under which the upstream diversion is considered to be in place.

Meanwhile, it is proposed that, if necessary, individual lot developments give consideration to elevating building pads above the published flood elevations in order to proceed with building construction prior to floodplain removal.

No plat action
until Amafca project is under construction

HYDROLOGY SUMMARY

	BASIN ID	CONDITION	DESCRIPTION	AREA (acres)	LAND TREATMENT DISTRIBUTION A	B	C	D	Q_{100} (FREE RUNOFF) (cfs)	Q_{100} (ALLOWABLE) (cfs)	PROPOSED DOWNSTREAM CONVEYANCE
EXISTING CONDITIONS	EX1	UNDEVELOPED	EXISTING TRACT L-1 (OFFSITE) AND LOTS 1-9, TRACT M	91.2	90	9	1	0	125.2	N/A	NOT APPLICABLE
DEVELOPED CONDITIONS	OS1	DEVELOPED	TRACT L-1 (PART)	0.9		NOT YET DETERMINED				0.09	BLUEWATER ROAD
	OS2	DEVELOPED	TRACT L-1 (PART)	0.7		NOT YET DETERMINED				0.07	BLUEWATER ROAD
	OS3	DEVELOPED	TRACT L-1 (PART)	0.7		NOT YET DETERMINED				0.07	BLUEWATER ROAD
	OS4	DEVELOPED	TRACT L-1 (PART)	2.3		NOT YET DETERMINED				0.23	BLUEWATER ROAD
	A1	DEVELOPED	PROPOSED LOTS 1 THRU 6	24.3		NOT YET DETERMINED				2.43	STREET "A" STORM DRAIN
	A2	DEVELOPED	PART OF PROPOSED LOTS 11,13,15,17,20	8.9		NOT YET DETERMINED				0.89	STREET "A" STORM DRAIN
	A3	DEVELOPED	PROPOSED LOT 9	2.9		NOT YET DETERMINED				0.29	STREET "A" STORM DRAIN
	B	DEVELOPED	PROPOSED LOTS 21 THRU 23	6.7	0	10	10	80	26.2	0.67	STREET "B"
	C	DEVELOPED	PART OF PROPOSED LOTS 11,13,15,17,20 PROPOSED LOTS 12,14,16,18,19	24.3		NOT YET DETERMINED				2.43	BLUEWATER ROAD STORM DRAIN
	D	DEVELOPED	PROPOSED LOTS 7 & 8	11.4		NOT YET DETERMINED				1.14	EXISTING AIRPORT DRIVE STORM DRAIN
	E1	DEVELOPED	PROPOSED STREETS "A", "B" & "C"	5.2	0	9	9	82	20.4	0.52	POND ON LOT 10
	E2	DEVELOPED	PROPOSED LOT 10	2.8	0	10	10	80	11.1	0.28	POND ON LOT 10

NOTES:

1. LAND TREATMENT DISTRIBUTION ASSUMED FOR BASINS B AND E2.
2. LAND TREATMENTS AND LOT-SPECIFIC POND DESIGNS FOR BASINS A1-A3, B, C & D PER INDIVIDUAL LOT GRADING AND DRAINAGE PLANS (FUTURE SUBMITTALS).
3. ALLOWABLE Q_{100} BASED ON 0.1 cfs/acre.
4. HYDROLOGIC COMPUTATIONS PER COA DPM 22.2, JANUARY 1993.

REPRESENTATIVE PRIVATE STORM DRAIN CAPACITY

MINIMUM SLOPE = 0.0050 ft/ft (typ)
MANNING'S "n"=0.010
DIAMETER = 1.0 ft

Using MANNING'S Equation

Q_{cap} = 3.28 cfs

$Q_{max\ req}$ = 3.08 cfs

NOTE:
FINAL HYDRAULIC ANALYSIS TO ACCOMPANY DETAILED STORM DRAIN DESIGN (FUTURE SUBMITTAL)

PRELIMINARY STAGE/STORAGE DATA FOR PROPOSED PUBLIC POND ON LOT 10

ELEVATION (ft)	LENGTH (ft)	WIDTH (ft)	AREA (sf)	STORAGE (ac-ft)	OUTFLOW (cfs)
5099	258	25	6,450	0.0000	.00
5100	266	33	8,778	0.1748	.67
5101	274	41	11,234	0.4045	.01
5102	282	49	13,818	0.6921	.26
5103	290	57	16,530	1.0404	.47

Notes

1. Hydrographs for Basins B, E1 and E2 computed and routed through a pond using AHYMO194 computer program.
2. Pond outlet configuration: 5.36" orifice at entrance to 12" outlet pipe(inlet control).
3. Maximum Computed WSE = 5102.94.
4. Final sizing and configuration to be determined with design of Subdivon Infrastructure Improvements.

REPRESENTATIVE STREETFLOW HYDRAULIC CALCULATIONS

MAXIMUM 100-YEAR STREETFLOW OCCURS ON THE APPROACH TO THE PROPOSED DOUBLE "C" INLETS NORTH OF LOT 11

Q_{max} = 20.44 cfs
STREET WIDTH = 40' F-F
PAVEMENT CROSS-SLOPE = 2.00%
GUTTER PAN CROSS-SLOPE = 6.25%
LONGITUDINAL SLOPE = 0.9% (typ)
MANNING'S "n"=0.017

Using the AHYMO COMPUTE RATING CURVE command,

$d_n \approx 0.47'$

and $d_n \overline{V} \approx 1.3$

CAPACITY OF DOUBLE "C" INLETS

OPEN AREA IN GRATE ≈ 6.8 sf/inlet
WITH 50% CLOGGING, EFFECTIVE AREA = 3.4 sf/inlet
WITH 6" WATER DEPTH, NEGLECTING CURB OPENING CAPACITY,

$Q_{cap} = 0.6(3.4)\sqrt{(64.4)(0.5)}$
$= 11.6$ cfs/inlet

$Q_{req} = 10.2$ cfs/inlet

NO.	REVISIONS	BY	DATE

CONCEPTUAL MASTER GRADING AND DRAINAGE PLAN

LOTS 1-23, MERIDIAN BUSINESS PARK

(REPLAT OF LOTS 1-9, TRACT M, UNIT 2 ATRISCO BUSINESS PARK)

STANLEY W. EASTERLING NEW MEXICO 6411 REGISTERED PROFESSIONAL ENGINEER

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DESIGNED BY: JML	DRAWN BY: JMM	CHECKED BY: CME	SHEET 2
JOB NO. 4320	DATE: 8/96		OF 2